

Whose labor? Labor, appropriation and the very idea of full automation

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Abstract

Is a "fully automated" capitalism possible? According to Marx's labor theory of value (LTV) and the theory of surplus-value derived from it, a fully automated economy cannot be profitable. To refute the theory, critics have put forth various thought experiments claiming to show that a fully automated but profitable capitalist economy is conceivable. I argue that the thought experiments fail to demonstrate conceivability, because they misunderstand the role of labor in a commodity economy. In the latter, labor is a means for acquiring the property of others, and so it cannot be eliminated so long as the economy is based on the commodity form. Quite apart from issues of technical feasibility, then, the idea of a fully automated commodity economy is conceptually incoherent. The ineliminability of labor reflects the limits to the socialization of production imposed by the commodity form.

Keywords: Marx; Labor Theory of Value; Labor; Thought experiments; Capitalism; Automation

1. Introduction

The rise of automation challenges Marx's labor theory of value (LTV) because it renders conceivable scenarios in which human labor is eliminated from capitalist production. According to the LTV and the theory of surplus-value derived from it, profit is explained by the existence of surplus-value, which is created through surplus labor; in a fully automated capitalist economy, however, no labor is performed and hence no surplus-value is generated; thus a fully automated economy cannot have positive profits. This consequence makes the theory vulnerable to two kinds of theoretical challenge. On the one hand, numerical examples can be devised that appear to demonstrate the compatibility of positive profits with fully automated firms. On the other hand, the development of artificial intelligence suggests the possibility of replacing specifically human characteristics of labor with machines. The radical replaceability of human workers by

machines, under certain social conditions, appears to make conceivable the production of surplus-value, and hence profits, without human labor.

I argue that, nevertheless, both challenges misunderstand the role of labor in a commodity economy. Drawing inspiration from Marx and Marxist historian Moishe Postone, I will argue that a commodity economy entails a specific mode by which producers come into possession of each other's use-values. By 'commodity economy,' I mean an economy in which the units of production are independent commodity producers. This mode of production is also what I will call a 'mode of appropriation' (borrowing the term from Marx¹), in which labor plays a role specific to the social structure of a commodity economy: labor becomes a necessary means for a producer to obtain the products of others. It thus becomes a condition for the individual producer to claim part of the social product. This role of labor stands in contrast with other modes by which individuals can claim part of the social product, for example community membership, citizenship, kinship ties, religious position, etc.

Given this socially specific role of labor, I then proceed to argue that "full automation" scenarios can only do one of three things: (i) they merely reproduce this role for labor in their hypothetical situations, but now featuring non-human producers; (ii) they effectively change the social relations to such an extent that they no longer describe a commodity economy; or (iii) they fail to make fully explicit the social relations that would have to obtain in those situations, relations which, once made explicit, imply the continuing necessity of labor. Since these scenarios exhaust the possibilities, it follows that full automation theorists face a dilemma. They must either fail to provide a model of full automation, or they must fail to describe a commodity economy. The second horn results when they remove labor altogether, because in so doing they

¹ "The capitalist mode of appropriation, which springs from the capitalist mode of production, produces capitalist private property" (Marx, 1976a, 929). See also section 3 below.

also remove a social practice essential to a commodity economy. The first horn results when the model retains some labor, either explicitly (i) or implicitly (iii), and so doesn't represent full automation. I conclude that full automation is incompatible with a commodity economy, even on the very favorable terms I concede to the automation theorists (see below).

So what is this activity that the full automation scenarios are trying to eliminate? I take it to be a necessary condition for an activity to count as 'labor' that it be intentional and directed towards the transformation of materials in order to create use-values. Following Sayers (2011), this condition allows for a variety of different activities, including hunting and gathering, agriculture, craft and industry, administrative work, and symbolic labor. Some make a stronger claim, that labor is a specifically human activity. I do not need to defend such a claim in order to make my argument. The latter concerns the socially specific role of labor in a commodity economy, and whether thought experiments concerning a putatively fully automated commodity economy are successful in eliminating activities that satisfy the intentionality and directness condition while also fulfilling the social role. By lowering the bar for success to these two criteria, I make my opponents' position more favorable and my refutation all the more conclusive.

Another caveat is that this article does not claim to offer a defense of the labor theory of value. It does *support* a traditional interpretation of the theory, however, according to which labor is the substance of value. On that interpretation, if no labor is performed, then no value is produced, no surplus-value and hence no profits. Some interpretations within that tradition make the stronger claim that *human* labor is the substance of value. This was (arguably) Marx's understanding. As discussed above, the automation theorists claim that capitalism is conceivable without human labor, or even without labor *tout court*. My purpose here is to argue that

capitalism is not conceivable without labor, which provides a necessary condition for the traditional interpretation. However, it is beyond the scope of this paper to defend the further claim that (human) labor is the substance of value.

These challenges share a common method: their arguments are based on thought experiments concerning a fully automated capitalism. Therefore, a comment on this method is in order. The thought experiments of the LTV critics may be usefully characterized as what Sorensen (1992, 135) calls ‘necessity refuters:’ “A necessity refuter is a supposition designed to refute a statement by showing that something ruled out as impossible by that statement is really possible after all.”² Besides individual statements, necessity refuters can also refute a *theory* by showing that something ruled out as impossible by a theory is in fact possible. In the case at hand, the theory is Marx’s LTV and the thing ruled out by the theory is a fully automated, but profitable, capitalism. The thought experiments at issue are designed to show that such a capitalism is in fact possible.

Some opponents of automation theory have responded by denying that there is any actual trend leading towards full automation.³ Others have argued that full automation cannot be brought about, regardless of actual trends (see section 2). Such responses are ineffective against the thought experiments, for the following reason. It is important to distinguish between (1) a thought experiment in which certain imaginary conditions are supposed, and (2) one in which, *in addition* to these conditions, a procedure or process is *also* imagined for bringing them about. This distinction is crucial for understanding how many famous scientific thought experiments, and theoretical idealizations more generally, work: Thought experiments achieve the analog of

² For an overview of philosophical discussions of thought experiments, see Brown and Fehige 2019.

