World Review of Political Economy Vol. 14 No. 1 Spring 2023 Pp. 99–121

A CRITIQUE OF THE SIMULTANEIST INTERPRETATION OF WORK INTENSITY IN MARX'S VALUE THEORY FROM THE TSSI PERSPECTIVE

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Abstract: This article makes an analytical critique of the position of Basu, Haas, and Moraitis, who, by extending the conventional linear system for the simultaneous determination of value, argue that in Marx's economic theory the intensification of work generates absolute surplus value and is not relative. This position is also contrasted with the original theory of Marx to verify its incompatibility. As an alternative in search of a rectification of the role of labor intensification as a generator of relative surplus value, this work incorporates labor intensity into the Temporal Single System Interpretation (TSSI), showing its full compatibility with Marx's original theory.

Key words: work intensity; relative surplus value; TSSI

Received 30 February 2022 **Revised** 8 June 2022 **Accepted** 20 June 2022 **Published** 21 April 2023

Introduction

Recently Basu, Haas, and Moraitis (2021) incorporated the intensity of work into the simultaneous interpretation of Marx's theory of value, starting from the crucial question, what is the impact of the intensification of work on the rate and form of exploitation? This means, in essence, asking whether the increase in labor intensity

DOI:10.13169/worlrevipoliecon.14.1.0099

generates absolute or relative surplus value. Solving the simultaneous equations determining the unit value of a commodity, they conclude, contrary to Marx's own theory, that the intensification of work generates absolute surplus value. In the first section, we present the simultaneous interpretation of work intensity and the reasons why it does not correspond to Marx's theory of the effect of work intensification. In the second section, we present an accurate interpretation of the intensity of labor in Marx's theory of value, and we expose why for Marx the intensification of labor generates relative surplus value. In the third section, we incorporate the intensity of work into the Temporal Single System Interpretation (TSSI). Finally, we conclude with a comment on the measurement of work intensity.

Critique of the Simultaneist Work Intensity

Basu, Haas, and Moraitis (2021)[1] consider that Marx was clear that extensions of the working day increase the rate of exploitation generating absolute surplus value (ASV) and that increases in labor productivity increase the rate of exploitation generating relative surplus value (RSV). However, they think that Marx was not clear on the effect that labor intensification (increased labor intensity) has on the rate of exploitation because this fundamental variable has two different effects: 1) on the one hand, it increases the capacity of the labor power to produce more use values, i.e., "increases labor's capacity to process inputs into output (CPIO)," and 2) increases labor power expenditure per unit of time, which they call "increases labor's capacity to create value (CCV)" (2021, 2). The overall result of the intensification of work then depends on which of the two effects is greater. If CPIO > CCV then both absolute and relative surplus value is generated, while if CCV > CPIO then absolute surplus value is generated. These conclusions, presented at the beginning of the work, are derived from the way in which they incorporate the intensity of work to the simultaneous interpretation of Marx's theory of value that we will address later. However, it is first necessary to address a question regarding the method of interpretation and reconstruction. It seems that they first looked for a way to consistently incorporate labor intensity into the simultaneous mathematical formalization and later, by contrasting their results with Marx's original theory, they found that Marx was ambiguous.

Misinterpreting Marx on Grounds Unrelated to His Theory

For Basu, Haas, and Moraitis (2021, 3), Marx was ambiguous about how he dealt with labor intensity because, according to them, in some passages of *Capital* vol. 1 he suggested that it produces RSV, while in others he suggested that the intensification of work is analogous to an extension of the working day, so he would allegedly be suggesting that it produces ASV. Therefore, they think that

"the disagreement in the later Marxist literature regarding the intensification of labor can be traced back, at least partly, to Marx's ambiguity" (Basu, Haas, and Moraitis 2021, 4). Ambiguity is possible in any written work, however, interpreters must also be careful that the reading they do is adequate and that their reconstructions themselves do not generate ambiguities, as occurs, for example, with Whiggish interpretations (Kliman 2014). What is relevant in this subsection is to identify the practices by which Basu, Haas, and Moraitis construct the ambiguities that, on this subject, do not really exist in Marx.

Marx was clear that the intensification of work generates relative surplus value. This is easily recognizable by looking at the content structure of *Capital* vol. 1. Theoretically Marx places the intensification of labor in Part IV, "The Production of Relative Surplus Value," addressing it specifically in Chapter 15 as a result of the effects of the use of machines on workers (section 3 and subsection c). It is precisely because the working day and the intensity of work become opposite poles of the expenditure of human labor power, that is, increases in the intensity of work only become viable and are encouraged when the working day is reduced due to a previous increase in labor productivity (Ioannides and Mavroudeas 2010), that the intensification of work necessarily corresponds to the section of relative surplus value. Furthermore, Marx always mentions labor intensification in the context of relative surplus value and never does so for the production of absolute surplus value. If this is indisputable, then why is this not directly sufficient to identify that intensification of work generates RSV? We think that in this case the position of Basu, Haas, and Moraitis (2021) was generated through a common procedure in economists when interpreting an author's ideas, not "as faithfully as possible to the times in which they were written" but "in the light of all that we now know" (Blaug 2001, 151). They looked for a way to incorporate the variable intensity of work into the simultaneous mathematical formalization "that is widely used in classical and Marxian economics" (Basu, Haas, and Moraitis 2021, 4) because they considered that by doing so, they were already expressing directly what Marx said and after obtaining the results from this formalization they went back to reconstructing how those results fit with Marx's words in various sections of *Capital* vol. 1.

