THE EFFECTS OF THE COSTS OF TRADE TRANSACTION AND FREE TRADE IN THE INTERNATIONAL SOY MARKET

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ABSTRACT

This study analyzes and discusses the impacts of the costs of trade transaction and tariff barriers and subsidies in the international soy trade. To achieve such a purpose, a partial equilibrium model is used, formulated as a Mixed Complementarity Problem - MCP - which allows including of the costs and the tariffs and subsidies in addition to building scenarios. Three simulations are built for testing the impacts: in the first one the costs are eliminated, in the second one, the trade policies are removed and in the third one, an increase of 20% in the consumption of soy is tested. The results show that eliminating the trade transaction costs favors Brazil, Argentina and China in the increase of exports and raises imports in the United States and Europe. The countries in the rest of the world are the ones who benefit the most from the free market condition. The scenario of increase in the world consumption shows that with the rhythm of soy consumption in the same levels of the years from 2009 to 2011 in the world and with the same pattern of the transaction costs and the trade policies, Brazil is the only one among the large producers who cannot manage to increase its participation in the world soy exports.

***Key words*:** free trade; trade transaction costs; PCM; soy.

1 INTRODUCTION

The positive relationship between trade and the expansion of the economic activities are ideals which stood out and stimulated the free trade regimens that prevailed in the second half of the XIX century. However, with the crisis of 1930, free trade began to be contested and the governments to adopt alternative policies, regulating the markets and stimulating the economic activities by means of restrictions to the free circulation of capital, work force and merchandize. The context of the barriers includes a number of restrictions which generated additional costs to the international trade which gather, for instance, in addition to the tariffs and subsidies, transaction costs[4], theft, bribery, smuggling, losses of merchandize, costs related to structural matters of transportation and logistics and costs of credit incurred by the agents as a form of participating on the market and also the costs of appealing to the World Trade Organization - WTO.

The litigation between countries with the WTO seeking to claim import restrictions, according to Arbix (2007), involve a great delay until the final resolution of the disputes and require human and material resources, expenses with administration and organization of the elements which are necessary and inherent to each proceeding. In addition, while a defined resolution is not achieved, the exports of the plaintiff are harmed. Also important in the formation of costs is the incurring of financing which are necessary for participating in the market, including the of costs of preparation of documents and contracts, monitoring of loans, risk management, expenditures charged by financial institutions or

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[4] Examples of transaction costs according to Azevedo (2000) are the gathering of information, use of the legal system, monitoring of performance, preparation and negotiation of contracts.

arbitration rates[5], in addition to suffering the impact of the macroeconomic conditions and governmental policies such as, for instance, the behavior of the interest rates, exchange, and banking spreads[6] .

An indicator of the international trade costs is the TED Spread[7]. The increase of the TED indicates a drop of liquidity, reflecting difficulty for raising credit for financing exports. According to Aisen et al (2013), during the crisis of 2008, the companies from the sectors which depend on credit the most were the ones affected the most in terms of drop of exported volume. According to Hwanga, and Hyejoon Im (2013), the smallest availability of financing during the crisis, implicated in the reduction of 14% in the exports of Korea in 2009 in relation to the exports of the previous year.

Infrastructure of transportation and logistics is also important in the formation of the transaction costs of international trade. It is assumed that the less efficient a system is, greater are the costs. A performance measure for the services can be the transportation costs and the time spent to take the merchandize from the production zone up to the point of shipment abroad. Deficiencies which result in delays of arrival can reflect in the delay of other proceedings or even in all the proceedings necessary for export, resulting in trade losses.

According to Limão and Venables (2001), countries with no frontier with a deficient infrastructure have high transportation costs that can reach 20% higher than in coastal countries. But, if the entire time that the merchandize remains in transit, which is from leaving the production area up to its release in the importing country, is considered, the costs can be quite high, even in countries with a shoreline. The time that the merchandize remains in transit is essentially important for the developing countries. The release of documents, according to Pontes et al (2009) is potentially a huge problem, as in the case of Brazil, which starts with the delays of arriving at port and the formation of waiting lines formed by the scarce infrastructure in the ports, such as the lack of warehouses and parking lots for trucks.

Crime, smuggling, bribery, cargo losses are also favored by system faults as a function of local factors and import in forming the costs in international trade. For the sake of comparison and according to Porto (2005), in 2003, regions of Europe, show the payment of non official rates with percentages of 0.7% of the total cargo and 0.3% of merchandize damaged and/or stolen face the transportation costs which was of approximately 11.6%. These and a large portion of the costs, however, are not noticeable and, because of that, are difficult to measure. In this regard, the purpose of this study is to analyze and discuss the effects of the costs which involve the trade transactions and compare them with the effects of the tariff barriers and the subsidies in the international market and in view of a shock of demand.

