Money and Foreign Trade Ricardo’s “Magic Numbers”
Jérôme de Boyer Des Roches

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“Of two countries having precisely the same population, and the same quantity of land of equal fertility in cultivation, with the same knowledge too in agriculture, the prices of raw produce will be highest in that where the greater skill, and the better machinery is used in the manufacture of exportable commodities. The rate of profits will probably differ but little; for wages, or the real reward of the labourer, may be the same in both; but those wages, as well as raw produce, will be rated higher in money in that country, into which, from the advantages attending their skill and machinery, an abundance of money is imported in exchange for their goods.
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Of these two countries, if one had the advantage in the manufacture of goods of one quality, and the other in the manufacture of goods of another quality, there would be no decided influx of the precious metals in either; but if the advantage very heavily preponderated in favour of either, that effect would be inevitable.”

Ricardo, 1817, p. 142

1. Introduction

Over the past two centuries, the connection David Ricardo made between money and foreign trade was widely commented on the basis of the 1809-1811 writings, notably the High Price of Bullion, Proof of the Depreciation of Bank Notes, of the 1816 Proposals for an Economical and Secure Currency, proposals taken again in the chapter twenty seven “On Currency and Banks” of the 1817 Principles of Political economy an Taxation, and of the 1823 Plan for a National Bank. On the other hand, the chapter seven “On Foreign Trade” of the 1817 Principles was mostly ignored with the exception of J.W. Angell (1926), F.W. Taussig (1927), K. Kojima (1951), M. Blaug (1976), J. de Boyer (1992) et G. Faccarello (2013) who did pay attention to it. Yet, according to Ricardo, the concept of comparative advantage cannot be understood without studying the international distribution of precious metals. However the chapter seven of the Principles did not simply resume the 1809-1811 Ricardo’s monetary ideas. Here, Ricardo reconsidered the link between value of money and exchange rate, and used arguments he had criticized seven years before.

The aim of this paper is to present and compare Ricardo’s monetary and foreign exchange analysis in the writings of 1809-1811 on one side, and in the chapter seven of his 1817 book on the other side. By means of a numerical example, the second section recalls the main features of the 1809-1811 analysis. According to Ricardo, the value of money in two trading countries must be equal for the foreign exchange equilibrium to be reached. Several notions such as the price specie flow mechanism, the quantity theory and the criticism of Thornton’s gold point mechanism are emphasized in this section. The third section presents the theory of the comparative advantage developed in chapter seven of the
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Principles; more than half of this text is consecrated to monetary components. Emphasis is placed on the distinct effects and mechanisms that intervene in the dynamics of money prices and wages that led to international specialization. The numerical example is used to bring to light the quantity of labour effect, the gold points mechanism, the quantity of money effect and the substitution of imports for production effect that lead to the money prices - i.e. £45, £50, £50, £45 – linked to the "magic numbers" – i.e. 80, 90, 120, 100.

The fourth section studies first the disconnection established by Ricardo in chapter seven of the Principles between the values of currencies and exchange rates, and concludes.

Our research provides the following conclusions. Firstly, Ricardo’s statement of the comparative advantage theory involves the monetary theory; specifically it presupposes the validity of the quantity theory. The specie inflow (outflow) in one country drops (increases) the value of money in this country. Secondly, according to the comparative advantage theory, “England would give the produce of the labour of 100 (English) men, for the produce of the labour of 80 (Portuguese)” (Ricardo, 1817, p; 135). It entails that the money price of the produce of 80 Portuguese men is equal to the money price of the produce of 100 English. It means that the money price of the produce of a given quantity of labour is 25% higher in Portugal than in England; i.e. that the value of a given quantity of money is 20% lower in Portugal than in England. Third, the specie flow between countries is not described with Hume’s price specie flow mechanism, but with Thornton’s gold points mechanism. Fourth, fixed exchange rate under gold standard does not involve gold has the same value in various countries. The symmetrical changes, in two countries,

3 so that the terms of trade/exchange are not indeterminate contrary to an opinion inherited from John Stuart Mill. Concerning the alleged (by J.S. Mill) indeterminacy “of the division of the advantage” in Ricardo’s chapter seven, see Sraffa (1930)

4 “Thus, suppose ... in England, the price of wine here were £50 per pipe, and the price of a certain quantity of cloth were £45, whilst in Portugal the price of the same quantity of wine was £45, and that of the same quantity of cloth £50 ...” Ricardo, 1817, p. 138

5 In “England ... to produce the cloth may require the labour of 100 men for one year; and if she may attempted to make the wine, it might require the labour of 120 men for the same time. ... To produce the wine in Portugal, might require only the labour of 80 men for one year, and to produce the cloth in the same country, might require the labour of 90 men for the same time.” Ricardo, 1817, p. 135
in the quantities of money, that lead to symmetrical changes in the values of money, do not modify the market prices of gold in any of these countries. To conclude, the seventh chapter of the *Principles* does not support Ricardo’s monetary view at the time of the Bullion Committee.

