Introduction to Economic Growth

Charles I. Jones

New York, W. W. Norton & Company, 1998, xii + 200 pp., AU$41.95, ISBN 0-393-97174-0

The purpose of this book as stated in its introduction is to explain and explore the modern theories of economic growth, and to make this cutting-edge research accessible to readers with only basic training in economics and calculus (p. 2). The author, who is one of the major contributors to this literature, has fully achieved his aim. This relatively short book (about 160 pages of main text) is a must for anybody looking for a comprehensible and concise introduction to the highly technical literature on modern 'mainstream' economic growth theory. It makes the literature accessible to undergraduates and non-specialists. The book provides an admirable synthesis of the subject area. It is an ideal stepping-stone for those wanting to consult the original literature. It also emphasises the importance of non-economic factors, and the lack of a formal theory of the ultimate sources of growth.

The book addresses three central questions about economic growth. (1) What explains the differences in levels of development and the world distribution of per capital income (why are some countries poor, why are others rich)? (2) What is the engine of economic growth (technological progress, how does it occur, how is it sustained)? (3) How can growth miracles be explained? The author provides a summary of the answers to these questions in the last chapter (chapter 9). Throughout, theory is supplemented by empirical data to illustrate the main issues.

Chapter 1 begins with an outline of the 'stylised facts' of economic growth, i.e. the broad empirical regularities of growth and development which a theory of economic growth has to explain. It should be noted that the major stylised facts are concerned with cross-country differences in growth rates of per capita income, superseding Kaldor's stylised facts which were the focus of the 'old' neoclassical growth theory.[1] This clearly indicates the shift in focus which has occurred in mainstream growth theory over the last 10 years or so.

Chapters 2 and 3 introduce the well-known Solow-model, the workhorse of neoclassical growth theory, its recent descendants and empirical applications of the models. As is well-known, although economic growth in the long-run depends on technological progress in these models, the latter is exogenous, i.e. it is not explained. In terms of growth empirics, the importance of the principle of transition dynamics towards the steady state equilibrium of economies is emphasised, i.e. the fact that the growth rate of an economy is inversely related to the distance from its steady state. Lack of catching up of poor with rich countries can easily be explained with these models by differences in steady states between countries.

Chapters 4 and 5 deal explicitly with technological progress, which is regarded as the engine of economic growth. Chapter 4, entitled 'The Economics of Ideas', is largely non-formal. It begins with a general definition of technology as 'the way ... inputs are transformed into outputs' (p. 72). The author hints that this is a broad concept which goes beyond 'feats of engineering' to include organisational changes. Next, he discusses the characteristics of ideas or knowledge and how their nonrivalry creates increasing returns which require the modelling of imperfect competition. The author also highlights the vital contribution of institutional factors to economic growth, especially those identified by Douglass North.[2] In particular, the establishment of a system of intellectual property rights is seen as the major factor leading to the industrial revolution.

Chapter 5 formalises the ideas of chapter 4 and presents a modified version of Romer's well-known endogenous growth model which can explain why technology grows over time.[3] Technological progress is due to individuals trying to capture some of the profit generated by new ideas. The model is modified in such a way that the rapid increase of resources devoted to R&D in advanced countries in the past does not imply a rapidly rising growth rate in these economies. This feature of the original model contradicts the data. However, Jones' modified version is distinctly more neoclassical, in that economic policies can no longer have long-run effects on the growth rate. Rather, they have level effects like in the Solow model. Jones calls such endogenous growth models with strongly neoclassical policy implications 'semi-endogenous'.

Chapter 6 introduces a simple technology diffusion model, i.e. the model of the previous chapter is extended by adding a channel for technology transfer in the form of more advanced capital goods. The mechanism by which countries achieve the ability to use various intermediate capital goods is investment in human capital, which increases the skill level of workers. There is no distinction between different types of knowledge spillovers and/or spillover channels; the different dimensions of absorptive capacity and creative destruction of existing knowledge capital are not explored; nor is the complex web of institutional factors characterising 'national systems of innovation'. The author admits that the model is also incomplete in that it assumes that all countries have the same level of total factor productivity, which is clearly contradicted by the facts (p. 121).

Chapter 7 addresses the question of why investment rates of physical and human capital, which in the models of the previous chapters were given exogenously, might vary across countries. This takes the reader to much of the current frontier of research and reveals some of the major contradictions and limitations of the new growth theory research agenda. The author concedes that there is, as yet, no consensus regarding these questions. He therefore does not present a formal model. Rather, he discusses the factors that might favour or hinder investment. He focuses in particular on 'infrastructure', which he defines in a very broad way as a country's bundle of government policies and institutions. Differences in infrastructure are seen as ultimately responsible for the observed inter-country differences in growth rates. This contradicts some of the earlier conclusions, in particular that government policies do not have long-run growth effects.

It is encouraging to see references to the work of economic historians like Douglass North and Joel Mokyr. Institutional factors are seen as crucial for the explanation of growth miracles and disasters, with the ultimate answers depending on political economy and economic history which determine the fate of wealth-promoting institutions and infrastructure in a country over time. Other authors have emphasised the fact that policies aimed at facilitating technological change are very diverse among countries, indicating that there is no 'universal' innovation system and making generalisations very difficult if not impossible.[4]

Formal theory has yet to come to terms with these insights. Jones aptly summarises the progress of new growth theory as 'starting to resemble the beautiful *matrioshka* dolls of Russia, in which each figurine contains another inside it. Each of our answers to the question of what determines long-run economic success seems to raise another question' (pp. 138–39). It remains to be seen whether formal theory can incorporate the insights obtained from less formal theorising about institutional, technological, social and political change, and the diverse roles of information and knowledge in economic growth. I suggest that this would necessitate the adoption of a fundamentally different

modelling approach from that of an extended production function framework which is typical of old and new growth theory.