Soy is the product chosen for analysis for configuring as one of the merchandize most traded internationally and with the perspective in raising the consumption as a function of the increase in the demand of their subproducts, oil, brans and biofuels, and for various percentages of tariffs incurring on the grains and types of subsidies between the countries, allowing an evaluation of the different impact of the trade policies on the market. In addition, on account of being an agricultural product, the soy market involves risks and uncertainties which are related to the non tariff barriers, such as, for instance, the delays in the frontiers as a function of requirements concerning sanitary and phytosanitary controls which tend to be greater in countries having a greater deficiency in the infrastructure and logistics system. In this context, the structural inequalities allow capturing the different effects of spill over[8] between the regions which were analyzed. The regions selected correspond to the largest producers and consumers of soy. Other countries with lesser importance in the production and import of the product are added in the variable “rest of the world”.

The development of the study must answer the following questions: what is the influence of the trade transaction costs among the main soy producing regions in the world? What is the difference of

[5] Activity in the financial market of commodities, which consists of selling merchandize in a trading center for a higher price than the purchase price in another. The arbitration can be, for instance, in the commodities market, such as wheat and soy (SANDRONI, 2008). The arbitration generates costs, for instance, commissions and/or spreads (RABELO JUNIOR and IKEDA, 2004).

[6] “Spread is the additional risk rate collected in the international financial market. It is variable according to the liquidity and the guarantee of the of the loan borrower and term of redemption” (SANDRONI, 2008).

[7] TED Spread is the difference between the interbank loan rates, LIBOR – London Interbank Offered Rate – and the interest rates of the United States Treasury. (KORINEK et al, 2009).

[8] Spill-over is the same as externalities (SANDRONI, 2008).

impact in the international trade between the trade transaction costs and the policies of tariffs and subsidies? What is the participation of the countries in these costs? And, what are the effects of the costs which incur in trade transaction and the trade policies in the international soy market if the market maintains the same level of consumption of the period analyzed in this study?

To that effect, a partial balance model is used, formulated as a Mixed Complementarity Problem - PCM - in which the inclusion is made of the transaction costs and the trade policies, in addition to building alternative scenarios. Three simulations are built for testing the impacts and the reference period being used are the years from 2009 to 2011. The contribution of this paper is in the inclusion of a variable to the PCM model which represents the trade transaction costs not computed as transportation costs, tariffs and subsidies.

The division of the article is organized into three chapters in addition to this introduction; The first chapter shows the methodology that was used with the inclusion of the trade transaction costs on the PCM; the second shows the results which were produced and the third one presents the final considerations.

2 METHODOLOGY

The model used for obtaining the estimates of this study is a mathematical programming method based on the work of Anania et al (2011) which introduces the transaction costs as a calibration variable for the model originally developed by Samuelson (1952) and Takayama and Judge (1994). The method consists of generating an adjustment variable for the mathematical programming problems which, according to the authors, in general show differences between the estimated results and the data observed. Such differences can be attributed to the inaccuracy of the costs which take place on the trade transactions or the inaccuracy of the measures for the parameters of offer e demand functions, or for both reasons. The use of the model without correcting such differences can result in distorted evaluation of policies.

Anania et al (2011) use the primal-dual that is calculated based on the Karush-Kuhn-Tucker - KKT[9] conditions. In this study, the authors' method is adapted to the PCM, a spatial balance model developed by Rutherford (1994) based on the optimization problem with restrictions represented in the form of inequalities. The method presupposes that the products are homogeneous and takes into consideration the offer and demand functions of each region, the costs of transportation between regions and the presence of trade barriers, leading to estimating the quantities produced and consumed, the trade flows and the level of prices in balanced. The PCM has the advantage of allowing the incorporation of tariffs, quotas and subsidies more easily than the primal-dual models.

The estimates are obtained by means of two phases: in the first one the transaction costs (exogenous variable) represented by $\gamma_{i,j}$, the quantities and the prices of offer and demand, the quantities of trade flow and the transportation costs (endogenous variables). In the second phase of the problem, the transaction costs ($\hat{\gamma}_{i,j}$) generated in the first one are introduced in the model with the quantities and prices off offer and demand. The quantities of trade flow now become na endogenous variable. The expression of the PCM in the first phase is given by:

$$q_j^d \leq \sum_i^I X_{i,j} \qquad \lambda_j \geq 0 \qquad \left[\sum_i^I X_{i,j} - q_j^d\right] \lambda_j = 0 \tag{1}$$

$$\sum_j^J X_{i,j} \leq q_i^s \qquad \varphi_i \geq 0 \qquad \left[q_i^s - \sum_j^J X_{i,j}\right] \varphi_i = 0 \tag{2}$$

[9] Karush-Kuhn-Tucker - KKT conditions are necessary conditions given from the restrictions which define an optimum as the solution of a mathematical programming problem. KKT (CHIANG, A.C.; WAINWRIGHT, K, 1982).

$$X_{i,j} = \bar{X}_{i,j} \qquad \gamma_{i,j} = free \qquad \left[X_{i,j} = \bar{X}_{i,j}\right]\gamma_{i,j} = 0 \tag{3}$$

$$\lambda_j \leq \varphi_i + t_{i,j} + \gamma_{i,j} \qquad X_{i,j} \qquad \left(\gamma_{i,j} + \left(t_{ij} + \varphi_i\right)\left(1 + tar_{i,j}\right) + subs_{i,j} - \lambda_j\right)X_{i,j} = 0 \tag{4}$$

