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The Temporal Single-System Interpretation:
Underdetermination and Inconsistency

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Abstract

This paper critically evaluates a recent contribution by Kliman and Freeman (2009) in this journal. It is argued that none of their arguments dispel previous criticisms of the ‘temporal single system interpretation’ (TSSI). Indeed the paper confirms the suggestions of many critics that, as the missing parts of the TSSI theoretical constructs are provided, in particular the Monetary Expression of Labour Time, the TSSI rests on inconsistency and arbitrary assumptions.

JEL: B24 (Socialist; Marxist).

Keywords: Value, exploitation, TSSI.

1 Introduction

In a recent contribution to this journal, Kliman and Freeman (2009) reconsider some of the criticisms of the Temporal Single-System Interpretation (TSSI) of Marx's theory of value, of which they are two of the most prominent exponents. In particular, they focus on a paper by Veneziani (2004) and argue that all the criticisms contained in the article are either logically incorrect or simply false. They conjecture that this is not apparent to Veneziani because of a psychological *a priori* commitment to the falsity of the TSSI, in turn founded on a psychological *a priori* commitment to the demonstration of the internal inconsistency of Marx.

This paper provides a brief response to Kliman and Freeman (2009). We make no conjectures about the psychology of Kliman and Freeman, and seek to remain on the terrain of the logic of their arguments in favour of TSSI and against their critics. Specifically, we argue that none of their arguments convincingly dispels previous criticisms of the TSSI. Indeed we demonstrate that as soon as the missing parts of the TSSI theoretical constructs are provided, the inconsistencies and arbitrary assumptions of the TSSI are more exposed.

We begin with two preliminary points. First, although we have some differences with Kliman and Freeman (2009) as to what constitutes an accurate representation, and what constitutes distortion, of an argument with which they disagree (particularly here the original arguments in Veneziani 2004), in what follows we will only engage with the issue of who exactly said what, when it is necessary to the main arguments in the paper. The contributions are publicly available and we encourage interested readers to form their own opinion. Second, although they focus on Veneziani (2004), Kliman and Freeman (2009) present a number of arguments that apply to the wider set of scholars who have criticized the TSSI. Hence we will concentrate on the main theoretical issues thereby raised, because their relevance goes beyond any particularity of their debate with Veneziani (2004). Since we have commented previously on TSSI arguments (Mohun 2003; Veneziani 2004, 2005; Mohun and Veneziani 2007), we will attempt to be brief and to the point. All of our previous criticisms stand and need not be reiterated.

The plan of the paper is as follows. The next section briefly outlines the main TSSI claims as a benchmark for subsequent reference. These claims are divided into those that are primarily ‘methodological’ and those that are primarily ‘logical’. Two sections analyze these in turn. The first takes TSSI ‘logic’ for granted in order to focus on claims such as ‘to criticise the TSSI is to criticize Marx’, and the second explicitly examines TSSI ‘logic’, in particular, whether the TSSI has a well-defined concept of the MELT. The paper concludes that none of the TSSI claims (whether ‘methodological’ or ‘logical’) withstand serious scrutiny.

2 The TSSI

What is the main aim of the TSSI? As repeatedly stated, it is to rescue Marx from the accusation of logical inconsistency. According to TSSI proponents, not only have they provided an interpretation of Marx that is fully coherent, but the TSSI corresponds to Marx’s own theory in a way that all other approaches do not. As Veneziani (2004) noted, TSSI proponents claim to have proved the correctness of the following propositions: “(a) all of Marx’s aggregate value-price equalities hold; (b) values cannot be negative; (c) profit cannot be positive unless surplus-value is positive; (d) value production is no longer irrelevant to price and profit determination; (e) the profit rate is invariant to the distribution of profit; (f) productivity in luxury industries affects the general rate of profit; and (g) labor-saving technical change can cause the profit rate to fall” (Kliman and McGlone 1999, p. 55). In what follows we will call these “Claims (a)-(g)”. TSSI adherents argue that since the TSSI establishes Claims (a)-(g), then the TSSI fully replicates Marx’s original theory and thus, *as an interpretation of Marx*, it is indisputably superior to all alternatives. Furthermore, any criticism of the TSSI is inevitably a criticism of Marx: “By claiming to refute TSSI findings that vindicate the internal consistency of Marx’s theory, Veneziani claims to confirm the charges that Marx himself is internally inconsistent” (Kliman and Freeman 2009, p. 339).

