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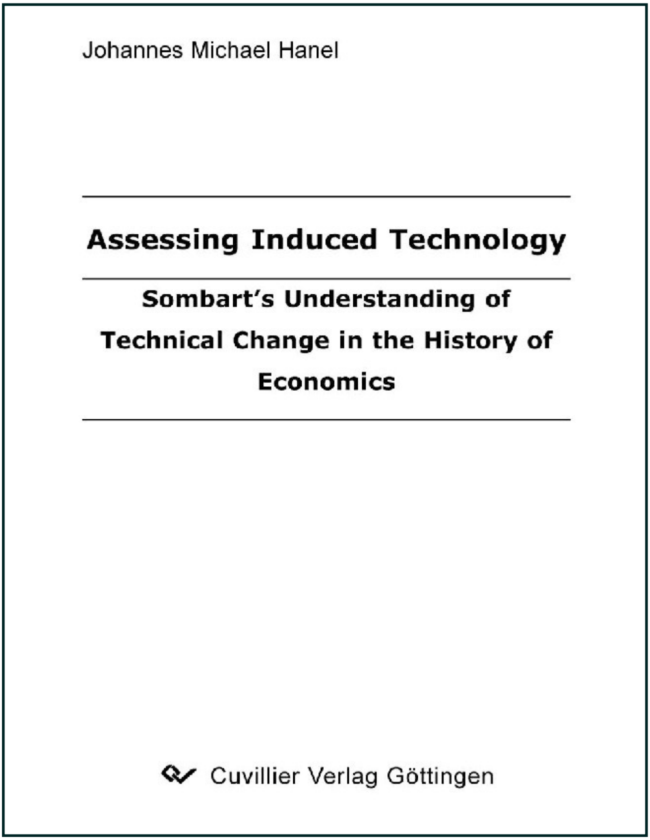
Assessing Induced Technology

Sombarts Understanding of Technical Change in the History of Economics



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1 Introduction

Not only did it take ten years to defeat Troy, but it took also 10 years for Odysseus to travel home to his island still called Ithaca. One of the best-known challenges is the passage through the straight that the monsters Scylla and Charybdis safeguard. How should the hero and his friends ship through the wrecking straight? In life, especially in social life, we often face similar dilemmas:

- Beneficial or destructive technical or organizational change[2]
- Growing reliability or built-in obsolescence[3]
- Increasing long-term unemployment or ecological catastrophes[4]

I could go on enumerating such awful choices; indeed, each economic institution and each technology has two sides starting from barter up to biotechnology.[5] The prices can be too high or too low, the market too broad and liberal or too narrow and regulated, work too long and strenuous or too short and boring. In the development of the sciences there are at least as many Scyllas and Charybdises: a subject or concept can be too narrow or too broad; a method can be too empirical or too deductive; a scientist can be too detached or too involved. Everybody can be too egotistical or too altruistical etc.

Such imbroglios often become manageable once they are dealt with more concretely and scientifically, once we move from an abstract or aggregated to a concrete or individual level. That is why philosophy has fallen apart into various sciences and subdisciplines along with the advent of what we call with

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[2] In their book on the year 2020 Ernst, Hauser, Katzenstein and others show how ambiguous all trends are by listing at the end of every chapter plus and minus factors. In "Technology: Permanent Innovation" they juxtapose for example: "'learning systems' accelerate progress" and "new forms of crime slow down the introduction of innovative technologies." (p.67)

[3] See for example the interesting essays on *Sustainability as Ideal for the Shaping of Technology* ed. by Böhm etc. (1996). They are in German, but I translate titles in footnotes when this is helpful for the argument. Full bibliographical details are to be found in the bibliography.

[4] This does not imply that all kind of economic grfowth must be bad for the environment. The *5000 Days to Save the Planet* we had left according to Edward Goldsmith, Nicholas Hildyard, Patrick McCully, and Peter Bunyard (1990) were about over when the film "The Day after Tomorrow" (2004) appeared. Since the planet and humanity are still living and trying to save ourselves including the earth, the environmental problem is not just a physical one, but also a social and cultural one, as this study elucidates. See also the essays edited by Henry Jarrett already in 1966 *Environmental Quality in a Growing Economy*, especially the one by K.E. Boulding, and the work by Walter Oswald (e.g. 1991).

