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Ricardo's Vice and the Virtues of Industrial Diversity

by Steve Keen

That specialization is the primary source of economic gain has been accepted by economists ever since the famous example of the pin factory with which Adam Smith opened *The Wealth of Nations*:

> One man draws out the wire, another straights it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head; . . . ten persons, therefore, could make among them upwards of forty-eight thousand pins in a day. . . . But if they had all wrought separately and independently, and without any of them having been educated to this peculiar business, they certainly could not each of them have made twenty, perhaps not one pin in a day.[1]

David Ricardo extended Smith's vision of specialization within a given industry to specialization between industries and nations, and made the argument that two countries can benefit from free trade even if one country is absolutely less competitive in both industries than the other. In his hypothetical example,

Portugal could produce both cloth and wine with less labor than England. If England specialized at the industry it was comparatively better at (cloth, obviously) and Portugal specialized in wine, then the total output of both industries would rise.[2]

This concept of the advantages of specialization became the core insight of economics, and it continues to be ingrained in and promoted by economists today. Lionel Robbins's proposition that "Economics is the science which studies human behaviour as a relationship between ends and scarce means which have alternative uses"[3] is the dominant definition of economics. It implicitly emphasizes the importance of specialization, so that those "scarce means which have alternative uses" can be efficiently allocated to achieve the maximum level of output.

This belief in the advantages of specialization lies behind the incredulity with which economists have reacted to the rise of populist politicians like Donald Trump in the United States, as well as the United Kingdom's vote for Brexit. They have, at their most self-righteous, blamed the rise of anti-globalization sentiment on the public's irrational failure to appreciate the net benefits of trade. Or, more commonly, they have conceded that perhaps the electorate has reacted negatively because the gains from trade have not been shared fairly.

There is, however, another explanation for why anti–free trade sentiment has risen: the gains from specialization at the national level were not there to share in the first place, for sound empirical reasons that were ignored in Ricardo's example. That ignorance has been ingrained in economics since then, as Robbins's definition—dominant and superficially persuasive, but fundamentally limited—gave economists a starting point from which they could not properly perceive either the advantages or the costs of globalization.

Deus Sine Machina

Robbins's definition codifies arguably the most egregious oversight in economic theory. It omits a realistic treatment of resources that do not "have alternative uses," by which the great wealth of modern society has been created: machines. Today, with 3-D printers, increasingly adaptable robotics, and the beginnings of AI, we can contemplate the eventual creation of a single machine that could be deployed across a range of industries. Yet for the foreseeable future, most machines are tailored for specific tasks in specific industries and are useless in any others, as was also the case in the distant past when the theory of comparative advantage was invented. Smith acknowledged the need for specialized machinery in pin production (and attributed the development of that specialized machinery to the division of labor itself, though it can just as easily be argued that the specialization of machinery is what gave rise to the specialization of labor):

> A workman not educated to this business (which the division of labour has rendered a distinct trade), nor acquainted with the use of the machinery employed in it (to the invention of which the same division of labour has probably given occasion), could scarce, perhaps, with his utmost industry, make one pin in a day, and certainly could not make twenty.[4]

Ricardo also acknowledged the need for machinery. But in considering not one industry but two, Ricardo assumed a crucial *and false* equivalence between physical machinery and monetary capital that has bedeviled economics ever since: he treated the specialized machinery in different industries *as if* it were equally as liquid (and so could be as easily repurposed) as the money with which it had been purchased.[5]

The gain from trade arose, Ricardo asserted, because of different production technologies in different countries (whether that was due to different labor skills, different weather, or different machinery).[6] These differences could not apply within one country, but did apply between them, so that "the produce of the labour of 100 Englishmen may be given for the produce of the labour of 80 Portuguese, 60 Russians, or 120 East Indians."[7] The reason for this difference between domestic and international trade was, he claimed, because capital moved easily within a country, whereas it was effectively immobile between them.[8]

This is a confusion of monetary capital (which Ricardo, as a stockbroker by trade, knew intimately) with the physical machinery in factories (about which he knew very little). Yes, monetary capital moves easily in search of a profit—today, even internationally. But machinery is specific to each industry, and the crucial machines in one industry cannot simply "move" to another without loss of productivity.

