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AND RICARDO'S INVARIABLE MEASURE

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Off-print from « ECONOMIC NOTES », vol. 7 no. 2-3
Published by *Monte dei Paschi di Siena*

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In Ricardo's theory of value an important problem, as is well known, was to identify a commodity that could constitute an invariable measure of value¹.

To be perfect a measure should have had the characteristic of not varying with the variations of what had to be measured². It would have been compatible with such an aim that the unit of measure could vary, but its variations, from what has just been said, should not have depended on the variations of what had to be measured, and should, of course, be known³.

Following this general approach, Ricardo, in his writings on the theory of value, wanted to identify a commodity whose technical coefficients would always be the same, and which would be such that, its value, being invariable to changes of distribution, would be able to measure the variations of the values of other commodities, when the distribution of the product changed between wages and profits⁴. The aim of such a commodity was to isolate and measure the influence of distribution on those commodities which would be affected in their relative values by such a change⁵. Once this had been made possible by the invariable measure, the main cause of variations of relative values, i.e. the change of technical coefficient⁶, could be recognized and quantified⁷. Ricardo also allowed the technical coefficients of this commodity to vary, supposing the way that these variations took place to be known⁸.

* * *

The construction of Sraffa's standard commodity is well known and it will not be repeated here⁹. Suffice it to say that if we indicate with the symbol s such a composite commodity, taken at unitary level, and with

¹ See, for ex, Sraffa pag. xi.

² See Ricardo IV, pag. 361, 399, 400; IX, 356, 361.

³ See Ricardo IV, pag. 380, 399, 400.

⁴ See Ricardo I, pag. 44; II, pag. 29; IX, pag. 346.

⁵ Some commodities, those with the same temporal structure of the invariable measure of value, would not be hit by those changes. See Ricardo I, pag. 44; IV, pag. 386. The measurement of the variations relates to the commodities other than these ones. See Ricardo II, pag. 29.

⁶ See Ricardo I, pag. 45, pag. 59; VIII, pag. 142, 279; IX, pag. 152.

⁷ Ricardo does not seem to state this point explicitly. It could be derived from, for ex., Ricardo I, pag. 45; II, pag. 29; IX, pag. 178.

⁸ See Ricardo IV, pag. 382, 402.

⁹ See Sraffa chapters IV, V.

the symbol l_s the workers employed in order to produce it, one can identify its process of production as

$$s_s + l_s \rightarrow s$$

Suppose now the wage-commodities vector to be formed by v and give to s price 1. We can then calculate s_w , the quantity of s to be given to the workers of the s industry, from $l_s \cdot 1 \cdot s_w = v p_v$, where p_v indicates the vector of production prices. We then have

$$(1 \cdot s_s + l_s \cdot 1 \cdot s_w) (1 + r) = 1,$$

supposing that the wage-commodities vector is payed in advance. If there is a variation in the distribution and hence in the wage vector, that, for ex, is now greater in vector terms, there is no need for industry s to vary its price, which can still be equal to one. All that would happen in this industry, with the variation of distribution, is a change of s_w so that $l_s \cdot 1 \cdot s'_w = p'_v v'$, where the apex indicates the new situation. The above expression would then become.

$$(1 s_s + l_s 1 s'_w) (1 + r') = 1$$

The variations of prices that occur in the system of production of commodities, which we suppose to be indecomposable, i.e. made up only of basic commodities¹⁰, can then be measured in terms of a commodity whose price does not change when the distribution, and hence relative prices, changes. It should be noted that the price of commodity s is *not* invariable in relation to relative prices and their measurement because we have taken it as numeraire, both before and after the variations in distribution, a property that would not satisfy Ricardo's requirements, but rather that we have taken such a commodity as a numeraire, because its price does not need to change following those variations in distribution.

