

Testing the Ricardian Model: Do the Data Confirm the Assumptions?

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Abstract— The insight of David Ricardo’s international trade theory can be proved by the way he managed to capture the economic problems of his era and by the fact that his theory is still studied and applied in the construction of new economic models and theories. Ricardo has accepted Adam Smith’s idea, that the “absolute advantage” determines domestic output and trade between countries, under the assumption of perfect mobility of factors of production. The aim of this paper is to do an empirical analysis of Ricardo’s model not only to test the validity of his assumptions, but also to see what are the main categories of goods that the European Union, the United States and Japan export and which specialization should each of them choose.

Keywords—Ricardian model; international trade; country specialization, comparative advantage

I. INTRODUCTION

Ricardo has taken on and developed some of the basic notions (labor division, labor value theory etc.) from his predecessor, Adam Smith. Furthermore, even the concept of “comparative advantage” for which he is famous belongs to a contemporary of his, Robert Torrens (An Essay on the External Corn Trade, 1815). However, this concept has become known and has undergone full scientific acknowledgment through Ricardo’s “Principles of Political Economy and Taxation” (1817). [1]

Chapter VII, entitled "On Foreign Trade" uses the concepts of comparative cost, relative value, relative price, and relative advantage. Ricardo considers that “the same rule which regulates the relative value of goods in one country does not regulate the relative value of goods exchanged between two or more countries.”

This dichotomy is not specific to Ricardo’s theory, the mercantilist being the first to notice the differences between domestic output and external trade performance as well as some features of the latter, which is based on different principles, bigger markets that are riskier but more gainful.

Basically, the comparative advantage, based on the idea of specialization of nations or individuals considered an entity,

assumes that even if a nation has absolute disadvantages for two goods it could benefit from and gain from trade if it will specialize in producing the good for which it has the lowest relative disadvantage compared to the partner country. [2]

This model that analyzes a world with two goods and two countries, known as the simplified 2 x 2 model, as simplifying and criticized as it has been represents a concept and a step stone in the development of economic theory that cannot be ignored.

The simplifying comes from the way the model could describe and analyze a world that sells a variety of goods and is formed from a variety of countries that operate under a number of very strong restrictions. The critics are based on two arguments: on one hand that this principle of comparative advantage seems counterintuitive and on the other hand, it would be easily confused with the absolute advantage which is entirely intuitive.

Nonetheless Ricardo’s model was a source of inspiration for many other theories of international trade. Empirical research on the Ricardian model was very vast, but after Balassa’s last word on the subject [3] its importance has been rather diminished. In the beginning of the 21st century however, the Ricardian model has found no applications.

The innovative work of Eaton and Kortum [4] regarding the gravity equation is one example, while in their article, Golub and Hsieh have argued that labor productivity variation is the source of comparative advantage since the other factors of production are mobile between countries.

Choudri and Schembri [5] analyze the USA-Canada trade flows and integrate product differentiation into the Ricardian framework. [6]

In spite of being considered antiquated and not applicable to nowadays economic reality, the Ricardian model still provides a valuable platform for introducing new ideas. [7]

II. MAIN HYPOTHESIS OF THE RICARDIAN MODEL

David Ricardo was the one who proved that a country will specialize in producing those goods that can be manufactured

efficiently and will buy from other countries those goods that it produces less efficiently, even if it could produce these goods more efficiently than a third country.

Ricardo's reasoning was based on three hypotheses:

- The relative immobility of the factors of production

He considered the factors of production, such as labor and capital to be mobile and that goods could be exchanged freely within the country. At an international level though, he considered only goods to be mobile, while labor and capital would be immobile and therefore would not influence the competition between countries.

These two assumptions summarize the particularities of international trade and explain why external trade flows are different from national ones. Furthermore, these two assumptions reflect the classical and neo-classical views on a nation, which was defined as the "locus" where factors of production are intersecting (perfect national mobility, international immobility).

- A pure and perfect competition

In each country, competition is "pure and perfect", which means that no firm has sufficient power to impose conditions on the market and affect the price or volume of supply and that there is no restriction on entry or on the movement between sectors (intersectoral mobility).

Based on the "labor theory of value" Ricardo postulates that, within each country, trade flows depend on the amount of labor required to produce them. If, for example, the production of one unit of cloth requires two hours of labor and the production of one unit of wheat requires an hour, a unit of wheat will be exchanged for two units of wheat.

- The existence of a static equilibrium

For any type of good, its production involves the use of production factors in well-defined proportions. In other words, production takes place under conditions of "fixed coefficients" without the possibility of substitution.