The archetypal machines for cloth and wine manufacturing in Ricardo's time included the spinning jenny and the wine press. It is stating the obvious that one cannot be turned into the other, but stating the obvious is necessary, because the easy conversion of one into the other was assumed by Ricardo, and has been assumed ever since by mainstream economic theory.

In fact, the relative mobility which Ricardo assumed for his ubiquitous concept of "capital" is the opposite of what applies to machinery. Machinery designed for one industry simply cannot move to any other, even in the same country; but machinery in one industry can (and frequently is) shipped between countries.

Ricardo's Vice

By not calling out Ricardo's confusion of physical machinery with monetary capital, economics fell into what Schumpeter later called "the Ricardian Vice": the practice of deriving logically watertight conclusions from impossible premises that today economists euphemistically call "simplifying assumptions." Schumpeter eloquently characterized Ricardo's method as follows:

> The comprehensive vision of the universal interdependence of all the elements of the economic system that haunted Thünen probably never cost Ricardo as much as an hour's sleep. His interest was in the clear-cut result of direct, practical significance. In order to get this he cut that general system to pieces, bundled up as large parts of it as possible, and put them in cold storage—so that as many things as possible should be frozen and "given." He then piled one simplifying assumption upon another until, having really settled everything by these assumptions, he was left with only a few aggregative variables between which, given these assumptions, he set up simple one-way relations so that, in the end, the desired results emerged almost as tautologies. . . . The habit of applying results of this character to the solution of practical problems we shall call the Ricardian Vice.[9]

The Ricardian Vice is well evidenced by Ricardo's arithmetic example that became the foundation of international trade theory. If it were true that the machinery for producing wine could be converted (at no cost and with no loss of productivity) into machinery for producing cloth and vice versa, then it would also be true (assuming continued full employment, and less controversially the capacity for a vigneron to retrain as a shepherd, and vice versa) that the ending of autarky and the overnight opening up of free trade between England and Portugal would have increased the aggregate output of both industries across the two countries. Ricardo's conclusions follow from his premises. But his premises are manifestly false.

What would have been the realistic sequence of events following the change from production of wine and cloth in England and Portugal under autarkic conditions, to free trade? Firstly, it was not the case that Portugal was more efficient at both: for climatic reasons, wine production in Portugal was highly developed, whereas in England it was barely feasible (as Ricardo's own language attests: "England . . . *if she attempted to make the wine* . . . might require the labour of 120 men"); cloth production, on the other hand, was far more efficient in England than on the continent because higher wages in England had encouraged the development and adoption of machinery there, rather than on the European mainland.[10]

Had there been any English vineyards, they and their attendant machinery would have been rendered worthless and scrapped. Portuguese vineyards would have expanded their production to take advantage of a new market. Similarly, Portuguese cloth manufacturers would have found their machinery—what there was of it—rendered valueless, for England's far more mechanized cloth manufacturers would have expanded their output as well.

Whether the aggregate production of wine and cloth increased or decreased now depended both on economies of scale and the macroeconomic effects of changes in trade policy.

Economies of scale can arise if the increase in the size of the respective markets causes a significant fall in production costs, or if it encourages the development of new technologies that would have been too expensive without the larger market generated by exports. Economists have considered this issue to some extent (work in this area led to Paul Krugman's Nobel Prize in 2008) but without escaping the limitations of Ricardo's 1817 model in which the role of machinery in production was ignored: "There will be assumed to be only one factor of production, labor. All goods will be produced with the same cost function."[11]

Of course, the most complex issues surrounding the impact of trade are macroeconomic: will trade liberalization lead to higher or lower employment, to higher or lower investment, to higher or lower growth? Here, economists have not disappointed: from Ricardo on, they have completely shirked these issues.

