



Canadian Industrial Capacity Utilization Rates: A Brief Summary of Methodology

I Introduction:

Statistics Canada's rates of capacity use (utilization) are available from the first quarter of 1962. They cover goods-producing industries other than agriculture. Service-producing industries are not covered.

The rate of capacity use is the ratio of actual output to capacity (potential) output. The measures of *actual output* used in the production of the rates of capacity use are the measures of real gross domestic product (GDP) at factor cost, seasonally adjusted, by industry. Whereas actual output is observable and measurable, *potential (or capacity) output* is not directly observable. Also, there are different definitions of what exactly is potential output.

One measure of potential output is the *engineering or maximum yield* measure of capacity. This is a measure which reflects the output possible if a plant is operating 24 hours a day, 7 days a week. It assumes the ready availability of all necessary inputs in sufficient quantity to allow producers to reach capacity levels of output. However, the physical capability of a plant does not set its production ceiling so much as the scarcity of inputs, for example, labour. Thus even when the economy is operating at full employment, many plants do not operate at their maximum because other inputs are not available. The availability of labour, raw materials or other inputs can be just as important as market demand in determining intensity of plant use.

Although there are some exceptions (such as blast furnaces), typically plants do not operate continuously - rather, they adopt *normal operation schedules*. Such schedules are based on the usual number of hours per shift, shifts per day, days per week, overtime, vacation and down time for maintenance and repair. When all facilities are operating according to schedule, a physical limit known as the *maximum practical capacity* is reached. This is the level Statistics Canada has adopted in measuring rates or capacity use.

Output-capital ratios are calculated from capital stock estimates and GDP measures and used as the basic ingredient in the estimation of the rates of capacity use. When the rates of capacity use were originally created during the 1970's, the peak output-capital ratio for an industry was considered to represent the period when that industry was approaching its production limits and was set to 100% with the values for all other periods in the series being measured relative to that peak. The method was a form of the so-called "*trend-through-peak*" method.

In 1992, the method adopted to estimate potential output was the *Hoddrick-Prescott filter (HP)*¹. This procedure provides a trend curve which is mathematically derived and thus is more objectively determined than one derived from a visual inspection of the original series. Whereas the trend-through-peak method produces a trend line made up of linear segments at angles to one another, the HP filter produces a smooth, continuous profile. The HP technique also allows the user to adjust specific periods to make the trend curve consistent with related economic indicators of industry performance to maintain, as much as possible, the concept of maximum practical capacity.

II Current Methodology for Manufacturing Industries:

When the HP filter was adopted in 1992, annual survey-based measures of capacity use for manufacturing industries were used in conjunction with other indicators of economic activity to establish annual rates of capacity use. The HP filter series were adjusted accordingly, beginning with the reference year 1991.

As of 1995, a more direct and operationally simpler technique of incorporating the annual levels replaced the HP method. Under the new method, a quadratic minimization function², the annual measures are converted to quarterly measures by incorporating the quarter-to-quarter changes in the output-capital ratios while maintaining a smooth transition from the fourth quarter of one year to the first quarter of the next.

The annual survey

The annual rates of capacity use are collected by the Capital and Repair Expenditures Survey which covers approximately 7,000 establishments. The annual survey question and guide instructions for capacity use in a given year (yyyy) are given below.

Capacity Use Question:

For yyyy, this plant has been operating at what percentage of its capacity?..... % _____

Capacity is defined as maximum production attainable under normal conditions. With regard to normal conditions, please follow the company's operating practice with respect to the use of productive facilities, overtime, work shifts, holidays, etc. When any of your facilities permit the substitution of one product for another, use a product mix at capacity which is most similar to the composition of your yyyy output.

¹For more information, see Laxton D. and R. Tetlow. *A Simple Multivariate Filter for the Measurement of Potential Output*. Technical Report No. 59. Ottawa: Bank of Canada, 1992

²The method is of the Denton (1971) type, based on quadratic minimization subject to constraints. In the case of the rates of capacity use, a linear variant is used and the method minimizes the additive first differences. The resulting adjusted (benchmarked) series is as "parallel" as possible to the observed quarterly series of output-capital ratios (i.e. the quarter-to-quarter movements in the resultant series are kept, as much as possible, to that of the original output-capital ratio series). The resultant series satisfies the annual benchmark values in that the annual average of the resultant series is the same as the annual "benchmark" series.

Instructions on Capacity Use (from reporting guide that accompanies the questionnaire):

Capacity use (utilization) is calculated by taking the actual production level for an establishment (measured in dollars or units) and dividing it by the establishment's capacity production level.

Capacity production is defined as maximum production attainable under normal conditions.

To calculate capacity production, follow the establishment's operating practices with respect to the use of productive facilities, overtime, work shifts, holidays, etc. For example, if your plant normally operates with one shift of eight hours a day five days a week, then capacity will be calculated subject to these conditions and not on the hypothetical case of three shifts a day, seven days a week.

Example

Plant 'A' normally operates one shift a day, five days a week and given this operation pattern, capacity production is 150 units of product for the month. In that month, actual production was 125 units. The capacity use rate for plant 'A' is $(125/150) * 100 = 83\%$.

Now suppose that plant 'A' had to open for a shift on Saturdays to satisfy an abnormal surge in demand for its product. Given this plant's normal operation schedule, capacity production remains at 150 units. Actual production has grown to 160 units, so capacity use would be $(160/150) * 100 = 107\%$.

Weighting of survey responses:

The survey uses sampling weights and gross revenue to weight responses for aggregation to industry levels as defined by the Canadian system of industrial classification (SIC).

III Methodology for estimating rates of capacity use in non-manufacturing:

Electric Power Systems:

Annual rates of capacity use are established by using information on power generated and installed capacity from Manufacturing, Construction and Energy Division and the Canadian Electricity Association. As with manufacturing industries, the annual measures are converted to quarterly measures by incorporating the quarter-to-quarter changes in the output-capital ratios.

Logging and Forestry; Mining, Quarrying and Oil Wells; Construction; Gas Distribution Systems

The quarterly rates of capacity use for these industries are based on output-capital ratios used with the HP filter to determine the trend.

IV Aggregation:

Aggregation of the data (to the level of total manufacturing, for example) is achieved using the gross

domestic product data (GDP) and the rate of capacity use to create estimates of potential output per industry. The GDP by industry is then summed to the level of the desired aggregate and divided by the corresponding sum of the potential output to derive the rate of capacity use at the aggregate level.

For more information:

Mychèle Gagnon,
Investment & Capital Stock Division,
Statistics Canada
Phone (613) 951-0994
Fax (613) 951-3153
e-mail mychèle.gagnon@statcan.ca