

Marx, devalorisation, and the theory of value

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This article investigates the implication of devalorisation of fixed capital in Marx's value theory. It shows why an exact, algebraic value theory is impossible. It also indicates how analysis of devalorisation provides a basis for understanding the nature of crises.

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Introduction

I am offering yet another reinterpretation of Marx's value theory. Although this value theory does not easily lend itself to algebraic or statistical modelling, the approach that I propose has the advantage of providing a closer link between Marx's crises theory and his theory of value. The core of this article concerns the treatment of constant capital in Marx's value theory. All quantitative treatments of Marxian value theory must find a way to measure the transfer of value from constant capital to the final products. Although the expanding literature on the solutions to Marx's so-called transformation problem has worked on this problem, none to my knowledge has satisfactorily come to grips with the impossibility of correctly measuring this transfer of value.

An alternative approach

Let us begin at the beginning. In the first volume of *Capital*, Marx analysed commodities at their most abstract level. We might refer to the quantitative value theory that Marx presented there as a presentation of 'simple value', to indicate an affinity with simple reproduction or the most simplistic version of Marx's model of expanded reproduction.

We should keep in mind that both simple reproduction and expanded reproduction were merely analytical devices, neither a full description of reality nor a formal model. Nonetheless, neither simple nor expanded reproduction is entirely without interest. Both simple reproduction and simple value theory represented a significant theoretical advance over classical economics. For example, Marx's reproduction schemes laid the foundation for a more concrete investigation of a dynamic economy in the sense that they illustrate

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the difficulty of establishing the right proportions among different sectors of the economy. In effect, Marx proposed an anti-equilibrium theory, which demonstrates that, unless certain unlikely conditions are met, the economy can experience a disproportionality crisis, similar, in some respects, to the Harrod–Domar model. Had he gone no further, Marx might be remembered today as an interesting economist, but perhaps not much more.

Both simple value theory and simple reproduction presume either a static or, at least, a proportionately expanding economy, implying that all relationships retain all aspects of their initial structure, including relative prices. Nobody would argue that Marx's schemes of simple reproduction were a realistic model of the economy, rather than a conceptual device that demonstrated the weak foundations of the sort of theory that Say's Law represented.

Neither simple value theory nor simple reproduction was a mere mental exercise. Marx used both to analyse the contradictory nature of capitalism. Despite their indisputable importance in this regard, both simple reproduction and simple value theory are inadequate for a more concrete level of analysis.

The limits of simple reproduction theory are easier to recognise than those of simple value theory. To acknowledge the limits of simple value theory does not minimise the analytical importance of this concept, any more than the unrealistic assumptions underlying simple reproduction theory invalidate the insights that the reproduction schemes provided.

Although Marx developed enormous insights from simple value theory in the first volume of *Capital*, simple values are inadequate for analysing the dynamic economy that Marx analysed in the later volumes. Certainly, Marx was interested in the dynamic nature of the economy. He saw himself as breaking new ground by realising that '[c]apital . . . can be understood only as a motion, not as a thing at rest' (Marx, 1967, Vol. II, p. 105). Before he could begin his dynamic analysis, Marx had to move beyond simple value analysis. Of course, Marx had already moved away from simple value theory, even before he began his dynamic analysis. For example, he allowed for deviations due to different organic compositions of capital, although he considered that modification to be minor.

To sum up the argument to this point, most of the literature on Marx accepts the assertion that Marx's general method was to begin with a very abstract analytical approach, which he would progressively modify as he applied his theory to more concrete levels of analysis. Value theory is a case in point. Marx continually developed his value theory as he moved to more concrete levels of analysis. This value theory was not a formal model to be used to derive a mathematical rule for establishing prices, but rather a way of understanding the laws of motion of capital.

Capital valuation and technical change

Depreciation rules and simple value theory

Let us look at how Marx developed his more concrete concept of value. We all know that unsophisticated critics have alleged that Marx suddenly discarded value theory in mid-course once he realised that he left something out of his original analysis of value theory. But nothing of the sort ever happened. Disregarding the debates over whether value should be interpreted as a monetary expression of value or not, value theory and price theory operate on different levels of abstraction. From my perspective, each serves a different purpose. The more abstract theory can reveal aspects of the economy that more

concrete levels of analysis would obscure. Marx's application of value theory analysis to the wage form stands as the classic case. Price theory hides the nature of exploitation. Simple value theory makes it transparent.