Ricardo set the standard in a tangential observation about one potential riposte to his case: if Portugal were genuinely better at everything than England, would not English industry simply decamp from England and move holus bolus to Portugal if free trade were allowed? He conceded that it could do so, but then asserted that, if this happened, it would be advantageous not merely to English capitalists but to English and Portuguese consumers as well:

> It would undoubtedly be advantageous to the capitalists of England, and to the consumers in both countries, that under such circumstances, the wine and the cloth should both be made in Portugal, and therefore that the capital and labour of England employed in making cloth, should be removed to Portugal for that purpose.[12]

This could only be advantageous "to the consumers in both countries" if their incomes were unaffected by the shift—and Ricardo simply accepted that they would be. Here he was probably relying on his expressed belief in "Say's Law" that "demand is only limited by production,"[13] but without considering

whether, if production fell in England by the transfer of all its wine and cloth production to Portugal, employment, wages, and consumption in England would also fall.

On the issue of the relocation of production from high-wage First World to low-wage Third World countries, modern economists have pushed Ricardo's Vice past even Ricardo's limits. While he did contemplate the possibility of capitalists moving production offshore, Ricardo was of the opinion that this was both unlikely and undesirable:

> Experience, however, shews, that the fancied or real insecurity of capital, when not under the immediate control of its owner, together with the natural disinclination which every man has to quit the country of his birth and connexions, and intrust himself with all his habits fixed, to a strange government and new laws, check the emigration of capital. These feelings, which I should be sorry to see weakened, induce most men of property to be satisfied with a low rate of profits in their own country, rather than seek a more advantageous employment for their wealth in foreign nations.[14]

Trade Theory's Adverse Effects on Policy

Ricardo cannot be faulted for not anticipating a future in which, shorn of the need for the owner of capital to emigrate with his money, financial capital would be as mobile as it is (and often accompanied by the movement of physical capital as well). But his followers can be faulted for dismissing the macroeconomic and social consequences of practices that Ricardo was unable to contemplate.

My first professional exposure to economists and policymakers simply assuming that trade and the relocation of production would have no deleterious macroeconomic effects came when I organized a conference on trade between Australia and Asia in 1979.[15] In a presentation entitled "The Case for Trade Liberalisation," Alan Powell (then director of the Australian government's trade modeling group) showed the simulated effects on employment of a severe shock to Australia's economy: "a cut of one quarter in the tariff levels of Australia's most highly protected industries." Employment, the modeling exercise asserted, would fall by as much as 5.5 percent in car manufacturing, but rise by as much as 2.3 percent in coal mining.[16]

What about the aggregate effects? Powell noted that the main underlying assumptions were:

(a) Good macroeconomic management prevails throughout;
(b) The adjustment takes place over a period of about two years, so that changes in the capital equipment of different industries over the adjustment period may be neglected.[17]

Assumption (b) continued Ricardo's practice of ignoring the impact of trade on machinery. When pressed as to the meaning of assumption (a), Powell explained that it meant *the modeling exercise assumed that aggregate employment would be unaffected by the tariff cut*: the modelers simply assumed that falls in employment in once-protected industries would be precisely offset by gains elsewhere.

Even papers published as recently as 2016 admit that, two centuries after Ricardo, the macroeconomic dynamics by which trade policies actually operate have not been considered. Hirokazu Ishise notes that investment and growth are normally ignored in trade models by the Ricardian Vice of assuming "an endowment economy"—that is, an economy in which no production occurs at all, and countries simply exchange goods as "manna from heaven." When they do consider production and investment, they explicitly assume that a machine can produce any commodity, and not a specific good alone:

> While investment drives several aspects of aggregate economy, trade models frequently abstract [sic] investment decisions regarding capital goods by considering an endowment economy. In models that do include investment decisions, capital goods are commonly assumed to be homogeneous.[18]

Diversity Is Strength

Thus, although they claim to be experts on the effects of trade policy and argue almost unerringly for liberalization over protection, economists have not yet even asked the questions that are crucial to the real-world impact of trade liberalization: what does it do to the level and distribution of output, income, and employment?

