International Dairy Trade: Analysis of stimulus policies for milk production in Brazil

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Abstract: - The recent stimulus programs for the dairy sector seek to increase the domestic production of milk and dairy products. Based on this, we sought to analyze if these policies have influenced on the Brazilian foreign position, as a net importer, in the international trade of the dairy sector. Two scenarios were simulated, each consisting of two proposals; The former assumed a 10% and 20% subsidy increase for milk and milk products, whereas the latter assumed, a 10% and 20% tax reduction on the use of primary factors in the production of milk and milk products. In order to simulate such changes, we carried out the General Equilibrium Program (PAEG) for the Brazilian Economy. The results indicated that an increase in subsidy for the production of dairy products in Brazil would result in more significant variations in the foreign prices and in the levels of imports and exports than the variations in the domestic tax exemption.

Key-Words: Brazilian dairy sector; production stimulus policies; foreign trade; imports; exports; prices.

1 Introduction

Brazil´s dairy farming went through different moments since the commercial opening in the 1990s. In the following decade, the dairy sector experienced a crisis triggered by a sharp fall in the prices received by dairy farmers. Consequently, several of them left the activity and milk production decreased. However, with the devaluation of the domestic currency and the dairy crisis in Argentina (the sector´s main commercial partner), Brazil increased by 121.5% the sector´s exports. Despite that, the country continued to register a deficit in its dairy trade balance, due to changes in milk production, resulting from the selling price (CEPEA - Center for Advanced Studies on Applied Economics, 2003).

This dependence on dairy imports has been growing over recent years, especially after 2009, and is associated with trade tariffs exemptions and a favorable tax burden from Argentina and Uruguay, MERCOSUR member countries, and main milk exporters to Brazil. With this policy, milk and milk products from these countries get into the Brazilian market with more competitive prices than those offered for domestic products. Thus, this increased competition of dairy products from MERCOSUR, associated with domestic supply shortages, has contributed to increasing imports of these products (CEPEA, 2009).

However, Brazil is currently among the largest milk producers in the world, due to its territorial extension, which is favorable to agricultural and livestock farming. This is corroborated by the fact that milk production is present in practically 90% of the country's rural properties. Most of these activities are carried out for commercial purposes; not only for subsistence (EMBRAPA - The Brazilian Agricultural Research Corporation, 2015).

Despite the large production of milk and milk products, demand for the sector´s products has concomitantly increased income. Hence, a higher purchasing power is reflected in the consumption expansion of goods with higher nutritional value, which is the case of milk and milk products (DIEESE, 2014). In addition, demand for these products has been increasing due to the society's concern with most nutritious and healthy food.

On the other hand, the sector has been experiencing difficulties in meeting this increased demand for milk and milk products, which is the case of producers who, due to economic constraints, are unable to expand production at a sufficient pace, to keep up with demand (CEPEA, 2014). Furthermore, production costs have been increasing, due to increases in the price of salt, concentrated animal feeds, medicines, and salaries paid to the employees.

Aspects like these, justify the purpose set in this work, which consists of evaluating how incentive programs for milk production, influence on the commercial situation of Brazil as a net importer, in the international market of the dairy sector. This proposal does not find any discussion in the literature since the dairy sector has not previously been studied under this approach (CARVALHO et al., 2013, MACHADO, 2014, PEREIRA, TEIXEIRA and GURGEL, 2009, ALVIM, 2010).

Besides the introduction, the text is structured into five sections. Section two presents the scenario of the Brazilian dairy trade and its relation to the sector's foreign trade. Section three describes the methodological aspects, followed by the results. Finally, section five presents the final considerations.

2 The Brazilian dairy sector and the international market

2.1 Evolution of the Brazilian international dairy trade: Latest dynamics of the trade balance

Although production and consumption have grown at almost similar levels over the last few years, it should be noted that the domestically produced milk also serves as raw material for the production of every milk product. Therefore, it is necessary for this production, proportionally larger amounts of liters, besides the fresh milk acquired by consumers (CEPEA / Leite, 2015).

The changes that occurred in the demand for dairy products in Brazil in 2006 corroborate this aspect. According to Stock (2013), these changes

were mainly related to wages increases and the government income transfer programs. A behavior that could be evidenced by the increased per capita consumption of dairy products (6.0% per year), which led to an increase from 137 kg/ inhabitant/ year in 2006 to 173 kg/ inhabitant/ year in 2011; a consumption that continued in the following years.

This scenario increased the dependence on refrigerated milk since Brazil increased its imports volumes to supply the domestic demand of both milk processing companies and final consumers. Consequently, since 1998, Brazil has been registering a negative balance in its dairy trade balance, as shown in Figure 1. Despite the deficit improvement in 2003 that turned into a surplus in 2004, 2005, 2007 and 2008, the dependence increased again in 2009 (MDIC, 2015).

According to Carvalho, Alvim, and Martins (2006), Brazil had not registered a surplus in its dairy trade balance since the commercial opening. However, with investments in powdered milk and condensed milk plants in 2004 and 2005, the country registered a surplus in its dairy trade balance, boosted mainly by these two products. In the following years, it registered a new deficit resulting mainly from the high-interest rates and the Real evaluation. Consequently, Brazil exports diminished and the product lost its competitiveness in the international market.

Chart 1 - Trade balance of the Brazilian dairy products between 1998 and 2014, in US$.
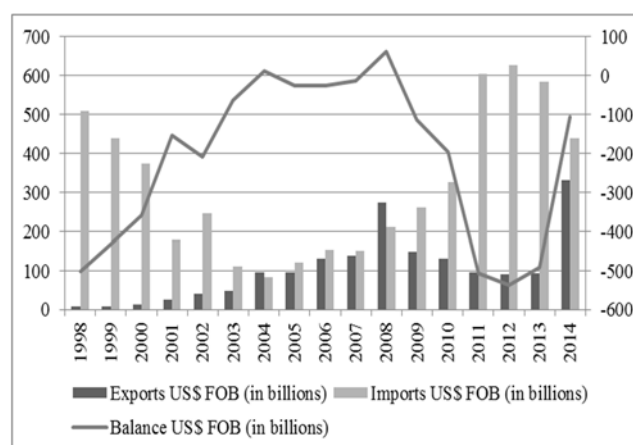
Source: Developed by the authors, based on data from MDIC (2015) and IBGE (2014).
Note: Exports and imports are on the left side and trade balance on the right side.

