Ricardo's comparative advantage vs. "Ricardian" model

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Abstract

The so-called Ricardian model of contemporary economic textbooks differs significantly from the famous numerical example included in chapter seven of the *Principles*. The difference is not merely with respect to the definition of the four numbers, but also in terms of underlying proposition, logical construction, assumptions and theoretical implications. Therefore, the textbook model should no longer be considered as part of Ricardo's international trade theory, nor taken as basis for understanding Ricardo's superior demonstration of comparative advantage in the *Principles*.

Keywords

comparative advantage, Ricardian model, CULC model, international trade theory, free trade

Introduction

"Classic". A book that people praise and don't read.

Mark Twain

Comparative advantage — i.e. the proposition that a country might import a certain amount of a commodity even though it could produce it internally with lower real labor costs than the exporting country — has played a paramount role within international trade theory. The numerical demonstration of this proposition figures in current economic textbooks as the basic theoretic model of international trade. In deference to the classical political economist who announced and demonstrated comparative advantage, David Ricardo, this basic model of international trade has been called the *Ricardian model*.

The numerical demonstration of comparative advantage that can be found in contemporary economic textbooks[1], though, differs rather significantly from the original demonstration in chapter seven of the *Principles*. If one is willing to contrast the textbook trade model with what is actually written in the *Principles*, then it is relatively easy to realize that the former departs from the original in terms of underlying proposition, logical construction, assumptions and theoretical implications. The main contribution of this paper is precisely to highlight these crucial differences.

The CULC model of international trade

Nowadays one can find many different versions of the numerical demonstration of comparative advantage in the economic literature. While most of these alternative versions use different numbers from the ones in the *Principles*, a few of them seem to be at the first

[1] Krugman & Obstfeld (2000, p. 12-34) and Samuelson & Nordhaus (1995, p. 679-686) are perhaps the most well-known textbook versions of the *Ricardian* model.

glance quite similar to the original.[2] In either case, though, the numbers are always defined as labor costs necessary for producing a *single* unit of the commodities traded in the respective countries.[3] These unitary labor costs are supposed to remain constant regardless the amounts of the commodities produced.

After Roy Ruffin (2002) rediscovered the correct interpretation of Ricardo's numbers in Sraffa (1930), the above definition of the numbers is no longer valid for Ricardo's numerical example in the *Principles*. Given the significance of this dissimilarity in the definition of the four numbers between Ricardo's original numerical example and the textbook international trade model, which I will refer later on in the article, it would have seem odd and self-contradicting to refer to the textbook model as the "Ricardian model". Then, how to call it? In this paper I will call it the Constant Unitary Labor Costs model (CULC), in order to highlight the two distinguishing attributes of the four numbers found in the textbook models.

The basic versions of the CULC model that can be found in popular economic textbooks usually explain the commodity composition of international trade by a single cause: persistent differences in the productivity of labor between countries, which are presumably the result of employing different production technologies. The persistent nature of these technological differences are due to the fact that the unitary labor costs in the respective countries usually differ and are assumed to remain constant.

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[2] See, for example, Caves et al. (1993), Kenen (1994), Krugman & Obstfeld (2000) and Samuelson & Nordhaus (1995, p. 679) for the first approach, Haberler (1936), Viner (1937), Hollander (1979) and Dunkley (2004) for the second approach.

[3] For example, Gottfried Haberler (1936, p. 128) begins his analysis of the theory of comparative cost by asserting the following: "In chapter VII of his Principles he [Ricardo] gives the following celebrated example: In England a unit of cloth costs 100 and a unit of wine 120 units of labour; in Portugal a unit of cloth costs 90 and a unit of wine 80 units of labour." Jacob Viner (1937, p. 445) presents a table containing the same four numbers, described as the amounts of "labor required for producing a unit" of cloth and wine in UK and Portugal. Samuel Holander (1979, p. 462) defines Ricardo's numbers as follows: "Input per unit of cloth and wine respectively — in terms of labour for one year — are supposed to be 100 and 120 in England; and 90 and 80 in Portugal."

The assumption of persistent technological differences between countries seems to suggest either that there are socioeconomic and cultural barriers that preclude the inhabitants of less developed countries from copying, assimilating or even improving the productive techniques invented in the advanced countries, or that the later group can effectively prevent the reduction or elimination of their technological advantages with respect to the less developed countries. Both explanations for the persistency of the technological differences between countries may seem plausible in the short term, but they are not particularly convincing in the long term. There are plenty of historical examples where a less developed country initially copies and later improves the production technologies of advanced countries. Japan, today's second largest national economy after the United States, is probably one of the best examples in recent economic history. China might become another example of this kind of economic development in the coming decades.

