

## 4. Technical progress and obsolescence of capital and skills: theoretical foundations of nineteenth-century US industrial and trade policy

**Michael Hudson**

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This chapter reviews some early technological theories of competitiveness and (what often is left out of account) economic obsolescence. The implications of technological change and industrial head starts for the problem of economic backwardness in societies where progress was not occurring were analysed by mid-nineteenth-century American economists who are largely forgotten today: Calvin Colton, Henry Carey and E. Peshine Smith. These American School writers were associated with Whig (and after 1853, Republican) politicians in shaping the industrial policies that transformed the United States from a raw-materials-producing ('Southern') economy into the world's major industrial power (a 'Northern' economy).

Members of the American School, if they are discussed at all, typically are dismissed as protectionists. A more accurate name for them would be technology theorists, futurists or prototypical systems analysts. Their theory of productive powers focused on industrial and agricultural technology, especially the substitution of capital for labour and land. A quarter century ago (Hudson 1972a and 1975) I collected examples of their theorizing. More recently (Hudson 1992, especially Chapters 7 to 9) I placed them in the context of the evolution of international trade theory. But inasmuch as mainstream theory continues to ignore their remarkable contributions, it is not out of place to present a summary of their work. This chapter therefore contrasts their technological assumptions with the narrower assumptions adopted by subsequent *laissez-faire* orthodoxy. I conclude by suggesting some features needed to formulate a modern theory of the financial and social preconditions for international competitiveness versus backwardness.

Twentieth-century trade theory has diverted economists down the path of hypothetical 'what if' reasoning unabashedly at odds with economic reality. Year after year, Nobel economics prizes have been given for mathe-

matical demonstrations that under certain highly restrictive assumptions economies tend to settle at stable and equitable equilibria. Under these assumptions, international wage and profit rates tend to converge.

There is reason to suspect that the selection of unrealistic assumptions underlying this economic orthodoxy is not innocent. It is axiomatic to historians of economic thought that when a speculative theory is chosen in preference to a more realistic one, some industry's or nation's self-interest is acting as an invisible hand, turning economic doctrine into a public relations ploy to promote specific desired policies. The effect is to divert analysis from economic reality.

Today's economics discipline has become a science of assumptions whose badge of scientific reasoning is simply the internal consistency of these (arbitrary) assumptions. If trade theory bears much of the blame for economics' circular reasoning and practical irrelevance, it is largely because of the role played by the tariff debate during the formative period of classical economics and the mobilization of economic theory to promote status quo dependency patterns today.

The factor-price equalization theorem, for instance, diverts attention from the reasons why, in practice, wages and profits do not converge (much less equalize) in the international economy. What is remarkable to the historian of economic thought is that more than a century ago international trade theory recognized an everyday fact of life that proves fatal to the factor-price equalization theorem: capital competes with other inputs (labour and land) as well as with other capital. This means that the market for goods is not shaped mainly by low-wage labour competing against high-wage labour, as unsophisticated protectionists argue. (More sophisticated protectionists progressed beyond this assumption a century and a half ago.) High-productivity, power-driven capital competes with manual labour and also, to a lesser degree, with skilled high-wage labour.

When Japanese auto makers captured a large part of the American automotive market from the 1960s onward, for instance, it was Japanese capital that undersold American labour as Japan's scientific mechanization of production – and the yen's rising international value – raised the remuneration of Japanese auto workers above that of their US counterparts. Likewise, when American grain undersells that of Argentina and other countries, it is not simply because of the higher natural fertility of US soil. Rather, American agriculture has become more highly mechanized and capital-intensive than that of any other nation. Agricultural capital has been substituted for land and farm labour. Meanwhile, US foreign aid lending provides easy grain credits to food-deficit countries and World Bank lending (reinforced by chronic currency depreciation) diverts their agricultural investment toward the production of plantation export crops. These two

pressures combine to enforce the status quo, keeping these ‘Southern’ economies in debt to ‘Northern’ economies, preventing them from developing more profitable industries and destabilizing their governments if they attempt to chart an independent course. Thus Guatemala, Cuba, Chile, Nicaragua, Brazil and other countries undertaking serious land reform have found themselves the objects of political and economic destabilization.

What do the factor-price equalization theorem and other free-trade orthodoxies have to say about these phenomena actively shaping trade patterns? Very little.

