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0521835615 - Economic Growth and Macroeconomic Dynamics: Recent Developments in Economic Theory

Edited by Steve Dowrick, Rohan Pitchford and Stephen J. Turnovsky

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## ECONOMIC GROWTH AND MACROECONOMIC DYNAMICS

Interest in growth theory was rekindled in the mid-1980s with the development of the endogenous growth model. In contrast to the earlier neoclassical model in which the steady-state growth rate was tied to population growth, long-run endogenous growth emerged as an equilibrium outcome, reflecting the behavior of optimizing agents in the economy. This book brings together a number of contributions in growth theory and macroeconomic dynamics that reflect these more recent developments and the ongoing debate over the relative merits of neoclassical and endogenous growth models. It focuses on three important aspects that have been receiving increasing attention. First, it develops a number of growth models that extend the underlying theory in different directions. Second, it addresses one of the concerns of the recent literature on growth and dynamics, namely the statistical properties of the underlying data and the effort to ensure that the growth models are consistent with the empirical evidence. Third, macrodynamics and growth theory have focused increasingly on international aspects, an inevitable consequence of the increasing integration of the world economy.

Steve Dowrick is Professor and Australian Research Council Senior Fellow in the School of Economics, Australian National University. He is coeditor with Ian McAllister and Riaz Hassan of *The Cambridge Handbook of Social Sciences in Australia* (Cambridge University Press, 2003) and author of numerous papers in leading journals in economics including the *American Economic Review*, the *Review of Economics and Statistics*, and the *Economic Journal*. A Fellow of the Australian Academy of Social Sciences, Professor Dowrick's current research focuses on the factors promoting as well as deterring convergence for economic growth.

Rohan Pitchford teaches economics in the Asia Pacific School of Economics and Management of the Australian National University. His research interests are in law and economics, industrial organization, and contract theory and application, including creditor liability and the economics of combining assets. Dr. Pitchford's papers have appeared in the *American Economic Review*, the *Journal of Economic Theory*, and the *Journal of Law, Economics, and Organization*, among other refereed publications.

Stephen J. Turnovsky is Castor Professor of Economics at the University of Washington, Seattle, and previously taught at the Universities of Pennsylvania, Toronto, and Illinois, Urbana-Champaign, and the Australian National University. Elected a Fellow of the Econometric Society in 1981, he coedited with Mathias Dewatripont and Lars Peter Hansen the Society's three-volume *Advances in Economics and Econometrics: Theory and Applications, Eighth World Congress* (Cambridge University Press, 2003). He has written four books, including *International Macroeconomic Dynamics* (MIT Press, 1997) and *Methods of Macroeconomic Dynamics: Second Edition* (MIT Press, 2000), and many journal articles. His current research in macroeconomic dynamics and growth covers both closed and open economies.

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# Economic Growth and Macroeconomic Dynamics

## Recent Developments in Economic Theory

Edited by

STEVE DOWRICK

Australian National University

ROHAN PITCHFORD

Australian National University

STEPHEN J. TURNOVSKY

University of Washington



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## Preface

Economic growth continues to be one of the most active areas in macroeconomics. Early contributions by Robert Solow (*Quarterly Journal of Economics*, 1956) and Trevor Swan (*Economic Record*, 1956) laid the foundations for the research that was conducted during the next 15 years or so. Intense research activity continued until the early 1970s, when, because of inflation and oil shocks, interests in macroeconomics were redirected to issues pertaining to short-run macroeconomic stabilization policies. Interest in growth theory was rekindled in 1986 with the contribution by Paul Romer (*Journal of Political Economy*, 1986) and the development of the so-called endogenous growth model. In contrast to the earlier models in which the steady-state growth rate was tied to the population growth rate and, thus, was essentially exogenous, the long-run growth emerged as an equilibrium outcome, reflecting the behavior of the optimizing agents in the economy. Research in growth theory is continuing and is now much more broadly based than the earlier literature of the 1960s.

This book brings together a number of contributions in growth theory and macroeconomic dynamics that reflect these more recent developments and ongoing debates over the relative merits of neoclassical and endogenous growth models. In so doing, we focus on three areas that have received attention recently. First, we develop a number of growth models that extend the theory in different directions. Second, one concern of the recent literature in growth and dynamics is on the statistical properties of the underlying data and on trying to ensure that the growth models are consistent with the empirical evidence. Third, macrodynamics and growth theory has focused increasingly on

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international aspects, no doubt a reflection in part of the increasing integration of the world economy.