³ See, for example, Benanav (2019a,b) and Casilli (2019).

actual experimental control over variables by stipulating extraneous variables away.⁴ To give a simple example, Galileo famously imagined a ball rolling along one side of an inclined plane that was infinitely long, with no friction or air resistance. These stipulations allowed him to demonstrate a consequence of the law of equal heights, without having to achieve actual control over variables like friction, resistance or the finite length of real planes.⁵ Similarly, the LTV critics are conducting thought experiments in which they attempt to demonstrate the *falsity* of a consequence of the theory by stipulating conditions of full automation, without having to achieve the kind of technical control that would be necessary to determine experimentally whether the LTV holds under them. Theories have consequences that go beyond what can be achieved in practice. So, criticizing a thought experiment, on the grounds that it goes beyond what can be thus achieved, has the effect of sheltering the experiment's target theory from certain kinds of counter-argument. A more conclusive way to refute the experiment is to show that, even if the conditions depicted in it are granted, it does not refute the LTV. That is how I will proceed in this paper.

The paper is structured as follows. In section 2, I review challenges to the LTV based on the notion of "full automation." I also discuss replies to these challenges by the theory's defenders. I argue that the challenges assume what I will call an 'asocial' interpretation of labor in the theory. In section 3, I argue that labor takes on characteristics in a commodity economy that go beyond the asocial interpretation. I use this account to refute the full-automation scenarios in section 4. In conclusion, I suggest that the automation theorists' basic error is to assume that the productive forces can be developed independently of the relations of production.

⁴ I intend to invoke here, without the technical language, the distinction found in Sorensen, 1992, 202-5, between 'internal' and 'external' suppositions. I thank an anonymous reviewer for encouraging me to present the distinction non-technically.

⁵ See Sorensen, 1992, 8-9 for a discussion of Galileo's thought experiment.

2. The “full automation” objection to the LTV

In his *Late Capitalism*, Marxist economist Ernest Mandel (1972) claimed that full automation represents an insurmountable limit to the capitalist mode of production:

It lies in the fact that the mass of surplus-value itself necessarily diminishes as a result of the elimination of living labour from the production process in the course of the final stage of mechanization-automation. Capitalism is incompatible with fully automated production in the whole of industry and agriculture, because this no longer allows the creation of surplus-value or valorization of capital. It is hence impossible for automation to spread to the entire realm of production in the age of late capitalism. (Mandel 1972, 207; emphasis in original)

Mandel’s claim is based on the LTV. Since then, the view he expresses, and the theory it is derived from, has been subject to a number of criticisms. I have identified three strands of criticism. One originates in Sraffian economics, another in analytical Marxism, and a third in autonomist Marxism.

The Sraffian Ian Steedman, for example, in his (1985) “Robots and Capitalism: A Clarification,” offers a numerical example in the context of a critique of Tessa Morris-Suzuki’s (1984) analysis of the role of innovation in highly automated capitalism. He considers an economy with three industries, producing software, hardware and a consumption commodity, respectively. Initially, the only labor involved is in the production of software; the production of hardware and the consumption good are assumed to be fully automated. This economy is illustrated in the following Table 1:

Table 1. Steedman’s model of a fully automated capitalist economy.

	Software	Hardware	Labor		Software	Hardware	Consumption
Software	1	1	L	→	5	—	—
Hardware	3	5	—	→	—	8	—
Consumption	1	2	—	→	—	—	1
TOTAL	5	8	L		5	8	1

Source: Steedman (1985).

The first row means that one unit of software, one unit of hardware, and L units of labor are used to produce 5 units of software. The second and third rows are to be interpreted similarly, except that no labor is involved. The fourth row shows that the net product is one unit of the consumption good.

Steedman derives the following equations for the gross revenue in each industry:

$$\begin{aligned} 1) & (p_s + p_h)(1 + r) + wL = 5p_s \\ 2) & (3p_s + 5p_h)(1 + r) = 8p_s \\ 3) & (p_s + 2p_h)(1 + r) = 1 \end{aligned}$$

Here, r is the rate of profit per period, p_s and p_h are the prices of one unit of software and hardware, relative to the price of the consumption good, and w is the real wage rate. According to equation (1), for example, the gross revenue in the software industry is $5p_s$, which must cover the capital costs $p_s + p_h$, together with the profit at rate r on those costs, $(p_s + p_h)r$, and the wages bill wL .⁶ The revenues for the other industries are analogous, except that they do not include wages. Setting $L = 1$ entails that the labor value of the consumption commodity is unity. This is compatible with the extraction of surplus-value. For example, if $w = 0.5$, then half the net product goes to workers and half to capitalists. It follows that the total surplus-value = $S = 0.5$. From the equations above Steedman calculates the following values for the other parameters of the system:

$$\begin{aligned} r &= 13.31\% \\ p_s &= 0.226 \\ p_h &= 0.328 \end{aligned}$$

⁶ Steedman here follows Piero Sraffa's practice of treating wages as paid in arrears at the end of the production period, so that wages do not form part of the capital on which profit accrues. Were wages treated as paid in advance, as Marx does, the calculation of r would be more complicated in cases where $L \neq 0$ but would not affect the general conclusion.

He then supposes that $L = 0$ in the example above, in other words that there is complete automation. It follows that $S = 0$, but the values of the other parameters are well-defined and positive:

$$\begin{aligned} r &= 31.73\% \\ p_s &= 0.115 \\ p_h &= 0.322 \end{aligned}$$

Indeed, the rate of profit has risen, despite the fact that the surplus-value has vanished. Steedman concludes that “[w]hat is revealed by full automation, is *not* the ‘inner limit’ of capitalism but rather the ‘inner limit’ of the labour theory of value and of surplus-value theorizing” (Steedman, 1985, 126).

