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Abstract

The purpose of this paper is to contribute to an interpretation of Ricardo's theory of foreign trade following the lead of Sraffa's own 1930 critique of Ricardo's alleged error and recently developed by other Sraffians. We argue that Ricardo assumed that trade happened at natural prices in each country. And once we take the process of gravitation towards those prices into account it follows that : (i) Ricardo's theory is not incomplete, but fully determined so there is no need for price elastic *demand functions*, contrary to what John Stuart Mill argued; and (ii) in the simple cases of the examples of chapter 7 of Ricardo's Principles, the terms of trade are determined by the ratio of the given actually traded levels of reciprocal *effectual* demands.

Keywords: Ricardo, Comparative Costs, Foreign Trade

JEL Codes: B12, B17, B24

I Introduction

The purpose of this paper is to contribute to a Sraffian interpretation of Ricardo's theory of foreign trade put forward by recent works such as Faccarello (2015), Kurz (2015) Maneschi (2004, 2008, 2014) and particularly Gehrke (2015, 2017). The usual interpretation of Ricardo's theory of foreign trade, be it Neoclassical (Marginalist) (Chipman, 1965) or Heterodox (Maneschi, 1998), is that Ricardo's theory is incomplete for it does not determine the equilibrium terms of trade, and that the "closure" to the theory is only made possible through reciprocal demand functions – elastic in respect to relative prices - for each good. The origin of this interpretation is found in J.S. Mill (1967 (1844), 1965 (1848)), where Mill states that Ricardo's theory would be incomplete and that only by adding demand functions, we can determine the equilibrium of the model. Mill's interpretation became the standard interpretation of Ricardo's theory on foreign trade and spread the idea that demand functions are necessary to determine terms of trade governed by "comparative advantages".

The Sraffian interpretation is based on Sraffa's 1930 paper *An Alleged Correction of Ricardo* (ironically rediscovered by a neoclassical economist Ruffin, 2002). Sraffa argued that in Ricardo's example of cloth and wine trade in chapter 7 of the *Principles*, the quantities of labor taken as given magnitudes are not labor coefficients, but the *total* quantities of labor that a country exchange with one another (and, thus, the gains from trade can be directly calculated from these numbers). Gehrke (2017) argued that, since these total quantities of labor actually traded must be the labor coefficient multiplied by the quantity actually traded - and since the labor coefficients are given because the available methods of production are given in Ricardo's theory - then Sraffa's reasoning must imply that, for the total quantities of labor actually traded to be given, the quantities of each commodity actually traded must also be given in Ricardo's example.

To this , our own purpose here is to add that these given quantities actually traded, however, are not arbitrary but are necessarily the given actually traded effectual demands of products being traded ("actually" because , as we explain below, they should be net of the part of these that may be supplied domestically by superior coexisting techniques, if that happens to be the case). As Ricardo assumes that trade occurs at natural prices in each economy, this means that the gravitation of market prices towards natural prices

makes quantities traded between countries – which are quantities brought to the market - adjust to their respective levels of effectual demands. Thus, gravitation ensures that there is no room for other quantities to be traded other than those effectual demands. And this means that the terms of trade in balanced trade position will be entirely determined by the reciprocal of those effectual demands. Moreover, through the condition of balanced trade, the reciprocal levels of effectual demands affect the value of money in each country (and thus their relative money wages) and therefore the monetary cost of production and natural price in terms of money of the exporting countries. In short, we argue that: (i) Ricardo's theory is not incomplete, but fully determined; and (ii) that in the simple case of exchange involving two goods as in Ricardo's examples of chapter 7, the terms of trade are determined by the ratio of the given actually traded levels of reciprocal effectual demands. There is no need for price elastic demand functions.

The rest of the paper is organized as follows. In section II we present a brief overview of both the conventional interpretation of Ricardo and the recent Sraffian interpretation. In section III we discuss the process of gravitation that guarantees that quantities traded move towards the reciprocal effectual demands in a simple trade of barter. In section IV we examine how the international flows of money distribute gold among countries and ensure that money prices in each country are adjusted to obtain balanced trade. In section V, we discuss Ricardo's famous example of trade between cloth and wine trade (both being luxury goods). In section VI we extend the ideas put forward in the previous section but to the example where there is trade in a wage good – corn - and how it affects distribution as well as the possibility of partial specialization. Section VI concludes with brief final remarks.

II Interpretations of Ricardo's Theory of Foreign Trade

The reason for Mill's interpretation of Ricardo's supposedly incompleteness is that he considers, in the classic example of trade involving cloth and wine in Chapter 7 of the *Principles*, that Ricardo provides only unit labor costs, which are not sufficient to determine the terms of trade. In chapter 7, Ricardo explains the basics of his theory through a numerical example, where England and Portugal exchange cloth and wine. According to Mill, in his example, Ricardo provides the unit labor costs in each country to produce each commodity and compares these costs to determine which country would have an advantage in producing and exporting which commodity. Unit labor costs determine only the conditions for trade, and since Ricardo assumes equilibrium in the Balance of Payments (BP), equilibrium terms of trade should consider quantities imported and exported. Mill then proceeds to introduce these quantities traded in *equilibrium* through relative price-elastic reciprocal demand functions.