2. **Price specie flow mechanism and foreign trade: Ricardo 1810-1811**

*Autarchic equilibrium*

In 1810-1811, Ricardo resumed and deepened the price specie flow mechanism formulated first by Davis Hume (1752). Also, Ricardo developed the idea that the balance of trade, either surplus or deficit, is a monetary phenomenon. In these writings he did not refer yet to the comparative advantage; he will do it later, in 1817. Nevertheless, we suggest to study the 1810-1811 Ricardo’s monetary analysis of the balance of trade in the framework of the theory of foreign trade developed in 1817. For this purpose, and in order to get to the point, we introduce six assumptions below: (1) first, we substitute France for Portugal in order to facilitate the description of exchange rates mechanisms; (2) second, we introduce the domestic goods - the brick whose transportation cost is prohibitive - in order to discuss the purchasing power of money; (3) third, we suppose that the two countries have “precisely the same population, and the same quantity of land of equal fertility in cultivation, with the same knowledge too in agriculture” and in the manufacture; (4) fourth, the level of the subsistence wage \( w/\text{man} \) is the same in the two countries, so that the profit rate \( r \) is 20% in both; (5) fifth, neither wine, cloth nor brick no2 is a wage-good; (6) finally, the international stock of precious metals amounts to 5547.35 gold ounces and the quantity theory holds. The two countries use different monetary units: the legal price of the gold ounce is 98.20 FF in France and £3 17sh 10.5d in England giving

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6 “Suppose now we have bricks, so bulky in proportion to value that cost of transportation is prohibitive.” Taussig (1927, p. 35)

7 Cf. Ricardo, 1817, p. 142.

8 Concerning the link between these hypothesis and Ricardo’s correspondence with Malthus in October 1816, cf. Ruffin (2002). See also Ruffin (2005) and Gehrke (2013)
25.22 FF/£ as the par of exchange rate. Taking into account 3.85% «expense of transportation» for gold\(^9\), the gold import point in France (gold export point from England) is 24.28 FF/£ and the gold export point from France (gold import point in England) is 26.19 FF/£. We have the autarchic equilibrium as follows:

Table 1

<table>
<thead>
<tr>
<th>e = 25.22 Fr/£</th>
<th>Wine</th>
<th>Cloth</th>
<th>Brick 1</th>
<th>Brick 2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>France</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(W = 945.75) FF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(W = £ 37.5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour</td>
<td>80</td>
<td>80</td>
<td>60</td>
<td>20</td>
<td>240 men</td>
</tr>
<tr>
<td>Quantity</td>
<td>59.3 p.</td>
<td>71.2 cq</td>
<td>600 b1</td>
<td>100 b2</td>
<td></td>
</tr>
<tr>
<td>Natural price in FF</td>
<td>1.330 FF</td>
<td>1.275 FF</td>
<td>113 FF</td>
<td>227 FF</td>
<td></td>
</tr>
<tr>
<td>Natural price in £</td>
<td>£ 60.7</td>
<td>£ 50.6</td>
<td>£ 4.5</td>
<td>£ 9</td>
<td></td>
</tr>
<tr>
<td>Price of the production</td>
<td>£ 10.800</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gold ounces</td>
<td>2.773,7 oz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>England</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(W = £ 37.5)</td>
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<td>30</td>
<td>10</td>
<td>240 men</td>
</tr>
<tr>
<td>Quantity</td>
<td>74.2 p.</td>
<td>89 cq</td>
<td>300 b1</td>
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<td>Gold ounces</td>
<td>2.773,7 oz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(oz = 98.20\) FF
\(oz = £3\) 17sh. 10.5d.

- Although the two countries produce a different quantity of goods, the quantities of labour necessary for the aggregate production in both countries are the same (240 men) so that the values of the aggregate productions are identical\(^{10}\). Therefore, since the quantities of money are also the same in both countries, i.e. 2.773,68 oz, the values of money are identical in France and in England.

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\(^{10}\) The price of the production is the same, equal to 240 men . w/man . (1+r) = £10.800
Concerning the natural prices of aggregate productions, we have to distinguish prices expressed in gold – i.e. the gold prices - from prices expressed in the money of account – i.e. the Sterling and Franc prices.

- The natural gold price of the aggregate production in both countries is 2.773,68 oz
- The natural Sterling price of English production (EP) is £10.800. It is equal to the natural gold price of the English production multiplied by the Sterling price of gold:
  \[ \frac{2.773,68 \text{ oz}}{\text{EP}} \times \frac{\£3 17\text{sh. 10,5d.}}{\text{oz}} = \£10.799 \text{ 19sh. 1d. / EP} \]
- The natural Franc price of French production (FP) is 272.375 FF. It is equal to the natural gold price of the French production multiplied by the Franc price of gold:
  \[ \frac{2.773,68 \text{ oz}}{\text{FP}} \times \frac{98,20 \text{ FF}}{\text{oz}} = 272.375,38 \text{ FF / FP} \]
  Note that 272.375,38 FF = £10.799 19sh. 1d. x 25,22 FF/£.

- The money wages – “wages rated in money”\(^{11}\) - are also at the same level: 945,75 FF in France and £37,5 in England.
  Note that 945,75 FF = £37,5 x 25,22 FF/£

- The levels of natural prices of the goods – i.e. wine, cloth and bricks “rated in money”\(^{12}\) - are also the same: 1.530 FF = £60,7 x 25,22 FF/£ for pipe of wine; 1.275 FF = £50,6 x 25,22 FF/£ for certain quantity of cloth; 113 FF = £4,50 x 25,22 FF/£ for brick n°1; 227 FF = £9 x 25,22 FF/£ for brick n°2
  The purchasing power of gold ounce on wages, wine, cloth and bricks n°1 and n°2 - reciprocal of the wages, wine, cloth and brick n°1 and n°2 rated in gold – are also the same.