* * *

The standard commodity is a highly artificial construction. Can we consider it, in terms of its physical composition, given by the relative multipliers q_i , $i = 1 \dots n$, to be Ricardo's invariable measure? For Sraffa's standard commodity, as just defined, to be Ricardo's invariable unit of measure, once we can isolate and measure the effects of the variation of distribution on prices, we have to deal with the main cause of variations of prices, i.e. the facility or difficulty of production. The road we have travelled thus far is only a necessary preparation for the main task. The standard commodity, as defined so far, however, fails to do just this!

¹⁰ See Sraffa par. 6. Non basic commodities, in the sense of Sraffa par. 6, could be easily accommodated in the considerations that follow.

The change of technical coefficients of our original system, and hence of relative prices, in fact entails, a part from particular cases, a change of the physical composition of our commodity, which then varies with the phenomena that it should measure, contrary to Ricardo's intention. Our standard commodity s derives from our original system, previous to the change of technical coefficients, via a series of relative multipliers q_i , $i = 1 \dots n$ ¹¹. The standard commodity will then change physically in its composition when the technical coefficients of the other commodities change, because those relative multipliers will change¹². Ricardo's aim to find a measure that does not change with the variation of the phenomena, i.e. relative prices, that have to be measured cannot be satisfied¹³.

Nor the consideration of the variations of the technical coefficients of the standard commodity, allowed by Ricardo in his invariable measure, can enable us to deal with the above problem. The technical coefficients of the standard commodity in fact can change only if the technical coefficients of the original system change. The variation of the technical coefficients, allowed by Ricardo in his invariable measure, can then happen in the standard commodity only according to an equal proportional change in its coefficients, i.e. if all the technical coefficients of the original system change in the same proportion. Only in this case our standard commodity does not change its physical composition so that it does not change with the phenomena that it should measure. In this case, however, what happens is simply that all the prices of the other commodities change in the same proportion relatively to the standard commodity, so that with a physical unit of the standard commodity, of price 1, it is possible to buy $x\%$ more (less) of the other commodities, if all technical coefficients, and hence the technical coefficients of the standard commodity, diminish (rise) by $x\%$. This change in (absolute) prices does not interest the price relations of commodities other than the standard one. The above change of prices then does not refer to the generality of cases that we want to deal with, following Ricardo's steps.

Sraffa's standard commodity, as considered here, seems only to succeed in shifting the problem of the invariable measure from the variations of distribution (prices) to the variations of the technical coefficients (quantities). In dealing with Ricardo's problem, in the way followed so far, we can only either keep all the technical coefficients fixed and deal with variations of distribution, or keep the distribution fixed and deal with

¹¹ See Sraffa, *cap. IV*.

¹² The q_i multipliers have the task to proportionate the various industries in such a way that the sum of the various productive equations of those industries, taken in those proportions, will form a composite commodity to which the process of production indicated above in the text can be applied. If one (or more) of the technical coefficients of one (or more) industry changes, the relative proportions in which the industries are taken to form the composite commodity will change and the composite commodity will change its internal composition.

¹³ See, on similar lines, Mielelesì pag. 633. Roncaglia, pag. 79.

variations of technical coefficients. We cannot however deal simultaneously with the two problems as Ricardo's invariable measure should have done.

* * *

There is no reason, however, also in view of its artificiality, to consider the standard commodity, to be used as Ricardo's invariable measure, as a physical commodity of a given composition. We can simply identify and use it as an invariable measure, stating its general characteristics of having its composite outputs proportional to its inputs, independently of the particular composition that it could have at a certain period of time.

Let us now consider the problem of a change in relative prices of commodities that results from variations in the technical coefficients of these commodities. Due to these latter variations, as we have already seen, the physical composition of the standard commodity changes, i.e. the relative multipliers q_i , $i = 1 \dots n$, change. The change of these multipliers, however, can now be thought of as a known change in the technical coefficients of production of the standard commodity — which is now independent of its composition — in the same way as in Ricardo's perfect measure. We can then say, sharing Ricardo's viewpoint, that in our system of relative prices there are now changes due both to the change of technical coefficients of our measure, and to the change of the technical coefficients of commodities others than our standard measure¹⁴.

