

Metaphorical Economics; or, the Metaphor is the Message

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Following *The Reconstruction of Economic Theory* (1986) and *Against Mechanism* (1988), Professor Philip Mirowski of Tufts University has published *More Heat Than Light** (1989). It has as its sub-title "Economics as social physics: Physics as nature's economics", and is dedicated: "To the most profound economic philosophers of the 20th century: Thorstein Veblen and Nicholas Georgescu-Roegen".

Although the jacket assures us that the discussion is "technically detailed but does not require extensive knowledge of mathematics", the reader whose knowledge of physics does not extend beyond high school level and whose mathematics is only slightly better, will find some parts of the book heavy going, especially the first three chapters: Ch. 1, "The fearful spheres of Pascal and Parmenides"; Ch. 2, "Everything an economist needs to know about physics but was probably afraid to ask: The history of the energy concept"; Ch. 3, "Body, motion and value". The author's aim in these first three chapters is to provide a sufficient background in physics to enable the reader to appreciate the message of the following five chapters - viz. the interdependence between physics and economics. If Mirowski is correct, it would seem that much of what we take for economics has really been borrowed from physics, and that the economists responsible for the borrowings often misunderstood or misapplied the physics. Economics was able to return the favour by allowing some of its concepts to be hijacked by physics; but as a physicist of undistinguished high-school performance, I will leave to others an assessment of Mirowski's version of the contributions of economics to physics, and of the history of physics.

Mirowski's fundamental thesis appears to be that developments in nineteenth century economics were similar to and dependent upon developments in nineteenth century physics. In the first part of the nineteenth century, an essential feature of classical economics was its adherence to a "substance theory of value", with an associated belief in the "conservation of value". This substance theory of value reflected the current "substance theories of physics with their emphasis on the conservation of matter". In the second part of the nineteenth century, the rise of neoclassical or marginalist economics, with its emphasis on utility, was similar to, and derived from, the newly-developed field theories of physics, with their emphasis on energy.

The argument behind this thesis is presented in Ch. 4, "Science and substance theories of value to 1870"; and Ch. 5, "Neo-classical economic theory". In Ch. 6, "Corruption of the field ... Neoclassical production theory" the story is carried forward into the twentieth century, and it is argued that the tendency to return to substance theories in physics has been associated with a similar tendency to return to substance theories of value (e.g. Sraffa), or at least to adopt an eclectic approach to value - partly classical, partly neoclassical - according to the circumstances or the mood of the economist.

The final two chapters - Ch. 7, "The ironies of physics envy", and Ch. 8, "Universal history is the story of different intonations given to a handful of metaphors" - recount the harmful consequences (for economics) of "physics envy", but suggest that the influence of physics on economics has in recent times begun to wane. However, having escaped from the dominating influence of these physics metaphors, the former coherence of economics has now begun to disintegrate - "Every man his own capital theorist" (p. 334) - and current economics is characterised by a wide [might one even say chaotic?] variety of theories and models. But the influence of physics on economics has by no means ceased because "when given the choice between preserving their physics metaphor and innovating a truly indigenous economic theory,

neoclassicals have invariably opted for the former". (p. 351).

The work ends with a rather slight four-page index, and a staggering 32-page 800-item bibliography.

Good physics and good economics

In showing that the physics used by economists has often been bad or second-rate or out-dated, Mirowski appears to be motivated by the laudable desire to produce good economics by freeing it from such pernicious influences. His implied programme is to ensure that the physics used by economics is good physics. He seems to equate good physics with good economics, bad physics with bad economics.

But might not this equation be an over-simplification of the analogical relationship between physics and economics? It presumes that the laws of physical nature and the laws of human and social nature constitute one integrated, non-contradictory whole; and that what is good in physics must be good in economics. But it could be argued that the laws of physical nature and the laws of human nature are more unlike than like, and that an attempt to understand or direct the economy of humans by applying the laws pertaining in the non-human universe must be at best futile and at worst disastrous. If, for example, the laws of biological evolution are given free rein in human affairs, they might wipe out the weak and inefficient, but would they produce a society that is humane, compassionate and pleasant? In other words, there is the possibility that good physics and good biology might not produce good economics, if "good economics" is understood to mean something more than mere efficiency.

