GEORGE L. PERRY
Brookings Institution

Capacity in Manufacturing

INFORMATION ABOUT THE AMOUNT of available industrial capacity and about the degree of its utilization are employed in many forms of economic analysis. Data on utilization—operating rates—have proven useful in explaining price movements and in forming projections of the future course of business capital investment. Less directly, operating rates can help explain the cyclical behavior of productivity and, through that, changes in profits and income shares. In some industries, operating rates could contribute to explanations of the size of order backlogs and, at times, could offer clues to real limitations on the expansion of output.

Three series of indexes on operating rates are regularly available and widely used. They are published by the Federal Reserve Board, McGraw-Hill, and the Wharton School. Together with data on output, each of these series implies an index of capacity. In addition, a separately estimated index of capacity, published by McGraw-Hill, can be used with output data to provide a fourth measure of operating rates. All of the four measures are available for the manufacturing sector as a whole. The Federal Reserve Board index is also disaggregated into a two-way classification of primary

Note: I am grateful to Ellen Hahn for her able research assistance in the preparation of this paper, and to Richard Benson of Harvard University for his assistance in estimating some of the price equations used in the paper and for providing price and wage data from the Data Resources, Inc., data bank. And I want to thank Nathan Edmonson of the Division of Research and Statistics of the Federal Reserve Board for data and for information about capacity measures.

processing and advanced processing industries, while the three other indexes are available for finer industry breakdowns, generally at the standard industrial classification two-digit industry level. The main purpose of this paper is to examine these four measures.

For a limited number of industries, trade associations compile further information on capacity. Recently such data have been combined by the Federal Reserve into an index of "capacity utilization in major materials industries."[1] The index is a potentially useful addition to the available information about capacity and deserves scrutiny by the profession. However, it covers only a small fraction of all manufacturing and is not publicly available for the individual industries from which it is derived. Thus, it cannot be easily evaluated or used to check the more comprehensive indexes just described, although some casual comparisons are reported below.

Finally, numerous attempts have been made to build up properly weighted series on capital stocks to serve in much the same way as capacity measures in economic analysis.[2] In fact, capital stocks are employed in one part of the procedure for developing the Federal Reserve Board capacity index. However, no measure of capacity or operating rates generated entirely from capital stock estimates has come into widespread use and none is evaluated here.

Recent Developments

An unusual amount of attention has centered on operating rates during the expansion of 1971–73, particularly since the outburst of inflation in 1973. In the six quarters following the introduction of the new economic program in 1971, real gross national product grew at an average annual rate of 7.2 percent. Real growth exceeded an 8 percent rate in the last quarter of 1972 and the first quarter of 1973. This extremely rapid expansion led many observers to argue that the economy was stretching its available pro-

1. Nathan Edmonson, "Capacity Utilization in Major Materials Industries," *Federal Reserve Bulletin*, Vol. 59 (August 1973), pp. 564–66. The Federal Reserve had maintained such an index in the past, but had not done so for many years before Edmonson reconstructed it.

2. A recent attempt is described in Robert M. Coen and Bert G. Hickman, "Aggregate Utilization Measures of Economic Performance," Memorandum 140 (Stanford University, Center for Research in Economic Growth, February 1973; processed).

ductive capacity and that capacity limits would restrain subsequent expansion and create strong inflationary pressures in the industrial sector of the economy. In the second and third quarters of 1973, real GNP growth did slow substantially from its hectic earlier pace, to an average annual rate of 3.0 percent, at the same time that wholesale prices for industrial products rose rapidly.

The capacity-limits hypothesis is a tempting explanation for these developments. However, other forces were at work pushing up prices in this period: the price control program had been substantially weakened, the dollar was devalued against other currencies, and worldwide commodity prices were soaring. Against this background, the price acceleration cannot be blamed simplistically on excessively high operating rates. Nor is it possible to identify readily the role, if any, of capacity limitations in slowing the growth of real output after the first quarter of the year. Consumption spending alone accounts fully for the deceleration in GNP growth in the second quarter, and consumer demand is extremely volatile and presumably was restrained by the sharp rise in prices during the period. More revealing, virtually the entire slowdown in real GNP between the first and subsequent quarters of 1973 is traceable to output in two sectors: agriculture and automobiles. Aside from these sectors, real GNP grew at a 6 percent rate in both the first and third quarters and at a 4½ percent rate in the second. Omitting the GNP produced by other minor sectors that have nothing to do with U.S. capacity limits—general government, households and institutions, and the rest of the world—the annual GNP growth rate in the remainder of the economy was 6.4 percent, 5.2 percent, and 6.5 percent in the first three quarters of 1973, respectively. These statistics offer little support for a supply-limit hypothesis of a slowdown. On the other hand, the rate of inventory accumulation in the second and third quarters was lower than most forecasters had predicted and could constitute evidence of supply constraints for some products.

Operating rates have also been the focus of attention for forecasters of plant and equipment spending in 1973, and continue to be an important clue to many projections of business investment for 1974. High operating rates have generally produced high levels of business investment outlays, and the extent of such an investment boom is one of the important determinants of the length and strength of any economic expansion.

Operating rates, then, promise significant clues to the most important stabilization questions of the day. Unfortunately, the published indexes tell

quite different stories. For the second quarter of 1973, the Federal Reserve Board reported a rate of 83.4, McGraw-Hill's utilization rate index was 86.9, Wharton reported 96.4, and calculations based on the McGraw-Hill capacity survey indicated an operating rate of 81.4.[3] Such a range corresponds to the difference to be expected in manufacturing operating rates between the trough and peak of a mild business cycle. There is some ambiguity about whether the levels of utilization rates in these measures are directly comparable. Historical evidence presented below suggests that they are. But even adjusting the FRB and McGraw-Hill measures by "preferred operating rates"—the largest adjustment for comparability that anyone has suggested—still leaves a sizable discrepancy among the measures. For second quarter 1973, this adjustment puts the FRB index at 89.7, the index from the McGraw-Hill utilization survey at 93.4, and calculations based on the McGraw-Hill capacity survey at 87.5, compared with 96.4 for Wharton. By these measures, the Federal Reserve index and the McGraw-Hill capacity survey indicated ample spare capacity, but the Wharton index suggested that a wide range of manufacturing industries were pushing against capacity limits. The answer to the crucial question of how much unused capacity exists in American industry depends to an altogether unacceptable degree on which of the widely used measures one looks at.

Alternative Measures of Capacity

No one concept of capacity has general acceptance. Very loosely, capacity is meant to measure the output that can be produced with the available stock of plant and equipment. This level of output depends on the amount of other inputs used with the capital and on changing technical relationships that define how the inputs are combined and how much output they will produce in various combinations. If the mix of output varies, and if capital is specialized in its uses, the relation is complicated further. Finally, a given physical facility can be utilized more or less fully by operating more or fewer shifts and longer or shorter workweeks.

None of the indexes attempts to narrow this range of ambiguity by de-

3. The McGraw-Hill measures analyzed here are available as end-of-year data. Estimates for periods within the year are made by the author by interpolating capacity growth between its yearly end-points. For 1973 quarters, capacity is estimated for this purpose to grow at the same rate as it did in 1972.

fining its concept of capacity. Plainly, all of them refer to a reasonably "normal" form of operation: They do not measure what could be produced by a fully war-mobilized economy. Nor can they measure what limits to total production might arise from serious bottlenecks in one or more key industries. The emerging fuel shortage threatens to limit total output in a way that could not be measured by any capacity index. There is some evidence that the measures refer to production near a minimum average cost point on a cost curve.[4] In the absence of a more precise definition, the saving feature of any of the present capacity and utilization indexes must be the assumption (warranted, one hopes) that the index is consistent through time so that at least it is always measuring the same—if unspecified—concept. The usefulness of the measure can then emerge in its ability to predict.

The available indexes of manufacturing capacity are based on distinctly different approaches to measurement. McGraw-Hill surveys firms directly about their capacity and operating rates. The Wharton analysts estimate capacity by looking directly at the amount produced. The Federal Reserve Board combines information from the McGraw-Hill surveys with heroic assumptions about the relation between capital stock estimates and capacity. The way each of the measures is formally constructed can be briefly described.

MCGRAW-HILL SURVEYS

The Economics Department of the McGraw-Hill Publications Company compiles information on investment plans, capacity growth, and operating rates from the responses of individual companies to survey questions. The sample of firms surveyed in 1972 accounted for 63 percent of total capital investment, 41 percent of sales, and 38 percent of employment in manufacturing.[5] While companies that participate in the survey are usually the larger firms in their industries, an attempt is made to provide a representative cross-section of firms, and the survey responses are blown up to make

4. Testimony of Lawrence R. Klein, in *Measures of Productive Capacity*, Hearings before the Subcommittee on Economic Statistics of the Joint Economic Committee, 87 Cong. 2 sess. (1962), pp. 61–63.

5. The McGraw-Hill survey and the indexes reviewed here are described in "Business' Plans for New Plants and Equipment, 1972–75," 25th Annual McGraw-Hill Survey (McGraw-Hill Publications Company, Economics Department, April 28, 1972; processed).

them directly comparable with government statistics for each industry. To obtain more aggregated estimates, individual industries are combined using weights from the index of industrial production.[6]

McGraw-Hill does not define capacity or operating rates, and firms respond according to their own definitions. Firms also indicate what their "preferred operating rates" are, and again McGraw-Hill does not attempt to define the concept. The capacity survey asks firms about both their plans for additions to capacity in the current year and their actual additions in the previous year. The analysis in this paper is based on the actual additions to capacity that firms have reported.

The McGraw-Hill series on additions to capacity and on operating rates are separate and independent from one another. The level of capacity indicated by the one cannot be divided into a measure of output for the industry to obtain the operating rate provided by the other. The survey on operating rates refers to December of each year and in the present analysis is treated as an average operating rate for the entire month. Thus, when divided into seasonally adjusted output for December as measured by the Federal Reserve Board's index of industrial production, this series yields an estimate of capacity for that month.