In this scenario, Brazil has again more imported than exported. Consumption surplus comes from the MERCOSUR countries; especially Argentina, Uruguay, and Chile, whose share in the total of

Brazil imports is about 81% during the period under study (see Table 1). The trade flows have been improved, due to tariffs reduction as agreed upon by member countries. As a result, the milk from the bloc gets into Brazil with a more competitive price than that from the European Union, the United States, and other major countries, producers of milk.

On this point, Pedro, Pigatto, and Santini (2008) argued that the dairy trade deficit increased from the 1990s to the 2000s due to changes in the exchange rate and products competitiveness in the international market. On the other hand, in the 2000s, Brazil exports started becoming more significant and contributed to improving the dairy trade balance; although not enough, to fully supply the domestic market.

As shown, the MERCOSUR countries, especially Argentina and Uruguay, with shares averaging 54% and 25%, respectively, of the total of imports between 1998 and 2014, participate largely in the Brazilian dairy market. In addition to these countries, Chile, with a smaller share, about 3% of the total, appears in the list of exporters to MERCOSUR. The remainder of milk and milk products imports, about 18%, come from New Zealand with 3%, followed by the United States, Germany, and France, with less than 1% each.

Table 1 – Total of Brazil regional imports of dairy products in US$, during the period between 1998 and 2014.

Period	Total Imports	Imports from MERCOSUR		Imports from the rest of the world	
	U$$ FOB	U$$ FOB	Share	U$$ FOB	Share
1998	508,828,794	352,531,893	69.28%	156,296,901	30.72%
1999	439,951,375	376,091,859	85.48%	63,859,516	14.52%
2000	373,189,441	300,822,582	80.61%	72,366,859	19.39%
2001	178,636,996	131,046,439	73.36%	47,590,557	26.64%
2002	247,557,093	198,241,855	80.08%	49,315,238	19.92%
2003	112,291,590	90,175,588	80.30%	22,116,002	19.70%
2004	83,923,350	71,653,132	85.38%	12,270,218	14.62%
2005	121,192,779	98,224,873	81.05%	22,967,906	18.95%
2006	154,689,100	128,103,636	82.81%	26,585,464	17.19%
2007	150,833,540	112,944,141	74.88%	37,889,399	25.12%
2008	211,593,755	157,523,783	74.45%	54,069,972	25.55%
2009	261,888,311	234,662,686	89.60%	27,225,625	10.40%
2010	326,951,303	284,217,274	86.93%	42,734,029	13.07%
2011	604,905,131	541,395,371	89.50%	63,509,760	10.50%
2012	627,894,578	546,507,354	87.04%	81,387,224	12.96%
2013	585,738,587	495,251,053	84.55%	90,487,534	15.45%
2014	438,650,308	353,355,555	80.56%	85,294,753	19.44%
Period average	319,336,237	263,102,887	82.39%	56,233,350	17.61%

Source: Prepared by the authors (2015) based on data from IBGE (2015).

It can be noted from this evidence that there is a pressing need for the expansion of milk production in Brazil, in order to reduce the dependence on the foreign market, while domestically strengthening the sector. However, there should be, to this end, discussions on sectoral policies that may boost the product´s competitiveness and trade measures to protect and stimulate the sector.

2.2 Milk production in the different Brazilian regions

The Brazilian dairy sector has been undergoing many changes since the 1990s, due to the market deregulation of that time. After the end of the State´s intervention in 1972, a fierce competition between milk collecting companies took place, which led producers to professionalize milk production (TESSARO, TORRES, BULAWS, 2008).

Another aspect was in the process of milk products diversification by multinational companies

that were already working in the market. This resulted in an increased production since the companies needed more raw material for the production of milk products. Consequently, the producers began to offer more fresh milk, as demand for milk products increased (MENDES, PEREIRA, TEIXEIRA, 2011).

However, with this favorable environment, each region in Brazil developed milk production differently either with more technological intensity or just as a subsistence activity. It should be noted that there is in all the regions of the country, a structured chain of production, industrialization, and commercialization that generates income and distributes milk products (GOMES, 1995).

This scenario can be evidenced by the evolution of the production of raw (fresh) milk, acquired by processing companies in the different Brazilian regions, during the period between 1998 and 2014 (see Table 2). The amount of milk, shown in Table 2, reflects only the formal milk production and does not take into account the unprocessed milk, produced and marketed by the producers themselves.

Table 2 – Amount of refrigerated fresh milk, produced and marketed by the producers in the Brazilian macro-regions (in thousand liters).

Period	Amount of marketed milk in the Brazilian macro-regions *					
	Northern	Northeastern	Southeastern	Southern	Midwestern	Brazil
1998	903427	2069959	8465198	4410592	2844739	18693915
1999	958382	2041819	8540203	4606121	2923524	19070048
2000	1049768	2159230	8573731	4904356	3080121	19767206
2001	1236607	2266111	8573152	5187765	3246318	20509953
2002	1566783	2362973	8745553	5507640	3459832	21642780
2003	1498265	2507793	8933782	5779489	3534533	22253863
2004	1662888	2704988	9240957	6246135	3619725	23474694
2005	1743253	2972130	9535484	6591503	3778490	24620859
2006	1699467	3198039	9740310	7038521	3721881	25398219
2007	1676568	3338638	9803336	7510245	3808478	26137266
2008	1666368	3454696	10140778	8268360	4055144	27585346
2009	1672820	3813455	10419679	8957284	4222255	29085495
2010	1737406	3997890	10919686	9610739	4449738	30715460
2011	1675284	4109527	11308143	10226196	4777064	32096214
2012	1658315	3501316	11591140	10735645	4818006	32304421
2013	1846419	3598249	12019946	11774330	5016291	34255236
2014	1946149	3882860	12169774	12200824	4969238	35174271
Period average	1541069	3057628	9924756	7620926	3901493	26046191

Source: Prepared by the authors based on data from IBGE (2014).