Ruffin (2002) had the merit of "rediscovering" Sraffa's 1930 paper (*An Alleged Correction of Ricardo*), where Sraffa argues that in Ricardo's numerical example the quantities of labor are the total quantities of labor and not labor coefficients. Some Sraffian authors recognized the importance of Ruffin's contribution (Kurz, 2015; Gehrke, 2015, 2017; Faccarello, 2015; Maneschi, 2004, 2008, 2014). Ruffin's interpretation, however, has a number of problems and ends up incorrectly treating the equilibrium terms of trade as determined by the marginalist forces of supply and demand, but these difficulties have been thoroughly cleared up by Gehrke (Gherke, 2015)

A common feature shared by the Sraffian interpretation of Ricardo's example (based on Sraffa, 1930) is to consider that if the numbers in it represent the given total quantities of labor exchanged, then the quantities of the products actually traded must also be given, since total quantities of labor are the labor coefficients multiplied by quantities traded.

Faccarello (2015) correctly points out that Sraffa's interpretation allows for rejecting Mill's idea that reciprocal demand *functions* are necessary to determine terms of trade. Notwithstanding, Faccarello states that: "A first difficulty ensues from the fact that the initial exchange ratio [...] is taken for granted. But this relative price is assumed, not explained." These given terms of trade are interpreted as given arbitrary magnitudes,

which imply that, although the quantities actually traded are given (and are sufficient to determine the gains from trade), they are not explained by the theory.

Gehrke (2017) follows a similar reasoning. After stating that: “The given terms of trade in Ricardo’s example are not halfway between the autarky price ratios, but rather simply refer to a situation of balanced trade,” he says:

“Ricardo's exposition leaves no room for a determination of international values by reciprocal demand, because the terms of trade were considered by Ricardo to be governed by the monetary production costs of the exported and imported commodities, which are liable to change with the change in the quantities traded, in a situation of balanced trade.” (Gehrke, 2017)

Given the condition of balanced trade and the adjustment towards this position through changes in the value of money – through inflows and outflows of gold - monetary costs of production are endogenous in Ricardo’s theory and are in fact the result of balanced trade, which only happens after the terms of trade are known. In a situation of balanced trade, the value of money is the result of the process that distributes gold among countries and is determined by quantities of labor actually traded, which must be determined not only by the methods in use and the given real wage, but also by the physical quantities actually traded.

But unlike Gehrke, we think that these quantities are not arbitrary. The process of gravitation of market prices towards natural prices in each country (Garegnani, 1983) implies that they adjust to and are determined by the given levels of effectual demands for each product.

III The Gravitation of Quantities Actually Traded Towards the Reciprocal Effectual Demands

In Ricardo's theory of distribution and relative prices, market prices adjust towards natural prices through the mechanism of capital mobility (within each country, as Ricardo assumes there is no international mobility of capital) in which the quantities brought to the market adjusts to the respective effectual demands. Therefore, whenever two countries trade, if the quantities exported and imported (quantities brought to the market) are different from their respective effectual demands, in each country, the market price of the exported commodity will deviate from its natural price, and internal profit differentials will appear. Under free domestic capital mobility, capital will move across different domestic industries until profit differentials are eliminated. This, as it is well known, will happen only when the quantities brought to market are equal to the effectual demands in every sector, including the one that produces the commodity that is exported. This can be illustrated in a simple case of a trade of barter involving two commodities in two countries.

Suppose that England and Portugal trade two commodities, where England exports cloth and Portugal exports wine. In a trade of barter, a quantity of wine imported by England must be paid for with a quantity of cloth exported to Portugal, which means that a trade of barter is always represented by a situation of balanced trade. But if the quantities traded are arbitrary, it is most likely that there will be a mismatch between the quantity of a certain commodity brought to the market and its effectual demand.

Let us assume that initially there is excess demand for cloth in England. In this case, its market prices will be above its natural price, and the capitalists who export this commodity will earn profits at a rate higher than the natural rate of profits. But eventually other capitalists in England will decide to produce and export this commodity as well, which will increase the quantity brought to the market (quantity exported) and decrease its market price until it reaches its natural price and the quantity brought to the market equals its effectual demand. The same process would happen in reverse if the quantity brought to the market is initially higher than the effectual demand for English cloth, with market prices falling and quantity brought to the market decreasing to bring the market prices up to the natural price. The same type of process would be happening in Portugal,

for any given excess or shortage of the quantity brought to the market relative to the effectual demand for wine. It is then the gravitation of market prices towards natural prices inside each of the two countries that ensures that the quantities traded will be always gravitating towards their respective effectual demands.

Throughout the Principles, Ricardo always assumes that this process of gravitation has already occurred when he discusses his theory of foreign trade. In chapter 28, Ricardo makes it clear: “[...] it is the *natural* price of commodities in the exporting country, which ultimately regulates the prices at which they shall be sold, if they are not the objects of monopoly, in the importing country” (Ricardo, 1951(1821), vol. I, ch.28, p.375, our emphasis). It is clear that commodities can only be sold at their natural price once the adjustment of realized rates of profits towards natural profits has taken place.