The McGraw-Hill capacity survey is not benchmarked to a level of utilization rates. Capacity in each industry is an index number equal to 100 in 1967. Dividing this index into output yields a utilization index. In the present analysis, this utilization index for each industry was then scaled so that its average over the entire data period equaled the average rate from the McGraw-Hill utilization survey for the corresponding industry.

Both of the McGraw-Hill measures are subject to the normal technical problems of survey sampling. By the nature of what they measure, they can also be suspected of having certain distinctive strengths and weaknesses. Estimates from the capacity survey suffer from having no periodic benchmark, so that any systematic error in the annual estimates of capacity growth will cumulate. By contrast, errors in estimates of capacity growth from the operating rate survey are unlikely to cumulate since new operating rate benchmarks are provided annually. This survey, however, could suffer from a cyclical bias if respondents treated marginal facilities differently at

6. Aggregation should be made using capacity weights rather than output weights. However, all the measures reviewed have used some form of output or value-added weighting and the error in doing so is probably small.

different stages of the cycle, say, by ignoring some idle facilities in estimating operating rates during slack periods but counting them when they were put back into use.

FEDERAL RESERVE BOARD INDEX

The Federal Reserve Board index of manufacturing capacity is the most eclectic of the indexes in construction, relying on three distinct sources of information. The data from these sources are combined in a way that aims to utilize the best features of each set and minimize its weaknesses. The FRB methodology relies on the McGraw-Hill utilization rate survey to benchmark its capacity index over the longer run. However, to estimate year-to-year changes in capacity, it uses two indicators of short-term capacity growth: year-to-year changes in the McGraw-Hill capacity survey and estimates of the size of the capital stock. The FRB index merges these three kinds of information on capacity growth by estimating the historic relationship between the two short-run indicators and the utilization rate survey.

The historic drift in capacity between the two McGraw-Hill surveys is estimated by time trends. The time trend for the latest interval is then applied to the estimates from the capacity survey to provide one estimate of yearly capacity growth. The same procedure is used to establish the time trend of the drift between the capital stock and capacity calculated from the utilization survey. This time trend is then applied to the annual growth of the capital stock to provide a second estimate of capacity growth year by year. These two estimates of yearly capacity growth—one from the drift-adjusted capacity survey and one from the drift-adjusted capital stock—are then averaged to provide the final FRB capacity index. Quarterly estimates are interpolated from yearly estimates; and quarterly estimates of capacity utilization are derived by dividing capacity into the FRB industrial production index.[7]

A serious weakness of the FRB index is that the benchmarking to the utilization survey is based on historic statistical relationships that are simple at best and that may change substantially. In particular, estimates for recent years are based on simple time trend estimates of the drift that are

7. The most thorough published description of the index and its construction is given in Frank de Leeuw, "A Revised Index of Manufacturing Capacity," *Federal Reserve Bulletin*, Vol. 52 (November 1966), pp. 1605–15.

heavily weighted with historical information. The estimates are not currently updated;[8] and even if they were, they would still not adequately reflect any abrupt recent changes in the relation of investment and capital stock to capacity or in the bias in the McGraw-Hill capacity series.

THE WHARTON INDEX

The Wharton measure of capacity is produced by an extremely simple procedure. Seasonally adjusted quarterly data on output for each of the two-digit manufacturing industries are recorded to determine peak quarters of output, and output at the peaks are taken as measures of capacity in each industry. Between successive peaks, capacity is assumed to grow along a straight-line path connecting them. For the period after the most recent peak, capacity is assumed to grow along the same straight line that it followed before that peak. If output subsequently goes above this line, a new capacity estimate is defined by that level of output, and a final estimate is established when output eventually turns down. Thus at no time does utilization exceed 100, and it reaches 100 at every cyclical peak. Some exceptional cases are dealt with separately, such as a peak followed by a brief decline and a return of output to new highs, or a declining industry whose output achieves local peaks that lie below previous peaks. In arriving at a capacity measure for all manufacturing, individual industries are aggregated using value-added weights.

On one occasion, Klein and Preston checked the estimates of capacity based on the basic Wharton methodology by comparing them with estimates from a production function for several individual industries.[9] In light of evidence that some of the basic Wharton series were drifting away from the production function estimates, the Wharton index was adjusted upward through 1960. Wharton capacity estimates for later years have been made with the basic methodology.[10]

The obvious drawback to the Wharton methodology is its treatment of

8. The most recent estimates of the drift use data through 1970.

9. L. R. Klein and R. S. Preston, "Some New Results in the Measurement of Capacity Utilization," *American Economic Review*, Vol. 57 (March 1967), pp. 34–58.

10. The basic methodology is not considered sacred and apparently some of the estimates have occasionally been amended. However, the index is constructed essentially as described here.

every peak in output as a point of "full utilization." The criticism that the 1959–60 output peak clearly should not have been regarded as a point of full utilization spurred the adjustment to the series just described. And in their analysis, Klein and Preston concluded that the adjustment was required because the output peaks in the early 1950s represented overutilization for purposes of the Wharton index as well as because the 1959–60 peaks were periods of less than full utilization.[11] Since, for individual industries, operating rates at peaks are defined to be 100, the basic Wharton methodology cannot distinguish differences in the intensity of utilization from one peak to another. The peak operating rate for all manufacturing or some other aggregation will be less than 100 since all industries do not peak in the same quarter. Thus peak operating rates for manufacturing can differ from cycle to cycle because of differences in the distribution of individual industry peaks in time, but not because the intensity of utilization at those industry peaks is measured to be different.

Because the most recent estimate of capacity in the Wharton methodology is provisional until a peak in output is reached, another drawback of the Wharton methodology is that current estimates of capacity and operating rates are always subject to revision depending on the course of output. If output exceeds the capacity line extrapolated from the most recent peak, capacity will be defined to coincide with output until output slows and a new peak is established to define capacity for the present cycle. Retrospectively, operating rates initially reported as 100 may be revised downward substantially. Conversely, if output expands weakly and peaks before reaching the capacity line that had been extrapolated from the most recent peak, initially reported operating rates will be revised upward. Quarters in which spare capacity was initially reported to have been ample will historically be shown to have been periods of full utilization. Thus the Wharton index can tell different stories to the researcher using it historically and to the decision maker using it currently.

The simplicity of the Wharton methodology is also its great strength. The technique is easily applied and yields prompt estimates of capacity utilization over a wide range of industries. In recent years, it has been applied to data on industrial production in many countries other than the United States to produce historic and current estimates of utilization. While

11. "Some New Results," pp. 54–55.

its drawbacks are unmistakable, the Wharton index may serve very well where a measure of changes in utilization rates over relatively short time intervals is useful.

Characteristics of the Measures

Several characteristics of these four measures of manufacturing capacity and utilization can be examined by comparing their past behavior. Some of the findings from this examination are suggested by the descriptions of how the several measures are constructed and how they have been utilized in the past. But there are also a few surprises.

CYCLICAL BIAS

Table 1 shows regression estimates summarizing the relation between capacity as estimated by the four alternative measures and two other variables, output and the capital stock. All variables are in logarithmic form and thus summarize the relation between changes in output and in the capital stock and changes in the capacity measure. Separate estimates are shown for the 1954–65 and 1966–72 periods. A variety of evidence, including the regression estimates of Table 1 themselves, point to a change around the mid-sixties in the relation among the four measures of capacity and in the relation between two of the measures and investment or the capital stock. The form of the equation does not represent any structural hypothesis, but rather offers a preliminary way to view the characteristics of the several capacity measures.

The principal result of interest is the significant positive relationship between output changes and changes in capacity as measured by the McGraw-Hill utilization survey. The estimated effect is virtually identical in both regression periods. There is no important relation between current output and current capacity for any of the other measures. Since output enters without a lag, and since variation in the capital stock should capture much of the true variation in capacity, it is extremely doubtful that this relation between output and capacity represents a genuine case of rising output inducing capacity growth. Rather, capacity as measured from the utilization

Table 1. Relation between Manufacturing Capacity, Output, and Capital Stock, Measured by Four Indexes, 1954–65 and 1966–72[a]

Index	*Period*	*Coefficient estimates*[b] *a*	*b*	*c*	*Standard error of estimate*	R^2	*Durbin-Watson statistic*
McGraw-Hill—C[c]	1954–65	−22.2	0.08	1.38	0.015	0.992	1.0
		(−12.3)	(1.1)	(12.6)			
	1966–72	−21.5	0.12	1.34	0.016	0.980	0.9
		(−12.4)	(0.8)	(12.2)			
McGraw-Hill—U[c]	1954–65	−16.2	0.23	1.03	0.009	0.996	2.9
		(−13.9)	(4.9)	(14.5)			
	1966–72	−11.6	0.23	0.80	0.004	0.997	2.0
		(−24.7)	(5.7)	(27.0)			
Wharton	1954–65	−26.7	0.05	1.38	0.015	0.990	0.7
		(−14.1)	(0.7)	(11.9)			
	1966–72	−17.2	0.02	0.89	0.008	0.988	1.0
		(−19.8)	(0.3)	(16.3)			
Federal Reserve Board	1954–65	−21.7	0.05	1.37	0.007	0.998	0.7
		(−26.1)	(1.4)	(26.9)			
	1966–72	−20.8	0.01	1.32	0.001	0.996	1.3
		(−29.0)	(0.1)	(29.4)			

Sources: Capacity indexes are from McGraw-Hill Publications Company, Economics Department, "Annual Survey of U.S. Business' Plans for New Plants and Equipment," April 1973 and preceding annual issues; Wharton School of Finance and Commerce, University of Pennsylvania, Economic Research Unit, "United States Aggregate Industrial Capacity Utilitization Rates" (July and September 1973; computer printouts); Board of Governors of the Federal Reserve System (computer cards). Industrial production and capital stock data were provided by the Federal Reserve System.

a. The data are observations for the fourth quarter of each year. The numbers in parentheses are *t*-statistics.

b. The estimating equation is

$$\ln C = a + b \ln Q + c \ln K,$$

where

C = capacity measure, last quarter of each year
Q = Federal Reserve index of industrial production in manufacturing
K = capital stock.

c. Here and in the following tables McGraw-Hill—C and McGraw-Hill—U are indexes based on McGraw-Hill capacity and utilization surveys, respectively.

survey does seem to have a cyclical bias. It appears that respondents "find" capacity when output rises sharply, and "lose" it when output slackens.

