Jill Hills ('Communication, information and transnational enterprise') examines the way in which the United States and United Kingdom governments have sought to alter physical infrastructures, information flows and regulation in favour of their transnational companies. She skilfully traces the development of such mercantilist policies in a global economy in which to be rich in information resources is to be powerful. This is most obviously seen in the North-South divide over free flow, sovereignty and, with the increasing ability of multinational corporations to bypass national telecommunications networks, the remaking of international networks in an American image — a situation of fragmented public and private provision in which the private pays nothing towards the public. In the final analysis, the losers will be sovereign nations, the rural population in the developing countries and the citizen everywhere.

Bernard Dasah ('Application of neoclassical economics to African development') argues that neoclassicism, which views human relations in a commodity exchange mode is inappropriate to the needs of the economic culture of Africa. It is important that we attempt to reconcile some of the traditional African values of family and kinship, social bonding and group solidarity with the imperatives of economic efficiency and accumulation. Here again, the case is made for economic progress to be viewed as but special instances of more general communication processes: economic activities are exchange activities and all exchange activities are social behaviours, defining spheres of influence and power. Consequently, certain activities that may appear irrational according to the economist's individualistic model, may be quite rational and beneficial from the community point of view.

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The British Industrial Revolution: an Economic Perspective *edited by Joel Mokyr* (Westview Press, Boulder, Colorado, 1993), pp. xi + 362, US$55.00 hc., 18.95 pb., ISBN 0-8133-8509-1/5.

The term "Industrial Revolution" has long been a source of controversy among economic historians. This collection of essays seeks to illuminate the debates of recent years, applying the methods of the New Economic History or Cliometrics — that is, bringing to the traditional qualitative and judgmental approaches to history the theoretical approaches of economics and the measuring instruments of econometrics. About one matter at least there seems little argument, namely that the British economic experience of the time is a matter of compelling interest to economic historians, as witness the fact that all five contributors to the book are based outside the United Kingdom, in North America.

Though the term "Industrial Revolution" was coined by a Frenchman towards the end of the eighteenth century, it is perhaps appropriate to consider what we understand by the key term: the Oxford Dictionary defines revolution as a "complete change, turning upside down, great reversal of conditions, a fundamental reconstruction". In these contexts, the American,

French and Soviet revolutions might seem better candidates, for revolution carries with it an implicit connotation of rapidity, of drama speedily concluded on the historical scale. But the Industrial Revolution cannot be dated from a tea-party, or a stormed building; it is an altogether subtler affair. To some economic historians of an older generation, the drama was there, with heroic inventors, new industries growing like mushrooms, and a simple acceptance of statistics which suited their case. More recently others have pointed out that the transition was not so dramatic, that there was significant scientific and industrial progress before 1770, and that the revolutionary concept was a misnomer and outright mistake.

In the present work, five eminent contributors summarise and analyse the current state of debate, emphasising the careful use of quantitative data and its systematic testing. The editor, Joel Mokyr, is well versed in the complexities of economics as well as economic history and has a strong interest and reputation in technology. His contribution to the book is masterly. It occupies almost 43 per cent of the text and guides the reader in fine detail through the mass of controversies and evidence of the past two or three decades, during which time the New Economic History has consolidated its intellectual respectability — not least by provoking controversy within its own ranks!

The second contribution, a stylish and readable chapter from David Landes, covers similar ground to Mokyr's. To this reviewer, it would have been a gentler entry to the non-specialist reader had Landes's chapter come first, a more modest *hors d'oeuvre* to the solid meat provided by Mokyr. But the taste of the two is certainly compatible, that the Industrial Revolution merited its name but that the difficulties of analysing it in precise econometric terms are so profound that, at least in this context, Cliometrics is more Clio than metrics, notwithstanding the invaluable contribution of the latter.

Mokyr begins, sensibly, with problems of definition and a brief survey of different schools of thought on the Industrial Revolution: Social Change, Industrial Organisation, Macroeconomic, and Technological. In examining their various claims and preoccupations, he offers many fascinating insights into the problems of historical detective work. For example, in discussing the significance of inventions he contrasts macro-inventions (novel changes which involve a discontinuous leap from past technology and create a new technological paradigm, which could include the hot-air balloon as well as the steam engine and the spinning machine) with micro-inventions, which are incremental and by nature less spectacular. Yet the economic impact of the latter may be vastly greater, especially in the short run, than that of macro-inventions; Henry Cort's puddled and rolled iron technique for converting pig-iron to wrought-iron was a micro-invention of prodigious economic impact, quickly felt, whereas practicable air travel was a century and a half in coming.

To answer the question whether the Industrial Revolution was as abrupt a change as its supporters allege invokes a host of problems of evidence and measurement which Mokyr treats at length. In the vexed question of measuring technological change he is unenthusiastic for patent counts. Calculations of Total Factor Productivity might appeal to neo-classical economists though their problems in a contemporary context pale beside those of the economic historian, desperately short of reliable data, but such calculations that have been made, most notably by Crafts, suggest that post-Revolutionary growth has not been as pronounced as many historians thought.