Furthermore, there is no advantage (or disadvantage) in producing on a large scale rather than small. The price per unit is considered to be the same in both cases. Hence, production occurs at "costs or constant returns to scale". [8]

Based upon these three main hypotheses, Ricardo's theory represents an original analysis of international trade, which was able to explain the fundamentals of specialization, efficiency and economic growth.

III. A NUMERICAL EXAMPLE OF THE RICARDIAN MODEL

The easiest way to test Ricardo's theory is by a numerical example, which will allow determining the comparative advantage of the countries that according to Ricardo is the cause for country specialization, for international trade and for gains for all countries that decide to take part in these exchanges.

In order to make our numerical example we will analyze international trade flows for the three biggest players on the

world market, the European Union, the United States and Japan. Therefore, we will extend Ricardo's basic 2 x 2 model to a world with three countries and three goods.

The reason behind this numerical example is not necessarily to contradict Ricardo's theory. We simply want to see what goods should each country produce according to Ricardo and if indeed the specialization corresponds to his idea.

Therefore, we will consider a world where trade takes place only between EU-27, USA and Japan and that they exchange agricultural goods, manufactured goods and services.

We will keep Ricardo's assumption that labor is the only factor of production and that it is mobile within each country but immobile between countries.

Table I shows the labor requirements for producing the three goods targeted in EU-27, USA and Japan, during 2008-2011.

We will use only the number of workers needed for production in the three sectors analyzed without multiplying it with the wage since we are interested more in the actual labor requirements in each sector and country. Furthermore, we consider that the difference in wage between EU, USA and Japan will affect our results.

TABLE I. LABOR REQUIREMENTS IN EU-27, USA AND JAPAN

Year	Number of workers (thousands)								
	Agriculture			Industry			Services		
	EU	USA	Japan	EU	USA	Japan	EU	USA	Japan
2008	11455	15740	29640	140435	178000	877760	537563	112756	558410
2009	11147	14806	29320	129918	159510	858490	539481	110604	557200
2010	11172	13323	28430	126054	161800	854810	541952	109810	559310
2011	11263	13073	27670	127008	164610	852740	545970	110400	561490

^a. Source: Eurostat [9]; U.S. Bureau of Labor Statistics [10]; The Statistics Bureau of Japan [11]

As we can see from Table I, the labor requirement in Japan is a lot bigger than the one in the European Union or in the United States in all of the three sectors targeted. However, the United States have a bigger labor requirement than the European Union in all three sectors.

It does not come as a surprise that services require a larger labor requirement than agriculture or manufacturing, but Japan seems to be an exception from this rule, since the biggest labor requirement is found in the manufacturing sector.

Table II shows the value of exports for agricultural products, manufactured goods and services in EU-27, USA, and Japan during 2007-2011.

As we can see the European Union is the largest exporter of the world, followed by the United States. Nonetheless, Japan is a very important exporter on the world market, with a higher value of exported services than EU and USA and a higher value of exported manufactured goods than the European Union.

TABLE II. VALUE OF EXPORTS IN EU-27, USA AND JAPAN DURING 2008-2011

Year	Exports (million \$)								
	Agriculture			Industry			Services		
	EU	USA	Japan	EU	USA	Japan	EU	USA	Japan
2008	569470	140161	8351	4629965	973394	693235	3587424	295171	1060106
2009	496146	119737	7904	3619541	724902	507992	3110707	254064	999232
2010	533949	142538	10168	4008479	870180	680290	3228888	279991	1082888
2011	625886	168208	10955	4622289	966486	725298	2879188	287919	1180513

b. Source: World Trade Organisation [12]

Table III shows the ratio between the number of workers needed to export 1000\$worth of agricultural products, manufactured goods and services in EU-27, USA and Japan.

Based on the data below we can see that the European Union has a bigger advantage in all sectors, while the high labor requirement registered by Japan determines its comparative disadvantage.

TABLE III. LABOR REQUIREMENTS PER VALUE EXPORTED IN EU-27, USA AND JAPAN

Year	Number of workers (thousands) / Exports (million \$)								
	Agriculture			Industry			Services		
	EU	USA	Japan	EU	USA	Japan	EU-27	USA	Japan
2008	0.0201	0.1123	3.5493	0.0303	0.0183	1.2662	0.1498	0.3820	0.5267
2009	0.0225	0.1237	3.7095	0.0359	0.0220	1.6900	0.1734	0.4353	0.5576
2010	0.0209	0.0935	2.7960	0.0314	0.0186	1.2565	0.1678	0.3922	0.5165
2011	0.0180	0.0777	2.5258	0.0275	0.0170	1.1757	0.1896	0.3834	0.4756

c. Source: own calculations based on Tables I and II

Figure 1 illustrates the data from the table above. We can see clearly that the ration between the number of workers and the value of exports is a lot higher in Japan than in the European Union and the United States.