\(^{11}\text{Ricardo (1817, p. 142)}\)
\(^{12}\text{idem}\)
The price-specie flow mechanism

Let us consider the discovery of a gold mine in England which increases by 100% the English stock (5.547,36 oz instead of 2.773,68 oz) and by 50% the world stock (8.321,04 oz instead of 5.547,36 oz). This entails a decrease by 50% of the natural value of the gold ounce in England; the monetary wages and prices increase by 100%. In France, however, the natural value of the gold ounce does not vary because the quantity of gold within the territory remains constant; the monetary wages and prices remain unchanged. As a consequence, the relatively cheap gold ounce leaves England for France where gold is relatively dear:

“Gold and silver, whether in coin or in bullion, obeying the law which regulates all other commodities, would immediately become articles of exportation; they would leave the country where they were cheap, for those countries where they were dear…”(Ricardo, 1810, vol III, p.54).

In return for the gold exported to France, wine and cloth are imported from France, giving rise to English balance of trade deficit and French surplus:

“In return for the gold exported, commodities would be imported; and (...) what is usually termed the balance of trade …(is) against the country exporting money or bullion, …”(Ricardo, 1810, vol III, p.54)

As much as the quantity of gold symmetrically increases in France and decreases in England, the natural wages and prices goes up in France and down in England. The process lasts until the equality in the value of money in both countries is re-established. Such an equality is reached when natural wages and prices will have increased by 50% in France and decreased by 25% in England, in other words, when the value of money will have decreased by one third in France and increased by one third in England. Then the total stock of gold (8.321,04 oz) will have been distributed equally [50%-50%] between the two counties: 4.160,52 oz in England and 4.160,52 oz in France.

The establishment in England of a bank issuing convertible banknotes, for an amount of £10.800 (= 2.773,68 oz x £3 17sh. 10,5d), circulating beside and in addition to the
outstanding gold specie, is similar to the case of the discovery of a gold mine except for one point. It is similar as for the effects on the value of gold, which decreases in England. It then impacts France as predicted by the price specie flow mechanism. It is distinct insofar as in the end of the process, France has 4.160,52 oz and England has 1.386,83 oz, which means that the gold distribution in each country in fine is 75% for France and 25% for England. Then, if the new international stock of currency - 5.547,36 oz in gold + £10.800 in banknotes - with a total value of £32.400, is distributed equally between the two countries - worth £16.200 in each - the £10.800 in banknotes are exclusively in England. In this country, the banknotes which, when issued, were added to gold, finally were substituted for gold; gold which migrated to France, putting the English bank in liquidity risk. Hence the dangerousness of issuing banknotes\textsuperscript{13}.

This scenario is avoided if the bank issues notes exclusively by buying gold, if it is prohibited to issue banknotes by granting credit\textsuperscript{14}. In this case, banknotes are not added to the circulation of gold specie but substituted for it: gold leaves the circulation to join the bank cash reserve. The quantity of specie and banknotes does not increase, the value of gold (and banknotes) does not diminish, gold is not exported, etc... We have the essence of Ricardo’s (1823) \textit{Plan for a National Bank}, thereafter of the \textit{Currency Principle} that inspired the 1844 Bank of England charter act.

So, according to the price-specie flow mechanism analysis, the balance of trade is a monetary phenomenon. A trade deficit (surplus) is identified with the export (import) of money, and this export (import) of money is the consequence of a fall (rise) in its value. Moreover, this export (import) of money brings about a rise (fall) in the value of money which restores the balance of trade. At this point, it is worth to emphasize that fall and rise in the value of money mean fall and rise, respectively in England and France, in the purchasing power of gold ounces on wine, cloth, and bricks n°1 and n°2. Indeed, in the expression “price-specie flow mechanism”, the word “price” refers to the natural (monetary) prices of goods. Since the money of account prices of the gold ounce are fixed

\textsuperscript{13} Cf. de Boyer (2003, 2013 - b)  
\textsuperscript{14} loans granted to traders or government.
in England and France, every variation in the natural prices of goods expressed in Sterling or Franc results exclusively from variation in the prices expressed in gold. These last vary with the quantity of money, not the Sterling and Franc prices of gold\(^\text{15}\).

Another remark concerns the distinction between the nature and the cause of the balance of trade. To say that it is a monetary phenomenon does not mean that its cause is monetary. We have described the monetary process of adjustment of the balance of trade following monetary shocks – discovery of a gold mine or establishment of a bank – but the shock may be real. For example, consider that the French population, therefore the production, increases by 25\%. The quantity of money being given, natural prices of goods decrease by 20\%. Of course this fall is not due to a fall in the natural value\(^\text{16}\) of wine, cloth and bricks but to the rise in the value of gold. The purchasing power of gold increases in France whereas it did not change in England; gold becomes relatively cheap in England and relatively dear in France. It is exported from England and, in exchange, wine and cloth are imported. The cause of the disequilibrium is real, but its nature is monetary. The price specie-flow adjusting process is monetary. The flows of money and symmetrical variations in prices last until the equality of the value of gold in both countries is restored. The international distribution of gold is as follows: 55.6\% for France and 44.4\% for England; in proportion of population and value of the aggregate production in both countries.