In order to solve Ricardo's problem of measuring the variations of prices due to facility or difficulty of production, when the technical coefficients of the invariable measure varied in a known way, we simply have to measure the influence of both these changes and attribute the observed variation of prices to their respective contribution.

We can calculate the effect on the system of prices that the change of the technical coefficients of the standard commodity, as defined in this paragraph, has had on the prices of other commodities, similarly to the case already seen (p. 126). Whereas, however, in the previous case the physical unit of our standard commodity had price 1, both before and after the change of technical coefficient, now our standard commodity — having changed its physical composition, but not its peculiar definitional characteristics of having its outputs proportional to its inputs — has price 1, after the change, being the standard commodity our numeraire, but its price, before the change, has to be calculated. This can be done considering the price that a commodity, of the same composition of our standard commodity, after the change of technical coefficients, would have had prior to the change, i.e. applying the previous system of prices to the new composition of our standard commodity. The difference between this price and the actual price of our standard commodity, which is equal to one, gives us, for example in percentage terms, the influence that the change of the technical coefficients

¹⁴ Of course the two changes are not independent, but this is not important for our present aim.

of our measure has had on relative prices. The remaining changes in the system of prices can then be attributed to the changes of the technical coefficients of the other commodities.

* * *

Of course, if, at the same time, there had been changes of distribution, these last ones would not affect our measure.

The possible various compositions of our standard commodity would not alter its property of being value invariant to changes in distribution, and consequently to changes of relative prices of other commodities due to this cause — although of course, the above shown calculations, related to change of wages from p_v to p'_v , could be quantitatively different, according to the different compositions of this invariable measure.

In presence of changes in the system of prices due both to changes of distribution and of technical coefficients, we can then calculate their respective influence using our standard commodity, as defined in the previous paragraph. Keeping constant the technical coefficients of our system, i.e. not considering the change due to the last cause, the change of prices due to the former cause can be calculated in terms of, say, the percentage change that the prices of the commodities exhibit, following our considered variation, in relation to the price of our standard commodity, unvaried in this case, both in its physical composition, and in its value. Keeping, at its turn, the distribution constant, the changes due to the variations of technical coefficients can be calculated using our standard commodity of a changed composition, in the way indicated above, taking into consideration the changes in the system of prices caused by the variations of the technical coefficients of our measure.

All the variations that we observe can then be broken down into the ones caused by I) change of technical coefficients of our measure, II) change of technical coefficients of the other commodities, III) change of distribution. In relation to the last phenomenon, our measure does not change its value.

Following Sraffa's construction and giving a wider meaning to the standard commodity than the one usually considered, we can construct a measure that, even if it does not satisfy Ricardo's strong requirements of having constant technical coefficients, is such that its technical coefficients and their changes can be known independently of the variations of relative prices (which are the phenomena that we want to measure). We can thereby satisfy Ricardo's weaker requirements about his measure and conclude that the standard commodity, as defined in the last paragraph, would constitute Ricardo's (variable in a known way) perfect measure.

* * *

At this point, however, it should be recognized that this (weak) solution to Ricardo's problem also implies the cancelling of it. The way that

Ricardo dealt with changes of relative prices was a complicated and unnecessary one. By using *any* arbitrary numeraire we are able to decompose, given the relevant information, the variations of relative prices of an economic system, characterized by a uniform rate of profit, into those due to variations of distribution and those due to variations of technical coefficients. All that the use of *any* numeraire further implies, compared to Ricardo's measure in presence of variations of technical coefficients and distribution, is that, contrary to Ricardo's measure, we have to calculate the change in the system of prices due the effect of variations of distribution on the price of our unit so as to consider these changes together with the variations allowed to happen in Ricardo's measure (i.e. those seen above due to the change of technical coefficients of his measure). This can obviously be done on identical lines as seen above. Ricardo's way of dealing with these problems was unduly influenced by his findings in value theory.

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