

# Marx's Concept of an Economic Law of Motion

John P. Burkett

Karl Marx's ultimate aim in *Capital* ([1867] 1965, 10) is "to lay bare the economic law of motion of modern society." A reader wondering what to expect from the book may try to recall laws of motion of earlier vintage. The laws that most readily come to mind are those with which Isaac Newton begins his *Mathematical Principles of Natural Philosophy*.<sup>1</sup> Not surprisingly, some commentators have surmised that Marx aspired to do for economics what Newton had done for physics. For instance, Michael Barratt Brown (1972, 127) argues as follows:<sup>2</sup> "In his model of the economic structure Marx seems to be following Newtonian concepts. Two examples may suffice, both taken from *Capital*, Volume 1. 'In the form of society now under consideration, the behaviour of men in the social process of production is purely atomic' (ch. 2). 'As the heavenly bodies, once thrown into a certain definite motion, always repeat this, so it is with social production . . .' (ch. 25)."

The cited examples do not, in fact, make a strong case that Marx

Correspondence may be addressed to John P. Burkett, Department of Economics, University of Rhode Island, Kingston, RI 02881; e-mail: burkett@uriacc.uri.edu. I am grateful to William Grenzebach, Yngve Ramstad, David Whitehouse, David Winet, and two anonymous referees for comments on previous drafts.

1. Law 1: "Every body continues in its state of rest, or of uniform motion in a right line, unless it is compelled to change that state by forces impressed upon it." Law 2: "The change of motion is proportional to the motive force impressed; and is made in the direction of the right line in which that force is impressed." Law 3: "To every action there is always opposed an equal reaction: or, the mutual actions of two bodies upon each other are always equal, and directed to contrary parts" (Newton [1687] 1994, 14).

2. A similar view is expressed by David Harvey (1969).

*History of Political Economy* 32:2 © 2000 by Duke University Press.

aspired to follow Newton's lead. With regard to the first example, we should note that Marx's views on atomism were formed in his dissertation on Democritus and Epicurus ([1841] 1975). While Epicurus is mentioned in *Capital*, Newton is not. Furthermore, in some passages Marx seems to find atomism a misleading or at least shallow point of view. For example, he states that "in competition the immanent laws of capital, of capitalist production, appear as the result of the mechanical impact of capitals on each other; hence inverted and upside down" ([1863] 1991–94, 33:102).

With regard to the second example, Marx is less likely to have been thinking of Newton than of Johann Kepler<sup>3</sup> as interpreted by G. W. F. Hegel, a point borne out by the following passage: "It is a contradiction to depict one body as constantly falling towards another, and as, at the same time, constantly flying away from it. The ellipse is a form of motion which, while allowing this contradiction to go on, at the same time reconciles it" (Marx [1867] 1965, 104). This view is reminiscent of Hegel ([1847] 1970), who viewed Kepler's elliptical planetary orbits as an expression of the dialectics of space and time, rather than of Newton ([1687] 1994), who viewed them as a special case of his inverse square law of gravitation.

There are two other reasons for doubting that Newton's laws of motion were paradigmatic for Marx. First, as Marx noted in a letter to Engels (1858, cited in Nicolaus 1973, 26), his method was influenced by Hegel's *Logic* ([1812] 1966, 2:86), which dismisses much of Newton's analysis as "empty and tautological talk." In two other letters to Engels, Marx concurred with Hegel's low opinion of Newton. In one he states that "taken as a whole Hegel's polemic amounts to saying that Newton's 'proofs' added nothing to Kepler, who already possessed the 'concept' of movement, which I think is fairly generally accepted now" ([1865] 1987b, 184–85). In the other, Marx ([1882] 1992, 380), following Hegel ([1847] 1970, 58), unfavorably contrasts the "mystical method of Newton and Leibniz" in differential calculus to "Lagrange's strictly algebraic method."<sup>4</sup>

Second, while Newton's exposition of physical laws of motion centers on mathematical functions that summarize observational and exper-

3. Marx ([1865] 1987a, 568) listed Kepler, together with Spartacus, as his heroes in a semi-serious "confession."

4. That Engels's opinion of Newton was no higher is clear from his *Dialectics of Nature* ([1882] 1987, 322–23).

imental data, Marx's exposition of his economic law of motion is almost exclusively literary and qualitative.<sup>5</sup>

All in all, the evidence for an "essential difference," as Jindřich Zelený (1980, 221) puts it, between Marx's and Newton's views on laws of motion is sufficient to justify consideration of alternative interpretations of *Capital*.