It is not clear whether the results reflect simply a bias of respondents to the survey, or the thinking of management about how much capacity is actually available. If they reflect the thinking of decision makers, then a reported utilization rate that subsequently proved to be too high when out-

put expanded and new capacity was "discovered" could still produce the economic consequences of tight capacity. The index with cyclical bias could predict well. Indeed, since most economic developments one would forecast using utilization rates are just as cyclical as the bias in the index is, predictions could be expected to be little affected by the bias, whatever its source.

The estimated elasticity between output and capacity measured by the utilization survey is about one-quarter. Thus, assuming any given actual growth in capacity, if output were to grow 8 percent rather than zero in a given year, the utilization survey would indicate a 2 percent difference in capacity growth and a corresponding two-point narrower spread in utilization rates than actually would characterize the two alternative output paths. For individual years, there is some evidence that the bias may have been noticeably larger: in 1966, the survey indicated a growth in capacity of more than 10 percent, and in 1970, a growth of only 0.3 percent. If, as seems reasonable, capacity is interpreted as the quantities that firms find they can produce when actually put to the test, the utilization survey estimates are most reliable at high levels of utilization, and comparisons with other indexes are best made for such periods.

This finding also validates the use of the utilization survey to benchmark information about capacity levels in the FRB index while other measures are used to estimate year-to-year changes in the index. However, the FRB methodology of estimating time trends among the different measures may not be optimal, since for relatively short time intervals, a trend estimate can be too much influenced by a few observations. It might be better to benchmark to estimates from the utilization survey at its latest peak. Even better might be adjustment of the capacity implied by the utilization survey with an equation such as that in Table 1 and application of the adjusted estimate to correct the drift in the other inputs of the FRB index.

The other result of interest in Table 1 is the change in the relation of capital stock growth to capacity growth between the two periods for the utilization survey index and the Wharton index. The relation is little changed between the two periods for the other capacity indexes. Since some drift is expected between measures of capital stock growth and capacity, and the timing between the two is not known accurately, no great significance is attached to the differences in coefficients among the measures. But the decline in the estimated elasticity between periods in two of the measures does correspond to the hypothesis that pollution control efforts, and possibly other developments, have reduced the annual increment to capacity that

goes along with a given level of investment spending. The size of the effect is substantial. According to the estimates for the utilization survey index, to achieve a given percentage increase in capacity now requires 25 percent faster growth in the capital stock—roughly equivalent to 10 percent more gross investment—than it used to. The effect estimated for the Wharton index is even greater.

GROWTH IN CAPACITY

In Table 2, the growth in manufacturing capacity, as measured by the four alternative indexes, is shown for different intervals since the mid-1950s. The capacity measures are for the end of each year, and the end points of the intervals shown correspond approximately to cyclical peaks in output. Average capacity growth rates were not far apart in the four measures for the decade from the end of 1956 to the end of 1966. But in the 1966–72 period, they diverge substantially. The FRB index and the McGraw-Hill capacity survey record a speedup in capacity growth while the McGraw-Hill utilization survey and Wharton record slowdowns. This divergence coincides with the changes in the relation of the capital stock to the various measures of capacity implied in Table 1.

The growth rates for the smaller subintervals shown in the second part of the table are more erratic, particularly for the McGraw-Hill utilization measure during the first decade. Allowing for the cyclical bias that has been identified in this index smooths the picture considerably. Over the 1956–60 interval, output grew at an average annual rate of only 0.6 percent; it accelerated to an 8.1 percent growth rate over the 1960–66 interval. The

Table 2. Growth Rates in Manufacturing Capacity, as Measured by Four Indexes, 1956–66, 1966–72, and Subintervals

Average percent per year

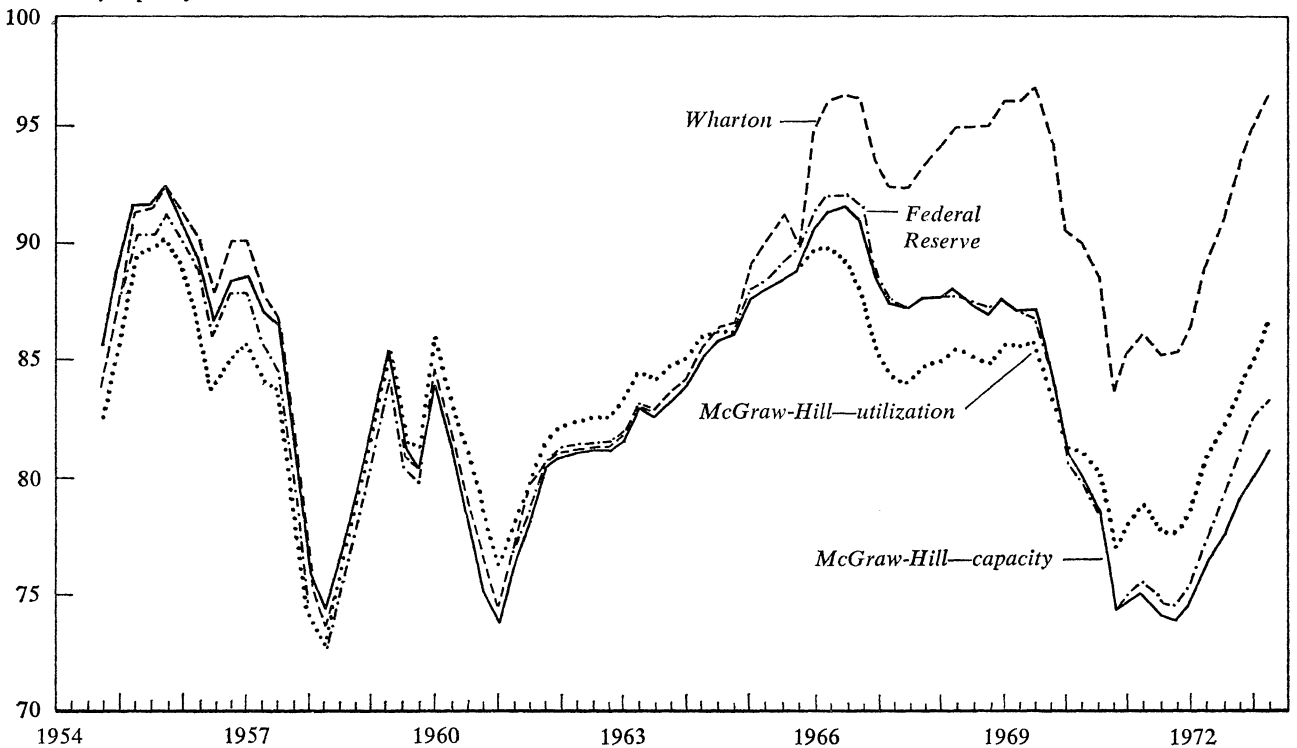
	Intervals[a]		*Subintervals*[a]			
Index	*1956–66*	*1966–72*	*1956–60*	*1960–66*	*1966–69*	*1969–72*
Federal Reserve Board	4.6	5.0	4.3	4.8	6.0	4.0
McGraw-Hill—C	4.7	5.4	4.7	4.7	5.6	5.1
McGraw-Hill—U	4.7	3.7	2.7	6.0	4.8	2.6
Wharton	4.3	3.5	4.8	4.0	3.8	3.2

Sources: Same as Table 1.

a. Capacity was estimated for the fourth quarter of each year, except for the McGraw-Hill measures, which are for December of the years shown.

Figure 1. Alternative Measures of Utilization of Manufacturing Capacity, Quarterly, 1954–73

Percent of capacity utilized



Sources; Same as Table 1.

indicated regression adjustment to the capacity growth estimate would narrow the speedup of 3.3 percentage points shown between the two intervals to about 1.6 points. On an adjusted basis, the capacity growth rates in this index for the two periods would be about 3.7 percent and 5.3 percent.

The growth rate in the Wharton index slows successively in each of the subintervals; the deceleration during the first decade seems particularly implausible. Investment incentives were introduced in 1962 and contributed to a spectacular rise in investment spending and a marked acceleration in the growth of the capital stock. While a translation of this development into a capacity estimate cannot be made with any precision, it seems unlikely that capacity growth would have slowed in this period.

The adjustment to the Wharton index that was made through 1960 put its growth rate up to that point in line with those of the other measures. But as a result of lagging the others noticeably after that time, Wharton utilization rates were substantially higher at the 1966 and 1969 peaks than those recorded by the other measures:[12]

Index	*1966*	*1969*
Wharton	96.1	96.2
McGraw-Hill—U	90.0	85.8
McGraw-Hill—C	91.5	87.3
Federal Reserve Board	92.3	87.1

The divergences starting in the mid-1960s can be seen in Figure 1, which charts historical utilization rates for all four measures. Curiously, a disproportionate amount of the departure of Wharton from the other indexes occurs in one year, 1966.

PREFERRED OPERATING RATES

The usefulness of any index of operating rates can be judged from its performance as an economic time series. The absolute level of the series need not have any well-defined meaning. But for purposes of comparing one index with another, it is useful to know how their levels are expected to be related. The Federal Reserve index was explicitly benchmarked to the McGraw-Hill utilization survey when it was constructed, so no adjustment

12. Peaks did not occur in exactly the same quarters for all measures. The operating rates given are for the second quarters of 1966 and 1969.

is needed in comparing their operating rates. The McGraw-Hill capacity survey yields only an index number of capacity levels that, for the present study, has been benchmarked to average the same as the utilization survey. Thus, of the four indexes under review, only the McGraw-Hill utilization survey and the Wharton index produce independent estimates of the level of operating rates. It is useful to know how they should be related.