Moreover, singling out persistent technological differences as the only cause for international trade has an important limitation: such a theoretic trade model cannot explain trade between national economies that are at the same level of economic development. With countries achieving similar levels of economic development and technological differences among them eroding over time, the single cause for international trade according to the basic textbook version of the CULC model would disappear and the national economies would become autarkies with no reason to trade with each other.[4]

Critics of free trade have center their criticism in this as well as other restrictive and unrealistic assumptions like…Other scholars, while acknowledging the restrictive nature of the CULC model of economic textbooks, have deployed their considerable mathematical

[4] This shortcoming of the CULC-model, among others, led to the formulation of another neoclassical model of comparative advantage: the Heckscher-Ohlin model of international trade (H-O model). The H-O model offers an alternative explanation for international trade. Instead of technological differences, the H-O model identifies the differences in factor endowments as the primary cause for international trade, while assuming that the production technology is identical everywhere.

skills in order to relax some of these assumptions.[5] A less sophisticated but more effective way to bypass the restrictive assumptions of the basic CULC model and counter the critique towards free trade is to follow to the letter the numerical example in chapter seven of the *Principles*. Ricardo's original numerical demonstration of comparative advantage does not rely on the restrictive assumptions of the CULC model.

Furthermore, it is relatively easy to demonstrate that the CULC model departs from Ricardo's numerical example in other key aspects such as underlying proposition, logical construction and theoretical implications, as the next section will show.

Differences between Ricardo's Numerical Example and the CULC model

Diverging underlying proposition and logical constructions

For Ricardo, the proposition that his labor theory of value does not determine the relative value of commodities in international trade when the factors of production are immobile between countries was indeed the main new insight he intended to illustrate with the numerical example. Strong evidence supports this interpretation: First, the comparative-advantage section in the *Principles* actually starts with the above proposition (Ruffin, 2002); second, immediately after proving this proposition Ricardo announces a positive rule for price-determination in international transactions (Vol. I, p. 137)[6]; third, the fact that more than a third of the comparative-advantage section is dedicated to explain the assumption of factor-immobility between countries, which Ricardo identifies as the main cause for the non-appliance of the labor theory of value in international exchanges; forth, this interpretation offers a plain explanation for why Ricardo only considered the real labor costs of producing

[5] See, for example, Eaton and Kortum (2002).

cloth and wine in the respective countries in the numerical example, abstracting from the costs of other factors of production; and last but not least, the fact that Ricardo could not have proven the comparative-advantage proposition in his famous numerical example without contradicting the labor theory of value.

In order to prove the last assertion, let us formulate Ricardo's numerical example in general terms, i.e. using parameters instead of specific numbers. There is country 1 exporting a certain amount of commodity A to country 2 in exchange for a certain amount of commodity B. The parameters a_i and b_i indicate the number of men working for a year required to produce the amounts of commodities A and B respectively in country *i*.

	Number of men working for a year required to produce a given quantity of	
	A	B
1	a_1	b_1
2	a_2	b_2

Table 1: General Formulation of Ricardo's numerical example

For country 1 to be interested in exporting a given amount of commodity A in exchange for a given amount of commodity B, the exchange has to satisfy the classical rule for specialization, i.e. $a_1 < b_1$. For country 2 to be also interested in this exchange, the condition $b_2 < a_2$ has to be fulfilled. For the featured international exchange to take place, both conditions have to be fulfilled simultaneously.

Under the labor theory of value, the amount of labor embodied in the amounts of commodities A and B traded has to be the same, or $a_1 = b_2$. Making the respective substitutions in the two inequalities, we obtain $b_2 < b_1$ and $a_1 < a_2$.

For proving the proposition that country 2 would import a given amount of A from country 1 despite the fact that it could produce the same amount of A at home with less

[6] Throughout this paper, all references or direct quotations of Ricardo are from *The Works and Correspondence of David Ricardo*, Volume I to XI, 2004, edited by Piero Sraffa. I will refer to them usually by indicating the volume and page numbers only.

amount of labor than country 1, however, it must be that $a_2 < a_1$. Therefore, if the labor theory of value would determine the relative value of commodities in international exchanges, Ricardo could not have proven the above proposition. The non-appliance of the labor theory of value in international trade when labor and capital are immobile between countries is indeed critical for the logical construction of Ricardo's numerical example.[7]

Despite the importance of the proposition regarding the labor theory of value for the logical construction of Ricardo's numerical example, one may not find any reference to this proposition in the CULC model of contemporary economic textbooks. Instead, the CULC model tries to prove the famous corollary of this proposition — i.e. that a country might import a certain amount of cloth from another country although the former has a real labor cost advantage over the later in producing the amount of the commodity traded at home — without ever mentioning the labor theory of value at all.