A further danger associated with the deliberate use of physics in economics is that, as Mirowski has shown, the good physics of one generation

can become the bad physics of the next. Physics-based economics is therefore resting on very wobbly foundations. Any economic theory which uses physics, or physics metaphors, runs the risk of being discredited when that particular kind of physics is replaced or becomes irrelevant.

Another possibility is that even bad physics might produce good economics. It is conceivable that some unsophisticated, outdated and even erroneous ideas from physics might just happen to provide a telling metaphorical explanation of economic events. Mirowski has opened the eyes of economists to the weaknesses in their physics inheritance, but it does not follow that economics is necessarily flawed because of its bad physics. The criterion for assessing physics-based contributions to economics will be their usefulness in explaining economic phenomena, not their metaphorical origins. This point is made by Bruce Caldwell in a letter quoted by Mirowski (p. 398): "The economists who borrowed the metaphors didn't understand them very well. My initial reaction was: So what? It doesn't matter if they completely misunderstood the metaphor as it was used in physics, or if they took an outdated one ... What matters is not the status of the metaphor in the originating science, but its usefulness in the one that appropriates it."

Mirowski paraphrases this sort of objection in the following terms:

OK, so maybe the early neoclassicals derived their inspiration from physics. Nevertheless, this fact has no bearing on the content or subsequent evolution of the theory itself, although one might be willing to admit it had some impact upon external considerations, such as the favor of funding agencies or the untutored impressions of the public. Further, metaphors are just metaphors, not scientific research programs. They belong in literature, not in science. Therefore, any attempt to use the structure of the physical metaphor to analyze modern theory is fundamentally misleading and irrelevant. Complaining that economists misunderstand the physics

is a waste of time: They had no reason to need to know it, because they were working on economics. The best and the brightest have now wisely left all of that behind (pp. 276-77).

The same argument has been expressed by Karl Popper by means of a distinction between "the context of discovery" and "the context of justification" (quoted by Mirowski, p.277). According to Popper, metaphors are useful as rhetorical stimuli, but science should avoid them.

Mirowski responds by arguing that the attempted separation of discovery and justification is "profoundly mistaken", and resorting to a pharmacological metaphor, he describes it as:

a vain attempt to cleanse the theoretical object of any worldly taint and isolate it in a hermetically sealed environment so that the scientist can commune with its essence in splendid isolation. One reason these purification rites are self-defeating is that most scientific reasoning is metaphorical. (p. 277).

Are metaphors necessary in economics?

Although Mirowski believes that most reasoning in science (and, presumably economics) is metaphorical, he also believes that there is "no such thing as a perfect scientific metaphor" (p. 279). The fact that any particular metaphor is flawed is not important; what is important, he argues, is that "the appropriate research community responds to those flaws in a responsible, systematic, and scientific manner ..." (p. 279).

Is there an element of circular reasoning, or infinite regress, in this argument? Mirowski urges scientists to respond scientifically to the flaws in their metaphors, and at the same admits that most scientific reasoning is metaphorical. But a scientific response is a form of scientific reasoning, and

must therefore also be metaphorical. Mirowski thus seems to be saying: Don't try to eliminate metaphors. Respond to their flaws by formulating new metaphors, which also will be necessarily flawed.

Mirowski cannot (logically) reject the use of metaphor in economics, because he in effect uses a metaphor in his explanation of the development of economics over the last two hundred years. This metaphor is his alleged analogy between substance theories of physics and substance theories of value, and between the force-field of physics and the marginalist theory of economics. This historiographical construct into which he fits the history of economics may or may not be useful or true, but it is definitely metaphorical. Mirowski thus appears to need a metaphor to explain the use of a metaphor. Even if Mirowski is correct in saying that most scientific reasoning is metaphorical, several heuristic responses are possible. We could either

- (a) encourage the use of our current economic metaphors, and rejoice in the cultivation of new and more imaginative ones; or
- (b) accept the ubiquity and inevitability of metaphorical reasoning in economics, and learn to live with it without actively rejoicing in it; or
- (c) try to eradicate, or at least minimise, the use of metaphors in economics, recognising that they are unscientific or pre-scientific modes of thinking, that they are rhetorical devices which can exert enormous influence for good or ill, and that an economist who resorts to the use of a metaphor is really confessing his inability to provide a reasoned justification for the theory he is espousing or the policy he is advocating. A start could be made by substituting physics-neutral terminology for physics-borrowings (for example, "balance" for "equilibrium", and "responsiveness" for "elasticity", which is rarely used nowadays in the

original Marshallian sense), and by re-writing economics texts without their metaphors (to see what, if anything, remains).