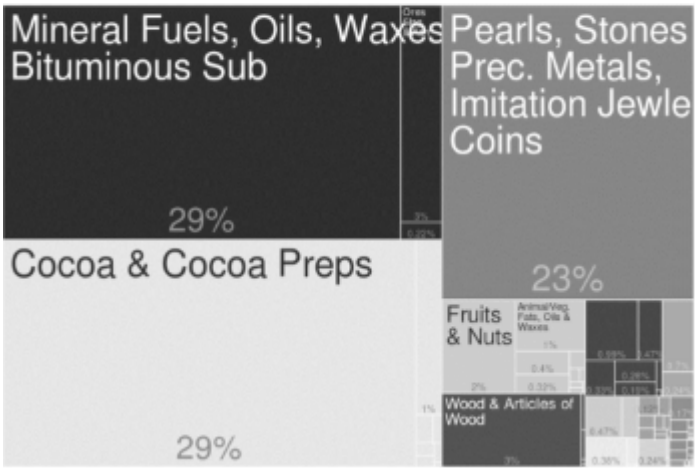
Given that economists have not even considered these issues, it is not surprising that other researchers who have done so have reached conclusions that are diametrically opposed to the biases of economists. By analyzing the enormous Standard International Trade Classification database of international trade flows, data scientists at Harvard University, working on what they have christened *The Atlas of Economic Complexity*,[19] have found that diversity, rather than specialization, leads to national success in international trade.

Their methodology was to classify products on the basis of their "ubiquity," which they defined as how many countries exported the product, and countries on the basis of "diversity," which they defined as how many products a given country exported.

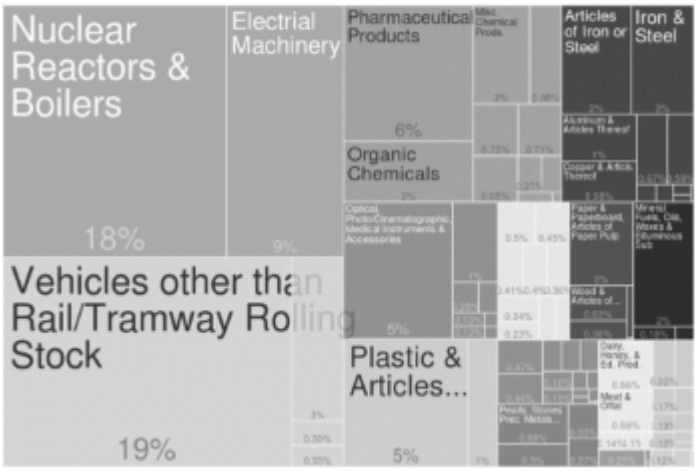
The theory of comparative advantage would lead you to expect that in a world with very low trade barriers—basically the modern globalized world—most countries would have specialized trade profiles, so that they would score low in both ubiquity and diversity. This proved to be true of underdeveloped economies like Ghana, in which the top three exported products—fuels, precious metals, and cocoa—make up 81 percent of its exports. But it was not true of advanced economies like Germany, where the top three products account for only 46 percent of its exports. Nuclear reactors and boilers accounted for 18 percent of Germany's exports, but Germany also exported a wide diversity of goods—including "pearls, stones, precious metals, imitation jewelry and coins" at almost 1 percent.

EXPORTS BY INDUSTRIAL SECTOR:

GHANA[20]



GERMANY[21]



The message that comes through loud and clear in this empirically grounded analysis is that, for countries to succeed at both growth and trade, specialization is essential at the individual level, and diversity matters at the level of the nation-state:

> Modern societies can amass large amounts of productive knowledge because they distribute bits and pieces of it among its many members. But to make use of it, this knowledge has to be put back together through organizations and markets. Thus, individual specialization begets diversity at the national and global level. Our most prosperous modern societies are wiser, not because their citizens are individually brilliant, but because these societies hold a diversity of know how and because they are able to recombine it to create a larger variety of smarter and better products.[22]

The researchers used the measures of ubiquity and diversity to develop a composite index they called "complexity," which quantified "the amount of productive knowledge" products and economies contain.[23] This complexity metric correlated well with living standards—with countries like Japan and Switzerland at the head of the 2015 index (at 2.47 and 2.18 respectively) and Papua New Guinea and Nigeria at its tail (–1.81 and –2.18 respectively). But movements up the complexity scale also correlated strongly with improved growth performance:

> An increase of one standard deviation in complexity, which is something that Thailand achieved between 1970 and 1985, is associated with a subsequent acceleration of a country's long-term growth rate of 1.6 percent per year. This is over and above the growth that would have been expected from mineral wealth and global trends.[24]

The success of this index in predicting which countries are likely to outperform growth expectations in the future was related to the role of product diversity within a country, which enable new products to be invented. The authors of *The Atlas* found that a country was more likely to develop a new product if the country had other industries which were close to that product in a third metric they called "proximity." Technically this was measured as the likelihood that a country exported one product given that it exported another; practically, it indicated that invention of new products required knowledge of existing, closely related products. A country with a diversified export profile (and by implication a diversified industrial base),[25] rather than one with a specialized portfolio, is more likely to have the product proximity that allows new products to be invented and the economy to grow.

Innovation versus Allocation

These empirical conclusions point out the key blind spot in the conventional definition of economics. Robbins's definition emphasizes allocation over innovation: the better allocation of existing, multiple-use resources to the satisfaction of existing, known wants. But real-world growth comes from innovation rather than allocation—the development of new products via the combination of knowledge from different but related industries. It relies upon combining knowledge embodied in single-use resources—in the form of both highly specialized workers and highly specialized machines—rather than multiple-use ones. This knowledge is more likely to exist in countries with diversified industrial systems, rather than specialized ones.

These empirical findings also cast a very different light on the populist revolts that are currently disturbing the pro-globalization consensus, which has dominated economic policy for the last thirty years. These revolts are not unthinking reactions against rationality, as mainstream economists like to

believe, but reactions to the failure of the real world to conform to the irrational thinking of economists, and the damaging policies that have been imposed by politicians following their advice.

Thirty years of trade policies pursuing the false promise of specialization have meant that residents of the Rust Belt states of the United States, and the economically depressed regions of the United Kingdom, can now compare the promise of globalization with the reality. They voted against globalisation, not because they were too intellectually limited to perceive its benefits, but because experience gave them the lens through which to reject the Ricardian Myth of the advantages of national specialization.

Policymakers should too. The empirical research that underpins *The Atlas of Economic Complexity*—as opposed to the armchair speculation that has characterized the development of economic theory—provides strong guidance on how to achieve economic development. It starts from an understanding of where the increased prosperity of the last two centuries has come from. It has not come from specialization in the allocation of existing resources, but from acquiring and developing new knowledge over time:

> During the past two centuries, the amount of productive knowledge we hold expanded dramatically. This was not, however, an individual phenomenon. It was a collective phenomenon. As individuals we are not much more capable than our ancestors, but as societies we have developed the ability to make all that we have mentioned—and much, much more.[26]

Expanding the knowledge that a country contains is thus key to growth, but this does not happen in a haphazard way. Rather, economies can progress by combining knowledge resident in closely related industries, to develop new industries and thus new knowledge:

> Industries cannot exist if the requisite productive knowledge is absent, yet accumulating bits of productive knowledge will make little sense in places where the industries that require it are not present. This "chicken and egg" problem slows down the accumulation of productive knowledge. It also creates important path dependencies. It is easier for countries to move into industries that mostly reuse what they already know, since these industries require adding modest amounts of productive knowledge. By gradually adding new knowledge to what they already know, countries economize on the chicken and egg problem. That is why we find empirically that countries move from the products that they already create to others that are "close by" in terms of the productive knowledge that they require.[27]

Thus it is not undifferentiated "knowledge" per se that enhances growth and development. As the authors of *The Atlas* quip, "if a country were to achieve the goal of having everybody finish a good secondary education and if this was the extent of its productive knowledge, nobody would know how to make a pair of shoes, a metal knife, a roll of paper or a patterned piece of cotton fabric."[28]