Remember that in simple value theory, value depends on the direct and indirect labour embodied in the commodity. This indirect labor represents labour, which was previously deposited in capital goods and which gradually becomes re-embodied in the finished commodities. This transfer of value from capital goods to finished commodities is as unobservable as the process whereby labour values are abstracted. The question of abstract labour is instructive in pointing out some of the difficulties of quantitative Marxian theory.

How can labour values be measured in terms of abstract labour? Many readers of Marx have long understood that the process of abstraction of labour defies quantification. Faced with the challenge of quantifying the abstract labour process, we are left with two choices. Either we can measure the total amount of labour hours (presuming that each hour contains the same quantity of abstract labour) or we can weight each hour by the appropriate wage rate. The first choice is obviously wrong, since it rules out the process of abstraction altogether. The second choice involves circular reasoning. It suggests that we have to use the price system to get a handle on the value system, which was supposed to allow us to go beyond the price system in the first place.

Either approach makes quantification questionable, if not impossible. We shall soon see that even more difficult hurdles stand in the way of quantification when we address the movement from simple value theory towards a more concrete form of value theory. This analysis will be worth the effort since it throws light on some qualitative aspects of Marx's value theory that have not been properly appreciated. It also provides some guidance to those who want to pursue quantitative Marxian analysis.

At this point, we can extend Marx's famous hint, that there is nothing simple about a commodity, to the value of a commodity (see Schwartz, 1977). In the same vein, value theory is not as simple as it seems.

According to simple value theory, capital goods unrealistically depreciate according to predetermined patterns, just as they do in neoclassical production theory. If a tool is to be used over a fixed period of time with a known pattern of intensity, we can develop a rule to measure the rate at which the labour embodied in the tool is deposited in the flow of commodities. To argue for the realism of such conditions is tantamount to proposing some sort of 'rational Marxian expectations'.

Once we go beyond the analysis of semi-static, expanded reproduction, how could we make the theory operational? We should require knowledge about future economic conditions before we could calculate the amount of abstract labour transferred from constant capital to the final commodity. For example, if unpredictable technical change can make a tool obsolete in the near future, how do we develop an appropriate rule to allocate the transfer of value from the tool to the final product? In short, without a proper rule for determining the rate at which abstract labour is deposited in commodities, precise measurement and quantification of value is impossible.

The absence of such a rule does not present a problem if the primary objective of simple value theory is the qualitative information that it provides, as in the case of Marx's analysis of the wage form. Unfortunately, most of the literature on value theory treats values as if they are simple quantitative values, assuming that they do not stand in need of any modification to take account of more concrete analysis. I shall attempt to show why that interpretation prevents us from taking advantage of the full power of Marx's analysis.

Towards a more concrete theory of value: reproduction values

Marx did not always take pains to give us much guidance in following his methodology. He placed many of his valuable analytical signposts in prefaces and postscripts of his work, or even in letters or notebooks, rather than in the actual body of *Capital*. In the case of the process of continual modification of his value theory, Marx left little doubt about the importance that he placed on the subject, although he never established its methodological importance.

The most crucial step in his elaboration of the value theory is the shift from value as a measure of the sum of the actual labour values used to produce a commodity in the past to a new definition of value as the amount of labour that would be required to reproduce the commodity today. In his words:

[The] value [of a unit of capital] is no longer determined by the necessary labour-time actually objectified in it, but by the labour-time necessary either to reproduce it or the better machine . . . When the machinery is first introduced into a particular branch of production, new methods of reproducing it more cheaply follow blow upon blow. (Marx 1977, p. 528)

Reproduction value differs from simple value in one important respect: simple values are objective values (presuming that we can measure the previous inputs of abstract labour). In the case of simple values, we treat the lifetime of the capital goods as given in advance. If a machine lasts ten years, we can assume that one-tenth of its value is transferred to the commodities produced in a given year. Each commodity that the machine produces will account for a portion of that total value. Consequently, to calculate the value of a commodity, we merely have to take the sum of the direct labour input and the amount of value transferred to the commodity.