The essential role of the proposition regarding the labor theory of value in the original numerical example in the *Principles* is completely absent in the CULC model. This crucial omission makes it harder to grasp the rigorous logic of Ricardo's elegant demonstration of comparative advantage. The starting point of the numerical example in the *Principles* is that a certain amount of cloth and wine are exchanged between England and Portugal. The labor quantities required for the production of the traded commodities in the respective countries are chosen in accordance with the classical rule for specialization, so that both countries have an interest, independently from each other, in the exchange of English cloth for Portuguese wine. By importing a certain amount of wine from Portugal instead of producing it at home, England saves the labor of 20 men working for a year, while Portugal saves the labor of 10 Portuguese by exporting the wine in exchange for some amount of English cloth. Therefore, the international exchange featured in the numerical example is beneficial for both countries,

[7] See also Morales Meoqui (2011).

despite the fact that England is giving the output of a 100 men's labor in exchange for the output of only 80 Portuguese.

The omission of the labor theory of value in the CULC model leads to a differing logical construction for proving the comparative-advantage proposition. Thus, a significant difference between Ricardo's numerical example and the CULC model is that Ricardo builds up his demonstration of comparative advantage on a barter exchange where the nominal value of the respective amounts of the commodities traded have to be equal, whereas in the CULC model the terms of trade are left unspecified. Consequently, the definition of the four magic numbers differs. In the CULC model, the four numbers are defined as unitary real labor costs of producing a single unit of cloth and wine in England and Portugal, while in the original numerical example the four numbers are defined as the amounts of labor necessary to produce in each country the amounts of cloth and wine exchanged in the featured barter trade.

The divergent logical construction and definition of the numbers in the CULC model has led to a certain level of confusion with respect to which cost comparison should be considered as the relevant one for international specialization. Ruffin, for example, affirms that each country "exports the good in which it has the smallest absolute disadvantage or the largest absolute advantage" (Ruffin, 2005, p. 718). This seems to suggest that the relevant cost comparison for international specialization is the one between the unitary labor costs of the same commodity in the respective countries. Ricardo, on the other hand, unambiguously considers the internal cost comparison as the relevant one for international specialization (Vol. II, p. 383). Thus, in his numerical example in the *Principles* the relevant cost comparison for international specialization is unmistakably the one between the real costs of importing a certain amount of a commodity versus its home production, in correspondence with the classical rule for specialization.

Generations of economists have learned comparative advantage from the CULC model rather than from Ricardo's *Principles*. Unaware of the divergent logical constructions, many economists have found it rather difficult to grasp the theoretical antecedents and logical structure of Ricardo's numerical example. The usual reaction has been to reprimand Ricardo for his defective demonstration of comparative advantage, and to try to correct the alleged imperfections of the original numerical example. Consequently, Ricardo's rigorous and elegant yet simple demonstration of comparative advantage in chapter seven of the *Principles* has been "corrected" and "enriched" with several assumptions that have proven later on to be very harmful for the understanding and general acceptance of the comparative-advantage proposition as well as the free-trade case.

Additional Assumptions in the CULC Model

The logical construction used in the CULC model requires the addition of several assumptions that are absent in Ricardo's original demonstration of comparative advantage. These additional assumptions are the following: 1) constant unitary labor costs; 2) no transportation costs; and 3) perfect internal mobility of the factors of production. Let us explained briefly each of these assumptions.

An immediate implication of taking unitary labor costs as the starting point of the numerical example is the logical requirement of assuming constant labor costs. The CULC model is heavily dependent on this assumption, because with variable unitary labor costs it would be very difficult to identify the most beneficial pattern of international specialization. Ricardo himself never made such an unrealistic assumption. It was wrongly attributed to him because of the misinterpretation of the four numbers.

Furthermore, the basic CULC model of economic textbooks assumes that there are no transportation costs. This assumption seems to be implicit in the original numerical example

as well, since Ricardo makes no explicit reference to the cost of carrying the commodities from one country to the other in the numerical example. Ricardo, however, abstracts from the transportation costs, which is quite different then assuming that there are no transportation costs at all. One has to remember that he builds up his numerical example on certain amounts of cloth and wine traded between England and Portugal. This logical construction allows an abstraction from the costs of transportation, since these costs are usually included in the value of the commodities traded.