### Marx's Usages of Law

Marx's "economic law of motion of modern society" is not a single proposition but, rather, a collection of conceptually linked relationships—most notably the law of the falling tendency of the rate of profit and the general law of capitalist accumulation.<sup>6</sup>

It is not clear that all the "laws" Marx discusses conform to a single definition. At times, Marx seems to use the term in a broad or even metaphorical sense, perhaps influenced by Greek philosophical traditions. In commentary on Epicurus, Marx ([1839] 1975, 472–73) states that "*declinatio atomi a recta via*<sup>7</sup> is the law, the pulse, the specific quality of the atom . . . the *arbitrium*,<sup>8</sup> the specific substance, the true quality of the atom." In this broad sense, to lay bare an entity's law of motion means only to explain its essence or distinguishing characteristics.

However, in his mature economic writings, Marx usually uses *law* in a narrower sense. The clearest indication that he has in mind a specific meaning for *law*—quite different from Newton's—is found in his contrasting treatments of the rates of profit and interest in volume 3 of

5. The contrasting approaches of Newton and Marx should be seen in the context of the British and German traditions of science and natural philosophy. Newton drew on a British empiricist tradition, the leading figures of which included Francis Bacon, William Harvey, Robert Boyle, and Robert Hooke. Several German thinkers were critical of this tradition and of Newton in particular. Gottfried Wilhelm Leibniz, Immanuel Kant, and Johann Wolfgang von Goethe initiated a tradition of critical commentary on Newton that Hegel, Marx, and Engels continued (Gower 1997). It could be argued that as late as the nineteenth century, science was less sharply demarcated from other forms of scholarship in Germany than in Britain. *Wissenschaft* meant knowledge before it came to mean science. Thus the titles of Hegel's *Wissenschaft der Logik* and *Encyklopädie der philosophischen Wissenschaften* may have sounded less odd to nineteenth-century German ears than their usual English translations, *Science of Logic* and *Encyclopedia of the Philosophical Sciences*, sound to ours.

6. The former relates the rate of profit to time. The latter relates unemployment, underemployment, and associated maladies directly to the capital stock and labor productivity, which are expected to increase, and thus indirectly to time.

7. Declination of the atom from a straight line.

8. Free will.

*Capital*. After expounding a law of the falling tendency of the rate of profit, Marx denies that there can be any law governing the rate of interest. From a Newtonian point of view, this contrast makes no sense. The rate of interest is easier to observe than the rate of profit, as Marx acknowledges ([1894] 1962, 357). If Newton's laws had been the inspiration for *Capital*, Marx might have fit a mathematical function to time-series for the interest rate and called it a law of motion. But they were not and he did not. To understand Marx's divergent treatment of profit and interest, we must turn to Hegel.

### Hegel on Law

Hegel describes a law as a theoretical relationship distinguished by three main characteristics.<sup>9</sup> First, a law, in contrast to a rule, describes self-movement rather than externally driven movement.<sup>10</sup> Self-movement is necessary, while externally driven movement is contingent, in the sense that the former expresses the nature of the moving entity while the latter does not.<sup>11</sup> Hegel's leading examples of self-movement are the motion of falling bodies as described by Galileo Galilei,<sup>12</sup> the orbits of planets as described by Kepler,<sup>13</sup> and the behavior of good citizens as described by himself. The motions of falling bodies and orbiting planets may seem surprising as examples of *self*-movement, because under Newton's influence we customarily think of falling bodies and orbiting planets as moving because of gravity and, in the

9. "Law . . . is the stable presentment or picture of unstable appearance" (Hegel [1841] 1967, 195).

10. Law is "the peculiar determination of pure individuality or of the Notion which is for itself: as distinction in itself it is the imperishable source of a self-kindling movement; and, relating itself to itself alone in the ideality of its distinction, it is *free necessity*" (Hegel [1812] 1966, 2:365).