It can be noted that with about 39% of the total of produced liters in the period under analysis, milk production is more significant in the southeastern region than in the other Brazilian regions. Although it produces the largest amount of marketed fresh milk and the largest number of milked cows (35%), the region´s productivity index per milked animal is only the second highest in Brazil, with approximately 1333 liters/ year (IBGE, 2014).

In the case of the southeastern region, the average price is R$ 1.08 in the state of Minas Gerais and R$ 1.07 in São Paulo, slightly above the national average price in 2015 that was R$ 1.05 per liter.

Likewise, the southern region accounts for a significant share of the volume of produced fresh milk, about 29% of the total of milk production, and the highest milk yield - 2057 cows/ liters/ year. It is also responsible for employing about 11% of rural workers; a low number for the amount of milk that is produced, which characterizes milk production as one of a high technological level. In relation to the prices paid for the liter of milk in the southern region, they are lower than the national average price that is R$ 1.05 per liter.

Despite the low prices, the apparent consumption of fresh milk in the southern region, from 1998 to 2014, showed a declining trend at the beginning of the period up until 2008, when this trend was reversed. However, in 2014, this apparent consumption was 76% lower than that of 1998.

Since Brazil has dynamic and demographically different markets for fresh milk, demand for this product is lower in the southern and southeastern regions, because of the large number of processing companies that produce a wider range of milk

products (lactose-free milk powder, yoghurts, among others), (THE NATIONAL SOCIETY OF AGRICULTURE, 2015).

Another characteristic of the region is the fact that the milk activity is carried out, in large part, in small size properties. A large number of them deal with family agriculture and are close to other similar properties, which facilitates milk collection by the companies (TRICHES, 2011).

In the Northern region, the share of small size properties producing milk is about 6% during the period under study (IBGE - BRAZILIAN INSTITUTE OF GEOGRAPHY AND STATISTICS, 2014). With regard to the labor market, the region is responsible for employing about 9% of workers in the agricultural sector (DIEESE, 2014). Because of the relatively low proportion of workers to the land extension, labor-intensive techniques prevail in the region.

Despite the low level of fresh milk production in the region, the apparent consumption of fresh milk has been growing over the years. In the period between 1988 and 2014, demand for fresh milk expanded by 90%, reaching about 2 million liters in 2014. This growth is mainly due to the increase in income, from the federal government income transfer programs, and food distribution programs to schools, from family farming, such as the Food Acquisition Program (FAP) (THE NATIONAL SOCIETY OF AGRICULTURE, 2015).

Despite the considerable cattle herd, about 20% of the total of milked cows, and the largest concentration of rural workers in the country, about one-third has a low productivity average in relation to the other regions – 725 liters/ cow/ year.

As for fresh milk consumption in the region, its volume remained stable in the 2000s and reached about 4.6 million liters in 2014. When compared to the northern region, milk consumption is higher, since a larger volume of milk is produced in this region. Nevertheless, the region is a net importer of dairy products.

Finally, the Midwestern´s average share in milk production is about 15% of the total of milk production. As for the price paid for the liter of fresh milk, the price paid in the state of Goiás is above the national average price and is traded at R$ 1.06 per liter (CEPEA/ Leite, 2015). Moreover, the share of rural workers working in milk production is about 11% (DIEESE, 2014).

Although the Midwestern region accounts for about 15% of fresh milk production, milk consumption indicated to be unstable over the period under study. Although demand for fresh milk in the region was about 4.9 million liters in 2014, a consumption 43% higher than that of 2000, demand for fresh milk has been declining since 2010.

2.3 Incentive Policies for milk production in Brazil

The Brazilian dairy market has a very complex structure on account of a large number of agents working in the sector. If on one hand, there are producers and collectors, who are the agents responsible for reaching out the product to processing industries, on the other hand, there are industries responsible for reaching out milk and milk products to distribution channels.

Given this structure, the Brazilian dairy sector underwent many changes over the years. In 1995, the sector started undergoing a great expansion, mainly due to the entry of multinational companies in the Brazilian market, which spurred the producers to invest in technologies that could yield larger production. This assistance came in the form of new ideas to modernize production, and cooperative agreements instituting supply of coolers, more updated handling, and nutrition techniques. Besides, the companies would provide specialized technical assistance in pasture growing for feed (NARDI JÚNIOR AND SANTOS, 2013).

With this new productive and commercial configuration, the Ministry of Agriculture, Planning, and Supply (2014) started to launch incentive programs for milk production. Among them are per quality payment programs and regulations that determine the nutritional values that should be in the product. These regulations were the basis for the formulation of the price that should be paid to each specific producer for the milk liter.

Moreover, the ten-year cattle breeding incentive plan, which aims to sustainably increase cattle breeding productivity and competitiveness, has been launched recently in 2014. This plan is based on two programs, More Milk, and More Meat. The first one aims to increase dairy cattle productivity by 40%, and the main way to achieve this is through the adoption of technologies that will provide improvements in genetics, nutrition, and herd management.

The goal of this program is to increase per animal productivity, which is still very low in Brazil, especially in the Northern, Northeastern, and Midwestern regions. According to the Ministry of Agriculture, Livestock, and Food Supply (MAPA, 2014), one of the objectives of the program is to increase productivity to 2000 liters/ cow/ year, which will allow Brazil to reduce its dependence on the foreign dairy market. It should be noted that the

only region where this level of productivity, stipulated by the program, has already been reached, is the southern region; whereas the other regions still need to make some changes to reach this goal (IBGE, 2015).

The second program, More Cattle Farming, is associated with beef cattle farming, which aims to increase production by 40% and double productivity. To this end, the stocking rate per hectare would increase from 1.3 to 2.6 animals/ ha, without requiring expanding the agricultural frontier, resulting thus, in native forests preservation.