One would have wished for a clearer and more systematic statement by Mirowski of his views on the preferred role (as distinct from the past role) of metaphors in economics. Intimations of his preferred view can be found in isolated parts of the book, but they are not brought together in any systematic, detailed summary. The result is that even the most diligent and sympathetic reader is left in a state of considerable uncertainty about where the author precisely stands on this issue.

Does he subscribe to (a), or (b), or (c), or to some other position? Will progress in economics be fostered by condoning, or by encouraging, or by putting up with, or by discouraging, or by minimising, or by eradicating metaphors? As previously quoted, he seems in one place to adopt a deterministic stance in arguing that metaphors have a useful and inevitable role, and that it is vain to attempt to rid science of metaphor; but elsewhere he seems to suggest that metaphor is an inadequate basis for economics:

recourse to physical science (or scientific metaphor) is insufficient to render an economic theory fully determinate (p. 353).

If this means that metaphor is a useful and necessary element, but not a sufficient element, in the formulation of a fully determinate economics, we are left with the problem of delineating the relative magnitudes of the necessary cause(s) and the sufficient cause(s). To say that something is a necessary cause is not to say that it plays a significant role. When Hilary and Tensing conquered Everest - if you will pardon the metaphor - it was *necessary* for them to get out of bed in the morning, but I doubt whether the effort of getting out of bed represented a significant part of their work on that day. If the efforts of economists are directed along path (a) above, they may become very

proficient in taking their first metaphorical steps, but they may not succeed in climbing very far.

The fundamental question - not yet answered by Mirowski - is, although economics has had metaphorical beginnings, have they been on balance a help or a hindrance? Would economics now be more advanced, and not in a state of crisis, if it had rigorously eschewed all metaphors from the outset? Is the progress of economics currently being retarded by its leaders' reluctance (or inability - for psychological or ideological or career reasons) to abandon their pet metaphors? Or is economics epistemologically condemned to a parasitic dependence upon physics?

Having devoted most of the book to showing the nefarious results of importing physics metaphors into economics, it is strange that Mirowski should still wish to maintain that physics metaphors are *necessary* for progress in economics. His justification for this alleged necessary role of metaphor is far from compelling, given the strong case he has built up against metaphorical economics.

Some economists have exhibited a strong preference for metaphorical discourse and possess an enviable comparative advantage in metaphorical skills, and it would be churlish and foolish to suggest that they sublimate their metaphorical urges into graphs and equations. But if metaphorical discourse is said to be *necessary* for science, is it in itself an essential component of scientific discourse; or does it function only as a necessary preliminary to scientific discourse (as a stimulus to hypothesis conception?) without qualifying as scientific discourse in itself?

A non-metaphorical economics? A non-metaphorical Mirowski?

Mirowski's insistence on the role of metaphor in science is consistent

with his own extensive use of metaphor. It would be difficult to extirpate from economic discourse all traces of metaphor. That would involve abandoning some basic terms which entered economics as metaphors. "Inflation" originally meant the taking in of breath, and "investment" meant the putting on of clothes. A complete extirpation of metaphor would also render economic prose even more dismal. Mirowski, for one, would suffer, as he has a gift for the colourful metaphor. We read of literature that is "pockmarked with the language of the natural virtues of the market" (p.150); of Germans who have been "immune to bites from the Cartesian bug" (p.163); of Adam Smith being "the prime suspect in the smuggling [when working at the Customs House?] of Cartesian economics into the backyard of Newton" (p.164); of Adam Smith's culinary exploits - he "cooked up a weakened form of physiocracy, simmered it in a watered-down Cartesianism, molded it into a cosmology adapted from early Epicurean physics, and served it up in a great bed of digressions" (p.165); of the history of economic thought being "a single unbroken thread ... woven on the same loom" (p.197); of "the dowry that the displaced scientists brought with them to neoclassical economics" (p.374); of "this thicket of jumbled physics references" (p.383); of "tyro neoclassicals" being prevented by "their own physics envy ... from seeing over the walls of their own self-constructed labyrinth" (p.197) - a very difficult feat indeed, as labyrinths are usually underground; and of "neoclassical economics ... wedded to a straw man of a physical metaphor of vintage circa 1860" (p.374) - a ticklish situation for her, which would surely justify divorce proceedings. If metaphors are harmful and to be excluded from economics, Mirowski would regrettably have to forgo the exercise of his own entertaining metaphorical skills.