Chapter 8 discusses several of the major new growth theories which do not fit into the general model developed in earlier chapters, in particular it introduces the 'AK' class of models of endogenous growth in which changes in government polices do have long-run growth effects, and not just level effects. The author clearly regards such models as 'not the best way to understand long-run growth' (p. 157), despite the discussion in chapter 7 about the importance of government policies. He tries to resolve this logical problem by playing down the distinction between endogenous and exogenous growth models, arguing that the question of whether government policies have level or growth effects is somewhat misleading, as we are really interested in how long the effects last, i.e. a transitional effect in an exogenous growth model might be very long run, closely approaching that of a permanent effect.

There are two useful appendices. Appendix A briefly introduces the relevant calculus needed to follow the main text. Appendix B presents a table with data for 104 countries, commonly used in empirical growth studies. It also gives the Internet addresses of a number of web sites which contain economic growth references and data.

The book is ideal for an undergraduate course on economic growth, and postgraduates might also find it a useful introduction to the subject. The open-minded reader will learn a great deal from this book about the current state of new growth theory and its limitations. In particular, it has to be kept in mind that the book is an introduction to *mainstream* growth theory, and those readers aware of its limitations will find much to criticise. The use of production functions pervades this whole literature. There are many issues concerning the interaction of the variables in the growth process which are usually ignored. To give just one example, does causation run from human capital formation to growth, or vice versa?

Also, the controversy about level and growth effects of policy changes indicates that the economics profession has not yet come to terms with the ultimate sources of economic growth. Furthermore, there is much more to knowledge than R&D, and the information and knowledge diffusion processes are much more complex than indicated in the mainstream models. Organisational innovation is only hinted at, and issues of organisational evolution, maintenance and decay are not addressed. In short, the author neglects some other well-known non-mainstream growth theories which try to address some of these issues, e.g. evolutionary Schumpeterian theories of creative destruction of 'knowledge'. I would recommend to supplement the book with, for example, Nelson,[5] whose theorising about technological change is much closer to the real world complexities of the issues. However, the shortcomings mentioned are easily forgivable for a book such as this, which synthesises a highly technical literature from a particular school of thought and makes it accessible to undergraduates and non-specialists. The author has done an admirable job.

Notes and References

1. See N. Kaldor, 'Capital accumulation and economic growth', in F. Lutz and D. C. Hague (eds.), *The Theory of Capital*, Macmillan, London, 1961.
2. See, for example, Douglass North, *Structure and Change in Economic History*, Norton, New York, 1981.
3. D. Romer, 'Endogenous technological change', *Journal of Political Economy*, 98 (October, Part 2), 1990, S71–S102.
4. See, for example, R. Nelson (ed.), *National Innovation Systems: A Comparative Study*, Oxford University Press, Oxford, 1993.

5. R. Nelson, *The Sources of Economic Growth*, Harvard University Press, 1996. See also my review in *Prometheus*, 16, 4, 1998, pp. 535–7.

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From Central State to Free Global Market Economy

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Dordrecht, Kluwer, 1997, xiv + 196 pp., US$115.00, ISBN 0-7923-4520-7

This is another book from NATO's ASI (Advanced Science Institutes) Series on Science and Technology Policy which comprises the proceedings of the workshop on 'Moving from Central State to Free Market Economy', held in Moscow in November 1995. The chosen title does not fully represent all the aspects of the meeting and hence, the papers included in the book. Although a number of contributions focus on the transition from centrally planned to market economy, there are also papers which deal with issues only remotely relevant to the problems faced by the former socialist countries. Another important aspect of the workshop was the application of telecommunications and information technologies (13 of the 20 articles in the book deal with such issues). The publication contains a lot of challenging concepts, interesting case studies and practical experiences, but the editorial work is hardly at the same level. The papers are not organised in chapters and the one and a half page preface provides some background but does not highlight the contributions from the workshop. Being a conference proceedings, the responsibility for the accuracy of language and editing has apparently been left to the various authors. This has resulted in cases where the reader experiences significant difficulties, e.g. understanding the crucial abbreviation RTD in the paper by Vacca which aims to describe RTD, or looking for the missing 'solid' and 'dotted' lines in the paper by Kozlov. The book, nevertheless, contains some valuable concepts and practical solutions as well as description of developments in the field of science and technology policy.

The articles included in the book can be loosely grouped under six topics: science in Russia (three contributions); small- and medium-sized enterprises (SMEs) in Russia (three contributions); information technology (IT) and globalisation of innovation (four contributions); IT and SMEs (four contributions); local development (three contributions); and science and technology policy (three contributions).

The political and economic changes in the 1990s had a very significant impact on science in Russia. The catastrophic reduction of funding that occurred in 1991–1992 and resulted in a drastic decrease in the number of researchers and research organisations has been followed by a period of stabilisation. International foundations, such as the Soros' International Science Foundation and the European INTAS, Copernicus and Peka programmes, play an important part in fund allocation for civil research. The military complex is, hence, the most affected by the cuts. The comparative data provided by Kozlov, however, shows that Russia's military R&D expenses are still very high as a percentage of total R&D expenses (i.e. 54%) and higher than any OECD country. The Russian Academy of Sciences and the various government research institutes are underfunded and face serious difficulties in providing information links to the rest of the global research community (see the article by Mindeli and Gubanov). The tertiary sector