Respondents to the McGraw-Hill utilization survey indicate a "preferred" level of operating rate as well as an actual level in each period. Analysts have often suggested that actual rates should be adjusted by preferred rates for the purpose of comparing the estimates from the McGraw-Hill survey with those from Wharton[13]—in other words, that the level of the Wharton index should be comparable with the level of the utilization survey as a fraction of the preferred operating rate the survey reports. However intuitively appealing such a simple adjustment may be, the history of the two measures does not support its application.

The data below show the ratio of operating rates in the McGraw-Hill survey to those estimated by Wharton for periods starting with the first year for which the survey was available—1954—and ending with every year since 1965. As of the mid-1960s, the average level of operating rates reported by the two series was virtually identical. The ratio between the two declines every year as the period is extended from 1965 to the present. This occurs because the Wharton index rose substantially above the McGraw-Hill in 1966 and stayed above it thereafter. As a result, for the seven years from 1966 to 1972, the McGraw-Hill index (for December) averaged only 90.8 percent of the Wharton index (for the fourth quarter):

Period	*McGraw-Hill operating rate as a percentage of Wharton rate*
1954 to:	
1965	100.4
1966	99.6
1967	99.0
1968	98.3
1969	97.6
1970	97.4
1971	97.0
1972	96.7

13. See, for instance, Klein's comment in *Measures of Productive Capacity*, pp. 56–57.

The average relation between the two measures through the mid-1960s is appropriate for comparing the indexes. The Wharton index was examined and revised at about that time.[14] Furthermore, the recent and current evidence on operating rates is best examined using evidence about the relation between the two measures established from previous years. However, even if the ratio of the two measures up to 1972—96.7—were used to make them comparable, such a procedure would still imply a much smaller adjustment than adjusting by the preferred rate reported by McGraw-Hill, which was 93 in 1972 for all manufacturing.

An examination of individual industries reported in both surveys supports the conclusion that no level adjustment is required between the two. By 1968, when the average ratio over the 1954–68 period was still 98.3 percent in all manufacturing, the 1954–68 average McGraw-Hill operating rate exceeded the average Wharton operating rate over the same period in five of the eleven individual industries. Thus there is simply no evidence that over most of the history of the two surveys the levels of operating rates they report should not be compared directly, either at the all-manufacturing level or at some level of disaggregation. Adjusting the McGraw-Hill index by its preferred operating rate would bring operating rates in the two measures closer together for the most recent years, but only at the expense of moving them further apart in earlier periods.

OPERATING RATE CORRELATIONS

Despite the differences among the four measures already cited, their measures of operating rates are highly correlated, even over the whole 1954–72 period. The correlation of the Wharton index with the others is clearly the weakest. But as the marked divergence of the Wharton index from the others occurs rather abruptly in the mid-1960s, the Wharton correlations are much higher if the whole period is divided into two parts. When the period is separated into intervals covering fourth quarter 1954 to fourth quarter 1965 and first quarter 1966 to fourth quarter 1972, the Wharton correlations rise substantially and become virtually indistinguishable from the correlations among the other measures. These correlations are presented in Table 3.

Correlating operating rates is a weak test of the similarity of the indexes

14. Klein and Preston, "Some New Results."

Table 3. Correlation Matrix of Manufacturing Operating Rates among Four Indexes, 1954–72, and Subperiods

	Index			
Index	*McGraw-Hill—U*	*McGraw-Hill—C*	*Wharton*	*Federal Reserve Board*
	1954:4 to 1972:4			
McGraw-Hill—U	1.00			
McGraw-Hill—C	0.93	1.00		
Wharton	0.73	0.71	1.00	
Federal Reserve Board	0.96	0.99	0.75	1.00
	1954:4 to 1965:4			
McGraw-Hill—U	1.00			
McGraw-Hill—C	0.94	1.00		
Wharton	0.94	0.99	1.00	
Federal Reserve Board	0.97	0.98	0.99	1.00
	1966:1 to 1972:4			
McGraw-Hill—U	1.00			
McGraw-Hill—C	0.95	1.00		
Wharton	0.94	0.92	1.00	
Federal Reserve Board	0.97	0.99	0.93	1.00

Sources: Same as Table 1.

since all four measures have industrial production as a common numerator. The correlations do show that despite their differences, all four are likely to be useful for many purposes. At a minimum, they must all gauge cyclical variations with some success, measuring differences between years of high and low utilization that follow one another fairly closely. Since the measures have been shown to drift substantially apart over time, however, they cannot be comparably successful in answering harder questions, such as whether operating rates in 1972 were already near peak levels.

Recent Hazards for Estimating Capacity

Much of the preceding analysis points up the fact that alternative capacity estimates have been agreeing less with one another since the mid-1960s than they used to. Coinciding with this development are several occurrences in the economy that may have posed special difficulties for capacity measurements. Two of these, about which only a little can be said here, are the acceleration of wages and the striking changes in competitiveness between the United States and other nations.

The acceleration in wages of the late 1960s and 1970s is sometimes thought to have spurred more capital-intensive production techniques and hence to have altered the relation between the capital stock and capacity. If the prices of capital goods reflect actual wage levels—which they probably do—and if costs of financial capital reflect expected wage increases—which is much less certain—no shifts in production techniques would be predicted simply from the onset of inflation. It is beyond the present analysis to judge whether in the real world of recent years, inflation in fact affected production techniques and capacity growth.

Changes in international competitiveness have been striking and could well have affected economic capacity in U.S. industries. A concentrated oligopolistic industry such as steel has been subjected to competitive pressure from imports produced by technically more advanced facilities abroad. Modernization of the U.S. facilities also may have been profitable for some time; but they were not treated as obsolete until foreign competition intruded. More generally, the inroads of foreign competition in particular lines can make U.S. capacity obsolete even in competitive sectors. But as pervasive as such a development may appear to be, if the newest technology is available to U.S. producers, the presence of foreign competition itself is not the key to accelerated obsolescence. The key is a slower rise in unit labor costs abroad than here because of greater moderation of wages relative to productivity growth. The importance of this factor cannot be analyzed further here, and it is hard even to speculate about which of the available measures of capacity might most successfully detect obsolescence from this source.

THE ANTIPOLLUTION DRIVE

Somewhat more can be said about a third development in the economy over this recent period that may have posed special difficulties for some ways of measuring capacity: the intensified drive to reduce environmental pollution from industrial sources.

In recent years, a great deal of public attention has been focused on the problems of polluted air and water. Industry has been identified as a major source of pollution and has been the object of intensified antipollution efforts. These efforts have the effect of altering historically estimated measures of the capital stock and industrial capacity at both ends of the productive life of fixed capital: To the extent that some portion of current

investment expenditures are made for the purpose of cleaning up production processes, investment will add less to capacity than it has added historically, and less to the capital stock conceived as a means of augmenting production. And to the extent that some facilities are abandoned ahead of schedule because they cannot economically be altered to conform to new environmental standards, the capital stock and capacity are reduced by retirement more quickly than historical experience would predict.

Since 1967, McGraw-Hill has surveyed firms to determine the amount of investment expenditures being devoted to pollution abatement. According to these surveys, such expenditures have risen from $785 million in 1967 to $2.6 billion in 1972 for the manufacturing sector as a whole, and represented about 8 percent of total plant and equipment outlays by manufacturing firms in the later year.[15]

A good deal of ambiguity surrounds the McGraw-Hill estimates. Some firms may report new facilities that meet pollution standards as pollution control measures even though they are also additions to the firm's capacity. I know of no way to make an allowance for this possibility. But on the assumption that the outlays reported by McGraw-Hill are exclusively for pollution control and do not add to capacity, an estimate of the bias in a capital stock measure such as that used in constructing the FRB capacity index can be made. I have done this for the two subgroups of manufacturing for which separate indexes are presented, advanced and primary processing industries. The McGraw-Hill estimates of outlays for pollution control were calculated for these two industry groups and subtracted from total investment outlays in each group for each year. New estimates of capital stock were then generated by deflating this reduced level of investment spending, and these new estimates were translated into capacity figures by means of the FRB formulas.

By the end of 1972, according to these calculations, the portion of the FRB capacity measure that is generated using investment and capital stock estimates was 3.3 percent too high in the primary processing industries and 1.5 percent too high in the advanced processing industries. Since the FRB capacity estimates use the McGraw-Hill capacity survey together with these capital stock estimates, the actual FRB capacity index would be off by only half these amounts on the basis of this one adjustment. And if some part of the outlays identified with pollution abatement also add to

15. "Business' Plans for Plant and Equipment, 1972–75."

capacity, the importance of this adjustment for the aggregates that the FRB uses must be regarded as small. For individual industries, the effect could be considerably larger. But if the pollution control movement has had an important effect on industrial capacity over a range of industries, it must have come by the other route—by forcing early retirement of existing facilities.

There are no direct measures of the retirement or obsolescence of capital facilities. Historical estimates are available on average lives of various types of capital and these are used in empirical investigations such as the FRB capacity index. But they offer no warning of changes in typical historical patterns. In principle, some of the capacity estimates that are under review would be capable of detecting such changes. If output peaks were always caused by capacity limitations, the Wharton methodology would detect them along with other influences on capacity growth. The half of the FRB capacity measure that rests on a historical relation between capital stock and capacity could not detect such a change. And one can only hypothesize that respondents to the McGraw-Hill surveys take proper account of this source of change in their capacity. It could be that the capacity survey detects the capacity enlargement arising from new investment more accurately than it does the subtractions due to retirements or obsolescence. The former involves money—capital budgeting, contracting, and spending—while the latter does not. There is no comparable reason to believe that the operating rate survey is biased in its allowance for retirements and obsolescence since it represents, ideally at least, a fresh assessment each year of the utilization of available capacity.

The capacity growth rates displayed in Table 2 are consistent with these hypotheses about retirements and obsolescence: that they were unusually heavy during this period and that the utilization survey detected this fact while the capacity survey failed to do so. The utilization survey recorded a sharp slowdown in capacity growth after the mid-1960s, while the capacity survey reflected only a slight slowdown and recorded a capacity growth rate twice as large as the utilization survey during the 1969–72 interval.

