

*More Heat Than Light: Economics as Social Physics, Physics as Nature's Economics.* By Philip Mirowski. Cambridge: Cambridge University Press, 1989.

**F**ew books on the history of economics begin with a discussion of physics, but Mirowski's brilliant work is no ordinary book. He contends that economics, culminating in the currently dominant neoclassical school, has throughout its history been controlled by a metaphor. Most economists regard their discipline as a science; since, in the common understanding, physics is the best developed of the sciences, economics ought to be modeled on physics. Mirowski's radical thesis is that the model of physics has determined in detail the sum and substance of economic theory from the Physiocrats down to the present.

Mirowski has an even more ambitious goal than the presentation of his revolutionary view of economics. He writes not as a detached observer but as a vigorous partisan. He strongly opposes the control of economics by physics. Economists, in pursuit of their futile ideal of rigor, have misunderstood physics and generated "science, falsely so-called." Mirowski himself has enlisted in the institutionalist camp, but his own views of correct theory do not receive much discussion in *More Heat Than Light*.<sup>1</sup> He comes not to praise neoclassicism, but to bury it.

Mirowski contends that conservation principles are the *leitmotif* in the growth of modern physics. Very roughly, a conservation principle requires that some quantity, e.g., mass or energy, be kept constant in a given system. To take a case often used by nineteenth-century physicists, a perpetual motion machine disobeys the law of

<sup>1</sup>His institutionalism is discussed in more detail in his *Against Mechanism: Protecting Economics from Science* (Tottowa: Rowman & Littlefield, 1988), esp. pp. 57-93, 106-33, and 191-232.

energy conservation since it requires new energy to be generated out of nothing.

Mirowski once more writes not as a mere observer of the scene. He thinks that physics has placed undue reliance on conservation laws. They cannot be exactly stated; and the proofs of the laws, e.g., the impossibility of perpetual motion, rest more on assertion than argument. Even more importantly, a look at the history of physics shows that conservation principles have died "the death of a thousand qualifications."<sup>2</sup>

The sad tale begins with Descartes, who according to Mirowski made the conservation of mass basic to his program of reducing the physical world to matter in motion. I am inclined to think that Mirowski overemphasizes Descartes' philosophical adherence to conservation of mass. He did not believe that minds were physical. One of the minds, namely God, creates the physical world and constantly upholds it. Further, even within physics itself, Descartes's "extension" bears closer resemblance than Mirowski allows to the field concept that in his view emerged only in the nineteenth century.<sup>3</sup>

Oddly, Newton plays no role in our author's version of the story of physics, on the ground that he did not explicitly use conservation principles (p. 404). But readers inclined to complain that physics without Newton is like *Hamlet* without the Danish prince, will be surprised at the coherence and complexity of Mirowski's account. The importance of conservation laws lies principally in the fact that they allow the use of certain mathematical techniques, such as variational principles.

The fly-in-the-ointment is that the conservation laws had to be constantly modified and restricted, since otherwise they fail to work. Instead of operating with physical substance, physics in the nineteenth century turned to the impalpable notion of the field. The use of the field concept made possible the employment of powerful mathematical tools, such as Hamiltonians and Lagrange equations, at the cost of considerable difficulty in the statement of exactly what was supposed to be conserved.

Other developments, such as the rise of entropy, required further restrictions on conservation. Physicists at the beginning of the twentieth century could no longer readily console themselves over the surrender of conservation with their ever-refined formalism. Henri Poincarè showed that only under certain very limited conditions can

<sup>2</sup>This is a phrase used by the philosopher Antony Flew.

<sup>3</sup>A minority view, favored by Hiram Caton, does take Descartes to be a materialist, but Mirowski does not refer to this interpretation.

the mathematical methods cited above be used. As the reader will by now expect, the rise of special and general relativity and quantum mechanics in the present century has further complicated the story and altered the meaning of conservation laws. Mirowski goes so far as to suggest that physicists have really abandoned conservation but cling to an outworn metaphor.

All very interesting, no doubt; but what has this to do with economics? Mirowski's answer is practically everything. Economists have directly translated the models of physics in use in their time into economic categories. (Incidentally, this does not exclude the influence of economic concepts in physics.) Why, e.g., did Adam Smith define wealth as stock (p. 166)? Not because this definition was dictated to him by his observation of the economy. Quite the contrary, he was influenced by Cartesian physics, and stock, in Smith's view the substance of value, corresponds to the mass that is conserved in Cartesian physics.

Is Mirowski correct? I find it hard to decide. Smith does not say that he was transferring a physical concept to economic theory; and, even if he did, it does not follow that Smith's description of the economy is inaccurate. Mirowski emphatically dissents; in his view, the actual economical world plays only a limited role in economic theorizing. On Mirowski's behalf, however much one may think him mistaken about a particular economist, his piling up of case after case of parallelism between physics and economics will impress even the most skeptical reader.

Smith, as briefly suggested, believed that economic value was a substance. This notion dominated classical economics. Although Mirowski thinks extremely highly of Marx, calling him "an epoch-making economist" (p. 179), he shows very effectively that resort to value as substance proved Marx's undoing.

