

# Input-Output And Dynamic Values: A Spanish Perspective

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## **Introduction.**

In the last 20 years, there have been two very interesting developments in the field of marxist theory of value. On the one hand, input-output accounts have been used in order to empirically test some relevant aspects of Marx's theory, giving so birth to what could be called marxist input-output economics (MIO). On the other hand, a new approach to values have been developed from a dynamic perspective, which seems to have generated, among other things, a new solution to the old transformation problem: this approach has been usually referred to as the Temporal Single System (TSS) and is called in this Conference the "Temporalist Value Theory" (TVT)<sup>1</sup>. So far, both developments have tended to be seen as incompatible in a certain extent, but it is my contention that they are not in fact. If I am able to manage with my awful English and the fact that I am just beginning to get my first, preliminary, results, I hope to show in this paper:

1) that dynamic values and prices are not only superior from a theoretical point of view but look so as well in connection with the empirical results provided by the Spanish economy.

2) The main reason for that is that value has to be interpreted in the way TVT does: as a quantity of total abstract labor which coincides with the sum of the prices of the inputs plus the total direct labor performed by productive workers. Values and prices of production obtained in this way correlate with market prices better than traditional values and production prices do, and the average deviations between them are smaller with the new definition.

3) However, the traditional equations used in previous empirical research (Shaikh, 1984, 1995, Ochoa, 1984, 1989, Cockshott, Cottrell and Michaelson, 1995, Chilcote, 1997) are still valid and useful, as will be defended here on both theoretical and empirical bases. The reason why the supporters of TVT seem to believe they are not valid is the fact that they to some extent conflate the mathematics involved in solving the problem with the theories actually adopted by the users of these mathematical tools (Freeman, 1997, Moseley, 1997, Giussani, 1998).

I have divided the paper in five sections. In the first one I go briefly back to the old transformation problem and find that TVT is right in concluding that there is no need to transform the value of the inputs because according to Marx they must be computed in market prices (not production prices). In section 2, I develop a criticism on Shaikh's idea that the reason for necessary deviations between total profits and total surplus-values (and therefore between price-rate of profit and value-rate of profit) lies in the circuit of capitalist revenues, showing that no deviation of this genre should be expected. In section 3, I discuss epistemology and mathematics with some supporters of TVT (especially Alan Freeman with whom I have privately discussed certain points, but also A. Kliman, as well as other sympathetic critics of TVT like Foley, Giussani or Moseley). In section 4, I get deeper in Spanish results, and finally I get some conclusions.

## **1. Is really there an error in Marx's transformation procedure?**

### Marx's position

In the most general form, the total value produced in any sector of the economy during a fixed period of time ( $w$ ) can be written as the sum<sup>2</sup> of the sector's constant capital used up during the period ( $c$ ), the

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<sup>1</sup> I have studied both developments in my book on heterodox economic thought (see Guerrero, 1997a), but now I am dealing with both, MIO and TVT, in my own research on "Spanish input-output tables and theories of value", which is being developed at the New School, under the supervision of A. Shaikh.

<sup>2</sup> All values can be expressed in monetary terms even though they are ultimately quantities of labor. In fact, they can only appear as prices. But note: 1) individual prices reflect individual values and are quantitatively different from them; 2) total price reflects total value and is quantitatively identical to it, provided we use the appropriate ratio in order to convert at any

variable capital used to pay the productive labor in the sector ( $v$ ) and the surplus value generated by this labor ( $s$ ). So we have:

$$w = c + v + s \quad (1)$$

We can express the same idea in matrix notation and yet need no change in equation (1), provided we make  $w$  = the column-vector (all vectors contain 51 sectors in my actual research for the Spanish case) of sectoral values,  $c$  = the column-vector of sectoral flows of constant capital,  $v$  = the column-vector of sectoral flows of variable capital, and  $s$  = the column-vector of surplus-values.

But Marx believed that the direct regulator of the actual monetary price of the product in every sector would not be this total value, but the “price of production” of total output in the sector, which is identical to the sum of its costs of production (the sum of constant and variable capital spent) and an average profit on the total capital invested in the sector. So we can write the price of production as:

$$p = c + v + \_ * k, \quad (2)$$

where total profits are determined by multiplying the average rate of profit ( $\_$ ) by the vector of sectoral total stocks of capital invested ( $k$ ). Marx’s idea is the most easy to understand: the competition between different units of capital makes the profit be dependent on the total capital invested rather than on the variable capital alone, so that each capital intends to get a profitability which is proportional to the magnitude of its total capital. In trying that, the actual movements of capital inside and outside the different sectors (according to their relative profitability) generate a tendency for the sectoral rates of profit to adjust to a normal or average profitability. Actual prices are not of course prices which yield the same profitability to every sector, but Marx believed that actual prices would be regulated by these prices of production calculated according to the average profitability in the economy as a whole. So, in each sector, ( $\_ * k$ ) does not need to be equal to  $s$ , but in the economy as a whole  $\sum_i (\_ * k) = \sum_i s$ , because the effect of the competition between the different sectors or industries amounts to a redistribution of the surplus value generated without affecting its total magnitude.