The body-motion-value pyramid

Mirowski's metaphorical propensities reach their peak of expression in his metaphor of energy (p.107). This metaphor takes the form of a pyramid.

It has at its three vertexes motion (physics), body (anthropomorphics), and value (economics), each of which is a metaphor. These three metaphors "constituted the *a priori* content as well as the common context that made the energy concept possible, if not necessary", but they are not independent, self-sufficient, separable intellectual influences; their boundaries shade off "imperceptibly one into another" (p.107). The dimensions of the pyramid are significant:

As the vertexes grow further and further apart, the metaphorical distance between physics and economics also widens ... Nevertheless, they ... maintain a reciprocal metaphorical legitimation and support: They remain a pyramid (p.108).

Mirowski refers constantly to this pyramidal metaphor of metaphors, describing it variously as the "metaphoric triad" (p.140); the "triadic metaphor" (p.142); "the incipient meiosis of the body-motion-value metaphor" (p.147); "the metaphorical simplex of body/motion/value" (p.202). His intention is "to transcend the simple notion of intellectual influence and aim for a higher plane of synthesis, one that covers the unity of discourse behind the quotidian barriers of fields or disciplines, or indeed, between the social and the material." (p.107). But despite these elevated intentions and despite the author's persistent emphasis, the present reviewer, confronted by the body-motion-value pyramid, must confess to utter bewilderment and to a presentiment of foreboding usually associated with the malevolent influence of magical or astrological signs. Is the body-motion-value pyramid a contribution to economic semiotics, or is it a Marcel Marceau mime?

Value substance

Mirowski asserts that in all classical theories of value, value was "reified as a conserved *substance*" (p. 142). This substance theory of value provides

the link between economics and the substance theories of early nineteenth century physics. The connection might have been more convincing if it had been accompanied by statements from the writings of the classical economists which show clearly that they regarded value as a substance. In establishing his "value substance" thesis, Mirowski appears to argue that: Value is labour. Labour is a substance. Therefore, value is a substance.

But although (some) classical economists said that the cause of value is labour, did any say that value is labour? Classical economists believed that the cause of value is a substance, but how many believed that value itself is a substance? Value can be seen as an accident inhering in a substance, or as a property of a substance, or as a relation between a substance and a person, or as a relation between one substance and another substance. But I know of no classical economist - and Mirowski has not provided any compelling textual evidence** - who clearly said that the accident "value" is reified into a substance "value"; or who was a victim of "the tendency to transform a relation into a thing" (quoted p. 6 by Mirowski from Meyerson). In a (partial) sense it is true that the classical model placed value in "the physical world, 'out there', embodied in the physical commodity" (p. 233); but Mirowski's expression "embodied in the physical commodity" surely indicates that, for the classical economists, value was an accident (or property or relation) *in* the physical commodity, and was not itself a substantial physical commodity.

There is one sense in which Ricardo could be interpreted as holding a substance theory of value. His concept of natural value, as opposed to market value, though never adequately defined, could be regarded as the substance of value, meaning "that which subsists in the background, or behind the mutable phenomena" (Helmholtz, quoted by Mirowski, p. 405). But did Ricardo state that natural value is a substance in the philosophical sense, not merely an accident or relation inhering in a substance?

Conservation of value

Mirowski states quite categorically, and repeats many times, that classical economists were concerned with the conservation of value. Thus, for example, he alleges that in classical economics, "circulation" meant "to shift the location of the value substance between sectors, classes, or other functional categories *subject to the condition that the trade of equivalents would guarantee the conservation of the value substance in that process*" (p. 143; italics added). He also believes that "the *reified invariance* of this value substance is the predominant conservation principle" (p. 143; italics added). The most notable feature of these italicised statements, apart from their categorical universality, is the lack of textual support accompanying them. Mirowski will therefore not be surprised if his readers defer their assent to his fascinating conservation-of-value thesis until he provides the requisite textual evidence. Mirowski apparently bases his conservation-of-value thesis on his value-substance thesis - "the philosophical category of substance ... is thought to obey some conservation laws" (p. 7). If, as argued above, the classical economists did not regard value as a substance, then there is no philosophical reason for deducing that they believed in the conservation of value.