Disaggregating Measures of Capacity

As the overall level of business activity varies, capacity pressures are not even among individual industries. While some industries show more pro-

nounced cyclical variation in output than others, their tendency to do so is not strong enough to ensure regularity in capacity pressure across industries from one cycle to another. Aggregate measures of capacity utilization, such as the widely reported measures of operating rates in all manufacturing, thus conceal a great deal of irregularity in the position of individual industries. Yet it may make quite a lot of difference if the average operating rate for all manufacturing is a couple of points below full utilization because most manufacturing industries are in that position rather than because some industries are operating at the limits of their capacity while others suffer an overhang of idle facilities. In the 1973 economy, information from a variety of sources indicates that capacity limited the expansion of output in several industries such as paper, petroleum, steel, and some lines of chemicals, while many others exhibited evidence of ample spare capacity.

The significance of measures of capacity and of capacity utilization will vary from industry to industry. Prices can be expected to be more sensitive to the degree of utilization in some industries than in others. In sufficiently concentrated industries, where firms aim for a target rate of return, prices may even have a negative relation to utilization, rising when utilization, productivity, and profits are low. Similarly, the significance of utilization rates for explaining investment will differ among industries. In some industries, capacity represents a true physical limit to production. Those employing continuous process operations, such as petroleum and paper, typically use facilities as intensively as demand permits, running them nearly twenty-four hours a day, seven days a week. When all facilities are running at these rates, a meaningful physical limit to capacity is reached. Average cost curves may be flat or declining right up to this point in such operations. By contrast, in others, such as the automobile industry, production is geared to a typical workweek but is easily expanded by running production lines more days or longer hours each day. The average labor cost of doing so is higher, at least after a point, because of overtime pay. But other costs are spread more widely. It may be profitable to expand output very substantially beyond the normal operating level, with cost curves flat or declining well past what is customarily regarded as 100 percent of capacity. The implications, both for new investment and for price pressures, are thus widely different for petroleum refining and for automobile production.

Disaggregating the available measures of manufacturing capacity per-

mits a look at how utilization affects the different industries and, at the same time, how the alternative measures of utilization fare as forecasting variables. Such analysis can be helpful in several ways in evaluating the merits of alternative measures and in assessing the current state of capacity utilization. It can identify the measures that perform the best, and the industries for which correct measures of utilization are important. And it can determine the industries on which some agreement exists among the alternative measures.

Unfortunately, the measures of capacity and utilization available for all manufacturing are not all available in the same disaggregated form. The Federal Reserve Board index is disaggregated only into advanced and primary processing industries. The Wharton index is thoroughly disaggregated, basically at the two-digit industry level. The two McGraw-Hill survey measures are available for somewhat fewer industries. In the following analysis comparisons are limited to the Wharton and the two McGraw-Hill measures, and among these, to industries for which data were available for at least two of the indexes.

Predicting Capacity Growth

High operating rates should, other things equal, induce firms to add to their capacity. A natural test of the indexes under review, therefore, is their ability to predict their own capacity growth rates from their own past utilization rates. How the three measures under review fared in such a test is reported in Table 4. The percentage increase in capacity for each measure was explained by past values of its own operating rates and past increases in output. Output change is included as a way of capturing the effect of expected future changes in output on capacity decisions. The exact form of the equation used is shown in Table 4. The table presents the *t*-ratios of the operating rate variable in the equation explaining capacity growth for each of fourteen industries as well as for all manufacturing.

Both McGraw-Hill measures explain themselves well. The capacity survey measure registers a wrong sign in only one of the fourteen industries, food, and has a *t*-ratio lower than 2.0 in three others. The utilization survey measure does about as well. It has wrong signs in two industries and *t*-ratios lower than 2.0 in only one other. Both of these measures also perform well in explaining their own estimates of capacity growth in all manufacturing.

Table 4. Capacity Growth of Selected Industries as Explained by Own Operating Rates of Three Indexes

Standard industrial classification code	*Industry*	*t-ratio of operating rate variable in industry capacity equation*[a]		
		McGraw-Hill—C index	*McGraw-Hill—U index*	*Wharton index*
20	Food	−5.0	3.2	−6.5
22	Textiles	1.3	4.8[b]	4.9[b]
26	Paper	4.4	−0.5[b]	−3.0[b]
28	Chemicals	3.2	5.9	−0.4
29	Petroleum	3.6	3.1[b]	1.1
30	Rubber	4.0	2.9	0.6[b]
32	Stone, clay, and glass	7.7	4.1[b]	−1.3
33	Primary metals	4.3[b]	...	−3.4
333–36, 339	Nonferrous metals	5.0[b]	−1.2[b]	...
34, 38	Fabricated metals and instruments	0.6	5.6[b]	1.0[b]
35	Machinery	6.9	0.7	−4.0
36	Electrical machinery	3.0[b]	2.7	−8.4
371	Motor vehicles	6.9[b]	3.2	−0.4[b]
372–75, 379	Other transportation equipment	1.0	2.8	−1.1
	All manufacturing	5.1	5.1	0.2

Sources: Same as Table 1.

a. The capacity equation used was

$$\frac{C_t - C_{t-4}}{C_{t-4}} = a + b\left(\frac{U_{t-3} + U_{t-4} + U_{t-5} + U_{t-6}}{4}\right) + c\left(\frac{Q_{t-3} - Q_{t-7}}{Q_{t-7}}\right),$$

where

C_t = quarterly capacity
U_t = quarterly operating rate
Q_t = quarterly output.

The period of estimation is 1956:2 to 1972:4.

b. The output term had the wrong sign in the basic capacity equation. The *t*-ratio shown is for the operating rate term in the equation with the output term omitted.

The Wharton index fails in almost every industry. Only in textiles does its own estimate of operating rates succeed in explaining its estimate of capacity growth. Its operating rate variable has the wrong sign in nine other industries and *t*-ratios less than 2.0 in the remaining three industries. It also has a negligible coefficient in its equation for all manufacturing.

Predicting Investment

For GNP forecasting, the analyst is primarily interested in predicting investment spending rather than capacity growth. While the expected

causal relation between operating rates and investment is less precise than the relation between operating rates and capacity growth that was just analyzed, investment is, in most instances, the primary action that firms can take to expand capacity. In practice, operating rates are commonly used by forecasters to help explain investment, and the ability of such an index to do so is an important test of its general usefulness.

How the three indexes fared in explaining investment is shown in Table 5, which displays *t*-ratios for their operating rates in an investment equation for twelve industries as well as for all manufacturing. The equation explained the ratio of deflated investment to output by past values of operating rates. Capital stocks for individual industries were not available, so it was not possible to try to explain investment as a fraction of the capital stock. The exact form of the estimating equation is given in the table.

Table 5. Performance of Alternative Measures of Operating Rates in Explaining Investment

Standard industrial classification code	*Industry*	*t-ratio of operating rate variable in industry investment equation*[a]		
		McGraw-Hill—C index	*McGraw-Hill—U index*	*Wharton index*
20	Food	−2.3	1.2	1.4
22	Textiles	3.2	3.1	6.1
26	Paper	3.8	4.8	0.2
28	Chemicals	−2.4	3.7	0.1
29	Petroleum	0.0	2.9	4.1
30	Rubber	3.9	2.2	1.0
32	Stone, clay, and glass	5.0	7.5	2.2
33	Primary metals	3.0	n.a.	2.5
34, 38	Fabricated metals and instruments	2.0	3.9	4.7
35	Machinery	6.4	4.1	4.1
36	Electrical machinery	2.8	2.7	3.2
37	Transportation equipment	5.7	2.3	2.4
	All manufacturing	7.3	5.3	3.5

Sources: Same as Table 1.

a. The equation used is

$$\frac{I_t}{Q_t} = a + b\,\frac{U_{1(t)} + U_{4(t-1)} + U_{3(t-1)} + U_{2(t-1)}}{4},$$

where

I_t = investment in year t

Q_t = output in year t

$U_{T(t)}$ = utilization in the T quarter of year t.

The equations were estimated for the period 1956–71.

n.a. Not available.

Table 6. Prediction of Price Changes in Selected Industries from Operating Rates of Alternative Indexes

Standard industrial classification code	*Industry*	*Coefficient and t-ratio (in parentheses) of operating rate variable in industry price equation*[a]		
		McGraw-Hill—C index	*McGraw-Hill—U index*	*Wharton index*
20	Food[b]	−0.048	−0.033	0.090
		(−2.5)	(−0.6)	(1.9)
22	Textiles	0.116[c]	0.127[c]	0.057[c,d]
		(3.4)	(3.3)	(2.4)
26	Paper[e]	0.202	0.236	0.044
		(5.2)	(5.8)	(1.7)
28	Chemicals	0.010	0.027	0.025
		(1.0)	(1.1)	(1.2)
29	Petroleum	0.031[f]	0.050[f]	0.390
		(0.5)	(0.6)	(2.3)
30	Rubber	(0.031)[c]	0.098[c]	0.120[c]
		(1.7)	(2.6)	(4.3)
32	Stone, clay, and glass	0.005	0.015	−0.019
		(0.3)	(1.0)	(−0.9)
331, 332	Iron and steel[g]	0.073	...	0.064[h]
		(4.4)		(3.2)
333–36, 339	Nonferrous metals[g]	0.198[d]	0.196[d]	0.134[d,h]
		(3.6)	(3.3)	(2.8)
35	Machinery	0.031	0.035	0.021
		(3.6)	(2.7)	(2.6)
36	Electrical machinery	0.005	0.017	0.007
		(0.3)	(1.0)	(0.5)
371	Motor vehicles	−0.034	−0.049	−0.038
		(−3.6)	(−3.8)	(−3.6)

Sources: Price data were assembled by Richard Benson of Harvard University from wholesale price indexes. Wage data are from *Employment and Earnings*, various issues. The sources of the indexes are the same as in Table 1.

a. The equation used is

$$\frac{p_t}{p \text{ lagged}_{t-1}} = a + bU \text{ lagged}_t + c\frac{w_t}{w \text{ lagged}_{t-1}} + d\frac{P_t}{P \text{ lagged}_{t-1}},$$

where the time interval is one quarter and

p_t = the wholesale price of industry output
U_t = capacity utilization, scaled as a decimal (for example, 0.90)
w_t = straight-time hourly earnings in the industry
P_t = the price of material inputs to the industry
p lagged$_t$ = $0.4p_t + 0.3p_{t-1} + 0.2p_{t-2} + 0.1p_{t-3}$, and w lagged, U lagged, and P lagged are defined analogously.