[5] Neil Postman (1992) deals with the unavoidable ambiguity of technology, referring to Platon's story about the Egyptian king Thamus in his *Phaidros*. Why technology is ambiguous would lead us into the philosophy of technology to which I can only refer here; see e.g. Heidegger, Hommes, Lenk, and Rumpf in the bibliography.

Sombart *Modern Capitalism* as a most complex economic system with unpredictably changing technology and social relationships. Each such field renders possible rational choice that is rational in as much as it reduces risks and overcomes mechanisms and traditions to make insightful choice by individuals or groups possible.[6]

As social life became increasingly complex, general economics or Political Economy became more like a social philosophy with regard to market activities. In this sense, not only economics is a dismal science (Thomas Carlyle 1849), but general or theoretical physics as well when it tries to define “matter”, biology when it tries to define “life” etc.. From the point of view of the subfields of economics, general economics tries to determine what a market is and how it forms prices. It does not really unravel the knot we could call “free mechanism”, i.e. economics does not explain how billions of individuals can act freely in a global market mechanism.

Environmental economics, for example, is concerned with sustainable development in order to steer us through the straight of overprotection and overexploitation of the natural resources. This presupposes that the life sciences help economics in order that nature is overused neither as resource nor as dumping ground. -- Institutional economics, Public Choice, or Political Economy, on the other hand, have to use some findings of social pyschology, sociology, law, and political science in order to steer us through the straight guarded by the Scylla of over-regulation or discrimination and the Charybdis of under-regulation or neglect of the natural and important differences between sexes, races, religions or ages.

What discipline allows us to steer technology in the right direction at a humane speed? Whereas Political Economy is even older than pure economics, and environmental economics has become quite established since the 1960s, what rarely is called the economics of technical change (ETC) is mostly scattered over many subfields of economics. The challenge of this subfield is to combine the findings of economics and technology in such a way as to make technical change compatible with social (including economic) change, growth, evolution or development. When technical change is too fast, biased or one-sided, not only machines, but human beings can become obsolete too. When this change is too slow, both competitiveness and human progress in general are endangered.

Whereas the *speed* of technical change clearly implies an understanding of historical development, the *direction* of this kind of change has been analyzed more successfully by means of the concept of path dependency.[7] It implies

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[6] *A Theoretical-Historical Analysis* of issues like institutional variety and Public Choice can be found in Mierlo (2001).

[7] With this concept history can come back into economics, cf. e.g. Arthur (1994), Liebovitz and Margolis (1995) Mahoney (2000), and Puffert (1999)

transaction costs from one to another technology, but not necessarily an inflexible direction of technical change, because it can also suggest reliability. It is true that the concepts of the economics of technical change frequently have an ethical aspect. For example, technological shocks, slow, regressive or lock-in technologies are not only descriptive but also signify lacking social cooperation or a gulf between technical and moral advance.[8] More dangerous are the energy crises on the one side and the lock-in caused by the use of atomic energy whose waste will occupy millennia on the other. The biotechnological shock can also lead directly to a dangerous lock-in. Nevertheless, hampering further technical change is as impossible as hampering the tides[9] and consequently unsuited for avoiding technological hazards.

1.1 Technology and Innovation in Economics

There are not only economical[10] and technical lock-ins, but those of economics as a science as well. In a sense specializing leads to a lock-in situation unless it goes together with a philosphy of science that assures the compatability of the findings in the subfields. Another stumbling block on the road to theories can be a lack of subfields. One of the most famous blind spots in economics concerns our theme. In his famous paper of 1957, the later Nobel laureate Robert Solow tried to measure the factors leading to economic growth. He and most economists were surprised that neoclassical economics could account only for 12.5% of the growth of the American economy. In his growth theory, Solow attributed an 87.5% "residual" to technology. This, however, did not explain how technology changes; neither did it give any indication how to model innovation. Solow discovered that for the neoclassical growth model technical change is transpiring *Inside a Black Box*. This is the title of Nathan Rosenberg's (1982, vii) collection of essays that took up Solow's challenge. However, already in 1934 Schumpeter told one of his first graduate students at Harvard: "My dear Samuelson, how could any savant leave out for the 1899-1923 years the palpable fact of technological change?" (Samuelson 2001, 493)