We argue that this was the procedure followed by the authors under analysis because they deduce three possible cases of how work intensification can affect the "forms of exploitation" in their incorporation of work intensity into the simultaneous linear model (Basu, Haas, and Moraitis 2021, 6–8) and then proceed to present citations of fragments of Marx's *Capital* vol. 1 that could be linked to any of the three cases. The three cases arise from the way in which they separate work intensity effects—CPIO and CCV—in the same simultaneist value equation of the determination of the unit value of commodities, not from the theory of value of Marx himself, hence assigning to Marx three cases that he did not raise and are not

posed by his theory. If the three cases do not follow directly from what Marx said, why consider them to be consistent with his theory? What if the simultaneist interpretation contradicts Marx's theory of value? Could this not lead to a misinterpretation of the effect of labor intensification on the rate of exploitation? These are all questions that are not asked.

Because "methods are not in themselves neutral" (Naples 1996, 99), the method by which the effect of labor intensification on the rate of exploitation is studied is very important. If it is not possible to guarantee that the incorporation of work intensity into the simultaneist version will derive Marx's conclusions, then another way to reach them is necessary. A different and more fruitful way is to first understand the place of work intensity in Marx's value and surplus value theory and later mathematically formalize such theory through a method that reproduces the author's results based on his premises.

We will now proceed to criticize the simultaneist version of labor intensity and point out some important shortcomings of this position, therefore the second section shows it as incompatible with Marx's theory of value.

Criticism of the Simultaneist Version of Work Intensity

Basu, Haas, and Moraitis (2021, 7) present how the two effects (labor's capacity to process inputs into output or CPIO, and labor's capacity to create value or CCV) are incorporated into the simultaneous value equation in the linear model of a single commodity (corn) by means of two parameters: μ_1 representing CPIO and μ_2 representing CCV. With a the amount of corn required to produce 1 unit of corn and l the labor time necessary to produce 1 unit of corn, the value per unit of corn after labor intensification (λ') is computed as follows:

$$\lambda' \mu_1 = \lambda' \mu_1 a + \mu_2 l.$$

Both μ_1 and μ_2 are strictly greater than one $(\mu_1 > 1, \mu_2 > 1)$[2] because an intensification of work implies that more corn and more value are produced than previously.

The first thing that needs to be pointed out is that to incorporate the intensity of work into the simultaneist model its effects must be separated into two parameters and they have to be of different magnitude (at least in general terms) otherwise the entire analysis of value becomes irrelevant, since in that case we would arrive at the simultaneous general version without labor intensity.

The second thing to be pointed out is that although at first glance this interpretation seems to be adequately formalizing the intensification of labor, a deeper analysis reveals that it is in fact conflating work intensity with labor productivity because $\mu_1 a$ represents a positive shock in labor productivity and $\mu_2 l$ represents a negative shock in labor productivity. Let's analyze both separately.

First, for Marx the intensification of labor generates more goods because indeed more inputs are converted into more products, but this transformation is carried out through living labor because each hour of labor means a higher energetic expenditure performing a task, not because magically fewer inputs are needed to produce 1 unit of corn as this interpretation shows. According to the previous equation, the unit value would be $\lambda' = \mu_2 l / \mu_1 (1-a)$, i.e., the denominator shows that fewer inputs are required to produce 1 unit of corn, which is equivalent to decreasing a, or in other words a productivity increase. Therefore, we say this is a positive shock in *productivity*.

Second, for Marx the intensification of work generates more value because there is a greater expenditure of human labor power. However, in the simultaneist model this is not what happens. If l is the amount of work (in hours) needed to produce 1 unit of corn, then $\mu_2 l$ means that more work is required to produce 1 unit of corn and not that living labor performed a greater expenditure of labor power. Hence, we say this is a negative shock in *productivity*.

Basu, Haas, and Moraitis (2021) misinterpret work intensity as an equivalent of productivity. For them work intensity generates either a higher or lower output due to the pressure exerted on the worker to produce more output in the same labor time, however, when analyzing this way, it is equivalent to a change of productive forces of labor accompanied with a constant human labor power expenditure, which is contrary to Marx's stance. For Marx, what work intensification actually does is force the worker to carry out a higher labor power expenditure in the same production process, under the same technical conditions, in the same period of time, and for that reason more output is generated.

This simultaneist way of conceptualizing work intensity is in no way distinguished from work productivity. It is important to emphasize that none of the two parameters, neither CPIO (μ_1) nor CCV (μ_2), seek to capture the real way in which the intensity of work acts in the production process, nor in the valorization process, i.e., they do not capture the way living labor transforms more inputs into more outputs per unit of time in a length-invariant working day with no variation in productivity, nor the way in which this happens through a labor intensification that causes a greater expenditure of labor power. Both parameters are meant to generate effects equivalent to variations in labor productivity in opposite directions. Therefore, after determining the value of 1 unit of corn, before and after the intensification of work, it is found that the variation in unit value depends on which shock is greater:

$$\frac{\lambda'}{\lambda} = \frac{\mu_2}{\mu_1}.$$

This comparison gives rise to three cases: 1) if the negative shock is the same as the positive, then the unit value remains constant, 2) if the negative shock is

greater than the positive, then the unit value of corn increases, and 3) if the positive shock is greater than the negative, then the unit value of corn decreases. These are the three cases analyzed by Basu, Haas, and Moraitis (2021, 9–10). The derivation of the three cases is particularly astonishing because for Marx only case 1 is possible and he states it explicitly:

> Increased intensity of labour means increased expenditure of labour in a given time. Hence a working day of more intense labour is embodied in more products than is one of less intense labour, the length of each working day being the same. Admittedly, an increase in the productivity of labour will also supply more products in a given working day. But in that case the value of each single product falls, for it costs less labour than before, whereas in the case mentioned here *that value remains unchanged*, because each article costs the same amount of labour as before. (Marx 1992, 660–661; emphasis added)

Why the intensity of labor cannot modify the unit value of the commodity will be explained in the second section and in the third section Marx's ideas will be derived from a temporal interpretation. For the moment, it is enough to repeat that, as mentioned previously, under the simultaneist model the analysis of labor intensification only becomes possible if abstractly $\mu_1 \neq \mu_2$ (acting as labor productivity and consequently changing value per unit), because if both parameters were always equal then we return to the simultaneist case without work intensity and then the study of work intensification disappears. Thus, work intensity would have no place in this mathematical formalization of Marx's theory and consequently the intensity of labor would disappear, and no more analysis of its effects could be done. Moreover, precisely because in this simultaneous interpretation the effect of work intensity is conflated with that of labor productivity, it would not be possible to distinguish it from the productivity of work whenever trying to measure it.

