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HANDBOOK OF ECONOMIC GROWTH

VOLUME 1B

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NORTH-HOLLAND

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VOLUME 1B

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INTRODUCTION TO THE SERIES

The aim of the *Handbooks in Economics* series is to produce Handbooks for various branches of economics, each of which is a definitive source, reference, and teaching supplement for use by professional researchers and advanced graduate students. Each Handbook provides self-contained surveys of the current state of a branch of economics in the form of chapters prepared by leading specialists on various aspects of this branch of economics. These surveys summarize not only received results but also newer developments, from recent journal articles and discussion papers. Some original material is also included, but the main goal is to provide comprehensive and accessible surveys. The Handbooks are intended to provide not only useful reference volumes for professional collections but also possible supplementary readings for advanced courses for graduate students in economics.

KENNETH J. ARROW and MICHAEL D. INTRILIGATOR

PUBLISHER'S NOTE

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PREFACE TO THE HANDBOOK OF ECONOMIC GROWTH

> The progress which is to be expected in the physical sciences and arts, combined with the greater security of property, and greater security in disposing of it, which are obvious features in the civilization of modern nations, and with the more extensive and skillful employment of the joint-stock principle, afford space and scope for an indefinite increase of capital and production, and for the increase of population that is its ordinary accompaniment.
>
> John Stuart Mill, *Principles of Political Economy*, 1848

Interest is economic growth has been an integral part of economics since its inception as a scholarly discipline. Remarkably, this ancient lineage is consistent with growth economics representing one of the most active areas of research in economics in the last two decades. Perhaps more surprising, this activity followed a relatively long period of calm in the aftermath of the seminal theoretical and empirical work by Robert Solow on the neoclassical growth model [Solow (1956, 1957)]. Solow's research set the growth research agenda for over 25 years. In terms of economic theory, much of the work of the 1960's consisted of translating the Solow framework into an explicit intertemporal optimizing framework; this translation, enshrined in economics as the Cass–Koopmans model [David Cass (1965), Tjalling Koopmans (1965)] has been of great importance in much of the new growth theory as well. In terms of empirical work, Solow's accounting framework stimulated many studies [a style of work well summarized in Edward Denison (1974)] which attempted more elaborate decompositions of growth patterns into components due to human and physical capital accumulation and a technology residual. Indeed, from the perspective of 1980, growth economics might have itself appeared to have achieved a steady state.

This apparent steady state was shattered on both the theoretical and empirical levels in the late 1980's and the 1990's. In terms of theory, new models of endogenous growth[1] questioned the neoclassical emphasis on capital accumulation as the main engine of growth, focusing instead on the Schumpeterian idea that growth is primarily driven by innovations that are themselves the result of profit-motivated research activities and create a conflict between the old and the new by making old technologies become obsolete. On the empirical side, Robert Barro (1991) and N. Gregory Mankiw,

[1] Also based on capital accumulation are the so-called AK models of endogenous growth [Frankel (1962), Romer (1986), Lucas (1988)], in which capital accumulation generates knowledge accumulation. See the books by Grossman and Helpman (1991), Jones (2002), Barro and Sala-i-Martin (2003) or Aghion and Howitt (1998), for other references.

David Romer, and David Weil (1992) launched the use of cross-country growth regressions to explore growth differences across countries; a cross-section that is far more extensive and covers much more of the world than occurred in earlier growth studies. These two parallel developments themselves gave birth to a whole range of new theoretical and empirical explorations of the determinants of growth and convergence – in particular the economic organizations and policies and the political institutions that are growth-enhancing at different stages of development. At the same time, new empirical methods were developed to reexamine issues of growth accounting on one end and which have begun to employ sophisticated statistical methods to uncover heterogeneities and nonlinearities on the other.

This renaissance of growth economics reflects several factors. On the theory side, much of the work has been stimulated by modeling techniques imported in the 1970s from the new theory of international trade[2] or the new theory of industrial organization,[3] which made it possible to introduce imperfect competition and innovations in simple general equilibrium settings. Empirical work has been facilitated by the construction of new data sets, of which Alan Heston and Robert Summers [see Heston, Summers and Aten (2002) for the latest incarnation] has been especially influential. More recent work has made increasing use of new micro data, whether cross-industry, or cross-firm, or plant level. The availability of these new data sets, in turn has initiated a new phase in growth economics in which theory and empirics go hand in hand as the development of new growth theories generates or is itself prompted by the introduction of new statistical tools and empirical exercises. This phase is particularly exciting as one can more directly analyze the impact of specific institutional reforms or macroeconomic policies on economic growth across different types of countries.