11. What, if anything, a contingent movement expresses is not always clear in Hegel's works. Asserting that a motion is contingent could mean that (1) it is caused by outside forces, (2) it is random, (3) science has not yet accounted for it, or (4) philosophy has not yet demonstrated it to be necessary (Inwood 1992).

12. While there is some controversy about what Galileo demonstrated (Dijksterhuis 1961), Hegel's ([1847] 1970, 58–59) interpretation is clear and conventional: "the traversed spaces are proportional to the squares of the elapsed times."

13. Kepler's three laws of planetary motion are as follows: (1) "A planet describes an ellipse. The sun occupies one of the foci of this ellipse." (2) "The radius vector from the sun to the planet sweeps over equal areas in equal times." (3) "There exists for all planets a constant ratio between the square of their period of revolution and the cube of the mean distance from the sun" (Dijksterhuis 1961, 321, 323).

latter case, an initial tangential force. However, Hegel rejects Newton's explanation and insists that falling bodies and orbiting planets move freely according to their own nature.<sup>14</sup> The behavior of good citizens may also seem a strange example, particularly to a modern economist, who is accustomed to believing that individuals—whether their preferences run to “good” or “bad” activities—react to externally determined constraints, legal or otherwise. However, Hegel's ([1847] 1970, 49) view is that “the good man is free *in* his obedience to the law, and it is only the bad man for whom the law is something *external* to him.” While these three cases are Hegel's main examples, he entertains the possibility that more laws may be discovered, including some pertaining to “Spirit” or human affairs, “because there we have self-subsistent entities confronting each other.” He describes the task of discovering laws of social development in the following terms: “Now the laws of this motion concern two things: the form of the path and the velocity of the motion. The thing to be done is to develop this from the Notion. This would give rise to a far-reaching science and the difficulty of the task is such that this has not yet been fully accomplished” (72).

The difficulties a scientist would encounter in attempting to follow this precept lie foremost in distinguishing self-movement from externally driven movement. On this point Hegel gives little guidance, and what he provides is not convincing.<sup>15</sup> In one passage he suggests that self-movement eventually “prevails” over externally instigated movement. As an example he makes the startling claim that even a *frictionless* pendulum “would have to come to rest” because the downward self-movement of its weight must eventually prevail over “the foreign element” of swinging (55). Even if we were to overlook the queer

14. Hegel ([1847] 1970, 57) argues that Newton's interpretation of Galileo's law of falling bodies involves an illegitimate “conversion of the moments of the *mathematical* formula into *physical* forces, into an *accelerating* force . . . and . . . a force of *inertia* . . . determinations utterly devoid of empirical sanction and equally inconsistent with the Notion.” Hegel (58) introduces his preferred interpretation as follows: “As against the abstract, uniform velocity of lifeless, externally determined mechanism, the law of descent of a falling body is a *free* law of Nature, i.e., it involves an element which is determined by the *Notion* of body.”

15. Because Hegel's distinction between self-movement and externally driven movement is closely related to that between necessary and contingent movement, it is relevant here to cite Michael Inwood's (1992, 199) negative verdict on the latter distinction: Hegel “gives no satisfactory account of (a) where the line is to be drawn between the contingent and the non-contingent; (b) why it is to be drawn at that, rather than some other point; or (c) how the existence of sheer contingencies is compatible with other features of his thought.”

mechanics implicit in this example, we would have to object that counter-examples may exist<sup>16</sup> and that, in any case, a guideline that depends on an eventual future outcome is of no help in analyzing ongoing processes. In other passages Hegel ([1812] 1966, 2:67–68) asserts that contradiction is “the principle of all self-movement” and “self-movement . . . is nothing else than the fact that something is itself and is also deficiency or the negative of itself, in one and the same respect.” These assertions are difficult to understand, let alone justify.<sup>17</sup> In any event, they provide no clear basis for distinguishing self-movement from imposed movement; indeed, Hegel—reinterpreting Zeno’s paradoxes—claims that *all* motion involves contradiction.<sup>18</sup>

Second, a law relates two “determinations” or quantitative characteristics of the entity to which it pertains.<sup>19</sup> In the case of Galileo’s law of falling bodies and Kepler’s laws of planetary motion, the two determinations are space and time or distance and velocity.<sup>20</sup> The require-

16. From Aristotle onward, a favorite example of a self-moving entity has been a running animal. Yet, as roadkill reminds us, a running animal does not always prevail over external forces.