The world’s major nations – England throughout the Industrial Revolution, and the United States, Germany and Japan prior to the 1940s – developed dynamic industrial policies not based on free-trade orthodoxy and its ‘equilibrium economics’. However, as these nations have achieved industrial leads they have adopted international economic orthodoxy, at least as an ideology to export to increasingly dependent customer countries. International dependency and unequal gains from trade thus find their counterpart in asymmetrical economic policies and early theorizing.

The American School of political economists reflected their nation’s position as a less-developed country. They did not want their nation to develop in the ‘normal’ way, as a ‘hewer of wood and drawer of water’ providing raw materials to help England remain the workshop of the world; they viewed this as *maldevelopment*. Instead they wanted to create something more than economic growth: a new kind of economic civilization based on the productive powers of capital – above all energy-driven, mechanized production. They recognized that this high-productivity capital required skilled high-wage labourers as operators and managers.

## 1. THE ECONOMICS OF INTERFACTORAL COMPETITION: HOW CAPITAL UNDERSELLS LABOUR

An economic novice might imagine that only since the Second World War has the role of capital productivity in displacing labour become a subject on the economic horizon. Was it more natural a few centuries ago to reason that an economy’s labour competed with the labour of other countries, not with capital?

Actually the theory of how capital produces labour power (and horsepower) equivalents has a long history. James Steuart (1767, p. 159) noted that machines provide work effort without needing food. To be sure, he added, new labour is needed to make this machinery, so the result does not tend to be unemployment. Josiah Tucker (1931, pp. 241–2) had made the

same point in 1757, and William Petty had said much the same thing in 1691 (in a passage probably written in 1665, in *Verbum sapienti*; Petty 1899, p. 118). Adam Smith (*Wealth of Nations*, book I, Chapter i) believed that capital and labour would simply grow together in a natural proportion rather than capital displacing labour. (For a critique of his neglect of machinery in this respect see Hollander 1973, pp. 215, 217, 209.) But Lauderdale (1804, pp. 298–9), in his critique of *The Wealth of Nations*, noted that the nation need not fear that rising wages would stifle business upswings, for employers could substitute capital equipment. (The literature is reviewed in Hudson 1992, pp. 170ff.)

Writers in both Great Britain and the United States tracked machine power in terms of its labour equivalents, but it was the Americans who emphasized that capital was being substituted for labour at different rates internationally. British power looms supplanted labour not only domestically, but in India and the United States as well. If one country possessed machinery that doubled the output of its workers, Alexander Hamilton (1893, pp. 17, 35) wrote in his 1790 ‘Report on the subject of manufactures’, its labour cost to produce a given article would be halved, giving it a corresponding international advantage. Henry Clay picked up this idea in 1824, multiplying Hamilton’s example a hundredfold: ‘One man at home did the work of two hundred, less or more’ (cited in Colton 1846, pp. 159–60).

American economists also perceived another fact that British economists overlooked: the machinery that displaced the most poorly paid manual labour needed skilled high-wage labour to operate it as well as to design and build it. ‘It is not by reducing wages that America is making her conquests,’ US labour secretary Jacob Schoenhof (1884, p. 19) concluded, ‘but by her superior organization, greater efficiency of labor consequent upon the higher standard of living ruling in the country . . . High-priced labor countries are everywhere beating “pauper-labor” countries.’

Steam-powered production not only increased labour productivity, it also threatened to render unskilled and low-wage labour redundant, not only at home but in less industrialized countries as well. These poorer countries, which were ‘rich’ in low-wage labour, did not develop a comparative advantage in ‘labour-intensive’ manufactures because there was no such thing as inherently labour-intensive manufactures – or land-intensive agriculture, for that matter. In every sector, labour was being replaced by capital. This was the universal dynamic of industrial progress. Countries that failed to mechanize their production thus were in danger of finding their labour forces becoming industrially obsolete. Low wages were a curse, not an advantage.

The diplomat-lawyer-journalist Erasmus Peshine Smith viewed economic development in terms of energy per worker. Smith was a close

associate of William Henry Seward and, in his economic theorizing, a follower of Henry Carey. His *Manual of Political Economy* (1853) became one of the most famous American economic books of the period and was translated into French, Italian and German. Smith himself went to Japan as advisor to the Mikado following the Meiji restoration.