Later Basu, Haas, and Moraitis (2021, 8) analyze the effect of labor intensification on the rate of exploitation by comparing it before and after work intensification, coming to:

$$\frac{1+e'}{1+e} = \mu_1.$$

where e' is the rate of exploitation after intensification of work and e is the rate of exploitation prior to that change. This is derived from the fact that in the simultaneous interpretation the surplus value, when there is only one commodity, is the difference between the generated surplus and the workers' consumption $(=1-\lambda b)$, where b is the real wage (corn units consumed per hour of labor performed), and consequently the surplus value after intensification is equal to $\mu_2 - \lambda' b$.

Kliman (2007, 76–77) shows that the simultaneous determination of surplus value necessarily implies the existence of physicalism, i.e., that profit is determined not by the surplus labor performed by the workers, but by the physical surplus of goods. The comparison between the rates of exploitation presented reveals that this physicalism prevails in this analysis. After the intensification of work, exploitation increases to the extent that it produces more use values as the previous equation shows. Even if there were no living labor ($l = 0$), the increase in surplus value after labor intensification would be due to the increase in the maize surplus, as in the simultaneist case without living labor and without work intensity (Kliman 2001, 101–103).

After finishing the incorporation of labor intensity into the physicalist explanation of surplus value, Basu, Haas, and Moraitis (2021, 9–10) proceed to analyze the three cases mentioned previously in conjunction with the exploitation rate. For case 3, the effect of work intensification can also be seen as the following:

$$e' - e = \frac{\mu_2 - 1}{\lambda' b} + \left(\frac{1}{\lambda' b} - \frac{1}{\lambda b} \right),$$

where, according to them, the left-hand side addend represents ASV production and the one on the right RSV production. By isolating μ_2, they interpret that the first addend represents ASV because "it is as if workers had to work μ_2 hours in place of every 1 hour *keeping intensity fixed*" (Basu, Haas, and Moraitis 2021, 10; emphasis in the original). While the second addend represents RSV because they have assumed a constant real wage, necessary labor decreases that according to them is a key characteristic of relative surplus value. First, the left-hand side addend should not be considered ASV because the working day was not prolonged. It is not the same to say that more labor power expenditure was performed during a constant working day than prolonging the working day. But they know this, as this is the reason why they say "as if" and more importantly because they say *keeping intensity fixed*. If work intensity is fixed, then the only way to increase labor power expenditure is by prolonging the working day. But this is not what is happening (in fact it is the opposite) and the whole idea was to analyze the opposite case when the working day remains constant and work intensity is variable. Second, according to this interpretation, it is possible that labor intensification produces absolute and relative surplus value simultaneously, which was never hinted at by Marx as a possibility from the change of a single variable. Even if Marx had been ambiguous (which is not true for labor intensity) he never claimed that labor intensification generates both ASV and RSV. Absolute and relative surplus value can only be produced simultaneously if two variables, with different effects, change simultaneously, e.g., if the working day is prolonged and labor productivity rises at the same time.

For cases 1 and 2, Basu, Haas, and Moraitis (2021) find that labor intensification generates absolute surplus value because in both cases the value of labor power does not decrease. In case 1 the value of labor power remains constant (CPIO and CCV grow in the same magnitude), while in case 2 the value of labor power increases because the negative shock on labor productivity is greater than the positive shock, i.e., more labor hours are required to produce 1 unit of corn. That is, cases 1 and 2 are automatically discarded as RSV due to the definition that Basu, Haas, and Moraitis have of relative surplus value, according to which it is essential that the value of labor power decreases. Their reasoning is as follows, if there are only two ways to produce surplus value and RSV requires the value of labor power to fall, for whatever reason, then by elimination any case that does not automatically meet this characteristic is ASV. Even if the definition of absolute surplus value (extension of the working day) is not met! This way of interpreting not only alters Marx's original concepts, but also makes him seem like an extremely deficient theorist because his definitions would not even cover the possible cases that could be derived from his alleged argumentation.

This raises one last point that we need to address in this section. How the interpretation of ASV and RSV made by Basu, Haas, and Moraitis (2021) overlooks fundamental elements of both forms of exploitation (which have also been surprisingly neglected by the rest of Marxist scholars).

