Technology, Trade and Growth in OECD Countries

Does specialisation matter?

Valentina Meliciani

London and New York

Technology, Trade and Growth in OECD Countries

Presenting new material and a fresh perspective, this book provides a unifying framework for the exploration of the role played by specialisation in economic growth and international competitiveness. Particular attention is devoted to the role of Technological specialisation in Information and Communication Technology (ICT).

Building upon the idea that technical change is the driving force of economic growth, the author explores the channels through which specialisation can impact on growth, including:

- Difference in technological opportunity.
- Degree of pervasiveness.
- Demand elasticity of income across different technologies/products.

Besides the effects of specialisation on growth, the book indicates the importance of disembodied technical change and of the activity of investment in affecting rates of growth.

Essential reading for scholars and postgraduate students working in the fields of technical change, international trade and economic growth, this book will also be of substantial interest to policy makers and advisors involved in defining the priorities for science and technology.

Valentina Meliciani is a research fellow at the University of Teramo, Italy. She has an MA in International Economics from the University of Sussex, and a PhD from SPRU (University of Sussex) under the supervision of Keith Pavitt and Nick von Tunzelmann. She has mainly worked on the impact of technological change on economic growth and international competitiveness. In this area, she has published papers in international journals, such as *Weltwirtschaftliches Archiv, Applied Economics*, and *Technology Analysis and Strategic Management.*

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Contents

Tables

Figures

Foreword

Keith Pavitt

The research objectives of this book are ambitious and the results impressive. Its purpose is to evaluate the role of technology and of trade specialisation in economic performance of the OECD countries in the past thirty years. On the basis of a firm grasp of the various theoretical approaches to the subject, it presents the results of one of the most ambitious attempts so far to exploit the increasingly rich statistical sources that give reasonably reliable measures of scientific and technological activities. The author confirms the significance of these activities in determining national trade and growth patterns. She also shows the growth in the 1980s in the relative importance – in total technological activity and economic performance – of three technologies: ICT (information and communications technologies), biotechnology and new materials. These are precisely the three technologies that corporate R & D directors have identified over the past twenty years as those offering the greatest opportunities to transform advances in knowledge into profitable innovation. Intriguingly, Dr Meliciani confirms what corporate practitioners have also discovered in the past twenty years: that advances in these technologies both stimulate and depend on the capacity to make advances in other complementary fields of technology. Schumpeter's 'creative destruction' may happen to products and firms. Whether it also happens to fields of knowledge is more debatable.

This book should be high priority reading for those concerned with the determinants of growth and trade, and with public and corporate policies for science and technology.

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'Measuring technological opportunity: indicators and the data set', parts of 'Analysis of areas of strong technological growth' and 'Specialisation in new technologies and economic performance' in Chapter 5 have been reprinted from 'Specialisation in areas of strong technological opportunity and economic growth' in *The Microfoundations of Economic Growth: A Schumpeterian Perspective* edited by G. Eliasson and C. Green (Ann Arbor: The University of Michigan Press, 1998.)

1 Introduction

The theoretical framework

This book focuses on the role played by the composition of technological activities on countries' international competitiveness and economic growth. In particular it argues that in a process of growth sustained by innovation, the dynamics of specialisation assume an important role in affecting the performance of different countries because of differences in technological opportunities and in income elasticities of demand across different activities.

At a theoretical level, the areas of research relevant to this study can be identified within the theories of economic growth and international trade. These are two broad areas of investigation that have become increasingly interdependent in the mainstream economic analysis since the development of the *new growth theory* and the *new trade theory*. In particular it has now been recognised that the opening-up of trade can have permanent effects on country performance by affecting not only the level of macroeconomic activity but also the rate of growth. The main channels for this to happen are scale effects matched with endogenous technical change and resource allocation effects.

