VALUE AND NATURE: FROM VALUE THEORY TO THE FATE OF THE EARTH

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Abstract

Value is central to Marx's theory of capitalism, but it is a concept more honored in the breach than taken to heart. What value is there in value theory? How does it illuminate the problems for which critics of capitalism seek answers? Value theory did different things for Smith, Ricardo, and Proudhon, let alone Marx, and it has to evolve to serve contemporary purposes. One of these is making it speak to the central role of natural resources in production; another is to integrate nature with complex labor; yet another is to delineate all forms of exploitation in search of capitalist profit; and, finally, it must help us unmask the destruction of the earth through unlimited accumulation of capital.

Keywords: value, nature, labor, capitalism, accumulation, exploitation

Valor y Naturaleza

De la Teoría del Valor al Destino de la Tierra

Resumen

El valor es central para la teoría marxista del capitalismo. Sin embargo, mientras lxs no interesadxs por la economía lo evitan, los economistas marxistas lo despedazan hasta hacerlo inútil ¿Qué valor tiene la teoría del valor? ¿Cómo ayuda a comprender los problemas a los que lxs críticxs del capitalismo buscan respuestas? La teoría del valor tuvo significados distintos para Smith, Ricardo y Proudhon, y por supuesto para Marx, y debe evolucionar para contribuir a propósitos contemporáneos. Uno de esos propósitos es entender el rol fundamental de los recursos naturales en la producción. Otro es integrar a la naturaleza con las formas complejas de trabajo. Un tercer propósito es identificar todas las formas de explotación en busca de ganancias capitalistas. Finalmente, la teoría del valor debe ayudarnos a demostrar la destrucción de la tierra en la búsqueda ilimitada de la acumulación de capital.

Palabras clave: valor, naturaleza, trabajo, capitalismo, acumulación, explotación

Value is central to Marx's theory of capitalism. But it is a concept more honored in the breach than taken to heart. Those not economically inclined skip over it quickly, while Marxist economists kill it by a thousand cuts. The main question is: what value is there in value theory? How does it illuminate the problems for which critics of capitalism seek answers? Value theory plays different roles for Smith, Ricardo, and Proudhon, let alone Marx, and it has to evolve to serve contemporary purposes.

For people today, value has to say something pertinent about the way capitalism is rampaging across the natural world and putting the well-being of the

earth in jeopardy. Value without nature is an empty vessel, just as is Deep Ecology without humanism. Value theory ought to speak to the central issues of our time: the place of natural resources (like oil!) in all commodities; the way nature and labor always work in tandem; and to the process of exploitation of both at the heart of capitalism. Finally, value must help us understand the earthly destruction unleashed by the accumulation of capital and value theory ought to alert us to the political nature of any theory of the fate of the earth.

Why Value Theory?

Value theory is not simply a technical-theoretical problem in economics, but a tool for understanding capitalism as a whole, both as a material system and as a moral order. Value is both an analytical concept and a critical concept. Value is, moreover, a dynamic concept (as it must be to be true to historical materialism of Marx's kind). It is a way of bringing together the past, present and future – of considering the origins of capital, capturing capital in motion and the evolution of capitalist society, and imagining a better world (Henderson 2013).

Consider, for a moment, what the classical political economists were up to when they began to speak of value. They were in conversation with earlier and opposing views of economy, state and society. In the 17th century, William Petty (1690) criticized the artificial prices of state monopolies and defended the real values produced by land and labor. In the 18th century, the French Physiocrats opposed Mercantilist ideas of enrichment through trade imbalances and Royalist notions of gold hordes with a productionist theory of the agrarian basis of national wealth (a 'nature theory of value', of a sort)(Varney 2012). Adam Smith (1776) countered the Physiocrats with a full cost theory of value, with labor at its core, in order to make the case for manufacturing over agriculture in the wealth of nations. In the early 19th century, with the *Ancien Régime* safely dispensed with and the Industrial Revolution fully underway, Ricardo (1821) shifted attention toward the battle within Britain between industrial capital and landowners, and in the process jettisoned all other inputs for a pure labor theory of value.

In every case, value was mobilized in the effort to oust what were regarded as antiquated classes, policies and ideas in order to liberate the new forces of production released by the market and capital. In this Marx trod in the footsteps of his predecessors, but his target was new: the rising industrial capitalists, lately triumphant over the *rentier* class of landowners. A labor theory of value, modified from Ricardo, served his purposes well enough, but only after he had made the key addition of a theory of *surplus value* to unlocked the secret of capitalist exploitation of workers (Marx 1967a,b,c).

For Marx, the 'law of value' was a sensible starting point, but not something he dwelt on for long, and far from the centerpiece of his critique of capital. Value theory was not a technical approach to price determination, but a key to unlocking the source of profits, class struggle and the dynamics of accumulation. Not that he was unaware of the technical issues, as shown in everything from the distinction between variable and constant capital in volume I of *Capital* to the difference between labor time and production time in volume II, to the transformation from values to prices of production (because sectors have unequal capital/labor ratios) in volume III. He was nothing if not a stickler for detail and ready with solutions to puzzles that Smith, Ferguson, Say and Ricardo could not solve (Harvey 2010).