Misinterpreting Relative Surplus Value

The second misinterpretation that leads the authors to claim that, contrary to Marx, labor intensification generates absolute surplus value is contained in the definition of RSV. For most Marx's interpreters, including Basu, Haas, and Moraitis (2021), RSV can only occur if there is a reduction in the value of labor power. This perspective is based especially on Marx's claim,

> I call the surplus-value which is produced by the lengthening of the working day, *absolute surplus-value*. In contrast to this, I call that surplus-value which arises from the curtailment of the necessary labour-time and from the corresponding alteration in the respective lengths of the two components of the working day, *relative surplus value*. (Marx 1992, 432; italics in the original)

If this were the only thing Marx had said about the ASV and the RSV there would be no way to interpret it differently. However, this is not so. Before analyzing another quote from Marx, it is necessary to highlight two relevant issues regarding the previous fragment: 1) these definitions are provided in the introduction to Chapter 12 of *Capital* vol. 1 before Marx explains how labor intensification becomes possible, which is thanks to the reduction of the working day after an

increase in labor productivity usually accomplished by the introduction of machines, and 2) there is a sentence widely neglected: "the corresponding alteration in the respective lengths of the two components of the working day." This sentence is also mentioned in an excerpt in Chapter 16 titled "Absolute and Relative Surplus Value" where Marx presents a broader perspective that does include labor intensity:

> Once the capitalist mode of production has become the established and universal mode of production, the difference between absolute and relative surplus-value makes itself felt whenever there is a question of raising the rate of surplus-value. Assuming that labour-power is paid for at its value, we are confronted with this alternative: on the one hand, if the productivity of labour and its *normal degree of intensity* is given, the rate of surplus-value can be raised only by prolonging the working day in *absolute terms*; *on the other hand, if the length of the working day is given, the rate of surplus-value can be raised only by a change in the relative magnitudes of the components of the working day, i.e., necessary labour and surplus labour*, and if wages are not to fall below the value of labour-power, *this change presupposes a change either in the productivity or the intensity of the labour*. (Marx 1992, 646; emphasis added)

Here Marx is very clear that the intensification of labor generates relative surplus value. There are two alternatives to increase the rate of surplus value, the first is to extend the working day—ASV; the second is to increase labor productivity or work intensity—RSV.[3] When we interpret both fragments and the consistency between them, we find that the first one is a particular definition of ASV and RSV, while the second is a general definition of them. The connection between the quotes is the crucial neglected sentence "a change in the relative magnitudes of the components of the working day."

Relative surplus value consists of a change in the relative magnitudes of the components, necessary labor and surplus labor. Later we will see that this element of the definition is crucial because it allows us to interpret that a decrease in the value of labor power is not essential to produce relative surplus value. What is essential is a relative change in necessary labor and surplus labor in such a way that the rate of surplus value increases.

Basu, Haas, and Moraitis (2021, 9), considering that the reduction in the value of labor power is an indispensable element in the production of RSV, are led immediately to discard cases 1 and 2 as relative surplus values. When interpreting an author, it is crucial to pay attention to the whole argumentation instead of cherry-picking provisional definitions to try to fit the results of a mathematical formalization that might be alien to the author's original method.

As a final comment to this section and before proceeding to interpret accurately the intensification of labor in Marx's theories of value and surplus value, it is important to mention a fundamental element in the last quote that is absent in the work of Basu, Haas, and Moraitis (2021): normal work intensity. For Marx, normal intensity defines both the production of value and surplus value, as we will see below, and yet it is not mentioned by the authors who incorporate it into the simultaneous interpretation of Marx. This might seem to be an accident, but it is highly unlikely since this omission is also consistent with the above hypothesis that they first mathematically introduced work intensity to the simultaneist model and afterwards they looked at how the results could be related to Marx's words.

More importantly, under the simultaneous interpretation there seems to be no place for normal work intensity as a proper fundamental variable non-related to labor productivity. For normal work intensity to be included in the simultaneity model, it would be necessary to generate a diversity of μ_1 and μ_2 above and below average social parameters (say $\overline{\mu_1}, \overline{\mu_2}$). However, because intensity and productivity are conflated, this would lead to normal labor productivity rather than normal labor intensity and consequently would make the system unnecessarily more complex without offering the results of Marx's original theory.

Interpreting Work Intensity Accurately in Marx's Value Theory: Absolute Surplus Value or Relative Surplus Value?

Work Intensity and Labor Power Expenditure

To accurately interpret the role that labor intensity plays in Marx's theory of value and surplus value, we must begin with the theoretical place that this variable occupies. The intensity of work in combination with the time of work (working day) defines the expenditure of human labor power (Ioannides and Mavroudeas 2010, 91–93) that constitutes the substance of the value contained in the goods of society (Carchedi 2009, 149–151).

The working day is the extensive element while work intensity is the degree element of labor power expenditure (Marx 1992, 533). As it was mentioned in above, both elements become mutually exclusive poles to produce the same quantity of labor power expenditure. Thus, Marx defines value as the socially necessary labor time (SNLT) to produce a commodity, which must be performed "with the average degree of skill and intensity of labor prevalent in that society" (129).

Normal Work Intensity and Value Production

If the intensity of work grows in one branch of the economy above the normal labor intensity of the entire economy, then 1 hour of work in that branch produces $1 + x$ hours of value (Hdez. Solorza and Deytha Mon 2020, 265–266). Marx is

categorical as to the fact that the creation of value depends on the difference between normal work intensity and that which differs from it: "The value created varies with the extent to which the intensity of labor diverges from its normal social slight of intensity" (Marx 1992, 661). This is why if "the intensity of labor were to increase simultaneously and equally in every branch of industry, then the new and higher degree of intensity would become the normal degree for the society, and would therefore cease to count as an extensive magnitude" (Marx 1992, 661–662). Besides, it should also be taken into consideration that the intensity of labor in each historic period can only vary within strict physical, legal, and social limits.

Because only the work of the branches with labor intensity above the normal generates more value per unit of work employed, the intensification of work cannot alter the SNLT to produce a commodity and hence, as we mentioned previously, Marx strongly maintains that an

> [i]ncreased intensity of labour means increased expenditure of labour in a given time. Hence a working day of more intense labour is embodied in more products than is one of less intense labour [therefore] here . . . value remains unchanged, because each article costs the same amount of labour as before. (Marx 1992, 660–661)

For this reason, for Marx there is only one case of analysis for the unit value of commodities in the face of labor intensification (case 1 in Basu, Haas, and Moraitis 2021). If the intensification of labor could alter the unit value of commodities, it would be an element of the productive forces of labor and not of the expenditure of human labor power. With this said, it becomes crystal clear that any interpretation that considers labor intensity operating as if it were labor productivity is alien to Marx's theory of value. The simultaneous interpretation of the intensity of labor incurs precisely this fault.