According to equation (1), when the consumer market price which is represented by the shadow price λ_j, is equal to zero the total sum traded from the country i to the country j ($\sum_i^I X_{i,j}$) will be greater than the quantity demanded by the country j (q_j^d). But if the price that the consumers wish to pay is greater than zero, then, the total volume traded from the country i to the county j will be equal to the quantity demanded in the country j. Likewise, equation (2) shows that when the producer market price which is represented by the shadow price φ_i, is equal to zero the total sum traded from the country i to the country j ($\sum_j^J X_{i,j}$) will be smaller than the quantity offered by the country i (q_i^s). But if the price that the producers wish to receive is greater than zero, then, the total volume traded from the country i to the county j will be equal to the quantity offered in the country i. Equation (3) represents the trade flow between the regions i and j which is given by the ratio of equality between the observed flow ($\bar{X}_{i,j}$), i.e., the actual values, and the estimated flow ($X_{i,j}$). This is the portion of the equations system that allows estimating a measure for the transaction costs $\gamma_{i,j}$. Each $\lambda_j \geq 0, \varphi_i \geq 0,\ \sum X_{i,j} \geq 0$ and $\gamma_{i,j}$ represent a non negativity restriction, except for the variable $\gamma_{i,j}$ which is free, being able to assume positive or negative values. The negative values can occur, according to Anania et al (2011), due to the effect of trade policies, such as, for instance, the subsidies which, when they are higher than the transaction costs, make this variable negative. The positive variables are conditioned inequations and the free variables by equations, as per Ferris and Munson (2005).

The complementarity condition given by equation (4) determines that the market price of the region of demand j must be smaller than the offer price of the region i added the costs of taking the merchandize up to the region of demand (t_{ij}), the transaction costs, the subsidies and the percentile of tariff corresponding to the product, which depends on the policies of each country. If this sum exceeds the market price of the region j, the trades flow of product of the region of offer i to the region de demand j will not be put into effect. Thus, the condition in which the sum of the prices and costs exceeds the consumer's disposition of the consumer to pay must take into account a trend of trade reduction, i.e., costs excessively high can restrict the trade flow between the regions and/or countries. The expression of the PCM in the second phase is given by:

$$q_j^d \leq \sum_i^I X_{i,j} \qquad \lambda_j \geq 0 \qquad \left[\sum_i^I X_{i,j} - q_j^d\right]\lambda_j = 0 \tag{5}$$

$$\sum_j^J X_{i,j} \leq q_i^s \qquad \varphi_i \geq 0 \qquad \left[q_i^s - \sum_j^J X_{i,j}\right]\varphi_i = 0 \tag{6}$$

$$\lambda_j \leq \varphi_i + t_{i,j} + \gamma_{i,j} \qquad X_{i,j} \qquad \left(\hat{\gamma}_{i,j} + \left(t_{ij} + \varphi_i\right)\left(1 + tar_{i,j}\right) + subs_{i,j} - \lambda_j\right)X_{i,j} = 0 \tag{7}$$

The optimum solution is obtained from the convergence of the complementary equations (5), (6) and (7). In accordance with the complementarity condition given by equation (7), the market price of the region of demand j (λ_j) must be smaller than the offer price for the region i (φ_i) added the costs of taking the merchandize up to the region of demand (t_{ij}), the transaction costs ($\hat{\gamma}_{i,j}$), the subsidies and the tariff percentile corresponding to the product. The base and alternative scenarios can be created from the results obtained in this phase.

In this study, the first scenario is simulated with the elimination of the trade transaction costs, maintaining the tariffs and the subsidies. Certainly, there is no trade without these costs, since a few are inherent and inevitable in the trade transactions, such as arbitration in the financial market of commodities or transportation insurance. However, the intent is to test the potential impacts that the

transaction costs represent in the international trade. In the second scenario, the costs are maintained and a free trade simulation is done. The purpose of this unfolding is to make a comparison between the degree of influence of the traditional instruments of the tariffs and the subsidies, and the transaction costs in the external soy market.

In the third and last scenario a shock of demand of 20% is attributed on the world consumption. This percentage is based in raising the consumption of soy and of their subproducts in the years of reference which was of approximately 18% for the grain, 15% for the oil, 14% for the soy bran, according to data from FAOSTAT and 36% for the biodiesel, according to U.S. Energy Information Administration - EIA (2013), resulting in an average increase of products derived from the oleaginous close to 20%. The purpose of this follow-up is to evaluate the effects of the rise in consumption in the same levels of the studied period in view of the costs which incur in the trade transaction and the trade policies in the international soy market. The simulations were carried out with the use of the General Algebraic Modelling System - GAMS – by means of the solvers Path.