The *Handbook of Economic Growth* is designed to communicate the state of modern growth research. However, in contrast to other handbook volumes, we looked for chapters by active growth researchers. We then asked these authors to primarily convey the frontier ideas they are currently working on, anticipating that in order to put the reader up to speed with their current research agendas, the authors would also have to provide introductory surveys of contributions in their fields. As our readers will see, some chapters contain overlaps with other chapters and in a number of cases they partly disagree with one another. This only shows that growth economics is a lively field, with professional disagreements, alternative perspectives and outstanding controversies, but at the same time there exists a common eagerness to better understand the mechanics of economic development.

The Handbook consists of 28 chapters and is divided into six parts.

Part I lays out the theoretical foundations. The first chapter surveys the neo-classical and AK models of growth. The second chapter develops the Schumpeterian growth

[2] See the product variety models of Romer (1990) and Grossman and Helpman (1990) and the whole literature that builds upon this approach, surveyed in Chapter 3 below.

[3] The Schumpeterian models with quality-improving innovations, starting with Segerstrom, Anant and Dinopoulos (1990) and Aghion and Howitt (1992), belong to this second category.

model with quality-improving innovations and confronts it with new empirical evidence. The third chapter surveys the literature that built upon Paul Romer's product-variety model. The fourth chapter looks at growth in the very long run and analyzes the interplay between technical change and demographic transitions, and explores the issue of transitions between different growth regimes. The next chapter analyzes the central role of economic and political institutions, and describes the mechanisms whereby the dynamics of political institutions interacts with the dynamics of economic institutions and that of income inequality. The following chapter focuses on the emergence and existence of poverty traps, a question of particular importance in development contexts. The final chapter further explores the interplay of growth economics and development economics, with particular attention to how factors such as credit market constraints and intersectoral heterogeneity can explain outstanding puzzles concerning capital flows and interest rates, which are major elements of the growth process.

Part II examines the empirics of growth. An important aspect of these chapters is the diversity of approaches that have been taken to link growth theory to data. Growth accounting continues to play an important role in growth economics, both in terms of organizing facts and in terms of identifying the domain in which new growth theories can supplement neoclassical explanations. Growth economics has at the same time stimulated the development of new econometrics tools to address the specific data implications of various growth theories, implications in some cases challenge the assumptions that underlie conventional econometric tools. One theme of the work in this Part of the Handbook is that there exist limits to what may be learned about the structural elements of the growth process from formal statistical models. At the same time, empirical growth work plays a key role in identifying the stylized facts that growth theories need to address.

Part III of the Handbook examines a range of growth mechanisms. Some of these mechanisms have to do with the microeconomics of technology and education. Other mechanisms lie outside the domain of the neoclassical model and have to do with issues of political and economic institutions and social structure. Another theme that is developed here concerns the links between inequality and growth, which naturally raises issues of equity/efficiency tradeoffs. Finally, the role of government policy in affecting long run growth is studied. Much of the exciting work on growth has consisted of efforts to understand how factors beyond capital accumulation and technological change can affect growth; this very broad conception of the growth process is reflected in this section.

Part IV explores a range of aspects concerning technology. The discussion starts with a chapter that reviews the history of technology from a growth perspective. This discussion is a valuable complement to the formal statistical analyses studied in Part II. The analysis then turns to alternative theories by which technology evolves and diffuses in an economy. General purpose technologies are studied as an engine of growth. The consequences of technological diffusion for economic transformations are described and the inequality consequences of technological change are considered. Finally, the role of technology barriers in producing persistent international inequality is examined.

Part V considers the relationship between trade and geography. The discussion explores how trade and geographic agglomeration can affect growth trajectories as well as how growth interacts with geography to produce national boundaries.

Further, some of the consequences of economic growth for a range of macroeconomic phenomena are explored in Part VI. Different chapters explore how growth affects inequality, sociological outcomes, and the environment.

Finally, we are honored that Robert Solow has contributed a set of reflections on the state of growth economics to complete the Handbook. While growth economics has made immense strides in the last two decades, it is of course the case that the field "stands on the shoulders of giants". And in this regard, Solow's contributions are not alone. One can see the intertemporal optimization methodology that underlies the current theoretical analyses in the work of Frank Ramsey [Ramsey (1928)] and the ideas of social increasing returns in an early paper by Kenneth Arrow (1962). Such observations do not diminish the new growth economics, but rather speak well to the nature of progress in economics.

We would like to thank Kenneth Arrow and Michael Intriligator for their support in initiating this project as well as in providing invaluable guidance throughout the process. Valerie Teng of North-Holland, Lauren LaRosa at Harvard and Alisenne Sumwalt at Wisconsin have provided terrific administrative assistance at various stages of this project. And of course, we are deeply grateful to the authors for their work. If nothing else, their contributions reinforce our view that the human capital contribution to production takes pride of place, at least when the growth of knowledge is concerned.

Philippe Aghion and Steven Durlauf

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