Spencer Pack (1985) provides a similar counter-example to Mandel’s claim. He imagines a fully automated society that produces only three commodities: computers, gold and wheat. All commodities are made by “computers,” which presumably include robots or robotized factories. The means of production in each industry are owned by distinct groups of owners. Each group exchanges its products with the other groups, and so definite relative prices emerge. Social classes that do not own means of production survive by non-market means like theft or charity.⁷ This economy is summarized in the table below:

Table 2. Pack’s model of a fully automated capitalist economy.

	Inputs		Outputs	
	Computers	Computers	Gold	Wheat
Computer industry	28	56	—	—
Gold industry	16	—	48	—
Wheat industry	12	—	—	8
TOTAL	56	56	48	8

Source: Pack (1985).

⁷ Both Steedman and Pack acknowledge the socio-political instability of such systems. The point of the counter-examples, however, is to show that there is no logical incompatibility between profits and full automation, though there may indeed be socio-political incompatibility. Their approach is consistent with the methodology described in section 1, and so I will not include this instability as part of my critique. It is worth noting, however, that the instability arises from wage-labor’s role of securing means of subsistence, which is a special case of the social function of labor discussed in this paper.

At the end of the year, the owners of each industry possess the necessary number of new computers to resume production at the same scale the next year. In addition, they collectively own 48 units of gold and 8 units of wheat. Such an economy would produce zero surplus-value. Yet, Pack shows that both relative prices and the rate of profit would be positive.

Though he does not provide numbers, the analytical Marxist Jon Elster (1985) makes a similar point about profits and prices when he claims that “an economy worked by highly trained monkeys could have well-defined relative prices and a well-defined rate of profit, with no labour being used.” He further asks the reader to imagine

a fully automatized economy, with a class of capitalists and a class of badly paid soldiers making up a standing army. Here goods would be transferred between firms and from firms to consumers, according to well-defined notional prices, yet no labour would enter into the production of goods. There would be no exploitation ... One might object that such an economy would have had to be set up by human labour in the first place, but I do not think this would invalidate my point—unless the phrase “being products of labour” is taken in an extended historical sense that Marx probably did not intend. (Elster, 1985, 139-140).

As we will see later, the meaning of the phrase “being products of labour” is indeed at issue in assessing the force of the full-automation objection to the LTV. For the moment, I will note that these objections to the latter on the basis of formal models of fully automated societies can be traced back to the work of the Russian mathematical economist Vladimir Dmitriev, the first economist (1898) to produce such a model. On the basis of the latter, which also exhibits a well-defined and positive rate of profit, he claimed that

it is theoretically possible to imagine a case in which all products are produced exclusively by the work of machines, so that no unit of *living labour* (whether human or of any other kind) participates in production, and nevertheless an industrial profit may occur in this case under certain conditions; this is a profit which will not differ essentially in any way from the profit obtained by present-day capitalists using hired workers in production. (Dmitriev, 1974 [1904], 63).⁸

Another set of objections to the LTV stems from the nature of work in the age of artificial intelligence (AI). The autonomist Marxist George Caffentzis (1997, 2013) argues that the theory of

⁸ See also Pack (1985, Appendix C) for a discussion of Dmitriev’s model.

the Turing Machine and Church's Thesis are problematic for the LTV, for they imply that "if the notion of computation is properly generalized into any activity that is rule-governed, then one of its implications is that all labor (whether mental or physical) that is repeatable and standardized (and hence open to value analysis at all) can be mechanized."^{9,10} According to Caffentzis, the problem arises from basing the value-creating capacity of labor on its positive features, for example skill. But if all the positive features can be mechanized, and if it is these that create value, then machines can create value. To avoid this result, Caffentzis proposes to locate the origin of the value-creating capacity of labor in a negative feature, the worker's ability to refuse to work. Labor is not itself a commodity that can be used automatically by the capitalist; the performance of labor requires the consent of the worker. This fact, according to Caffentzis, is the source of a commodity's "value."

Dyer-Witheford, Kjoson and Steinhoff develop the scenario sketched by Caffentzis in considerable detail in their (2019) *Inhuman Power*. They distinguish "actually existing AI" from a speculative successor, artificial general intelligence (AGI). A characteristic of contemporary AI systems is that they have "little ability to do anything beyond their particular domain of functionality." In contrast, AGI refers to an AI "with the capacity to engage and behave intelligently in a wide variety of contexts and to apply knowledge learned in one context to novel situations" (Dyer-Witheford, Kjoson and Steinhoff 2019, 10). This would involve the ability to reason across

⁹ In 1936, Alan Turing demonstrated the possibility of a machine that could compute any function a human, or any other computer, can compute. Church's Thesis holds that if "a system produces results that are the product of computation, then its behavior should be simulatable by a Turing machine." If it is granted that all labor is rule-governed activity, and that all rule-governed activity is a species of computation, then it follows from the Thesis that all labor could be simulated by a Turing machine. See Caffentzis, 2013, 157-161.

¹⁰ Though Caffentzis does not elaborate on what he means by openness to value analysis, he seems to have in mind a standard interpretation of the value theory as being about the value of individual commodities. The requirement of repeatability and standardization would stem from the fact that their value is determined by the labor-time socially necessary to produce them. This social norm represents an average for a given society, and hence entails that performances of a kind of productive act are repeatable, commensurable in units of time, and standardizable in units of simple average labor. For alternative interpretations, including macroeconomic ones according to which value represents the aggregate abstract labor performed in the economy as a whole, see Saad-Filho (2002), Moseley (2015), and references cited therein.

many intellectual domains. An AGI is therefore potentially more flexible, adaptive and creative than contemporary AIs.