Mirowski also supports his conservation-of-value thesis by alleging (without textual support) that "In classical substance theories, value is conserved in exchange and is not conserved in production" (p. 353). The validity of this assertion appears to depend upon a somewhat arbitrary demarcation between exchange and production. In fact, most exchanges involve a process of production, because in most exchanges the time and/or space dimension of the commodity is altered. The physical appearance and the chemical composition of the commodity (i.e. what might be called its substance) may remain unaltered, but its temporal and/or spatial accidents have changed. Taking the commodity in its totality (i.e. as a supposit or as a combination of substance and accidents), it is now different from what it was

before. A process of production is implicit in the process of exchange, and if value is not conserved in production how can it be conserved in exchange?

One wonders whether the notion of conservation of value in exchange is a mere tautology. Does it mean anything more than, at any given instant, value is what it is?

Motivations v. consequences: the physics/economics connection - then and now

Although Jevons and others might have been motivated by a belief that economics could be turned into a sub-branch of physics, their personal motivations are of little concern to anyone else. Jevons believed that his lever had unlocked the secrets of the economic universe, but I suspect that the vast majority of economists who apply the marginalist approach have little interest in promoting a physics-economics nexus. Their concern is to explain the facts of economic life, and it is of no real concern to them whether Jevons was motivated by a desire to integrate physics and economics, or whether his motive was to buy himself a new hat. If Jevons' marginalism is useful in explaining economic events, then economists will use it; if not, they will discard it. Whether Jevons' marginalism proves to be a virtue or a vice for economics will be decided by its consequences, not by Jevons' motives.

If I may be permitted the use of a metaphor, the aesthetic merit of an abstract painting is not necessarily dependent upon the subject which was its starting point. One may carefully study an abstract "Nude with Flowers" without finding a trace of either the nude or the flowers. Voyeurism aside, this failure to see the starting point should not detract from one's appreciation of the painting. The starting point for Jevons' marginalism was, according to Mirowski, his desire to integrate economics with physics; but, once enunciated, Jevons' ideas proceed to live a life independent of his starting point, and their validity and usefulness for economics are not now dependent upon his motivation.

Even if Mirowski is correct in saying that neoclassical economics was derived from physics - and the fact that some of the early neoclassicals were versed in physics and explicitly desired to apply physics to economics is a persuasive argument - it is doubtful whether the influence of physics has persisted. Of all the thousands of economists throughout the world today who are teaching and inculcating the eternal truths of neoclassical economics, I suspect that the vast majority are quite bereft of any physics beyond high-school level, and before reading Mirowski, would have been quite unaware that the progenitors of neoclassical economics were victims of physics envy. This suggests that, whatever influence physics may have had in the early days of neoclassical economics, it has only a very limited influence now. Whatever influence remains is, for most economists today, only indirect and subliminal - a kind of folk memory or folk custom. Of the neoclassicals of my acquaintance, some may harbour a vague aspiration to be "scientific" (i.e. physics-like); but most are so convinced of their own scientific status that they feel no compulsion to emulate the physical sciences. Economics, for today's neoclassicals, is as scientific, as rigorous, and as positive as physics.

The degree of analogy

A further issue which Mirowski raises in the mind of his readers, but does not resolve, is that of the permissible degrees of analogy. Analogy, unlike pregnancy but like consanguinity, admits of degrees. An analogy can exist between x and y , yet they can be either more like than unlike, or more unlike than like. There is an element of economic truth in the invisible hand, the wall of brass, the pendulum coming to rest, etc., but is the truth element large or small? Is it the whole economic truth, or only a very small portion of the economic truth? The coming to rest of a swinging pendulum may be like what happens to economic variables, but what is the degree of likeness? Harmony-seeking neoclassicals (perhaps reifying a psychological yearning for

security, order and peace) would say "more like than unlike"; conflict-mongering Marxists would say "more unlike than like". Mirowski warns us to be beware of metaphors and analogies, but how close must the analogy be before it ceases to be misleading? Should economics abandon all but the near-perfect analogies, or can useful economic insights be obtained from analogies that are true-but-distant approximations? In the absence of agreed criteria for distinguishing good and bad metaphors, it is more than probable that economists will go on choosing to deploy metaphors which suit their own ideological or psychological biases. Free marketeers will invoke "the invisible hand"; capitalists and rentiers will rejoice in Confucius's "capital is the mother, and interest is her child"; and socialists will remind us that we have "nothing to lose but our chains".