Despite these programs, there are other factors working otherwise, discouraging thus milk production. This is the case of high-interest rates, charged by credit granting agencies and the high tax burden. With these factors, the agricultural inputs reach the producer with a less competitive price, leaving the activity with little profitability and an increased production cost (CEPEA, 2014).

Overall, it can be noticed that in terms of quality, the kind of incentives that exist in Brazil are related to the standardization of production, because several payment programs have been created over the years, to grant bonuses to quality milk producers. In addition to these programs, there are other bodies, such as the Brazilian Agricultural Research Corporation (EMBRAPA), the Technical Assistance and Rural Extension Company (EMATER), and State agencies that assist milk producers in finding new management practices able to facilitate production.

As corroborated, Camilo (2014) emphasizes that although still scarce, the incentives for milk production in Brazil, are through technical assistance and credit lines from public institutions and local credit agencies, to promote the purchase of materials, animals, and genetic improvement. In other words, there are no direct subsidies, through cash payments, intended for milk production.

3 METHODOLOGY

3.1 The PAEG Model

In order to reach our goal, which is to analyze the impacts of an incentive policy on milk production in Brazil, we made use of a multi-regional and static general equilibrium model, based on the General Equilibrium Analysis Project (PAEG) for the Brazilian Economy, version 3.0, developed by Teixeira *et al.* (2008).A data set that encompasses the five Brazilian regions and the main international partners of Brazil. Thus, it makes it possible to

analyze the domestic and foreign trade flows, as well as the changes in the political and trade variables.

As a basis for its formulation, the PAEG uses the basic structure of the Global Trade Analysis Project (GTAP) model, developed by Hertel (1997). However, it is carried out through the GTAPinGAMS (version 8.0 of GTAP), as shown in Rutherford and Paltsev (2000) and Rutherford (2005). Specifically, the GTAP model uses the database, whereas the formulation is defined from a nonlinear complementarity problem. Its implementation is through the GAMS (General Algebraic Modeling System) programming language, as found in Brooke *et al.* (1988).

In this language, the GTAP model is performed as a system of linearized equations and allows the model to be carried out as a nonlinear complementarity problem through the GAMS language. The PAEG model uses the same programming as the one used in the MPSGE (Modeling Programming system for General Equilibrium), proposed and developed by Rutherford (1999), and is performed through blocks of production functions, demand, and specific constraints. In this way, the MPSGE transforms the information contained in the economic blocks into algebraic equations, which are processed by the GAMS.

The PAEG model is known for being static, multi-sectoral and multi-regional, with each region having an input-output matrix that represents the production and distribution of goods and services. Specifically, Brazil was disaggregated, so as data from its five major regions could be got. Moreover, this general equilibrium model is based on optimization, in which consumers, either final or intermediate, seek to maximize their well-being, given their budgetary constraint. It should be noted that, because the model is static, the levels of investment and production of the public sector are also static.

The PAEG model is compatible with the GTAP 8.0 database. However, some adjustments needed to be made so that Brazil could be disaggregated and represented by its five main regions. In this case, the data that were previously in the GTAP were substituted with data from the input-output matrices of the Brazilian macro-regions.

For this substitution, trade flows between Brazil and other regions of the world were maintained in the same way as in the original GTAP database. The first survey ever on the input-output matrices of the five Brazilian regions was carried out by Parré (2000); and that of the PAEG 3.0 version was

updated for the year 2007, with the aim to standardize it with the GTAP, which also had its latest version released that same year. Another change made, consisted in disaggregating several important sectors of the Brazilian economy, which were jointly analyzed in the GTAP. Therefore, the PAEG model was aggregated into 19 sectors and 12 regions.

3.2 Scenarios of Analysis

At this point, simulated scenarios are presented to support the discussion on the impacts of incentives on milk production in Brazilian. These scenarios are based on the two policy lines, both domestic and foreign/ commercial, which are, subsidies to domestic production and taxes on the use of primary factors in production. These two guidelines were defined for financially influencing the milk and agricultural activities as a whole. With regard to subsidies to domestic production, they help reduce the production costs, since they serve as incentives for the dairy activity. However, it is worth noting that, in Brazil, subsidies for milk production are currently provided through financing and specialized technical support, by agencies for agricultural development and public companies.

According to Cardoso (2011), the Brazilian agricultural sector requires the intervention of the government because of its biological characteristics and taxes in the domestic market. Due to the high-interest rates charged by credit agencies, many rural producers are unable to enter and remain in the dairy market, requiring thus, the government´s intervention to implement subsidy policies, through credit line programs and loans´ interest rates equalization.

Moreover, seeking to encourage milk production, MAPA created in 2012, the Program, More Animal Husbandry, which aimed to increase milk production by 40% in the next ten years, starting in 2014. As guidelines, the program consisted in improving the animals' genetics to increase per animal productivity, expanding markets, incorporating new technologies, investing in safety and in the quality of the fresh milk that serves as the basis for milk products, in order to increase the products´ visibility in the foreign market.

As for the interest rates equalization (IRE), it would serve as a means to subsidize the agribusiness production, which has been contributing over the years, to the expansion of production and demand for agricultural implements. This equalization consists in subsidizing the rates differences between the fundraising costs from financial and official institutions, plus the administrative and tax costs of these institutions and the charges levied on the final loan taker. As a result, the government would compulsorily expand the private banks' participation in the financing of the rural sector, increasing thus, the credits supply (CARDOSO, 2011). This measure would provide more investment conditions for milk production since production costs have been growing steadily.

Milk production has increasingly higher costs, mainly due to the need for nutrient-rich feed to feed the animals, such as seeds, fertilizers and groundwork for pasture growing, and silages for food supplementation. The latter, have a large share in the financial outlay of rural producers. In addition, taxes on primary products are levied on them. Moreover, mineral supplements have been gaining ground in animal feed, especially during low rainfall periods (CEPEA/ Leite, 2015).

Following the discussions, Table 3 presents the two scenarios that propose changes in subsidies and taxes, in order to find alternatives to increasing milk production in Brazil.