Impact of the Intensification of Labor on Surplus Value

Regarding the effect of labor intensification in the generation of surplus value, we must first remember that the expenditure of human labor power is made up of two elements, one extensive, which is the working day and another of degree, which is the intensity of work. Absolute surplus value consists exclusively in prolonging the expenditure of human labor power by its extension element—the working day. This makes it impossible to consider work intensification as ASV. Second, we must return to the quote mentioned in the previous section where Marx defines RSV in a general way.

> . . . on the other hand, if the productivity of labour and its normal degree of intensity is given, the rate of surplus-value can be raised only by a change in the

> relative magnitudes of the components of the working day . . . and if the wages are not to fall below the value of labour-power, this change presupposes a change either in the productivity or the intensity of the labour. (Marx 1992, 646)

What is relevant about RSV production is that necessary labor and surplus labor are altered in such a way that surplus labor increases *relative to* necessary labor. When the productivity of labor increases this is evident because necessary labor becomes smaller and automatically surplus labor grows in the magnitude that necessary labor falls. While this is not obvious in the case of work intensification, it also does not mean that it is ambiguous. A work intensity above the normal level means an increase in necessary labor. The value of labor power rises above the normal level due to a higher physiological/biological attrition of the workers who labor with a work intensity higher than the social normal level.

Moreover, Marx clearly states that an intensification of labor may increase both components of the working day,

> Hence, if the length of the working day remains constant, *a day's labour of increased intensity* will be incorporated in an increased amount of value, and, assuming no change in the value of money, in an increased amount of money. The value created varies with the extent to which the intensity of labour diverges from its normal social level of intensity. *A given working day, therefore, no longer creates a constant, but a variable value*; in a day of 12 hours of ordinary intensity, the value created is, say 6 shillings, with increased intensity, the value created may be 7, 8, or more shillings. *It is clear that, if the value created by a day's labour increases from, say, 6 to 8 shillings then the two parts into which this value is divided, namely the price of labour-power and surplus-value, may both of them increase simultaneously, and either equally or unequally*. (Marx 1992, 661; emphasis added)

Thus, the intensification of work increases both necessary labor and surplus labor but, in order to generate surplus value, the surplus labor must grow more than necessary labor, or in other words the surplus labor must grow more *relative to* necessary labor (Hdez. Solorza and Deytha Mon 2020, 272–273).

Table 1 summarizes the production of absolute and relative surplus value according to the changes in the three variables that alter it (working day, labor productivity and labor intensity), as well as in the components of the working day (necessary labor and surplus labor).

There is a case that further highlights the fact that work intensity generates RSV. Let us assume that the value of labor power remains constant after an

Table 1. Absolute and Relative Surplus Value

Type of surplus value production		Components of the working day			Variation per variable		
		Component	Variation	Type of variation	Working day	Productivity	Intensity
Absolute surplus value		Necessary labor	Constant	—	Varies	Constant	Constant
		Surplus labor	Varies	Rise			
Relative surplus value	Case 1 (productivity)	Necessary labor	Varies	Decrease	Constant	Varies	Constant
		Surplus labor		Rise			
	Case 2 (intensity)	Necessary labor		Rise		Constant	Varies
		Surplus labor		Rise			

increase in labor intensity. This borderline case, though unrealistic, allows us to understand the mechanism behind the generation of RSV. By increasing the intensity of work, a greater quantity of product is generated per unit of time. As we have already seen, this does not mean a decrease in the individual value of the commodity. In this way, the most intense workday but of unaltered length is represented in a greater number of products with a constant value. Remembering that the value of labor power has been assumed constant, the worker has required a lesser amount of time during his working day to reproduce the value of his labor power and this means that surplus labor has in fact increased *relative* to necessary labor. It must not be forgotten that this is not physicalism because the substance of a higher surplus value is not a greater surplus product, but a higher labor power expenditure.

It is also very important to recognize that any Marxist, simultaneist or temporalist, could accept the interpretation of labor intensity according to Marx's theory of value and surplus value as previously stated. However, it is crucial to identify that simultaneous mathematical formalization is not compatible with Marx's theory for the reasons previously stated. While, as we will show in below, it is possible to incorporate this understanding of work intensity into a temporalist interpretation without introducing inconsistencies or ambiguities to Marx's theory, and this is because, as Freeman and Kliman (2011, 183–188) have shown, the TSSI is an interpretation of Marx's theory of value that allows the investigation to continue under relational laws between the fundamental variables of economics.

Incorporation of Work Intensity to the TSSI Framework

In this section, we will incorporate the intensity of work into the mathematical formalization of the TSSI of Marx's theory to explain how this fundamental variable participates in the determination of value and surplus value.

Work Intensity and Value Added

Labor power expenditure (L), which is the value added by living labor, is defined as the combination of work time (l) and work intensity (i).

$$L_t = l_t \times i_t \tag{1}$$

Work intensity could vary throughout the working day, but for simplicity we assume that it is constant, hence i_t is the average work intensity throughout a whole working day. Here i_t is also a second average in the sense that represents normal work intensity prevailing in a given period in a particular society. We must recall that work intensity represents the labor power expenditure per hour worked (e.g., calories per hour).