17. Precedents, but no convincing justification, for viewing self-movement as the result of something that might be loosely called contradiction can be found in Heraclitus and Aristotle. Heraclitus, in some interpretations, argues that movement results from an imbalance between opposites (Stokes 1967). Aristotle (1934, 335), while rejecting some aspects of Heraclitus’s thought, maintains that “the self-mover . . . must embrace a motor that cannot itself be a motum, and a motum that need not itself be a motor.”

18. “Something moves, not because it is here at one point of time and there at another, but because at one and the same point of time it is here and not here. . . . We must grant the old dialecticians the contradictions which they prove in motion; but what follows is not that there is no motion, but rather that motion is existent Contradiction itself” (Hegel [1812] 1966, 2:67). A moving body is “at once in and *not* in the same place” (Hegel [1847] 1970, 135). These contradictions of motion—unlike some “contradictions” that merely describe incoherent systems of beliefs and desires (Hegel [1841] 1967), the unintended consequences of uncoordinated actions, or the resultant of opposing forces (Marx [1867] 1965; [1894] 1962)—involve affirming a proposition (e.g., the arrow is here) and its negation (e.g., the arrow is not here). What these contradictions imply for the Hegelian system depends on one’s interpretation of implication. Under the classical interpretation (material implication), one pair of contradictory statements suffices to prove anything. Proving in this way that all motion is self-movement or that all motion is imposed would obliterate the distinction Hegel attempts to draw. In contrast, under some alternative interpretations, a pair of contradictory statements need not have such far-reaching implications (Routley and Meyer 1976; Routley et al. 1982).

19. “Law means the combination of two simple determinations such that merely their simple interconnection constitutes the whole relationship and yet each must have the show of freedom in regard to the other” (Hegel [1847] 1970, 71–72).

20. In a physical law of motion “it is necessary for motion to be broken up into the elements time and space, or again, into distance and velocity” (Hegel [1841] 1967, 199). “The

ment that the determinations be two in number is not as restrictive as it seems, since one determination may have multiple coordinates, as, for example, space has three dimensions. The motion of an entity can be described by either one comprehensive law relating a vector of all its important characteristics to time or several partial laws, each relating a single characteristic or a subset of characteristics to time.<sup>21</sup>

Third, the two determinations must have a degree of conceptual independence from each other. Hegel ([1841] 1967, 199) illustrates this point by stating that space and time have the requisite independence, while positive and negative charges do not: "Space is thought of as able to be without time, time without space, and distance at least without velocity—just as their magnitudes are indifferent the one to the other, since they are not related like positive and negative, and consequently do not refer to one another by their very nature." Movement due to magnetic attraction or repulsion "is not called a law" in "the strict sense" by Hegel ([1847] 1970, 71–72, 173) because he cannot conceive of north poles without south ones.<sup>22</sup> Arguably, Hegel's reason for stipulating conceptual independence for the determinations related by a law is to ensure an explanatory role for the "Notion" of the entity whose motion the law describes. If the relationship between the determinations were fully entailed by their definitions, reference to the entity's nature would be otiose. In terms of modern economics, an identity is not a behavioral equation.

Laws, unlike mere models or hypotheses—as these terms are used by contemporary economists and philosophers of science—must have a substantial range of empirical validity (Armstrong 1996; Kindleberger 1989; Walters 1967). Whether Hegel shares this modern view of laws is unclear. On one hand, his general statements and some of his examples drawn from the natural sciences seem to endorse the view that a law is a particular kind of empirical regularity, whose range of

---

laws of motion concern *magnitude*, and essentially that of the time elapsed and the space traversed therein" (Hegel [1847] 1970, 57).

21. Thus the "motion of modern society" could be described by either a single law relating a vector of all important socioeconomic variables to time or a collection of laws such as the general law of capitalist accumulation and the law of the falling tendency of the rate of profit. Marx, as we have seen, uses both modes of expression.