Table 3 - Proposed scenarios

Scenarios	Changes	
	Proposal 1	Proposal 2
1 – Subsidies to domestic production	Increase by 10% (1A)	Increase by 20% (2A)
2 - Taxes on the use of primary factors in production	Reduction by 10% (1B)	Reduction by 20% (2B)

Source: Prepared by the authors (2016).

Scenario 1 is related to the supply of production subsidies to the Brazilian dairy sector. As a basis for this scenario, arbitrary increases by 10% and 20% in subsidy for the production of milk and milk products (rmk) were proposed. The basis of this scenario is the effects that the expansion of rural credit and/ or interest reduction can exert on milk production and on regional and foreign trade flows.

Scenario 2 deals with taxes on the use of primary factors in production. In the case of the milk sector, according to the Ministry of Finance (2014), a tax rate of 16.25%, is currently levied on the trade of the fresh milk that is used either in the production of milk products or consumed as UHT milk, such as the long life milk. Therefore, the proposed change consists in reducing this rate. To this end, two reduction bands of 10% and 20%, are defined, from the current rates. The aim is to check for the effects, the behavior of the dairy production, and the production sensitivity to these costs.

As discussed in Lisboa and Latif (2013), the dairy sector has a complex tax burden that together

with other endogenous factors, contribute to increasing production costs. In addition, a ban on the use of presumed credit for dairy products, exempted from the PIS and COFINS taxes, has been established recently, in 2012. Therefore, the price received for the liter of refrigerated raw milk tends to rise.

The effects of these taxes on the dairy sector would initially be the generation of two distinct prices, the price received by producers and the one paid by consumers. The difference between the two prices is the tax that is levied. In this case, imposing taxes on the dairy sector would be harmful to the sector because of the inelastic demand of the sector. Further, there would be an increased cost to the producers. Therefore, the supply curve would shift in a larger proportion in relation to the amount that would be offered, whereas there would be few changes in the demand curve (BRUNOZI JÚNIOR *et al.*, 2012).

4 Results and discussions

4.1 Analysis of changes in foreign prices

Regarding the foreign commodities prices, a 10% increase in subsidy for the production of milk and milk products, as shown in scenario 1A, results, although marginally, in a price fall in all the exporting regions (see Table 3, Annex 1). Because, with the increased production of milk and milk products in the Brazilian market, and given that Brazil is currently a net importer, there would be a low demand for the sector´s products in the international market, since the domestic market would be supplied, albeit in part, by its own production. By symmetry, a larger supply of dairy products in the international market would result in a price fall.

The same thing occurs with scenario 1B in which there is a simulation of a more significant increase by 20% in subsidy for the production of milk and milk products. This situation results in a fall in the price of milk and milk products, imported into all the Brazilian regions and other regions under study. As expected, these results are more significant than those found in scenario 1A; however, their behavior is the same among the regions.

Regarding scenario 2A, a 10% tax reduction on the use of primary factors in the production of milk and milk products, results in a fall in the price of imported products. However, unlike scenario 1A, the results were found only in the Brazilian regions. This can be due to the Brazilian high tax burden which, despite the lower level of taxation, turns the

domestic product more expensive in the foreign market, which has reduced tax rates. So, only the domestic prices and trade between the regions will be affected.

Similar variations are found in scenario 2B. However, the results are more significant. In this case, a 20% tax reduction on the use of primary factors in the production of milk and milk products, results in a reduction in the price of imported products into all the Brazilian regions. These changes are also found in the other regions under study.

In analyzing the proposals for primary costs reduction, we found that the declining movements in the domestic products prices were more significant in all the regions when compared to the scenarios of increased subsidies for the production of milk and milk products. Therefore, it seems that a policy on tax reduction would have a more significant impact on the domestic prices than subsidies for the production of milk and milk products.

4.2 Analysis of variations in total imports and exports by region

Other implications of the simulated proposals for the dairy sector are related to foreign trade flows, given that Brazil is a net importer of these products. In this sense, we analyze the variations in imports and exports resulting from the simulations in scenario 1 – subsidy increase by 10% and 20% for the production of milk and milk products (scenarios 1A and 1B - Annex 2) and scenario 2 – tax reduction by 10% and 20% on the use of primary factors in production (scenarios 2A and 2B - Annex 2).

The analysis of scenario 1A, as shown in Table 4, evidenced that the Southeastern region, with an increase of 0.40%, was the region with the highest positive variation in milk and milk products exports (rmk) when compared to the other Brazilian regions. This result is due to the significant production of milk and milk products in the region, and also because the region accounts for a significant share of dairy products exports. About 65% of the total of the sector´s exports are from this region (IBGE, 2015).

A movement in the same sense was found in the Southern region, with an increase of 0.22% in milk and milk products exports. On account of this new situation and increased exports, the region is inserted into the foreign market, since it does not currently account for a large share of the Brazilian exports.

On the other hand, there was a fall, although marginally, in imports of milk and milk products in

the Southeastern and Southern regions by 0.06% and 0.01%, respectively. These results help reduce the dependence on the foreign market and contribute to improving the trade balance of the sector (see Table 5). Specifically, with respect to the Southern region, the fall in imports caused by production incentives through subsidies, and increased exports, highlight the growth potential of the milk and milk products sector of the region, mainly because of its high productivity.

The Northern, Northeastern, and Midwestern regions, in turn, showed different indices from those found in the other Brazilian regions, both in terms of exports and imports, especially in the Northeastern region, where the increase in imports was 0.90 %. Since the subsidy increase for the production of milk and milk products has decreased the sector´s production, following a reallocation of productive factors, imports from the other Brazilian and/ or foreign regions were inevitably increased to meet the growing demand for the sector´s products. Furthermore, milk production in the Northeastern region is largely carried out on small farms with a high production cost and a family labor, which is not always qualified for the task (EMBRAPA, 2015).

As for the other agricultural products, they generally, tended to follow the domestic production expansion, specifically corn and other cereals (gro), soybeans and other oilseeds (osd), meats and animals (Oap) and other agricultural products (agr), whose variations in imports and exports were positive.