**Price-specie flow mechanism versus gold points mechanism**

Ricardo (1810-1811) resumes and deepens Hume’s analysis in order to refute Henry Thornton’s explanation of the exports and imports of gold\(^\text{17}\). According to Thornton (1802), gold is exported from England to France when the exchange rate of the Sterling falls to the gold export point, i.e. 24.28 FF/£. And this may occur although the value of gold is the same in both countries. Furthermore, if the convertibility of English banknotes

\(^\text{15}\) A. Rosselli (2013, p. 870) develops a distinct view.

\(^\text{16}\) Ricardo uses the expression « real value »: “When commodities varied in relative value, it would be desirable to have the means of ascertaining which of them fell and rose in real value, ....” (Ricardo 1817, Chap 1, section vi, p. 43)

\(^\text{17}\) See de Boyer (2007, 2008)
in gold is suspended, the market price of gold in England may rise above its legal price. A phenomenon that may occur though the price of gold does not vary in France and the value of gold remains at the same level in both countries.

Indeed suppose again the autarchic equilibrium defined above. There is no trade between the two countries, then no activity on the exchange market. Consider an export of £105 capital from England to France. This provokes the appearance of a supply of £105 and a demand for 2.648,10 FF ( = £105 x 25.22 FF/£) on the exchange market. Since there is no other supply or demand on the market, there is excess supply of Sterling and excess demand for Francs so that the exchange rate of the Sterling diminishes. When the exchange rate reaches the level 24.28 FF/£, arbitragists supply 2.549,40 FF to buy the £105. Thereafter (1) they exchange in a London bank the £105 for 100 guineas, which contain 26,966 oz; (2) they send the guineas in Paris; (3) sell them for 2.648,09 FF ( = 26,966 oz x 98,20 FF/oz), making un gain of 98,69 FF. During this process, called “gold points mechanism”, gold circulate as a consequence of the level of exchange.

Now, if no London bank reimburses its debt in gold, but in inconvertible Bank of England notes, arbitragists go to the open market to buy gold with their £105. The competition between them provokes a rise in the market price of gold. This high price of bullion is therefore the consequence of the fall in the exchange rate of money, not in the natural\textsuperscript{18} value of money, or its purchasing power on wine, cloth and bricks. According to the gold points mechanism, the choice to export gold, and the high price of bullion, may occur though the value of money is not involved\textsuperscript{19}.

Ricardo rejects this analysis. According to him, export of gold and high price of bullion are proofs of the depreciation of bank notes, depreciation being understood as diminished purchasing power on goods caused by excess issues. His argumentation is as follow: the over-issue of inconvertible banknotes provokes a fall in the value of gold, causing an

\textsuperscript{18} Cf. supra footnote 16, p. 9

\textsuperscript{19} Furthermore, gold may be exported though its value is higher than abroad. Consider that the population, then the production, increase, so giving rise to an increase in the value of money, then to a balance of trade surplus, but at a moment where the export of capital is of higher scale.
increase in the prices of goods and wages, as well as in the price of gold bullion, bringing about the export of gold and, finally a fall of the exchange rate:

“An increase of paper currency … lowers the value of gold bullion but raises its money price. It is the fall in its value which causes its exportation, and therefore the fall of the exchange” (Ricardo, 1810, vol III, p.64, ft 1)

However, Ricardo fails to describe the market process that raises the price of gold, he does not succeed to integrate the exchange market in the price-specie flow mechanism\textsuperscript{20}. Yet, the analysis of this failure is not the subject of this article. For our purpose, it is sufficient to mention that Ricardo opposed the price-specie flow mechanism to Thornton’s analysis, which rests on the gold points mechanism.

3. Gold points mechanism and comparative advantages: Ricardo 1817

The determinants of natural prices

The theory of advantage theory is a theory of the relative value between wine and cloth, i.e. the ratio of the natural price of wine and the natural price of cloth. However, the natural prices of wine and cloth are expressed in money so that they are also relative prices. Therefore, following Ricardo’s suggestion …

“When commodities varied in relative value, it would be desirable to have the means of ascertaining which of them fell and rose in real value, ….” (Ricardo 1817, Chap 1, section vi, p. 43)

When natural prices vary, as “means of ascertaining which of’ wine, cloth, bricks or money “fell and rose in real value”, we suggest to focus on three distinct effects that make the natural (monetary) prices of goods change. Firstly, there is the quantity of money effect: an increase (decrease) in the quantity of money causes a fall (rise) in the value of money, therefore a proportional increase (decrease) in the natural prices of goods. Secondly there is the quantity of labour effect: an increase in the quantity of a good produced by a given quantity of labour results in an inversely proportional fall in the

\textsuperscript{20} Cf. de Boyer (2013 – a)
natural price of this good. Thirdly, there is the substitution of import for production effect: import of French wine in England leads to substitute in this country the French natural price of wine for the English one. Moreover we have to consider the variation of the exchange rate that generates the changes in the quantity of money according to the gold points mechanism.

Now, let’s consider an improvement in making brick no. 2 in England so that the production is doubled - 10 men produce 100 b₂ instead of 50 b₂ – and the natural price is cut by half - £4.5 instead of £9.