Flexibility, adaptivity and creativity would seem to be hallmarks of human labor. Basing themselves on trends in contemporary research, Dyer-Witthof, Kjoson and Steinhoff argue that machines are being developed with such capabilities at an incipient level. If these trends continue, it is at least conceivable that future AGIs might exist that are behaviorally equivalent to the flexibility, adaptivity, and creativity displayed by humans in the labor process.¹¹ In other words, they could labor. The authors conclude that “AGI ... profoundly challenges Marx’s labour theory of value; in particular the axioms that only human beings can labour and create value, and that machines categorically cannot” (Dyer-Witthof, Kjoson and Steinhoff, 2019, 110).¹²

Taking this conclusion to its speculative extreme, Dyer-Witthof, Kjoson and Steinhoff further argue that, under certain social conditions, “artificial proletarians” could conceivably emerge. These would essentially consist of free AGIs, “free” in the classical Marxian sense applied to humans: free to sell their labor-power, but also “free of,” i.e. separated from, the means of production. Assuming the latter would remain under capitalist control, the capital-labor relationship that currently exists between humans would be reproduced between capitalists and robot workers. Surplus-value would be produced, and capitalist accumulation would proceed as with human workers.

Clearly, this scenario would require AGIs to be developed to the point of being able to behave like commodity-owners, since they would have to be able to sell their labor-power and

¹¹ “Behaviorally” because it is not claimed that the processes employed by AGIs would have to emulate human cognition. For example, AI chess programs can perform as well as, or better than, humans, but do not necessarily employ the same processes to decide moves. See Dyer-Witthof, Kjoson and Steinhoff, 2019, 112 and 120).

¹² This claim would hold even if one were to deny that labor is a rule-governed activity (see above). The authors base their argument on the possibility of replicating the performance of human intelligence by neural networks, which are not simply rule-governed.

engage in the activities necessary to reproduce it, such as consuming sources of energy, getting repairs, etc. This ability would in turn require human-like characteristics like intentionality, autonomy, and a drive towards self-preservation (Dyer-Witthoff, Kjosen and Steinhoff, 2019, 135-138).

Such science-fiction scenarios may strike some readers as far too speculative to be taken seriously.¹³ For Marxists, at least two issues makes them worth considering. First, Marxist theory claims that capitalism necessarily depends on labor to be profitable. If it turns out not to, however, then this independence would cast doubt on the validity of Marx's theory of surplus-value even for actually existing capitalism. Perhaps profits really do derive from capital, as neoclassical economics holds. It is worth noting, though, that the nature of the necessity involved can be construed in different ways. It may be taken to mean that labor is *essential* for a profitable capitalism, that is, necessary under any conditions. Or it may be interpreted as the weaker claim that labor is *indispensable* for capitalism at a given stage of economic development. According to the latter interpretation, labor could, in principle, be dispensed with at a later stage. These speculative scenarios have the virtue of addressing very directly the question whether labor is essential or in-principle dispensable, for capitalism. This question is not merely intellectual, but is of political interest because capitalists frequently claim that workers are dispensable.

Second, for both political and scientific reasons, a proper understanding of the dependence of capitalism on labor is important for making certain kinds of predictions about the future. Political, because the limits of automation under capitalism affect the limits of working-class emancipation, by determining whether it is possible to liberate humanity from labor in that mode of production. The

¹³ For my part, in accordance with the methodology laid out in section 1, I will not hold it against these authors that they do not provide a complete account of how the transition from AI to AGI or commodity-owning AGI could be brought about.

belief that automation will eventually make labor markets obsolete has fueled recent calls for a universal basic income (Benanav 2019a,b). It has also fueled contemporary visions of post-capitalist futures, and strategy proposals for attaining them (e.g. Mason 2015 and Srnicek and Williams 2015).

Scientific, because the essentialness, or lack thereof, of labor will determine the conditions under which, and the extent to which, automation proceeds. Morris-Suzuki (1984), for example, argued that full automation of manufacturing would be possible only if surplus-value were to continue to be produced in software production, a prediction contested by Steedman in the paper discussed above.¹⁴

In any case, I contend that the full-automation objections to the LTV all interpret labor in “asocial” terms. By this I mean that they share a common assumption, that the function of labor, for the producer, is exhausted by its relation to nature.¹⁵ On this view, labor is an intentional activity that transforms natural materials into use-values. The objections impute this understanding of labor to the LTV. Under conditions of commodity production, labor becomes the “substance” of the value of commodities, which is represented in the exchange relations between them. According to the critics, the theory states how labor is organized and represented in a commodity economy, but restricts its function, for the producers, to the transformation of natural materials into use-values.

From this premise, different LTV critics go in different directions. Steedman, Pack, Elster and Dmitriev consider labor as a factor of production, along with land and means of production. It is not essential to their argument that labor be a specifically human activity.¹⁶ They then argue that this factor of production is not essential for capitalist production. Though it may well be technically

¹⁴ Mandel (1972) and Ramtin (1991) also argue that profits in fully automated sectors would have to be derived from surplus-value produced in other sectors.

¹⁵ I draw here on Marx’s distinction between the labor process as “the universal condition for the metabolic interaction between man and nature” and the same process considered in a determinate form of society (Marx, 1976a, 290-291; see also Postone, 2005, 71, 74).

¹⁶ I thank an anonymous reviewer for pointing this out.

indispensable at a given stage of development, it is, in principle, eliminable without eliminating profits as well. Caffentzis as well as Dyer-Witherford and colleagues focus more narrowly on the question whether there is something special about human labor in particular. Caffentzis argues that there is: the worker's ability to refuse to work. This ability is the ultimate source of value, according to him. Dyer-Witheyford and colleagues argue that, so far as capitalist production is concerned, there is nothing about human labor that could not also be done by AGIs, at least in principle.

