

UNDERSTANDING TECHNOLOGICAL PROGRESS

Everyone agrees that technical progress is the most important economic factor driving the long-run growth of economies. Yet the creation of new knowledge, and its eventual fruition as new products and processes of production, is one of the most difficult things to understand. In the latest issue of the *Economic Journal*, four leading economists in the field debate the current state of play in this problematic area.

In the first article, Professor **Vernon Ruttan**, from the University of Minnesota, argues that attempts by economists to understand the determinants of the rate and direction of technical change have run into a dead end by failing to make their theories wide enough.

The mainstream approach emphasises two potentially crucial determinants of technical progress: growth in demand, which pulls along the process of innovation; and growth on the supply side - increases in human and natural resources, including the knowledge and skills of the workforce. This approach is far too general, and despite finding support in early case studies in the 1960s, it is not possible to use it to explain much at the detailed level.

Economists working within the Schumpeterian tradition emphasise the evolutionary character of specific technological changes rather than the role of economic forces. Chance and history can combine with scale economies or market power to lock us into inefficient trajectories of technologies. The classic example is the continued use of the traditional inefficient QWERTY typewriter keyboard with the modern computer. This theory works well at the level of individual case studies, but not more generally.

Ruttan argues that each of these theories is limited and that further advances depend on the integration these theories. Professor **Gavin Wright**, an economic historian at Stanford University, disagrees. He suggests that the problem lies in economists' deeply ingrained reluctance to accept a view of economic life as genuinely historical, shaped by both the contingencies of the moment and by the evolutionary pulses of the times. Investments in new knowledge do respond to perceived profit opportunities, Wright acknowledges, but treating these as 'ordinary' economic decisions is unsatisfactory, because the system itself - the 'technology of technological change' - has continually restructured itself in the past and will surely continue to do so in the future. Wright calls for a 'more historical approach' to the economics of technology.

Professor **Giovanni Dosi**, an economist with the International Institute of Applied Systems Analysis (IIASA) in Austria, insists that the beginnings to a new approach are already at hand. Whereas traditional approaches treat firms and entrepreneurs as perfectly rational agents, we need to understand that they are less than perfect. New ideas are tried out, and

they are carried forward if they are successful: firms that happen to be successful at the time are imitated by other firms. Economic progress is more akin to Darwinian evolution than the unfolding of a divine plan.

‘Every now and again it is necessary for economists to step back and re-evaluate what they are doing’, comments the editor of the controversy section, Professor **Huw Dixon** of the University of York and CEPR. ‘There certainly seems to be a strong current of opinion in the profession that we need to develop our understanding of technical progress to take into account the rapidly changing environment in which we currently find ourselves.’

In the final contribution to the symposium, Professor **William Nordhaus** of Yale University argues that efforts by economists to measure the impact of advances in technology may be as inadequate as their efforts to understand the sources of technical change. This is because of inaccurate measures of price change, particularly when a quality change is involved, as with the shift from the kerosene lamp to the electric light.

Nordhaus estimates that increases in the price of lighting services since 1830 may be overestimated by as much as a thousandfold! Although lighting may be an extreme example, the same principle applies to many other consumer goods. If Nordhaus is correct, productivity growth and growth in real wages may have grown much more rapidly than indicated in official statistical series.

Note: ‘Controversy: The Source and Measurement of Technical Change’ edited by Huw Dixon of the University of York is published in the Autumn 1997 issue of the *Economic Journal*. The symposium comprises four articles: ‘Induced Innovation, Evolutionary Theory and Path Dependence: Sources of Technical Change’ by Vernon W. Ruttan of the University of Minnesota; ‘Opportunities, Incentives and the Collective Patterns of Technological Change’ by Giovanni Dosi of IIASA, Laxenberg, Austria; ‘Traditional Productivity Estimates are Asleep at the Technological Switch’ by William B. Nordhaus of Yale University; and ‘Towards a More Historical Approach to Technological Change’ by Gavin Wright of Stanford University.

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