Marx's labor theory of value worked to reveal key dimensions of capitalism, like exploitation, accumulation and industrialization. But what Marx was really after, as a revolutionary thinker, was to unmask the ideology of capital, grasp the contradictions that might tear capitalism down, and propel the working class to the overthrow of the ruling class. By contrast, what the late 19th century neoclassical counter-revolution, led by economists such as Leon Walras, Stanley Jevons and Alfred Marshall, achieved was to overthrow the idea of inherent value and replace it with a theory that said that equilibrium prices, based on the meeting of marginal cost and marginal utility (what people

desire), is all there is (Vanni & Groenewegen 2006).[1] In direct opposition to Marxism, neoclassical economics 'proved' that labor has no special standing, capital, too, is productive, and at the margin there is no profit (no exploitation). *Voilà!* The magic of well-crafted ideology. It was a perfect quietist theory mobilized to justify the post-Ricardian, Victorian order in Britain (and Third Republic order in France).

What can we learn from the history of the idea of value?[2] First, the classic labor theory of value was a sensible representation of reality at a point in history that has long passed, i.e., the age of manufacture, when simple labor inputs still dominated most sectors. Second, that value theory had to evolve along with capitalism and advancing forms of social labor and technology, as in Marx's analysis of industrial capital. Third, that classical value theory – including Marx's version – is inadequate to the analysis of an advanced capitalist regime of production, social labor, and exploitation of nature. Fourth, value theory is not a thing of the past, however, and it can still provide some essential touchstones for our understanding of capital; this is particularly so for Marx's approach. And, finally, the most urgent problem facing us, along with the liberation and well-being of the billions of people now incorporated into the capitalist world-economy, is the fate of the earth. If value theory cannot speak to this dialectic of human labor and natural forces in a way that is both analytically sound and visionary, it is a dead letter.

The Materiality of Value

Value is a trans-historical term, but not a universal one. Every society has operational values and conceptions of what is valuable and what is not. Value is not only an economic assessment, but it does rest on the material conditions of every social order and mode of production, broadly conceived. Great thinkers from Aristotle to Augustine to Alfred the Great have wrestled with the nature of value, long before the modern, commercial era, and done so in a way the combines economic and moral reasoning (Farber 2005).

Nevertheless, a sea change occurred around 1500 in Europe with the flourishing of the commercial economy, transition to general commodity production and eventually full-blown capitalism. As this process unfolded over time and space, value became a key concept for thinking about political economy. Why was this? Because the generalization of markets imposed systematic valuations on things entering into the circuits of commodity exchange to a degree never before realized. Markets had existed in many times and places, prompting earlier commercial notions of value, but these jostled uneasily with practices based on feudalism, monarchy and slavery, with their associated religious and moral orders (Farber 2005).

Under capitalism, the idea of economic value became more and more central to everyday life, just as 'the economy', as a separate arena of social interaction, became more apparent to people, rulers and philosophers alike. Value as the regulatory principle of markets – i.e., the 'law of value' – came to mean the measure of the worth of commodities beyond the vagaries of everyday prices and, along with it, the proper allocation of work in complex divisions of labor. Marx pinned value down as 'socially necessary labor time', an average of how much work is required to produce any manufactured good. It's more than just a statistic, because the market assembles a variety of practices into a prevailing mean that imposes itself on competing producers.

Value is, therefore, "real", as Quesnay, Smith, Ricardo and Marx thought. But it is neither nature produced, as Quesnay thought, nor as concrete and fixed as Smith and Ricardo said. Most of all, it is not a vaporous kind of 'utility', as in neoclassical economics. It is a living principle, a kind of DNA of the capitalist economy. Value is what David Harvey (1982) has called "a real abstraction", an abstract force with concrete effects all the same.[3] In this it is like 'average global temperature', which is both a statistic assembled from many specific measurements and a real force that is felt worldwide despite wide variations across time and space. Value is also a moving target as production

1 In long-run equilibrium, marginalist theory actually amounts to the same thing as Smith's cost-price theory of value.

2 I skip over 20th century debates, especially Keynes, here.

3 In the same way, "the market" and "the economy" are real abstractions, too, not just imaginary realms imposed on society by malevolent economic theorists or bourgeois ideology.

methods keep changing, imposing pressure on the average from the margins (as the neoclassicals put it, in their one important insight).

Furthermore, as Marx saw, in one of his key theoretical moves, value cannot rest as a purely abstract calculation, a floating signifier of worth; it needs to materialize, become concretized, in the form of money in order to for markets to function. Money acts as the universal equivalent and intermediary in all market transactions, providing a measure of prices and a store of value. Indeed, Marx observes, a generalized commodity system 'sweats money from every pore' in the process of millions of exchanges of one good for another. From that point on, something new and surprising happens: money turns the world of exchange on its head as money-holders reenter the market to make more money (Marx 1963a, chapter 3). Money in pursuit of money sets up a new circuit – not of commodities but of *capital* – and with that the unlimited possibility of accumulation of money becomes a new, more advanced "law of value" under capitalism (see also Marx 1963b, chapter 1).[4]

I will say more about money and accumulation later on, but first we have to look more closely at value production and the relation of labor to nature at the root of the labor process.