Instead, the successful expansion of knowledge comes from the development of new products that are closely related to products that a given country currently produces. The "proximity" measure developed in *The Atlas* can then be used to derive an "opportunity" indicator that shows how easily a new industry can be developed, and how likely it is to succeed. This gives an empirical basis on which to conduct industrial development policy—and the message is to diversify intelligently, based on the industries that you currently have:

> Create an environment where a greater diversity of productive activities can thrive and, in particular, activities that are relatively more complex. Countries are more likely to succeed in this agenda if they focus on products that are close to their current set of productive capabilities, as this would facilitate the identification and provision of the missing capabilities.[29]

The fundamental message of *The Atlas* is the opposite of the dogma preached by economists ever since Ricardo—and given the flimsy foundation of the comparative advantage argument, this is hardly surprising. But it is revelatory nevertheless: the secret to success in trade and economic progress, in general, is not specialization, but diversity.

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Notes

[1] Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations: A Selected Edition*, ed. Kathryn Sutherland (1776; Oxford: Oxford University Press, 1993) 12–13.

[2] "England may be so circumstanced, that to produce the cloth may require the labour of 100 men for one year; and if she attempted to make the wine, it might require the labour of 120 men for the same time. . . . To produce the wine in Portugal, might require only the labour of 80 men for one year, and to produce the cloth in the same country, might require the labour of 90 men for the same time. It would therefore be advantageous for her to export wine in exchange for cloth. This exchange might even take place, notwithstanding that the commodity imported by Portugal could be produced there with less labour than in England." David Ricardo, *On the Principles of Political Economy and Taxation*, vol. 1 of *The Works and Correspondence of David Ricardo*, ed. Piero Sraffra (Indianapolis: Liberty Fund, 2004), 135.

[3] Lionel Robbins, *An Essay on the Nature and Significance of Economic Science* (London: Macmillan, 1932).

[4] Smith, *Wealth of Nations*, 15.

[5] Luigi L. Pasinetti et al., "Cambridge Capital Controversies," *Journal of Economic Perspectives* 17, no. 4 (Autumn 2003): 227–32.

[6] Ricardo, *Principles*, 135.

[7] "The difference in this respect, between a single country and many, is easily accounted for, by considering the difficulty with which capital moves from one country to another, to seek a more profitable employment, and the activity with which it invariably passes from one province to another in the same country." Ibid., 135–36.

[8] Joseph A. Schumpeter, *History of Economic Analysis* (New York: Oxford University Press, 1954), 472–73.

[9] Robert C. Allen, "The Industrial Revolution in Miniature: The Spinning Jenny in Britain, France, and India," *Journal of Economic History* 69, no. 4 (2009):
901–27.

[10] Paul Krugman, "Scale Economies, Product Differentiation, and the Pattern of Trade," *American Economic Review* 70, no. 5 (Dec. 1980): 950–59.

[11] Ricardo, *Principles*, 136.

[13] Ibid., 290.

[14] Ibid., 136–37.

[15] Steve Keen, ed., *Trade: To Whose Advantage?* (Canberra: Centre for Continuing Education, 1980).

[16] Alan A. Powell, "The Case for Trade Liberalisation: A Brief Statement," in *Trade: To Whose Advantage?*, 99–112.

[17] Ibid., 102.

[18] Hirokazu Ishise, "Capital Heterogeneity as a Source of Comparative Advantage: Putty-Clay Technology in a Ricardian Model," *Journal of International Economics* 99 (March 2016): 223.

[19] Ricardo Hausmann et al., *The Atlas of Economic Complexity: Mapping Paths to Prosperity* (Cambridge: MIT Press, 2014).

[20] *The Atlas of Economic Complexity*, online visualizations,
http://atlas.cid.harvard.edu/explore/tree_map/export/gha/all/show/2015/.

[21] Ibid.

[22] *Atlas*, 6.

[23] Ibid., 44.

[24] Ibid., 27.

[25] There is no comparable database of domestic production to the SITC database of international trade broken down by product type, but the authors infer that a diversified export portfolio implies a diversified system of domestic production.

[26] *Atlas*, 6.

[27] Ibid., 7.

[28] Ibid., 34.

[29] Ibid., 57.