In this trade of barter, where a quantity of cloth must be paid for with a quantity of wine, the terms of trade are necessarily equal to the ratio of reciprocal quantities actually traded. But, when quantities brought to the market (quantities exchanged) adjust towards their respective effectual demands, this ratio is then uniquely determined by the ratio of reciprocal effectual demands. Thus, gravitation makes the price of cloth relative to wine in a trade of barter equal to the ratio of the effectual demand for wine in England relative to the effectual demand for cloth in Portugal:

$$\frac{p_1}{p_2} = \frac{D_2^E}{D_1^P} \quad (1)$$

Where p denotes the natural prices and D the effectual demands. The subscripts 1 and 2 stand for cloth and wine respectively and superscripts E and P mean England and Portugal.

Note however, that Ricardo’s reciprocal effectual demands were *not* price elastic demand functions that changed with relative prices, as in J.S. Mill and in the traditional neoclassical interpretation of Ricardo’s trade theory but the demand of those who are willing to pay the natural price. The latter is always taken by Ricardo as given during the gravitation process, even in the presence of a new technique caused by innovation or the need the use land of a lower quality, situations that lead to a permanent change in the

natural price (Garegnani, 2007). We consider that he consistently does the same also in his analysis of foreign trade.

IV The Monetary Adjustment Mechanism and the Value of Money

In the previous section above, we simplified our description of foreign trade as a trade of barter in order to isolate the mechanism of gravitation towards natural prices. But, of course, foreign trade is not a trade of barter and involves money. If there is money, exchanges can occur outside the equilibrium of balanced trade, where not only cloth and wine are used to pay for imports and exports, but also gold inflows and outflows. These out of equilibrium exchanges constitute a redistribution of gold between countries. The process of redistribution of gold lasts to the point where each country holds the amount of gold it must own and the exchange between countries takes place as if it were a trade of barter. According to Ricardo:

“Money, from its being a commodity obtained from a foreign country, from its being the general medium of exchange between all civilized countries, and from its being also distributed among those countries in proportions which are ever changing with every improvement in commerce and machinery, and with every increasing difficulty of obtaining food and necessaries for an increasing population, is subject to incessant variations.” (Ricardo, 1951(1821), vol. I, ch.1, p.48)

For Ricardo, the adjustment of gold distribution among countries is independent and happens after the gravitation process towards natural prices has taken place. Thus, Ricardo discusses changes in money prices considering they stem purely from monetary phenomena, that affect all money prices simultaneously in a country, always assuming that market prices are already equal to natural prices.

When two countries decide to trade, there is a change in the relative prices in each country, which changes the proportion that each should own of the world gold. This leads to a redistribution of gold between England and Portugal. To illustrate how this redistribution of gold occurs, let us assume a very simple case. Suppose that initially, countries do not trade and the gold distribution between England and Portugal is in equilibrium. At the same time, suppose that money prices in pounds of both cloth and wine are lower in Portugal. If the capitalists of both countries decide to trade, Portugal will produce and

export both cloth and wine, since the money price of both commodities is lower in Portugal. In this case, England imports the two commodities paying for them with gold exported to Portugal. Thus, the balance of payments is described as:

$$X_g = p_1 D_1^E + p_2 D_2^E \quad (2)$$

where X_g is the gold flow from England to Portugal. On the right side of the equation is the total value of English imports, which are made up of cloth and wine. The gold flow from England to Portugal causes prices in pounds to fall in England and rise in Portugal (given fixed exchange rates in the two countries). Throughout this process, commodities become cheaper in England and more expensive in Portugal. This occurs up to the point where some commodity becomes “cheap” as to allow for England to export it. The “first” commodity to become competitive in England is the commodity which is comparatively cheaper, cloth. Obviously, when this happens, Portugal starts to export only wine, because the increase in prices in Portugal makes the “first” commodity to lose competitiveness is the comparatively more expensive commodity. In this way, the prices in pounds in the two countries were adjusted until England began to export cloth and Portugal, wine.

In this case the *equilibrium* is restored, where each country has its equilibrium proportion of world gold and trade between the two countries acts as a trade of barter. The adjustment always takes place through money prices in the two countries. Let us assume another initial condition. Suppose England exported cloth and Portugal, wine, but at a different proportion than the equilibrium one. Suppose that the value of English cloth exports is not sufficient to pay for the import of Portuguese wine and that, therefore, Portuguese wine must be paid for with both cloth and gold. Thus, the balance of payments becomes is:

$$X_g + p_1 D_1^P = p_2 D_2^E \quad (3)$$

The gold outflow from England to Portugal causes prices in England to fall and prices in Portugal rise. This makes English wine imports more and more expensive. At the same

time, the fall in the price of cloth makes increasing amounts of gold necessary to pay for the total value of imports. The fall in prices in England causes both commodities, cloth and wine, to become competitive. Consequently, Portugal begins to import English cloth and wine, paying for these goods with gold. In this new configuration, Portugal imports both goods from England, as the flow of gold from one country to another caused Portugal to lose competitiveness in all goods, while the opposite occurred in England. When this occurs, the balance payments turns to:

$$p_1 D_1^P + p_2 D_2^P = X_g \quad (4)$$

where Portugal pays for all its imports with gold. Just as in the first example of the adjustment of the trade balance, the flow of gold from Portugal to England increases English prices while reducing Portuguese prices, to the point where England ends up producing and exporting cloth and Portugal begins to produce and export wine. From any initial situation, the gold flow between countries adjusts money prices to the point where the distribution of gold is in equilibrium between countries and the foreign trade operates as if it were a trade of barter.