A Dualistic Dead-End

In chapter 1 of *Capital*, Marx makes a simple distinction between the exchange value and use value of commodities. His point is to separate the concrete labor and its product from the real abstraction of value production, a source of immense confusion in classical political economy that he meant to sort out. One might add that he was aware of early attempts at utility theories of value and wanted to distinguish the worth of goods to consumers from the value of commodities in production. At the same time, Marx's distinction created a new conceptual division between 'wealth' as the accumulation of commodities and 'value' as the underlying basis of price, money and capital.

The separation of the wealth of nations versus the accumulation of capital (value) in this way grates against the commonsense use of the word 'wealth'. This is especially true because of the special power of money as the universal measure and store of value; wealth in monetary terms gives one the power over commodities and their use-values, whether goods for consumption, labor and equipment for production or buildings as living space. The ambiguity of the concept of wealth is not something Marx pursued, and ever since then Marxists have been slippery about the problem the dialectic of value and wealth presents.

This, of course, drives environmentalists wild. They insist on the wealth of nature and natural values, and see them as essential to the Wealth of Nations (and humanity). They often turn away entirely from economics, thinking it irrelevant to the ethical struggle to change ideas about the intrinsic value of non-human nature. Or they try to invent an environmental economics that adds new ways of measuring ecological values, either by proxy calculations (reservation value, scenic values, etc) or by setting up faux markets in carbon caps or environmental services. None of these, however, is adequate to the job of understanding whence comes the power of capital to devour the earth nor reversing the process. They end up as Liberal bandaids in place of major surgery (Robertson 2006).

What environmentalists don't see is any place for natural value in the Marxist lexicon, and so they reject what is still a powerful tool for unlocking the secrets of capitalism. Marx acknowledged that a wealth of use-values came from nature directly, but use-values were never central to his theory. Today's Marxists make matters worse by continuing to insist on the old schism, saying that 'well, yes, nature generates wealth, but only labor can create value' (Labban 2015). While no Marxist today is oblivious to environmental values or capitalism's exploitation of the earth, by clinging stubbornly to the classic labor theory of value we relegate ourselves to the margins in the contemporary political debates about how to save the earth from

4 In Marx's classic formula, C-M-C becomes M-C-M'. Because neoclassical utility theory ignores the material foundations of production behind exchange, it ends up with no serious theory of money (the so-called Money Veil) (Ingham 2004).

capital's rampage. How to extract Marxism from this dead-end?

Either we abandon Marxist economics or we reconstruct an alternative version of it that takes natural forces and values seriously. There have been several notable attempts to do so, such as James O'Connor's 'second contradiction of capital' as the rising costs of natural inputs through overexploitation (O'Connor 1998), John Bellamy Foster's treatment of the 'metabolic rift' as the key to capital's destruction of the earth, and Jason Moore's thesis of the capitalist pursuit of 'free gifts of nature' at the commodity frontier (Moore 2015a,b). While I think all of these are true, none quite grasps the nettle of value theory in the way I think is necessary. Now to explain how that might work.

The Co-Production of Value

The key, at the deepest level, to the reconciliation of Marxian value theory and environmentalist concerns with the wealth of nature is to go back to the foundation of economic life: production. The essential point is this the unity of labor and nature in all work and, more broadly, all social production. One does not have to look outside the social process of making commodities in a market system to assign value to nature's input. Nature is always there, ever present, and we have to be blind not to see it.

As Marx says, in his discussion of the labor process in volume I of *Capital*, human labor confronts nature as one of its forces and works on it and with it (Marx 1963a, chapter 7). 'Working *on* nature' is easy to grasp, as labor transforms materials into final products, such as iron ore into steel. 'Working *with* nature' is a bit more complicated, and is too often overlooked or reduced to the energy inputs that drive machinery or heat materials. But working with nature is, of course, much more than that: invisible natural forces are at work in every labor process, whether yeast transforming grain into alcohol in brewing, crystal lattices forming in metal alloys, or electrons running through circuits on silicon chips – not to mention the metabolism of the person doing the work! Marx was well aware of these natural processes, but put that topic off until Volume II (Marx 1963b, chapters 12-13). That won't do for our purposes. The truth of the matter is that labor and nature work in a synthetic way that is impossible to dissect in a clean way. Cut the two apart and you kill the patient, in this case value theory.

Labor and nature are necessarily a dialectic unity in production (and all human activity)(Moore 2015a). But value is produced and production is some kind of dialectical unity, then how is it to be measured? Measurement has been a stumbling block to all value theory, and its wider acceptance, and it just gets bigger in this case. But it may be that the economists overthink the problem, which is not about precision in the determination of market prices but about averages, tendencies and systemic dynamics (Shaikh 1982). Still, we need a reasonable answer. There are two ways of tackling the problem: keeping labor time as the central pillar or shifting to an additive labor-nature calculus.