In the case of reproduction values, quantitative measurement of value is more difficult. We could even say that it is subjective, since capitalists cannot know in advance what will happen to the cost of reproducing their machines once they purchase them.

Marx understood that these considerations were important. He was certain that, once produced, machines typically undergo dramatic revolutions in reproduction values. He went so far as to insist that new technology destroys capital values so rapidly that no factory ever covers its original production costs (Perelman, 1987, Ch. 4; see Marx to Engels on 14 August 1851, in Marx and Engels, 1982, p. 424; Marx, 1967, Vol. III, p. 114; Marx, 1963, p. 65; and Marx to Engels, 19 November 1869, in Marx and Engels, 1942, p. 270). Marx observed:

The value of machinery, etc., falls . . . because it can be reproduced more cheaply. This is one of the reasons why large enterprises frequently do not flourish until they pass into other hands, i.e., after their first proprietors have been bankrupted, and their successors, who buy them cheaply, therefore begin from the outset with a smaller outlay of capital. (Marx, 1967, Vol. III, p. 114)

Marx cited Babbage's example of frames for making patent net that initially sold for £1,200. They cost only £60 a few years later (Marx, 1977, p. 528; Babbage, 1835, pp. 286, 214; see also Baumol and Willig, 1981; and Gaskell, 1833, p. 43, cited in Alberro and Persky 1981). Babbage claimed: 'the improvements succeeded each other so rapidly that machines which had never been finished were abandoned in the hands of their makers, because new improvements had superseded their utility' (Babbage, 1835, p. 286).

Babbage's rule of thumb was that the cost of an original machine was roughly five times the cost of a duplicate (Babbage, 1835, p. 266). According to Babbage's estimates, one

hour of labour embodied in patent nets that were only a few years old would be equivalent to three minutes of direct labour embodied in a new machine.

To the extent that Babbage's example was typical, quantitative measurement of values would be difficult, if not impossible. Reproduction costs shift in unpredictable patterns. Because we cannot predict what future technologies will be available at any given time in the future, we have no way of knowing in advance how long a particular capital good will be used before it will be replaced. A machine that lasts 20 years would presumably transfer value to the output at a different rate from a machine that would be expected to last only a single year.

Because we cannot see into the future, we can only retrospectively calculate the appropriate amount of value transferred from the constant capital. In other words, some time in the future after the equipment used in the production process had been used up we could calculate the values of goods produced today. We cannot calculate the values of goods produced today, because knowing the appropriate values of the constant capital being transferred today is impossible without advanced knowledge of future reproduction values.

Alternatively, we could calculate the value of goods based on capitalists' estimates of future depreciation patterns. Once we embark on the path of taking subjective estimates of future depreciation into consideration, we open a new can of worms. To begin with, we have no way of knowing the capitalists' subjective opinions. In addition, Marx's assertion about bankruptcies suggests that these subjective opinions are grossly mistaken.

Although replacing simple values with reproduction values makes quantitative analysis more difficult, I want to demonstrate that the qualitative insights of reproduction value theory make Marx's analysis of business cycle theory more powerful than any analysis based on simple value theory. Parenthetically, let me mention here that reproduction values can also increase, especially if capitalism creates environmental destruction, which makes reproduction more difficult. Here again reproduction value theory offers deeper insights into that relationship between the resource base and economic conditions. I have treated this matter elsewhere (Perelman, 1987, Ch. 2). Now I want to concentrate on Marx's analysis of how reproduction values change and how, in the short run, the market allows prices to deviate from reproduction values.