When the intensity of work in a branch of the economy (i_t^b) varies from the normal level (i_t), the labor power expenditure per worker in the special branch generates more/less value exactly to the extent that more/less energy expenditure is made for each hour worked. In other words, if the working day is equal, the production of value varies in proportion to the difference between varied intensity and normal intensity.

$$\frac{L_t^b}{L_t} = \frac{l_t \times i_t^b}{l_t \times i_t} = \frac{i_t^b}{i_t} \tag{2}$$

From now on, the study of labor intensification will proceed on the following basis. In period t a branch in the economy is at the normal level of work intensity (i_t) and increases the intensity of work in period $t+1$ to a level above the normal (i_{t+1}), while the normal level remains constant, so what is said in Equation (2) is fulfilled for the comparison between two time periods. This study could be, in further writings, made more complex with multiple branches with different levels of work intensity and different variations over time. For the moment we will analyze the simplest case possible.

Since we will keep the working day constant ($l_{t+1} = l_t = l$), total labor power expenditure grows at the rate at which work intensity raises, therefore $L_{t+1} = L_t\left(1+\hat{i}\right)$.

Work Intensity and Production

For simplicity we will assume the production of a single final good (q_t^f), using a single type of simple labor power, and only one circulating mean of production (q_t^i)—there is no fixed capital.[4] a_t is the amount of means of production necessary to produce 1 unit of the final good (we also call it the efficacy of the means of production) and b_t is the expenditure of human labor power necessary to produce 1 unit of the final good (we could call this labor productivity). Thus, the production of the final good is given by the production function $q_t^f = \frac{b_t i_t l_t + a_t q_t^i}{2}$ and, in the optimal, the output is $q_t^f = b_t i_t l_t = a_t q_t^i$ (Hdez. Solorza and Deytha Mon 2014, 187, 189).

From now on we assume that productivity and working hours remain constant $(b_{t+1} = b_t = b; a_{t+1} = a_t = a)$ in order to isolate the effect of labor intensity and analyze only changes in this variable.

To carry out production it is necessary to do so with the appropriate combination of means of production and expenditure of labor power, which is given by the technical composition of capital $TC_t = \frac{q_t^i}{i_t l_t}$ (Saad-Filho 1993, 130–131), which, in turn, is determined by labor productivity and the efficacy of the means of production: $\frac{b}{a} \geq TC$ (Hdez. Solorza and Deytha Mon 2014, 189). After labor intensification, the technical composition remains unchanged $(TC_{t+1} = TC_t)$ because productivity remains constant. Thus, the quantity of means of production must grow in proportion to the intensity of labor:

$$\frac{q_{t+1}^i}{i_{t+1} l} = \frac{q_t^i}{i_t l} \Rightarrow \left(1 + \widehat{q^i}\right) = \left(1 + \hat{i}\right) \tag{3}$$[5]

In the same way, due to the optimality condition of production mentioned previously, the production of the final good grows in the same proportion as the intensity of work (see Appendix A):

$$\left(1 + \widehat{q^f}\right) = \left(1 + \hat{i}\right). \tag{4}$$

Work Intensity and Total Value Production

The TSSI value equation is given by $W_t = L_t + \frac{C_t}{m_t}$ (Kliman 2007, 185), which, to include work intensity, only requires Equation (1) to be substituted in L_t. W_t is total

value produced. C_t is constant capital and m_t is the monetary expression of labor time (MELT); the reason why C_t / m_t is the value transferred by means of production.

After the intensification of labor, constant capital grows in proportion to the means of production employed as shown in Equation (3), so $\left(1+\widehat{C}\right)=\left(1+\hat{i}\right)$.

The increase in value production after labor intensification is given by the difference between the total value production in both periods:

$$W_{t+1}-W_t = i_{t+1}l+\frac{C_t\left(1+\hat{i}\right)}{m_{t+1}}-i_t l-\frac{C_t}{m_t}. \tag{5}$$

When the MELT is constant and equal to 1 (value equal to price), value grows at the same rate as work intensity: $(1+\hat{i})=(1+\widehat{W})$. Appendix B shows how this result is obtained from Equation (5), as well as how Equation (6) is derived. This proportional growth is due to the fact that the value transferred by the means of production grows in exactly the same proportion as the added value increases through living labor. However, this is not the case when the value of money changes. Considering $\hat{m}$ to be the rate of inflation[6] ($m_{t+1}=m_t[1+\hat{m}]$) we find Equation (6) to be a general way to know the increase in total value:

$$W_{t+1}-W_t=(i_{t+1}-i_t)l+\frac{C_t}{m_t}\left(\frac{\hat{i}-\hat{m}}{1+\hat{m}}\right). \tag{6}$$

The first addend of Equation (6) shows the increase in value per hour of living labor, while the second addend shows the transfer of value of the means of production according to the variation in the value of money. When the growth rate of labor intensity is higher than the inflation rate, the means of production transfer more value and vice versa.

Work Intensity and Value per Unit

Now, what happens to the unit value of the final good? As we saw in the previous section, according to Marx labor intensification does not alter unit value. To see that this is fulfilled, we will use the results obtained in the previous subsections.

The value per unit is defined as the ratio between the total value and the output $=W_t / q_t^f$, therefore, to know how it changes we need to analyze each of the components:

(1) labor power expenditure grows at the same rate as work intensity: $L_{t+1}=L_t\left(1+\hat{i}\right)$,
(2) constant capital grows at the same rate as work intensity: $C_{t+1}=C_t\left(1+\hat{i}\right)$, and

(3) output grows at the same rate as work intensity: $q^f_{t+1} = q^f_t\left(1+\hat{i}\right)$—see Equation (4) and its derivation from Appendix A.