The first solution is to say that 'socially necessary labor time' must include the time taken working with and on nature, which is always in the mix. That is, a reasonable measure of labor time presumes the use of the necessary amount of fuel, necessary ingredients, the necessary waiting time, and so on, whether one is making wine, growing grapes or distilling brandy. This is a simple and elegant solution. Natural value in subsumed, or rather assumed, in labor value; there's no distinction. This is no different than the solution to the supposed quandary of skill levels in measuring labor time; socially necessary labor time is an average of the time require *at the appropriate level of skill* (otherwise, we're back in Smith and Ricardo's world of absolute labor time, which Marx showed to be false).[5] To make the point crystal clear, we should stop calling the socially necessary quantity of time 'labor value' and start calling it 'labor-nature value'.

Environmentalist will object that with this solution nature seems to disappear into labor. But, in a sense, that's exactly what happens in the labor process, if we

5 There are even trickier problems in valuing labor time in complex production systems with extensive divisions of direct and indirect labor (Sayer & Walker 1992), but I won't take those up here.

maintain the view that human beings are the creative force in production who are putting natural materials and forces to work in a pre-determined manner. This may seem like anthropocentrism, but there's no way around the fact that in a *social* economy, people are the primary actors and value has to center on the human factor. It is not dualistic thinking nor runaway humanism to say that in the human-nature dialectic, there is a dominant element – which cannot, however, exist or function without its synergistic partner (Smith 2006, Moore 2014).

Nevertheless, there might be a more complex solution to the valuation problem, which is to reduce natural inputs to a *numeraire* that works in the same way as "socially necessary labor": the socially necessary quantities of energy, yeast, and malt in beer, for example. The problem with this is commensurability: what do these nature inputs have in common? Given this objection and the pervasiveness of energy inputs in our petroleum-soaked economy, energy could be reasonable stand-in for a universal measure of nature inputs as a whole. Nicholas Georgescu-Roegen (1971) long ago proposed an energy-unit (BTU) measure of value, which is not unreasonable in a fossil fuel driven economy.

If value were additive between labor time and BTUs (or another measure), it would represent a reversion to something like Adam Smith's full-cost labor theory of value, with all inputs counted. It would still be a socially necessary cost measure of value based in material production, which is enough for value theory to do its work; but it would run into even more complicated problems of mathematical reduction and transformation than a labor theory of value.

I am not convinced that an additive value calculus is either necessary or the best route to a convincing theory of the roots of the capitalist economy. Recall that the point of 'the law of value' is that generalized markets impose social averages on every participant, and what value theory does is to go behind all short-term market prices, monopolistic prices and rents to ask what is the long-term average cost to society in terms of human labor time – *and* natural inputs. A synergistic labor-nature theory of value satisfies the basic criterion of value theory going back to Classical Political Economy, which has always been to probe deeper to reveal the inner workings of the capitalist system. For Marx this meant, above all, the pursuit of the secret of *surplus* value, not price formation. This is where radical theory parts ways decisively with conventional economics.

...And Of Surplus Value

Value is not enough. For Marx and his followers, surplus value is the crux of the matter. The trick for Marx was to show that in a system in equilibrium where every commodity exchanges at its rightful value (according to the 'law of value'), surplus value still appears to be pocketed by the capitalist. In Marx's theory of value, only labor can create value and other inputs just transfer value already present from their own prior production by other labor. Surplus value is the excess of the value of any commodity over the value of its labor input. And profit is just redistributed surplus value, i.e., spread over the total amount of capital invested and calculated as a rate over time. Overall, the value of all output - value of all inputs = total surplus value.[6]

The theory of surplus value is fundamental in differentiating neoclassical theory, in which 'capital' is a productive factor, from Marxist theory, in which capital is ownership which allows the boss to pocket the surplus. In neoclassical theory, only rent is an unearned increment, while in Marxist theory profit, rent and interest are all unearned. Neoclassical distribution theory allocated a just return to all three factors of production, land, labor and capital, in proportion to their (marginal) contribution. It's all very elegant, but it suffers from a fundamental contradiction, as revealed in the Cambridge-Cambridge controversy in capital theory some fifty years ago: the value of capital goods depends on the interest rate, which is also the

6 I know that in the mathematical formulations of the transformation of values to prices, a major question is what *numeraire* is preserved, and it cannot be total surplus value and rate of surplus value at the same time (Steedman 1971, Walker 1988). But, again, I'm interested in the general function of surplus value, not the puzzle of price formation.

reward to capital – a circular formulation (Harcourt 1972). This is even more serious than the value-price conundrum of the labor theory of value.

Now if we put aside the concept of value for a moment, the idea of a surplus is quite easy to grasp. In everyday market terms, the surplus derived from producing and selling a commodity is the difference between the price of the good and its cost of production (price of all inputs). Surplus *labor* is the difference between what workers produce and how much they are paid in wages. In either case, the necessity of a surplus is evident: employers would not bother to produce anything if the return were less than the cost, and they would not hire workers if they cost more than they generated in value added (a term, by the way, still used in conventional economics). Capitalists would not invest their money if they didn't think they would gain a profit from it.