A qualitative crisis theory

An application of qualitative crisis theory

The analysis of the depression of the late nineteenth century provides an excellent application of the sort of qualitative value theory that I am suggesting. For example, the 1880s were the most rapid decade of economic growth in the post-Civil War period, measured by per capita growth of reproducible tangible wealth, amount of savings, investment funds and growth of per capita income (Sklar, 1988, p. 44; Friedman and Schwartz, 1963, pp. 92–3). At the time, industry in the United States was rapidly introducing new technologies. During the period 1869–89, the average factory doubled in size and capital invested per manufacturing worker grew from \$700 to \$2,000 (O'Brien, 1988; Jensen, 1993, p. 834).

You might expect capital to have profited from a general prosperity during this period. In fact, profits suffered. This new technology forced owners of outdated plant and equipment to adopt one of three options. First, they could withdraw from production. Second, they could adopt improved technologies. Or, third, they could attempt to meet the competition by dropping their prices.

Apparently, relatively few took the first option, since prices plummeted. As a result, installed capital generally depreciated before firms could amortise their investments. Profits fell because firms had to abandon equipment before it had paid for itself. Consider the example of Andrew Carnegie, who was notorious for his single-minded determination to lower production costs. Once when his young assistant, Charles Schwab, reported a superior design for a rolling mill, Carnegie ordered him to raze and reconstruct an existing three-month-old mill (McCraw and Reinhardt, 1989, p. 595).

As a result of this ruthless pursuit of the best available technologies, the price of steel rails fell by 88% from the early 1870s to the late 1880s (Jensen, 1993, p. 835). Steel was not unique. Electrolytic refining reduced aluminium prices by 96%; synthetic blue dye production costs fell by 95% from the 1870s to 1886 (*ibid.*). Based on this experience, most major US economists abandoned their faith in the market and sought refuge in trusts, cartels and monopolies as a means to stabilise capital values (Perelman, 1994).

In one of the most dramatic mergers in history, J. P. Morgan bought out Carnegie's organisation and merged it with a number of lesser firms to form United States Steel. Freed from competitive pressures, the company did little to modernise its operations (*ibid.*, pp. 595, 607). In this regard, the editors of *Fortune* magazine reported:

Now there are two possible ways to look at a steel plant or an ore mine. One is as an investment that must be protected. The other is as an instrument of production, to be cherished only so long as it cannot be replaced by a more efficient instrument. The first may be called the banker's point of view; the second, the industrialist's. (Anon., 1936, p. 170)

According to the investigators at *Fortune*, United States Steel 'has always been a management with a financial rather than an industrial turn of mind' (*ibid.*, p. 63). This perspective reflected the origins of the corporation. 'The Steel Corporation was founded by financiers, [and] has been dominated ever since by financially-minded men' (*ibid.*, p. 170).

Under the leadership of United States Steel, the industry's management in the United States was notorious for its unwillingness to invest in modernisation. Even though basic oxygen furnaces and continuous casting offered substantial cost savings, the industry refused to invest in these technologies long after they had become standard in steel plants throughout the world (Adams and Dirlin, 1964 and 1966; Oster, 1982; Barnett and Schorsch, 1983).

Because capitalists with substantial market power can avoid the necessity of adjusting prices immediately when reproduction values fall below simple values, the price system will effectively attribute excessive values to capital goods—at least temporarily. Marx called these claims to excess values, 'fictitious capitals'.

The benign divergence of values and prices

In effect, firms in an industry with market power can act as if the values of their capital goods were simple values rather than reproduction values. The more this practice continues, the more their prices will diverge from reproduction values. When large divergences become typical throughout the economy, the price system will become increasingly incapable of coordinating the economy. Malinvestment will become common. This state of affairs cannot continue for ever. Eventually, the forces of competition will compel prices to fall in line with reproduction values (see Perelman, 1987, Ch. 6).

Marx repeatedly explained how, over and above changes in reproduction values,

value can appear to take on a more or less independent existence until a crisis brings values back in line with reproduction values. The following citation is worth considering in detail:

Capital, as self-expanding value . . . can be understood only as motion, not as a thing at rest. Those who regard the gaining by value of independent existence as a mere abstraction forget that the movement of industrial capital is this abstraction *in actu* . . . If social capital experiences a revolution in value, it may happen that the capital of the individual capitalist succumbs to it and fails, because it cannot adapt itself to the conditions of this movement of values. The more acute and frequent such revolutions in value become, the more does the automatic movement of the now independent value operate with the elemental force of a natural process, against the foresight and calculation of the individual capitalist, the more does the course of normal production become subservient to abnormal speculation, and the greater is the danger that threatens the existence of the individual capitals. These periodic revolutions in value therefore corroborate what they are supposed to refute, namely, that value as capital acquires an independent existence. (Marx, 1967, Vol II, pp. 105–6)

Of course, this ‘independence’ of values is only a partial independence. We shall explore the nature of this independence in the next section.