Therefore, policies meant for stimulating the production of milk and milk products through subsidies, cause positive effects on the other agricultural products that tend to raise the level of their foreign flows, mainly because Brazil accounts for a significant share of the world market for grains and meat (FAO, 2015). Specifically, it can be noticed an increase, mainly, in exports of agricultural products and meat, and food products, except for rice (pdr), which showed an opposite movement, a rise in imports and a fall in exports.

With respect to scenario 1B, which simulated a 20% increase in subsidy for the production of milk and milk products, changes in the same direction as that in scenario 1A – growth in imports of the dairy sector in the Northern, Northeastern, and Midwestern regions, and a fall in imports in the other regions – were found. It should be noted that whereas the former regions require larger volumes of imported products for consumption, the Southern and Southeastern regions, for having increased their production and reduced imports, allocate the milk

and milk products surpluses to the foreign market and the other Brazilian regions.

A 10% tax reduction on the use of primary factors in the dairy sector as in scenario 2A, resulted in an increase in milk and milk products (rmk) exports in the Southeastern and Midwestern regions. The highest positive variation occurred in the Southeastern region, with a 0.15% growth. Regarding the other regions, including the Southern region (-0.10%), exports fell, especially in the Northern region, where exports declined by 0.54%. This result can be explained by the fact that the Southeastern and Midwestern regions, together, account for about 70% of total exports of the Brazilian dairy sector. Therefore, it can be concluded that factors of production can be intensified in the most exporting regions, channeling their surpluses to the foreign market.

As for the other products, exports growth led to increases in all of the agricultural products in the Southeastern region; a behavior also observed in imports, except for the milk and milk products sector. This result indicates an improvement in the trade balance of the region, on account of the reduced need for imported dairy products. Regarding non-agricultural products, there is an increase in exports, mainly in the Northern and Northeastern regions, which is not the case in the Southeastern Region, which registered a fall in its exports of this kind of products.

Conflicting results were found by Pereira (2011), whose work evidenced an expansion of milk and milk products exports in the Northern, Northeastern, Midwestern, and Southern regions, and a marginal decline in dairy products exports in the Southeastern region. These trade flows are explained by the fact that the production increase occurred in regions that also increased their export volumes. Regarding the foreign purchases of the dairy sector, there was a fall in the volume of imports in the Northern and Northeastern regions, contributing thus to a positive trade balance, unlike the other regions, which registered an increase in imports.

With a larger tax exemption, as in scenario 2B, the impacts on imports and exports are even more significant than those observed in scenario 2A. Specifically, imports fell only in the Southeastern region, while foreign purchases increased in the other regions, even in the Southern and Midwestern regions. As for the positive variation in the Southern region´s imports, it is due to a fall in the production of milk and milk products, requiring thus, larger import volumes for consumption.

Broadly, the variations in exports indicated as expected, an increase in foreign sales in the regions

that had production surpluses (production expansion and fall in imports). However, there was an increase in imports and exports in the Midwestern region. A result that may be associated with the apparent consumption of fresh milk in the Midwestern region, which has been declining since 2010, at the moment when the State of Goiás has been strengthening its position as the largest exporter of milk and dairy products in Brazil.

Based on the changes, proposed and presented in Tables 10 and 11, the scenario of tax reduction on the use of primary factors in the production of milk and milk products, proved to be more efficient at promoting exports, since it resulted in increases in the most productive regions of fresh milk (Southeastern and Southern regions). As for the foreign purchases, the policy of subsidy granting resulted in a larger fall in imports, when compared to those from tax exemption. Therefore, the policy must be in line with the aimed goals of the sector, either in the domestic market or in the foreign market.

5 Conclusions

The expansion of the Brazilian agribusiness has boosted the development of milk production in the Brazilian regions. However, with the commercial opening occurred in the 1990s, the economic scenario of the dairy sector underwent major changes with the entry of multinational companies in the dairy sector, which introduced new ways to produce and market fresh milk, such as ultra-pasteurized milk and several other milk derivatives that were not yet marketed in Brazil. Nowadays, although milk production is configured differently in each of the Brazilian regions, there is still a need for imports, to supply the domestic market. This consumption surplus comes mainly from the MERCOSUR countries, because of their proximity to Brazil and the agreements signed by the group members as well.

It is in this context that we sought to assess how the latest incentive programs for milk production have influenced on the Brazilian foreign position, as an importer, in the international trade of the dairy sector. Two scenarios were simulated, each consisting of two proposals. The former assumed a 10% and 20% increase in subsidy for the production of milk and milk products. The latter assumed a tax reduction by 10% and 20%, on the use of primary factors in the production of milk and milk products. In order to simulate such changes and analyze the generated impacts, we carried out the General Equilibrium Analysis Program (PAEG) for the Brazilian Economy.

Overall, our findings suggest that there is a reduction in the foreign price for dairy products. This reduction is more visible in the scenario of increased subsidies granting in Brazil. In this case, incentives to production would reduce imports of dairy products. And as a consequence, the product´s stocks would grow in the other countries, inducing thus, a price fall. Furthermore, it was evidenced that an increase in subsidy to production would result in a reduction in the level of international exports since an increase in the domestic supply of milk would reduce the need for imports of the product. In addition, Brazil would increase the stocks volumes, including exports volumes, which would result in an increase in imports of dairy products from other countries.

From these results, a subsidy increase for the production of dairy products in Brazil would result in more significant variations in the foreign prices and levels of imports and exports than the variations in the domestic tax exemption. At the same time, it was evidenced that commercial policies would generate more significant impacts on the expansion of production and reduction of import surpluses than fiscal policies.

Although the results have shown important trends for the production growth of milk and milk products, some limiting factors such as the sector´s aggregation make carrying out a separate analysis of the market for fresh milk and milk products impossible. In addition, the lack of data on dairy products production made it difficult to better contextualize the market. Therefore, we suggest that other ways of promoting production, specifically, those aimed at increasing productivity, as well as per quality payment programs, be studied so that the Brazilian dairy market may be sustainably expanded.