The structure of the TSSI argument is essentially the following. Following the standard TSSI notation, at any given t , let p_t denote the price vector, let λ_t denote the vector of values, and let g_t

denote the vector of value-price deviations. Further, let the technology be described by (A, l) where A is the input-output matrix and l is the vector of direct labour inputs, both of which are assumed, for simplicity, to be constant over time. Let x_t be a vector of activity levels at t and let τ_t denote the TSSI Monetary Expression of Labour Time (MELT) at t . Then the TSSI asserts the following.

A1. In its core equations

$$\mathbf{p}_{t+1} = \tau_{t+1} \left(\frac{\mathbf{p}_t \mathbf{A}}{\tau_t} + \mathbf{g}_t + \mathbf{l} \right) \quad (1)$$

$$\boldsymbol{\lambda}_{t+1} = \frac{1}{\tau_t} \mathbf{p}_t \mathbf{A} + \mathbf{l} \quad (2)$$

$$\mathbf{g}_t \mathbf{x}_t = \mathbf{0} \quad (3)$$

the TSSI is an interpretation of Marx's theory of value. Note that the \mathbf{g}_t are the amounts of value gained or lost by individual capitals at unit level because individual prices are not proportional to values; equation (3) says that in total such transfers sum to zero.

A2. On the basis of equations (1)-(3), Claims (a)-(g) are established as a matter of logical deduction.

A3. Because Claims (a)-(g) are logically established, this hermeneutically validates the TSSI as an interpretation of Marx. Textual evidence (or lack of it) for equations (1)-(3), particularly regarding the labour value of constant capital, is not germane. The validity of the TSSI as an interpretation of Marx is hermeneutical, not textual.

A4. The issue of the empirical validity of Claims (a)-(g) is not relevant.¹ The main criterion in adjudicating between alternative theoretical approaches is their ability to replicate Marx's results.

A5. Only the TSSI provides a fully consistent account of Marx's theory.

We have made many criticisms of these assertions elsewhere, in particular concerning A1 and A3, and we shall not repeat our arguments. Here we focus primarily on A2, A4, and A5. There are two different types of issue involved. One concerns whether criticism of the TSSI is *ipso facto* criticism of

¹Kliman and Freeman (2009) state that they have never claimed all of Marx's insights to be true. It is worth clarifying that nobody suggested that they have done so; Veneziani (2004) simply noted that they maintain that all of Claims (a)-(g) to be true in the sense of logically valid.

Marx, how one should adjudicate between different approaches, and what is the nature and purpose of theory. We call these ‘methodological issues’. The other concerns the logic of the TSSI arguments used to establish Claims (a)-(g). We call these ‘logical issues’. We do not suggest that methodological issues involve no logical concerns, and we do not suggest that logical issues involve no methodological concerns. We consider these issues separately, and in turn, purely for the sake of clarity.

3 Methodological Issues with the TSSI

In order to focus on methodological issues, and *only for the sake of argument*, in this section we assume that A1, A2, and A3 hold. We first argue that, even if one assumes that A4 and A5 also hold, criticism of the TSSI is not equivalent to criticism of Marx, and TSSI claims to the contrary are just polemical rhetoric. Then we note that A5 is unwarranted, so that the alleged superiority of the TSSI over alternative approaches is not established, *even if* one believed in A1 to A4. Finally, we argue that the TSSI emphasis on A4 is misplaced.

3.1 Are Criticisms of the TSSI Also Criticisms of Marx?

First, even assuming, and *only for the sake of argument*, that A1 to A5 hold, the claim that to reject the TSSI is essentially equivalent to criticizing Marx is dubious, from both a logical and a theoretical viewpoint. For one may legitimately reject the TSSI and search for a different interpretation, which is also logically consistent and ‘replicates’ Marx. One may legitimately argue that the premises from which Claims (a)-(g) are derived are not entirely convincing and try to derive the results in a more satisfactory way. Perhaps more importantly, one may also argue that the relevant propositions to be established are not Claims (a)-(g), but some alternative set of results. That all of Claims (a)-(g) definitionally incorporate the essential insights of Marx’s theory is an implicit assumption of the TSSI, but it has not been convincingly proved and it is certainly not beyond dispute.

