DEBATES

"Say's Law and the Single-Factor Explanation of British Industrialization: a Comment"

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In a recent article in this journal, John Gaski raised the now rather unfashionable topic of the cause or causes of the Industrial Revolution in Britain. He came to the provocative conclusion that a 'single, primary cause' can be isolated as the sole necessary and sufficient condition among the host of factors by which historians have sought to explain industrialization. 'That factor is technology', he argued: it alone can impel industrialization. 'In summary, the position argued is that technological development or, more properly, the human capacity for it, is the ultimate cause of industrialization. This is tantamount to a statement that the invention of better machines was responsible for XVIIIth century British industrial development' (p. 223). In a subsequent issue Professor Inkster replied to Gaski's argument, suggesting various deficiencies in it.[1]

However Inkster's reply is itself deficient, for it completely fails to address the main analytical argument advanced by Gaski, and goes on to advance an implausible 'single-factor' explanation of a different type. The main purpose of this comment is to outline and refute the main theoretical point which underpins Gaski's argument.

The justification for returning to this issue lies in the historiographical

[1] JOHN F. GASKI, "The Cause of the Industrial Revolution: A brief 'Single-Factor' Argument', *Journal of European History*, Vol. 11, No. 1, 1982, pp. 227-233. I. INKSTER, "Technology as the cause of the Industrial Revolution, Some Comments", *JEEH*, Vol. 12, No. 3, 1983, pp. 651-658.

importance of the idea that technological change caused the industrial revolution.

This proposition may not in itself seem very remarkable, since the idea that technical change produced the Industrial Revolution can be traced back to the first systematic work on the topic, Toynbee's *Lectures on the Industrial Revolution in England*. He argued that although economic liberalisation was a permissive factor, innovations in steam power and textile machinery were crucial.[2] This idea has of course formed a central theme in the historiography of industrialization ever since. What distinguishes Gaski's account of industrialization is three very strong propositions. The first concerns those phenomena — such as population growth, agricultural revolution, market expansion and so on — which typically are associated with industrialization, and which often play some role in explanations of the process. Gaski holds that these phenomena are at best necessary rather than sufficient for industrialization, in the sense that their absence may hold back industrialization, but their presence cannot cause it. The second proposition is that they are not, in effect, autonomous necessary conditions at all: they are endogenous to the system, since technological change can 'induce' or 'elicit' or 'produce' them. The third proposition is that technical change is in effect *sui generis*, given technical feasibility and 'unsatisfied need' (*not*, it should be emphasised, market demand). To back this up, a sketch of a theory of technological development is offered, in which a combination of know-how and need produces innovations, and then innovations generate population change, capital accumulation, and all of the other paraphernalia of industrial society. It should be emphasized that this final argument is one of the few serious attempts to form a rigorous argument to support the widely-held view that technological change caused industrialization. As such, it deserves a reply: Professor Inkster's comments are in effect confined to the first set of propositions, concerning the sufficiency of non-technological factors. Therefore I shall not discuss these matters, but go straight to the theoretical core of Gaski's argument: this is that technological advance is a self-sufficient process in which entrepreneurs can ignore all factors other than unsatisfied needs (on the part of potential consumers) and technical feasibility (on the supply side). In particular they can ignore demand because of the operation of Say's Law of Markets, which Gaski interprets to mean that innovation decisions do not face a demand constraint. To what extent is this version of Say's Law acceptable?

[2] A. Toynbee, *Lectures on the Industrial Revolution in England* (1908), p. 69. See K. Bruland and K. Smith, 'Industrialization', Steam Power and Economic Historiography', *Economy and Society*, Vol. 10, No. 1, 1981 for a discussion of this notion in Toynbee.

Technological change, Industrialization and Say's Law

Before assessing Gaski's arguments here we must first of all get a problem of tautologous definition out of the way. Gaski defines technological innovation as 'the invention of the kinds of machines or gadgets that are vital to industrial and economic progress' (p. 231). Things look very circular indeed here. If new machines are 'vital' to industrialization, and if industrialization, is seen as the effect of the application of machines, then technological change does not cause industrialization: it *is* industrialization. In fact Gaski recognises this later in his article, without seeing that it provokes explanatory problems: 'frankly, the proposition that industrial machinery caused the industrial revolution hardly seems startling...'. From this perspective one might normally expect a search for the causes of technological change/industrialization. The really distinctive feature of Gaski's argument is that no such search is necessary.

Gaski's argument is that a self-sufficient process of technological change can, of itself, generate industrial and economic change. All that is necessary is that inventions are 'within human capabilities' and that they satisfy needs; then, the complex processes of invention, innovation and diffusion which make up technological change will occur with *no other causal factors present*. I now turn to the assessment of his argument here.