I will argue against the asocial assumption in what follows. The full-automation objection has already received some critical attention from Marxists. In her (1986) rejoinder to Steedman's (1985) paper, Morris-Suzuki argued that the LTV is increasingly irrelevant anyway due to corporations' growing use of free social knowledge to generate monopoly rents.¹⁷ In his (1991) *Capitalism and Automation*, Ramin Ramtin dismisses Steedman's objection on the grounds that it amounts to a logical trick of merely "stepping outside" the assumption of the LTV that labor is used in production, an assumption that is based on the reality of capitalist social relations. Steedman's example would simply not be capitalism.¹⁸ Others have sought to show that human labor possesses properties that cannot be completely mechanized, for example the aforementioned ability to refuse work, or skills of interpretation (Lohmann 2021).

None of these replies contests the asocial assumption that the function of labor is purely exogenous to commodity production, an intentional activity that transforms natural materials into use-values. In contrast, I will argue below for a *commodity theory of labor*, according to which labor

¹⁷ I note in passing that Marx recognized the role of 'free gifts' to capital. On this point see Smith, 2013.

¹⁸ Steedman anticipates this objection when he writes "to say that full automation is perfectly consistent with positive profits, exchange value, and private ownership—and to deny that the disappearance of surplus value entails that of profits—is not to ... debar anyone from saying that a system without wage-labour is, by definition, not a capitalist system" (1985, 127-8). Applying the distinction between essentialness and indispensability discussed above, perhaps one way of putting Steedman's point is that he is interested in the question whether living labor is *essential* for profits, or just *indispensable* at a given stage of economic development. Whether the economic system he describes fits a given definition of 'capitalism' or not is irrelevant to this question. See also Howard and King, 1992, 256).

has a further function, endogenous to commodity production, of serving as a means of appropriating the products of others.

3. A commodity theory of labor

My aim in this section is to defend this social view of labor, according to which the structure and function of labor in a commodity economy is determined, in part, by the relations between commodity producers. Getting clear on this determination will indicate a way to address the full-automation objection directly.

I draw textual inspiration for this view from certain methodological comments Marx intersperses in the text of *Capital*. In chapter 3 of *Capital*, which describes the circulation of commodities and money, he states that “up to this point we have considered only one economic relation between men, a relation between owners of commodities in which they appropriate the produce of the labour of others by alienating the produce of their own labour” (Marx, 1976, 203). Several hundred pages later, in the chapter on “The Inversion Which Converts the Property Laws of Commodity Production into Laws of Capitalist Appropriation,” Marx elaborates that

originally the rights of property seemed to us to be grounded in a man’s own labour. Some such assumption was at least necessary, since only commodity-owners with equal rights confronted each other, and the sole means of appropriating the commodities of others was the alienation of a man’s own commodities, commodities which, however, could only be produced by labour. (Marx, 1976a, 730)

This passage makes clear that the role of labor in a commodity economy is to serve as a means for appropriating the products of others.

Supporting quotes can also be found in *Theories of Surplus Value*, a text composed in 1861-1863 that consists of critical commentaries on past political economists.¹⁹ In the course of refuting Bailey’s view that there is no substance of value underlying the ratios in which

¹⁹ For a commentary on these commentaries, see Dussel, 2001.

commodities exchange with each other, Marx states that “[e]xchanges of products as commodities is a certain method of exchanging labour, and of the dependence of the labour of each upon the labour of the others a [*sic*] certain mode of social labour or social production.”²⁰ In his critique of Cherbuliez, Marx also describes commodity circulation as a labor exchange:

Commodities are exchanged with one another according to their value, that is, according to the labour embodied in them. Individuals confront one another only as commodity owners and can therefore only acquire other individuals’ commodities by alienating their own. It therefore *appears* as if they exchanged only their own labour since the exchange of commodities which contain other people’s labour, insofar as they themselves were not acquired by the individuals in exchange for their own commodities, presupposes different relations between people than those of [simple] commodity owners, of buyers and of sellers. In capitalist production this appearance, which its surface displays, disappears. (Marx, 2000, 378).²¹

Marx here distinguishes between the exchange of embodied labor in general, the exchange of *one’s own* embodied labor and the exchange of *other people’s* embodied labor. Commodity circulation accomplishes the exchange of embodied labor, but the analysis of exchange cannot distinguish between the exchange of one’s own embodied labor and the exchange of other people’s embodied labor. Indeed, because the exchangers relate only as commodity owners, the exchangers themselves appear as the only sources of labor. The analysis of capitalist production is required to show how the commodities could embody other people’s labor.

With respect to this role of labor, a commodity economy is fundamentally different from economies in which the product does not take the form of a commodity, a point clearly expressed by historian Moishe Postone (2005):

In a society in which the commodity is the basic structuring category of the whole, labor and its products are *not* socially distributed by traditional ties, norms, or overt relations of power and domination—that is, by manifest social relations—as is the case in other societies. Instead, labor itself replaces those relations by serving as a kind of quasi-objective means by which the products of others are acquired. A new form of interdependence comes into being where people do not consume what they produce, but where, nevertheless, their own labor or labor-products function as a quasi-objective, necessary means of obtaining

²⁰ Marx, 1968 [1861-3], 127; English in the original.

²¹ The “different relations” that are presupposed in capitalist commodity exchange are discussed below.

the products of others. In serving as such a means, labor and its products in effect preempt that function on the part of manifest social relations. (Postone, 2005, 74)²²

As examples of “manifest social relations,” Postone cites “kinship relations or relations of personal or direct domination” (Postone, 2005, 74). Marx, for example, in the section on commodity fetishism at the end of chapter 1 of *Capital*, describes a series of such relations by way of contrast with commodity production: the relationship between serf and lord, between the members of a peasant family, or between the members of an association of producers working according to a plan (Marx, 1976, 169-172). In all these cases, the individual’s access to the means of labor is determined by her membership in a community. This appropriation is a condition for her labor. In the *Grundrisse*, therefore, Marx describes the relation between property and labor in such cases succinctly as “[a]ppropriation not through labor, but presupposed to labour” (Marx, 1973, 485).