Moreover, the idea of a surplus arising from the exploitation of nature's inputs and forces is just as reasonable as the idea of a labor surplus. On this there ought to be no dispute between Marxists and environmentalists. A horse produces more in grain than it consumes or it is put out to pasture; the yeast costs very little compared to the value of the wine it creates; the energy used to make steel is worth the cost after the steel is sold; and so forth. The key point is that all forms of surplus are present in the commodity, and the exploitation of nature is, like the exploitation of labor, an essential part of the operation of the capitalist economy. No exploitation, no profit.[7]

In the labor-nature value theory I am arguing for, nature always works in tandem with labor and hence the two kinds of surplus are difficult, if not impossible, to dis-entwine. No doubt one can make calculations that try to break out the contributions and costs of every element in production, if so inclined; and in certain cases it may be useful in revealing what is going on. In most cases, it's not worth the bother. Like Marx, I am more interested in the theory of capitalist exploitation and growth dynamics that follows from this insight than the problem of static calculation.[8] The key point is that both kinds of surplus are free gifts to the capitalist, as Jason Moore (2015a, b) argues so eloquently.[9]

Because surplus (value) is the basis of profit, the capitalist has every interest in extracting the maximum amount possible, while keeping the flow of production going with ample labor, materials, energy and the rest. There are two basic ways for capitalists to extract more surplus value out of people and the earth. The first is to improve methods of production (intensive exploitation) and the second is to cheapen inputs (extensive exploitation). The environmental implications of capitalism follow from this, as I will now demonstrate.

Intensive Exploitation

Intensive exploitation means raising the output for each unit of labor- nature deployed in production. This can be measured in two ways: as simple labor productivity and as total factor productivity.[10] The two generally track each other closely, and both are important because the capitalist not only wants to get the most out of the workers but to get the most out of everything s/he pays for: machines, energy, materials, water, etc. The sources of heightened productivity are many, from better ways to working to faster machines and from better quality materials and to more efficient use of fuel.

The general term used today for all manner of advances in products and production methods is 'technology'. Technological innovation is the magical formula for capitalists, corporations and states, and its unrelenting pursuit is the reason why capitalism has been such a dynamic production system (von

7 Capitalists also "exploit" machines, but until we reach the age of thinking robots, this is not a social or ethical problem which value theory needs to address.

8 A good example of working directly with price and profit data to undertake a Marxian analysis of the modern economy is the work of Robert Brenner (2006).

9 The term 'free gifts' comes from Marx and has been used by John Foster (20xx) and others, but Moore makes the most general and profound use of the concept.

10 The latter is favored by neoclassical economists, but raises some of the same problem of commensurability and measurement of non-labor inputs, especially those functioning as 'capital'.

Tunzelman 1995). Technological progress is not just a matter of singular inventions; it represents the accumulation of past human learning (scientific and practical) put to use on specific problems. As Marx pointed out, technology is perhaps the greatest of the free gifts appropriated by the capitalists (Marx 1963, p. xx).

Why do capitalists pursue technical change with such a passion? The answer begins with the competitive advantage of the individual capitalist: any firm that comes up with a specific innovation gains an extra measure of profit (surplus) over its competitors (better sales or lower unit costs)(Schumpeter 1939).[11] Marx goes farther, arguing that the principal logic is that all capitalists gain from the diffusion of a new technology that lowers the value of labor inputs (cheaper consumer goods) (Marx 1963a, chapter 12). And the model can easily be generalized to say that improved overall productivity in all sectors will result in the reduction of costs for all inputs, not just labor power.[12]

What is important in terms of the history of value theory is that Marx did not rest on the abstract assertion that labor was the source of all value. He put the theory of surplus value to use to unlock the puzzle of why capitalism has been the most dynamic mode of production in history, in short, why capitalism unleashed the industrial revolution. This is hardly surprising, given the time at which he was writing. In the middle of the 19th century, the unprecedented advances brought by industrialization were most important and dramatic phenomena of economic life in the advanced economies.

There are various theories among economic historians to explain the industrial revolution – but the most popular is that coal and steam power launched the industrial revolution in England (Landes 1979). Yet it was water power not steam that drove most of the English and American mills before 1840 (von Tunzelman 1978). By contrast, Marx's labor theory of value led him to focus on the rationalization of the labor process through cooperation, division of labor, mechanization and the factory system – still the best explanation available for the first industrial revolution (cf. Mantoux 1961, Rosenberg 1982). Of course, technology has moved on a long way from that point and, as any environmentalist would aver, the harnessing of fossil fuels, from coal to petroleum to natural gas, has been essential to the progress of productivity in the Machine Age (Huber 2013). And today there is the new puzzle of knowledge and highly elaborated divisions of labor in what is commonly called the Information Age – a topic I will not broach in this essay.[13]

For our purposes here, the central question is the implications of intensive exploitation of humans and the natural world in search of labor-nature surplus value. There are several dimensions to this. The first is that rising productivity and output through improved methods of production requires ever-larger quantities of inputs of labor, materials and energy. This has propelled capitalists to recruit new workforces, demand greater supplies of wood, fiber, metals, water, and more, and, of course, to consume more and more energy. Absolute quantities of oil, gas, water, and materials have only gone up over time with the progress of capitalist industry, even though there has been a countervailing process of improving the efficiency of use of every input (reducing the quantity of labor, materials, energy per unit of output). And so we see that capitalism has steadily widened its search for new sources of wood, minerals, petroleum and all the rest from its inception. Moore (2015a, b) calls this outward push 'the commodity frontier', a topic I'll take up shortly. At the same time, the process of resource search is not only extensive; it can be intensive, too. That is, capitalists have improved their methods of search, discovery and extraction of natural resources dramatically over time, for the same reasons that they push for higher productivity in the making of consumer goods or machinery. Geographically such improvements have often taken place within the

11 Schumpeter and Keynes were the most important non-neoclassical economists of the 20th century.

12 Admittedly, the discussion of relative surplus value in *Capital* leaves many people scratching their heads and wondering if there isn't a more parsimonious way to think about the effects of productivity; but the essential idea of lowering costs by improvements in the methods of producing inputs is simple enough.