Revista de Economia e Sociologia Rural, Piracicaba, SP, vol. 48, nº 02, p. 405428, abr/jun 2010.

References

ALVIM, A. M. As Consequências dos Acordos de livre Comércio Sobre o Setor de Lácteos no Brasil.

BROOKE, A.; KENDRICK, D.; MEERAUS A.; RAMAN. R. GAMS: A user's guide. *GAMS Development Corporation*, 1988.

BRUNOZI JÚNIOR, A. C.; ABRANTES, L. A.; FERREIRA, M. A. M.; GOMES, A. P. Mercado e Tributação: Uma Abordagem Teórica sob a Perspectiva de Estruturas de Mercado na Cadeia Agroindustrial do Leite. *Documentos Técnico-Científicos.* Volume 43 | Nº 01 | Janeiro - Março | 2012.

CAMILO, P. J. A organização espacial da agroindústria do leite e seus impactos sobre a produção na região sul do Brasil. Anais... *VII Congresso Brasileiro de Geógrafos.* Vitória, Espírito Santo – 10 a 16 de Agosto de 2014.

CARDOSO, D. F. Efeitos da política de equalização das taxas de juros do crédito rural no crescimento econômico das regiões brasileiras. *Dissertação* (Mestrado em Economia Aplicada) - Universidade Federal de Viçosa, 2011.

CARVALHO, B. H. P.; ROSADO, P. L.; SHIKI, S. F. N.; CRUZ, A. C. Integração intra e inter-mercado: o caso dos preços do leite e derivados no Brasil. Anais... *Encontro Nacional de Pesquisadores em Economia*. ANPEC, Foz do Iguaçú (PR), 2013.

CARVALHO, M.P.; ALVIM, R. S.; MARTINS, M. C. Considerações sobre a inserção do Brasil no Mercado Mundial de Lácteos. Artigos. *Confederação Nacional da Agricultura,* CNA – BRASIL, 2006.

CENTRO de Estudos Avançados em Economia Aplicada. Boletim do Leite. In: CEPEA Leite, *ESALQ/USP*. Ano 10 - número 106 - janeiro de 2003.

_____. Boletim do Leite. In: CEPEA Leite, *ESALQ/USP*. Ano 15 - Nº 176 - Abril de 2009.

_____. Boletim do Leite. In: CEPEA Leite, *ESALQ/USP*. Ano 20 nº 233 | Setembro 2014.

DEPARTAMENTO Intersindical de Estatística e Estudos Socioeconômicos – *DIEESE*. Alimentos ainda pressionam o custo de vida em São Paulo. Nota à imprensa, dez 2014. Disponivel em http://www.dieese.org.br/analiseicv/2014/201411an aliseicv.pdf Acesso em: fev 2015.

EMPRESA Brasileira de Pesquisa Agropecuária. *Embrapa Gado de Leite*. Sistemas de Produção.

Disponível em http://www.cnpgl.embrapa.br/sistemaproducao/ Acesso em: fev 2015.

GOMES, S.T. Analise da economia leiteira brasileira. Artigos técnicos. *Universidade Federal de Viçosa,* 1995. Disponível em: http://www.ufv.br/der/docentes/stg/stg_artigos/Art_ 085%20%20AN%C1LISE%20DA%20ECONOMI A%20LEITEIRA%20BRASILEIRA%20%2819-195%29.pdf> Acesso em: fev 2015.

HERTEL, T. W. Global Trade analisys: modeling and applications. *New Yourk: Cambridge University Press*, 1997.

INSTITUTO Brasileiro de Geografia e Estatística – *IBGE*. Sistema de Recuperação Automática - Banco de dados. Disponível em: <http://www.sidra.ibge.gov.br/bda/ tabela/protabl.asp?c=1086&z=t&o=24&i=P.Acesso em jan 2015.

LISBOA, M. B.; LATIF, Z. A.. Democracy and growth in Brazil. INSPER. Instituto de Pesquisa e Ensino. Tradução: Francisco Marcos Macedo Salgado. *Working Papers*. São Paulo. 2013.

MACHADO, K. B.. A dinâmica das transações na cadeia produtiva do leite: uma análise das relações entre produtor, indústria e governo. Dissertação (Mestrado em Agronegócios) - *Universidade Federal de Goiás,* 2014.

MINISTÉRIO da Agricultura, Pecuária e Abastecimento. Plano mais pecuária / Ministério da Agricultura, Pecuária e Abastecimento. Assessoria de Gestão Estratégica. – Brasília : *MAPA/ACS,* 2014.

MINISTÉRIO do Desenvolvimento, Indústria e Comércio Exterior. *AliceWeb*. Disonível em < http://aliceweb.desenvolvimento.gov.br/>. Acesso em mar 2016.

NARDI JÚNIOR, G.; SANTOS, E. B. Evolução Da Produção Leiteira Nas Regiões Do Brasil. ISSN Impresso 0102 -5716 ISSN Eletrônico 2178-3764 *Revista de Veterinária e Zootecnia*, 2013.

PARRÉ, J. L. O agronegócio nas macrorregiões brasileiras: 1985 a 1995. Tese (Doutorado em Economia) - Escola Superior de Agricultura Luiz de Queiroz, *Universidade de São Paulo*. Piracicaba, 2000.

PEREIRA, M. W. G. ; TEIXEIRA, E. C. ; GURGEL, A.C. . Os custos do fracasso das negociações da Rodada de Doha para o setor lácteo nas regiões brasileiras. In: José Luiz Bellini Leite; Kennya Beatriz Siqueira; Glauco Rodrigues Carvalho. (Org.). Comércio Internacional de Lácteos. 2ed.Juiz de Fora: *Embrapa Gado de Leite,* 2009, v. , p. 203-232.

RUTHERFORD, T. F.; PALTSEV, S. V. GTAPinGAMS and GTAP-EG: Global database for econmic research and illustrative models. Boulder: *Departament of Economics* - University of Colorado, 2000.

RUTHERFORD, T. F. GTAPin GAMS: The dataset and statistic model. Prepared for the Workshop: "Alplied General Equilibrium Modeling for Trade Policy Analisys in Russia and the CIS". *The World Bank Resident Mission,* Moscow. December, 2005.