Secondly, even assuming, and *only for the sake of argument*, that A1 to A5 hold, one can criticize the TSSI without any implication concerning the logical consistency of Marx’s theory. For it is simply

false that *all of* Claims (a)-(g) must hold in order for Marx’s theory to be logically consistent. From a purely logical viewpoint, to argue that one, or even various propositions in a given set of results is/are incorrect is completely different from stating that the propositions in some set are logically inconsistent. Further, from a purely logical viewpoint, to state that one, or even some of Claims (a)-(g) are incorrect does not imply that all of them are. TSSI proponents have never proved that Claims (a)-(g) are logically equivalent, either in their own system or, more generally, under any plausible interpretation of Marx’s theory. From a theoretical viewpoint, it is important to note again that the TSSI *assumes* that Claims (a)-(g) jointly define Marx’s theory, but there is no reason why anyone else should accept this assumption. But then it follows that one can legitimately drop, say, claim (g) without deriving a contradiction in Marx’s value theory.² The statement that “not all of Marx’s results [as understood by the TSSI] hold” (Veneziani 2004, p. 339) means exactly that; not all of Claims (a)-(g) hold. For this statement to be true, it is sufficient that only *one* of Claims (a)-(g) is false, contradicting the TSSI but without implying that Marx is logically inconsistent.

But A5 is false, for the TSSI is not the only approach that provides a consistent interpretation of Marx’s theory of value and exploitation, and therefore to reject the TSSI does not entail abandoning the only approach that ‘makes sense’ of Marx. For example, the ‘New Interpretation’ (NI) proposed by Duménil (1980) and Foley (1982) represents a fully coherent account of Marx’s theory, although not all of Claims (a)-(g) necessarily hold. Indeed, the NI holds that a different set of Claims defines what is relevant in Marx’s theory. But given that A5 does not hold, the superiority of the TSSI compared to other approaches is far from evident: even if one endorses A4, a comparative evaluation of the TSSI and alternative approaches is not based on logical consistency, but at best on which and how many of Marx’ propositions hold in the various perspectives.³

From these observations, it follows that assertions such as

“although the TSSI is the immediate target of Veneziani’s critique, the ultimate target is

²Especially if Claim (g) is correctly understood as a well-defined claim in a properly constructed theoretical framework, under well-specified assumptions. More on this in Section 4 below. Of course, Claim (g) may be argued to be extremely relevant from a theoretical viewpoint, but that is a different issue.

³As argued in the next section (section 3.2), however, A4 is questionable, and hence these types of comparison are reductive and uninteresting. In Section 4 below, we argue that even in this more limited sense, TSSI claims of superiority are unwarranted.

Marx” (Kliman and Freeman 2009, p. 339)

and

“...why are Mohun and Veneziani trying to discredit the TSSI? We believe that their ultimate target is Marx. The essential function of Mohun and Veneziani’s contribution ... is suppressive and antipluralist: its function is to rule Marx himself out of court while keeping it free for his Marxist economist critics” (Kliman and Freeman 2008, pp. 108-9)

are merely polemical tropes with little credibility.

3.2 What Constitutes a Theory and How Should it be Evaluated?

Consider now A4. What makes a theoretical construct – where the latter term is here intended in a rather broad sense – interesting, or relevant? On the one hand, there is the issue of explanatory power of a theory, which turns on empirical relevance. Kliman and Freeman are insistent that this is not an issue for the TSSI, because the TSSI is not a theory at all. It is an interpretation. They are therefore not concerned with whether Marx was correct or incorrect, and are only concerned with whether the TSSI is a correct interpretation of Marx’s theory (in the sense of A3 above). Nor is the empirical relevance of Claims (a)-(g) addressed. There is some sleight of hand here, since if it were shown that Marxian propositions were indubitably *empirically* false, then A1-A3 would constitute a trivial and uninteresting episode in the history of economic thought. Since for Kliman and Freeman the TSSI stands or falls with Marx, there must be some unstated premise that Marx is interesting and relevant, and some reason why. Indeed, there should also be some unstated premise that what is interesting and relevant in Marx is captured precisely by Claims (a)-(g). But Kliman and Freeman will not engage with this.

