7 CAPACITY UTILIZATION AND PRODUCTIVITY MEASUREMENT: AN APPLICATION TO THE U.S. AUTOMOBILE INDUSTRY*
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7.1. Introduction

Capacity utilization measures have traditionally been constructed as indexes of output for a firm, industry, or economy, as compared to "potential" output. The determination of "potential" or "capacity" output has, however, rarely been based on an explicit theoretical economic foundation. Recently various studies, including Berndt and Morrison (1981) and Morrison (1982, 1985, 1986), have provided theoretical and empirical analysis in the tradition of Cassels (1937), Klein (1960), and Hickman (1964) on economic capacity utilization measures within an optimization framework. Capacity output, $Y^*$, is characterized by the steady-state level of production given the existing level of stocks and exogenous prices of inputs and determined as the tangency point between the short- and long-run average cost curves. The capacity utilization (CU) ratio is then constructed as the ratio between this and the realized level of output $Y$, $CU = (Y/Y^*)$.

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Theoretical models based on restricted-cost functions provide the required structure within which to characterize and analyze these measures. These measures allow capacity output to be characterized as an optimal, as contrasted to maximal, output level given input stocks. They also allow for economic interpretation; they provide explicit inference about how changes in exogenous variables will affect $Y^*$ and the CU ratio.

These quantity indexes are useful but it is also important to recognize that additional information can be obtained by analyzing deviations from potential or capacity production—the disequilibrium gap. This information is the implied cost of the gap, which will depend on the shape of the cost curves. This concept of costs is a very specific one; it reflects the costs of operating at an output level other than the steady-state output level given capital (or, in the more general case, with more quasi-fixed factors, given capacity defined as an aggregate of all quasi-fixed factors). This contrasts with the idea of costs of disequilibrium, costs of being at a level of capital ($K$) that is not the long-run equilibrium level given output demand. This distinction is critical; the definition and interpretation of utilization of capacity relies on the concept of optimal (steady-state) use of existing capacity, not on the adaptation of that capacity to existing demand conditions.

Note that this producer-side cost measure is a positive rather than normative concept. Specifically, the excess costs of producing a given output level in disequilibrium as reflected in the shadow valuation of the existing capital stock are costs of adjustment or costs of rigidity for the firm rather than necessarily costs to society. In addition, this measure is valid given many different market structures, for example, for a monopolist producing at a point of nonconstant returns to scale. At an output level $Y$ greater than the capacity level $Y^*$, the shadow value of capital at the margin will exceed the market price, indicating nonoptimal or excess cost use of capacity, even when the average cost curve is downward sloping at the tangency point defining $Y^*$. Finally, these measures are consistent with representations of CU in terms of capital utilization—by a multiplicative index on capital—if this index is based on the shadow price of capital services. This is, in a sense, a variation on Tobin's $q$, which indicates over- or underutilization of the existing capital in terms of its valuation. The approach taken here may, however, be used to model $q$'s for fixed factors in addition to capital, by assessing the deviation of their shadow values from market prices or utilization levels.

The contributions of this chapter include the development and analysis of the positive cost-side measure of utilization of existing capacity, the theoretical implementation of this and the corresponding quantity-side