13 But see Sayer & Walker 1992 for a start.

core areas of global capitalism, not just at the spatial frontiers (Wright 1990).

A second effect of ever-expanding throughput of materials and energy has been ever-larger quantities of waste products. These occur both as byproducts along the production chain, such as carbon emissions, wood chips or sediments, and as consumption waste, i.e., garbage, at the end of the line – packaging, unused parts, discarded goods, and human waste (Rogers 2005). Moreover, modern technology going back to the industrial revolution has rested on more than mechanical improvements; too often overlooked, as Adam Romero (2015) has forcefully reminded us, is the parallel process of chemicalization to improve inputs, methods and outputs of factories. This inevitably creates another dimension of the waste problem: new and exotic byproducts that are toxic to living things, including people. And, as Romero has also shown, the twisted genius of capital is revealed in the ability of firms to turn toxics into profitable commodities, assuring their diffusion as far and wide as possible (particularly in modern agriculture).

Romero's argument points to a major lacuna in most discussions of technological change and productivity gains: the development of wholly new products. In Marx's time, product innovation was not the vanguard of industrialization, but today it runs parallel with process innovation.[14] Major new product introductions, like smartphones, do not just give one firm an advantage, they open up whole new fields of play for capital and new arenas of production employing labor and nature to produce value and surplus value. This is an 'extension' of capitalism, to be sure, but through technical progress. Extensive exploitation, to which we now turn, is something else again.

Extensive Exploitation

Extensive exploitation rests on the ability of the capitalist to obtain inputs more cheaply, regardless of productivity or without making improvements in production methods. This can be as important as intensive exploitation in raising the rate of surplus value, and it has been prevalent throughout the history of capitalism. As Moore (2015 a, b) argues, the free gifts of surplus come in many packages, and one looks just as good to the capitalist as any other. Cheap labor, cheap fuel, cheap wood, whatever – it all adds up.

How do capitalists obtain such free gifts of cheap inputs? On the labor side, these come chiefly from the unpaid work of women in the household in raising children and supporting families so that husbands (and everyone today) can go out to work producing surplus value for capital. This free gift is even more marked in the case of migratory labor, which is produced outside the country/region/city where it is employed, usually under pre-capitalist or simple commodity modes of production. If capital had to pay the full cost of labor moving from farms into Chinese cities or from Mexico to the United States, the rate of profit would fall sharply in both countries.[15]

On the natural resources side of the ledger, capital has always reveled in the availability of new sources of virgin timber, rich lodes of metals, free soils, untapped rivers, and new oil and gas deposits. It exploits these as quickly as possible and then resumes the search ('discovery') for yet more sources. This is Moore's 'commodity frontier' of capitalist expansion, and he has shown how it works over many centuries and continents (e.g., Moore 2007). The search for such free gifts has been unrelenting in the history of capitalism, with predictable results for the plunder of the earth. It continues today from artic oil exploration to the clear-cutting of tropical forests.

14 Schumpeter (1939) gave more attention to product introductions than Marx, but after Leontief (1951) and input-output analysis the distinction between products and processes becomes harder to maintain.

15 As Moore says, the labor of women and peasants are free gifts that expand the rate of surplus value, even if they do not directly produce "value" in the market. This exclusion of non-wage labor from value production is not a bias of Marxist theory or political economy, but something that capital and the market do in reality. But the two sides of the overall system of social production are indeliably linked through the process of extracting surplus value. Without those free gifts, the cost of labor and other inputs would rise dramatically, choking profitability.

But the extensive exploitation goes beyond just the search for new supplies of labor and resources. As Marx so eloquently showed, the capitalist will always exploit labor and nature to the maximum until stopped by social protest or state controls. This he called 'absolute surplus value', a concept he used to explore the extension of the working day and literal using up of workers in the industrial revolution (Marx 1963a, chapter 10). Marx elsewhere notes the same effect in the using up of soils, an effect he called 'the metabolic rift' (Foster 2011). As Moore (2011) argues, this has been a general law of capitalist development everywhere: the *over-exploitation* of all resources and labor with devastating rapidity, resulting in the undermining the reproduction of natural ecosystems and even whole societies – and repeatedly forming a barrier to further profitability that drives capitalist to seek out yet more labor and resources to exploit.