The period of estimation is 1955:3 to 1971:2.

b. Data on wages were not available.

c. The input price variable entered the equation with the wrong sign. The coefficient shown is for the equation with input prices dropped.

d. The wage variable entered the equation with the wrong sign and was dropped.

e. Data on input prices were not available.

f. The utilization rate variable is for petroleum refining only (SIC industries 291 and 299).

g. The wage variable is for primary metals (SIC 33).

h. The utilization rate for primary metals (SIC 33) is used.

The Wharton index of operating rates explains investment much more successfully than it explains its own estimate of capacity growth. None of the indexes works well in the food industry, and Wharton displays a *t*-statistic greater than 2.0 in eight of the remaining eleven industries as well as in all manufacturing. It still does not perform quite as well as the two McGraw-Hill measures. The utilization series has a significant coefficient in every industry but food, while the capacity series fails in two others. They also have noticeably higher *t*-ratios in the all-manufacturing equation. But the Wharton index explains investment well, and, in the present form of the equation, only slightly less well than its competitors.

Predicting Price Changes

All three measures of operating rates prove useful in predicting price changes. Over all, the Wharton measure does as well as the two McGraw-Hill surveys, and no one of the three is clearly superior in predicting prices. A comparison of their performances is provided in Table 6, where the coefficients and *t*-statistics for the operating rate terms are compared in equations for twelve separate industries.

All the price equations were estimated for periods ending in the second quarter of 1971. Data were available to start the estimation period, with three-quarter lags, in the third quarter of 1955. Ending the estimation period in mid-1971 avoided the Phase I, II, and III price control episodes. Since there is no way to know the effect of controls on prices in individual industries during this era of abruptly changing wage-price policies, estimates of normal effects would be distorted. A utilization index that was "too low" during the initial freeze and Phase II would predict prices better than it should in that period. An index that was "too high" might do better than it should during the Phase III stage of suddenly absent controls. Confining the estimation to the years before Phase I avoids making special allowances in the equations for all these changes. During the wage-price guidepost period of 1962–68, restraints were much milder and, on the evidence as I interpret it, acted mainly by moderating wage increases and keeping prices in step with wages. Since cost changes are accounted for in the price equations estimated here, little room remains for a separate guidepost effect. In a few industries some effect may have been felt, particularly in 1968, but no attempt was made to allow for it.

For each industry, basic price equations were estimated explaining the change in the price of the industry's output by the level of capacity utilization, the change in the average wage in the industry (measured by straight-time hourly earnings of production workers), and the change in the price of the industry's material inputs. In two cases, data on wages or materials prices were not available. And in some others, one or both took on the wrong sign and the equation was reestimated without them. The three change variables had the form,

$$x_t/(0.4x_{t-1} + 0.3x_{t-2} + 0.2x_{t-3} + 0.1x_{t-4}).$$

When the variable is changing at a steady rate, this can be thought of as approximately 1 + ½ (annual rate of increase). Thus the coefficient on the utilization rate in this equation can be thought of as approximately one-half the elasticity of the variable with respect to the utilization rate, although the precise lag structure is rather complicated.

In addition to the industries for which statistics are reported in Table 6, it was possible to estimate price equations for six other two-digit industries —tobacco, apparel, lumber, furniture, leather, and fabricated metals— using just Wharton utilization data. Judged by *t*-statistics greater than 2.0, utilization rates were successful variables in all cases but apparel.

Besides the equation set forth in Table 6, two alternative forms of price equations were estimated for each of the industries. Since the level of utilization rates is used in the Table 6 equations, the estimates imply that in a steady state in which the utilization rate was unchanged, the rate of price increase would be unchanged. Since the rates of change of input prices and of wages in the industry are measured separately by the other explanatory variables in the equation, this implication is implausible. One should not expect margins to keep expanding or contracting indefinitely. Of course, one would not expect such a steady state to prevail. Expanding margins would be expected to induce firms to expand capacity faster, thereby reducing operating rates. The equations reported in Table 6 are too simple to capture all such effects. One might want to look for an independent effect on prices from changes in utilization rather than from its level. Quite apart from this argument, in industries whose pricing is characterized by market-clearing behavior, one would expect the change in utilization, rather than its level, to explain price movements.

Equations including the change in utilization were estimated for each industry and with each measure of utilization. Of the industries shown in

Table 6, this variation was successful in textiles and petroleum; it also succeeded in the lumber and leather industries, for which only Wharton utilization data were available.

Alternative equations were also estimated using a nonlinear form of the utilization rate, $1/(1.2 - U)$, where the U term was a distributed lag as before. In the denominator of this expression, 1.2 is used to avoid too much nonlinearity and the explosion of the term to infinity as utilization rates occasionally reached 1.0. It seems likely that utilization effects on prices are nonlinear, but these equations were virtually indistinguishable from those reported in Table 6.

The coefficients for two industries deserve special comment. Utilization had a significant negative effect on prices for motor vehicles, using all three measures, and for tobacco, for which only a Wharton estimate is available. It seems sensible to interpret this result as evidence of pricing based on a target rate of return in these industries.[16] It is much less likely that the significant negative coefficient on food estimated using the McGraw-Hill capacity survey can be interpreted in this way, since this industry is not as concentrated as autos and tobacco. While the equation reported in Table 6 cannot be considered an optimal pricing equation, it does seem to capture the importance of utilization rates once costs have been accounted for, and does provide a fairly straightforward comparison of the utilization rate measures. On the basis of these results, a price forecaster would want to pick and choose among the alternative measures of utilization. No doubt, the results for any one index or for any one industry could be improved with a more elaborate specification of the price equation. But even with the simple form used here, all three of the measures do well enough to be taken seriously.

Why does the Wharton index do as well as any in explaining prices when it failed in explaining capacity growth and was not quite up to its competitors in explaining investment? An explanation seems to lie in the fact that most of the price increase in the period 1954:4 through 1971:2 occurred during the years 1966–71. As Table 3 showed, manufacturing operating rates by all four measures are highly correlated with each other in this interval. Wharton's jump to a new plateau of operating rates relative to the

16. Richard Benson of Harvard University, who estimated some of the price equations for this paper, also reports this result for autos and tobacco in equations that include profit rates as explanatory variables for prices.

other measures in 1966 does not interfere with its predictive ability in price equations.

Operating Rate Levels

How tight has capacity utilization been in recent quarters? Before searching for the elusive answer to that question, some judgments must be made about the operating rates shown by the different measures. At a disaggregated level, the candidates are the two McGraw-Hill measures and the Wharton index.

Several of the utilization rate series calculated from the McGraw-Hill capacity survey exhibit marked time trends over most of the 1954–72 period. In some industries, the trends were so pronounced as to swamp any cyclical variation in operating rates: in food, utilization declined in all but two years of the 1955–72 interval; in chemicals, it rose in all but one year of the 1956–68 interval; in rubber, it rose in all but one year of the 1955–69 interval.

These cases, and a few others that are not so conspicuous, cast doubt on the reliability of the capacity survey for measuring the *level* of utilization despite its usefulness for other purposes. It is significant that two principal users of this survey benchmark it periodically to utilization rates from the McGraw-Hill utilization survey. As noted earlier, the FRB capacity index is constructed (in part) by adjusting the capacity survey to match the trend of capacity growth implied in the utilization survey. McGraw-Hill itself derives a special series of monthly utilization rates by a method that links capacity growth estimates from the capacity survey to utilization rates from the utilization survey.[17] The particular way in which these estimates are linked does not equate utilization from the two sources every year; but it keeps the capacity survey estimate from wandering very far over any period of time.

The equation results reported in Tables 4, 5, and 6 show that operating rates from the capacity survey can be useful predictors. In such equations, exponential drifts in the operating rate index can be compensated for in the estimated constant term of the regression. But the level of operating rates

17. See, for example, the bulletin, "McGraw-Hill Measure of the Industrial Operating Rate" (McGraw-Hill Publications Company, June 1972; processed).

derived from this survey cannot be relied on for assessing the current situation.

That leaves the Wharton index and the McGraw-Hill utilization survey. Table 7 compares operating rates recorded by these two measures for individual industries. It shows the peak rates achieved during the first half of 1973 and the difference between these rates and the peaks achieved in the 1968–69 and 1966 expansionary periods.

WHARTON

As a result of the considerable rise in production that had occurred through mid-1973, most industries in the Wharton measure showed operating rates at 100 at that time. It would be comforting to believe in such an apparently well-balanced expansion, but no other evidence supports such a view. The table also shows that by Wharton data, operating rates in 1973 have been above 1966 peaks in most industries. Yet there is widespread agreement that capacity was being utilized very intensely in most industries during at least part of 1966.[18] These facts, revealed in Table 7, reflect the two basic weaknesses of the Wharton methodology: its inability to distinguish any difference in the intensity of utilization achieved at different cyclical peaks; and its need to wait on a subsequent peak before settling on what operating rates have been—even by its own definitions—during an expansion. If the present expansion were to continue at an above-average pace for some time, the current capacity estimates in the Wharton index would be revised upward and the estimates of recent operating rates would be reduced.

MCGRAW-HILL UTILIZATION

All in all, the McGraw-Hill utilization survey seems the most believable of the available measures. Unlike the capacity survey, it can be expected to be reasonably free of drift over time. A priori, one would expect that changes in obsolescence of facilities, in their capital-labor ratios, or in other characteristics of production techniques should be accounted for by

18. This is true even though cyclical peaks were not recorded in every industry that year; otherwise Table 7 would never indicate a 1966 peak operating rate below a 1973 peak.