According to the logical construction of the CULC model, however, the assumption of zero costs of transportation is neither the result of an abstraction nor an omission but rather the necessary consequence of assuming constant unitary labor costs. Transportation costs per unit usually depend on the amount of the commodities transported: the more commodities are transported in a single lot, the less is the transportation cost per unit. Therefore, taking into consideration the costs of transportation in the CULC model would infringe the constant-labor-costs assumption. The alternative option to assume that the transportation costs per unit also remain constant would defy the most elementary notion of reality.

Finally, the CULC model assumes perfect internal mobility of the factors of production, i.e. labor and capital would move to the production of other commodities smoothly enough so that the costs of free trade would not outweigh the benefits. Presumably in order to augment the legitimacy of this unrealistic assumption, it has often been attributed to either Smith or Ricardo. A careful consultation of the *Wealth of Nations* and the *Principles* proofs that neither Smith nor Ricardo ever assumed perfect internal mobility of the factors of production. On the contrary, they were quite concerned about the negative consequences of any sudden short-term adjustment in international trade — capital may have sunk (irrecoverable) costs and workers may find it hard to get new jobs at equivalent pay. Thus, both advocated in favor of protection on a temporary basis in order to spread the expected

negative impact on certain groups over a longer period of time.[8] Ricardo, for example, states in the *Principles*:

> "From contingencies of this kind, though in an inferior degree, even agriculture is not exempted. War, which in a commercial country, interrupts the commerce of States, frequently prevents the exportation of corn from countries where it can be produced with little cost, to others not so favourably situated. Under such circumstances an unusual quantity of capital is drawn to agriculture, and the country which before imported becomes independent of foreign aid. At the termination of the war, the obstacles to importation are removed, and a competition destructive to the home-grower commences, from which he is unable to withdraw, without the sacrifice of a great part of his capital. The best policy of the State would be, to lay a tax, decreasing in amount from time to time, on the importation of foreign corn, for a limited number of years, in order to afford to the home-grower an opportunity to withdraw his capital gradually from the land. In so doing, the country might not be making the most advantageous distribution of its capital, but the temporary tax to which it was subjected, would be for the advantage of a particular class, the distribution of whose capital was highly useful in procuring a supply of food when importation was stopped. If such exertions in a period of emergency were followed by risk of ruin on the termination of the difficulty, capital would shun such an employment. Besides the usual profits of stock, farmers would expect to be compensated for the risk which they incurred of a sudden influx of corn; and, therefore, the price to the consumer, at the seasons when he most required a supply, would be enhanced, not only by the superior cost of growing corn at home, but also by the insurance which he would have to pay, in the price, for the peculiar risk to which this employment of capital was exposed. Notwithstanding, then, that it would be more productive of wealth to the country, at whatever sacrifice of capital it might be done, to allow the importation of cheap corn, it would, perhaps, be advisable to charge it with a duty for a few years" (Vol. I, p. 266-268).

Given the explicit concerns expressed by Smith and Ricardo regarding any sudden change in the general conditions of international trade, one cannot attribute to either of them the unrealistic assumption of perfect internal mobility of the factors of production. This is a crucial assumption for the general economic equilibrium paradigm, but not for the classical theory of international trade.

Diverging Theoretical Implications

Taking into consideration the above-mentioned differences in terms of main proposition, logical construction and assumptions between Ricardo's numerical example and the CULC model, one should also expect significant differences in the theoretical

[8] See, for example, Smith (1776, I, p. 491).

implications as well, for example, regarding the extent of international specialization. The CULC model implies complete specialization by each trading partner according to its comparative advantage.[9] Yet Ricardo himself explicitly refers in a footnote to partial specialization:

> "It will appear then, that a country possessing very considerable advantages in machinery and skill, and which may therefore be enabled to manufacture commodities with much less labor than her neighbors, may, in return for such commodities, import **a portion of the corn** required for its consumption, even if its land were more fertile, and corn could be grown with less labor than the country from which it was imported" (Vol. I, p. 136n.; emphasis added).

According to Ricardo, thus, even if a country were much more advanced in manufacturing than its neighbors, it might not end up completely specialized in the production of manufactured goods, because it might still satisfy part of its national demand for corn by home production. Partial international specialization is indeed the more likely outcome taking into consideration what complete international specialization actually means when applying the classical rule for specialization. It means that a country following a free trade policy would end up completely specialized in the production and exportation of a single type of commodity, for example cloth. The country would reach complete specialization in cloth if by exporting this commodity it could procure all other commodities demanded by its residents at lower real costs than by producing them internally. Therefore, complete international specialization is a very unlikely outcome of free trade under realistic circumstances.[10]

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[9] See Ruffin (2002, p. 730).