The data for the quantities of demand and offer and prices of soy was drawn the Food and Agriculture Organization of the United Nations – FAOSTAT – for which the average from the years 2009 to 2011 is used. The use of the averages is justified by the need of minimizing the variations of sudden changes in the economy. The quantity consumed is formed by the sum of the production and import, excluding the quantities of export. The elasticities of offer and demand were acquired in the Food and Agricultural Policy Research Institute - FAPRI. The subsidies and transportation costs were drawn from the Organização para a Cooperação e Desenvolvimento Econômico – OCDE [Organization for Economic Cooperation and Development]. The transportation costs were calculated[10] from information concerning the year of 2007[11] and data per unit of transportation cost in dollar per kilogram. The distances between the countries are in nautical Miles and were granted by Ileana Cristina Neagu of the World Bank, Washington-DC in 2002, according to Alvim (2003). The subsidies represent the transfer of the government to the producer in dollars per tons of soy. The transfer values were converted into dollars. The import tariffs are *ad valorem* and were collected in the World Trade Organization – WTO. Both the transportation costs and the tariffs refer to the international ranking method of the Harmonized System - HS of the Common Nomenclature of the MERCOSUL - NCM of code 120100. The trade flow between countries is represented by the net soy exports which are calculated by the difference between the exports and imports for each country. The data was drawn from the United Nations Commodity Trade Statistics Database - UN COMTRADE and aggregates as per regions selected for the study and which are being present in table form in the chapter that deals with the results. The results of these empiric tests are presented in the next chapter.

3 RESULTS

The initial results correspond to the information referent to the soy market and just afterwards the results produced by the model in the first phase which concern model calibration and generation of transaction costs are presented. Next, the base scenario and the alternative scenarios which are a part of the second results production phase are presented.

3.1 INTERNATIONAL SOY MARKET – DATA OBSERVED

According to information from the Food and Agriculture Organization - FAO (2013) and the United Nations Commodity Trade Statistics Database - UN COMTRADE (2013), the three major producers of soy in the world are the United States, Brazil and Argentina. The largest consumer is China that demands more than half the grain traded in the world. The United States are the largest producers of

[10]Calculation of the soy freight cost: (Cost in dollar to take 1 kilogram of soy from one country X a to one country Y * Quantity in kilogram) / Distance in nautical miles = cost in dollar to take the total quantity from the country X to the country Y * Distance in nautical miles between the country X and the country Y= Cost indicator * distance in nautical miles from each country = cost of freight in dollar to take the soy from each exporting country to the respective importer country.

[11] 2007 is the last year of data availability for the transportation costs of the soy by the OCDE.

soy with an offer of 88,738 million tons (35.56%) of the grain produced in the world. Brazil comes in second place with 66,972 million tons (26.84%) and Argentina in third with 44,183 million tons (17.71%). The European Union[12] (EU) and China are the countries with the smallest production among the countries selected, being, respectively 1,141 million tons (0.46%) and 14.850 million tons (5.95%) of the entire world production (Table 1).

According to the United Nations Commodity Trade Statistics Database - UN COMTRADE (2013), approximately 36% of the soy that is produced in the world is traded in the international market, where the main destination is China. This country is the largest consumer and importer of the grain in the world. In the period from 2009 to 2011, according to the FAO (2013), the consumed volume was of 66,988 million tons (26.85%) of the total produced of grain. The second largest consumer is the United States with 50,093 million tons (20.08%) of the total world consumption; The EU is the region that consumes the smallest volume of grain with 13,989 million tons which corresponds to only 5.61% of the world consumption. It is fitting to point out that the EU produces and consumes little grain because it imports the soy products already industrialized and consumes other oleaginous, such as, for instance, canola. In turn, China, in spite of producing a low volume, when related to the major producers, consumes relevant quantities as a function of the internal industrialization of the bran and oil.

Table 1 – Net production, consumption and export of soy in thousand tons for the selected regions– 2009/2011

Countries	Argentina	Brazil	USA	EU	China	RW	Production
Argentina	**34,883**		11,973	54,234	7,935	1,299	44,183
Brazil	4,123	**36,851**	306	4,497	19,395	6,225	66,972
USA			**50,081**	2,036	23,425	13,197	88,738
EU				**1,141**			1,141
China				12,299	**14,838**		14,850
RW				6,249	1,395	**25,987**	33,631
Consumption	34,887	36,851	50,093	13,989	66,988	46,709	249,516

Source: Prepared by the authors from the information of the UN COMTRADE (2013).

In Brazil, 55.02% of the grain is consumed within the country, the remainder is directed to the external market. According to the UN COMTRADE (2013), out of the volume exported by the Brazilian country, 28.96% goes to China; 6.71% to the EU; 9.30% to the countries of the rest of the world and less than 1% of the volume exported to Argentina and the United States. Argentina consumes 78.95% of what it produces and exports 17.96% to China. The United States consumes 56.44% of the soy produced and the greater portion of the exports is also directed to China, being equivalent to 26.40% of the production. From the remainder of the American grain production which is traded externally, 2.29% goes to the EU and 14.87% to the countries of the rest of the world. The EU consumes its entire production and the greater portion of its imports comes from Brazil and the countries of the rest of the world.