22. The modern search for a magnetic monopole would have struck Hegel as hopeless and ill-conceived.

validity must be determined by observation.<sup>23</sup> On the other hand, his claims about the good citizen's behavior seem to follow from his concept of citizenship rather than to emerge from empirical inquiry.<sup>24</sup> Hegel's good citizen, like a neoclassicist's rational agent, appears to be a conceptual starting point for deductive reasoning rather than an object of observation. Hegel tells us how the good citizens must behave, not whether they exist.

In summary, the features of Hegel's treatment of laws that most sharply differentiate it from the tradition of Galileo and Newton and are most likely to cause difficulties in scientific practice are (1) an attempt to limit law to describing necessary self-movement without providing any clear criteria for distinguishing it from contingent externally driven movement and (2) a willingness to treat as laws deductive propositions with no established realm of empirical validity. The former feature makes it tempting to dismiss inconvenient observations as contingent. The latter renders supporting observations optional. As a case study of these difficulties, we consider Marx's application of Hegel's conceptual framework in his study of interest rates.

### **Marx's Shifting Views on Interest Rates**

Interest rates tended to fall in England during the seventeenth and the first half of the eighteenth centuries, prompting economists to speculate about the cause of the decline and about whether profit rates shared in the downward movement (Tucker 1960). After an upturn in the late eighteenth century, interest rates again trended

23. "No less than Empiricism, philosophy recognizes only what is, and has nothing to do with what merely ought to be" (Hegel [1827] 1975, 61). "In no Induction can we ever exhaust all the individuals. . . . One and the other observation, many it may be, have been made: but all the cases, all the individuals, have not been observed. By this defect of Induction we are led on to Analogy. In the syllogism of Analogy we conclude from the fact that some things of a certain kind possess a certain quality, that the same quality is possessed by other things of the same kind. It would be a syllogism of Analogy, for example, if we said: In all planets hitherto discovered this has been found to be the law of motion, consequently a newly discovered planet will probably move according to the same law. In the experimental sciences Analogy deservedly occupies a high place, and has led to results of the highest importance" (Hegel 1827 [1975], 253–54).

24. Hegel's good citizen may have some anecdotal basis—for example, Plato's account of Socrates' voluntary submission to Athenian law. However, Hegel cites no systematic empirical inquiry to support his claims about good citizens and does not seem to be bothered by the lack of such an inquiry. In this regard, his approach to law is in sharp contrast to that of Kepler and Newton, who based their laws on Tycho Brahe's detailed observation of the planets.



downward from 1800 to 1844 (Homer 1977). The young Marx, accepting the widespread—although by then probably outdated—belief in a downward secular trend in interest rates, began to theorize about its causes, as in the following passage: “The fall in the *interest on money* is a necessary consequence and result of industrial development” ([1844] 1973, 157). If the fall in interest rates is “necessary” in the Hegelian sense of self-movement, then to formulate the fall as a law, an investigator would merely need to specify its two determinations as magnitude and time and assert their conceptual independence. But how could its fall be shown to be necessary?

Adopting Hegel's idea that self-movement involves internal contradiction and interpreting contradiction as opposition, Marx regarded an entity's motion as necessary if it is the resultant of inherent opposing tendencies. In this connection it is worth recalling Marx's description of elliptical orbits—deemed necessary self-movement by Hegel—as the resolution of a “contradiction” between centripetal and tangential impulses.

What are the opposing tendencies, inherent in modern society, that determine interest rates? Arguably, they are the actions of lenders and borrowers, both of whom Marx supposed to be mainly capitalists. Some such reasoning appears to have lead Marx to assert in the *Grundrisse* ([1858] 1987, 226) that the division of surplus value into interest and profit of enterprise “becomes a tangible, palpable one as soon as a class of MONIED CAPITALISTS confronts a class of INDUSTRIAL CAPITALISTS.” Under these circumstances, he concluded, “capital itself becomes a commodity” and adjusts “its price according to supply and demand like any other commodity. So it is this that determines the rate of interest.”