For Marx, market prices (which will be called here  $m$ ) are not the prices of production, because the tendency to equalization of the sectoral profit rates only imposes its law along the real time (but not instantaneously) and because there are other factors (State’s prices and regulations, short-term changes in supply and demand, etc.) that intertwine with the pure operation of forces of competition and make actual prices deviate from the “equilibrium point” marked by the prices of production. So we need a third equation for market prices, that can be written as:

$$m = c + v + (r * k) \quad (3)$$

(where  $r$  is the vector of market profit rates whose weighted average is represented by  $\_$ , and where the arrow above the parenthesis means the vectorized product of each couple of elements in the  $n^{\text{th}}$  row of vectors  $r$  and  $k$ ). So, for Marx, since  $(c+v)$  appear in the right side of equations (1), (2) and (3), two equalities follow as a necessary corollary (see equations (4) and (5)): it is not only possible to assert that total profits equal total surplus value:

$$\sum_i (r * k) = \_ * \sum_i k = \sum_i s \quad (4),$$

but also that the sum of values is equal to the sum of prices of production for the economy as a whole (even if this is not true for each sector separately):

$$\sum_i v = \sum_i p = \sum_i m \quad (5)$$

(note that each term in (4) and (5) is a scalar, because  $\sum_i$  means the column-sum of each element in the vector). And this is true even though, in general, we will have for each commodity  $m \neq p \neq v$ .

The logical next step consists in writing the average rate of profit as the ratio between two scalars, where the numerator can be written in three distinct but perfectly equivalent ways:

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moment the units of each one of them into the other’s units.

$$\begin{aligned}
\underline{v} &= [\sum_i m - \sum_i (c+v)] / \sum_i k \\
&= [\sum_i p - \sum_i (c+v)] / \sum_i k \\
&= [\sum_i w - \sum_i (c+v)] / \sum_i k \quad (6).
\end{aligned}$$

### **A logical error?**

Now, for many modern marxists Marx was wrong in this point. In doing so, they are actually following the path established by known marxists of elder generations (like Tugan-Baranowsky, Sweezy, etc.), which rather seemed to share the arguments employed by Marx's antagonists against him. One of the main arguments has been made popular by authors like Steedman, who locates himself in the long tradition coming from Bortkiewicz through Sraffa to modern neo-Ricardian economics. This argument imputes Marx a logical error in the process of deriving the prices of production from the labor values. However, TVT supporters have been able to demonstrate that there is no error in this point of Marx's theory, and shown at the same time how and why the dominant tradition of Marx's interpreters has failed to realize its deep involvement with neoclassical (i.e., Walrasian) theory (Freeman, 1995, 1996). The error imputed to Marx consists in the following reasoning. Since one could decompose the value of any amount of commodities into the product of the physical amount of them times their individual unit, it would be possible to write the value produced in any sector in a way which is different from equation (1). Let's write the physical amount of inter-sectoral flows of constant capital per unit of commodity, in the usual matrix notation, as the matrix of I-O vertical coefficients A, and the physical amount of each element in the total workers wage's bundle as matrix B. Then we could write values as:

$$w = (A+B)*w + s \quad (7).$$

But according to these authors, if we wanted to do the same with the prices of production, we could not just write (as Marx did):

$$p = (A+B)*w + \underline{v} * K \quad (8),$$

but:

$$p = (A+B)*p + \underline{v} * K \quad (9),$$

Marx's supposed error would have thus consisted in either not having realized that in general  $p \neq v$ , or, having noticed it, not having taken into account the implications of this inequality. And the implications would be several, according to these authors. The first one is that since:

$$(A+B)*p \neq (A+B)*v \quad (10),$$

then it is easy to see that either:

- a)  $s \neq (\underline{v} * K)$ , even if  $\sum_i v = \sum_i p$ ,
- b) or  $\sum_i v \neq \sum_i p$ , even if  $s = (\underline{v} * K)$ .

So that, in general, we could maintain one equality or the other, but cannot maintain both at the same time. Therefore, Marx was wrong.

But there is a second important implication: if (10) is true, we should distinguish between two different expressions of the average rate of profit: the average "value" rate of profit ( $\underline{v}$ ), which could be obtained as:

$$\underline{v} = \sum_i [I-(A+B)]*w / \sum_i (w*k) \quad (11),$$

and the average "price" rate of profit ( $\underline{p}$ ), which instead would have to be written as:

$$\underline{p} = \sum_i [I-(A+B)]*p / \sum_i (p*k) \quad (12).$$

### **Using market prices for the inputs solves the transformation problem**

The authors working in TVT have made easier to understand the reasons why the previous arguments

are wrong, and why was Marx right at the same time. Moreover, I think there is another simple way to write the equations of values and prices of production which allows us to use physical quantities of inputs and maintain at the same time both Marxian equalities (i.e., total prices equal to total values, and total profits equal to total surplus value). The mistake committed by the great majority of interpreters is very easy to understand. Marx's concepts of constant and variable capital both correspond to magnitudes of value that can indeed be expressed as the result of multiplying unit prices by physical quantities. But the relevant prices for this operation are actual market prices, not (equilibrium) production prices. So, following Marx and TVT's ideas, we could finally write the sectoral values and production prices as:

$$\begin{aligned} w &= (A+B)*m + s \\ p &= (A+B)*m + \_ *k \end{aligned} \quad (13).$$

Notice that again  $\sum_i (\_ *k) = \sum_i s$ , and  $\sum_i w = \sum_i p$ , so that both Marxian equalities hold at the same time. But we are now being able to express values and prices of production in a way that allows us to use the overall mathematical apparatus developed by both the I-O framework and the matrix algebra, and this has very interesting implications for empirical research on Marxian categories. But, first of all, notice that it is still possible to write the rate of profit exactly like in equation (6), which means that there is and can be no difference at all between the value rate of profit and the price rate of profit, despite what other Marxists seem to believe:

$$\_v = \_p = \_ \quad (14).$$

The couple of equations (13) raises two different questions which must be solved in this context. First of all, the reader must understand that they do not make of value a redundant concept, despite the fact that most authors seem to believe the opposite. On the other hand, it is necessary to grasp what are the exact quantitative discrepancies between equations (13) and the much more popular equations (7) and (9). We will deal with the second aspect in section 4, and turn now to the first one.