In terms of trade policies in the international market, according to the WTO (2011), Brazil and Argentina are the countries which apply the largest soy import tariffs, being equivalent to US$ 0.08 per kilogram of the grain. The countries of the rest of the world tariff the product in the average of US$ 0.07 per kilogram of the grain and China is the country that applies the smallest tariff in the amount of US$ 0.03 per kilogram of the oleaginous. The United States and the EU make no use of the tariff policy in their markets, but subsidize the product. The transfers which are passed on to the soy production in the countries selected for this study differ between the countries, chiefly in relation to China which does not apply any kind of loans program. The Chinese agriculturist is subsidized only from the payments based in

[12] The European Union - EU – corresponds to the union of 28 countries from Europe, according to the FAOSTAT ranking: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Holland, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom, .

internal price policies. The difference between such prices and the external prices is the form of subsidy used by China.

The transfers made by Brazil, the United States, Argentina and the EU to their producers is the difference of the loans rate and the payment at the moment of settling the operation which is generated from an indicator created based on transportation costs and the financial market, with the purpose of producing advantages to the producer. Out of the three countries, Brazil is the one that adheres the most this kind of transfer. The greater portion of the subsidies, however, adopted by Brazil is the payment based on the use of raw materials which are operational loans to help, basically, the small family farming property. No other country adopts this kind of subsidy. The United States provides payment based on the resources necessary to the production which loans are taken out based on the average for the harvest levels of the agriculturists in the event of the revenue dropping below the previous income levels and below the market prices. The information presented refers to the data observed relating to the soy market and which served to estimate the results presented to the next section, testing and validating the model.

3.2 CALIBRATION OF THE MODEL AND TRADE TRANSACTION COSTS

The first phase generates the trade transaction costs which make the calibration of the model, the trade flow and the quantities and prices of offer which are compared with the data observed so as to check the validity of the method. As shown in Table 2, the values estimated by the model have percentile differences in relation the information observed as null for all the quantities and for the prices. In this regard, the estimated model represents adequately the production, demand and the prices observed in the international soy market for the selected countries. The differences between the values observed and estimated in relation to the soy trade flow between the regions also presented zeroed differences, the same values presented in Table 1 which shows the net exports. In this regard, the estimates show the validity of the model.

Table 2 – Quantities of soy offered and demanded in selected regions - 2009/2011

Countries	Quantity of Offer			Quantity of demand			Prices		
	Observ.	Estim.	Dif.	Estim.		Dif.	Obs.	Est.	Dif
	Thousand Tons		%	Thousand Tons		%	US$		%
Arg.	44,183	44,183	0.00	34,887	34,887	0.00	0.419	0.419	0.00
Brazil	66,972	66,972	0.00	36,851	36,851	0.00	0.425	0.425	0.00
USA	88,738	88,738	0.00	50,093	50,093	0.00	0.454	0.454	0.00
EU	1,141	1,141	0.00	13,989	13,989	0.00	0.480	0.480	0.00
China	14,850	14,850	0.00	66,988	66,988	0.00	0.490	0.490	0.00
RW	33,631	33,631	0.00	46,708	46,708	0.00	0.479	0.479	0.00

Source: Prepared by the authors from the FAOSTAT data and estimates generated by the model.

Table 3 shows the transaction costs, in growing order of value. The transportation costs and the import tax which are introduced in the model are excluded from this value, while the transaction costs are estimated by the model and are equal to the measure in dollar per kilogram of soy. There are cases in which the transaction costs occur with negative values, as in the export from the United States to the rest of the world and other markets which follow in the order according the table, which can occur due to the effect of trade policies, as already shown.

Table 3 – Trade transaction costs in the international soy market for the selected regions – 2009/2011

Country		Transaction cost	Country		Transaction Cost
Exporter	Importer	US$/Kg	Exporter	Importer	US$/Kg
China	EU	0.076	USA	China	0.026
Brazil	EU	0.050	Argentina	RW	0.019
Argentina	EU	0.049	Brazil	RW	0.018
China	RW	0.045	Brazil	Argentina	0.004
Argentina	China	0.039	USA	RW	-0.001
Brazil	China	0.039	RW	EU	-0.006
USA	EU	0.034	RW	China	-0.013
Argentina	USA	0.027	RW	USA	-0.034
Brazil	USA	0.026			

Source: Prepared by the authors from the estimates generated by the model.

The highest costs refer to the trade from China towards Europe which are equivalent to US$ 0.076 followed by Brazil and Argentina which, respectively, are the second and third highest cost with US$ 0.05 and US$ 0.049 per kilogram of soy loaded to Europe. The next ones in order, in level of costs, are the exports from the Latin countries to China with US$ 0.39 for each country. The smallest costs, without considering the negative values are related to the market from Brazil to Argentina with US$ 0.004 and to the rest of the world with US$ 0.018 and from Argentina to the rest of the world with US$ 0.019 followed by the United States to China with US$ 0.26 per kilogram of transported soy. The base and alternative scenarios are presented next.