Sophisticated v. homely metaphors from physics

Mirowski's treatment of the influence of physics metaphors on economics concentrates mainly on those which (to the uninitiated amateur) involve relatively sophisticated concepts, such as energy, entropy, conservation of energy, substance theories, field theories, etc. But there is a wide variety of homely physical metaphors which have also exerted a considerable influence. That great metaphor man, Alfred Marshall, has had an enormous impact on economics with his scissors, his keystone of the arch, and his balls in a bowl. Malthus, also a gifted metaphor man, explained his "doctrine of proportions" (i.e his concept of the optimum) by the trajectory of a projectile. David Hume's statement "All water, wherever it communicates, remain always at a level" is a more powerful "proof" of the specie-flow doctrine than a multitude of diagrams and equations. Yet these influential homely metaphors are given scant attention by Mirowski. A case could be argued for an inverse relationship between the scientific sophistication of physics metaphors and the role they have played in the formation of economic consciousness.

Non-physics metaphors

In addition to the sophisticated and homely metaphors from physics, economists have used metaphors derived from a wide variety of other disciplines or other walks of life. Botanical metaphors (e.g. William Hearn's strong and weak grasses), biological metaphors (e.g. the Social Darwinism of Herbert Spencer), and metaphysical metaphors (e.g. Adam Smith's invisible hand) have all played, and continue to play, a formative role in the development of economic paradigms. One of the most influential - and one of the silliest - of current metaphors comes not from science but from the sporting arena. I refer to "the level playing field". The economists, politicians and journalists who rarely let a day pass without reiterating this particular metaphor would have us believe that a game of Rugby League football played between thirteen heavyweights on one side and thirteen lightweights on the other will produce an optimum result all round, provided that the game takes place on a "level playing field"; and that as a result of tackling and being tackled for eighty minutes, the team of lightweights will become more "efficient". (For "lightweights", read small-country economies like Australia; for "heavyweights", read USA, UK, Germany, Japan, etc). One might just as sensibly argue that a boxing contest between a bantamweight and a super-heavyweight will provide a fair and efficient result, provided the boxing ring is level. Mirowski is quite correct in pointing to the harm done to economics by the importation of mechanistic metaphors, but the harm being done by such infantile sporting metaphors is potentially just as great.

Metaphors and mathematics

"Pure" economists will probably urge that the dangers of metaphorical talk can be avoided by forsaking words and conducting all economic discourse in equations and diagrams. But this line of argument raises the epistemological question of whether geometrical diagrams and algebraic symbols are not themselves metaphors. We become so habituated to portraying economic

phenomena by lines and symbols that we forget the difference between the thing itself and its mathematical image. In lectures and conversation we say "this line is the demand", and "x is the supply", and conflate these fictional creatures with the things themselves. Mathematical economists are the most metaphorical of all.

The use and abuse of economic metaphors

Mirowski believes that "Economists have consistently lagged behind physicists [sic] in developing and elaborating metaphors; they have freeloading off of physicists [sic] for their inspiration, and appropriated it in a shoddy and slipshod manner". I would have thought, on the contrary, that economists have been most prolific in their use of metaphors - perhaps indeed too prolific for their own good, preferring to rely on the slick metaphor than to present a rigorous analysis of causal connections. In addition to the intrinsic metaphors of diagrams and equations, economists have either used or abused many extrinsic metaphors comparing economic to extra-economic phenomena. Some are cited elsewhere in this review. Further examples of the metaphorical skills of economists are:

Political economy is "a colliquative diarrhoea of the intellect" (R. Southey, himself a worthy political economist).

Unproductive labourers are as useful as "a fire in a warehouse" (D. Ricardo).

"Ricardo ... shunted the car of economics onto the wrong track" (W.S. Jevons).