Table 7. Industry Operating Rates in 1973 and at Previous Peaks, by Alternative Measures

Percent

Standard industrial classification code	Industry	Peak operating rate, first half 1973		Difference in operating rate peaks			
				1973 less 1968–69		1973 less 1966	
		McGraw-Hill—U index	Wharton index	McGraw-Hill—U index	Wharton index	McGraw-Hill—U index	Wharton index
	Comparable industries						
20	Food	86.8[a]	100.0	−0.5	2.4	1.5	5.0
22	Textiles	91.2	99.8	0.1	−0.2	−8.3	−0.2
26	Paper	93.7	100.0	0.3	0.0	−1.6	3.2
28	Chemicals	81.8	100.0	−0.5	0.2	−3.0	9.4
29	Petroleum	99.8	100.0	3.1	3.7	4.9	7.1
30	Rubber	91.4[a]	100.0	−2.1	0.0	−6.3	5.8
32	Stone, clay, and glass	90.8	100.0	8.5	0.0	4.1	0.0
34, 38	Fabricated metals and instruments	82.2	96.1	−2.1	−3.7	−9.0	−3.1
35	Machinery	89.9	97.4	3.1	2.1	−1.9	−2.6
36	Electrical machinery	83.4	100.0	−3.0[b]	0.0	−9.2	0.0
371	Motor vehicles	111.6	100.0	17.5	5.7	15.0	0.0
372–75, 379	Other transportation equipment	79.0	66.5	−10.6	−33.5	−15.4	−30.2
	Noncomparable industries					...	
21	Tobacco	...	87.3	...	−1.3[b]	...	−7.6
23	Apparel	...	95.2	...	−0.9	...	−4.8
24	Lumber	...	100.0	...	0.1	...	0.0
25	Furniture	...	100.0	...	2.4	...	0.0
27	Printing and publishing	...	90.7[a]	...	−5.4	...	−8.5
31	Leather	...	76.9[a]	...	−7.8	...	−8.1
33	Primary metals	...	100.0	...	0.0	...	0.0
333–36, 339	Nonferrous metals	86.4	...	3.0	...	−11.8	...

Sources: Same as Table 1.

a. Peak utilization rates for these indexes occurred in 1972. In the second quarter of 1972, the food industry showed an operating rate of 87.2 percent; the rubber industry, 95.0 percent; and the leather industry, 84.5 percent. In the fourth quarter of 1972, the operating rate in the printing and publishing industry was 91.1 percent.

b. Operating rates in these industries were declining throughout the period 1968:1 through 1969:4. The difference shown is based on the 1968:1 operating rate.

respondents to this survey at least as well as they would be by other available measures. And unlike the Wharton index, the utilization survey is capable of distinguishing among the degrees of intensity of utilization at different cyclical peaks. The utilization survey performed as well as or better than the other measures in explaining capacity growth, investment, and prices. Thus there is reason to prefer the picture of 1973 operating rates that emerges from this survey.

The utilization survey gives a picture of recent operating rates noticeably different from that provided by the Wharton index. In the first half of 1973, several industries experienced exceptionally high operating rates by historical standards; but more industries had operating rates below 1966 peaks than above them. The average operating rate for all manufacturing conceals a considerable dispersion among rates in individual industries. And if information were available at a more disaggregated level, it would undoubtedly reveal capacity bottlenecks in parts of various industries that are concealed at the two-digit level of aggregation. The provision of only a single operating rate for an industry with as varied a product line as chemicals has to be counted a serious shortcoming of available statistics.

While high operating rates are not as pervasive in the utilization survey as in the Wharton index, the economy operated in the first half of 1973 with less spare industrial capacity than one might have expected, given the modest growth in industrial output since the mid-1960s. Overall capacity has grown slowly in recent years. The FRB index and the capacity survey fail to measure this slowdown and record far more spare capacity in 1973 than they should (see Figure 1).

Price-Sensitive Operating Rates

In late 1972 and in 1973 a particular need arose for a measure that would answer the questions of whether capacity utilization pressures were causing inflation, and if so, where. For this purpose, the results here show that a measure of utilization in all manufacturing was not very useful. Price equations indicated that utilization rates matter far more for predicting prices in some industries than in others. The analyst can work directly with individual equations for individual industries to predict price effects. But a summary index can convey the general picture of tightness or slack that exists, and one can be constructed using the information from the individ-

ual industry equations summarized in Table 6. Such an index is formed by weighting the utilization rate for each industry by the relative importance of output in that industry and the coefficient in the price equation for that industry.

Three such indexes of operating rates in price-sensitive industries are shown in Table 8. The three indexes arise from using the McGraw-Hill utilization index alone, the Wharton index alone, and a mixture of the two. For reasons already given, the McGraw-Hill utilization index is preferred for comparing operating rates at successive cyclical peaks. However, this index is not available separately for several important industries and the Wharton index did outperform McGraw-Hill in the price equations in a few industries for which both were available. Thus data from both are used in the Table 8 measures. When Wharton data are used, no index is presented for years before 1966; the Wharton index moved to a higher plateau relative to the McGraw-Hill then, making comparisons with the 1950s especially suspect.

Table 8. Operating Rates in Price-Sensitive Industries, by Three Measures, Selected Quarters of High Utilization, 1955–73

Percent

Year and quarter	*McGraw-Hill—U index*[a]	*Wharton index*[b]	*Combined index*[c]
1955:4	92.9	...	...
1956:1	92.9	...	...
1959:1	84.0	...	...
2	86.9	...	...
1966:2	95.9	96.4	96.1
3	96.0	96.5	95.9
1969:1	90.3	96.0	93.2
2	90.1	96.1	92.8
1972:4	89.4	96.3	92.9
1973:1	90.2	96.7	93.2
2	90.2	97.9	93.8

Sources: Same as Table 1.

a. The McGraw-Hill—U index includes the textile, paper, rubber, nonferrous metals, and nonelectrical machinery industries.

b. The Wharton index includes the textile, lumber, furniture, petroleum, rubber, leather, primary metals, fabricated metals, and nonelectrical machinery industries. Wharton utilization in the primary metals industry is used once with weights for iron and steel, and once with weights for nonferrous metals.

c. The combined index includes McGraw-Hill—U utilization rates for the textile, paper, rubber, nonferrous metals, and nonelectrical machinery industries; and Wharton utilization rates for petroleum, iron and steel, lumber, furniture, leather, and fabricated metals.

An industry was included in a Table 8 index if utilization produced a *t*-statistic greater than 2.0 in the price equations summarized in Table 6. By restricting the index to nonfood industries, I avoided the uncertainty about an equation for food. And I omitted the motor vehicles industry, with its significant negative coefficient, on the grounds that the index is designed not to forecast average price changes, which would call for including negative as well as positive effects of utilization, but rather to indicate roughly the upward price pressures arising from high operating rates. Table 8 shows the index values for the three most recently available quarters and for two peak quarters from past episodes of high utilization rates.

The index based on the McGraw-Hill measure, shown in the first column, has the fewest number of industries. It shows that price-sensitive industries in recent quarters had about the same operating rates as they had at the 1969 peaks, but were well below the 1966 peaks. The 1966 peaks are noticeably higher than any others, including those of 1955–56. The Wharton-based index shown in the second column is constructed from a larger number of industries. Unfortunately, it clearly displays the tendency of the Wharton methodology to make all peaks look alike.

The index in the third column combines the industries in the McGraw-Hill index with any others that show significant effects in equations with the Wharton measures, using Wharton utilization rates. In addition to the industries for which McGraw-Hill utilization estimates are available, it includes petroleum, steel, lumber, leather, fabricated metals, and furniture. Thus it provides substantially better coverage by including some additional key industries, although with the Wharton utilization data. However, for the important petroleum, steel, and lumber industries, the high operating rates reported by Wharton are supported by journalistic accounts and other sources. In recent quarters, this combined index is very near 1969 levels but still below those of 1966. Industrial capacity pressures on prices have been evident; but the pressures have not been exceptionally intense for a period of booming business activity.

Major Materials Industries

A good deal of attention has been given recently to capacity pressures in some major materials industries that have been a special feature of the current expansion. Edmonson, as noted above, has reported the reconstruction of an index of capacity utilization in major materials industries that used

Table 9. Operating Rates in Major Materials Industries, Three Measures, Selected Quarters, 1955–73

Percent

Year and quarter	Federal Reserve Board special index[a]	McGraw-Hill—U index[b]	Wharton index[b]
1955:4	91.7	94.3	...
1956:1	93.3	94.9	...
1966:2	92.0	96.5	96.9
3	92.0	96.6	97.7
1969:3	91.1	91.3	98.4
4	91.6	90.6	98.7
1972:4	92.4	91.3	99.1
1973:1	93.8	91.7	99.4
2	94.4	91.8	99.5

Sources: Column 1, Nathan Edmonson, "Capacity Utilization in Major Materials Industries," *Federal Reserve Bulletin*, Vol. 59 (August 1973), p. 564; columns 2 and 3, see Table 1.

a. The FRB special index is based on trade association statistics and is described in the text.

b. The industries included in the McGraw-Hill utilization index are textiles, paper, petroleum refining, and nonferrous metals; the Wharton index, in addition, includes lumber and steel.

to be maintained regularly by the Federal Reserve.[19] The index is a weighted average of utilization measures compiled separately for twelve manufacturing industries: basic steel, primary aluminum, primary copper, man-made fibers, paper, paperboard, wood pulp, softwood plywood, cement, petroleum refining, broadwoven fabrics, and yarn spinning. These are small industries compared with all of manufacturing, accounting for about 8 percent of total value added in manufacturing; but they are thought to be of a strategic importance that is disproportionate to their size. The utilization index for each industry is assembled from estimates of capacity and physical units of output reported by industry trade associations and government agencies. The data are fragmentary and not always available annually; but they offer an interesting alternative to the other available measures of capacity.