The labour theory of value as a requirement of capital

Under the ideal conditions that Marx used in presenting his simple value theory, a capitalist economy would maintain its balance by exchanging commodities at prices roughly equal to the underlying labour values. Again, the treatment of simple values parallels the treatment of simple reproduction. We know that Marx never claimed that the algebraic equations of simple reproduction provided predictions of equilibrium. He was merely showing that an economy that failed to satisfy the requirements of the model could fall into a crisis. In this sense, the reproduction schemes are consistent with a qualitative value theory.

Marx’s simple labour theory of value worked in the same fashion. Like the simple reproduction model, simple value theory showed the difficulties that arose when economic conditions failed to meet certain relatively stringent conditions. Simple values, like simple reproduction schemes, suggested a requirement of capitalist stability. Marx demonstrated that prices had to indicate underlying labour values in order to steer the economy away from crises (see Perelman, 1987, Ch. 6).

In the analysis that some call the transformation problem, Marx acknowledged that prices would not exactly equal values, even in the context of a system of simple values. Nonetheless, in writing about crises, Marx indicated that, despite the deviations of prices and values, the structure of prices should still roughly conform to the structure values. Otherwise, prices cannot give a signal to capitalists that is adequate to maintain a coherent economic organisation (see Perelman, 1987, Ch. 6).

Just as the mathematical relations of simple reproduction are unlikely to hold in a real economy, actual prices tend to drift away from underlying labour values. As the linkage between prices and values becomes looser, the price system gives increasingly misleading signals, making speculation more profitable than earning profits by producing goods and services for the market.

The deviations of prices and values owing to the failure to adjust prices in light of the gaps between simple values and reproduction values can cause far more substantial deviations of prices and values than the deviations caused by the transformation problem.

More important, unlike the deviations associated with the transformation problem, these deviations are not systematic and will accumulate over the business cycle.

As fictitious capital accumulates during an upswing, it drags down the rate of profit. As we suggested above, when these fictitious capitals become too extreme they contaminate the price system, which can no longer give the proper signals. The continued functioning of the system then requires a crisis strong enough to wipe out fictitious capitals and bring prices back in line with values (Perelman, 1987, Ch. 6). If the system can withstand the shock of the crisis, a new cycle will begin with a higher rate of profit and a coherent system of prices and values.

Here we have a different crisis theory from that of a regular, decennial replacement cycle. This one revolves around the irregular accumulation and destruction of fictitious values. I believe that this non-periodic crisis theory will prove to be a more fruitful line of investigation than the more algebraic analysis commonly associated with Marxian crisis theory (Perelman, 1987). This analysis also helps to clarify finance's role in crisis theory.

Reproduction values and business cycle theory

We have seen that, in an unpredictable, dynamic world current values depend on the future reproduction values of constant capital. Revaluations of reproduction values create a parallel, but delayed counterpart on the price structure. In addition, these shifting prices of capital assets can be a major influence on the rate of profit.

Let us look at this relationship between capital asset revaluations and profits more closely. The profit resulting from a purchase of fixed capital depends upon the sum of current profits from basic business activities plus any appreciation or depreciation that occurs as a result of that investment. Often, the introduction of a new capital investment entails the devaluation of a capital good that the new investment replaces.

In an economy with high capital–output ratios (measured in value terms), such fluctuations in asset prices can swamp current profits. Both Kliman and Perelman have argued that the rate of profit has a tendency to fall when sufficiently rapid technical change devalues existing assets before their values can be realised in finished commodities (Perelman, 1987; Kliman, 1988 and 1996).