Table 2

<table>
<thead>
<tr>
<th></th>
<th>Wine</th>
<th>Cloth</th>
<th>Brick 1</th>
<th>Brick 2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>France</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>W = 945,75 FF</td>
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<td>W = £ 37.5</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour</td>
<td>80</td>
<td>80</td>
<td>60</td>
<td>20</td>
<td>240 men</td>
</tr>
<tr>
<td>Quantity</td>
<td>89 p.</td>
<td>95 p.</td>
<td>79 cq</td>
<td>24 2 cq</td>
<td>600 b₁</td>
</tr>
<tr>
<td>Natural price in FF</td>
<td>1.020 FF</td>
<td>0.500 FF</td>
<td>1.148 FF</td>
<td>225 FF</td>
<td>113 FF</td>
</tr>
<tr>
<td>Natural price in £</td>
<td>£ 40.5</td>
<td>£ 60.7</td>
<td>£ 45.5</td>
<td>£ 50.6</td>
<td>£ 4.5</td>
</tr>
<tr>
<td>Price of the production</td>
<td>£ 3.600</td>
<td>£ 3.600</td>
<td>£ 2.700</td>
<td>£ 900</td>
<td>£ 10.800</td>
</tr>
<tr>
<td>Gold ounces</td>
<td>924.6 oz</td>
<td>924.6 oz</td>
<td>693.4 oz</td>
<td>231.1 oz</td>
<td>2.773.7 oz</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
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<th>Brick 1</th>
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<td>£ 60.7</td>
<td>£ 50.6</td>
<td>£ 4.5</td>
<td>£ 4.5</td>
<td>£ 9</td>
</tr>
<tr>
<td>Price of the production</td>
<td>£ 4.500</td>
<td>£ 4.500</td>
<td>£ 1.350</td>
<td>£ 450</td>
<td>£ 10.800</td>
</tr>
<tr>
<td>Gold ounces</td>
<td>1.155.7 oz</td>
<td>1.155.7 oz</td>
<td>346.7 oz</td>
<td>111.6 oz</td>
<td>2.773.7 oz</td>
</tr>
</tbody>
</table>

oz = 98,20 FF
oz = £3 17sh. 10.5d.

It is worth noting that although the purchasing power of the ounce of gold over the brick no. 2 has doubled, it is not due to a rise in the value of money but to the fall in the value of brick no. 2. Furthermore the price of the production of bricks no. 2 is unchanged - £450 - so that the quantity of gold necessary to circulate it (111.6 oz), but also the quantity...
necessary to circulate all the production in England (2.773.7 oz), is also unchanged. Since brick n°2 is a non-traded good, there is no other change in the economy. The value of money is not modified.

Further, let’s consider an improvement in making cloth in France so that the production increases - 79 cq instead of 71,2 cq – and the natural price decreases inversely proportional – 1.148 FF ( = £45,5) instead of 1.275 FF ( = £50,6) – so that the price of the production of cloth - £3.600 – is unchanged. As in the case of the brick n°2 in England, the increase in the purchasing power of the gold ounce over French cloth should not to be interpreted as the proof of an increase in the value of gold but a decrease in the value of cloth. Here again, there is no change in the price of the production in the country and in the quantity of money necessary to circulate it. Taking into account the cost of transportation of wine and cloth that amounts to 1/9 of their price, there is no profit for England to import French cloth. There is no other change in the economy. The value of money is not modified.

The comparative advantage (I) : the conditions of international specialization

To end, let’s consider an improvement in making wine in France so that the production increases by half - 80 men produce 89 pipes instead of 59,3 – and the natural price decreases by a third -1.020 FF instead of 1.530 FF ; i.e. £40,5 instead of £60,7. As in the case of brick n°2 in England and cloth in France, the increase in the purchasing power of the gold ounce over French wine should not to be interpreted as the proof of an increase in the value of gold but a decrease in the value of wine. Again the value of money and the quantity necessary to circulate the production have not changed. However, in this case, given the £60,7 price of the pipe of English wine, even if there is £4,5 ( = £40,5 x 1/9) cost of transportation wine from France to England, therefore £45 total cost, it is profitable to export French wine to England. This leads to supply sterling and demand francs on the currency market.

Before describing the adjustments process that follows, we would like to make some remarks.
Money and Foreign Trade Ricardo’s “Magic Numbers”

1. England needs 100 men to produce 74.2 pipes of wine. It means that England would need 120 men to produce 89 pipes; i.e. the quantity produced by 80 French men.

2. France needs 80 men to produce 79 cq of cloth. It means that France would need 90 men to produce 89 cq of cloth, i.e. the quantity produced by 100 English men.

The numbers underlined are Ricardo’s “magic numbers”

Table 3

<table>
<thead>
<tr>
<th></th>
<th>Wine</th>
<th>Cloth</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quantities produced before specialisation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>France</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Production</td>
<td>89 pipes</td>
<td>79 cq.</td>
</tr>
<tr>
<td><strong>England</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Production</td>
<td>74,2 pipes</td>
<td>89 cq.</td>
</tr>
<tr>
<td><strong>Magic numbers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wine</td>
<td>80</td>
<td>90</td>
</tr>
<tr>
<td>Cloth</td>
<td>89 pipes</td>
<td>89 cq.</td>
</tr>
</tbody>
</table>

3. France has the relatively greater advantage to specialise in the production of wine and England the smaller disadvantage to specialise in the one of cloth: 160 French men could produce 178 pipes of wine (instead of 163.2 p. if we add the non specialized production of 80 French [89 p.] and 100 English [74,2 p.]) and 200 English produce 178 cq. of cloth (instead of 168 cq. if we add the non specialized production of 80 French [79 cq.] and 100 English [89 cq.]). Thanks to international specialisation, the aggregate production increases by 14,8 pipes of wine and 10 cq. of cloth, the production of bricks being unchanged.