On the other hand, instead of focusing on the explanatory power of theories, one might emphasize the logical validity of theorems, and this seems the main explicit justification of the TSSI enterprise (see, e.g., Kliman and Freeman 2008, p. 116 n. 5). Setting aside A1 and A3, for the sake of argument, this implies that the validity of A2 is essential for the TSSI. To see this, suppose that, as claimed by

many critics, equations (1)-(3) only ‘prove’ Claims (a)-(g) by producing a severely underdetermined system in which no variable is determined except *ex post*. Then the TSSI would be theoretically vacuous. For the interpretation that we can observe p_{t+1} , p_t and l , and then determine g_t is just a tautology: it is always possible to define p_{t+1} to be equal to something plus an arbitrary variable h_t and support it with the data, but this arbitrary h_t has no meaning.⁴

We now turn directly, and substantively, to the internal logic of the TSSI to show that A2 is untenable.

4 Logical Issues with the TSSI

In this section, we focus on A2 and argue that the TSSI core results can only be obtained by assumption within a theoretically underdetermined system. As soon as the system is closed, inconsistencies and arbitrary assumptions emerge, and this is particularly evident in the TSSI treatment of the Monetary Expression of Labour Time. We also show that, as suggested in Section 3.1 above, even the alleged superiority of the TSSI as compared to alternative approaches can only be established by assumption, as a brief analysis of the falling rate of profit and the Fundamental Marxian Theorem forcefully demonstrates.

4.1 The Monetary Expression of Labour Time

Consider A2. In general, critics of the TSSI face a serious problem in evaluating TSSI substantive claims: the TSSI theoretical system is severely underdetermined, in that some crucial variables are undefined and the meaning of some of the key relations is unclear, so that it is often obscure what determines what. This implies that in any attempt to evaluate Claims (a)-(g), critics have either to fill in the relevant gaps with some assumptions that seem coherent with the rest of the approach, and/or to formulate their criticisms in the form of conditional statements, trying to produce an exhaustive list of possibilities. It is not difficult for TSSI proponents then to rebut criticisms by noting that

⁴We thank Jesus Fernandez-Villaverde for this observation.

critics are making arbitrary assumptions that are not part of the TSSI system, or even noting that alternative criticisms are inconsistent.

The best example of this is the TSSI treatment of the MELT. As noted by many critics, TSSI proponents “fail to put forward a single, consistent definition” (Foley 2000, p. 33; see also Mohun 2003, Veneziani 2004; Mohun and Veneziani 2007). In TSSI contributions, the ‘simplifying’ assumption is often made that $\tau_t = 1$, all t , ‘without loss of generality’ (see, for example, Freeman 1996, p. 235, Kliman and McGlone 1999, p. 36), but this is completely arbitrary, given that no formal, explicit definition of MELT is provided.

Of course TSSI adherents disagree. For the temporalist MELT is

“usually defined as the ratio of total money price to total labor-time value” (Kliman 2007, p.187).

On the face of it, this claim is straightforward. For multiplying each of equations (1) and (2) through by the gross output vector \mathbf{x}_t , combining them and using equation (3) yields

$$\mathbf{p}_{t+1}\mathbf{x}_t = \tau_{t+1}\boldsymbol{\lambda}_{t+1}\mathbf{x}_t \quad (4)$$

whence

$$\tau_{t+1} = \frac{\mathbf{p}_{t+1}\mathbf{x}_t}{\boldsymbol{\lambda}_{t+1}\mathbf{x}_t} \quad (5)$$

as Kliman asserts. But this is not a definition that is different from equations (1)-(3) – it merely repeats them in a different guise. For the TSSI MELT is also on the right hand side of equation (5) by virtue of equation (2).

Kliman has another definition of the MELT:

“The temporalist MELT, usually defined as the ratio of total money price to total labor-time value, can also be defined, equivalently, as a ratio of a unit of money to the amount of labor commanded by a unit of money.” (Kliman 2007, p. 187. See also Kliman and Freeman 2006, p. 122.)