How does struggle between the classes of monied and industrial capitalists eventuate in falling interest rates? Marx ([1894] 1962, 354) saw indications that interest rates tend “to fall quite independently of fluctuations in the rate of profit . . . due to two main causes.” First, the balance of supply and demand in capital markets shifts to the advantage of the borrowers, the industrial capitalists.<sup>25</sup> Second, industrial capitalists create a credit and banking system through which they can cheaply

25. “In old and rich countries, the amount of national capital belonging to those who are unwilling to take the trouble of employing it themselves, bears a larger proportion to the whole productive stock of the society, than in newly settled and poorer districts” (George Ramsay, *An Essay on the Distribution of Wealth*, quoted in Marx [1894] 1962, 354).

access the “savings of all classes of society.” These considerations suggest that as industrial capitalists gain the upper hand in their struggle with monied capitalists, interest rates fall relative to the rate of profit. Thus, provided that the rate of profit does not rise, all the elements are in place for a Hegelian law of the falling tendency of interest rates.

Yet Marx ultimately backs away from his characterization of monied and industrial capitalists as distinct classes. In the concluding chapter of *Capital* he lists just three classes, “wage-labourers, capitalists and land-owners” (862). Melding the monied capitalists and the industrial capitalists together in one class, Marx whisks away the opposing forces that he had earlier supposed to determine interest rates and render their movements “necessary.” Accordingly, he now asserts that the division between interest and profit of enterprise is “fortuitous” (840). Consigning the share of interest in profits to “the realm of accident” (357), Marx asserts that “the average rate of interest . . . cannot be determined by any law” (355) and that “there is no such thing as a ‘natural’ rate of interest” (357).<sup>26</sup>

Because Marx alters his characterization of interest rate movements from necessary to accidental without giving convincing reasons for either classification, we must wonder what might have prompted the change. It seems likely that in 1844 Marx still believed in a secular fall in interest rates, regarded it as evidence—as other economists had—of a falling tendency in the rate of profit,<sup>27</sup> and hoped to prove both “necessary.” However, just as Marx was adopting this position, the behavior of interest rates changed. From the mid-1840s through 1870, English and German interest rates exhibited a mild *rising* trend (Homer 1977). It is very likely that Marx, while drafting the third volume of *Capital*, was aware of this change and thus less inclined to treat interest rates as indicative of profit rates and more willing to dismiss their movements as accidental. Interest rates that are stable in absolute terms but falling relative to the profit rate imply a rising profit rate. This

26. Recalling the multiple meanings that might be attached to *contingent* in Hegel’s writings, we may wonder how to interpret Marx’s use of *fortuitous* and *accidental*. Unlike modern modelers of small open economies, Marx does not suggest that interest rates are contingent on forces outside the society under investigation. Rather, he seems to mean that interest rates are either random or not yet understood by science. It may be anachronistic to ask which of those two possibilities Marx had in mind, because the distinction between them was not as commonly observed in his time as in ours (Klein 1997).

27. Paraphrasing Adam Smith, Marx ([1863] 1988–89, 3:449) once identified interest rates as “indices from which the approximate level of the rate of profit can be judged.”

implication threatens the credibility of the law of the falling tendency of the rate of profit, which Marx ([1858] 1987, 748) had identified as “in every respect the most important law of modern political economy.”<sup>28</sup> Downgrading the movement of interest rates from necessary to accidental removed these refractory variables from the vector to be explained by “the law of motion of modern society.” This maneuver may be arbitrary or even tendentious, but it is in no way prohibited by Hegel’s methodology. Hegelian investigators are free to find contradiction, necessity, and law where they like.

Saying that a motion is accidental or contingent does not exclude it as evidence concerning a necessary motion.<sup>29</sup> Although interest rates are not among the variables covered by Marx’s law of motion, they may have some value as evidence concerning those that are. If interest rates (whether by necessity or accident) are stable in absolute terms but falling relative to the profit rate, the latter variable must be rising. Even if interest rates are not known to be falling relative to the rate of profit, they may be linked to the profit rate via conditional probabilities. Coherence requires that if a falling interest rate is admitted as evidence for a falling profit rate, a non-falling interest rate must be regarded as evidence of a non-falling profit rate.<sup>30</sup> Unfortunately, nothing in Hegel’s methodology or Marx’s applications suggests sensitivity to such relationships.