The first question relates to the way Marx sets out the relationship between prices and values. Many authors tend to see this relationship as the perfect example for understanding what is what the word "esoteric" really means. But it is in fact not such a hard thing to grasp. Let's see. The process of production is at the same time a means of valorizing capital, and we should look at both of them as processes which take place in real time. Now, as long as valorization is involved, the important thing to focus on is the spending of new value-creating labor, whose quantity is being developed in exactly the present time. But when the process of labor is actually taking place, the means of production only enter in the subjective (but collective) process of production as something whose value is already an objective and fixed one, and whose quantitative determination belongs to a previous period in real time<sup>3</sup>. Thus, actual present values are created by means of the use of direct living labor, whose contribution to the creation of new values depends on the time it lasts in the process, and means of production whose objective value existed already at the moment they entered the process, and existed only in the form of the average market price actually paid for them.

This interpretation does not make the concept of value a redundant one, because the new prices established in this way cannot be determined nor understood without the intermediation of values. But it is more than that: new prices cannot be formed nor measured unless we are able to calculate and measure the magnitude of value created in the same process, which is a precise magnitude of abstract labor. This can easily be seen in equations (13), since it is straightforward that  $\_$  can only be

<sup>3</sup> I agree with Moseley (1997) in emphasizing the following Marx's passage: "For even if a commodity's cost price may diverge from the value of the means of production consumed in it, this error in the past is a matter of indifference to the capitalist. The cost price is a given precondition, independent of his, the capitalist's, production, while the result of his production is a commodity that contains surplus-value, and therefore an excess value over and above its cost price" (Marx, 1981, p. 265).

quantitatively determined once we know the magnitude of  $\Sigma_i s$  (since  $\bar{w} = \Sigma_i s / \Sigma_i k$ ), and in each sector  $s$  is just the difference between  $w$  (total labor used in production, measured in \$: see note 2) and “(A+B)\*m” (total capital spent).

## **2. Two rates of profit or just one?**

Only the labor theory of value offers an answer to the question of the substantive quantitative determination of the average rate of profit across the economy. By substantive I mean not just a mathematical answer, because I think we need answers which are correct at the same time from a substantive as well as from a formal mathematical point of view. We can write a set of equations for (equilibrium) production prices which allows us to solve the vector of prices and the rate of profit at the same time. But this is not an explanation. We need to make sense of the mathematical solution. Why is the rate of profit 20%, and not 0.2% or 2000%? We cannot answer this question from inside mathematics, thus we need to look at the theoretical interpretations of this fact.

We have got three main answers to this question in the history of economic thought. By a majority of authors, the average of profit is determined by the market rate of interest, which is itself conceived as a simple “rate of return”. But we could ask again: which determines the magnitude of this rate of return? No answer is indeed offered at this point.

The second type of answer is offered by the labor theory of value: the average rate of profit is exactly determined by the ratio between the sum of profits, which is exactly equal to the sum of surplus-value, and the sum of capital invested; and the sum of surplus-value is not but the monetary expression of the surplus-labor, i.e. the labor spent by workers above the labor necessary to reproduce their bundle of consumption.

There is a third answer attached to the idea that the rate of profit is determined by the natural rate of growth (Von Neumann, Pasinetti, Shaikh: see Shaikh, 1984, pp. 60ss), i.e., the rate of growth which could be obtained if all profits were reinvested (no capitalist consumption out of profits), situation which is called by Shaikh the “maximum expanded reproduction”. But it is hard to understand why these authors do not realize that they are in fact inverting the actual causal relation between both rates. In my opinion, it is not the rate of profit which is determined by this rate of growth, but the opposite: the maximum rate of growth is given by the average long run rate of profit<sup>4</sup>.

Next point is obviously related to the previous one. Some (Marxist and non Marxist) authors believe that we should distinguish between two different expressions of the rate of profit in order to accurately express Marx’s ideas in correct mathematical terms. I am especially concerned here with the support given to this idea from the Marxist approach, and I intend to particularly criticize it as it is expressed in Shaikh’s papers<sup>5</sup>. Shaikh begins by recognizing that since in circulation only transfers of values, but not creation of values, can happen, then “for the economy as a whole the sum of these prices [arbitrary prices] is equal to the sum of direct prices” (1984, p. 53). But since this is not necessarily true for the individual capitalists, then some capitalists could lose a part of the value produced by them if they were forced to sell their commodities for a price under their direct price (price proportional to values), and others could obtain from the market more than the value they have produced.

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4 This inversion is similar to the inversion usually made by neoclassical economists in relating rate of profit and rate of interest. As I wrote in another paper, “it is true that interest rates and profit rates are related, but in the opposite direction, which means that the net interest of the bank sector (after deducting the rate paid on their liabilities and other costs of operation), which is the form adopted by the rate of profit in this sector, has of course to be put in line with the rate of profit in the whole economy, because the bank industry is not but one of the industries where capital can inflow or outflow according to the movements of relative actual profitability” (Guerrero, 1997b, p. 5).

5 Since not only I believe this author has made especially relevant contributions to developing Marx’s ideas and making them appropriate to deal with present economies, both theoretically and empirically, but is also the founder of a line of research in I-O Marxian economics inside which I am placing my own work, some of which preliminary results I am presenting in section 4 of this paper.