Formally, this seems to be a simple rewriting of equation (5) as follows:

$$\tau_{t+1} = \frac{1}{\frac{\lambda_{t+1} \mathbf{x}_t}{p_{t+1} \mathbf{x}_t}} \quad (6)$$

Again, this is obviously not a formal definition that is different from equations (1)-(3); it is just their repetition. Again the TSSI MELT remains on the right hand side of equation (6) by virtue of equation (2). Moreover, the interpretation that equation (6) represents the “ratio of a unit of money to the amount of labor commanded by a unit of money” clearly requires the auxiliary assumption that there are no hoards of money. Yet in an economy with metallic circulation, Marx (*Capital I* ch. 3) considered hoarding to be essential (Marx 1976[1867], pp.231-2). The Kliman and Freeman interpretation of equation (6) therefore does not seem readily compatible with Marx’s writings on money.⁵

Finally, yet another definition of the MELT appears to be implied when Kliman and Freeman state

“By definition, the price of any item ... equals τ times the amount of labor the item commands in exchange” Kliman and Freeman (2009, p. 351)

That is, for *any* commodity, not just the gross output vector \mathbf{x} ,

$$\text{price} = \tau \times (\text{labor commanded}) \quad (7)$$

As is so often the case in the TSSI, in equation (7) ‘labor commanded’ is not defined. But we can use the i th equation in equation (1) to define it as follows:

$$p_{i,t+1} = \tau_{t+1} \left(\frac{\sum p_{j,t} a_{ji}}{\tau_t} + g_{i,t} + l_{i,t} \right) \quad (8)$$

‘Labor commanded’ is then the brackets in equation (8). But again this is just a rewriting of equations (1) and (2), and the MELT is not independently defined.

⁵Of course, Kliman and Freeman can argue that equation (6) is not what Kliman (2007) intended, and it is our own arbitrary interpretation of it. In that case, it would be interesting to see an explicit formalisation of Kliman’s (2007) verbal discussion, and how such a formula is consistent with equation (6).

In all of these ‘definitions’ the words seemingly make sense, but the best that one can do in terms of causal relations of determination is to combine equations (1) and (3) to derive the difference equation

$$\tau_{t+1} = \frac{\tau_t \mathbf{p}_{t+1} \mathbf{x}}{\mathbf{p}_t \mathbf{A} \mathbf{x} + \tau_t \mathbf{l} \mathbf{x}} \quad (9)$$

And that is all.

In fact, TSSI adherents do argue that the TSSI MELT should be ‘determined’ dynamically, and equation (9) is all that matters in deriving the main conclusions of the TSSI.⁶ Kliman and Freeman write

“the magnitude of the MELT is always *determined* inter-temporally, since the amount of labour commanded, and the price and value of output, depend in part upon prior events” (Kliman and Freeman 2008, p. 113, their emphasis).

By contrast,

“At every moment, the MELT can be *expressed* as the reciprocal of the amount of labour commanded by a unit of money, and, equivalently, as the ratio of the money-price of output to the labour-time value of output” (Kliman and Freeman 2008, p. 113, their emphasis).

Is the latter distinction useful in order to provide a clear definition of what the TSSI MELT is, and how it changes over time? It might be useful if the TSSI were able to provide a clear definition of the MELT at the initial period $t = 0$, which is consistent with the rest of their theoretical and formal system, and in particular with equations (1)–(3). As is obvious from Kliman and Freeman’s (2009) own discussion, the MELT is not a physically observable magnitude, one that can be measured without a theory, but a theoretical construct and thus the determination of the MELT at $t = 0$ requires the specification of the variables that define it and that must be measured at $t = 0$.

The distinction between ‘determination’ and ‘expression’ is of no help in resolving this issue.