The admirable comprehensiveness of Mokyr's chapter makes it impossible to do full justice to him in this review. On the question of why Britain was the central seat of industrial change, the hypotheses are generally too broad to admit satisfactory econometric analysis, but they do allow extremely informative discussions on the impacts of British geography, technological creativity, social and institutional factors, government and political issues, the influences of demand, supply and foreign trade, and the role of science and technology. Issues raised in these areas surface again in later sections on labour and capital. Again,

measurement is a problem: what can we say about factor productivity unless we can measure factor inputs accurately? We need to know who was employed in which industries, for how many hours and so on; yet the first census was not taken until 1801 — well into the revolution, forcing us into a difficult search for satisfactory proxies. In the end we are obliged to include casual empiricism in our armoury, if only because the proxies permit it. As Mokyr puts it, "after 1750 the fetters on sustainable economic change were shaken off...Britain taught Europe and Europe taught the world how the miracles of technological progress, free enterprise, and efficient management can break the shackles of poverty and want. Once the world has learned that lesson, it is unlikely to be forgotten",

In the closing section of his extensive introduction, Mokyr explores the progress of wages and the standard of living across the period. This is an emotive area, long fought over. Optimists maintain that industrialisation raised living standards, where pessimists saw a fall and political romantics (from Engels to Hobsbawm) saw the destruction of a rustic idyll and its substitution by satanic mills and rampant capitalism. After carefully sifting the evidence, which included many new contributions in the 1980s and ranges over wages, sectoral shifts, unemployment data, income distribution, biological data and a valid caveat that indices typically understate benefits due to technological improvements in consumption patterns, Mokyr confesses that the evidence cannot resolve the battle between the optimists and the pessimists. While later generations have benefited from the revolution, it seems quite plausible that the working participants were practically no better off.

The three remaining chapters deal with specific issues. Knick Harley examines the macroeconomic analyses of the revolution, showing that the earlier work of Deane and Cole ascribed too much to its impact on output; his own and Nick Craft's work suggest that output in the mid eighteenth century was higher than they thought and the subsequent rate of growth more modest. Factor productivity analysis now suggests that the residual contribution to economic growth was also more modest, though there were undoubtedly major changes in cotton textiles, iron-making, canals, railways and shipping. But it is important to appreciate that textiles and iron accounted for only a third of manufacturing industry by 1840, and that there were substantial craft sectors which were more or less unaffected by the changes. Agriculture was another area of major changes, releasing labour to manufacturing, but evident advances could have odd side effects: the increased efficiency of the textile industry, which was highly competitive, resulted in lower prices for textile exports, shifting the terms of trade against Britain.

Gregory Clark explores the agricultural sector in detail in the fourth chapter, showing how it too requires forensic skills to grub out the evidence. Probate records, rent series, even the food budgets of Eton College have been used; but all need skilled interpretation, not least in the technique of inferring output at an earlier period, and then analysing what contributed to the subsequent growth of output at a better-documented time in the future. Rents for example tended to be sticky upwards, either because of long (21 year) leases or because shorter period rent reviews were irregularly done. Enclosure was a relative sideshow in its contribution to increased agricultural productivity. Increased grain yields seem to be the only uncontroversial fact, and Clark concludes that the Agricultural Revolution did not parallel its industrial counterpart, with substantial improvement in England before the period.

The final chapter by David Mitch concerns the role of human capital in the revolution examining the role and progress of literacy, which he notes had high social and private rates of return but seems to have increased only slowly in Britain and been of little significance in many industries. England had little or no advantage over her rivals, but the proposition is examined that all that is necessary for successful industrialisation is a threshold proportion of literates in the population, which Britain and most of Western Europe were well past. On the job training is thought to have had significant benefits, however — conclusions which

may offer comfort to the developing world. This chapter I felt was rather narrow and disappointing in its treatment of human capital, although I agree with its thrust that progress did not rest strongly on formal education.

All told, this is an authoritative and invaluable survey of the present state of the academic literature. As such it is invaluable to economic historians, among whom it will enlighten the non-quantitative and sober the cliometricians; but it is also of major interest to economists like myself, and to anybody with an interest in economic development. The contributions are varied enough to be read as individual offerings, but with a degree of overlap which makes for useful reinforcement and mutual support. Certainly no bookshelf concerning the Industrial Revolution can possibly afford to be without it.

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On Target? Review of the Operation of External Earnings Targets for CSIRO, ANSTO and AIMS *by Australian Science and Technology Council* (Australian Government Publishing Service, Canberra, 1994) pp.xviii + 92, ISBN 0-644-33079-1, Summary Report, pp.xvi + 24, ISBN 0-644-33149-6.

Within Australia, political pressures arose in the 1980s to make the research of Commonwealth Government research agencies "more relevant to the well being and economic prosperity of the nation" (main report, p.xv). By the end of the 1980s, the Government had embarked on a policy of setting targets for external fund raising for a number of its research agencies. In 1988, such a target was set for the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and in late 1990 targets were set for the Australian Science and Technology Organisation (ANSTO) and the Australian Institute of Marine Sciences (AIMS). The target was for CSIRO to earn 30 percent of is total income from external sources by mid-1991, ANSTO to earn 30 percent of its appropriation income from such sources by mid-1994 and for AIMS to do likewise by mid-1996. Why the 'magic' figure should be 30 percent is difficult to know. However, the effective percentage is slightly higher for CSIRO than for the other two agencies because in the former case it is estimated in relation to total income not appropriation income.

This ASTEC report was requested by Senator Chris Schacht, Minister Assisting the Prime Minister for Science and the report and its summary basically follows the terms of reference supplied by the Minister. The report includes an ASTEC executive summary, a set of recommendations, background information on the history and purpose of external earnings targets and comparisons with policies affecting overseas government research agencies, trends and changes in external earnings by CSIRO, ANSTO and AIMS, the impact on the quality and level of interaction of these bodies with industry and other users of research and the impact of the targets on the research responsibilities of CSIRO, ANSTO and AIMS and on the balance of their research effort. There is also considerable discussion of how targets have affected the management of resources and organisation in the above mentioned agencies, the way in which targets might be modified in the future and the possibility and desirability of introducing additional performance indicators to external earnings (funding) targets. Particular attention is given to the importance of promoting links with small and medium sized enterprises. The concluding chapter of the report deals with broader issues in exactly one page in a relatively vague and nonprescriptive manner.