When countries decide to trade, it is as if wine was produced through cloth in England (and the opposite in Portugal). It would be the equivalent of developing a more efficient method of producing a commodity, producing a cheaper one and trading it in the international market. This relative price movement leads to a new configuration of gold distribution in the world, which generates capital flows between countries. This results in a process of money price adjustment.

In Ricardo's monetary theory¹, the *equilibrium* distribution of gold between countries is such that each country has a given proportion of gold and there are no flows of gold between countries. This means that in equilibrium, gold is not used to buy other commodities. The absence of gold flows in equilibrium means that in the case of our

¹ For a more thorough explanation of the interpretation of Ricardo's monetary theory we follow here, see Takenaga (2013) and Bhering (2017).

example, cloth must be paid for with wine. Therefore, for each country it must be true that the value of imports is paid for with the value of exports. This equilibrium condition can be written as:

$$p_1 D_1^P = p_2 D_2^E \quad (5)$$

On the left side of the equation we have the value of English exports, where the quantity of cloth exported is determined by the Portuguese effectual demand for cloth. Conversely, the value of English imports is determined by the price of wine multiplied by the English effectual demand for wine. In this simplified case involving two commodities, the *only* price of cloth relative to wine compatible with balanced trade is the ratio of actually traded given reciprocal effectual demands given by our equation (1) where we represented a trade of barter.

This allows us to understand why Ricardo argued that the value of money was different between rich and poor countries. From chapter 28: “[...] estimated in corn, gold may be of very different value in two countries. I have endeavoured to shew that it will be low in rich countries, and high in poor countries [...]” (Ricardo, 1951 (1821), vol. I, ch. 28, p. 377). This is explained in chapter 7:

“If [...] Poland should be the first to improve her manufactures, [...] she would obtain an additional quantity of gold in exchange for this commodity, which would operate on the price of her corn, cattle, and coarse clothing [...] and money would be permanently of lower value in Poland than in England. If, on the contrary, the advantage of skill and machinery were possessed by England, another reason would be added to that which before existed, why gold should be less valuable in England than in Poland, and why corn, cattle, and clothing, should be at a higher price in the former country. These I believe to be the only two causes which regulate the comparative value of money in the different countries of the world [...]” (Ricardo, 1951 (1821), vol. I, ch. 7, pp. 144-45)

Rich countries, having acquired some advantage in technology through the employment of more productive methods, would tend to have an absolute advantage in the production of many commodities where these innovations took place. However, these commodities would probably be exported due to their lower price. Other poorer countries would purchase these goods with outflows of gold, which would invade rich countries' markets and operate on money prices till prices raise to the point where foreign trade is regulated by comparative costs. The result is that the money prices will be higher in rich countries and lower in poorer countries.

V Ricardo's Example of Trade in Luxuries

In chapter 7, before explaining what and how trade between two countries is determined, Ricardo argues that: “The same rule which regulates the relative value of commodities in one country, does not regulate the relative value of the commodities exchange between two or more countries.” (Ricardo, 1951 (1821), vol. I, ch.7, p.133). The rule which Ricardo refers to is the ratio of embodied labor between two commodities. The reason for this is that Ricardo assumes that there is no mobility of capital and labor between countries in order to equalize the rates of profit and wages between countries. For Ricardo, an English capitalist does not employ his capital in Germany, even though the rate of profit there could be higher, because of institutional and cultural differences between the two countries. According to Ricardo:

“Experience, however, shews, that the fancied or real insecurity of capital, when not under the immediate control of its owner, together with the natural disinclination which every man has to quit the country of his birth and connexions, and intrust himself with all his fixed, to a strange government and new laws, check the emigration of capital. These feelings, which I should be sorry to see weakened, induce most men of property to be satisfied with the low rate of profits in their own country, rather than seek more advantageous employment for their wealth in foreign nations.” (Ricardo, 1951 (1821), vol. I, ch.7, p.136-7)

Consequently, since there is no mobility of capital and labor force between two countries, we cannot take profit rates as equals or real wages. Thus, the price of one commodity relative to another, in different countries, can no longer reflect quantities of embodied labor as this rule would prevail only for domestic relative prices within an economy. Thus, the process of gravitation that guaranteed a uniform rate of profit within countries is no longer true for the whole world.