I call this 'hyper-extensive exploitation', and it literally drives capital to devour the earth at its root. Workers have fought back, of course, and that has put limits on working human labor to death, but the levels of exploitation of migrant, slave and child labor around the world today are chilling (e.g., Seabrook 2015).[16] Some people, whom we call 'environmentalists', have fought back to limit the digging up, killing off and befouling of the natural world, with some impressive victories, to be sure, such as the creation of national parks, ocean reserves and pollution control laws. But capital keeps leaping over and battering down such barriers to new terrains of destruction, from Indonesian forests to Canadian tar sands (e.g. Klein 2014).[17]

Unfortunately, the search for cheap inputs has remained secondary in Marxian theory, though Marx makes several passing references to it throughout the three volumes of *Capital*. Generally, the cheapening of inputs is relegated to a secondary process of 'counter-tendencies' to the falling rate of profit or to the weakly theorized dynamics of primitive accumulation. Fortunately, primitive accumulation is an idea that has gained new life in recent years, as observers have gained a more global perspective and realized that the spread of capitalism means the assimilation of vast new territories and billions of people around the world (Harvey 2004, Glassman 2006). This has shifted the traditional left focus from rising productivity in the centers of capitalism to the uptake of new labor, resources, and energy still going on with a vengeance around the globe.

The awakening of the Marxist left to global environmental change – loss of tropical forests, extinction of species, ploughing of grasslands, oil drilling in the Arctic, etc. – is only to be welcomed. But the concept of primitive accumulation, even dressed up in new clothes as 'dispossession', will not suffice. Moore's 'commodity frontier' is an important addition to the radical theoretical edifice, but it, too, is not sufficient unless it is harnessed to the Marxian theory of the accumulation of capital, the topic of the next and last section.

Value in Motion: The Accumulation Vortex

One final element of value theory of pertinence to the fate of the earth, including humankind, is the idea of the endless accumulation of capital. Marx's value theory is, as I've said, not principally about prices, nor is it limited to unlocking the secret of profit making. To stop there is to neglect one of Marx's greatest insights: how the age of capitalism unleashed a limitless process of growth via accumulation. Even a theory of capitalism as an eternal 'frontier economy' doesn't quite capture the core dynamism of this economic system and why capitalism has both revolutionized all human activity and swept across the world, infecting and devouring everything in its wake, in the endless pursuit of money-making.[18]

Understanding capital accumulation was one of Marx's ultimate targets. Capitalism is a dynamic system that has catapulted humankind to an entirely new

16 But this has hardly been the automatic response of societal enlightenment supposed by Karl Polanyi (1944). Better to call it class struggle in the manner of Marx.

17 As Joel Kovel (2007) argues, there is a problem of who is the agent of the protection of nature.

18 This is a debating gambit to make a point, and is a bit unfair to Jason Moore, who has just joined me in writing a combined theory of accumulation and the commodity/gift frontier (Walker & Moore 2015).

level of prosperity and exploitation of labor and nature (Marx & Engels 1848). A key question, therefore, is why accumulation is such an inexorable, dynamic and rapacious process. Marx's reasoning follows directly from the theory of value, and the answer lies in the nature of money in a universal market lubricated by money.

Recall that money functions in a system of generalized commodity circulation as the bearer of value and the means of exchange – and as the materialization of the real abstraction of labor-nature value. But money soon becomes more than that, because it can reenter the flux of the market in search of more money, reemerging as profit on investment. Money is invested to make more money, and thereby is capital born. [19] As the market economy spreads, capital becomes more and more present and ultimately turns general commodity circulation into generalized *capital* circulation (or the circulation of value in search of surplus value) (Harvey 1982, pp. 157-66). In the early stages of capitalism, such money was used as loan capital by early bankers or as commercial capital by merchants engaged in long-distance trade. But once capital was harnessed to industry, it could generate a whole new level of profits by pumping surplus value out of labor (and nature), and the industrial revolution ensued. From there, capitalism drove its commodities, money and factories wider and farther, first across Europe, then North America, and now Asia.[20]

That is the long, historical-geographical arch of capitalist development, but Marx alerts us at the very beginning of volume I of *Capital* to the peculiarity of what the circulation of money entails in the new system of universal value (Marx 1967a, chapter 3). Money is the tangible, measurable, and accumulable form of value, and hence it is the purest form of wealth. Concretely, it has the power to command all other commodities. Abstractly, it is nothing more than set of numbers. And therein lie the perfection of its power and the unlimited nature of monetary wealth. Capitalists, unlike all previous ruling classes, use money to make money and measure their wealth in monetary terms, which is why they are more than misers, money-lenders, or landed aristocrats, and ultimately more powerful than lords and emperors. They are money-makers, and there is no limit to what they can or want to accumulate, as one sees plainly in the grotesque disjunction between any reasonable human need (or greed) and the wealth of contemporary billionaires.

Accumulation of capital becomes the systematic driver of the modern economy, an unlimited spiral of investment, profit and piling up of wealth by individuals, families, enterprises and corporations. Yes, competition matters, but the pursuit of accumulation precedes competition, which develops out of the accumulation of contending capitals.[21] The accumulation of capital rests on vacuuming up surplus value wherever and however it can be done, without any other social rationale or endpoint. Because free gifts of labor and nature can issue forth from factories, offices, peasant farms, mines and wells, rivers and forest, fisheries and more, capital will search out every source of surplus value it can get its hands on. This is the full and most general 'law of accumulation': endless search, continual absorption, unrelenting exploitation, unlimited horizons, unprecedented productivity, and more.