Smith's basic premise was that mechanization lowered the cost of work-effort applied in the production process (as measured in joules or, by logical extension, horsepower or kilowatt-hours). The economic imperative of technological progress was to raise labour from the role of providing merely brute force to that of applying skills. Smith proceeded to develop a refined theory of what subsequently would be called human capital.

Following David Ricardo, the English economists had viewed capital merely as an adjunct to their value theory: the value of capital in production reflected the labour embodied in its manufacture. But as Carey had pointed out, the value of commodities reflected their reproduction costs. These costs tended to fall steadily with the progress of technology. It followed that comparative advantage among nations was to be gauged mainly by the productive powers of the capital with which labour operated.

Smith accordingly formulated what might be called an energy-productivity theory of value in which capital played a more important role than in English economics. Rejecting the 'pauper labour' argument that industrial tariffs were needed to keep out the products of low-wage countries, he described the American System of political economy as resting 'upon the belief, that in order to make labor cheap, the laborer must be well-fed, well-clothed, well-lodged, well instructed, not only in the details of his handicraft, but in all general knowledge that can in any way be made subsidiary to it. All these cost money to the employer and repay it with interest' (Smith 1852, p. 42). What appeared to be highly paid labour on a per diem basis thus turned out to be inexpensive on a unit-cost basis.

Employment of labour required a complementary investment in capital, noted Smith (1853, p. 107): 'As we rise to labor in connection with more complicated machinery, the value of general intelligence becomes distinctly apparent.' As Schoenhof observed a generation later (1892, p. 27): 'In almost every employment of an industrial nature a very great amount of training is requisite to make it effective or to make it serviceable at all. Only in times of a very great demand and scarcity of labour would any one employ crude labor in factories where skill is required.' The minimum necessary educational level rose over time, as labour required increasingly intensive training and education as a precondition for employment – not only within the national economy, but internationally as well. It followed that nations that promoted education would be in the best position to ride the wave of technological progress and undersell other nations. This inci-

dentally seemed to favour democracies over autocracies (a principle long noted by British writers as well).

If there is no such thing as inherently labour-intensive commodities (given the tendency of machinery to displace labour), then factor endowment theories miss the point in viewing countries as having a natural advantage in either labour- or capital-intensive products. Trade does not necessarily provide a demand for each nation's particular mix of labour and capital. Countries may be left behind if their unskilled labour becomes too poor and technologically obsolete to work with high-productivity capital.

In focusing on steam-powered production as the mainspring in economic development, Peshine Smith exemplified the dictum of Friedrich List (1885, p. 170) that political economy should not aim simply at increasing 'the values of exchange in the nation, but of increasing the amount of its productive powers'. But he went further. List had remained in the German Romantic tradition in not explaining just how to quantify productive powers economically. It is a reflection of how far Smith's generation of American protectionists progressed beyond List that in reviewing the first American translation of List's *National System*, Smith complained (in Horace Greeley's *New York Tribune*, 12 April 1856) that the book was too historical and empirical. In terms of actual economic theory, 'all he has done is to substitute the "Theory of Productive Force" for that of Values'. To be sure, Smith granted:

He shows that the European Economists overlook the truth that 'the power of creating wealth is vastly more important than wealth itself.' . . . Their system ignores what may be called virtual or latent wealth, and treats nations as if they were actually exerting the whole productive power of which they are capable; and the only question was how their forces should be directed. The moment this idea is introduced, their theory explodes.

The obsolescence function – the degree to which existing capital equipment and labour find their revenue reduced because of rising productivity from newly produced capital and more recently educated labour – applies in agriculture as well as industry. It reflects the tendency of technological innovation to render existing technologies – and the labour required to operate them – obsolete. The upshot has been that the industrial nations have become supreme not only in manufactured products but also in food-stuffs. While North American and European agriculture has enhanced soil fertility by the application of fertilizers, pesticides and herbicides, and freed labour by mechanizing production, the socially backward 'Southern' economies have been unable to compete. Over the past century the world has seen raw materials monocultures from Latin America to Africa deteriorate into food-deficit economies.

Most European economists rejected the technological analysis of economic development. Reviewing the *Manual* in France, Jean Gustave Courcelle-Seneuil (1853), just before leaving for a decade-long professorship in Santiago, Chile, complained that Smith's approach was too 'specifically American' for him to understand: 'In order to found his theory on purely physical laws, Peshine Smith has simply left the realm of economic science.' The *Manual's* emphasis on the effect of international trade on soil productivity (in viewing ecological depletion as a by-product of single-crop monocultures) entailed propositions 'in truth, more agricultural than economic'.