## Conclusion

Marx’s avowed intent “to lay bare the economic law of motion of modern society” has led some commentators to suppose that he aspired to

28. Whether Marx ever retreated from his 1858 view is unclear. The most emphatic statement of the law in *Capital* (“in reality, as we have seen, the rate of profit will fall in the long run” [3:225]) has not been found in Marx’s original manuscript and was presumably inserted by Engels (Reuten 1997).

29. For example, consider a naturalist who believes that the motion of a running deer is necessary but the motion of a deer being dragged by a lion is contingent. Observing the latter, the naturalist might infer the deer did not run as fast as the lion.

30. To demonstrate this, let  $H$  be the hypothesis that the profit rate falls,  $\neg H$  be its negation,  $E$  be the event that interest rates fall,  $\neg E$  be its complement,  $P(\bullet)$  be a prior probability, and  $P(\bullet|\bullet)$  be a posterior probability. An economist who treats  $E$  as increasing the odds on  $H$  indicates that  $\frac{P(H|E)}{P(\neg H|E)} > \frac{P(H)}{P(\neg H)}$ . From that inequality one can, using Bayes’s theorem, easily deduce that  $P(E|H) > P(E|\neg H)$ ,  $P(\neg E|H) < P(\neg E|\neg H)$ , and thus  $\frac{P(H|\neg E)}{P(\neg H|\neg E)} < \frac{P(H)}{P(\neg H)}$  —i.e., that  $\neg E$  decreases the odds on  $H$ .

do for economics what Newton did for physics. Were this interpretation correct, we would have to conclude that he failed, since *Capital* contains nothing like the mathematical summaries of observational and experimental data that are central to Newton's works. However, a more reasonable interpretation is that Marx consciously rejected Newton's concept of laws in favor of Hegel's. In this interpretation, Marx provides perhaps the leading example of an attempt to carry out Hegel's scientific agenda. While viewing Marx's research as exemplifying Hegel's methodology may increase our understanding of the former, it may also reinforce distaste for the latter.

Hegel's problematic distinction between necessary and contingent movement, his failure to provide clear criteria for applying the distinction, and his willingness to proclaim a simple deduction to be a law despite its lack of empirical content open the door to dismissing awkward facts as contingent and treating supportive evidence as optional. Taking advantage of this opening, Marx consigned interest rates to the realm of chance after they ceased to fall and continued to proclaim as law, with no empirical evidence, the falling tendency of the rate of profit. The general law of capitalist accumulation likewise concerns variables—principally rates of unemployment and underemployment—which were unobserved in Marx's day and are still difficult to measure in ours. Selectively ignoring observed variables and theorizing about unobserved ones, Marx produced *a model* of capitalism with no compelling claim to be called *the law* of motion of modern society.<sup>31</sup>

## References

- Aristotle. 1934. *The Physics*. Vol. 2. Translated by Philip H. Wicksteed and Francis M. Cornford. Cambridge: Harvard University Press.
- Armstrong, David M. 1996. Laws of Nature. In *The Encyclopedia of Philosophy, Supplement*, edited by Donald M. Borchert. New York: Macmillan.

31. Even if we were to accept analytic statements as laws, we should have to reject the claim that those of Marx constitute *the law* of motion of modern society. While Marx bases his analysis on his concept of capital, alternative premises are available. Put differently, Mr. Moneybags, Marx's personification of capital, has rivals—including Hegel's good citizen and the neoclassicists' rational agent—for the lead role in the dramas of social theory. This deflationary view of Marx's "law" does not diminish the importance of his more modestly phrased insights, some of which deserve greater attention than they customarily receive—for example, his insight that expanding markets coupled with what are now called nonhomothetic production functions could alter the distribution of income among classes (Burkett 1995).