In an economy in which all products circulate as commodities, namely a capitalist one, this relationship between property and labor appears to be inverted. When all products circulate as commodities, the only way to obtain them is through exchange. If one does not already have property, then the only way of acquiring something to exchange is through labor.²³ Property appears a result of labor, not a presupposition of it. But then, this inversion endows labor with a new function: from being a means for the production of use-values for the producers, to being a

²² The following passage from the critique of Cherbuliez, which follows the one quoted above, describes this transition from interdependence mediated by manifest social relations to one mediated by labor:

as soon as the first animal state is left behind, man’s property in nature is mediated by his existence as a member of a communal body, family, tribe, etc., by his relationship to other men which determines his relationship to nature. The “propertyless labourer” as a “fundamental principle” is rather a creature of civilisation and, on the historical scale, of “capitalist production.” (Marx, 2000, 378)

See also the text on “Pre-Capitalist Economic Formations” in the *Grundrisse* (Marx, 1973, 471-514).

²³ Forcible appropriation, like theft or ‘primitive accumulation,’ is obviously another way, but only by “circulating” goods as non-commodities.

means for the acquisition of property. When producers relate to each other solely as commodity-owners,²⁴ then the relationship between property and labor can be characterized as follows:

1. The use-values of others are appropriated through exchange
2. there can be no appropriation of the use-values of others outside exchange (e.g., through kinship systems, or systems of overt force like slavery or serfdom)
3. one's own use-values can only be acquired through labor (setting aside the exchange of commodities themselves obtained from exchange, or monopolies on non-reproducible "commodities" like land).

(2) results from the fact the commodity-owners are formally free and equal. No individual is in a position to force labor out of other individuals. Moreover, since by assumption the only bond between such individuals is one of exchange, the appropriation of labor through family ties and other forms of kinship is excluded.

The result of (1)-(3) is an exchange of labor for labor: commodity-owner A indirectly appropriates the labor represented by the commodity of owner B, and vice-versa.²⁵ When the system functions ideally, commodities are exchanged in proportions corresponding to an equal exchange of labor, and there can be no exploitation through exchange.

The problem is that no such system can exist in isolation. Non-market economic relationships are always involved. Even in the case of what is sometimes called 'simple commodity production,' where the performance of labor presupposes that the workers own their means of production, this property is necessarily assured outside exchange, for example by the

²⁴ As will become clear, I am aware of the idealization implicit in this condition. Every actually existing capitalist society is an amalgam of various modes of production and appropriation. See, e.g., Williams, 2021 [1944] for a classic argument that enslavement is part of capital.

²⁵ Besides the passage from *Theories of Surplus Value* and the "Pre-Capitalist Economic Formations" in the *Grundrisse* cited above, it is also worth mentioning a passage immediately following the latter in the *Grundrisse*. This passage, intended by Marx as an addendum to the "Pre-Capitalist" text, explicitly describes the market as labor exchange, while linking that role of the market to the absence of property. He concludes that "*the exchange of labour for labour—seemingly the condition of the worker's property—rests on the foundation of the worker's propertylessness*" (Marx, 1973, 514-515; emphasis in the original).

guild system.²⁶ Under capitalism, capitalists exchange money for the workers' ability to work (labor-power). Ideally, the labor represented by the money is equal to the labor represented in the commodities needed to sustain the workers' labor-power. The capitalists have the use of this commodity for a limited time, say, a working-day. Since the product belongs to the capitalists, they can appropriate the use-values *produced* by the workers without violating (2). This fact explains the persistence of exploitation, despite the equality of exchange. The capitalists' monopoly on the means of production, in turn, ensures that workers can only produce use-values through their own labor (3). But the capitalists also conform to (3), since they acquire use-values by means of labor as well—just not their own.

In other words, the characterization of the relationship between property and labor described in propositions 1-3 should not be read as completely determining the mode of production. Rather, they should be read as necessary but insufficient *characteristics* of commodity production, whatever the specific mode of production. Hence, those propositions do not refer to “one's *own* labor”, but just to “labor,” because they do not distinguish between simple commodity production and capitalist commodity production. Here, I follow a line of interpretation that considers commodity production to be a social form of labor. The underlying philosophical idea, which goes back to Aristotle (by whom Marx was influenced), is that the form of a kind of thing is its fundamental causal structure.²⁷ In the case of commodity production, the commodity form structures labor in a specific way. For example, in the

Grundrisse Marx writes

²⁶ See Marx, 1973, 497-99; also “Results of the Immediate Process of Production,” written in 1863-6 but unpublished by Marx. Available as an appendix in Marx (1976) (see p. 1029 for the guild example).

²⁷ I am here indebted to the interpretation of the commodity form in Engelskirchen (2010). On the category of ‘form’ in Marx and its lineage, see Sève (2014) and (1984, “Forme, formation, transformation”). In addition to Engelskirchen and Postone, interpretations of the commodity form that can plausibly be read as causal-structural include Bidet (2004), Bettelheim (1969), and Lukács’ “Reification and Class Consciousness” in his (1923) *History and Class Consciousness*.