Then the question arises: “who are these buyers and how do their gains and losses appear in the determination of total money profits?” (ibidem). Shaikh’s answer is twofold: on the one hand, “any transfer of value arising from price-value deviations of means of production MOP and workers’ means of subsistence MOS remain internal to the circuit of capital: what one capitalist loses as capitalist-seller of MOP and MOS, another gains as capitalist-investor in MOP and LP [labor power]” (pp. 53-54). But on the other hand we need to distinguish the circuit of capital from the circuit of revenue, which is the circuit where enters that part of the surplus value which is not reinvested by consumed by the capitalists themselves in other means of consumption. Shaikh says that taking this into account, which is not usually made, would lead us to see that “to the extent that price-value deviations give rise to transfers between the circuit of capital and the circuit of capitalist revenue, these transfers will manifest themselves as differences between actual profit and direct profits” (p. 54).

But the latter amounts to discard one of the two equalities we can find in Marx: the equality between the sum of surplus values and the sum of profits, even if Shaikh maintains, as other authors do as well, the equivalence between total prices and total values. If profits and surplus values are not the same amount, we should try and figure out the magnitude of this discrepancy as well as the discrepancy between the value rate of profit and the price rate of profit, and these are the next steps in Shaikh’s argument. He writes the “percentage deviation of profits from surplus-value (from direct prices)” as a fraction of the “average percentage price-value deviation of capitalist consumption goods”, so that:

$$(\pi - \pi^0)/\pi = (b/1 + \_) * \delta_F, \text{ and}$$

$$\delta_F = \sum_{i=1}^n (p^0 - p_i/p_i) * F_i/F$$

[where  $\pi^0$  are direct profits (money profits proportional to surplus-value),  $\pi$  are actual money profits,  $b$  the fraction of actual profits which goes towards capitalist consumption,  $\_$  is the average growth rate of the economy,  $\delta_F$  is the average percentage price-value deviation of articles consumed by capitalists,  $p^0$  and  $p_i$  are the actual and direct prices of the  $i$ -th good,  $F_i$  is the capitalist expenditures on these goods, and  $F \equiv \sum_{i=1}^n F_i$ ]. After writing the former of these expressions in a different way, as a function of  $\_$  (the average rate of profit before taxes),  $\_$  and  $\delta_F$ , he reaches the conclusion that the average percentage deviation in profits from surplus-value “would be roughly 64% of  $\delta_F$ , the average price-value deviation of capitalist consumption goods” (57), so that if we assume that the latter is “of the order of -10%”, then the former would be about -6% (-0.064 in fact).

Shaikh seems to think that this is a small deviation (it is indeed) and it would be “even lower” if we took into account “fixed capital and differences in turnover time” (p. 57). Finally, he reaches the conclusion that the deviations between the price rate of profit and the value rate of profit would be only “a bit larger than profit mass deviations” (he actually figures out a deviation of -7%), and adds that it is important to understand that this numerical result implies that a value rate of profit of 13% would appear as a price rate of profit of 12%. “Such a difference”, he concludes, “is considerably less than the probable error in any empirical measurement of  $\_$ , and we may as well say that for empirical purposes  $\_$  and  $r^0$  (as well as  $\pi$  and  $\pi^0$ ) are virtually indistinguishable -providing, of course, that our estimate of price-value deviations is of the correct order of magnitude” (p. 58).

Well: it is my contention that his estimate of price-value deviations for the consumption of the capitalists is not of the correct order of magnitude. And I believe that the reason is easy to understand. First of all, he is arbitrarily assuming that the average deviations for the means of consumption of the capitalists is of the order of 10%. This figure may seem reasonable to anybody thinking about individual commodities, but notice that the range and variety of goods in the capitalists’ consumption basket are bigger, not smaller, than those in the worker’s basket. Moreover, notice that what Shaikh calls “social consumption” (all labor performed in the spheres of distribution and social maintenance and reproduction: see Shaikh and Tonak, 1994) must be included in that basket because they are paid

out from the total surplus-value generated in the productive sector of the economy.

Therefore:

- 1) since the purchases from the government sector also include some types of investment goods;
- 2) and -more important- since every actual type of consumption goods would be included in this basket of goods, because the now extended “capitalist consumption” basket would have to include all unproductive consumption having its origin in surplus-value, including consumption generated in taxes, interests, rents and royalties, etc., paid out of surplus-value; and, finally,
- 3) since it would be completely unsound to assume that the average deviation for these goods is of the order of -10%, because it would imply that the average deviation for the remainder of goods -the complementary basket of productive workers’ consumption goods and private investment’s goods- should be exactly<sup>6</sup> of +10% (because they have to compensate each other in order to make the global deviation for total production equal to 0), and this one is a completely arbitrary assumption, we have to conclude that Shaikh’s assumption is wrong.

So, to the question of what would be the correct assumption, the answer is simple. Since for the total output produced the sum of the prices is equal to the sum of the values, and the circuit of revenue is such a large part of the whole economy, the correct assumption is to make the average percentage deviation between values and prices for the entire basket of the “total capitalist consumption” equal to zero ( $\delta_F = 0$ ). Then, the percentage deviation of profit from surplus-value would be 0 as well, and we would not need to distinguish between a “value” rate of profit and a “price” rate of profit anymore. Note that this assumption is not made in order to make easy any empirical calculations nor is due to any other practical reasons, but is based only in theoretical considerations and I think is the only one which is consistent with Marx’s thought. Of course, the 0% deviation for the entire circuit of revenues is an actual abstraction. In practice, we could have some positive or negative deviation for this year or the following one, but they would tend to cancel each other alongside the real time. Moreover, the differences would be so small that they would be probably “considerably less than the probable error in any empirical measurement”. This was the idea that Marx had in mind when he warned his readers that in using market prices for computing the magnitudes of constant and variable capitals we must necessarily allow for some quantitative differences, but this did not prevent him from using this way of computing values and prices of production.