The classic example of the exchange between England and Portugal for cloth and wine refers to trade in luxuries, as pointed out by Gehrke (2015). Neither cloth nor wine enter the workers' real wage basket of consumption. At the beginning of chapter VII, Ricardo states:

“It has been my endeavor to shew throughout this work, that the rate of profits cannot be increased but by a fall in wages, and that there can be no permanent fall of wages but in consequence of a fall of the necessaries on which wages are expended. [...] The rate of wages would not be affected, although wine, velvets, silks, and other expensive commodities should fall 50 per cent., And consequently profits would remain unaltered.” (Ricardo, 1951 (1821), vol. I, ch.7, p.132)

In other words, trade between cloth and wine does not affect the rate of profit because it is not an exchange involving wage goods².

Suppose that England and Portugal know how to produce both wine and cloth. However, the cost of producing wine in terms of cloth in Portugal is lower than in England, i.e. the price of wine in terms of cloth is lower in Portugal. Within each country we measure any relative price as a ratio of quantities of embodied labor, because in each country the rate of profit is uniform across industries and workers receive the same wage (and also reasons as if only unassisted labor is being used, see footnote 4 below). To better illustrate the example, let us show the price system that would reflect only the production methods available in each country, that is, without trade between countries. Suppose each country produces corn (wage good), cloth and wine. Thus, natural prices are represented as³:

$$p_i^j = w^j l_i^j (1 + r^j) \quad (6)$$

² Kurz provides a different interpretation, treating cloth as a wage good and wine as a luxury good: “[...] the two products under consideration, cloth and wine, stand for two types of commodities that perform different roles in the economic system: while cloth is a ‘necessary’ or wage good, wine is a ‘luxury’” (Kurz, 2015, p. 25).

³ Following Gehrke (2013), we represent normal prices in Ricardo’s theory as if production used only unassisted labor. Of course, Ricardo was well aware that production required both direct labor and indirect labor (capital goods). However, since Ricardo treated all advanced capital as wages paid in the same period (which allowed him to determine relative prices as ratios of quantities of embodied labor), the only way to represent his theory in a formally consistent manner is to treat it as if production required only unassisted labor.

Where $i = \{1,2,c\}$ and $j = \{E,P\}$. Here, c is corn. Nominal wages in each country can be described as:

$$w^j = p_c^j b_c^j \quad (7)$$

Where the nominal wage is the quantity of corn consumed by the workers (subsistence wage) of each country multiplied by the monetary price of corn. Combining the price system described above with the wage equations, the rate of profit of each country can be determined by the levels of the real wage and the unit labor coefficient of corn (the product of these variables being the wage share) as:

$$r^j = \frac{1 - b_c^j l_c^j}{b_c^j l_c^j} \text{ or } 1 + r^j = \frac{1}{b_c^j l_c^j} \quad (8)$$

Within each country, the price of one commodity relative to another is given by the ratio of quantities of labor. If we were to determine, for example, the price of cloth in relation to wine in England, we would have:

$$\frac{p_1^E}{p_2^E} = \frac{w^E l_1^E (1 + r^E)}{w^E l_2^E (1 + r^E)} = \frac{l_1^E}{l_2^E} \quad (9)$$

By stating at the beginning of the section that the price of wine relative to cloth in Portugal is cheaper than in England (which is equivalent to saying that cloth is cheaper than wine in in England) we are saying, in terms of our equations, that:

$$\begin{aligned} l_1^E &< l_2^E \\ l_1^P &> l_2^P \end{aligned} \quad (10)$$

That is, the relative price of a commodity within each country reflects the difficulty of producing each commodity. If England produces cloth and exports it to Portugal in exchange for Portuguese wine, the ratio of exchange between the two commodities will be:

$$\frac{p_1^E}{p_2^E} = \frac{w^E l_1^E (1 + r^E)}{w^P l_2^P (1 + r^P)} \quad (11)$$

Since neither wages nor profit rates are equal between the two countries, the exchange ratio between commodities can no longer reflect quantities of labor. It is for this reason that Ricardo asserts at the beginning of chapter 7 that the rule that applies to explain relative prices within each country does not apply to the case of exchange between two countries. If England and Portugal exchange cloth for wine, the relative price of these commodities should reflect the nominal wages in each country, the quantities of labor and the rates of profit. However, only relative costs do not tell us under what conditions there will be international trade, nor whether the capitalists of both countries will actually have an incentive to exchange cloth for wine.