Once more the question arises: did Marx use this notion of value because he was consciously seeking a model of the economy based on the physical sciences? The case seems to me suggestive but unproven. Mirowski stands on much firmer ground, however, in his treatment of the neoclassicals.

When the field concept came to dominate physics, many scientists in a flush of enthusiasm thought that a new discipline, energetics, would prove capable of unifying both the physical and the social sciences. As the name suggests, energy was the key to the mystery; and here the application to economics is clear and straightforward. Utility, the basic concept of neoclassical theory, is identical with energy.

Mirowski's claim is startling, but he documents to the hilt that

Léon Walras and William Stanley Jevons, both of whom had scientific backgrounds, directly intended to use the physics of their day to transform economics into an exact science. Even more clearly, Irving Fisher, whose 1892 doctoral dissertation at Yale remains, if the reader will forgive me, a classic of neoclassicism, made crystal clear his goal. Fisher himself drew detailed parallels between mechanics and economics. His thesis was written, not under the supervision of an economist, but with J. Willard Gibbs, one of the greatest of all American physicists, as its director.

In the neoclassical view, utility is a vector-field corresponding to energy. Mirowski ably shows how the entire neoclassical edifice falls into place once one grasps this basic idea. But this does not vindicate neoclassicism: far from it. Utility has to be regarded as an entity separate from the goods and services people consume, in a way that defies common sense. Such eminent neoclassicals as Milton Friedman were at one time skeptical about the validity of this notion of utility (p. 366).

An obvious neoclassical rejoinder is that whatever the intuitive implausibility of utility as a field concept, the system works. Mirowski dissents and challenges the school at its point of greatest pride, its use of advanced mathematics. He finds in the neoclassical system a profusion of incorrect assumptions and arbitrary errors. I cannot present at length the technical details of Mirowski's case but can indicate only a few of its highlights. The system is unable to explain production: it is goods and services that are produced, not energy or utility. Neoclassicals have been unable effectively to account for production through their field concept. Further, the system wrongly assumes that utility must have certain features needed to make mathematical manipulation easier. Unless these features are present, the powerful Hamiltonian techniques mentioned earlier cannot be used. But the assumption that utility has these features is without basis. Further, the system depends on the law of one price, another assumption Mirowski considers arbitrary. Hermann Laurent, a noted mathematician, pointed out some of these errors to Walras; but Walras could not grasp the points at issue.

Mirowski's criticisms appear penetrating and will give neoclassicals a difficult time. I am not entirely convinced, however, by his objections to the law of one price. This law states that a single price for each commodity tends to prevail on the market. Mirowski seems right that the law is, from the point of view of mathematics, arbitrary. But he too readily dismisses the "common-sense" point that competition among traders will eliminate differences in prices. For once one

can retort to Mirowski that his vague references to strategic considerations and game theory (p. 236) are no substitute for a rigorous refutation of the law.

Of course, common-sense arguments have no place in a system that purports to be completely mathematical, and to the extent that neoclassicism has this goal, Mirowski's challenge to the law of single price is perfectly justified. But does contemporary economics altogether eschew arguments not based on physics? It will hardly do to dismiss the use of such arguments just because they do not conform to Mirowski's own picture of neoclassicism.

Regardless of this and other details, Mirowski's case is formidable. How can economics escape its longstanding bewitchment by physics? Readers familiar with Austrian economics cannot fail to note that the Austrian school avoids all of the errors that Mirowski finds in both classical substance accounts of value and neoclassical energetic theories of utility. Mirowski rightly notes that Carl Menger "cannot be considered a neoclassical economist" (p. 261), since he repudiated the imitation of physical science. But evidently viewing Menger's path as leading nowhere, he does not give a detailed analysis of the Austrian system. (Elsewhere, he refers briefly to Hayek but never to Mises.) Had Mirowski done so, he would have found the answer to his difficulties. In the Austrian view, exchange takes place only where each party values the good he gains more than the good he surrenders. By repudiating the spurious principle that exchange is an equality, the problem of conservation of utility disappears. Further, the best developed version of Austrianism, that of Mises and Murray Rothbard, views utility as simply a ranking of goods. It is not a mysterious substance or field; and there is no problem of integrating production and distribution. The theory always operates with preferences for concrete goods and services, not the quintessence "utility" to which Mirowski objects. With this school, I suggest, not with the institutionalism Mirowski favors, lies the future of economics.

There is much else in this outstanding work that merits discussion. Influenced by the anthropologist Mary Douglas, Mirowski believes that both economics and physics take many of their concepts from the human body; and he presents an elaborate scheme of the evolution of these concepts. Further, he views theories as metaphors that are imposed on reality. Like Donald McCloskey and Richard Rorty, he rejects a realistic theory of knowledge. I do not think this is the place to discuss these views at length, and any attempt to do so is handicapped by the failure of our author to define "metaphor." One question that does come to mind, however, is this: is not

Mirowski's continual claim that precisely the same conservation laws are present in both physics and economics itself an instance of just the sort of domination by the metaphor of conservation he complains of in others? For Mirowski, it is apparently the conservation laws that must be conserved.

The book is immensely stimulating and suggestive. It is must reading for all economists and intellectual historians.

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