Normally, economic theories of technological change relate innovation and diffusion more or less directly to expected profitability.[3] For firms, this entails some conception of competitive conditions and the state of demand, with prospects of profit being held out by satisfying market demand. Now demand is, of course, the willingness and ability to pay a price for a good; in Gaski's own words, it is need backed by purchasing power. Gaski's argument is that purchasing power is a redundant terms here: need alone will do. The argument runs as follows:

> While demand was proposed as a necessary condition for innovation, "unsatisfied need" more accurately expresses the factor. Once a need is identified, innovation can proceed with the expectation that the output of the improved technology will create its own demand via Say's Law of Markets. The basic sequence is that adoption of a new technology results in increased per capita output, which translates into greater per capita wealth and purchasing power. This, then, is the cornerstone of the argument: concurrence of technology and market demand is sufficient for industrialization... (but) since technology is capable of producing the other jointly crucial factor it becomes the sole sufficient condition. (p. 232)

[3] cf P. Stoneman, *The Economic Analysis of Technological Change* (1983), or almost any work on this topic.

This argument stands or falls by the validity of the claims made concerning 'Say's Law of Markets'. The core of Gaski's position is the suggestion that supply decisions involving technological change face no demand problems. On the contrary such supply will 'create' demand for the products concerned.

Now the proposition that 'supply creates its own demand' may or may not be an accurate representation of Say's Law, for this law has given rise to conflicting interpretations in the history of economic theory. Certainly this proposition is, as Clower and Leijonhufvud rightly remark, 'perhaps the most ambiguous statement that students of economics are ever asked to ponder'.[4]

While this is not the place for a detailed discussion of Say's Law,[5] something must be said about its meaning. In general Say's Law concerns the identical equality of the planned trades of individual transactors: no-one plans a supply decision without also planning a use for the income thus generated. For the economy as a whole — for plans summed over all transactors — this implies an equality between planned excess demands and planned excess supplies. Because individual plans are only consistent — in the sense that all excess demands are zero — in general equilibrium, Say's Law is compatible with the existence of unemployment and quantity constraints. While it is true, therefore, that productivity-raising technological change will not give rise to a general excess supply — for reasons outlined by Gaski — his conclusion that this will not inhibit technological change is false, because excess supplies of individual commodities remain feasible and even likely.

The reason for this — and hence the basic flaw in Gaski's argument — springs from the fact that while firms tend to be specialists in production, workers tend to be generalists in consumption. While it is an accounting truism, therefore, that in the production of any particular commodity the incomes generated will be equal to the net value of output, it is not true that this implies zero excess demand for the particular product concerned, which is what is required for Gaski's account to work.

Another way of putting this would be to say that Say's Law — where it is not simply an accounting identity — concerns the equality of notional demand and notional supply. But for entrepreneurs it is effective demand which counts: in making supply decisions, particularly those involving technological change, it is the saleability of the product which matters; this involves estimates of effective market demand and its growth, and conjectures concerning the way in which price changes (consequent upon productivity-raising technological change) are likely to affect the actual quantity traded. So

[4] R. Clower and A. Leijonhufvud 'Say's Principle: What it means and Doesn't Mean', in A. Leijonhufvud, *Information and Coordination*, 1981, p. 88.

[5] See the excellent discussion in Leijonhufvud, op. cit., or T. Sowell, *Say's Law*, 1972.

while demand may not be a factor independent of supply at the aggregate level,[6] it is vital at the level of individual enterprises or industries.[7] Mere 'unsatisfied need' will not do.[8]

If this is the case, then Gaski's whole argument is defective. If Say's Law does not hold for individual producers — and it should be emphasized that technological decisions are micro-economic decisions by 'isolated' entrepreneurs — then technological change cannot be the final cause which Gaski claims it to be. It is at best a *proximate* cause, something which, rather than explaining economic change, itself requires explanation. The unsatisfactory nature of Gaski's rejection of other causal factors, outlined by Inkster, is thus paralleled by an unsatisfactory theory of industrialization.

It might be added that, quite apart from the difficulties sketched out above, Gaski's thesis would make it very difficult to explain two crucial problems of industrialization.

If a conjunction of technological feasibility and need are sufficient, then how does one explain (a) the timing of British industrialization (for most of the crucial innovations had been feasible for some time, and presumably needs also existed) and (b) the fact that Britain was first (were textile innovations not within human capabilities in France and Germany? Did they have fewer needs?).

None of my objections to Gaski's arguments should be taken to mean that technological change is unimportant in explaining the dramatic growth of output and income in Britain in the century from 1780. On the contrary, I would agree with Gaski that it is central to the growth of output, productivity and income. However, it is something which is itself the product of complex and as yet little-understood causal factors. Until we know much more about what generates technological change the question of causal origins of the industrial revolution will remain wide open.

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[6] J. Mokyr, 'Demand vs Supply in the Industrial Revolution', *Journal of Economic History*, 37, (1977), pp. 981-1008.

[7] See D.N. McCloskey, 'The Industrial Revolution 1780-1860: a survey', Floud and McCloskey, op. cit. pp. 120-123.

[8] An important part of the literature of development economics, beginning with the work of Rosenstein-Rodan in the 1940s and culminating with the 'balanced growth' literature is precisely concerned with this problem. It argued for the coordination of supply decisions, for the simultaneous development of industries, corresponding to the variegated character of consumer demand. Individual decisions would be unprofitable because of deficient demand caused by the fact that the incomes of a production process are rarely — in fact never — spent entirely on the outputs of that process.