3.3 BASE SCENARIOS AND ALTERNATIVE SCENARIOS

The results of the second phase generate the base scenario that serves as a parameter for the alternative scenarios. Table 4 shows the base scenario for the international soy market with the quantities and prices of offer and demand after the calibration of the model with the introduction of the transaction costs. The estimated values refer to the results obtained in the first phase and the column to the side of the base scenario is the differences in percentiles between the estimated values and the values of the base scenario. The percentiles displayed show that the distribution of the variables and the values remain practically the same ones estimated in the first phase with small differences for some of the values, as it can be observed in Table 4, but which are not relevant to the results.

Table 4 – Base-scenario for the international soy market - 2009/2011

Countries	Quantity of Offer			Quantity of demand			Prices		
	Estimated in the 1st phase	Base scenario	Dif.	Estimated in the 1st phase	Base scen.	Dif.	Estim. 1st phase	Base scen.	Dif.
	Thousand Tons		%	Thousand Tons		%	US$		%
Arg.	44,183	44,188	0.01	34,887	34,884	-0.01	0.419	0.419	0.00
Brazil	66,972	66,971	0.00	36,851	36,852	0.00	0.425	0.425	0.00
USA	88,738	88,737	0.00	50,093	50,100	0.01	0.454	0.454	0.00
EU	1,141	1,141	0.02	13,989	13,990	0.01	0.480	0.480	-0.21
China	14,850	14,853	0.02	66,988	66,997	0.01	0.490	0.490	0.00
RW	33,631	33,640	0.03	46,708	46,709	0.00	0.479	0.479	-0.21

Source: Prepared by the authors from the estimates generated by the model.

Table 5 depicts the alternative scenarios. The first scenario simulates the absence of the transaction costs, showing that the countries which present an increase in the offer of soy are those which

have the largest transaction costs: China, Brazil and Argentina. The largest impacts are to China which registers an increase of 3.16%. The production by this country is stimulated by the greatest offer prices which rise in 7.14% and causes the convergence of the demand prices, reducing them in -6.94%. The reduction of prices raises the demand in 1.45%, one of the largest effects in the quantities of soy consumed between the regions.

The effects to China, in the second scenario, in relation to the quantities being offered are contrary to and smaller than the ones from the first panel, showing a drop off 0.06%. The quantities of demand suffer a raise of 0.01% and the prices suffer no change. An explanation for this phenomenon can be based on the kind of subsidy passed on to the producers, which depends on the policy of internal prices and by the low import tariff. When the trade policies of this country is equivalent to eliminate the price policies related to the subsidies, making the prices of offer and demand and since the import tariff is only US$ 0.03 for each kilogram of soy, the impact of the trade policies on the variables of offer and consumption which is not considerable. This context shows that the reduction of the transaction costs could make the trade policies adopted by China more efficient.

The EU is the second region with greatest impacts in the quantities of soy offered in relation to the first scenario; however, instead of increasing the production, the region reduces in 2.78%. In terms of consumption and prices of offer and demand, the block stands out more than the other regions, staying in front even of China with a positive variation of 1.83% in the consumption and a reduction of 8.54% and 8.75% respectively at each price of offer and demand. With the removal of the trade policies, the EU presents contrary and smaller movements in all the market variables. The quantity of offer rises in 0.91%, the quantity demanded reduces in 0.51%, the prices of offer and demand rise in 3.13% and 2.5% respectively at each price.

The differentiated behavior of the EU in relation to the other regions can be determined by the peculiar characteristics of the block. The region adopts no tariff measures, only subsidizes their producers and the low production of the EU is totally consumed by the region. Without the trade transaction costs, the region begins to import a greater volume as a function of the smaller prices. On the side of the offer, the producers are less stimulated in producing and, considering that the region is not specialized in the production of soy, the drop in the quantities of offer shows the preference for the imports that are already made easier by the smaller prices. The increase in the volume of soy consumption by the EU suggests the increase of the exports from China for this region seen that the Chinese country is the supplier of soy for the block. This estimate, however, depends on the elasticities of export and import which are not used in this study, preventing more concrete inferences on this regard.

The contrary movement between the first two scenarios suggests that the effects of the transaction costs distort the effects of the subsidy policy in the EU. If it is considered that the region's trade policy is based on indicators which depend on the transportation costs and the financial market, and that, in turn, can be under the action of other costs, such as of arbitration or insurance in the case of transportation and, considering that the impacts that the transaction costs cause on the market, then the policy of subsidy adopted for the soy market by the region may not be the one most appropriate in the presence of the transaction costs.