The idea for this book was stimulated in part by the writings of John Pitchford, an emeritus professor at the Australian National University (ANU), who has worked extensively in the general area of macrodynamics over the past 40 years, making many seminal contributions. Perhaps most notable is the fact that his 1960 paper published in the *Economic Record* was in fact the first published formulation and analysis of the constant elasticity of substitution (CES) production function, which of course has been a central relationship in both theoretical and quantitative macroeconomics since then. Most people are unaware that the Pitchford paper actually predates the Arrow, Chenery, Minhas, and Solow paper (*Review of Economics and Statistics*, 1961), but that is in fact the case. In his paper, Pitchford also demonstrated that, for a high elasticity of substitution, the equilibrium in his model might involve ongoing growth, making it an early (but not the earliest) example of an endogenous growth model as well. Pitchford also made important contributions, of both a theoretical and statistical nature, in international macroeconomics, including work on the current account. Thus, the purpose of this book is to bring together high-level contemporary contributions in some (but not all) of the areas of macrodynamics with which Pitchford himself is associated.

It will be apparent to readers of this volume that it has a distinctly “Australian” and, more specifically, “ANU” flavor. Indeed, Trevor Swan himself wrote his seminal paper at the ANU, whereas Pitchford’s 1960 paper was written during the period he was at the University of Melbourne, shortly before he joined the ANU. In fact, the ANU has a strong tradition in macroeconomic dynamics in which John Pitchford has played a pivotal role. Back in 1977, he and Stephen Turnovsky edited a collection of ANU papers titled *Applications of Control Theory to Economic Analysis* and published by North-Holland. This was one of the first comprehensive sets of papers in the area and had some influence in this growing area over the subsequent years. Accordingly, in selecting the papers, and in part to honor this tradition spearheaded by Pitchford, most (but not all) of the authors have some Australian, and in particular some ANU connection, either as former students, colleagues, or visitors. We view this as significant, since

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Australia, being a small open economy, offers its own challenging problems to issues in macroeconomic dynamics and growth.

The book comprises eight chapters dealing with the following topics.

#### PART ONE: TOPICS IN GROWTH THEORY

The book begins by reprinting John Pitchford's seminal paper on the CES production, which was originally published in the *Economic Record* in 1960. In addition to exploring its properties, this paper also shows how for values of the elasticity of substitution greater than one capital accumulation is capable of generating long-run endogenous growth. Thus, in addition to pioneering the CES production function, it is also one of the first endogenous growth models as well.

Chapter 2 by Long and Shimomura investigates an old idea that has not received the attention it deserves in economics, which is the proposition that people are concerned with their relative rather than their absolute well-being. Recently, a number of papers have been written under the rubric of "keeping up with the Joneses," "habit formation," and "time-dependent utility." According to this literature, agents' utility depends on their relative, as well as their absolute, level of consumption. Long and Shimomura apply this to wealth, rather than consumption, investigating its implications for the dynamics of both the standard neoclassical growth models and endogenous growth models. They consider the possibility that individuals may desire to increase their wealth not just for its own sake but to improve their standing relative to others, investigating the consequences for inequality and growth. Concern for relative wealth induces a "Rat Race": everybody tries harder because everyone else is trying harder, increasing the level of saving, investment, and growth above the social optimum. Wealth consciousness also tends to reduce inequality over time – the relatively poor have a greater incentive to improve their position than the rich have to maintain their position. The authors find sufficient conditions for these tendencies to hold.

Aghion, García-Peñalosa, and Howitt take a different view of the process driving growth. Rather than relying on the accumulation of physical capital, they argue that growth is fueled by investment in research and development, producing innovative products and processes.

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The paper responds to the challenge of the 1990s neoclassical counter-revolution by showing that adaptations to the simple Schumpeterian model of endogenous growth do allow it to explain features such as conditional convergence among “clubs” of countries, once allowance is made for technological spillovers between countries. Countries that invest in human capital and research are able to take advantage of ideas developed in other countries. An innovative aspect of the paper is the distinction the authors draw between “creating knowledge” and “absorbing knowledge.” With regard to the first issue, the authors show how the Schumpeterian framework can yield insights on the impact of institutions, legislation, and policy on the rate of knowledge creation and, thus, on the growth rate of productivity. The second topic pertains to the transmission of knowledge across countries and its consequences for cross-country convergence.

#### PART TWO: STATISTICAL ISSUES IN ECONOMIC GROWTH AND DYNAMICS

Chapter 4 by Dowrick is also concerned with the dynamics of economic growth. The focus here is on the method used to approximate the growth dynamics of the neoclassical growth model in order to estimate the speed of convergence to steady state. A celebrated paper by Mankiw, Romer, and Weil (*Quarterly Journal of Economics*, 1992) takes a first-order approximation to the growth dynamics and estimates rates of convergence for a cross section of 97 countries. Dowrick demonstrates that these estimates underestimate the true rate of convergence because of errors in specifying the linearized dynamics. He provides corrected estimates based on nonlinear estimation techniques.