### **3. Epistemology and mathematics.**

In dealing with the relationships between TVT and MIO, one crucial aspect is the way that both schools treat the question of dynamics and its relationship with statics. TVT correctly emphasizes the importance of using a dynamic approach to value problems, but I think they risk to make of this approach a kind of fetishistic and separate field where you need to be initiated in a mostly sacred way in order to be able to understand anything. I do not think we should treat statics and dynamics as though they were two different worlds without no bridge between them: that sounds like the way many conventional economists treat the relationship between values and prices. So I turn now to the positive and negative sides in the contribution made by TVT in the especial aspect which has to do with the field I am writing in.

For instance, I believe that Alan Freeman has made important contributions to the correct understanding of the dynamic approach to value theory. He is correct in recalling that Marx emphasized the temporal dimension in studying value theory, and was able to see that “value functions as capital only in so far as it remains identical with itself and is compared with itself in the different phases of the circuit, which are in no way ‘contemporary’, but rather occur in succession”<sup>7</sup>. It is also

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6 In the specific case that both baskets would share the GDP at 50%.

7 Marx, 1978, p. 186. In fact, I think that the quotation from Kant Freeman uses to explain this approach is a marvelous one

important the way Freeman has shown us how deeply was Bortkiewicz involved with Walrasian methodology (see Freeman, 1995). But I think he is presently seeing the gap between TVT supporters and other interpreters of Marx's theories like if it were as big as which in fact exists between neoclassical and marxian economics<sup>8</sup>.

The basis of this misunderstanding lies, in my opinion, in the fact he is conflating the use of mathematical instruments with the theories supported by a majority of users of these instruments. Let's me explain this. For instance, neoclassical economists are often referred to as marginalists, due to the extensive use they actually make of the marginal mathematical apparatus, and especially due to the relatively larger use they made of it at the beginning of the history of their school. But being a marginalist is not the same thing as being a neoclassical, and this is so not only in historical terms (for instance, Cournot is an excellent example of an early brilliant marginalist who not only did not espouse any utilitarian theory as the basis for a theory of value, but even actually used the Ricardian distinction between wealth and value in a sense very close to Ricardo and Marx's), but is also true nowadays. Everyone can make use of the total and partial derivatives, and the integrals and so on, without by this fact having to be necessarily blamed for using the neoclassical theories.

It is my contention that exactly the same thing can be applied to the use of the I-O framework (mostly developed by the neoclassical economist W. Leontief<sup>9</sup>) and to the use of the instrumental concept of "vertically integrated labor coefficients" (developed by the Sraffian economist L. Pasinetti following also some Leontief's ideas). The fact that most of the users of both instruments are not marxists<sup>10</sup>, or

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and I cannot help without repeating it here: "The principle of the causal connection among appearances is limited in our formula to their serial succession, whereas it applies also to their existence, when cause and effect are simultaneous. For example, a room is warm while the outer air is cool. I look around for the cause, and find a heated stove. Now the stove, as cause, is simultaneous with its effect, the heat of the room... Now we must not fail to note that it is the order of time, not the lapse of time, with which we have to reckon; the relation remains even if no time has elapsed. The time between the causality of the cause and its immediate effect may be [a] vanishing [quantity], and they may thus be simultaneous; but the relation of the one to the other will always still remain determinable in time. If I view as a cause a ball which impresses a hollow as it lies on a stuffed cushion, the cause is simultaneous with the effect. But I still distinguish the two through the time-relation of their dynamical connection. For if I lay the ball on the cushion, a hollow follows upon the previous flat smooth shape; but if (for any reason) there previously exists a hollow in the cushion, a leaden ball does not follow upon it. The sequence in time is thus the sole criterion of an effect in its relation to the causality of the cause which precedes it" (Kant, 1993, p. 288).

<sup>8</sup> In private correspondence, Freeman places me in "one particular current in Marxism, the Vertically-Integrated-Labor-Embodied school or as Valle Baez calls it the Sweezy-Morishima-Seton approach", and writes that "the temporal method has no more in common with the equations in your paper than Galileo with the Ptolemaics". He goes on by making of TVT something really difficult to grasp for ordinary mortals: "The temporal approach is not just a different model, a different re-combination of equilibrium concepts, but a different paradigm. Everything that you thought you knew must be re-thought, re-examined, re-studied, submitted to rigorous questioning and criticism, taking nothing for granted (as is the basic method of the rationalist approach). Everyone working in our framework has had to do this, over a long period of time, because we are establishing a new paradigm. I'm afraid you won't understand what we are saying unless you devote some time to it also... I think you seriously underestimate just how different the temporal approach really is from everything that you have previously encountered".

<sup>9</sup> Despite the usual attempt to include Leontief in a Classical tradition coming from Quesnay and Marx (see Chilcote, 1997), the fact is that Leontief himself wrote that "the input-output method is an adaptation of the neo-classical theory of general equilibrium to the empirical study of the quantitative interdependence between interrelated economic activities" (Leontief, 1965, p. 134).