Table 5 – Base scenario and the alternative scenario with no costs of trade transactions, no trade policies and with shock of demand

First scenario – no costs of trade transactions												
	Quantities						Prices					
	Offer			Demand			Offer			Demand		
Countries	Base scenario	Alternative scenario	Dif.	Base scenario	Alternative scenario	Dif.	Base scen	Alt. scen.	Dif	Alt. scen.	Dif
	Thousand Tons		%	Thousand Tons		%	US$		%	US$	%
Arg.	44,188	44,794	1.37	34,884	34,516	-1.05%	0.419	0.437	4.30	0.437	4.30
Brazil	66,971	67,752	1.17	36,852	36,651	-0.54%	0.425	0.440	3.53	0.440	3.53
USA	88,738	88,251	-0.55	50,100	50,416	0.63%	0.454	0.446	-1.76	0.442	-2.64
EU	1,141	1,110	-2.78	13,990	14,246	1.83%	0.480	0.439	-8.54	0.438	-8.75

China	14,853	15,322	3.16	66,997	67,967	1.45%	0.490	0.525	7.14	0.456	-6.94
RW	33,640	33,464	-0.52	46,709	46,898	0.41%	0.479	0.472	-1.46	0.472	-1.46
Second scenario – free trade											
Arg.	44,188	44,560	0.93	34,884	35,355	1.35	0.419	0.431	2.86	0.397	-5.25
Brazil	66,971	67,431	0.69	36,852	37,156	0.83	0.425	0.434	2.12	0.404	-4.94
USA	88,737	88,668	-0.08	50,100	50,124	0.05	0.454	0.453	-0.22	0.453	-0.22
EU	1,141	1,152	0.91	13,990	13,919	-0.51	0.480	0.495	3.13	0.492	2.50
China	14,853	14,843	-0.06	66,997	67,001	0.01	0.490	0.490	0.00	0.490	0.00
RW	33,640	34,035	1.17	46,709	41,174	11.85	0.479	0.497	3.76	0.491	2.51
Third scenario – shock of demand											
Arg.	44,188	49,344	11.67	34,884	38,402	10.09	0.419	0.592	41.29	0.592	41.29
Brazil	66,971	75,209	12.30	36,852	41,872	13.62	0.425	0.598	40.71	0.598	40.71
USA	88,737	98,374	10.86	50,100	55,460	10.70	0.454	0.627	38.11	0.627	38.11
EU	1,141	1,255	9.97	13,990	15,787	12.85	0.480	0.653	36.04	0.652	35.83
China	14,853	17,065	14.90	66,997	75,568	12.79	0.490	0.667	36.12	0.667	36.12
RW	33,640	37,333	10.98	46,709	51,491	10.24	0.479	0.664	38.62	0.664	38.62

Source: Prepared by the authors from the estimates generated by the model.

Brazil and Argentina show similar impacts between each other in relation to the transaction costs and the trade policies in the quantities of offer of soy; however, the impacts of removing the transaction costs which raise the offers in 1.17% and 1.37% respectively at each country are larger than the removal of the trade policies which raise the quantities in 0.69% to Brazil and 0.93% to Argentina. The reduction of costs or the elimination of tariffs increases the offer prices stimulating production. The variables for demand have a different behavior in each scenario. The removal of costs causes the rise of demand prices which reduces the consumption of soy in the two countries, showing that the markets do not move towards the previous balance, suggesting that Brazil and Argentina in view of the smaller transaction costs raise their percentiles of soy export in the world market. From the equation for consumption[13] used in this study and from the estimated percent differences of the variation between offer and demand it is possible to observe that with the removal of the transaction costs, Brazil raises the quantity of imported soy in 1.71% and Argentina in 2.42%. According to the equation, as the volume of consumption is reduced and of production is increased, the exported volume. An estimate for the variation and heading of the exports and imports, however, needs other studies.

In the absence of trade policies, the demand prices are reduced, raising the quantities consumed, showing a return to the previous. This process must take place due to the rise of the prices and the quantities being offered which causes the convergence of the demand prices to smaller values, stimulating consumption. The increase in the production and consumption suggests that the soy exports benefit the most from a reduction of the transaction costs than from the adoption of the trade policies adopted by both countries.

The United States present one of the smallest impacts in relation to removing the transaction costs, registering a reduction of 0.55%. In the free trade condition, the United States also present the smallest impacts after China, reducing the offer in 0.08%. In both scenarios, the reduction of production forces the prices down, raising the quantities of consumption. The largest effects are also in relation to the first scenario and with the drop of the prices of offer in 1.76% and of demand in 2.64% while in the second scenario the reduction is of 0.22% for the prices of offer and demand. The quantities consumed in the first scenario rise in 0.63% without the transaction costs and 0.01% with the trade policies. This phenomenon can be pointing to a favoring of China, Brazil and Argentina in relation to the exports by eliminating the costs.

[13] The equation consumption used in this study is given by: Consumption = Production + Import - Export

The countries of the rest of the world have an atypical behavior in relation to the trade policies presenting strong impacts before the elimination of tariffs both on the quantities being offered and the consumption with a rise of 1.17% and 11.85% respectively to each variable of offer and demand. With the exclusion of the transaction costs the countries have the smallest variation in the offer of soy among the regions with a drop of 0.52%. This reduction causes the drop of the offer prices and the rise of the quantities consumed in 0.41%, causing the reduction of the demand prices. This panorama and the increase of the offer of China, Brazil and Argentina suggest that eliminating the transaction costs promotes China's participation in the world soy market and disfavors the smaller markets of the grain. In view of the exclusion of the trade policies, the regions of the rest of the world raise their consumption and participation in the world market both in offer and consumption of soy.