The Edmonson index, denoted FRB special, is shown in Table 9, together with indexes based on the McGraw-Hill utilization data and the Wharton data. The latter two are attempts to cover the same industries as the FRB special, but clearly provide only loose approximations. They are

19. Edmonson, "Capacity Utilization."

based on those two-digit industries that encompass the industries in the FRB special index, but they encompass many other industries as well.

The FRB special index has received attention because it indicates that the major materials industries experienced, in the first two quarters of 1973, operating rates higher than any previously recorded in the postwar period. The Wharton-based index, again not shown for years before 1966, supports this picture of exceptionally high recent operating rates in these industries. The major materials index based on the McGraw-Hill data tells a substantially different story. Recent operating rates are equal to or above those reached in 1969, but comfortably below the 1966 peaks. Again, as in the index of price-sensitive industries, this index omits the lumber and steel industries. This omission could give it some downward bias, although those industries had high operating rates in 1966 as well as 1973. Of the industries included, textiles and nonferrous metals operated at noticeably lower levels in 1973 than at the two previous peaks, according to the McGraw-Hill index.

The source of this discrepancy in the indexes of Table 9 is difficult to identify. The FRB special is of unknown quality. Analysts could evaluate it more easily if data for its constituent industries were available separately. The index based on McGraw-Hill data has substantially different coverage. Its reading of present utilization rates is not inconsistent with the possibility that significant bottlenecks exist in some parts of the industries that it does include. The ambiguous results of Table 9 reemphasize the need for more disaggregation in reliable measures of utilization. But detecting bottlenecks can probably never be accomplished by looking at capacity utilization measures. Bottlenecks can occur in too many places and at too detailed an industry level. And they can arise from raw materials bottlenecks more readily than from shortages of manufacturing capacity.

Advanced and Primary Processing Industries

A special feature of the Federal Reserve's regular index is its disaggregation into primary and advanced processing industries. This feature has attracted attention because, after reaching comparable levels at their 1966 and 1969 peaks, operating rates in these two categories diverged sharply in recent years. By the end of 1972, the moderate operating rates recorded in the FRB all-manufacturing index represented an average of exceptionally low rates in advanced processing industries and rates near the 1969 peaks in

primary processing industries. This divergence continued through the second quarter of 1973 in the FRB index.

In Table 10, the McGraw-Hill utilization rates are used to construct indexes comparable to the FRB measures for advanced and primary processing industries. These show a rather surprising disagreement with the FRB index. By the second quarter of 1973, operating rates in advanced processing industries were at levels similar to the 1966 peaks as measured by McGraw-Hill rather than at the recession levels indicated by the FRB index. For primary processing industries, the measure based on McGraw-Hill data shows somewhat lower operating rates in 1973 than the FRB index, but the disagreement is not great. And since the lumber and steel industries are omitted by McGraw-Hill, the two measures can be considered in substantial agreement here.

Apparently most of the error that has accumulated in recent years in the FRB index is concentrated in the advanced processing industries. As the

Table 10. Operating Rates in Advanced and Primary Processing Industries, Two Measures, Selected Quarters, 1955–73

Percent

	Advanced processing industries			*Primary processing industries*	
Year and quarter	*Federal Reserve Board index*	*McGraw-Hill—U index*[a]	*Year and quarter*	*Federal Reserve Board index*	*McGraw-Hill—U index*[a]
1955:3	88.0	87.8	1955:3	95.0	92.4
4	89.1	89.3	4	95.3	94.0
1960:1	82.9	83.4	1960:1	86.4	85.9
2	81.4	80.8	2	80.9	83.9
1966:3	92.0	89.3	1966:2	92.9	93.4
4	92.2	88.5	3	92.7	93.5
1969:1	87.1	85.4	1969:2	88.7	88.0
2	86.2	84.9	3	88.9	87.8
1972:4	77.8	84.6	1972:4	88.3	85.8
1973:1	79.1	87.1	1973:1	89.6	87.2
2	79.7	88.9	2	90.1	88.0

Sources: The FRB indexes were provided by the Board of Governors of the Federal Reserve System. The other indexes were derived from data provided by McGraw-Hill, cited in Table 1.

a. The lumber and steel industries are not included in the McGraw-Hill utilization primary processing index; the tobacco, apparel, furniture, printing and publishing, leather, and miscellaneous manufacturing industries are not included in the McGraw-Hill utilization advanced processing index. Chemicals are omitted from both McGraw-Hill utilization indexes.

FRB methodology is supposed to benchmark to the McGraw-Hill utilization survey, this part of the index simply must be regarded as badly in error.

The Inflation of 1973

When prices started accelerating in 1973, many observers quickly drew the inference that the U.S. economy was straining its productive capacity. According to the present analysis, this inference seriously overstates the case as far as plant and equipment facilities in manufacturing are concerned. Operating rates in manufacturing have risen substantially in many industries since early in 1973 when the alarm was first sounded. Manufacturing firms added 277,000 workers to their payrolls between the first and third quarters of the year (seasonally adjusted) and durable goods output expanded at an 8.1 percent annual rate over the interval. But a more serious capacity problem emerged in 1973 than one may have had reason to expect from any projections made a few years ago.

By the measure that comes out best in the present analysis, the McGraw-Hill utilization survey, capacity growth has been slow in recent years. In most industries, operating rates were higher in the second quarter of 1973 than in mid-1969, in contrast with the 4.9 percent unemployment rate in the second quarter of 1973 against 3.5 percent in 1969. Furthermore, the distribution of operating rates in 1973 was quite uneven, with key industries such as steel and petroleum producing at capacity while others operated with considerably underutilized facilities. Accelerated economic obsolescence and an unanticipated mix of final demands stemming from rapidly shifting international trade patterns presumably contributed to the current capacity situation.

Yet granting this, manufacturing capacity problems can hardly account for much of the inflation. In the first half of 1973, industrial wholesale prices rose at a 12.7 percent annual rate, a sharp acceleration from the 2.5 percent rate of increase experienced during the preceding six-month period. Yet evidence from the measures constructed here indicates that operating rates in sensitive industries have been high, but not as high as in earlier periods when prices were rising much less. Shortages have occurred, but primarily in raw materials rather than in industrial capacity. Wholesale prices of industrial materials rose at a 36 percent annual rate in the first six months of 1973. And they had been rising rapidly throughout 1972 when

price controls constrained the rise in finished goods prices. The combination of increases in materials costs and the end of Phase II price controls are the main causes of the 1973 price explosion. Any additional contribution to the inflation from the relatively high operating rates in manufacturing was minor.

Conclusions

Each of the four available measures of operating rates in manufacturing —compiled by the Federal Reserve Board, by McGraw-Hill from its utilization and capacity surveys, and by the Wharton School—exhibits different characteristics. Some of the measures appear to be in substantial error in their picture of available industrial capacity in 1973. The FRB index was designed to combine information from capital stock data with information from the McGraw-Hill capacity survey to estimate year-to-year changes in capacity, with the estimation benchmarked to evidence on capacity growth from the McGraw-Hill utilization survey. But the index has wandered away from its benchmark to the utilization survey in recent years and understates current operating rates in manufacturing. The error is concentrated in the advanced processing industries portion of the index where, by the middle of 1973, the FRB operating rate of 80 percent was some 10 percent too low. To get the index back on track, the link between the two estimates of year-to-year changes and the benchmark series should be redesigned so that the index is brought nearer its current benchmark and is not allowed to wander away again.

The other three measures of capacity and utilization are available at a more disaggregated level and have been analyzed for their ability to help the economic forecaster. All three indexes prove useful in measuring the effect of utilization rates on inflation and on business investment spending, two important concerns of the forecaster. But they differ in other characteristics and are not equally reliable for comparing utilization rates in separate business cycles.

The Wharton index provides the most thorough industry detail of the three. It is constructed, basically, by defining cyclical peaks in output as an industry's capacity and connecting successive peaks to establish the growth path of capacity for each industry. This simplicity of construction is Wharton's great advantage and the methodology has been used to create utiliza-

tion measures for industries outside manufacturing in the United States and for industries in other industrialized nations around the world. Its major drawback is its inability to distinguish any difference in the intensity of utilization at different peaks in an industry's output. This makes the index of little value for comparing utilization rates from one business cycle to the next. In addition, the Wharton index suffers from the disadvantage that before a new peak is established during an expansion period, its estimates of utilization are preliminary.

The McGraw-Hill capacity survey displays substantial time trends in its implied measure of operating rates. These arise because any bias in the annual estimate of capacity growth as measured by the survey accumulates through time. In addition, respondents to the capacity survey seem to have failed to detect the slowdown in capacity growth that other evidence suggests has occurred in recent years.

The McGraw-Hill utilization survey turns out to have a cyclical bias such that capacity growth is overstated, and the rise in operating rates understated, in periods when output grows rapidly, with the reverse being true in periods of slow output growth. Respondents to the survey apparently "find" capacity when output grows rapidly, and "lose" it when output growth slows. Such a bias in a survey can be adjusted for; and even without adjustment, the utilization survey is useful for comparing utilization rates at successive business cycle peaks or at other roughly comparable stages of successive business expansions and contractions. Thus it is the most useful measure for comparing 1973 operating rates with previous periods of rapid business expansion.

TODAY'S ECONOMY

Capacity in manufacturing has grown slowly in recent years—at only a 2.8 percent annual rate since 1969, according to the McGraw-Hill utilization survey. As a result, operating rates today are substantially higher than one might have expected in view of the modest growth rate in industrial output over this period. However, output was pushing against capacity limits in only a few industries during 1973. What supply problems have appeared have arisen from shortages in raw materials and from isolated rather than widespread shortages in industrial capacity.

Similarly, an explanation of the rapid run-up in industrial wholesale prices that has occurred during 1973 should be sought not in a widespread

shortage of manufacturing capacity but in the end of Phase II price controls coupled with the spectacular rise in raw materials prices, which climbed rapidly throughout 1972 and accelerated to a 36 percent annual rate of increase in the first half of 1973. Throughout 1973, average operating rates in manufacturing were still substantially below those of 1966. And despite high operating rates in a few industries, capacity shortages can account for only a very minor part of the price explosion that has occurred.