<sup>10</sup> For instance, in the same article commented above, Shaikh, refers to the empirical evidence existing on the relationship between values and prices, and he mentions not only Leontief (whose belonging to the neoclassical school did not however prevent him to measure the total labor, direct plus indirect, necessary for producing a unit of commodity: see Leontief, 1953 and 1956), but also the neo-Ricardians Marzi and Varri (who base their work on "Sraffa's circulating capital model which Steedman, for example, also uses in his numerical examples"), the marxist Edward Wolff or even the mathematician Jacob Schwartz. I think this is the correct way to proceed, and the results can be criticized on a theoretical basis but not just on the basis of the school to which previous users belonged to.

even the fact that some of their marxist users do not follow Marx in every respect<sup>11</sup>, are not a reason enough to discard the use of such useful instruments. Moreover, some users fail to distinguish between the instrumental and the conceptual sides of a body of work<sup>12</sup>. For instance, one can refer to the kind of empirical work in marxian I-O as a work which is “utilizing the framework developed by Sraffa (1960), Leontief (1986), Pasinetti (1980), Ochoa (1986), and Shaikh (1995)” (see Chilcote, 1997, p. 97), but it is rather confusing just to say “framework” without clearly stating that it is a matter of “mathematical framework”, which by the way is the only possible way to put together such a heterogeneous list of authors.

What I mean is hopefully clear. Simultaneous equations inside a static framework are part of an extremely valuable apparatus which we should not put aside in any case. Mathematics is only a form of logic: it must be submitted to strict rules in order to make possible a correct understanding of the problems involved. But the kind of knowledge set out by mathematics is just a formal one, formal meaning not necessarily inferior to its opposite -the material side of knowledge- but necessarily needing the other half in order to let the overall process of thinking to become a complete one. So we cannot ask Mathematics to give us the answer to economic (social, material) problems, but as a corollary of this we cannot either blame it for giving us the wrong answers. It is in fact the economists using mathematical tools who intertwine both sides of the process of thinking in a way which is not always clear.

Another related point is the fact that Freeman seems not to take into account the following sentence I am extracting from his quotation of Kant (see note 5): “The time between the causality of the cause and its immediate effect may be [a] vanishing [quantity], and they may thus be simultaneous; but the relation of the one to the other will always still remain determinable in time”. That means to me that we can use statics in the context of a dynamic approach (I tried to do that in Guerrero, 1995, in order to better understand the limitations of the static approach to the theory of competition). Freeman criticizes “the assumption that vertical integration produces labour values” (Freeman, 1997, p. 1) and seems to believe that the very use of the idea of “vertically integrated labor coefficients” actually betrays Marx’s thought. The reason for that is that the “meaning assigned to the concept of labour-value by the great majority of those working with input-output data begins from two ideas, both introduced by Bortkiewicz, and both challenged by recent work”, these ideas being:

“1) values are defined in the Bortkiewicz tradition as the solution to a set of simultaneous equations which represent rates of exchange in a *hypothetical* economy, which would permit this economy to reproduce itself if net value added in each sector were directly proportional to labour-hours worked.

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11 For instance, the author of the well known empirical work in this field, Ed Ochoa, clearly states, following Shaikh in this point, that “Marx’s ‘error’ consisted of redistributing surplus-value among capitals of different compositions in accordance to their size measured in value units, rather than in (transformed) price-of-production units. The earlier correction of this procedure was made in 1905 by Tugan-Baranowsky. This was followed two years later by von Bortkiewicz. Both solved the problem for a simple three-sector circulating-capital model” (Ochoa, 1984, p. 8). It is clear that this way of reporting the history of the debate looks like the way used by authors like Steedman (1981?) or Howard and King (1994?) and is not an accurate description of the real facts (see Freeman, 1996, or Guerrero, 1997a).

12 For instance, Paolo Giussani writes: “Since the eigenvector/eigenvalue formalism of the Surplus-Sraffian school can not be rejected as such from the neo-classical mainstream, it is useful and necessary to the aim of carrying on polemiques which be respectable within the academic milieu” (Giussani, 1998, p. 12). The reason why this formalism cannot be rejected by the neoclassical school, or by any other school, is that it is correct. So, the fact that a valid instrumental tool is being used by Surplus-Sraffians, neoclassicals, or whoever else, is no reason for not using it. Likewise, Fred Moseley writes: “The neo-Ricardian interpretation attributes to Marx’s theory the logical method of Sraffa’s theory, i.e. the method of linear production theory” (Moseley, 1997, p. 111). I agree with Moseley’s 4 “conclusions” in his page 114, and with his criticism on Foley for sharing the idea that there are two different rates of profit (p. 116), but I disagree about the statement I quoted because I believe that we should distinguish again between the linear production framework, which is a mathematical tool suitable for being used by anybody, and the economic theories of its users.

2) the value transmitted to constant capital (constant capital) by consumed means of production is given by the *vertically-integrated* (henceforth VI) values so calculated, and the value appropriated by the workers (variable capital) is given by these vertically-integrated values” (p. 7, his emphasis).

But we should begin by distinguishing three different things:

1) we must test whether is or not true that most users of the I-O framework assign to the concept of labor-value the same meaning as Bortkiewicz did;

2) but even if Freeman is right and the latter is true, this would not necessarily imply that all past, present and future users of the I-O framework have to share these ideas; so we can skip over question 1.

3) And, finally, we could ask whether these ideas are or not true. This is the real crucial point.

Let’s look at the first idea. My opinion is that if equations (13) are correct, there is no problem at all in viewing them as a set of simultaneous equations. In this case, Freeman would be wrong because Marx’s dynamic approach, and not only Bortkiewicz’s static one, is perfectly compatible with these equations. The difference between them does lie in the fact that for Bortkiewicz the rate of profit is just the mathematical solution to this set of equations, and for Marx’s thought expressed in modern mathematical terms, this solution, being mathematically essentially the same as in Bortkiewicz’s (once we replace  $p$  by  $m$ ), is at the same time the expression of the ratio between the value created by surplus-labor and the value contained in capital invested.