Although economists have generally overlooked this problem of capital revaluation, business has not. Because of the resulting capital losses on existing equipment, business resists replacing capital-intensive investments unless the savings that result from the investment repay the cost of the investment in a very short period of time; however, such a strategy is not always feasible. As Marx observed:

On the one hand the mass of the fixed capital invested in a certain bodily form and endowed in that form with a certain average life constitute one reason for the only gradual pace of the introduction of new machinery, etc., and therefore an obstacle to the rapid general introduction of improved instruments of labour. On the other hand competition compels the replacement of old instruments of labour by new ones before the expiration of their natural life, especially when decisive changes occur. Such premature renewals of factory equipment on a rather large social scale are mainly enforced by catastrophes or crises. (Marx 1967, Vol. II, p. 170)

In short, Marx realised that, in an economy where large firms can blunt the force of competition, some firms will be able to treat obsolete capital values as if the forces of devalorisation had never existed.

Toward a rehabilitation of qualitative value theory

My concern here is twofold. I am warning against a one-sided application of Marxist theory in which we take simple value theory to be an objective representation of reality. Second, we must guard against being lulled into a false sense of scientificity in working with empirical measures.

I could have mentioned other difficulties with quantitative value theory. For example, estimating a social rate of profit requires knowledge of total constant capital. Unfortunately, measures of aggregate constant capital are of questionable validity because of the complications created by changes in the social division of labour (Perelman, 1987, Ch. 5). In addition, many of the quantitative measures used in making empirical estimates are of dubious accuracy. For example, Engels observed, when supplying Marx with estimates of surplus value in English spinning mills, that such statistics are not readily available only because 'few capitalists ever think of making calculations of this sort with reference to their own business' (Marx, 1967, Vol. III, p. 76; see also Perelman, 1987, pp. 126–8; and Marx, 1977, pp. 327–8).

My emphasis on qualitative value theory does not mean that we must throw quantitative theory overboard. The sort of algebraic analysis associated with the mathematics of reproduction schemes or a rising organic composition of capital will be appropriate at some times and inappropriate at others. In this sense, we might also interpret the respective analysis of reproduction values and reproduction schemes as complementary. To begin with, we can look at the reproduction schemes as a qualitative method for demonstrating the difficulty of establishing a balance between sectors even when values are fixed. Reproduction value theory reinforces that analysis, since with reproduction values fluctuating and fictitious capitals accumulating and then vanishing, economic stability is even more unlikely.

In addition, quantitative analysis, such as we find in the reproduction schemes, might be more appropriate during specific periods. Babbage witnessed what was apparently a process of rapid technological change, which would make estimation of future capital depreciation all but impossible. Under such conditions, quantitative value theory would become especially problematical. In contrast, according to Engels' account of the cotton industry, capital goods were relatively long-lived. Quite possibly, values were relatively stable in that industry at the time. Under these conditions, simple value theory might offer a reasonable tool of quantitative analysis, since capitalists might not go terribly wrong in their estimates.

I do not want to deny the importance of quantitative analysis. We still need empirical analysis to get a rough handle on broad social issues such as the rate of profit. Although such empirical work is undeniably important, we should be modest in the way we regard it. We must also keep in mind that quantitative analysis reflects capital's own tendency to reduce everything down to quantitative measures.

In short, quantitative analysis can yield, at best, a crude approximation. We should drop any pretence of exactitude. Marx's comparison of rates of surplus value across widely different social formations, from Britain to Danubian feudalism, is an excellent example of modest empiricism. These estimates are on a different level of abstraction from Marx's value theory, which deals with unmeasurable units of analysis. Although they are not precise, they illustrate an insight that some might find counter-intuitive—that capitalism is more exploitative than a vestigial form of feudalism. In this sense, a closer reading of Marx's qualitative value analysis will not supplant empirical research. Instead, it will strengthen empirical research by making it more realistic.

Conclusion

We have seen that quantitative value theory faces a serious problem in determining in advance how fast fixed capital goods will lose value. No algebraic theory of value can ever attain some sort of exactitude without prior knowledge of the future. We can still apply quantitative value theory in a macroeconomic setting to get a rough handle on empirical questions, such as the falling rate of profit, but we must be aware of the limits of any such calculation.

