sense technometric indicators are an ideal measure of technical progress, unlike other indicators – such as R&D or patents – they are not a proxy for the process of technical change but a direct quantification of it. This is an area in which the author has done a great deal of original research, and this chapter is pivotal to the rest of the book. The chapter discusses the match between theory and technometric measurement in some detail, and provides a convincing case that technometric indicators provide the closest match to theoretical concepts of innovation. As the author notes, the main drawback in using them is the high data costs incurred in creating such indicators. As a result few empirical tests have been undertaken using the indicators, a situation that the last part of the book aims to rectify.

The tests of the indicators involve a number of situations including the relationship between innovation and economic growth and international trade, and the nature of learning over time (chapters 7 and 8). The limitations of the indicators immediately become apparent in these chapters. The first set of tests relating to economic growth and international trade uses technometric indicators but notes the problems concerning their coverage, which is limited in terms of countries and goods, and the level of aggregation. The chapter on learning is faced with the lack of data over time, making it impossible to use the indicators so the author chooses to use a patent indicator instead. As this makes clear, the applicability of the technometric indicators to broad issues – such as economic growth and learning over time – appears to be limited. Their use seems to be more appropriate in the case studies presented later in the book, which are of specific product markets and thus make it difficult to draw general conclusions concerning the innovation process.

The last chapter gives an outline of the main results including an excellent table summarising the different measures used and the outcome in each case. The book is excellent at presenting the problem – the gap between theory and applied work in the economics of innovation – and suggesting a solution, but seems unsure of the actual contribution of technometric indicators to solving the problem. I drew the general conclusion that for data reasons a pragmatic approach needs to be adopted and though technometric indicators would be preferred for theoretical reasons, they are of only limited practical use.

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Economists in the Schumpeterian tradition have, for some time now, emphasised the conceptually important distinction between incremental, radical, and 'pervasive' or 'general purpose' technologies. The notion of General Purpose Technologies (GPTs) introduced in the mid-1980s by Bresnahan and Trajtenberg has become increasingly popular in analyses of economic growth. This
book edited by Elhanan Helpman presents an integrated collection of original contributions providing new insights into the importance of GPTs by approaching the problem at stake from both a theoretical and empirical point of view. In addition, this composition of high-quality papers may be the foundation of and may induce future research into this new area of economic growth theory.

After a short introduction, Richard Lipsey, Cliff Bekar, and Kenneth Carlaw first consider the theoretical literature, in some way complementary to GPTs, to obtain a comprehensive working definition. By focussing on both appreciative and formal theories they characterise the set of technological advances that is induced by the introduction of a new GPT. In their analysis they introduce the model of Helpman and Manuel Trajtenberg (chapters 3 and 4) which tracks the effects of a new GPT on macroeconomic aggregates and considers the process of a new GPT diffusion. This model analyses long-run dynamics in the form of repetitive cycles, that result from the arrival of new GPTs. The main finding of the approach is a view of the growth process in which the notion of increasing returns underlying new growth theory can be explained by the fostering complementary advances induced by new GPTs.

Philippe Aghion and Peter Howitt (chapter 5) argue that the Helpman-Trajtenberg model is incomplete and introduce social learning into the model. This variable is included to analyse and explain the fact that each sector must develop a specific intermediate good before anyone in that sector can make components for the GPT. In this manner they can also explain why the process of the arrival and introduction of a new GPT is a smooth one instead of leading to a dramatic fall (at first) in production, as in Helpman and Trajtenberg. Howitt (chapter 9) extends this argument by investigating the resulting implications for capital obsolescence.

Richard Harris (chapter 6) and Nathan Rosenberg (chapter 7) apply the theoretical framework of GPTs to the Internet and chemical engineering, respectively. Harris finds that, due to the introduction of the Internet, enhancing communication, productivity levels of small countries equal those of large countries. In addition, he observes that globalisation is expressed in increased volumes of trade in services. Finally, when the Internet is defined as a GPT, the introduction of communication networks like the Internet enhances virtual mobility of mostly skilled labour resulting in a wage premium to skilled labour. Kevin Murphy, Craig Riddell, and Paul Romer (chapter 11) investigate this result empirically for Canada and the US and conclude that new GPTs are relative complements with more educated labour, which is closely related to the thesis that machinery and new technologies harm low-skilled workers. Rosenberg suggests that the notion of a GPT has to be broadened to include intellectual methodologies, such as in chemical engineering, which may bring to the forefront valuable new insights into the underlying determinants of technological change and the diffusion of GPTs.

In chapter 8 Lipsey, Bekar, and Carlaw pick up their framework laid out in chapter 2 to focus on the consequences of changes in GPTs by particularly stressing the debate between the Helpman-Trajtenberg and Aghion-Howitt model. By building a structuralist model, including, alongside the neo-classical
components, technology and policy variables, they argue that it is the structure of technology systems which should be focussed on. According to these authors structural issues are the core of an understanding of growth as driven by technological change.

Timothy Bresnahan and Alfonso Gambardella (chapter 10) examine the division of inventive labour and the extent of the market. They endogenise the arrival of GPTs, which was assumed to be exogenous in the models of Helpman and Trajtenberg and Aghion and Howitt. They find a self-enforcing loop of inventions induced by increasing specialisation of knowledge and diverse markets in which new GPTs continue to contribute to growth, and most importantly that growth continues to permit their invention.

The general tone in Helpman’s book is that the concept, theoretical nature, and empirical application of GPTs is an important new contribution in the explanation of economic growth. By both providing theoretical models and empirical results an important link is established with studies of economic history.

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This book is a contribution to the growing literature on technology and development. A particular focus of interest in the early days of research in this field (pioneered by Frances Stewart in her 1977 book Technology and Underdevelopment) was the effect of income redistribution on consumption and technology choice, and thereby on employment. The present volume stands in that tradition: James and Khan believe that redistributing income to the poor in developing countries will favour consumption of more ‘appropriate’ products, and thereby stimulate production utilising more ‘appropriate’ (i.e. labour-intensive) technology – which increases the demand for abundant unskilled labour.

A lot of work on technology and development, both theoretical and empirical, has been done in the past twenty years. This is partly due to the challenge posed by the success of the newly industrialising countries (which was not in any obvious way guided by considerations of ‘appropriate technology’), and partly due to developments in economics more generally. In particular, the dynamic effects of technology choice, information imperfections, and other market failures have received increasing attention in the past ten to fifteen years. Also, a more sophisticated analysis of political economy factors and governance has emerged; all this has had a profound impact on development economics.

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