Freeman is also wrong in counterposing hypothetical and actual economies in an excessively simplistic way. For him, the usual justification of considering a hypothetical economy (for instance, those which are expressed in the set of equations of production prices) as a first approximation, or center of gravity, of the actual state of the economy (an idea which I believe is a correct one, and is correctly shown in Shaikh, for instance) is not valid anymore, because this assumption “in neither a first approximation nor a centre of gravity if productivity is rising systematically” (ibid, p. 8). Freeman writes that the supporters of the TVT approach instead “deal, neither with hypothetical values nor with hypothetical prices but with the actual prices at which goods are traded, that is, with the directly observable magnitudes of the economy”.

But this is simply not true. Such a thing could have been said by the most base businessman, but a theorist needs to deal with theories and concepts, which both are necessarily hypothetical. If there were only actual prices, values would not exist and Marx’s theory would be wrong. Freeman seems to mean that only actual prices matter in computing the inputs who enter in the formation of new values and new prices. That is true indeed, but we need the values as something which is quantitatively different from the prices at the individual level, and we need the individual level, and not just the social level, in order to understand competition. The problem with Freeman’s interpretation has perhaps to do with the difference between abstraction by typification (the correct one) and abstraction by idealization (the improper one). Hypothetical categories are not wrong per se but only when they are obtained by means of a process of abstraction that allows us just to catch some irrelevant features of reality, or even some relevant ones but clearly inferior in content than those which could be captured by a more realistic method.

The second of the Bortkiewicz’s ideas looks also false for Freeman, but for different reasons. But we must first of all distinguish between the individual and the social level. It is true that unit values are different from unit prices (both market and production prices), so that in general we have  $m \neq p \neq v$ . But we should recall that each individual input’s price can deviate from its value from above or below, and if we think that every input is able to enter in every kind of commodities, it would not be surprising at all that in the overall set of different inputs these deviations canceled each other to a great extent, so that we should expect on theoretical grounds that the solutions offered by equations (13) are in fact

very close in practice to the solutions we can get from the usual equations (see (7) and (9)), in which case the overall apparatus developed by Pasinetti, Shaikh, Ochoa, etc. could be applied with good empirical results. This in fact the case, as we will see in section 4.

#### **4. Some empirical Spanish results.**

According to Shaikh, we could represent the evolution in time of unit values in the way we can see in figure 1, where we have three different monetary expressions of value: the direct price (which is proportional to the labor-value), the production price (sort of equilibrium price we can get assuming every sector is earning the average rate of profit) and the actual (observed) market price.

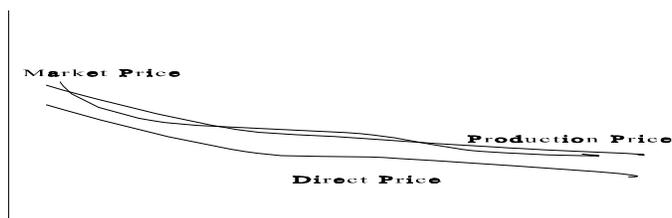


Figure 1

Direct prices are the primary regulators of market prices, which means that labor-values are in fact the ultimate regulator, but we need production prices as an intermediate step. This just means that in each sector market prices tend to be more closely related with production prices than with direct prices, because actual competition between capitals in different sectors tend to make sectoral profits be proportional to capital invested, more than to direct labor spent in production. In figure 2 I, have represented the relationship between market prices and production prices for each one of the 51 Spanish I-O sectors (in 1987). Production prices are calculated using equation (13), which gives better results than equation (9), and are set equal to 1 in the figure, so that one can see in it the percentage deviation actually existing between both kinds of prices for each sector. The reader can observe that the deviations are really small (an average of ??), the major ones being related to sectors where the relative weight of indirect taxes or subsidies are much higher (tobacco, petrol, drinks, railway transportation, agriculture or private education).

In figure 3, I have represented the deviations between production prices and direct prices together with the relative compositions of capital.

Table 1: Correlations between unit values and unit prices (1986-91)

1986-91	Labor-values	Capital-values	difference
agric	0.842	(0.048)	0.889
hulla	0.936	(0.213)	1.148
lignito	0.979	0.557	0.422
coque	0.995	0.034	0.961
petrol	0.973	0.334	0.639
refino	0.699	0.540	0.159
gas	0.301	0.715	(0.414)
agua	0.394	0.788	(0.394)
electr	0.909	0.901	0.007