For an English capitalist to decide, instead of producing cloth and wine, to produce only cloth and to exchange it for wine, the price of the cloth relative to wine must be greater than the relative price which would prevail in autarky. That is, the exchange ratio of cloth for wine must be greater than the relative price of cloth for wine in England. In the same way, a Portuguese capitalist will only produce and export wine if he sells it with some profit. When England exports cloth, the price of cloth exported in pounds must be greater than the price of cloth produced in England and less than the price of cloth produced in Portugal. At the same time, Portugal must sell wine at a higher price to England, which must buy at a lower price than if it were to be produced domestically. That is to say:

$$\begin{aligned} p_1^E &> p_1 > p_1^P \\ p_2^P &> p_2 > p_2^E \end{aligned} \quad (12)$$

The relations above in (12) mean that, for countries to trade, the terms of trade must lie within this interval:

$$\begin{aligned} \frac{p_1^E}{p_2^E} &> \frac{p_1}{p_2} > \frac{p_1^P}{p_2^P} \\ \frac{p_1^E}{l_2^E} &> \frac{p_1}{p_2} > \frac{p_1^P}{l_2^P} \end{aligned} \quad (13)$$

The terms of trade must lie between the relative prices of producing cloth relative to wine in both countries. Since we know the methods available in each country, we know that if countries trade, trade must necessarily be characterized by England producing and exporting cloth and Portugal producing and exporting wine. The opposite cannot be true, since cloth is cheaper than wine in England compared to Portugal. In deciding not to produce wine and to produce only cloth and export it, an English capitalist “produces” wine more efficiently, for he now “produces” wine through cloth. Of course, as wine costs more relative to cloth in England, England could never “produce” cloth through wine.

The unit labor costs of each country therefore only provide the conditions that make foreign trade profitable to the capitalists of each country. Given these cost differentials, depending on the terms of trade, cloth and wine can be “produced” more efficiently. As we have seen in section III above, the equilibrium terms of trade are determined as if a trade of barter through the ratio of given reciprocal effectual demands. In this trade of barter, the condition for “a profitable trade of barter” is:

$$\frac{l_1^E}{l_2^E} > \frac{D_2^E}{D_1^P} > \frac{l_1^P}{l_2^P} \quad (14)$$

In condition (14) all the variables are exogenous and, therefore, there is no mechanism that guarantees that the ratio of effectual demands is actually within the interval. If this condition is not satisfied, it will not be advantageous for the capitalists of each country to trade. The difference in costs between countries does not mean that countries will necessarily trade commodities, as it depends on the relation between the ratios of effectual demand and unit labor costs.

We must now understand how the prices determined by the price equations are comparable with the terms of trade determined by the ratio of effectual demands. If England and Portugal exchange cloth for wine, the price of the cloth relative to wine should be:

$$\frac{p_1^E}{p_2^P} = \frac{w^E l_1^E (1 + r^E)}{w^P l_2^P (1 + r^P)} \quad (15)$$

If we substitute the ratio of reciprocal effectual demands in equation (15) and simplify using (8), the value of money in England relative to the value of money in Portugal, as the result of the adjustment towards balanced trade, can be expressed by the ratio of money prices of corn between the two countries⁴:

$$\frac{p_c^E}{p_c^P} = \frac{l_c^E}{l_c^P} \cdot \frac{l_2^P D_2^E}{l_1^E D_1^P} \quad (16)$$

Where the money price of corn in England relative to the money price of corn in Portugal is equal to the ratio of quantities of embodied labor in the production of corn in each country multiplied by the ratio of total quantities of labor actually traded⁵. More generally, if workers consumed not only corn, but a set of different commodities, the value of money between countries would be determined by the ratio of money wages:

$$\frac{w^E}{w^P} = \frac{\sum b_i^E l_i^E}{\sum b_i^P l_i^P} \cdot \frac{l_2^P D_2^E}{l_1^E D_1^P} \quad (17)$$

Where the sums of bl , are the wage share in the product of each country. In other words, given the normal price equations and equilibrium terms of trade as the ratio of effectual reciprocal demands, the adjustment variable is the nominal wage in each country. For a given nominal exchange rate between pounds and escudos, this adjustment means an adjustment of the price of corn in pounds and the price of corn in escudos. This would be somewhat similar to an adjustment of the “real exchange rate”, however, as we follow Ricardo and do not use price indices, there is no such concept. In the simple example where corn is the only wage good, the price level of corn in each currency is adjusted so

⁴ In chapter 7, Ricardo uses the money price of corn as a measure for the value of gold (and, thus, the value of money): “This difference in the value of gold, or which is the same thing, this difference in the price of corn in the two countries [...]” (Ricardo, 1951 (1821), vol. I, ch. 7, pp. 144).

⁵ The total quantities of labor actually traded are also used to calculate the gains from trade in each country. The gain from trade is the difference between the total quantity of labor used in the production of commodities in autarky and if commodities are imported. For England the gain is $l_2^E D_2^E - l_1^E D_1^P$ and, for Portugal, it is $l_1^P D_1^P - l_2^P D_2^E$.

that the nominal wage is adjusted and money prices reflect the equilibrium established by the condition of balanced trade.

At the end of Chapter 7, Ricardo comments that if there were no perfect convertibility of gold with paper in circulation, there would be a change in the nominal exchange rate. In fact, a change in the amount of gold in circulation due to the adjustment of the trade balance that is not accompanied by a change in the paper in circulation leads to a different nominal exchange rate. In any case, the adjustment takes place either through movements in all money prices or in the nominal exchange rate. If gold is perfectly convertible, prices adjust, if gold is not convertible, the nominal exchange rate adjusts.