Kliman and Freeman argue that the MELT can be *expressed* at time $t = 0$ as τ_0 even though

⁶It is worth noting in passing that equation (9) forcefully shows that, far from entailing no loss of generality, the assumption that $\tau_t = 1$, all t , is completely arbitrary, given the lack of restrictions on all variables.

its *determination* involves knowledge of what happened before $t = 0$. The difficulty is that the *determination* shown in equation (9) and the *expression* shown in equation (8) involve the same intertemporality. It is just not true that the MELT at $t = 0$ can be *expressed* without knowledge of what happened prior to $t = 0$. It is not surprising then that no explicit formal definition of τ_0 is provided in TSSI writings, and that the ‘proof’ of the positivity of the MELT in Kliman and Freeman (2009) provides no explicit formula, with clearly specified variables defining τ_0 . This is not a minor issue. For suppose that the initial MELT τ_0 can indeed be defined as “the ratio of total price to total value”; then all terms must be defined in terms of variables observable at time $t = 0$, or else a problem of infinite regress arises. According to equation (9), the TSSI definition of total value at t involves the MELT at $t - 1$. If infinite regress is to be avoided, this cannot hold at $t = 0$. Yet it is never explained why the TSSI MELT at $t = 0$ is defined in terms of concurrent variables, when it is not so defined at any other t .

The discussion of the MELT in Kliman and Freeman (2009) adds further elements of perplexity. Given the ‘dynamic determination’ of the MELT by equation (9), nothing more can be said without a clearly specified initial condition (see for example Kliman and Freeman 2009, p. 343, n. 5). Hence without such a condition, nothing can be said about the sign of τ_t at an arbitrary t . The difficulty of course is not in supplying *some* arbitrary initial condition, but in providing an initial condition that is coherent with the rest of the system. So far, the TSSI have not been able to do this and there exists no explicit formula for τ_0 that could be used, for example, to construct an empirical measurement of the TSSI MELT at $t = 0$. Noting that semi-formal and ill specified statements like equation (7) do not constitute a rigorous formal treatment, Kliman and Freeman (2009) seem to limit themselves to a verbal discussion because an explicit formulation of the MELT would expose the *ad hoc* nature of their treatment.

Consider in particular the claim that, at $t = 0$, “the total value of commodities (in terms of labor-time) was at first just the living labor extracted, a positive quantity” (Kliman and Freeman 2009, p. 352), which would seem to imply that the numerator of the TSSI MELT at $t = 0$ is just total labour time, lx . Of course, this solves the issue of infinite regress, but it raises more issues than it resolves.

We consider two of these.

First, there is no way in which this statement can be made consistent with the rest of the TSSI system, and in particular with equations (2) or (9), unless $p_t A x_t = 0$ at $t = -1$. Indeed, this is the only way of using equations (5) or (9) consistently at $t = 0$ without infinite regress. But why does constant capital vanish in the determination of value at $t = 0$, given that the specification of constant capital in value theory is one of the defining features of the TSSI? It is worth stressing that the definition of MELT at $t = 0$ is not a matter of innocuous simplifying assumptions, because a number of crucial properties of the TSSI depend on the sign of τ_0 .⁷ Possibly Kliman and Freeman have in mind an actual historical initial period, lost in time, in which pre-capitalist commodity production took place without intermediate inputs. Even were we to accept such a strange assumption, this would render their whole system theoretically undetermined, as it would rest on an initial condition that simply cannot be observed.⁸ Or, perhaps they consider their assumption as a simplifying one, but this is not possible because in their own system it is always true that value derives (is transferred from) from constant capital too. In sum, in any dynamic system, the choice of $t = 0$ is in principle arbitrary and if such a simplifying assumption can hold, without loss of generality, at any arbitrarily selected $t = 0$, then for the TSSI an inconsistency arises: it cannot be true at the same time that (i) at any given t , value depends on the constant capital of the previous period, and (ii) at any arbitrary t chosen as the initial period the total value of commodities is just equal to the living labour that was performed.

Second, in their reply to Veneziani (2004), they claim that in a steady state (in which prices and the MELT do not change over time) the following expression⁹ holds:

$$\tau = \frac{\mathbf{p}_0(\mathbf{I} - \mathbf{A})\mathbf{x}}{l\mathbf{x}} \quad (10)$$

But again the only way in which equation (10) is compatible with the claim that the TSSI MELT is “the ratio of *total* price to total value” (Kliman and Freeman 2009, p. 352, emphasis added) is when

⁷In particular, in the initial period that their analysis describes, the assumption of commodity production is crucial to the TSSI ‘proof’ that the TSSI MELT is strictly positive.

⁸And, as well as theoretically undetermined, empirically useless.

