

The State of Productivity Research: *The Oxford Handbook of Productivity Analysis: A Review Article*

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As a key concern both for policymakers and businesses, productivity is the focus of a large body of academic and statistical agency research. The range of measurement approaches and analytical findings is so wide that keeping up with the field is a real challenge.

Help with this problem has arrived with the publication in 2018 of the *Oxford Handbook of Productivity Analysis*, by Oxford University Press edited by Emili Grifell-Tatjé from Universitat Autònoma de Barcelona, C. A. Knox Lovell from University of Queensland and Robin C. Sickles from Rice University. The *Handbook* provides a broad overview of productivity measurement and analysis followed by in-depth explanations of many productivity techniques and findings. In addition, the *Handbook* addresses topics of interest to users and compilers of national accounts and price statistics, such as hard-to-measure services of businesses and the public sector, and branches out into emerging areas of indicators of well-being.

This review article begins with a discussion of the Editors' Introduction in Part I of the *Handbook*, which provides overviews of both the general field of productivity analysis and of the chapters in the volume. It next summarizes the areas of inquiry and key findings of the 23 topical chapters of Parts II, III and IV. It concludes with some reflections on the strengths and weaknesses of the *Handbook* and on the general state of the field.

Editors' Introduction: Overview of Productivity Analysis: History, Issues and Perspectives

Coming in at 73 pages, the editors' introduction integrates highlights of each of the *Handbook's* chapters with an impressive general review of the field of productivity analysis that considers productivity's significance, measurement, dispersion, and drivers. The significance of productivity includes microeconomic aspects such as businesses' financial performance,

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macroeconomic aspects such as the time required to implement major innovations across the economy, and well-being aspects. Regarding well-being, the faster growth of the standard of living than real GDP implied by Gordon's (2016) history of the US standard of living since the Civil War suggests that measured output growth (which the productivity statistics reflect) has often understated the welfare gains from new and improved goods. But recent headwinds such as rising inequality suggest a measurement gap in the opposite direction. Inequality and environmental impacts are critical aspects of well-being for understanding the significance of measured productivity growth. The Stiglitz-Sen-Fitoussi (2009) report has highlighted their importance and is part of the backdrop of the chapters that cover dimensions of well-being.

The editors' overview of productivity measurement includes dynamic productivity measures, in which intermediate inputs are produced for use in a later period. It also reviews index number and estimation-based approaches, efficiency (distance from the frontier) and knowledge spillovers in models of endogenous growth, issues in empirical estimation by statistical agencies and others such inputs of varying quality and hard-to-measure outputs, and methods to distinguish efficiency from technology. Inefficiency and slow diffusion of best practices are taken up again in the discussion of productivity dispersion, which is often found to be large. Distance-to-the-frontier scores also find a role in analysis of drivers of productivity performance as part of the calculation of the World Bank's *Ease of Doing Business* index.

The Topical Chapters

The depth and breadth of coverage of the field of productivity research and analysis in the topical chapters is indicated by the heft of this book, which contains 843 pages. Part II contains seven chapters on foundations, Part III contains eight chapters on microeconomic analysis of productivity drivers and effects, and Part IV contains eight chapters on macroeconomic analysis. The large number of distinguished productivity researchers who contributed chapters adds to the interest of the book.

Chapters in the foundations section explain productivity growth indexes and productivity level change indicators, distance function techniques for analysis of production processes with multiple outputs, and estimation of dynamic efficiency and technical change using data envelope analysis (DEA) techniques. The chapter on the labour and multifactor productivity indexes produced by the U.S. Bureau of Labor Statistics explains the details of their construction, including questions such as why the productive capital stock is not the same as the wealth capital stock. Other chapters in this section consider the measurement challenges presented by the high-tech, financial and health care industries and the unpriced services of the public sector. The section concludes with a chapter on productivity and the environment that considers materials balance models of joint production of goods and environmental "bads," and static and dynamic models of productivity effects of environmental regulations.

The microeconomic section of the *Handbook* opens with several chapters on analyt-

ical links between productivity and financial performance of firms. Analyses of productivity and the socioeconomics of family-owned firms have found that family ownership tends to be associated with higher productivity when the firm is relatively small, but lower productivity when the firm is large as the effects of prioritizing the preservation of family socioeconomic wealth and jobs for family members became more prevalent. An examination of innovation, management practices and productivity finds that reliable progress in the short run may come at the cost of sacrificing large but riskier advances in the long run, as good management practices for fostering incremental improvements may be bad for fostering truly novel innovations. Here, Amos Tversky's observation about wasting years by not being able to waste hours seems apropos.

Other chapters in this section examine the effects of international trade on innovation and productivity at the firm level. Mark-ups reflecting market power can distort standard techniques for estimating the productivity effects of trade and trade liberalizations, as well as firm-level productivity effects in other contexts. The chapter on this problem also reviews techniques for estimating mark-ups and the presence of market power, a much-discussed concern in the present era of increasing industry concentration.

The microeconomic section concludes with chapters on measuring efficiency and productivity in regulated industries. The explanations of strategies for handling noisy and incomplete information and multiproduct firms, and of DEA approaches to regulatory benchmarking are particularly

useful.