This adjustment via money prices, however, does not affect distribution in this example. As it deals with trade involving two luxury goods, neither real wages nor profit rates change with the introduction of trade between countries. The same principle that was true in chapter 1 is true here: “profits depend on wages”. As we shall see in section VI, trade will affect distributive variables insofar as it includes the exchange of wage goods.

VI Ricardo Against the Corn Laws: Trade Involving a Wage Good

In chapter 28 of the *Principles* and in his 1815 work *An Essay on the Effects of a Low Price of Corn on the Profits of Stock (Essay on Profits)*, Ricardo considered trade involving corn, a wage good. Ricardo used this case to advocate against the Corn Laws in England, which prohibited corn to be imported. According to Ricardo, the prohibition compelled English capitalists to produce the whole corn demanded domestically. Given the scarcity of more productive and fertile lands in England, corn production had to resort to use both more fertile lands (good lands) as well as less productive lands (bad lands). The difference in land productivity is measured by the difference of labor used in the production of corn in each type of land. Good lands use less labor than bad lands.

Competition ensured that profits were the same in all activities and that there was only one price of corn. This led to a situation where the natural (uniform) rate of profits was determined in the less productive lands (land that pays no rent), while capitalists who used the good lands paid a rent to land owners determined by the difference in productivity. If England could import cheap corn from France, English capitalists would not have to resort to corn production in bad lands and, thus, the greater amount of labor required to produce corn in these lands would not result in a lesser rate of profits. The increased rate of profits allowed by foreign trade would, then, through Say's Law, produce a higher rate of accumulation. This is the basic argument put forward by Ricardo against the Corn Laws.

As we investigate this case, two results are noteworthy. First, the rate of profits in England is affected by foreign trade, since it depends on the price of corn, which is imported. Second, the existence of more than one method to produce corn in England allows for either partial specialization or full specialization, depending on relative prices in both countries.

First, we deal with England's situation in autarky. As we referred to above, if England produces corn using both good lands and bad lands, the normal rate of profits is determined by the "difficulty of production" in the land that does not pay rent. Let us call technique I the method employed in good lands, which uses less labor per unit of output

than technique II, which is the method employed in less productive lands. The rent paid by capitalists to land owners of more fertile lands is determined by the difference in costs of production when the price of corn produced in both lands is the same. In autarchy, the rate of profits in England is determined by:

$$r^E = \frac{1 - b_c^E l_c^{E(II)}}{b_c^E l_c^{E(II)}} \quad (18)$$

And the rent on land:

$$\rho = \frac{l_c^{E(II)} - l_c^{E(I)}}{l_c^{E(II)}} \quad (19)$$

Where the superscripts (I) and (II) denote methods I and II and ρ is the rent paid to land owners. In France, since there is only one method to produce corn and corn is always produced domestically, its rate of profits is determined by the same relation that determined each country's rate of profits in the previous section.

If England could produce corn using only the more productive method, there would be no rent and the rate of profits would be determined by the difficulty of production of employing only method I. But this is not allowed by a scarcity of good lands in England. In France, on the contrary, good lands exist in abundance. The more fertile lands in France can meet the whole effectual demand both in England and domestically at a lower cost⁶. English capitalists would then find it profitable to import corn from France in exchange for cloth, which England produces with comparatively less labor.

⁶ This abundance in more fertile lands in France also meant, for Ricardo, that the difficulty of producing corn in France would probably not vary according to the effectual demand for it. In Ricardo's words: "If at this time, the prohibition of importation were removed, corn would fall in the English market [...] ultimately and permanently to the natural price of France [...] and it would remain at this price, whether England consumed a hundred thousand, or a million of quarters." (Ricardo, 1951(1821), vol. I, ch. XXVIII, p.374-5).

Of course, as discussed in the section III above, this is only possible if the price of corn sold to England is higher than the one existing in France and that cloth is sold at a higher price than it is sold in English markets. This means that terms of trade must lie in the profitable interval defined by the price of corn relative to cloth in France and in England. Here, for this interval, the autarky price of corn relative to cloth in England is the ratio of the labor quantity employed in the less fertile lands relative to labor employed in cloth production, since, in autarky, England must produce corn using bad lands as well:

$$\frac{l_c^F}{l_1^F} < \frac{p_c}{p_1} < \frac{l_c^{E(II)}}{l_1^E} \quad (20)$$

There are two possibilities, one that leads to partial specialization in England and another that leads to full specialization. If technique I in England produces corn with less labor than in France, it is still profitable to produce corn in England using only more fertile lands. This means that, in this case, England would import only a fraction of its total effectual demand for corn, comprising exactly of that portion that cannot be satisfied by production employing method I. Thus, the ratio of traded effectual demands is defined by the ratio of France's demand for cloth relative to this fraction of England's demand for corn. Here, the quantities actually traded do not comprise of England's whole effectual demand for corn, only a fraction of it. If this ratio lies inside the profitable interval, countries trade. In this case, costs would be described as:

$$\frac{l_c^{E(I)}}{l_1^E} < \frac{l_c^F}{l_1^E} < \frac{l_c^{E(II)}}{l_1^E} \quad (21)$$

Here, there is only partial specialization, for England would meet its effectual demand for corn with a combination of both corn produced domestically and corn imported from France. As in the wine and cloth example, the possibility of foreign trade can be interpreted as the introduction of a new method of production, where one commodity is produced "indirectly" by means of another. When England imports corn, it is actually indirectly producing the quantity of corn demanded that method I cannot satisfy through the production of cloth, which uses less labor per unit of output than method II to produce corn in less productive lands.