⁹Equation (8) in Kliman and Freeman (2009).

production requires no non-labour inputs.¹⁰ This is particularly evident if one notes that for equation (10) to hold, it is sufficient for the economy to be stationary in two adjacent periods: equation (10) need not describe the limit point of a long dynamic process. Therefore if all variables are stationary across the two periods $t = 0$ and $t = 1$, equation (10) holds for the relevant periods. Therefore, it is immediately obvious that if “the total value of commodities (in terms of labor-time) was at first just the living labor extracted” (Kliman and Freeman 2009, p. 352), in general the right hand side of equation (10) represents *total* price over total value only in an economy without non-labour inputs. It is difficult to imagine that the TSSI was intended to apply as a theory for Adam Smith’s world prior to the accumulation of ‘stock’.

Hence despite all claims to the contrary, Kliman and Freeman (2009) have not convincingly shown that the TSSI has a well-defined notion of the MELT. Without it, equations (1) and (2) are not well-defined, and the only precise claim that can be made about MELT is that there are an (uncountably) infinite number of time paths of the TSSI MELT consistent with equation (9). Given this theoretical underdetermination of the TSSI, any critic who wishes to take TSSI claims seriously (for example, concerning the fundamental difference between the TSSI and the NI, and the possibility that the TSSI MELT can be set equal to unity in every period without loss of generality) is hard put to find a way of rendering the whole system coherent, without making completely ad hoc assumptions.

In sum, TSSI adherents have to provide a definition of the MELT that is coherent with the rest of their theoretical system. The TSSI MELT is defined by, and expressed by, equation (9), and functionally there is nothing else. Specificity requires some initial condition τ_0 . But TSSI adherents make two mistakes. First, they seek to apply one or another of their verbal definitions to τ_0 , but this is not possible without infinite regress. Secondly, they seek to ‘prove’ $\tau_0 > 0$, and this too is not possible, for either equation (9) applies to τ_0 , or τ_0 is a nonzero arbitrary initial condition of any sign. Kliman and Freeman maintain that critics who object that it is arbitrary to assume that the MELT is non-negative, give us “absolutely no reason to believe that a negative temporalist MELT is

¹⁰Or when only one good is produced, or when the organic composition of capital is equal in all sectors. That is, unsurprisingly, whenever all other approaches hold.

logically possible. A negative MELT would imply that a quantum of labor-time is represented by a negative amount of money. In the absence of any reason why we should believe in such an absurd situation, it is hardly arbitrary to assume that the MELT is positive" (Kliman and Freeman 2009, p. 349). This is absurd. The burden of proof is on TSSI adherents. Thus far they have not been able to provide a coherent account of their MELT, and, given the nature of their mathematical framework, it is unlikely that they will ever be able to do so.

4.2 The Falling Rate of Profit and the Fundamental Marxian Theorem (FMT)

All of the TSSI 'refutations' of the FMT and the Okishio theorem (Okishio 1963, Roemer 1981) are not refutations in the strict mathematical sense of disproving a result, as acknowledged by Kliman and Freeman (2009). Both the FMT and the Okishio theorem are mathematically true. At best, the TSSI arguments show that, once the assumptions are violated, the results do not hold: positive profits can occur without positive surplus value (and vice versa) and the rate of profit may increase after the introduction of cost-reducing technical change. This is indisputable and indeed has long been acknowledged, as have the rather restrictive assumptions under which the two results hold. For example, Roemer (1981, p. 49 ff.) notes that it is sufficient to drop a technical assumption (called 'Independence of production') to allow for a situation whereby profits are positive in the absence of exploitation. On the other hand, Skillman (1997) has shown that, once the traditional assumption of perfect competition is dropped, cost reducing technical changes can decrease the rate of profit. Therefore, in general terms, the issues raised by TSSI proponents are far from original. To reiterate, it is well-known that the FMT and the Okishio Theorem hold only under very restrictive assumptions (for example, the general version of the FMT proved by Roemer, 1981, p.48, is based on no less than seven technical hypotheses and the assumption of stationary expectations), and that if the latter are violated the results do not hold.

TSSI adherents can only claim originality for their results by ignoring the existing literature.

Consider the following defence of an example with a zero real wage allegedly refuting the Okishio Theorem.