All forms of surplus value propel accumulation and the more surplus there is, the faster the spiral spins upward and outward. Hence, the plunder of nature, like the exploitation of labor, cannot stop under capitalism. I like to call this 'the capitalist vortex', the maelstrom passing over the earth and sucking up everything in its path (Walker & Moore 2015). But, as we all know now, this plunder cannot continue indefinitely. If global environments are too maimed and diminished, then all the free gifts they give to humanity and all living things cannot be sustained. Since capitalism cannot stop, people had better rise up to stop it.[22] The fate of the earth hangs in the balance.

19 As Marx's simple but powerful formula expresses it, C-M-C becomes M-C-M', the same thing seen from a different starting point but revealing a wholly different logic.

20 In an otherwise excellent treatment of money, Geoff Ingham (2004) does not grasp the connection between value, money and capital, and dismisses Marx as a commodity-money theorist – which couldn't be farther from the truth.

21 Competition is barely mentioned by Marx until well into volume I of *Capital.*

22 I do not take up here the question of resource exhaustion

Conclusion

To come back to my starting point: why bother to think about value theory in relation to global ecology? This is not merely an idle exercise in Marxology, whatever one may think of the power and pertinence of Marx's ideas. The question of value is being forced upon us by the material realities of a major turning point in history, just as it was for early bourgeois thinkers like Petty, Smith and Ricardo trying to liberate the new capitalist political economy from the tethers of *ancien regimes* of kings, aristocrats, peasants and landlords. Indeed, we are at a transition in *earth history* that scientists are calling 'the anthropocene', even as they warn of the dire impacts of global warming and mass species extinction that humanity can no longer ignore (Kolbert 2014).

Things must be very grim, indeed, for the findings of earth science and the question of value to make their way into the inner sanctums of theoretical economics to disturb the silences of marginalist equilibrium. Yet we see even conventional economists taking up the cudgels to propose systems of carbon pricing and introduce the market value of 'environmental services' (Robertson 2006). In this (neo)liberal, technocratic approach, environmental disruption is a regulatory matter for the well-tempered state to put right, aided by a bit of technical economic wizardry (Robertson & Wainwright 2013).[23]

Nonetheless, value theory is more than a tool of bureaucratic management; it is an essential building block for critical analysis of the functioning of the (political) economy as a whole. A more promising use of the concept of value is to be found among ecological economists, who criticize the mindless valuation of any and all commodities spewing forth from factories and offices, along with the treatment of GDP as a true summation of human progress. To them, the answer lies in moving toward sustainable forms of capitalist growth (Constanza 1991). But is that possible? What does capital care about the substance of output (use-values) if the essence of the matter is the (co)production of value and surplus value? And how is an infinite spiral of accumulation ever going to be 'sustainable'?

Claiming many of the same intellectual roots is the 'No Growth' movement, which questions the whole notion of endless expansion of modern economies and the possibility of sustainable capitalism (Fournier 2008, D'Alisia *et al.* 2015). They make a valid case against the mindless spiral of accumulation versus the limited nature of human needs and the earth's resources. But they, too, run up against a wall that is quite real: value is not just abstract, it congeals as real money in the hands of a class of capitalists and modern corporate enterprises whose only criterion is profitability and the accumulation of capital. "Accumulate, accumulate, is Moses and the Prophets", as Marx says (1963, p. xx), and consumption is the effect, not the driver, behind that credo.

Ecological criticisms of the value of things and the value of growth do not go far enough. We need to utilize value theory in its classical sense as a tool for making a systemic critique of our *ancien regime*: the capitalist mode of production and its relation to the earth and humankind. This means, first of all, accepting the co-production of value by labor and nature, recognizing the exploitation of the surplus value (free gifts) generated by both, and going from there to open up the full range of ways that capital extracts the surplus – and the life force – from people and the earth. The last piece of value theory is the one that leads us through money to accumulation, which is, and must always be, an endless spiral, a vortex that sucks any and all sources of surplus value into the capitalist maelstrom. There is no rest from the endless motion of capital, no stopping its manic growth imperative, and no exit from the vortex through simple tricks of recalibrating values.

A final lesson of value theory is that it is a political weapon that has been wielded freely in the past. In doing the same with it today, we are not only engaging in economic analysis and criticism. In taking up the

as a source of accumulation crisis. Foster (2011) thinks it's not worth the bother, but Moore (2011, 2015a) takes up the cudgels.

23 Robertson & Wainwright make an excellent case against this kind of thinking, but I would go farther in saying that it is not a contradiction *within* the state, but one facing the capitalist system as a whole.

cudgels of value theory, as Marx did, we are necessarily thinking beyond the present problem of capitalist value to the wider political problem of how to value the world differently, as George Henderson (2013) has wisely demonstrated. And from there, we have to undertake the task of wrestling a different kind of political and moral economy from the goods and the wreckage thrown down by the capitalism of today.

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