But the main difference here relative to the example in section III is that now a wage good is being produced indirectly through a luxury good. The implication is that the rate of profits depends now on the difficulty of production of cloth, which now has the function of being the technique to produce corn that does not pay rent. The real wage that enters this difficulty of production of cloth is weighted by the terms of trade (price of corn relative to cloth), since real wages are a quantity of corn consumed by workers and must be acquired through the exchange with France. If we call m the fraction of England's effectual demand for corn that must be met by imported corn, then, the condition for a profitable trade of barter in this case is:

$$\frac{l_c^F}{l_1^F} < \frac{D_1^F}{mD_c^E} < \frac{l_c^{E(I)}}{l_1^E} \quad (22)$$

The ratio of exchange between corn and cloth now enters the calculation of the wage share and the rate of profits and rent. In this case, the rate of profits and the rent on land in England is:

$$r^E = \frac{1 - \frac{D_1^F}{mD_c^E} b_c^E l_1^E}{\frac{D_1^F}{mD_c^E} b_c^E l_1^E} \quad (23)$$

$$\rho = \frac{\frac{D_1^F}{mD_c^E} l_1^E - l_c^{E(I)}}{l_1^E} \quad (24)$$

Rent now reflects the difference between method I and the method employed in the production of cloth. Since cloth uses less labor per unit of output than method II, this difference is shortened and rent is lowered, whereas profits raise due to the adoption of the more “productive method”. However, note that rent is not completely eliminated, because of our hypotheses that method I is more productive than the method employed in France, which still make the coexistence of techniques prevail in England.

For France, the analysis is carried out as in section III. Since France imports a luxury good and the increased production of corn does not lead to increased costs measured in labor, distribution is not affected. The difference is that now France can produce cloth indirectly through the production of corn, which is cheaper. Contrary to England, France specializes in the production of corn and all of the cloth consumed is imported from England. Thus, the natural price of corn in a common currency is determined in France.

Let us assume now that the method employed in the production of corn in France uses less labor than both methods I and II. There are two possibilities. If the ratio of effectual demands lies between the price of employing method I and the price of employing method II, there will be partial specialization as in the case discussed thus far. Even if France possesses the most efficient technique, if the ratio of exchange makes production using method I still profitable, England would import only the fraction of corn that would otherwise be produced using method II and produce the rest using method I. The rate of profits would be higher and rent would not be eliminated, but diminished as in the previous case.

However, if the ratio of exchange is such that it is profitable to import the whole effectual demand for corn from France, England would specialize in the production of cloth and acquire all corn needed through foreign trade. Corn is now produced entirely by means of cloth. Costs are described as:

$$\frac{l_c^F}{l_1^F} < \frac{D_1^F}{D_c^E} < \frac{l_c^{E(I)}}{l_1^E} < \frac{l_c^{E(II)}}{l_1^E} \quad (25)$$

The rate of profits in England is now determined by the difficulty of production of cloth and the terms of trade, as corn must be acquired through foreign trade. In this case, rent is completely eliminated, since there is now only one method to produce corn, which is to produce cloth and export it:

$$r^E = \frac{1 - \frac{D_1^F}{D_c^E} b_c^E l_1^E}{\frac{D_1^F}{D_c^E} b_c^E l_1^E} \quad (26)$$

V Final Remarks

We have shown that competition ensures that in the process of gravitation of market towards natural prices, the quantities of commodities traded by the countries, starting from any initially given level, will always move towards their respective effectual demands. This process seems to us sufficient to demonstrate that Ricardo's theory of trade is complete and does determine the terms of trade by the reciprocal of these actually traded effectual demands, both in the simple examples of chapter VII in the Principles and, more generally, also determines the value of money and thus the monetary costs of production. We believe that Gherke (2017) is right in stating that 'Ricardo's exposition leaves no room for a determination of international values by price elastic "reciprocal demand"' but we also think that given the fact that Ricardo always takes as given the set of effectual demands, the available methods of production and the real wage in each country, there is also no room for the quantities traded, and thus also for the terms of trade in a balanced trade situation, to be determined by anything else but by the reciprocal of the actually traded levels of effectual demands, in the simple examples of two commodities. For the general case (not treated in detail by Ricardo and which will be the subject of another paper), to ensure balanced trade the value of money is determined by the ratio of money wages. The latter is itself determined by the ratio of the wage shares of the two countries multiplied by the ratio of total quantities of labor of commodities actually traded. On the other hand, the terms of trade of a country, understood in modern terms as the price index of exports relative to imports is determined by the ratio of the total (absolute) quantity of labor contained in the imported commodities relative to the total quantity of labor contained in the exported commodities.

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