Therefore, value per unit changes to:

$$\frac{W_{t+1}}{q^f_{t+1}} = \frac{l_t\left(1+\hat{i}\right)+\dfrac{C_t\left(1+\hat{i}\right)}{m_{t+1}}}{q^f_t\left(1+\hat{i}\right)}.$$

Equation (7) reveals that the new value per unit is equal to the previous because all variables, both in the numerator and denominator, increase exactly at the same rate (work intensity), hence they are canceled out. Except that now the value transferred by the means of production depends on m_{t+1}.

$$\frac{W_{t+1}}{q^f_{t+1}} = \frac{l_t+\dfrac{C_t}{m_{t+1}}}{q^f_t} \tag{7}$$

When the value of money remains constant ($m_{t+1} = m_t$), we find that value per unit remains constant. Since Marx assumed in *Capital* that the value of money remains constant, unless otherwise stated, this result shows that the TSSI faithfully reproduces Marx's theory where only the case where value per unit remains constant exists.

Work Intensity and Surplus Value Production

TSSI's definition of surplus labor (Ls_t) is the difference between labor power expenditure and the value of labor power (w_t), which is the ratio of variable capital (V_t) and the MELT (Kliman 2007, 186):

$$Ls_t = L_t - w_t = \left(l_t xi_t\right) - \frac{V_t}{m_t}.$$

When work intensity rises above the normal level, the level of attrition of the workers rises, hence the value of their labor power also rises. But unlike what happens with the means of production, which increase in proportion as the intensity of labor increases, the value of labor power may increase in any other proportion, let's say $(1+\hat{x})$. If we assume, as Marx did, that the value of labor power is fully compensated, then variable capital also rises at such a rate: $V_{t+1} = V_t(1+\hat{x})$.

The change in surplus labor is: $Ls_{t+1} - Ls_t = (i_{t+1} - i_t)l + \left[\dfrac{V_{t+1}}{m_{t+1}} - \dfrac{V_t}{m_t}\right]$. The first addend, as we saw above, is the increase in labor power expenditure. The second

addend is the difference in the value of labor power. Therefore, the change in surplus labor is the following:

$$Ls_{t+1} - Ls_t = (i_{t+1} - i_t)l - V_t\left[\frac{1+\hat{x}}{m_{t+1}} - \frac{1}{m_t}\right]. \tag{8}$$

Equation (8) allows us to analyze the case when the MELT is constant and equal to 1: $Ls_{t+1} - Ls_t = (i_{t+1} - i_t)l - V_t\hat{x}$. This means that surplus labor only grows when the increase in work intensity is higher than the increase in real hourly wage: $(i_{t+1} - i_t) > \frac{V_t\hat{x}}{l}$. However, Equation (9) is the general way to know surplus labor variation after labor intensification:

$$Ls_{t+1} - Ls_t = (i_{t+1} - i_t)l - w_t\frac{\hat{x} - \hat{m}}{1+\hat{m}}. \tag{9}$$

Using Equation (9) we have the means to say that surplus labor only grows when work intensity increase is higher than the increase in hourly wage altered by the difference between attrition and inflation (inequality [10]):

$$Ls_{t+1} - Ls_t > 0 \Leftrightarrow i_{t+1} - i_t > \frac{w_t}{l}\frac{(\hat{x} - \hat{m})}{1+\hat{m}}. \tag{10}$$

Assuming that the full value of labor power is paid, if the inflation rate is higher than the growth rate of the value of labor power, then capitalists who intensified the working day would receive less surplus value than before. This would also occur whenever wage negotiations with workers caused the rate of change in payroll to be greater than the true attrition carried out to increase the expenditure of human labor power $(\hat{x})$.

Now we can analyze the rate of exploitation (e_t), which is defined as the quotient between surplus labor (Ls) and necessary labor (Ln), the latter is always equal to the value of labor power, hence: $e_t = Ls_t / Ln_t$. Therefore, the difference between the exploitation rates would be the quotient between the difference in surplus labor and the necessary labor increased by the rate of attrition of the labor power:

$$e_{t+1} - e_t = \frac{Ls_{t+1}}{Ln_{t+1}} - \frac{Ls_t}{Ln_t} = \frac{(i_{t+1} - i_t)l}{Ln_t\left(1+\hat{x}\right)} - \frac{\hat{x} - \hat{m}}{\left(1+\hat{x}\right)\left(1+\hat{m}\right)}. \tag{11}$$

Replacing surplus labor from Equation (9) in the numerator of the rate of exploitation and solving for the inequality we can find that the difference in exploitation rates is only positive when inequality (10) is satisfied. This shows how the incorporation of work intensity into the TSSI faithfully reproduces Marx's idea that only surplus labor generates surplus value.

The case that variable capital grows at the same rate as the value of labor power may not be what happens as Marx says in the last quote mentioned in above,

> It is clear that, if the value created by a day's labour increases from, say, 6 to 8 shillings then the two parts into which this value is divided, namely the price of labour-power and surplus-value, may both of them increase simultaneously, and either equally or unequally. They may both simultaneously increase from 3 shillings to 4. *Here, the rise in the price of labour-power does not necessarily imply that it has risen above the value of labour-power. On the contrary, this rise in price may be accompanied by a fall below its value. This occurs whenever the rise in the price of labour-power does not compensate for its more rapid deterioration.* (Marx 1992, 661; emphasis added)

Capitalists could negotiate wages with a smaller growth rate than the true wear and tear of the labor power. For example, if variable capital rises at a rate $\hat{z}$, lower than the growth rate of labor power's attrition ($\hat{z} < \hat{x}$), then surplus labor would grow even more and consequently the rate of exploitation would raise to a higher level. We can see this using Equation (11), where now the denominator becomes smaller and consequently the difference between the rates of exploitation increases.

$$e_{t+1} - e_t = \frac{(i_{t+1} - i_t)l}{Ln_t\left(1+\hat{z}\right)} - \frac{\hat{z} - \widehat{m}}{\left(1+\hat{z}\right)\left(1+\widehat{m}\right)}$$

In fact, if capitalists managed to increase wages at a smaller rate than that of inflation, they would even appropriate an additional surplus value—the second addend becomes positive.