In the third scenario (shock of demand in the presence of the trade transaction costs and the tariffs and the subsidies), the variables rise, but China is the country that increases the most the offer of soy with 14.90%; Brazil presents the largest variations in the consumption (13.62%) in relation to the other regions and Argentina suffers the largest increases in the prices of offer and demand with 41.29%. The EU displays the smallest rise in the quantity of offer for the oleaginous with 9.97% and also in the prices of offer and demand with 36.04% and 35.83% respectively. The EU and China, which present the largest increases in the quantities of consumption in relation to the other regions in the absence of the trade transaction costs, do not achieve the result in such a satisfactory manner as Brazil with the shock of demand, but continue with a better performance than the United States, Argentina and the rest of the world.

A better viewing of the effects of the shock of demand can be obtained by means of comparison of the three scenarios plotted with the percentages of variation for each variable of offer and demand in graphs which is shown in Figure 1. The characteristics of the curves show that there is a similarity between the movements of the third and the first panel. The shape of the columns suggests that in view of the warm-up in consumption, the producers altered the offer of soy in levels close to the variation without the presence of the trade transaction costs in the market. The Graph for quantity of offer also shows that the impacts suffered by Brazil and by China in relation to the other regions with the shock of demand.

Figure 1 – Percentiles of variation of the quantities and prices of offer and demand soy in relation to alternative scenarios - 2009/2011

	Arg.	Brazil	USA	EU	China	RM
No Costs	1,37	1,17	-0,55	-2,78	3,16	-0,52
Free Trade	0,93	0,69	-0,08	0,91	-0,06	1,17
Shock Dem.	11,67	12,3	10,86	9,97	14,9	10,98

	Arg.	Brazil	USA	EU	China	RM
No Costs	4,3	3,53	-1,76	-8,54	7,14	-1,46
Free Trade	2,86	2,12	-0,22	3,13	0	3,76
Shock Dem.	41,29	40,71	38,11	36,04	36,12	38,62

	Arg.	Brazil	USA	EU	China	RM
No Costs	-1,05	-0,54	0,63	1,83	1,45	0,41
Free Trade	1,35	0,83	0,05	-0,51	0,01	11,85
Shock Dem.	10,09	13,62	10,7	12,85	12,79	10,24

	Arg.	Brazil	USA	EU	China	RM
No Costs	4,3	3,53	-2,64	-8,75	-6,94	-1,46
Free Trade	-5,25	-4,94	-0,22	2,5	0	2,51
Shock Dem.	41,29	40,71	38,11	35,83	36,12	38,62

Source: Prepared by the authors from the estimates generated by the model.

The increase of 20% in the world consumption shows that the continuity of the soy consumption rhythm for the period of analysis of this study in the world, in the same level of the transaction costs and with the same trade policies adopted, Brazil and the EU are the only regions which are not favored in terms of rise in the participation of exports. All the countries, including the regions of the rest of the world, raise the exports in an average of 1.3%. Brazil, in spite of presenting the best performance in productive terms, after China, raises its consumption in a percentage greater than the offer, increasing their imports in 1.32%. The EU raises their imports in 2.88%. The final considerations are presented next.

3 FINAL CONSIDERATIONS

The study analyzes and discusses the impacts of the trade transaction costs and the tariff barriers and subsidies in the international soy trade. Three simulations are built to test the impacts. The results show that eliminating the transaction costs favors Brazil, Argentina and China in the increase of exports and raises the imports of the United States and Europe. The countries of the rest of the world benefit the most from the free market condition. The scenario of increase in the world consumption shows that with the rhythm of soy consumption in the same levels of the years from 2009 to 2011 in the world and with the same pattern of the transaction costs and the trade policies, o Brazil is the only one among the major producers which cannot manage to increase their participation in the world soy exports.

In general, the results allow inferring that the impacts of the trade transaction costs in the soy market depend on the policies adopted and the characteristics of production and consumption of each region, which can be opposite or not to the trade policies which efficiency can be distorted in the presence of the costs. The elimination of the transaction costs proved to be the most efficient of the three scenarios in regard to changing the dynamics of the international trade with the largest participation of Brazil, Argentina and China in the increase of exports and the United States and Europe in the rise of imports, favoring these markets more than the countries of the rest of the world which benefit the most by the free market condition.

In this regard, the study suggests the importance of policies directed to the improvement of reduction of the trade transaction costs for Brazil, Argentina and China. Particularly in relation to Brazil, the transaction costs which are possibly related largely to problems such as the structure of transportation, roads, procedures of frontiers and ports can serve as hindrances to an increase in the participation of the soy exports. In view of the same levels of soy consumption in the world for the three years of analysis, Brazil takes the risk of even losing the market for countries such as Argentina, due to, for instance, the procrastination in the term of delivery for the grain. So, the importance of planning in the outflow structure of the Brazilian soy is stressed, in regard to following, at least in part, the levels in the increase in the offer of soy. However, it was not possible to estimate the re-directioning of the trade flow due to the limitations of the model.

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