Now, to be implemented, the specialisation supposes two conditions.

- First, we have the well-known conditions concerning the relative price of wine in cloth in France and in England :

\[
0.89 \text{ cq/p (} = \frac{79 \text{ cq}}{89 \text{ p}} \text{)} < P_{\text{wine,cloth}} < 1.20 \text{ cq/p (} = \frac{89 \text{ cq}}{74,2 \text{ p}} \text{)}
\]
Second, the importations and exportations would be financially profitable:

a) The cost of production of English wine must be higher than the import price in England of French wine, i.e. higher than the cost of production of French wine plus the transportation cost.

b) The cost of production of French cloth must be higher than the import price in France of British cloth, i.e. higher than the cost of production of British cloth plus the transportation cost.

Therefore we have the condition:

\[ 1.23 < \frac{\ell W_{France}}{\ell W_{England}} \cdot \frac{(1 + r_{France})}{(1 + r_{England})} < 1.35 \]

21 Angell (1926) & Taussig (1927)

22 For French wine imported in England:

\[ \frac{\ell W_{France}}{\ell W_{England}} \cdot \frac{(1 + r_{France})}{(1 + r_{England})} < \frac{120 \text{ men}/89 \text{ p} \times \ell W_{France}}{80 \text{ men}/89 \text{ p}} \cdot \frac{1}{1 + 1/9} \]

\[ \Leftrightarrow \frac{\ell W_{France}}{\ell W_{England}} \cdot \frac{(1 + r_{France})}{(1 + r_{England})} < 1.35 \]

23 For English cloth imported in France:

\[ \frac{100 \text{ men}/89 \text{ cq} \times \ell W_{England}}{90 \text{ men}/89 \text{ cq}} \cdot \frac{(1 + 1/9)}{1} < \frac{\ell W_{France}}{\ell W_{England}} \cdot \frac{(1 + r_{France})}{(1 + r_{England})} \]

\[ \Leftrightarrow 1.23 < \frac{\ell W_{France}}{\ell W_{England}} \cdot \frac{(1 + r_{France})}{(1 + r_{England})} \]

24 In Negishi’s model (1982) inspired from Sraffa, in a framework deprived from money and thus also without monetary wages, and without transportation cost, wage rates are labelled in a unit of account and are the same in each country so that the spread of productivity engenders a gap of profit rate between countries. The condition of exchange is that the level of ratio of \((1+r_{France})\) to \((1+r_{England})\) – and not the ratio \(\ell W_{France} (1+r_{France})\) to \(\ell W_{England} (1+r_{England})\) – is between two limits defined by the ratios of quantity of labour required to produce the two goods. In our example, the condition of exchange in accordance with Negishi is \(1 < \frac{1+r_{France}}{1+r_{England}} < 1.5\). The equilibrium is
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There is a continuum of equilibriums. Ricardo gives (cf. table 4) the equilibrium where:

a) the monetary wage rate in France (1.050 FF = £41.67 x 25.22FF/£) is 25% higher than the monetary wage rate in England (£33.33).

b) In France, the price of wine is £45 and the price of cloth is £50. The relative price of wine in cloth equals 0.9 cq/p, which is higher than 0.89 cq/p.

c) In England, the price of wine is £50 and the price of cloth is £45. The relative price of wine in cloth equals 1.11 cq/p, which is lower than 1.2 cq/p.

Therefore the conditions (1) and (2) are verified.

Table 4

<table>
<thead>
<tr>
<th>e = 25.22 Fr/£</th>
<th>Wine</th>
<th>Cloth</th>
<th>Brick 1</th>
<th>Brick 2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>France</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour</td>
<td>160</td>
<td>0 men</td>
<td>60</td>
<td>20</td>
<td>240 men</td>
</tr>
<tr>
<td>Quantity</td>
<td>178 p.</td>
<td>0 cq</td>
<td>600 b1</td>
<td>100 b2</td>
<td></td>
</tr>
<tr>
<td>Natural price in FF</td>
<td>1.134 FF</td>
<td>1.261 FF</td>
<td>126 FF</td>
<td>252 FF</td>
<td></td>
</tr>
<tr>
<td>Natural price in £</td>
<td>£ 45</td>
<td>£ 50</td>
<td>£ 5</td>
<td>£ 10</td>
<td></td>
</tr>
<tr>
<td>Price of the production</td>
<td>£ 8.000</td>
<td>£ 3.000</td>
<td>£ 1.000</td>
<td>£ 12.000</td>
<td></td>
</tr>
<tr>
<td>Gold ounces</td>
<td>90 men would produce 89 cq</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>England</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour</td>
<td>0 men</td>
<td>200</td>
<td>30</td>
<td>10</td>
<td>240 men</td>
</tr>
<tr>
<td>Quantity</td>
<td>0 p.</td>
<td>178 cq</td>
<td>300 b1</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Natural price in £</td>
<td>£ 50</td>
<td>£ 45</td>
<td>£ 4</td>
<td>£ 4</td>
<td></td>
</tr>
<tr>
<td>Price of the production</td>
<td>£ 8.000</td>
<td>£ 1.200</td>
<td>£ 400</td>
<td>£ 9.600</td>
<td></td>
</tr>
<tr>
<td>Gold ounces</td>
<td>120 men would produce 89 p</td>
<td></td>
<td></td>
<td></td>
<td>3.082 oz</td>
</tr>
<tr>
<td>oz = 98.20 FF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>55.6 %</td>
</tr>
<tr>
<td>oz = £3 17sh. 10.5d.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Because neither wine nor cloth is a wage-good, the changes in their natural value do not change the real wages, then the rate of profit remains at 20% in both countries.
The comparative advantage (2) : the natural prices