- Brown, Michael Barratt. 1972. Marx's Economics as a Newtonian Model. In *The Rules of the Game*, edited by Teodor Shanin. London: Tavistock.
- Burkett, John P. 1995. *International Trade and Factor Prices in a Model with Non-homothetic Production Functions*. Kingston, R.I.: Institute for the Study of International Aspects of Competition, working paper 95-1.
- Dijksterhuis, E. J. 1961. *The Mechanization of the World Picture*. Oxford: Oxford University Press.
- Engels, Friedrich. [1882] 1987. *Dialectics of Nature*. In vol. 25 of Marx and Engels 1975–98.
- Gower, Barry. 1997. *Scientific Method: An Historical and Philosophical Introduction*. London: Routledge.
- Harvey, David. 1969. *Explanation in Geography*. London: Edward Arnold.
- Hegel, G. W. F. [1812] 1966. *Science of Logic*. New York: Humanities Press.
- . [1827] 1975. *Logic*. Oxford: Oxford University Press.
- . [1841] 1967. *The Phenomenology of Mind*. New York: Harper and Row.
- . [1847] 1970. *Philosophy of Nature*. Edited by A. V. Miller. Oxford: Oxford University Press.
- Homer, Sidney. 1977. *A History of Interest Rates*. New Brunswick, N.J.: Rutgers University Press.
- Inwood, Michael. 1992. *A Hegel Dictionary*. Oxford: Blackwell.
- Kindleberger, Charles P. 1989. *Economic Laws and Economic History*. Cambridge: Cambridge University Press.
- Klein, Judy. 1997. *Statistical Visions in Time*. Cambridge: Cambridge University Press.
- Marx, Karl. [1839] 1975. Notebooks on Epicurean Philosophy. In vol. 1 of Marx and Engels 1975–98.
- . [1841] 1975. Difference between Democritean and Epicurean Philosophy of Nature. In vol. 1 of Marx and Engels 1975–98.
- . [1844] 1973. *The Economic and Philosophic Manuscripts of 1844*. Edited by Dirk J. Struik. New York: International Publishers.
- . [1858] 1987. *Grundrisse*. In vol. 29 of Marx and Engels 1975–98.
- . [1863] 1988–89. *Theories of Surplus Value*. In vols. 30–32 of Marx and Engels 1975–98.
- . [1863] 1991–94. A Contribution to the Critique of Political Economy. In vols. 33–34 of Marx and Engels 1975–98.
- . [1865] 1987a. Confession, 1 April. In vol. 42 of Marx and Engels 1975–98.
- . [1865] 1987b. Letter to Engels, 31 May. In vol. 42 of Marx and Engels 1975–98.
- . [1867] 1965. *Capital*. Vol. 1. Moscow: Progress Publishers.
- . [1882] 1992. Letter to Engels, 22 November. In vol. 46 of Marx and Engels 1975–98.
- . [1893] 1967. *Capital*. Vol. 2. Moscow: Progress Publishers.
- . [1894] 1962. *Capital*. Vol. 3. Moscow: Foreign Languages Publishing House.
- Marx, Karl, and Friedrich Engels. 1975–98. *Collected Works*. New York: International Publishers.

- Newton, Issac. [1687] 1994. *Mathematical Principles of Natural Philosophy*. In vol. 32 of *Great Books of the Western World*. Chicago: Britannica.
- Nicolaus, Martin. 1973. Foreword to *Grundrisse*, by Karl Marx. Baltimore: Penguin Books.
- Reuten, Geert. 1997. The Notion of Tendency in Marx's 1894 Law of Profit. In *New Investigations of Marx's Method*, edited by Fred Moseley and Martha Campbell. Atlantic Highlands, N.J.: Humanities Press.
- Routley, Richard, and Robert K. Meyer. 1976. Dialectical Logic, Classical Logic, and the Consistency of the World. *Studies in Soviet Thought* 16:1–25.
- Routley, Richard, Val Plumwood, Robert K. Meyer, and Ross T. Brady. 1982. *Relevant Logics and Their Rivals*. Atascadero, Calif.: Ridgeview.
- Stokes, Michael C. 1967. Heraclitus of Ephesus. In vol. 3 of *The Encyclopedia of Philosophy*, edited by Paul Edwards. New York: Macmillan.
- Tucker, G. S. L. 1960. *Progress and Profits in British Economic Thought, 1650–1850*. Cambridge: Cambridge University Press.
- Walters, R. S. 1967. Laws of Science and Lawlike Statements. In vol. 4 of *The Encyclopedia of Philosophy*, edited by Paul Edwards. New York: Macmillan.
- Zelený, Jindřich. 1980. *The Logic of Marx*. Totowa, N.J.: Rowan and Littlefield.