An interesting feature of the work undertaken in the old neoclassical tradition, both in the domain of economic growth and of international trade, has been the long-lasting neglect of the process of technical change. The assumptions of an equal rate of exogenous technical change across countries within the traditional neoclassical growth theory, and of given technologies within the traditional neoclassical trade theory, have been crucial for the predictions of convergence in growth rates. Another aspect that has characterised the neoclassical approach to economic growth (and that is still present in the new growth theory) is the lack of any role played by demand in affecting the rate of growth. With exogenous and even technical change and no demand constraints, the neoclassical growth theory does not leave any role for the composition of national activities and the process of structural change to affect country performance.

It has been observed that the neoclassical work on economic growth has been affected by the need to maintain logical consistency with a pre-conceived pure-exchange theoretical scheme deriving from the marginalist revolution of the end of the nineteenth century (Pasinetti, 1981). The advent of the marginalist revolution,

with the attention coming to be focused on the optimal allocation of scarce goods, led to a decrease in the attention devoted to the process of production and accumulation that was central in the work of Classical political economy. In this period the work of Schumpeter represented the only major exception. The central role attributed to innovation in his work was exceptional and modified the focus of the economic analysis to the extent that he had to look for a name to give to his area of investigation (he defined it as *dynamics* in contrast to the static analysis undertaken by the marginalists, or *development* in contrast to their study of the circular flow: Schumpeter, 1934; 1982). Another aspect of the marginalist revolution (though originally debated within classical political economy) was the adoption of Say's Law, i.e. the thesis that supply creates its own demand. In the context of the general-equilibrium static model, this meant that demand could not be a constraint on full employment, and in the context of dynamic analysis that economic growth had to be independent from demand. The critique of this view in the context of a stationary economy was the focus of Keynes' *General Theory* (1936) which stressed the role played by effective demand in affecting the rate of macroeconomic activity.

The new growth and trade models recognise the crucial role played by technical change and its endogeneity, however this stream of literature still understates the strong uncertainty that surrounds the innovation process, the discontinuities that arise from technical change, and the role played by demand. The conviction that the uneven and disequilibrating nature of technical change on one hand, and the role of demand on the other, are essential for understanding the long-run processes of international competitiveness and economic growth led us to develop this book using a richer framework. In particular, on the supply side the main source of inspiration is the Schumpeterian idea that technical change is the driving force of economic growth and that it is not evenly distributed through time or across countries and sectors, but appears discontinuously in swarms. Moreover we adopt the view that in the course of different waves of development different sectors or technologies play a major role in the process of growth, affecting the whole economic system through the existence of intersectoral links. *Technological opportunity* is not equally distributed across different technological classes; rather, over time, various activities offer different opportunities for innovation. Moreover, not all innovations have the same degree of *pervasiveness*; i.e. they do not have the same ability to affect different branches of the economy. If this is the case, countries that have a high share of activities in fields of high technological opportunity and a high degree of pervasiveness might experience faster rates of technical change and of economic growth. In the last wave of development, information and communication technologies (ICTs) appear to be areas of high technological opportunity and a high degree of pervasiveness.

This approach is concentrated on the supply side of the economy and downplays the role played by demand in affecting countries' long-run rates of growth. On the demand side, this study draws on the idea that different products have different income elasticities of demand and that as income grows the composition of goods consumed changes (Engel's law). As a consequence, which goods countries produce

turns out to be important in affecting their capability of benefiting from an increase in international demand.

The simultaneous account of the concepts of technological opportunity and pervasiveness on the supply side, and income elasticities of demand on the demand side, is the framework used in this book for analysing the impact of technological specialisation on international competitiveness and economic growth. Other studies have linked together the role played by technological competition (as stressed by the Schumpeterian-evolutionary approach) with post-keynesian accounts of growth based on the balance-of-payments constraint (e.g. Fagerberg; 1988a). The contribution of this book consists in introducing the role played by the composition of national technological activities within this framework. In particular we consider both the direct effects of specialisation on growth and the indirect effects of specialisation on growth through its impact on the income elasticities of export and import. A summary of these linkages in represented in Figure 1.1.