For international exchange to take place, the monetary wage rate has to rise in France (it increases by 11,11 % from 945,75 FF to 1050,83 FF – from £37,5 to £41,67) and fall in England (it decreases by 11,11% from £37,5 to £33,33) so that the price of cloth in England drops (from £50,6 to £44,9), making it an exportable good to France where the production cost of cloth has increased (from £45,5 to £50,7). Consequently, after international specialization:

- The price of wine has increased in France by 11,11 %; from 1.020 FF [= £40,5] to 1.134 FF [= £45]
  The natural price of wine in England is no more determined by its cost of production in this country (£53,9) but by its natural price in France (£45) plus the £5 of cost of import, i.e. £50. It has decreased by 17,6 %; from £60,7 to £50.

- The price of cloth has decreased in England by 11,11%; from £50,6 to £45
  The natural price of cloth in France is no more determined by its cost of production in this country (£50,6) but by its natural price in England (£45) plus the £5 of cost of import, i.e. £50. It has increased by 9%; from 1.148 FF [= £45,5] to 1.261 FF [= £50]

- Therefore, the relative price of wine in cloth has risen in France (from 0,89 [=£40,5/£45,5] to 0,9 [=£45/£50]) and dropped in England (from 1,2 [=£60,7/£50,6] to 1,11 [=£50/£45])

- The prices of bricks n°1 and n°2 have increased in France (from 113 FF [= £4,5] to 126 FF [= £5] for the first and from 226 FF [= £9] to 252 FF [= £10] for the second) and decreased in England (both bricks from £4,5 to £4).

- The price of the aggregate production increases in France (from 272.376 FF [=£10.800] to 302.639 FF [= £12.000]) and decreased in England (from £10.800 to £9.600)

These prices variations involve that 308 ounces of gold have transited from England to France, incurring:
A new quasi-parity - except for the transport costs - of gold purchasing powers:

- on wine: 0.0866 p/oz in France and 0.0780 p/oz in England
- and on cloth 0.0780 cq/oz in France and 0.0866 cq/oz in England.

The appearance of a disparity of the purchasing power of gold on brick n°1: 0.7788 b₁/oz in France and 0.9734 b₁/oz in England whereas it was before 0.8653 b₁/oz in both countries

The increase of the disparity of purchasing power of gold on brick n°2: 0.3894 b₂/oz in France and 0.9734 b₂/oz in England whereas it was before 0.4326 b₂/oz in France and 0.8653 b₂/oz in England

It is worth underlying that the new distribution of gold between the two countries – 55.6% / 44.4% instead of 50% / 50% - takes place even if the value of the production, i.e. of the aggregate outstanding goods circulating, in each country did not vary, but the value of “utilité produite”, i.e. of utility produced:

“In the 7th Chap. of this work, I have endeavoured to shew that all trade, whether foreign or domestic, is beneficial, by increasing the quantity, and not by increasing the value of production. We shall have no greater value, whether we carry on the most beneficial home or foreign trade, or in consequence of being fettered by prohibitory laws, we are obliged to content ourselves with the least advantageous. The rate of profits, and the value produced, will be the same. The advantage always resolves itself into that which M. Say appears to confine to the home trade; in both cases there is no other gain but that of the value of an utilité produite.”(Ricardo, 1817, chap. XXII, “Bounties on Exportation”, p.319-20).

To sum up, technical progress makes the French wine an exportable good, the export of wine entails a transfer of gold between the countries that provokes symmetrical variations in the value of money, then in the natural price of goods so that English cloth becomes an exportable good. These modifications of natural and relative prices caused by
the transfer of gold have been widely neglected in the literature\textsuperscript{26}, except from Taussig (1917, 1918, 1929)\textsuperscript{27} and his pupils\textsuperscript{28}.

\textit{The comparative advantage: (3) The gold points mechanism}

Now, how does gold transit from England to France. Which mechanism prevails? To answer, one should admit that the price-specie flow mechanism is of no help. Indeed, \textit{before any adjustment}, and as a result of technical progress in France, i.e. 80 men producing 89 pipes wine instead of 59,3 p; there are only two variables that have changed. On the one hand the natural price of the pipe of wine in France falls by a third, 1.020 FF instead of 1.530 FF. On the other hand the quantity of wine produced in France increased by half. Therefore, \textit{before any adjustment}, the price of the production of wine, and the quantity of gold ounces that circulate it, are unchanged:

\[
\begin{align*}
89 \text{ pipes} \times 1.020 \text{ FF/p} &= 89 \times 1.020 \text{ FF} = 90.780 \text{ FF} = £3.600 = 924.6 \text{ oz} \\
59.3 \text{ pipes} \times 1.530 \text{ FF/p} &= 59.3 \times 1.530 \text{ FF} = 90.780 \text{ FF} = £3.600 = 924.6 \text{ oz}
\end{align*}
\]

It means that the natural\textsuperscript{29} value of the ounce of gold is unchanged and that the lower natural price of wine is exclusively due to the decline in the natural\textsuperscript{30} value of wine. Because the value of money has not changed, Ricardo cannot rely on the price specie flow mechanism to explain the transfer of gold. The process he put forward is other.