“However, even though the present example assumes a zero real wage rate, it too serves to disprove the theorem, since the latter only assumes that the real wage rate remains constant, not that it is positive. Okishio (1961) did acknowledge that viable technical changes can result in a fall in the maximum rate of profit, but only in order to stress that the actual rate must nevertheless rise or remain constant. When the real wage rate is zero, the maximum rate of profit equals the actual rate, and the theorem therefore implies that neither can fall. That claim is disproved below.” (Kliman and Freeman 2009, fn. 14).

That the maximum profit rate (corresponding to a zero wage rate) would fall after a cost-reducing innovation has been known for very many years, and it has been admitted even by supporters of the Okishio Theorem (see the discussion in Roemer 1981, pp.115ff).

In order to provide some original results on these issues, TSSI adherents would need to construct an economically interesting and theoretically relevant setting in which the FMT and the Okishio Theorem do not hold, so that one could derive interesting insights on the reasons why this might be so. None of this can be found in TSSI writings, which simply pick arbitrary combinations of parameters and variables to construct *ad hoc* examples wherein the FMT and the Okishio theorem do not hold. From an economic viewpoint, little insight is gained from this kind of refutation.¹¹

Finally, consider the claim that, unlike the TSSI, no simultaneist approach to value theory can preserve the Marxian relation between exploitation and profits. Since we have analyzed the issue at length elsewhere (Mohun 2003; Veneziani 2004; Mohun and Veneziani 2007), we will not examine all the TSSI arguments here. However, an additional argument can be provided to illustrate a number of problems plaguing the TSSI. The main TSSI proof that in the NI it is possible to have positive profits with negative surplus value (and *vice versa*) consists in some examples allegedly showing that

¹¹For example, if in order to establish Claim (g), namely the result that the profit rate can fall after the introduction of a cost reducing innovation, it is sufficient to produce an example such as the economy with zero wages analyzed in Kliman and Freeman (2009), then it is easily proved that Claim (g) holds in every theoretical approach, Marxian or mainstream.

the NI MELT can be negative (Kliman 2001). Suppose, for the sake of argument, that the type of counterexample constructed by Kliman (2001) is sufficient to establish the desired claim. Then it is easy to show that exactly the same argument proves that the relation between surplus value and profits cannot hold in the TSSI. That is, if Claim (c) does not hold in the NI, then it does not hold in the TSSI either. First, take Kliman and Freeman (2009) at face value and suppose that equation (10) does indeed coherently describe the TSSI MELT in the situation in which prices do not change, so that in the special case of a stationary economy equation (10) holds. But then, at least in this special case, the TSSI MELT coincides with the NI MELT and therefore whenever the latter is negative, so too is the former. One might argue that, from a TSSI perspective, the TSSI MELT is equal to the NI MELT only in a very special case. Yet, according to TSSI epistemological principles, this objection is irrelevant, because one example – no matter how special, arbitrarily constructed, or far from the original assumptions – is sufficient to disprove the claim of generality.¹² Provided that the TSSI MELT is analyzed in a steady state, all of the examples used by Kliman (2001) against the NI are immediately applicable to the TSSI.

This provides a nice illustration of the inconsistencies of the TSSI and the logical problems in the ‘derivation’ of their results. For either the ‘proof’ in Kliman and Freeman (2009) that the TSSI MELT is always positive is wrong, or equation (10) never holds in the TSSI. If the former, one would have to conclude that the claim that the TSSI has proved a general positive relation between surplus value and profits is false. But if the latter, the TSSI MELT is undetermined, which problematizes the determination of the TSSI system both in the steady state, and in general, as noted in the previous section and by Veneziani (2004).

5 Conclusions

The Temporal Single-System Interpretation of Marx’s theory of value does not convincingly prove the claims that it makes. As repeatedly noted by critics, TSSI results hold only by assumption, that is

¹²See for example Kliman and Freeman (2006), p. 120.

the relevant conclusions are assumed to be definitionally true, thanks to the severe underspecification of the TSSI system. Whenever the TSSI system is closed, inconsistencies and arbitrary assumptions immediately emerge. The paper by Kliman and Freeman (2009) is an excellent illustration of this property.

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