Jevons shunted economics "onto a loop line" where it is "still circulating"; Keynes and Kalecki "detached a few coaches" before putting it "back onto the main track" (Joan Robinson).

Land is "the great warehouse of nature" (R. Torrens).

J.H. Clapham on neoclassical economics: "empty economic boxes" and "the limbo of the categories".

Economics is "an engine for the discovery of concrete truth" (A. Marshall).

"the point of exact equilibrium may be as momentary, but is nevertheless as real, as the level of the sea" (J. S. Mill).

"capital is a sort of cabalistic word, like Church or State, or any of those general terms which are invented by those who fleece the rest of mankind to conceal the hand that shears them" (T. Hodgskin).

"gales of creative destruction" (J.A. Schumpeter).

"with self-love the main-spring of the great machine" (T.R. Malthus).

"A man who is born into a world already possessed, if he cannot get subsistence from his parents, ... and if the society do not want his labour, has no claim of *right* to the smallest portion of food, and, in fact, has no business to be where he is. At nature's mighty feast there is no vacant cover for him" (T.R. Malthus).

Society should not "drift rudderless upon the sea of competition" (F.D. Maurice).

Employees and employers are "the privates and the officers of the economic army" (F. Soddy).

J.R. Commons on neoclassical economics: "we are floating in a limbo of pure geometry".

Malthus on war and population: "fresh harvests of human beings for the scythe of each successful conqueror".

J.K. Galbraith on wages, prices, and inflation: "One cannot single out a particular spoke in a wheel, paint it black (or red) and say that it shoves all the others.

"The teachers of economics suffer from curriculum constipation - an inability to eliminate waste material" (Anon.).

Metaphor has a role in economics as an aid to conceiving, clarifying, embellishing, reinforcing, and propagating ideas; but one suspects that at times the discourse of poetic imagery has been used as a substitute and fudge for the discourse of reasoned analysis, and that in some cases economists have

resorted to metaphor when they are unable to find rational arguments to support their theories or to answer their opponents. Joan Robinson argued that one such notorious use of metaphor as fudge was Marshall's appeal to the natural limits to tree growth, in an attempt to explain why the more efficient firm would not come to dominate the market, and why competition would not inevitably self-destruct.

Other notorious examples of the role of metaphor as a thought substitute in economics are the use of "capital is stored up labour" and "nature labours along with man" to support the labour-embodied theory of value.

The power (for good or ill) of the metaphor arises not only from its pictorial and emotional appeal but also from its ability to nullify an opposing point of view. Thus, the "trickling down effect" - a powerful metaphor in support of a supply-side or profits-led theory of growth - stifles debate on any alternative demand-side or wages-led theory of growth. Everyone knows that water does not flow uphill, and that a "trickle-up effect" is a physical impossibility. The laws of physics "prove" that economic policy must give priority to the interests of profit.

The lesson from the history of metaphorical economics is that no economic theory or policy prescription can hope to succeed unless accompanied by a colourful metaphor, and that the status of economic theories and policies is directly proportional to the power of the metaphors deployed in their support. The strong penchant of economists to indulge in metaphor is therefore understandable. But one cannot help wondering whether for some economists the metaphor is the message; and that without metaphor their economics would disappear.

The rejection of Samuel Bailey

Mirowski treats Samuel Bailey very harshly - in my opinion,

undeservedly so. Bailey had argued that value is a relation, or a ratio; that any commodity can be chosen as a standard by which to measure the value of another commodity; that value can be measured without the measure having an invariable value; and that no one commodity has an invariable value. Mirowski describes Bailey's position as "outrageous ... and idiosyncratic" (p. 188); he interprets Bailey as saying "that value does not exist, or rather, that the question is of no analytical consequence for economic science" (p. 188); he states that "Bailey's assertions are thoroughly self-contradictory, as is to be expected from one who claims to renounce all metaphorical reasoning" (p. 189); and concludes that "Bailey ends up advocating a species of nihilism, repudiating the value concept by the Pyrrhic gambit of denial of all calculation of consequences of all economic activity." (pp. 189-90). Mirowski remarks that "Bailey had gotten under Marx's skin, to judge by the number of pages allotted to [Bailey] in Marx's ... *Theories of Surplus Value*" (p. 190), and it is obvious that Bailey has also gotten under Mirowski's skin. The vehemence of the attacks of Marx and Mirowski on Bailey is understandable when it is realised that Bailey represents a major challenge to both writers (for different reasons in each case). In Mirowski's case, if Bailey's relativist theory of value is valid, and if Bailey is recognised as a classical economist of some standing, then Bailey represents a significant exception to Mirowski's thesis that the classical economists believed in a substance theory of value. To maintain his thesis, it is necessary for Mirowski to assist Marx in demolishing Bailey's credibility.

