

*Prime Movers of Globalization: The History and Impact of Diesel Engines and Gas Turbines.* By Vaclav Smil. Cambridge, MA: MIT Press, 2010. Pp. 261.

Economic historians love technology. From Karl Marx to David Landes and Nathan Rosenberg, our tribe has always felt machines and devices to be endlessly fascinating. Whether or not one feels that “technology drives history,” it is clear that we cannot do economic history without it. Yet there has been a rather quaint estrangement between economic history and the history of science and technology as currently practiced. Despite our best efforts, economic historians have never felt quite comfortable with “social constructivism.” Somehow economics and postmodernism never really got on. Fortunately, the history of technology is a big field, and within it a few scholars continued to work as if the entire SCOT program did not exist. What they see was technological advances, the solution of bottlenecks, inventors and engineers struggling to get things to work better and make us richer and more comfortable, to raise productivity through persistence and ingenuity, and improve living standards. Among those, none is better and more accomplished than Vaclav Smil.

Smil is something of a phenomenon. Arguably in the field of Science and Technology Studies, he may himself be regarded as a “prime mover.” The author of about a book a year for the past decade, he counts among his admirers none other than Bill Gates, and has been designated as one of *Foreign Policy* “top 100 global thinkers” (whatever that means). Smil, working solo from the Canadian prairies in Winnipeg, is somewhere between a historian of technology and an environmental scientist, a historian of the planet and what humans have been doing to it through their technological prowess. Computing, he feels, has been overrated in the technological advances of the twentieth century. For him it is hardware, chemistry, and energy that counts. [He even agreed to participate in a rather inane discussion initiated by *The Economist* last year in which he and another pundit debated what was more important, the computer or the prime movers, a debate that reminded

this reviewer of the insipid story of Richard Strauss's opera *Capriccio* which is devoted to a risible debate which one is better, music or poetry.]

Smil is quite clear what he means by globalization. For him the internet, a world of instant communications and huge instantaneous data-processing and access to information is at best secondary. Globalization is about moving *things* and *people* from here to there cheaply, rapidly, and safely. To do that, we need the technological means he calls "prime movers." This book is about two of the main breakthroughs that made this possible: the Diesel engine and the Gas Turbine. While neither of these inventions is new, their full impact was only felt in the past twenty years. More than any other technological innovation, these two have made the world smaller, reduced the importance of distance and national borders, and allowed the integration of markets for goods and services to accelerate at a rate nobody could have predicted in 1950. The former moves the vast majority of all goods in the world, the latter has made personal freedom of movement a global reality.

Was this integration of the world "caused" by these two innovations (plus a few other, scarcely less important ones, such as cargo containers)? Did technology drive history? Smil points out that these two inventions have not received the credit they deserve in reducing transport costs and that their "Cinderella roles" in doing "virtually all the work of modern globalization" deserves much better understanding. It is hard to disagree. The book is chock-full technical details and pictures of these two inventions, and Smil cannot hide his admiration for the breath-taking achievements of human ingenuity that they embody. The Diesel, he notes, is one of those prime movers "that have had the most profound impact on the course of the global economy and ... the everyday lives and expectations of billions of people."

In so doing, he asks the Fogel question: what would have happened without those two prime movers? Is there some kind of "indispensability axiom" here? Smil clearly thinks so. Some future

economic historian is likely to compute that there were closer alternatives to Diesel engines and turbo-fan plane than Smil lets on, and that the “social savings” of these two inventions as a proportion of GDP is less than overwhelming. Perhaps economic welfare in the world would not have been vastly reduced if Walmart’s supply pipeline from China did not have modern Diesel engines driving enormous container ships or British tourists did not take advantage of low-fare airlines, driven by modern gas-turbine engines, to dissipate the fruits of human ingenuity through beer-laden weekends in German towns. The point is that perhaps these prime movers have driven the marginal utility of globalization down to a point at which we may want to pause and reflect on its full effects.

Smil’s own views on this are clear. He realizes fully that the costs of globalization are high, in terms of the environment and many other variables besides. Moreover, these costs are likely to go up as non-reproducible inputs, above all fuel, will become scarcer and as some of the negative externalities become internalized by a public increasingly concerned with both global (rising temperature) and local (airplane noise) side-effects. Yet in the end he shares the view that in the long-run there will always be more globalization, not less, and that these two prime movers will continue to be central to the technology driving it. He is reluctant to pass judgment: there are costs and there are benefits, and he admits being unable to weigh them against one another. What might be added is that the achievements of these magnificent machines may be undone at any moment by the folly and fanaticism of a few, as happened to the proto-globalization of the decades before 1914 and as was (mercifully briefly) threatened following 9/11. The world has become richer and in many ways better thanks to those and similar machines, but the global economy is brittle. Container ships, for example, are not inspected very carefully, and one highly successful act of terrorism utilizing just one container would undo the cost-reductions of decades of technological progress in Diesel engines.

The same is true, a fortiori, of Boeing 747's. Against the actions of fools, even those mighty engines themselves are powerless.

JOEL MOKYR

Northwestern University