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## Multifactor Productivity Measurement: A Wild Goose Chase?

*Productivity and Value. The Political Economy of Measuring Progress.* By Folke Døvring New York Praeger, 1987, 194 pages, \$35 00

Reviewed by James H. Hauver

Folke Døvring challenges conventional economic theory in this important new book by arguing that multifactor productivity measurement is conceptually invalid due to insurmountable aggregation and index number problems. Instead, he proposes a disaggregated approach, relying on accumulated single-factor partial productivity measures.

Døvring fails. He ignores important developments in index number theory, which mitigate the problems he describes. He is fundamentally mistaken in his evaluation of chain-link indexes (such as Divisia indexes). He exaggerates the apparent weaknesses of neoclassical production theory, minimizing, for instance, the significance of price adjustment in the working of the economy. He treats labor and capital inconsistently by exaggerating labor's homogeneity. And, he offers no acceptable alternative to multifactor productivity indexes.

Døvring's critique of multifactor productivity measurement is founded on a rejection of neoclassical production theory. Døvring places particular stress on the impossibility of aggregating capital. Capital goods, he argues, are too heterogeneous in purpose or structure, presenting unique problems due to their duration, obsolescence, and variation in lifetime. They have no common quantitative unit analogous to, say, the acre or Btu.

Aggregation problems provide the rationale for Døvring's rejection of multifactor productivity measurement. The measurement of multifactor productivity assumes that both inputs and outputs can be measured and aggregated in a manner that makes them acceptable proxies for physical quantities. Because no common physical unit of measurement exists, aggregation can take place only through the use of constant prices. Døvring argues, however, that the use of constant prices depends upon two false assumptions: that price weights can be used to give meaningful comparisons over time, and that constant prices represent efficient market outcomes. Nor can chain-link indexes provide a basis for aggregating either outputs or inputs.

Døvring argues that multifactor productivity measures are not objective gauges of real productivity gains but reflections of underlying social structure. To escape from institutionally determined class laws, Døvring argues, we must abandon multifactor productivity measurement, with its dependence on market values. Factors must instead be specified in physical terms, which can be done only on a factor-specific basis.

To avoid methodological nihilism, Døvring proposes a return to partial productivity indexes but on a revised basis. Recognizing the limitations of simple partial productivity indexes, Døvring proposes the use of accumulated single-factor productivities for energy, land, and, especially, labor. An accumulated labor productivity index includes both labor used directly in production, and indirect labor embodied in other factors of production. Døvring rejects quality adjustment of labor.

Capital goods must be treated differently. They are heterogeneous and have no common physical unit in common. Nonetheless, capital goods incorporate land, labor, and energy. An economist can calculate how much of these resources have gone into the accumulation of the capital stock. The contribution of design changes (a purely qualitative concept) to overall efficiency improvements can be indirectly inferred from the accumulated quantities of land, labor, and energy. Ultimately, one can obtain an estimate of the capital coefficient without aggregating capital at all.

The conceptual and practical difficulties facing productivity measurement do not justify abandoning the whole enterprise of multifactor productivity research. Real world empirical research will never satisfy all the strictures of pure aggregation theory, but the gap has narrowed over the past 20 years. Researchers have found that some of the most restrictive assumptions used in model building and estimation can be relaxed. Weak separability, for instance, is not required for the estimation of a Tornqvist index of productivity growth. The assumption of homotheticity can also be relaxed. Duality theory, flexible functional forms, and hedonic indexes are theoretical tools that are now expanding the scope and power of productivity research. Economists have a better understanding of the assumptions implicit in their models and the data required for implementing new approaches.

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Economists can initiate improvements in productivity measurement. First, the new fields of duality theory and hedonic indexes appear to offer promising avenues for future productivity research. Duality theory and flexible functional forms have enabled economists to relax many of the stringent assumptions previously required for empirical estimation in productivity studies. Hedonic models express goods in terms of their characteristics rather than the inputs used to produce them, providing a better representation of production technology. Second, capital theory and measurement are probably the weakest areas of productivity measurement. Economists need more accurate and timely estimates of stocks, improved depreciation estimates, and some valid measure of lifetimes of different types of capital stocks. Quality changes in inputs in general are important in understanding the sources of growth.

The US Department of Agriculture (USDA) is already improving its existing productivity measures through the introduction of national Tornqvist indexes of outputs, inputs, and productivity. The new indexes will appear in the next annual *Economic Indicators of the Farm Sector: Production and Efficiency Statistics* in 1989. Along with the shift toward Tornqvist indexes, USDA is making substantial improvements in its estimates of the individual input components.

Dovring fails to offer a credible alternative to multifactor productivity measurement. He exaggerates the homogeneity of land, energy, and especially labor, in contrast to capital. How can the labor of a starting

level professional be considered homogeneous with that of someone with 15 years experience in the same profession? Accumulated single-factor measures are not comprehensive, as Dovring attests. They ignore the contributions of other factors not accounted for in indirect labor. Because capital intensities can vary across economic sectors, the direction of the resulting bias is unclear. Dovring relies on input-output tables to derive technical coefficients for computing indirect labor and energy. Technical coefficients are fixed and can be outdated. Fixed coefficients fix productivity relationships and constrain substitution possibilities. Consequently, Dovring's proposals represent a retreat in productivity research.

Dovring's study of productivity is admirable in some ways. The book is sweeping in scope, and despite its moderate size, covers many productivity issues in surprising depth. Dovring explores the issues raised in analyzing productivity in land, labor, capital, and combinations of inputs. He presents a lucid analysis, remarkably free of technical jargon unless absolutely necessary. Dovring's analysis is nonmathematical, suitable for a general reader and successfully avoids slipping into superficiality. Dovring's work remains cogent, substantial, and penetrating. The book is well worth reading, even by the specialist in productivity studies.

The heart of Dovring's argument, nonetheless, is an attack on multifactor productivity measurement. His arguments fail in destroying the foundations of multifactor productivity research. His proposed alternatives offer no attractive substitute.