[i]n the first positing of simple exchange value, labour was structured (*bestimmt*) in such a way that the product was not a direct use value for the labourer, not a direct means of subsistence. This was the general condition for the creation of an exchange value and of exchange in general. Otherwise the worker would have produced only a product—a direct use value for himself—but not an exchange value. This exchange value, however, was materialized in a product which had, as such, a use value for others, and, as such, was the object of their needs.²⁸

Thus commodity production entails the following structure of labor: (i) the producer produces products not useful to her; (ii) she produces independently of others; and (iii) in virtue of (i) and (ii) she is compelled to exchange. Now, despite the use of the gendered personal pronoun by Marx and myself, it is crucial to note that the causal structure imposed by the commodity form *does not imply any concrete mode of production*, be it “slavery, the product of peasants (Chinese, Indian ryots), of a community (Dutch East Indies), of state production ... or of half-savage hunting peoples, etc.”²⁹ At the simplest level of abstraction, the commodity form is not precise enough to allow us to know the actual relation of direct possession connecting the producers to the means of production. It is worth noting here that Marx sometimes uses ‘producer’ in the sense of “the owner of the product.”³⁰ At this level of abstraction, it is perhaps best to understand ‘producer’ to mean ‘unit of production.’

In summary, my suggestion is that (1)-(3) represent the underlying relationship between property and labor implied by generalized commodity circulation. It follows from this characterization that whatever performs the labor be capable of being a commodity-owner. That is, the producer must be capable of making a commodity independently, selling it, buying others,

²⁸ Marx, 1973, 266-267; 1976, 189. *Bestimmen*, which Martin Nicolaus rendered as “to structure” in his translation, carries a number of meaning in German (“to decide,” “to define,” “to ascertain,” etc.), but is generally rendered as “to determine” in translations of Marx. Whatever the best translation, the idea expressed here is that the commodity form imparts specific characteristics to labor that it lacks with other social forms.

²⁹ Marx, 1978, 189. See also Marx 1976, 273 and 949-950, where Marx is very clear on this point.

³⁰ E.g., *Capital, Volume III*: “the capitalist is therefore the actual commodity producer” (Marx, 1981, 118); also pp. 289, 443, among others. It is also hard to read the early chapters of the first volume as being about capitalism (as opposed to simple commodity production)—which is the standard view nowadays—*unless* one understands Marx’s repeated use of “commodity producers,” or his references to the labor of the commodity-owners, as referring to capitalists or capitalist firms.

consuming them, and exercising an autonomous will. With regard to the consequences of automation for the validity of the commodity theory of labor, then, the questions are what functions are exercised by the commodity-owners in the wake of automation. I turn to this question in the next section.

4. The commodity theory of labor and “full automation”

How does focusing on the commodity-owner, as the agent of labor, help deal with the possibility of full automation? In this section, I will argue that, *in practice*, “full automation” can only amount to three general scenarios:

- A. the existence of non-human commodity-owners, e.g. android workers
- B. the existence of a non-market-mediated economy, in which products are appropriated by means other than exchange
- C. the persistence of some (human) labor after all.

It should be noted that these scenarios are thought experiments, similar in spirit to those of the critics of the LTV. By “in practice,” then, I merely mean that the scenarios make explicit the social relations *implicit* in the critics’ thought experiments.

Scenario A is that developed by Dyer-Witthof, Kjoson and Steinhoff (2019). It is in fact the simplest to deal with, since it merely posits the re-creation of human capacities on a different physical basis, in the form of AGI. If we grant the conceivability of AGIs that can perform labor, that need and desire use-values in order to reproduce themselves, and that can and must sell their labor-power in order to obtain those use-values, then such entities are compatible with the mode of appropriation described in 1-3.

This is not a case of automating labor, however. The only thing that is fully automated here is the internal functioning of the laborer. But the “machines” perform labor nonetheless, in

the sense of an intentional activity that transforms materials into use-values. In this case the intentionality is not even the remote kind of the designer or user of a machine (see below), but rather that of the machine itself. In addition, this activity has the same social role for it as for a human worker. So though AGI may challenge the view that only humans can perform labor, it does not challenge the social role of commodity-determined labor. Moreover, this kind of worker would presumably need instruments, just like human workers. By focusing on the reproduction of human capacities, rather than the reasons why labor might be necessary, such scenarios reproduce the initial situation that automation theorists take as starting-point, namely the existence of workers and machines. We are back at square one.

It does the automation theorist no good, however, to challenge the necessity of labor itself. Let us imagine a case of full automation that doesn't involve robots with that kind of independence. In a system with no non-human commodity-owners, but with strictly no human intervention in production, then the productive apparatus of the economy as a whole would itself amount to a very large automaton. Such a scenario is envisioned by Primož Krašovec (2018). For the latter, capital is essentially a self-augmenting automaton engaged in a constant drive towards technological improvement. Though labor and markets have been indispensable for this dynamic up to now, neither is essential to it: "It could be that markets were only a temporary solution to the problem of fast and efficient communication between individual units of production through quantitative price signals that can be replaced by more efficient IT systems connecting artificially intelligent entities" (Krašovec, 2018, *Real Subsumption of Labour Power and Artificial Intelligence*). On this view, because it dispenses with labor and the commodity altogether, any theory of commodity-producing labor is fundamentally irrelevant to understanding the essence of capital.

The word “temporary,” however, obscures an essential change in the relations of production. The reason markets could be a solution to the problem of “communication” between production units is that those units consisted of commodities belonging to different owners. The replacement of markets with IT systems implies the extrusion of commodity-owners from the economy altogether. Assuming that humans would continue to appropriate its products, property relations would no longer be mediated by commodities. Production would have become thoroughly ‘socialized,’ with individual users receiving a portion of the product through non-market mechanisms (scenario B). For example, each member of the community might receive a claim to a share of the product.³¹ His or her property in the product would be determined by community membership rather than the ability to produce commodities. Certainly, individuals could express their preferences for particular products by selectively “spending” their claim, but the fact that they have anything to spend would be determined, not by their or anybody else’s labor, but by membership. This scenario might be described as a kind of “market communism” that has little to do with the capitalist mode of production. ‘Profits’ would here consist of the material surplus over and above the reproduction needs of society.