The 33% decrease in the natural price of wine in France, quite higher than the 1/9 of transport cost, makes profitable the export of wine to England. This results in a supply of Sterling and demand for Francs on the foreign exchange market. Because the natural prices of cloth have not moved, there is no trade of cloth resulting in a supply of Francs and demand for Sterling. Because \textit{“every transaction in commerce is an independent

\begin{footnotes}
\item[26] K. R (1951) is an exception
\item[27] Cf. F. Sember (2010, 2013)
\item[28] Cf. Notably Angel (1926)
\item[29] Cf. supra footnote 16, p. 9
\item[30] Cf. supra footnote 16, p. 9
\end{footnotes}
transaction”\(^{31}\), at the par of exchange rate (25.22 FF/£) there is an excess demand for francs (supply of sterling). This brings about a fall in the exchange rate of the Sterling which lasts until it reaches the gold export point (24.28 FF/£). Then arbitragists demand Sterling and supply Francs to export gold from England:

“… the importer (…) would equally purchase a bill; but the price of that bill would be higher, from the knowledge which the seller of it would posses, that there was no counter bill in the market by which he could ultimately settle the transaction between the two countries; he might know that the gold or silver money which he received in exchange for his bill, must be actually exported to his correspondent (…), to enable him to pay the demand which he had authorized to be made upon him, and he might therefore charge in the price of his bill all the expenses to be incurred, together with his fair and usual profit.” (Ricardo, 1817, p. 139)

The causalities at work are those of the gold points mechanism criticised by Ricardo at the time of the Bullion Committee. The import of French wine is not due at all to an export of gold, consequence of a decrease in its value in England or an increase in France. The import of French wine results in the issue of a bill of exchange that brings about a fall in the exchange rate, which results in the export of gold. Gold is exported to settle one independent transaction\(^{32}\). Thus, in Chapter 7 of The Principles, Ricardo uses the Thorntonian mechanism he rejected seven years earlier. Thornton described how gold was exported to settle one financial independent transaction.

4. value of money, comparative advantage and gold standard

How, between “two countries [England and France in our numerical examples] having precisely the same population, and the same quantity of land of equal fertility in

\(^{31}\) (Ricardo, 1817, p. 138)

\(^{32}\) Gold is exported “to settle the transaction”. The reader can refer to de Boyer and S. Diatkine (2008) on the circulation of gold as an international means of payments.
cultivation, with the same knowledge too in agriculture”\(^{33}\), hence with the same real wage rate and profit rate, it is possible that one country “would give the produce of the labour of 100 men, for the produce of the labour of 80”\(^{34}\) ? Ricardo’s prerequisite condition is that we do not consider this “exchange” as a barter but two independent transactions\(^{35}\), which involve the exchange market: firstly, a demand for (an import of) French wine against a supply of Sterling, i.e. a demand for francs on the exchange market; secondly, a demand for (an import of) English cloth against a supply of francs, i.e. a demand for sterling on the exchange market. Ricardo’s additional condition is that the natural price of the produce of 100 Englishmen is equal to the natural price of the produce of 80 French men, therefore that the money wage rate in England is 20\% lower than in France. This entails that the value of money is 25\% higher in France than in England.

“[The]\(^{36}\) value of money will not be indicated by the exchange; bills may be continue to be negociated at par although the prices of corn and labour should be 10, 20, or 30 per cent. higher in one country than another. Under the circumstances supposed, such a difference of prices is the natural order of things, and the exchange can only be at par, when a sufficient quantity of money is introduced into the country excelling in manufactures\(^{[5]}\), so as to raise the price of its corn and labour.” (Ricardo, 1817, p. 146).

Although the value of the produce in the two countries is the same, the quantity of money is 25\% higher in France than in England:

“When each country has precisely the quantity of money which it ought to have, money will not indeed be of the same value in each, for with respect to many commodities it may differ 5, 10, or even 20 per cent, but the exchange

\(^{33}\) Ricardo, 1817, p. 142

\(^{34}\) Ricardo, 1817, p. 135

\(^{35}\) Cf. Above, Ricardo, 1817, p. 138

\(^{36}\) In Ricardo’s text, this sentence begins with « This higher value of money » although in the preceding paragraph Ricardo describes a fall in the value of money: “… the value of money will be lower, and the price of corn and labour will be relatively higher …” (Ricardo 1817, p. 146). He should have written: “This lower value of money”. Sraffa does not mention this error
will be at par." (Ricardo, 1817, p. 147).

Therefore, according to Ricardo (1817, chap. 7), contrary to Ricardo (1809-1811), international gold standard does not mean that gold has the same value in different countries. Our numerical example shows that if gold flows result in symmetrical variations in the value of gold in the two countries, these flows are not due to changes neither in the value of gold nor in the price of gold but to changes in the exchange rate. Gold standard does not mean fixity of the value of gold but of gold price, therefore of gold points.

To conclude, Ricardo’s comparative advantage theory relies on two pillars, the quantity theory of money and the gold points mechanism. It is not in accordance with Ricardo’s bullionism, which exposes the quantity theory of money in order to reject the gold points mechanism.

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