This did not say much for the relevance of economic science to the dynamics set in motion by industrial and agricultural technology. Ricardo's theory that each nation gained from specializing in 'what it was good at producing' turns out, upon examination, to be static and obsolete when applied to real-world development. Today's trade theory remains in the Ricardian tradition by not recognizing the technological imperatives analysed a century and half ago by the American School.

## 2. FITTING TECHNOLOGY AND OBSOLESCENCE INTO TRADE THEORY (AND ECONOMICS PROPER)

By failing to trace the effect of trade on national productive powers, free-trade theorizing (and neoclassical economics in general) remains merely a theory of market-clearing price equilibrium achieved through the forces of supply and demand, not a dynamic analysis of how economies evolve in terms of their long-term trends and social structures. It would be more than a century before modern economists would rediscover the principle that production costs fall as capital is substituted for labour, and the corollary that economies (or specific companies within given industries) may achieve such great progress as to render existing technologies commercially obsolete, along with outdated machinery and relatively untrained labour. The obsolescence function applies to labour because 'low-paid laborers cannot afford to acquire the training or education necessary to raise their status in production at the rate required by twentieth-century technology' (Hudson 1972a, pp. 125–6). These phenomena are fatal both to the factor-price equalization theorem and to its twin factor endowments theory of comparative advantage.

Instead of asking what conditions might lead wages and profits to equalize in the world economy, economics could gain greater respectability as a discipline by asking why the world's economies are polarizing rather than converging. But a methodological trap lurks for economists who imagine

that the badge of scientific method is the ability to mathematize problems. A single determinate mathematical solution emerges only in a world of diminishing returns. Increasing returns would not produce an equilibrium tendency, and certainly would not lead to factor-price equalization but rather to a polarizing world in which lead nations extend their advantage over economically obsolete countries. Such countries are not so much 'less developed' as maldeveloped. Latin American and African agriculture, for instance, is blocked by inequitable land tenure patterns, rendering these continents dependent on the industrial economies for their basic food needs and hence subject to potentially coercive diplomacy (Hudson 1972b and 1977). Diplomatic coercion, especially in reinforcing agricultural backwardness, shows up, for example, in the financial pressures that the IMF and the World Bank applied in Russia, Indonesia and elsewhere in the late 1990s. These loan programmes promote capital-intensive export sectors, whose proceeds accrue to the large multinationals, side by side with capital-starved low-wage domestic subsistence sectors.

### 3. THE FINANCIAL CONTEXT FOR CAPITAL-INTENSIVE TECHNOLOGY

In addition to failing to analyse competitive advantage in terms of capital productivity, today's economic theory neglects to analyse how capital is 'costed'. By this term financial analysts refer not merely to the purchase price of a machine amortized over its productive lifetime on a unit-cost basis, but also to its financial costs, reflecting the interest rate charged, the debt maturity and the mix of debt and equity financing. The important point is that in today's world, technology is not only a product of engineering; it exists in a financial context. As technological paths become more capital-intensive, the decision to employ a given technology turns largely on how it is financially costed. Direct investment in machinery and factories must be financed either internally (with retained earnings) or externally by some combination of bonds, equity stock issues and bank debt. Interest rates on such debt vary from country to country, as do price-earnings ratios for stocks (and hence the cost of equity capital).

Modern economies accordingly must be analysed not just in terms of their factors of production, but also in terms of their growth (often over-growth) of financial and other rentier claims on income and wealth. Yet today's 'value-free' economics mistakes the FIRE-sector (finance, insurance and real estate) overhead for wealth itself. It counts all labour and other remunerated economic activity as productive, regardless of its economic consequences.



Yet when we examine the competitiveness of specific industries (for example, electronics, autos and other manufacturing), the key variable often turns out to be the cost of capital. Countries are financially uncompetitive when their banking systems provide credit at so high a price that producers must factor in higher interest rates, higher debt–equity ratios, lower price–earnings ratios and shorter debt maturities than their foreign competitors. Austerity programmes which tighten domestic credit block new capital-intensive investment.