Following the Schumpeterian-evolutionary approach general technological competitiveness and investment activity directly impact on economic growth through product and process innovation and diffusion. Specialisation in fields of high technological opportunity also directly impacts on growth because new technologies have a pervasive effect in the different sectors of the economy. Moreover general technological competitiveness and favourable specialisation interact as higher R&D expenditures allow entry into the fields of high technological opportunity, and favourable specialisation induces a higher rate of technical change. Technological competitiveness and favourable specialisation patterns also impact on international competitiveness by creating favourable income elasticities of demand. Finally, international competitiveness impacts on growth through the balance-of-payments constraint. The feedback mechanism works as follows: economic growth feeds back directly on investment activity and technological competitiveness through the accelerator mechanism and demand-induced innovations, thus creating the possibility of virtuous and vicious circles of growth.

In this framework technological innovation and diffusion are the driving forces of economic growth and international competitiveness. Moreover patterns of specialisation affect economic growth since different technologies have different degrees of pervasiveness and different products have different income elasticities. We also expect favourable income elasticities of demand and specialisation in fast-growing technologies to be related due to the larger share of income spent on high quality or 'newer' goods. The emphasis on technological competitiveness as affecting international competitiveness stresses the role played by absolute advantages: in a system where there are idle resources the main effect of an increase in international demand is an increase in resource utilisation. Since most countries cannot sustain, in the long run, permanent surpluses or deficits in the current account of the balance-of-payments, technological competitiveness and patterns of specialisation become important in affecting the income elasticities of export and import. Countries with favourable elasticities can appropriate a larger share of the increases in world demand and, at the same time, can face larger increases in domestic income without running into balance-of-payments problems. In this book we will

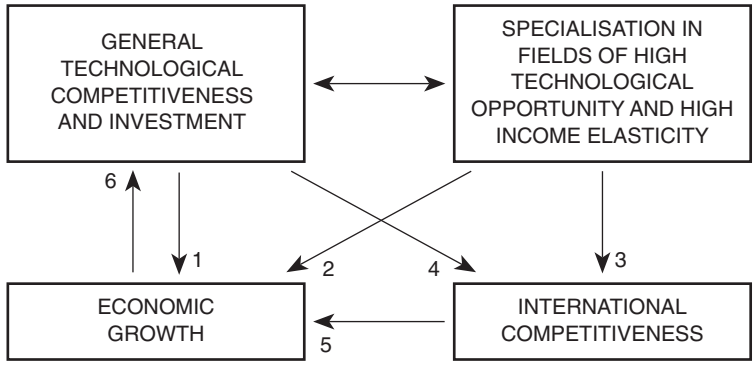

Figure 1.1 The framework of the book

investigate what determines differences across countries in income elasticities of demand. Finally, in our view, innovation and a large share of activities in fields of high technological opportunity contribute to an overall increase in world income.

The methodology

The contribution of this book is mainly empirical. As with any other empirical analysis, this research is inspired by the objective of trying to answer some theoretical and empirical issues. In particular, it tries to interpret some stylised facts on technical change, international competitiveness and economic growth, in the light of an eclectic theoretical approach.

The theoretical approach adopted in the book has already been presented in the previous section; here we want to clarify some methodological issues that arise from it. In the first place we want to emphasise that this work does not aim at discriminating between alternative theories of international competitiveness and economic growth. It rather aims at shedding some light on the factors lying behind uneven development and international competitiveness across countries. In doing so, we decided to work on some building blocks borrowed from various theoretical frameworks. This choice presents some drawbacks on the side of the theoretical rigour of the analysis but also has some advantages in the set of keys that it offers for interpreting a complex set of relationships.

We believe that the central theme of this book, the impact of technological specialisation on countries' performance, can be analysed in depth only by taking into account, at the same time, technology and demand. Moreover we find that the Schumpeterian-evolutionary approach and the post-keynesian approach can be used together in order to enrich the theoretical framework without creating problems of conceptual inconsistency. The strong uncertainties that characterise the environment in which economic agents operate and their consequent sub-optimal behaviour depicted by the Schumpeterian-evolutionary approach appear to us perfectly consistent with the macroeconomic problems of *ex-ante* disequi-