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**Technological Innovation,
Competitiveness, and Economic Growth**

edited by

**Onorio Clauser, Peter Kalmbach,
Giovanni Pegoretti, and Luisa Segnana**



Duncker & Humblot · Berlin

**ONORIO CLAUSER, PETER KALMBACH,
GIOVANNI PEGORETTI, and LUISA SEGNANA (Eds.)**

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Begründet von Prof. Dr. Dr. h. c. J. Broermann †

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Introduction

by Onorio Clauser, Peter Kalmbach, *
Giovanni Pegoretti and Luisa Segnana *

A General Outlook

Economic analysis of technological change has developed along different, but often intersecting, dimensions and levels that ramify into almost every branch of economics. Perhaps the most striking result of its theoretical evolution over recent decades has been the emergence of technological change as the central problem of entire lines of research and as an inalienable aspect of classical problems (those, for example, addressed by the theory of the firm). In parallel, a process of disciplinary specialization has developed which, although it furnishes approaches, theories and models used across a quite wide spectrum of enquiry, has also had the natural consequence of restricting opportunities for broad-gauge comparison among its various facets. Such comparison, conducted within precise limits, provides an opportunity for discussion of the essays collected in this book. The contributions that follow are arranged along a series of “paths” which – without any claim to exhaustiveness – draw comparisons among the various dimensions of economic analysis of technological change and concentrate on both theoretical and empirical aspects.

Within this wide-ranging comparative framework, four lines of debate can be distinguished here:

- 1) Approaches which have as their common feature that technological change is not understood as “manna falling from heaven” but rather as the outcome of special circumstances and of decisions taken by the economic agents, i.e. innovation as well as diffusion are considered to be endogenous.
- 2) Investigations which are mainly interested in the consequences of technological change or of special new technologies, particularly in the effects triggered by the latter on employment and skill demand.

* *Translation by Adrian Belton.*

- 3) The international dimension which, for example, addresses the questions of international competition, spillovers and the relation between innovating and non-innovating countries.
- 4) The structural dynamics of the economic system.

The first line of debate concerns research and development activity, its significance and its role within the firm, the process by which innovations are diffused. One may conveniently begin with a number of aspects to the debate that has centred on the so-called “Schumpeterian hypotheses”: namely, the notion that innovative activity is more dynamic the greater the market concentration, and the notion that investment in R&D is positively correlated with a firm’s size. These first issues were initially addressed, of course, by the SCP (Structure-Conduct-Performance) approach, which has the major shortcoming of defining market structure as an exogenous component which conditions the behaviour and performance of firms. A second approach, the “strategic competition” one, has sought to overcome these restrictions and to address, apart from the questions mentioned above, the following: the influence of the type of competition in the market on R&D investments, the kind of firm most favoured by technical progress, the function of research activities in relation to the formation of barriers to entry, optimum allocation, and others. In the various models based on this approach, the market structure is not exogenous but is influenced by firms’ strategies and market behaviour. In the models employed by the “strategic” approach (e.g. strategic commitment), the “strategic” element is explicit and taken to be a decisive influence on market structure. Game theory is frequently used as an analytical tool. Alternatively the strategic element can enter indirectly through the assumption of maximizing behaviour – while technological conditions can play a role in the definition of market structure – in the models of the “efficiency” approach (e.g. contestable market). A third branch of analysis belonging to the first line of debate, the powerful “evolutionary” approach, pursues ambitious objectives although, as yet, its potential has only been partly explored. Its objects of inquiry range from the motives for research on “innovative opportunities”, to the capacity of firms to generate innovations, to the ways in which new technological forms acquire economic significance, to changes in the structure and performance of industries, to the mechanisms by which innovation is diffused and which by feedbacks emerge from diffusion. The approach’s crucial component is the interactive relationship between the firm and an environment that contains a variety of economic behaviours and organizational forms. Among the essential mechanisms of evolutionary change are the following: a) the principle of variation, according to which there are changes in at least one feature of the population significant for the purposes of selection; b) the principle of selection whereby certain forms withstand environmental pressures better than others. In the theory’s various models, this evident biological basis is in fact tempered by its adaptation to economic issues, although it occasionally re-emerges in some areas. The competitive

mechanism is perceived as a process of change which is strongly influenced by technological differences among firms and produces constant change in the relative economic importance of the various competing technologies¹. Selection operates at two distinct levels: one relative to selection among technologies, the other relative to selection among firms. On these premises, firms obviously do not adopt the optimizing behaviour hypothesised by traditional theory. On the other hand, because aggregation is necessary, some form of strategic interaction among firms must be taken into consideration. This obliges the analysis, in the absence of well-founded alternative theories, to use tools (like game theory) that draw on theoretical notions of equilibrium (on this see Siniscalco²). The distinctive feature of “evolutionary” analysis is its contention that “change” and “coordination” are inseparable and that the latter is determined by the evolutionary dynamics of the system³.

The second path identified here concerns the relationship between technical progress and labour. One of the chief focuses of discussion – which, without going too far back in time, can be traced to the classical economists – is obviously the effects of innovative processes on employment. The problem of technological unemployment should be carefully distinguished from other types of unemployment, namely Keynesian and structural. The analysis cannot be partial, however, but must consider the “compensation” effects that may arise at various points of the productive system or of the labour market and counteract the initial impact of technological change. Be these price effects, income effects, or technology multiplier effects, they should be flanked by the effects of change (in structure, in behaviour, in spending) induced by product innovation. Mere classification of these various effects is not enough to give them thorough theoretical specification, which depends on the form of the adjustment mechanisms assumed as operating in the system. Traditional approaches, which rely mainly on the allocative properties of a flexible price system, are counterposed by other approaches emphasising the dynamic structural aspects of the capital/labour ratio (vintage capital models) or the role of the growth of aggregate demand tied to the growth of income through labour productivity. Finally – to cite only the main currents of thought – there is the dynamic input-output approach and the approach based on the concept of vertical integration.

Standing symmetrically to this position, though not yet explored with equal thoroughness, is the problem of the relationship between new technologies requiring skilled manpower and the supply of such manpower,

¹ Metcalfe/Gibbons (1989).

² Siniscalco (1990).

³ Dosi/Orsenigo (1988).