Barnett and He look at the bifurcation of parameter spaces in macroeconomic models. They identify the presence of what they call singularity bifurcation and compare it to other more familiar forms of bifurcation, such as the Hopf bifurcations. Bifurcation in general is important in understanding the dynamics of modern, macromodels, and singularity bifurcation, although known in engineering, is less familiar to economists. Barnett and He emphasize its potential importance to economics, particularly with the increased usage of Euler equations and in the estimation of their underlying “deep” parameters.



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## PART THREE: DYNAMIC ISSUES IN INTERNATIONAL ECONOMICS

In Chapter 6, Fisher and Vousden develop an  $n$  country model, with each levying its own tariff, capital flowing freely across international borders, but wherein labor is a fixed factor in each country. It contrasts static trade creation, an increase in the volume of trade at a fixed growth rate, with dynamic trade creation, which arises if the change in the growth rate raises the volume of trade. The paper shows that the introduction of a tariff creates net trade if and only if it raises the growth rate of the world economy. The authors also establish that the growth effects of customs unions and free trade areas depend on whether their member countries are sources or hosts of foreign investment.

Chatterjee and Turnovsky explore the implications of tying foreign aid to public investment, an important issue motivated by recent conditions imposed by the European Union on potential member nations. The analysis uses the framework of an endogenous growth model in which both public and private capital are productive factors. The model allows for installation costs and for varying degrees of substitutability between public and private capital, employing for this purpose the CES production function. The paper demonstrates that the benefit of tying aid to public investment is crucially dependent on the elasticity of substitution and the magnitude of installation costs. It has important public policy implications, suggesting that tied aid may be particularly appropriate for less-developed economies, where the elasticity of substitution between public and private capital is typically low.

The final paper by Jones discusses an important issue in aggregation, emphasizing how smooth aggregate data may disguise what he calls churning behavior at the microlevel, whereby some sectors are growing at, say, 40% a year while others are declining at the same rate. The paper considers a pair of examples of this phenomenon in an open economy, one focused on international trade and the other on technology. The analysis shows how some of the current leaders may become the next period's followers in a world in which there is technological progress, despite the existence of perfect foresight and no myopia.

Overall, we view these eight papers as providing a cohesive set of contributions in three intersecting areas of modern macrodynamics, encompassing the theoretical aspects, particularly of growth, and the numerical and statistical aspects, as well as dealing with some

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international issues. In focusing on these topics we feel that it is a reflection of modern macrodynamics, in general, and growth theory, in particular. At the same time, by linking the material back to some of the early work on production theory and growth, we are reminding ourselves of the origins of some of our current work, something that is all too often forgotten. One final note: Neil Vousden, the coauthor of Chapter 6, was John Pitchford's first Ph.D. student and subsequent colleague at the ANU. Neil was an outstanding economist and an important contributor to the literature on trade protection, among other fields. Regrettably, he passed away in December 2000 at an all-too-early age.

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## Contributors

Philippe Aghion  
Department of Economics  
University College London  
London, United Kingdom  
and  
Department of Economics  
Harvard University  
Cambridge, Massachusetts

William Barnett  
Department of Economics  
University of Kansas  
Lawrence, Kansas

Santanu Chatterjee  
Department of Economics  
University of Georgia  
Athens, Georgia

Steve Dowrick  
Department of Economics, School of Economics  
Australian National University  
Canberra, Australia

Eric Fisher  
Department of Economics  
Ohio State University  
Columbus, Ohio

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*Contributors*

Cecilia García-Peñalosa  
GREQAM  
Université Aix-Marseille III  
Marseille, France

Yijun He  
Department of Economics  
Washington State University  
Pullman, Washington

Peter Howitt  
Department of Economics  
Brown University  
Providence, Rhode Island

Ronald W. Jones  
Department of Economics  
University of Rochester  
Rochester, New York

Ngo Van Long  
Department of Economics  
McGill University  
Montreal, Quebec, Canada

John D. Pitchford  
Department of Economics  
Research School of Social Sciences  
Australian National University  
Canberra, Australia

Rohan Pitchford  
Asia Pacific School of Economics and Management  
Australian National University  
Canberra, Australia

Koji Shimomura  
RIEB  
Kobe University  
Kobe, Japan

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*Contributors*

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Stephen Turnovsky  
Department of Economics  
University of Washington  
Seattle, Washington

Neil Vousden (now deceased)  
Australian National University  
Canberra, Australia