Indeed, social reproduction under such conditions would ultimately become a political process rather than an economic one. Politics would be necessary to determine how much each member receives, and why. It would also be necessary to determine who makes these decisions, and according to what criteria. This would be a qualitatively different social framework from one

³¹ Such a system was envisioned by C. B. Macpherson (1965): “If one envisages the extreme of an automated society in which nobody has to labour ... [t]he property that would then be most important to the individual would no longer be the right to access to the means of labour; it would be instead, the right to a share in the control of the massed productive resources” (quoted in Pack, 1985).

where the defining social relationship is reproduced through agreements between formally free individuals.³²

In short, once labor ceases to have the social function of mediating the interdependence of people, we no longer have capitalism. Now, one might point out that I defined a commodity economy in terms of independent commodity producers in the introduction, and so the claim that scenario B is not capitalism follows trivially. What does not follow trivially, however, is labor's mediating role and the necessity of a new set of practices for replacing it, the practices of "market communism" or whatever.

The only alternative to a socialized automaton is that social production be split up into independent, private, automated units, however large in size (C). Either it is one, or it is many. Moreover, in the absence of android workers, automation could only consist of highly automated factories equipped with items like computers, conveyor belts, robotic arms, etc. but no entity capable of behaving like a commodity-owner. These production units would have to be owned by humans. This is the kind of scenario envisioned by Steedman, Pack, and Elster.

Ex hypothesi, AGIs are excluded from this scenario. That leaves only humans and AIs to carry out production. But as established in section 2, AIs lack characteristics that are necessary to deal with the vicissitudes of production (perhaps especially in a market economy), namely flexibility, adaptivity and creativity.³³ Together with the fragmentation into independent units, this fact implies that the owners could not simply remain passive with respect to the production process, no matter how automated. For example, each owner would have to oversee and manage production, fix and modify machines, and handle transfers of inputs and outputs to and from the

³² I thank Tony Smith for pointing out to me the role of politics in such a scenario.

³³ Lohmann (2021, 65) gives an idea of the importance of "creative, living interpretive labour" in dealing with the vicissitudes of production.

firm. Furthermore, the production process would have to be modified in order to make different products, which would require developing new methods of production or adapting old ones to the new targets. The selection of new products to make depends in part on an understanding of sources of demand, which in turn requires applying understanding of human cultural practices, social meanings, and existing institutions. The owners would be required to work simply in order to satisfy human needs.³⁴

Sayers (2011) argues that, despite mechanization, “industrial production is still formative in that it is intentional activity that gives form to materials and creates use-values that embody human labour” (Sayers, 2011, 39). The owners of these highly automated factories would have to engage in intentional activity that gives form to materials, which activity would then be represented in the value of the commodities, even if the owners are not directly fashioning the material product itself.³⁵ In short, the owner-operators of the high-tech factories would have to perform what Marx calls the ‘work of supervision and management.’³⁶ He considered this work necessary for all forms of combined social labor, though class societies endow it with additional functions of exploitation.³⁷

Is such work limited to the supervision and management of *humans*? Not according to the *Grundrisse*’s famous “Fragment on Machines.” There, Marx describes the progressive mechanization of large-scale industry in the following terms: “Labour no longer appears so much

³⁴ One might also add here various kinds of commodified care labor, such as child care, elder care or psychiatric therapy. I thank Mihnea Tudoreanu for pointing this out.

³⁵ Such is already the case with some forms of labor, such as agriculture or transportation, which Marx considered value-creating. See, for example, Marx, 2000, volume 1, 171-172, where he states that the exchange-value of a commodity “has nothing to do with its corporeal reality.”

³⁶ On this kind of work, see Marx, 1981, 505-514 and 1976, 448ff.

³⁷ It may be objected that I have not considered the possibility that AGIs exist as slaves rather than commodity-owners, and the human owners delegate this work to them. No human labor would be performed in this case. It seems to me this situation would simply be a variant of B, with the automaton having AGIs as parts.

to be included within the production process; rather, the human being comes to relate more as watchman and regulator to the production process itself” (1973, 705).

In short, the numerical examples discussed in section 2 overlook the human labor that would be required to carry out the work of supervision and management necessary to run those automated firms. This myopia is a pitfall of using mathematical models to understand social practices: it is easy to make a variable equal to zero, less easy to eliminate it in practice.

Talk of the “vicissitudes of production” might seem problematically ‘asocial’ for my view, based as the latter is on the social function of labor in capitalism. But, as noted in the introduction, I am not denying that labor is an activity that transforms natural materials into use-values. What I am asserting is that the commodity-owner’s *property* in those use-values is mediated by labor. In a commodity economy, no other social practice provides the individual with a claim on the social product. So either humans labor to produce a use-value for exchange, or another kind of agent does the work. If the latter, then there must be AGIs dealing with the vicissitudes of production if individual humans are to realize their claims on the social product. Scenario A or B must obtain. If there is no AGI, then the situation will involve human labor, giving scenario C.

5. Conclusion

In this paper, I have taken a textually informed and practice-oriented approach to the full-automation objection to the LTV. I have argued, on purely conceptual grounds, that a focus on the social function of labor in a commodity economy reveals that labor is essential in such an economy, and therefore cannot be dispensed with, in the absolute, by automation. Thus numerical models purporting to show the profitability of zero-labor capitalism are necessarily

incomplete. On the other hand, qualitative models based on speculations about robots must either be mistaken about the object of automation, or about the nature of the economy they describe.

Ultimately, this ineliminability of labor reflects the limits to the socialization of production imposed by the commodity form. The basic error the automation theorists make is to suppose what one might call ‘technological autonomism,’ the assumption that the productive forces can be developed independently of the relations of production. The analysis of this paper shows that such autonomy is impossible when the use of the forces—i.e., labor, at least in the first instance—plays an essential role in realizing the relations.

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