

## **Cost Structure and the Measurement of Economic Performance: Productivity Growth, Utilization, Cost Economies, and Related Performance Indicators**

By Catherine J. Morrison Paul.

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This book, a revised version of Professor Paul's 1992 monograph, examines the measurement of productivity growth (as a measure of economic performance) from the production and cost function perspectives, and its decomposition into technical change and scale economies components. Productivity growth is measured as the growth rate in output (or outputs in the case of multiple outputs) minus a weighted average growth rate in inputs. Technical change occurs when a larger maximum quantity of output can be produced from a given quantity of inputs. From the cost side, technical change is measured by the rate of decline in total cost over time, accounting for other factors that could affect total cost. Scale economies refer to the proportional change in output due to a change in inputs by the same proportion, all other factors held constant. From the cost side, scale economies are typically measured using the total cost elasticity with respect to output.

The total cost elasticity can be used to obtain an accurate measure of scale economies when there is one output, exogenous input prices, and all inputs change by the same proportion. The presence of fixed inputs, multiple outputs, endogenous input prices, and other factors affect the cost elasticity independent of output. The computed cost elasticity with respect to output would include these factors, and as a result does not provide an accurate measure of scale economies. Cost economies are referred to as the impact on total cost of a change in output, accounting and adjusting for fixed inputs, multiple outputs, endogenous input prices, and other factors that could affect total cost. The measure of cost economies is the total cost elasticity when these factors are taken into account. The measure of scale economies, computed using the total cost elasticity independent of other factors that can affect total cost, is a component of the measure of cost economies. The author analyzes how externalities, public goods, fixed inputs, regulation, and other factors can affect production cost, productivity growth and its components, and also how to adjust the measures of productivity growth and its components from the production and cost function perspectives to account for these various factors. A description of the chapters in the text is listed below.

Chapters 1 and 2 provide a good and thorough discussion of productivity growth and technical change from the production and cost side perspectives, single-factor and multifactor measures of productivity growth, and the problems encountered with each type of measure. The author also includes a discussion on the determinants of technical change and testing whether technical change is input specific. Chapter 3 focuses on measuring the scale economy component of productivity growth when there are fixed or quasi-fixed inputs, which in turn brings about a discussion on capacity utilization. The author develops production and cost side (dual) measures of capacity utilization. The chapter also describes how to adjust measures of productivity growth when adjustment cost occurs when quasi-fixed inputs deviate from their steady-state values and capital characteristics such as quality, energy efficiency, and vintage are incorporated into the production and cost functions.

Chapter 4 describes short-run and long-run measures of cost economies, primarily from the cost side, when there are multiple outputs, fixed inputs, and endogenous input prices. With multiple fixed inputs or endogenous input prices, a method is presented for incorporating these

factors to measure a long-run total cost elasticity with respect to output. Chapter 5 analyzes how external factors, such as public capital expenditures, education, research and development, capital-specific technology, and human capital, can affect production cost and economic growth. A short-run total cost function would include as arguments different types of capital (private and public), adjustment costs associated with the capital inputs (fixed in quantity), and external factors. The total cost elasticity with respect to output measure that is developed allows for the identification of the contributions of the various types of capital and the external effects to the elasticity.

Chapter 6 discusses how market power in output and input markets can be measured and accounted for in determining the rates of technical change from the production and cost side perspectives. For each market, the author presents a method for measuring market power, and the necessary adjustment in the elasticities of total cost and total output with respect to time (growth rates of total cost and total output over time) for the elasticities to be dual and accurately measure the rate of technical change.

Chapter 7 focuses on the impacts of regulatory constraints on production and cost, as well as parametric and nonparametric methods to measure and model such effects. Using the example of capital investment in pollution abatement equipment, the capital stock measure would be divided into productive and nonproductive (which includes the pollution abatement equipment) capital. The cost side measure of the rate of technical change, adjusted for regulation, involves removing the nonproductive capital component from the total capital stock.

