Introduction

Special Issue on Technology and the Economy

The role of technological change has always been central to the economy, but much less central to economics. The economic analysis of technology and innovation is a relatively new branch of the economics discipline, although the number of contributions in this subfield has grown rapidly over the last decades. At a practical level (policy makers), technological change is one of the central themes in discussions surrounding economic policy making, as is evident from, for example, debates on the ‘knowledge economy’ at the European as well as the national level.

This special issue brings together a number of papers that contribute to the analysis of technological change and innovation. The papers were first presented at a conference entitled ‘The Future of Innovation Studies’ in September 2001 at the Eindhoven Centre for Innovation Studies (ECIS) of the Eindhoven University of Technology in the Netherlands.

The papers collected here all focus on macro-economic or macro-institutional aspects of technology and the economy. The article by Nick von Tunzelmann focuses on the issue of coevolution of technology and modes of governance. The article by Joachim Schwerin and Claudia Werker raises the question how innovation policy can be made more responsive to changes in our knowledge and understanding of the regularities in socio-economic change. The other three papers are empirical studies of specific aspects of the relationship between technology and the economy. The paper by Marcel Timmer discusses the relationship between investment in technological capabilities and the rate of return in a successful late industrialising country, South Korea. The paper by Michael Peneder addresses the impact of structural change and spillovers on growth in the OECD countries. The paper by Rinaldo Evangelista and Maria Savona provides estimates of direct impacts of innovation on employment in the Italian service sector. Together the papers providing valuable insights into ongoing debates at the forefront of research on technological change and economic growth.

Taking a broad historical perspective, Nick von Tunzelmann calls for the development of an evolutionary theory of governance and the explanation of the coevolution of governance and technology. Von Tunzelmann takes a macro-perspective on governance distinguishing between structure (the form in which decisions are made), control (the power to make decisions through structures) and process (the implementation of structure and control). The three major industrial revolutions—the first industrial revolution of 1750—1815, the second industrial
revolution of 1870–1914 and the third industrial revolution since 1973—correspond to changing forms of governance: small firms interacting via markets, large corporations (the visible hand of Chandler) and modern networks within and between corporations. Changes in modes of governance imply changes in the roles of governments. Complicating these trends, are persistent national variations in governance systems. The key question raised by Von Tunzelmann is how changes in governance and technologies are or are not aligned in an evolutionary process.

While von Tunzelmann analyses the coevolution of governance and technology, Joachim Schwerin and Claudia Werker discuss one specific aspect of this relationship. They introduce an interesting question: how can policy be structured in such a way that policy decisions and improvements are based on learning mechanisms? In this way, the coevolution of policy change and systemic changes in economic and technological processes would be more or less built into the system. Of course, the notion of learning policy in itself is not new. All policymakers pay lip service to policy evaluation, feedback and learning from past experience. In practice, however, the learning capacity of policy is very limited. Werker and Schwerin propose a procedure for identifying stylised facts or structural regularities as a basis for changing policies and policy rules. They illustrate their procedure with a case for innovation policy. The learning model is based on scientific consensus within the scientific community. When at least two thirds of the scientific researchers agree on a given scientific hypothesis, it can used as a basis for the formulation of learning innovation policies. The value of the paper lies in a proposal for a self-adjusting policy framework based on interaction with the world of science and research. The paper raises interesting questions about the evolutionary value of scientific consensus or dissonance.

The paper by Marcel Timmer examines the impact of technological effort on rates of return to capital investment in a catch-up economy, South Korea. By now, there is widespread agreement on the importance of learning and investment in technological capabilities as a condition for successful catch up. However, the Asian crisis of 1997 has brought us down to earth again, calling attention to the need for the financial profitability of investment. The hypothesis underlying the paper is that investment in technology is required to maintain rates of return to physical capital investment. The closer a country or sector comes to the technological frontier, the harder it is to maintain rates of return. In the paper, rates of return to capital in four technology intensive sectors are regressed on three indicators of technological effort: R&D expenditures, FDI and technology licensing fees. The paper provides evidence of declining marginal rates of return to investment in the absence of investment in technological capabilities. An interesting finding is that FDI and technology payments are more important than R&D expenditures, which have decreasing returns. This is an interesting result, given the standard perception of Korea as country that succeeded in acquiring technology while limiting the role of FDI. A second important conclusion of the paper is that investment in diversification may be more important for catch up than the single-minded search for technological leadership.
The impact of structural change on growth is one of the recurring themes in the literature on growth, development and technological change. Since Colin Clark and Simon Kuznets, the classical literature suggests that structural change is one of the key sources of growth and development. In the recent literature, an apparent paradox has emerged between two strands of literature. Growth accounting studies of developing countries tend to show that structural change within manufacturing has little or no impact on aggregate growth of output and productivity. There is no structural change bonus. On the other hand, the evolutionary literature emphasises the importance of spillovers from leading sectors such as electronics as one of the important engines of growth. This debate is epitomised by papers in a previous special issue of SCED, by Timmer and Szirmai (2000) on the one hand and Fagerberg (2000) on the other (see also the comment on Fagerberg by Carree, 2003). Written from an evolutionary perspective, the article by Michael Peneder neatly synthesises the two approaches. It combines both accounting and regression techniques. Peneder’s shift and share analysis confirms the empirical results of earlier studies. Economy-wide there is a structural change burden, due to the shift to the service sector. Within manufacturing there is hardly any aggregate productivity effect of structural change. Within-sector productivity change drives aggregate productivity growth. In the aggregate, the effects of various sectoral shifts tend to cancel out. However, Peneder’s detailed examination of specific sectors and his regression analysis point to the evolutionary importance of key sectors and the existence of user-related and producer-related spillovers as a source of aggregate growth.

While Peneder focuses on the growth effects of changes in structural composition, Rinaldo Evangelista and Maria Savona measure the employment effects of innovation in the service sector. The point of reference here is Baumol’s proposition that productivity growth in services is slower than in manufacturing, resulting in a reallocation of jobs to services. In the recent literature, the notion of services as a stagnant sector has been challenged. It has also been noted that Europe lags behind the USA in services. Using data from the Italian Community Innovation survey, the authors provide estimates of the direct employment effects of innovation in the service sector. In general, innovation leads to the replacement of lower-skilled jobs by higher skilled-jobs. But the quantitative impacts differ between sectors and types of firms. In smaller firms and dynamic subsectors, innovation leads to the net creation of higher-skilled jobs and to the upgrading of jobs. In larger firms and in capital intensive and financial service sectors, labour saving effects of technological change predominate. In Italy, the overall net effect of innovation on employment is negative. Evangelista and Savona conclude that some service sectors are much more dynamic than others: they produce services with a high qualitative and knowledge based content. Growth in these sectors results in an increase in the demand for highly qualified labour.

The analysis has interesting implications for policy. In Italy growth of services seems to be too much concentrated in technological lagging sectors, where the employment effects of innovation are negative. Policy should focus on movements into the most dynamic branches of services.
References


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