[10] Individuals, unlike countries, might very well end up completely specialized. It is therefore not accurate to affirm that Ricardo reverted to the case of complete international specialization, as Hollander (1979, p. 465) wants us to believe, when the former wrote in the very same footnote quoted above that *"two men can both make shoes and hats, and one is superior to the other in both employments; but in making hats, he can only exceed his competitor by one-fifth or 20 per cent., and in making shoes he can excel him by one-third or 33 per cent.; — will it not be for the interest of both, that the superior man should employ himself exclusively in making shoes, and the inferior man in making hats?"* Ricardo is just parafrasing here Smith's famous taylor and shoemaker example in order to support the counterintuitive notion that the "superior" country is still interested in the exchange with the "inferior" country.

Another divergent theoretical implication between Ricardo's numerical example and the CULC model refers to the explanation given to the commodity composition of international trade. As already said, the CULC model explains the pattern of international specialization and the commodity composition of international trade by a single exogenous cause: persistent differences in labor productivity among countries. Ricardo, however, explains the pattern of international specialization and the commodity composition of international trade by the gains in labor productivity in the home country, and explicitly mentions several sources — not a single source as the CULC model does — for having a comparative advantage in the production of certain commodities.[11] In this point Ricardo follows his intellectual mentor Smith, who pioneered the multi-factor approach for explaining the commodity composition of international trade.

Some Negative Consequences of Omitting the Differences

The longstanding omission of these crucial differences between Ricardo's numerical example and the CULC model has had important consequences for the reception and understanding of Ricardo's contributions to classical international trade theory. As already pointed out, the reliance on the CULC model has made it harder — not easier — to understand what Ricardo originally pretended to illustrate with his numerical example.

Moreover, the predominance of the CULC model has caused a rift between the analysis of domestic and foreign trade in contemporary economic theory. Under the influence of the CULC model, the theory of foreign trade became increasingly formalized in terms of a static cross-section analysis of the existing pattern of trade based on the efficient allocation of certain resources with the given labor productivity, while the analysis of the domestic trade

[11] Ricardo states: "It is quite as important to the happiness of mankind, that our enjoyments should be increased by the better distribution of labour, by each country producing those commodities for which by its situation, its climate, and its other natural and artificial advantages, it is adapted, and by

continued along Smith's broader dynamic lines in terms of capital accumulation, population growth and the explicit recognition of the diminishing returns from land.[12]

After highlighting the significant differences between the CULC model and Ricardo's numerical example in the *Principles*, it seems clear that the former should no longer be considered as part of Ricardo's international trade theory. Some implications of the CULC model are even in flagrant contradiction with important passages of the *Principles*, as has been shown here. Thus, the continued association of this textbook model with Ricardo's name seems unjustified and misleading.

For supporters of the general economic equilibrium paradigm, though, the CULC model offers some important advantages over Ricardo's numerical example. The CULC model does not rely on the labor theory of value, which is of course the rival and opposing framework to general equilibrium economics. Furthermore, as Buchanan and Yoon (2002, p. 403) point out, there is no inherent conflict between the CULC model and the neoclassical constraint of constant returns to scale. That is why some neoclassical economists may prefer the CULC model instead of the original numerical example of the *Principles*. They are certainly free to do so, but in that case they should look for another denomination for their preferred theoretic trade model, because the current one is misleading: the "Ricardian model of international trade" of contemporary economic textbooks has very little — if anything — in common with Ricardo's original demonstration of the comparative-advantage proposition.

Conclusions

Ricardo's numerical example — if properly understood — and the so-called "Ricardian model of international trade" of contemporary economic textbooks are actually quite

their exchanging them for the commodities of other countries, as that they should be augmented by a raise in the rate of profits" (Vol. I, p. 132).

[12] See Myint (1977, p. 234).

different things. They differ in terms of the underlying proposition, logical construction, assumptions and theoretical implications. Therefore, the current praxis of referring to the textbook model as the *Ricardian* model of international trade seems no longer acceptable. Instead, the textbook model might be called, for example, the Constant Unitary Labor Costs model (CULC).

Ricardo's numerical demonstration of comparative advantage is clearly superior in terms of elegance and simplicity. Moreover, it has the additional advantage that it does not rely on any of the unrealistic assumptions made in the CULC model, like the ones regarding constant labor costs and perfect internal mobility of the factors of production.

From a methodological perspective the most important recommendation than can be extracted from this paper is the following: Scholars should abandon the misleading methodological approach of trying to interpret Ricardo's numerical example through the lenses of the CULC model. This methodological approach makes it actually harder to correctly understand the insights and implications of the four numbers in chapter seven of the *Principles* for international trade theory. Instead, one should always make a clear distinction between Ricardo's original numerical example and the international trade model named after him in today's economic textbooks.

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