Chapter 8 incorporates technical efficiency into the production process. The author provides a good discussion of the functional forms for estimating stochastic production frontiers and distance functions, with single and multiple outputs, the estimation techniques and statistical packages available, the different error term specifications used in measuring technical efficiency, and the index number approach to measuring productivity growth.

Chapter 9 discusses the theory underlying and properties of the cost, profit, and revenue functions, and how information from the functions can be used to describe the production technology. Chapter 10 describes problems encountered in measuring outputs and inputs, aggregating across outputs and inputs, and the index number approach for computing price and quantity indices. Chapter 11 describes the estimation methods (parametric and nonparametric), models, techniques (least squares, seemingly unrelated regressions) used to estimate the various functions, and situations when the various techniques are appropriate.

Professor Paul has provided readers with a very intuitive, substantial, and well-written book on the measurement and decomposition of productivity growth. In Chapters 3 through 8 the author does a very good job of providing the reader with the intuition behind how externalities, public goods, fixed inputs, and other factors can affect the technical change and cost economies components of productivity growth, and how to adjust the component measures to account for the impacts. The author also reviews numerous studies that have examined the factors and how the factors were incorporated into empirical models. In most cases the author analyzes each factor utilizing a short-run cost function, and then provides a good discussion of how the long-run measure of cost economies can be obtained from the short-run cost function. The author presents in a clear manner how information from the cost function (short-run and long-run), while incorporating these factors, can be used to describe characteristics of the production technology.

In Chapter 9 the author does a very good job of providing the reader with the intuition behind the various functions (cost, production, output distance function), the theoretical prop-

erties the functions satisfy, and the assumptions and restrictions surrounding the various functions. In Chapter 10 the author discusses in great detail the conditions under which aggregation of data are justifiable, the problems encountered when the conditions do not hold, and the information lost when errors in aggregation occur. In Chapter 11 the author provides a very good discussion on properties and problems encountered with estimating several flexible form cost functions, such as the transcendental logarithmic, generalized Leontief, and generalized Leontief quadratic cost functions. The author also provides a good discussion of the various estimation methods mentioned above.

Overall, this book is an excellent book for anyone interested in measuring and decomposing productivity growth, as well as factors that affect its measurement and decomposition. The book gives readers methods to account for the impact of such factors in the measurement of productivity growth and its components. The book also provides readers with insights useful when considering whether a short-run or long-run cost function is the appropriate function to estimate. Professor Paul has provided readers with a very intuitive, substantial, and well-written book on the subject matter with many good references. The book could be used as a textbook for a graduate economics course on productivity growth measurement.

Gerald Granderson  
Miami University

## References

Morrison, Catherine J. 1992. *A microeconomic approach to the measurement of economic performance: Productivity growth, capacity utilization and related performance indicators*. New York: Springer-Verlag Press.

## Economic Conditions and Welfare Reform

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Perhaps nothing makes a good empirical researcher more uncomfortable than being asked to speculate on the effects of policy changes that represent a big departure from previous policy. *Economic Conditions and Welfare Reform* is an intriguing collection of essays that presents this exact challenge to several of the top welfare policy researchers across the country. The nine papers in this volume (presented as part of a conference organized by the Joint Center for Poverty Research) ask the authors to "use their analyses to predict what is likely to happen to welfare caseloads, to recipient well-being, and to state budgets and policies when the next recession arrives" (p. 2). Given that the "next recession" is now upon us, it is hard to imagine a more timely collection of essays.

The papers in this volume are among the first to explore the implications of the new era for the welfare system in the United States, ushered in with the passage of the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) in August 1996. PRWORA ended the entitlement to cash support for low-income single-parent families by abolishing Aid to Families with Dependent Children (AFDC) and replacing it with block grants to the states, that is, the Temporary Assistance for Needy Families (TANF) program. TANF allows states more discretion in setting rules for their welfare programs, and has intensified the emphasis on