Such financial considerations are central to any corporate planner but have not found their way into academic economics. Economists have no perception of countries falling so deeply into debt that most of their income must go to service their debt, which, in turn, prevents them from competing with low-debt and low-rent economies. Although the same physical technology is available to all countries, financial considerations may render any given technology less remunerative in one economy than in others. Unfortunately, economists avoid having to cope with such problems by dismissing them as ‘external economies’, that is, considerations lying outside the narrow scope of factors recognized by most policy-making theory.

The fact that new technology requires lead time for research and development means that profits cannot simply be paid out to investors as dividends. They must be reinvested in research to develop more new products or to cut costs on existing output. But the spread of corporate raiding in the 1980s led companies to make quick pay-outs rather than invest in long-term development. Such pay-outs were needed either to support stock prices against potential raiders or (in the case of companies that were already raided) to pay off the high-interest (‘junk’) bond-holders.

Postclassical economics has dropped the study of land as a distinct factor of production, telescoping it into capital in general. This obviates the study of land tenure as a cause of backwardness and agricultural obsolescence. To be sure, the mechanization of farming is largely responsible for America’s remarkable growth in agricultural productivity. But land also has a pure site value. Fortunes are made by reclassifying rural land as developable suburban land. And to the extent that savings are recycled to create a real estate bubble (as distinct from a stock market bubble), rents may be raised.

Fiscal, financial and related rentier charges do not reflect factor prices as such. They are claims on income or wealth that do not reflect actual inputs. If they have been neglected by most economic theorists, the reason seems largely to reflect the FIRE sector’s interest in not allowing its behaviour to become a subject of economic analysis, part of the screen of invisibility which has been erected around the FIRE sector and its rentier income overhead.

#### 4. THE ROLE OF CAPITAL TRANSFERS IN FACTOR-PRICE POLARIZATION AND THE CHOICE OF TECHNOLOGIES

An implicit corollary of the factor-price equalization theorem is the purchasing parity theory of exchange rates. This theory (perhaps 'rule of thumb' might be a more accurate label) states that currency values tend to reflect the cost of a similar market basket of commodities in different countries. The logic is that if such prices vary (at least under free-trade conditions), trade will occur to equalize prices in a unified world economy. But as any traveller knows, international prices tend to vary widely, especially in Third World debtor economies. And any balance of payments analyst knows why: most foreign transactions (like most transactions within domestic economies) are not for goods and services but for capital investments and their reciprocal debt service or earnings remittances. These capital account items (and I include debt service as being functionally a part of the capital account of assets and liabilities) overshadow commodity trade. Stated another way, currency values have become primarily a function of capital transfers. In balance of payments terms, the capital account drives the current account.

To be sure, international prices are plugged into certain common denominators. Raw materials have a common world price, as do physical capital goods. Capital and management also have more or less common world prices. These prices typically are set in US dollars, and hence are not influenced by currency depreciation.

When currencies are devalued, the major price influenced is that of domestic labour. In addition, foreign debt service becomes more expensive as calculated in the local currency. Devaluation therefore diverts purchasing power from the domestic sector to the foreign sector. The case of Latin America is instructive in this regard. Debt service, along with domestic capital flight, exerts chronic downward pressure on the entire region's currency values as governments devalue their currencies in a desperate (and vain) attempt to stimulate trade in order to service their debt and replace lost domestic capital.

Austerity programmes deny the credit needed to apply capital-intensive technologies. The policy of 'stabilizing public budgets' by taxing domestic income while depreciating the currency favours crude labour-intensive technologies rather than more capital-intensive ones

## CONCLUSION

If the purpose of economic theory is to explain existing (and future) production and trade patterns, it is necessary to take into account not only the physical engineering aspects of technology but also the broad array of financial, fiscal and institutional factors that determine the economy-wide costs of such technologies. All these factors contribute to making Third World countries and the formerly socialist economies ‘hewers of wood and drawers of water’, as the American technology theorists put it in the nineteenth century.

A total economic theory is needed – not merely a theory of market-clearing prices, but an overall development theory. As long as such theories are marginalized into special subdisciplines of academia, economics will remain sidetracked by a non-developmental, asocial and apolitical theory based on tenets it takes as God-given, not to be questioned. Neoclassical economic theory does not accurately describe or adequately explain what actually happens in the real world. As Groucho Marx put it in one of his movies, ‘Who are you going to believe – me, or your eyes?’

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