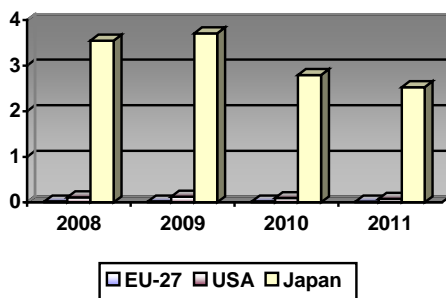


Fig. 1. The labor requirement for 1000\$ of agricultural products exported

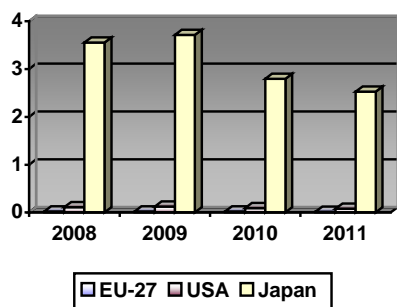


Fig. 2. The labor requirement for 1000\$ of manufactured products exported

In Figure 2 we can see in the case of manufactured goods the biggest disadvantage is registered once again by Japan, while the United States have the comparative advantage.

Figure 3 illustrates the comparison between the United States, the European Union and Japan in the case of services.

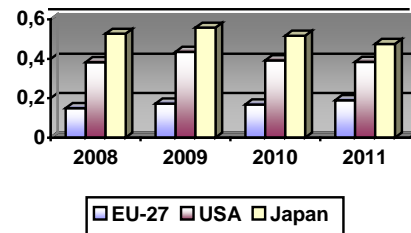


Fig. 3. The labor requirement for 1000\$ of services exported

The comparative advantage is held by the European Union, while Japan is in disadvantage.

So, what will happen if our three countries world should decide to take Ricardo's advice and specialize in producing the good for which it has a comparative advantage, while buying the other goods from its commercial partners?

If, for instance, a country would decide to specialize in producing only agricultural products it will have to sacrifice the gains from exporting the other two goods.

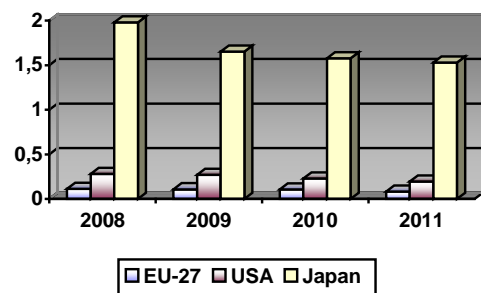
In Table IV we show the comparative advantage that the European Union, the United States and Japan would have if they would decide to specialize in agricultural products.

TABLE IV. THE COMPARATIVE ADVANTAGE FOR AGRICULTURAL PRODUCTS

Year	EU	USA	Japan
2008	0.1116	0.2805	1.9796
2009	0.1075	0.2705	1.6504
2010	0.1049	0.2276	1.577
2011	0.0829	0.1941	1.5296

d. Source: own calculations based on Table III

Fig. 4. The cost of specializing in agricultural products



As we can see from Figure 4, the European Union would gain the most if it will decide to specialize in agricultural products, while Japan will stand to lose from the tradeoff.

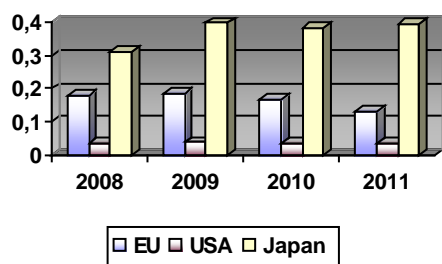
Table V shows the comparative advantage in case of a country specialization in manufactured goods.

TABLE V. THE COMPARATIVE ADVANTAGE FOR MANUFACTURED GOODS

Year	EU	USA	Japan
2008	0.1783	0.0370	0.3106
2009	0.1833	0.0394	0.3961
2010	0.1664	0.0383	0.3793
2011	0.1325	0.0369	0.3917

^e Source: own calculations based on Table III

Fig. 5. The cost of specializing in manufactured goods



From Figure 5 it is obvious that if the United States should decide to specialize in the production of manufactured goods, they will hold the biggest comparative advantage, followed by the European Union and Japan.