To say that technical change is not explained does not mean that technology is not mentioned by mainstream economics. Indeed, references to it abound e.g. in production functions and growth theories, in studies of economic development and unemployment, in capital theory and business administration, in

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[8] On the difficulties to identify "shocks to technology" see Christiano et.al. (2004, 381); clearly, this requires a historical analysis as provided by Sombart. -- On "technological lock-in" see Kurdas (1999); on encouraging moral along with technical progress see Schmoller (1903).
[9] To use the image of the scientist, entrepreuneur and social reformer Ernst Abbé (born in Eisenach in 1840), He died in 1905, so Gerth (2005) and others discussed him in 2005.
[10] How an economic system can be a lock-in, this study answers implicitly.

the theories of factor productivity and international trade.[11] As long as these fields are separated, however, they are of little help in assessing technical change in order that it is neither sucked in by Scylla nor beheaded by Charybdis, that it neither becomes a sucking Scylla nor a head-cutting Charybdis. Technical change may take on all these faces; it implies a new production function because it affects the quality of capital and labor.

Qualitative changes we often call *innovations*; they are related to new or rediscovered knowledge. As such, knowledge is not another factor of production beside capital, labor, and land, but unifying them.[12] Because it takes time for knowledge to boil down to inventions and innovations and as such to diffuse over a sufficiently large part of the world to become economically significant, we are most likely to find comprehensive analyses of technical change in studies of economic history. Some of the best known are by such economists and historians as Fogel, Landes, Rosenberg, Rostow, Nelson and Winter.[13] This suggests that we can understand technical change better from the viewpoint of history with changing institutions, skills and capital compositions than from the viewpoint of a well-established market economy with relatively stable and ahistorical rules.

As the name suggest, evolutionary or dynamic economics are concerned with the changing or historical dimension of the economy.[14] Although they employ various new methods, they pursue similar goals as 'historical economics' (cf. Kindleberger 1990) or the historical school(s) of economics, which dominated the science in Germany from Wilhelm Roscher (1817-1994) to Werner Sombart (1863-1941) and which is akin to (old) institutional economics (Veblen, Ayres). Economists dealing with these issues are more concerned with how markets are established, how the economy grows and declines over decades or centuries than with how specific markets, households or firms function in times without (much) innovation. They are more interested in the preconditions for prices than in explaining particular prices for specific goods. Their perspective is more social and historical than micro- or macro. They are

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[11] Sombart was still writing on the last edition of the last volume of *Modern Capitalism* when Heckscher (1919) published his paper on international trade which is still discussed as *Heckscher-Ohlin Model* (cf. Leamer 1995) Nevertheless, "[n]eoclassical growth is usually modeled under autarky despite the fact that this scenario does not seem to be a good approximation of reality." (Cuñat and Maffezzoli 2004, 707) With the decline of international trade during World War I, the realist Sombart began to discuss autarky and technology assessment.

[12] In general, wisdom makes production possible if it includes the wisdom embedded in nature as it is increasingly discovered by ecology. See Cloos (1958) for an early study on *The Living Earth*. For a perspective including the social sciences see the transdisciplinary journal of the International Society for *Ecological Economics* (ISEE), Volume 1(1989).

[13] Helpful is Rostow's (1990) survey book *Theorists of Economic Growth*. For other titles, see the mentioned authors in the extended bibliography and Kindleberger/di Tella (1982) in honor of Rostow.

[14] Cf. e.g. Erdmann 1993 and since 1991 the periodical *Economics of Innovation and New Technology* in http://www.informaworld.com/smpp/title~content=t713641545.