gas manuf	0.968	0.918	0.050
nuclear	0.085	0.928	(0.842)
min hierro	0.988	0.737	0.252
min no ferr	0.248	0.951	(0.703)
cemento	0.181	0.753	(0.572)
vidrio	0.930	0.019	0.911
ceramica	0.394	(0.466)	0.860
otros min	0.960	0.884	0.076
quimica	0.980	0.331	0.649
Prod metal	0.974	0.876	0.098
maq agr/in	0.985	(0.592)	1.577
maq ofic	0.685	(0.333)	1.018
mat electr	0.816	(0.181)	0.998
automov	0.996	(0.314)	1.310
oo ms tpte	0.686	0.797	(0.111)
carne	0.772	(0.645)	1.417
leche	0.883	(0.617)	1.500
oo. aliment	0.984	(0.591)	1.575
bebida	0.617	0.124	0.492
tabaco	0.827	0.593	0.235
textil	0.983	(0.009)	0.992
cuero	0.869	(0.301)	1.170
madera	0.985	(0.624)	1.608
papel	0.994	0.605	0.389
impresion	0.996	(0.405)	1.401
caucho	0.723	(0.079)	0.802
oo manuf	0.972	0.425	0.547
construcc	0.976	0.959	0.016
recuperac	0.534	0.325	0.209
comercio	(0.040)	0.895	(0.934)
restaurant	0.986	0.941	0.044
ferroc	0.287	0.414	(0.127)
tpte carret	0.058	0.177	(0.120)
tpte mar	0.768	0.699	0.069
tpte aereo	0.999	0.609	0.390
anexo tpte	0.048	0.792	(0.744)
comunicac	0.906	0.759	0.146
cred y seg	0.966	0.634	0.333
serv. empr	0.943	0.824	0.119
enseñanza	0.893	0.933	(0.040)
sanidad	(0.350)	0.716	(1.065)
oo serv p	0.993	0.920	0.073
AVERAGE	0.735	0.353	0.382

(Fig 3 did not transmit: AF)

### Figure 3

In table 1, I have collected another set of interest results. Taking into account that we can use the I-O apparatus in order to deriving other “values” (see for instance Cockshott, Cottrell and Michaelson, 1995), I have made this for the total stock of fixed capital (using the path opened by Leontief, 1953, 1956). I have correlated the time-series (for the years 1986/1991, which are the only ones from which I am been able to get so far my preliminary results) of unit labor-values and unit market prices (see column 1) and made the same for “capital-values” and market prices (column 2), and the difference between both of them seem very revealing (note that I am using unit values and prices, so that I am avoiding the problem of spurious correlation denounced by Freeman, 1997).

Fig 2 did not transmit: AF)

Finally, I have calculated the Mean Average Weighted Deviations (MAWD) and the Mean Average Deviations (MAD) between unit direct prices and unit market prices, on the one hand, and between unit production prices and unit market prices. The average magnitudes of these statistics (in the six years) are in the order of those computed previously by other authors (see Ochoa, 1984, Shaikh, 1995,

Chilcote, 1997) when calculated with equations (7) and (9), but are better when calculated with equations (13), which I have been so far able to do it only for 1987: MAWD and MAD for values and market prices are 0.133 and 0.189, but they are much better for production prices and market prices: 0.081 and 0.084 respectively, which by the way confirms the patterns expected by theory (see figure 1). However, the correlation between what we could call static and dynamic values is almost perfect at the empirical level, so supporting the idea that we must be allowed to use the traditional equations in this kind of works. The correlation coefficient between the two “w” -the traditional w, defined as in equation (7), and the dynamic one, defined as in equation (13)- is 0.974, and the coefficient for both production prices -corresponding to equations (9) and (13)- is an amazing 0.999999.

## Conclusions.

I have dealt in this paper with some aspects which could be of common interest for people working inside what I called above MIO (marxian input-output economics) and TVT (temporalist value theory). Referring to the studies developed in the first stream, Duncan Foley has recently written that “since replicable empirical regularities are rather rare in economics, the strong evidence these studies offer for a widespread coherence between embodied labor coefficients, prices of production and market prices is of indubitable scientific interest” (Foley, 1997, p. 45). I agree with that. But he adds: “Its exact theoretical significance and explanation, however, remains obscure. Some of the key figures in this tradition, for example, Shaikh, have not yet to my knowledge publicly discussed their views of the theoretical significance of this work in detail in relation to the issues addressed in this paper” (ibidem). May be Foley is right in this point as well, but I would like to instead raise here the question of how I see the relationship between the results I have presented in this paper and Shaikh’s views.

I agree with Shaikh in that prices of production “act as centers of gravity of actual market prices” and “are themselves dominated by the underlying structure of production, as summarized in the quantities of total (direct and indirect) labor time involved in the production of the corresponding commodities” (Shaikh, 1995, p. 1). But I have some remarks to do to the idea that his “approximation is the ‘vertically integrated’ version of Marx’s own solution to the transformation problem” (ibidem). I think this is partially true, in the sense he is using the modern correct mathematical procedures to compute values, but is also partially false, in the sense that it is only possible to apply the Leontief’s inverse if we use the same values and prices of production in both sides of their respective equations. My equations (13) show that equations (7) and (9) are not exact, but the empirical results I have so far obtained show that they are almost exact, because the correlation between static and dynamic values (and production prices) is almost perfect.

I do not know what is what Shaikh thinks about TVT, but knowing what he wrote about the “new interpretation” of Dumenil, Foley, etc., it is quite possible he is discarding it as a deeper involvement (because extended now to constant capital as well) with “Smith’s second definition of labor value as living labor commanded by price” (Shaikh and Tonak, 1994, p. 179). On the other hand, I do not know if TVT supporters think that my own interpretation of dynamic values fits with theirs. Some of them seem to believe that “simultaneous valuation and the exploitation theory of profits are incompatible”, and even ask if “simultaneist value theory”, which “plays no role in explaining the dynamics of capitalism”, has really “any role to play at all” (Kliman, 1998). As a final conclusion, I would say we all should pay more attention to each other’s arguments, so that I prefer to share Foley’s hope (Foley, 1997, p. 50):

“I also think this convergence of empirical method carries with it some hope for Marxist economic pedagogy. It should be possible for adherents of these different positions to teach their own and the alternative interpretations of Marx’s labor theory of value honestly and clearly as alternative theoretical foundations for a unified empirical practice that can yield important insights into capitalist reality”.

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