Qualitative value theory, in contrast, is a valuable analytical tool for understanding the capitalist economy. It casts considerable light on the nature of exploitation. It reveals how at any moment the underlying contradictions of markets can break out into a crisis. I regret that we have paid too little attention to the qualitative side of Marx. This article is intended to stimulate a renewed interest in that dimension of his work.

Bibliography

- Adams, W. and Dirlin, J. B. 1964. Steel imports and vertical oligopoly power, *American Economic Review*, vol. 54, no. 4, September, 626–55
- Adams, W. and Dirlin, J. B. 1966. Big steel, invention, and innovation, *Quarterly Journal of Economics*, vol. 63, no. 2, May, 167–89
- Alberro, J. and Persky, J. 1981. The dynamics of fixed capital revaluation and scrapping, *Review of Radical Political Economy*, vol. 13, no. 2, Summer, 21–37
- Anon. 1936. U.S. steel: the corporation. Part 1, *Fortune*, March, 59–65 and 152–91
- Babbage, C. 1835. *The Economy of Machinery and Manufactures*, 4th edn, London, Charles Knight
- Barnett, D. F. and Schorsch, L. 1983. *Steel: Upheaval in a Basic Industry*, Cambridge, MA, Ballinger
- Baumol, W. J. and Willig, R. D. 1981. Intertemporal failures of the invisible hand: theory and implication for international market dominance, *Indian Economic Review*, vol. 16, nos 1 and 2, January–June, 1–12
- Friedman, M. and Schwartz, A. J. 1971 (1963). *A Monetary History of the United States, 1867–1960*, Princeton, Princeton University Press
- Gaskell, P. 1833. *The Manufacturing Population of England*, London
- Jensen, M. C. 1993. The modern industrial revolution: exit and the failure of internal control systems, *Journal of Finance*, vol. 48, no. 3, July, 831–80
- Kliman, A. 1988. The profit rate under continuous technological change, *Review of Radical Political Economy*, nos 2 and 3, Summer and Fall, 283–9
- Kliman, A. 1996. A value theoretic critique of the Okishio theorem, pp. 206–24 in Freeman, A. and Carchedi, G. (eds), *Marx and Non-equilibrium Economics*, Cheltenham, Edward Elgar
- McCraw, T. K. and Reinhardt, F. 1989. Losing to win: U.S. steel's pricing, investment decisions, and market share, 1901–1938, *Journal of Economic History*, vol. 49, no. 3, September, 593–619
- Marx, K. 1963. *The Poverty of Philosophy*, New York, International Publishers
- Marx, K. 1967. *Capital*, 3 Vols, Moscow, Progress Publishers
- Marx, K. 1977. *Capital*, Vol. 1, New York, Vintage
- Marx, K. and Engels, F. 1942. *Selected Correspondence*, Moscow, Progress Publishers
- Marx, K. and Engels, F. 1982. *Collected Works*, Vol. 38: *Marx and Engels: 1844–1851*, New York, International Publishers
- O'Brien, A. P. 1988. Factory size, economies of scale, and the great merger wave of 1898–1902, *Journal of Economic History*, vol. 48, no. 3, September, 639–49
- Oster, S. 1982. The diffusion of innovation among steel firms: the basic oxygen furnace, *The Bell Journal of Economics*, vol. 13, no. 1, Spring, 45–56
- Perelman, M. 1987. *Marx's Crises Theory: Labour, Scarcity, Finance*, New York, Praeger
- Perelman, M. 1994. Fixed capital, railroad economics and the critique of the market in the United States, *Journal of Economic Perspectives*, vol. 8, no. 3, Summer, 189–95
- Schwartz, J. G. 1977. There is nothing simple about a commodity, pp. 474–500 in Schwartz, J. G. (ed.), *The Subtle Anatomy of Capitalism*, Santa Monica, CA, Goodyear Publishing
- Sklar, M. J. 1988. *The Corporate Reconstruction of American Capitalism: 1890–1916*, Cambridge, Cambridge University Press