The demolition job is not at all convincing. Mirowski provides no textual justification for his view that Bailey claimed "that value does not exist" (p. 188), or that "since there was no such thing as an economic invariant, *there is no such thing as value*" (p. 189). Bailey denied the existence of absolute value, but did he say there is no such thing as value? Bailey's position on value was relativist, but is it fair to conclude that his position was "a species of nihilism"? The assertion that Bailey denied the possibility of all calculation of

consequences of all economic activity is also textually unsupported. Mirowski's desire to demote Bailey as a classical economist appears to have led him into extreme and unwarranted interpretations.

Mirowski's view of Bailey is paradoxical. If the classical economists held a substance theory of value, and if this substance theory of value is an example of the undesirable influence of physics on economics, then Bailey's relativist theory of value should be regarded as a brave attempt to resist the influence of imported physics metaphors, and Mirowski should really be commending Bailey rather than condemning him.

A paradox of interdisciplinarity

A further paradoxical aspect of Mirowski's thesis concerns the role of interdisciplinarity in economics. The engineering/physics backgrounds of Cournot, Jevons, Fleeming Jenkin and others enabled them to introduce interdisciplinary insights into economics. If these insights have misled economics, is this an argument against interdisciplinarity for economists? That would be a strange conclusion, given that commentators on the "current crisis" in economics frequently advocate more, not less, interdisciplinarity in the training of economists. And, whether or not one agrees with it, *More Heat Than Light* is an interdisciplinary contribution to the resolution of the "current crisis". But if we encourage (or even enforce) interdisciplinarity in the education of young economists, do we run the risk of having our noble science further distorted by intrusions from other disciplines? We have, it seems, suffered from the engineers and physicists. What will we have to put up with if we admit contributions from chemistry, botany, biology, zoology, archaeology, agronomy, and animal husbandry?

A good idea exaggerated

Having identified some examples of the influence of physics on

economics, Mirowski appears to exaggerate the connection. A moderate degree of exaggeration is understandable and perhaps even necessary, as a rhetorical device to shake intellectually lethargic readers into an appreciation of the new ideas. But in his enthusiasm Mirowski forces classical and neoclassical economics into an extraordinary dependence upon and similarity with physics. Using the concepts of "value substance" and "force field" he establishes a symmetrical nexus between early nineteenth century physics and economics, and later nineteenth century physics and economics. But one cannot help wondering whether the nexus is just too neat; and whether it has been achieved by ignoring the considerable individual differences that exist within the broad convenience categories "classical" and "neoclassical". Mirowski's essential point - "Beware of physics!" - has been convincingly, even brilliantly, made; but is not strengthened in any way by hyperbolic rallying calls such as: "the payoff to this reconceptualization of value theory is a clarification of *the entire history of economic thought*." (p. 142; italics added); "there is no way of understanding economics and social theory in the twentieth century without first understanding 'energy'" (p. 11); "these questions ... are intended to set into motion an entire research program" (p. 401).

Conclusion

There is much that is new and fascinating in Mirowski's work. Through his knowledge of both physics and economics, he has been able to provide a provocative interpretation, not otherwise available to the mono-disciplinary economist, of the historical relationships between the two disciplines. One is tempted to suggest that, from now on, all university courses in economics should include a compulsory physics segment (as well as a compulsory unit in the history of economics and economic methodology). If economists study physics, they will be more able to protect economics from those who seek to turn it into physics.

Footnotes

- Published by Cambridge University Press, 1989, pp.xii, 450. Aus \$119. ISBN 052 1350 425.
The writing of this review benefited from discussions with colleagues Peter Cribbett, Malcolm Cook and John Nightingale, but none of them can be blamed for the result.
- ** The expression "man of substance", meaning a person with considerable capital, is not convincing evidence that the classical economists had "substance theories of value" (p.335).