In its macroeconomic section, the *Handbook* returns to the topic of the public sector, reviewing the productivity analysis literature on education and health care. A chapter on productivity and welfare performance of the public sector uses several approaches to subsume multiple dimensions of well-being (in this case, poverty, inequality, unemployment, life expectancy and education) in an overall welfare index. The results illustrate one of the drawbacks of this type of welfare index. An approach similar to that of the UN's *Human Development Index* ranks Spain last among 28 EU countries, while another welfare index based on unconstrained DEA scores has Spain tied for *first* place. The sensitivity of Spain's rank to the way the index is constructed (whose origins can be traced to the weights on unemployment and life expectancy) shows that caution is necessary when using welfare indexes. These indexes have become popular for summarizing multiple dimensions of well-being in a single number, but dashboards appear to be a safer alternative.

The macroeconomic section also contains a helpful discussion of methods for defining and measuring productivity dispersion—differences in productivity levels across establishments—and of its significance. It is followed by a chapter presenting a decomposition of value-added change into the five sources of efficiency: output prices, input prices, primary inputs, technical progress, and returns to scale. A chapter by Dale Jorgenson on the World KLEMS initiative and its findings includes a novel comparison of productivity in the United States and Japan based

on industry-level purchasing power parities (PPPs).

Standard KLEMS analyses have been complicated by the fragmentation of the production process into many steps done in different countries. A chapter on global value chains decomposes these value chains² using tools originally developed for input-output analysis. Global value chains have raised the share of the income from production going to capital, which includes the returns to intangible capital. Shares received by highly skilled labour have also risen, leaving less for low skilled labour, and capital is found to be complementary to high skilled labour.

Industry-level productivity analysis is taken up next, in a chapter that analyses sources of differences in productivity levels and growth, finding evidence of convergence. The chapter on “Productivity and Economic Development” looks beyond growth to focus on inequality and inclusive growth as key aspects of development success, noting that productivity growth is necessary but not sufficient for achieving shared prosperity. The article also highlights the key role of education in the development of the Asian “tigers,” noting the human capital accumulation needs to be biased towards higher skills to have a large pay-off.

The volume closes with a very useful review of techniques and some new findings on the labour productivity growth of nations. Human capital is among the factors included in the analysis of the drivers of

labour productivity. Human capital deepening has an important effect, and omitting this variable causes the contribution of physical capital deepening to be overestimated.

Comments and Items for a Future Work

The *Oxford Handbook of Productivity Analysis* is not the first handbook on productivity; handbooks already exist that focus on productivity measurement for purposes such as official statistics or industrial management. However, this handbook fills a need for an academic reference that covers the wide range of research techniques and findings on productivity analysis and identifies emerging areas.

Some minor weaknesses of the book are that its review of the literature mentions some papers of dubious quality, and in the topical chapters a few rambling discussions could be sharpened. Also, it is unfortunate that space could not be found in this already-lengthy volume for some important and emerging topics in productivity research. Decompositions showing the industry contributions to aggregate productivity change, inputs of natural resources and the environment, and the measurement of human capital receive little attention. Issues related to globalization, such as effects on productivity measurement of profit-shifting by multinational enterprises are not mentioned. And notwithstanding the commendable attention to well-being

² The inclusion of the value added attributable to the intangible capital such as R&D, brand equity and logistics systems distinguishes “value chains” from “supply chains”.

in the introduction on the significance of productivity, the coverage of inequality and other aspects of well-being in the chapters is rather sparse. In light of the growing emphasis on well-being and sustainability, how indicators of these dimensions can help to inform our interpretation of the productivity statistics and give a more nuanced picture of economic performance would be worth exploring in greater depth in a future volume.

Finally, the productivity slowdowns that started in 1973 and in the mid-2000s also receive no attention despite the large literatures that they have inspired. The most recent slowdown has generated findings and raised questions that would be worth exploring in a future reference on productivity analysis. Some findings that might be covered are that financial frictions exacerbated by the financial crisis depressed productivity growth, and that the slowing diffusion of best practices has expanded the productivity distance between the average firm and the firms at the frontier.

A debate over measurement of the digital economy sparked by the productivity slowdown also raises questions worth considering. Tight links between prices and marginal costs (which underlie many productivity estimation techniques) have become an increasingly untenable assumption as free and nearly-free services from digital platforms have proliferated, and network externalities help small numbers of winners to control nearly the entire market. The suppliers of the free services generally enjoy ample profits, reflecting the fact that the free items help them sell other marked-up items. Using shadow prices that undo the cross-subsidization may change the picture

of productivity growth. For example, when Aizcorbe, Byrne and Sichel (2019) correct the weights on the nearly-free cell phones and adjust the cell-phone index for quality change, they find that these corrections add 4 percentage points to the estimated growth rate of the index for the bundled phones and telecom services. Furthermore, new kinds of data assets have enabled innovation and product differentiation that are rewarded through higher mark-ups.

Of course, a single book-length reference cannot be expected to cover everything in such a multi-faceted field as productivity analysis. All-in-all, the *Oxford Handbook of Productivity Analysis* is an extremely valuable reference, either for a general introduction and overview of the field of productivity analysis or as a reference for looking up in-depth explanations, findings and examples. In view of the Handbook's importance, its pricing at a level that will impede its accessibility to many researchers is unfortunate. The price of the hard copy is \$125 US. Access for many will only be through libraries that have purchased a hard copy or have access to the on-line version, and in an area of tight library budgets, their number may be limited. Let us hope that a reasonably priced paperback version of the Handbook will appear soon, so that the many excellent papers in this important volume will have the attention they greatly deserve.

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