Conclusion

In the first section, the simultaneous interpretation of labor intensification was criticized showing that it contradicts Marx's original theory of how it affects the production of value and surplus value. This criticism was complemented with an accurate interpretation of the intensity of work in Marx's economic theory, especially about the normal intensity of work, also showing that labor intensification generates relative surplus value thanks to the identification of a general definition of this form of exploitation that has been largely overlooked by Marxist economists. Based on the second section, the third incorporated the intensity of work into the TSSI, showing that it consistently reproduces Marx's original ideas.

This is the first addition of work intensity to the TSSI. However, it is possible to develop many more and get new findings with future research under this approach.

As a final comment, it is worth talking about the issue of measuring work intensity. While in simultaneous interpretation it would be necessary to measure the CPIO and CCV parameters within the system of simultaneous equations of values and/or prices, it is highly probable that it would not be possible to distinguish changes in productivity from changes in labor intensity, making it extremely difficult for a theoretical use and even more difficult for an empirical verification of its effects. In contrast to this, the TSSI provides greater flexibility, since the intensity of work can be measured outside the equations of value or surplus value (for example, as suggested by Mavroudeas and Ioannides [2011] or Hdez. Solorza and Deytha Mon [2020], or any other approximations for other variables) and introduced for the determination of other variables such as the exploitation rate, while keeping all the results of Marx's theory consistent.

Appendix A. Proportional Increase in Output and Work Intensity

The change in final output is:

$$q^f_{t+1} - q^f_t = \frac{bL_t\left(1+\hat{i}\right) + aq^i_t\left(1+\hat{i}\right)}{2} - \frac{bL_t + aq^i_t}{2}.$$

We can restate as:

$$q^f_{t+1} - q^f_t = \left(1+\hat{i}\right)q^f_t - q^f_t.$$

Simplifying the equation:

$$q^f_{t+1} - q^f_t = q^f_t\hat{i}$$

Hence

$$\frac{q^f_{t+1} - q^f_t}{q^f_t} = \hat{i}$$

Therefore

$$\widehat{q^f_t} = \hat{i}.$$

Appendix B. Increase in Total Value Produced by Work Intensification

The change in total value is:

$$W_{t+1} - W_t = L_t\left(1+\hat{i}\right) + \frac{C_t\left(1+\hat{i}\right)}{m_{t+1}} - L_t - \frac{C_t}{m_t}.$$

When the MELT is constant and equal to 1 we have

$$W_{t+1} - W_t = \left(1+\hat{i}\right)\left[L_t + C_t\right] - \left[L_t + C_t\right].$$

Simplifying

$$W_{t+1} - W_t = \left[L_t + C_t\right]\left(1+\hat{i}-1\right).$$

Hence

$$W_{t+1} - W_t = W_t\hat{i}.$$

Therefore

$$\widehat{W} = \hat{i}.$$

For the general case, we have:

$$W_{t+1} - W_t = i_{t+1}l + \frac{C_t\left(1+\hat{i}\right)}{m_{t+1}} - i_t l - \frac{C_t}{m_t}.$$

Hence

$$W_{t+1} - W_t = \left(i_{t+1} - i_t\right)l + C_t\left[\frac{\left(1+\hat{i}\right)m_t - m_{t+1}}{m_t m_{t+1}}\right].$$

Considering the rate of inflation $m_{t+1} = m_t(1+\widehat{m})$ we can restate as:

$$W_{t+1} - W_t = \left(i_{t+1} - i_t\right)l + C_t\left[\frac{m_t\left[\left(1+\hat{i}\right) - \left(1+\widehat{m}\right)\right]}{m_t{}^2\left(1+\widehat{m}\right)}\right].$$

Simplifying

$$W_{t+1} - W_t = \left(i_{t+1} - i_t\right) l + C_t \left[\frac{\left[\left(1+\hat{i}\right) - \left(1+\hat{m}\right)\right]}{m_t \left(1+\hat{m}\right)} \right].$$

Therefore

$$W_{t+1} - W_t = \left(i_{t+1} - i_t\right) l + \frac{C_t}{m_t} \left[\frac{\hat{i} - \hat{m}}{1+\hat{m}} \right].$$

Notes

1. In this work, only section 2 of the work by Basu, Haas, and Moraitis (2021) will be dealt with, which corresponds to the model of a single commodity (corn), since this is enough to identify the flaws in this interpretation of the intensification of work. These failures do not disappear with the generalization of the model to 2 goods or *n* goods.
2. Cases where work intensity might be less than 1, which is normal work intensity (Deytha Mon and Hdez. Solorza 2021, 19) and therefore would produce less value per hour of labor, are automatically excluded due to the focus on the intensification of labor and the neglection of normal work intensity as will be explained later.
3. Given that the workday is constant, then another way to explain the impact of work intensity on relative surplus value production is the following: being technology and the expenditure in variable capital constant, then the only way to increase the rate of surplus value is to increase work intensity.
4. Therefore, there is no possibility to make savings in the use of machinery due to the increase in labor intensity.
5. In the case where *n* means of production are used, all the circulating means of production would have to increase in the same proportion as the intensity of work, due to the optimality condition. Hence the result would be the same, as in Equation (3).
6. Marx did not study inflation in volumes 1 and 2 of *Capital*. Nevertheless, the TSSI of his theory of value implies that the variation in money's value must be considered in order to fully grasp changes in value. Therefore, it is taken into consideration in this analysis.

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