Table VI allows us to determine the comparative advantage in the case of a specialization in services.

TABLE VI. THE COMPARATIVE ADVANTAGE FOR SERVICES

Year	EU	USA	Japan
2008	2.9722	2.9250	0.1094
2009	2.9692	2.9876	0.1033
2010	3.2084	3.4987	0.1275
2011	4.167	4.0486	0.1285

^f Source: own calculations based on Table III

And as we can see from Figure 6, Japan will gain from specializing in services and buying agricultural products and manufactured goods from the European Union and the United States.

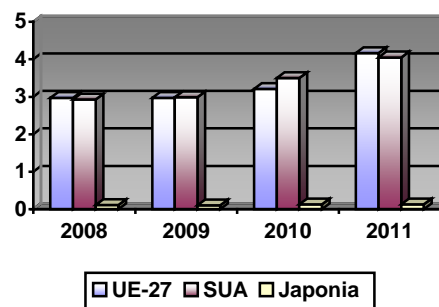


Fig. 6. The cost of specializing in services

From the tables and the figures above and following Ricardo's assumption and conclusions, the European Union should specialize only in agricultural products, the United States in manufactured goods, while Japan should specialize in services, which is not surprising considering that factor endowments have a key importance in Ricardo's model.

IV. CRITICISM TO RICARDO'S THEORY OF TRADE

Ricardo's theory of trade, as shown above, was built based only on differences in labor requirement per unit of production, which reflect technological differences and contribute to differences in labor productivity. This was what led Ricardo in concluding that a country that has higher labor requirement in the production of all goods should trade and even gain from trading with another country, which is more technologically advanced.

As shown by Ricardo and verified by our numerical example, the model supports a mutual benefit for all countries and is not a zero-sum game, where one player's gain is at the cost of the other's loss.

The Ricardian model, based on two countries, two goods and a single factor of production, labor, is based on a generality feature of perfect competition, on the goods' market as well as on the labor market.

This leads to a homogeneity of the goods, which can be exported without costs of transportation, while labor is considered homogeneous within the country, but has different productivities between countries, based on technological differences. Furthermore, work could be transferred without costs between sectors, but is immobile between countries. This assumption has been proven to be wrong since the transfer of workers between sectors implies high costs but also because labor is highly mobile between countries.

Moreover, the model assumes that the only factor of production used, labor, is fully employed, which is economically inaccurate since unemployment has been a constant reality for every country. In addition, it is rather simplistic to consider that there is only one factor of production needed and that it is labor, since capital has an essential role in production as well as in the process of decision making, perhaps a more important role than labor.

V. CONCLUSION

By assuming the existence of perfect competition the Ricardian model then uses the whole set of characteristics specific to this type of competition. Therefore, since perfect competition implies an atomicity of firms in each sector, where there is a large number of firms with small economic power, which implies that firms don't have the power to influence the price of goods and of the factor of production that is therefore exogenously determined. However, firms can choose the level of production that will maximize their profit, which is their main goal, by establishing a level of price equal to the marginal cost of production. Once again, we consider this assumption to be inaccurate since markets with perfect competition are utopic. Furthermore, due to globalization firms have become more and more powerful and there are large transnational corporations that are considered to have more power and more capital assets than some small countries.

Homogeneity implies a complete substitutability between goods and workers, in other words, the goods that are produced by various firms have the same utility for all consumers. We consider this assumption to be incorrect since we cannot assume that all goods have the same quality and the difference is given by the technological differences between countries.

In their goal of profit maximization, firms can enter and leave the market freely. Making a profit will be an incentive for firm entry, while losses will cause firms to leave the sector. This is probably the only assumption of the model that can be applied to today's economy. However, if we consider that many firms have expanded their activities in other countries (often in less developed ones) in order to reduce the costs of production and/or to expand their market share, we find that leaving a sector is not a firm's first option in case of a loss.

Ricardo believes that international trade flows depend on the opportunity costs of each country (of one good in terms of another). In reality, international trade flows are influenced by the prices on different international markets.

The validity of the "relative advantage" concept that Ricardo introduced was questioned directly or indirectly by various economists (S. de Sismondi, Fr. List, H. Ch. Carey, S. N. Patten, K. Marx, O. Bauer, J. Hobson, J. M. Keynes, M. Manoilescu ş.a.) that didn't share the liberal optimistic view on spontaneous market self-regulation, on perfect competition and on this type of market organization.

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