SOCIEDADE Nacional da Agricultura. Notícias. Consumo de lácteos perde fôlego no País. 2015. Disponível em http://sna.agr.br/consumo-de-lacteos-perde-folego-no-pais/ Acesso em jan 2015.

STOCK, L. A. Boletim CBLeite: consórcio brasileiro para comparação de modelos de produção de leite. Ano 7, nº 19, outubro/2013. Juiz de Fora. *Embrapa Gado de Leite*, 2013

TEIXEIRA, E. C.; GURGEL, A. C.; PARRÉ, J. L.; PEREIRA, M. W. G..; BRAGA, M. J.; LÍRIO, V. S. Projeto de Análise de Equilíbrio Geral da Economia Brasileira (PAEGBrasil). *Relatório Técnico Final de Pesquisa CNPq*. 2008. 63p.

TESSARO, A. B.; TORRES, E. F.; BULHÕES, R. Comportamento da produção de leite e exportação de lácteos do Paraná entre 1996 e 2006. In... VII Seminário do Centro de *Ciências Sociais Aplicadas. Cascavel* – PR – 17 a 19 de junho de 2008.

TRICHES, E. Importância da atividade leiteira na agricultura familiar e uma análise na Propriedade Ghion – Marau- RS. 2011. 63 p. *Trabalho de Conclusão* (Graduação). Universidade Federal do Rio Grande do Sul – Porto Alegre, 2011.

Annex 1

Tabela 3 – Change in foreign prices for milk and milk products and commodities under study (in %)

	Scenario 1A							Scenario 2A						
	pdr	gro	Osd	c_b	Oap	rmk	agr	pdr	gro	Osd	c_b	oap	rmk	agr
N	-0.016	-0.004	-0.003	-0.006	-0.009	-0.282	-0.002	-0.002	-0.001	-0.001	-0.001	-0.001	-0.058	
NE	-0.019	-0.005	-0.004	-0.013	-0.011	-0.306	-0.004	-0.003	-0.001	-0.001	-0.002	-0.002	-0.059	-0.001
MW	-0.021	-0.005	-0.003	-0.008	-0.011	-0.288	-0.003	-0.003	-0.001	-0.001	-0.001	-0.001	-0.049	-0.001
SE	-0.022	-0.006	-0.002	-0.010	-0.012	-0.268	-0.002	-0.003	-0.001		-0.001	-0.002	-0.038	
S	-0.005	-0.003	-0.005	-0.003	-0.006	-0.285	-0.003	-0.001	-0.001	-0.001		-0.001	-0.057	-0.001
RMS		-0.001			-0.003	-0.001	-0.001							
USA						-0.003								-0.001
RNF						-0.001								
ROA					-0.001	-0.002								
EUR		-0.001	-0.001			-0.001								
CHN			-0.001			-0.001								
ROW				-0.001		-0.002								

	Scenario 1B							Scenario 2B						
	pdr	gro	Osd	c_b	oap	rmk	agr	pdr	gro	osd	c_b	oap	rmk	agr
N	-0.032	-0.008	-0.007	-0.011	-0.018	-0.563	-0.004	-0.004	-0.001	-0.001	-0.002	-0.003	-0.116	-0.001
NE	-0.039	-0.01	-0.007	-0.026	-0.022	-0.61	-0.008	-0.005	-0.002	-0.001	-0.004	-0.003	-0.119	-0.002
MW	-0.043	-0.01	-0.006	-0.016	-0.022	-0.576	-0.006	-0.005	-0.002	-0.001	-0.002	-0.003	-0.099	-0.001
SE	-0.044	-0.013	-0.004	-0.02	-0.024	-0.535	-0.005	-0.006	-0.002	-0.001	-0.003	-0.003	-0.076	-0.001
S	-0.011	-0.006	-0.011	-0.005	-0.012	-0.569	-0.006	-0.002	-0.001	-0.002	-0.001	-0.002	-0.114	-0.001
RMS		-0.002			-0.006	-0.003	-0.002					-0.001	-0.001	
USA						-0.005	-0.001						-0.001	
RNF						-0.001								
ROA					-0.001	-0.004							-0.001	
EUR		-0.002	-0.002			-0.003	-0.001						-0.001	
CHN			-0.002			-0.001								
ROW		-0.001	-0.001	-0.001		-0.004							-0.001	

Source: Developed by the authors. Research results (2015).

Note: The sectors under analysis in the table are: Rice (pdr); Maize and other grain cereals (gro); Sugarcane, sugar beet, sugar ind.(c_b); Meat and live animals (oap); Milk and Milk products (rmk); Other agricultural products (agr). In addition, the aggregated regions in the model are: Rest of Mercosur (RMS); United States (USA); Rest of Nafta (RNF); Rest of America (ROA); European Union (EUR); China (CHN); And Rest of the World (ROW).

Annex 2

Table 4 – Change in total exports by region (%)

	Scenario 1A							Scenario 2A						
	pdr	Gro	Osd	c_b	Oap	rmk	Agr	Pdr	Gro	osd	c_b	Oap	rmk	agr
N	-0.154	-0.003	-0.004	-0.039	0.01	-0.398	-0.009	-0.019			-0.004	-0.005	-0.541	-0.001
NE	-0.15			-0.037	-0.016	-1.974	-0.002	-0.02			-0.005	-0.002	-0.144	-0.001
MW	-0.097	0.018	0.007	-0.034	0.002	-0.174	0.017	-0.007	0.004	0.001	-0.004	0.002	0.036	0.003
SE	-0.036	0.017	0.022	0.026	0.01	0.405	0.038		0.004	0.004	0.008	0.003	0.146	0.008
S	0.116	0.016	0.005	0.039	0.028	0.225	0.001	0.012	0.002	0.001	0.005	0.004	-0.095	
RMS	-0.075	-0.001	-0.003		-0.001	-0.027	-0.004	-0.01		-0.001			-0.005	-0.001
USA		-0.001	-0.003	-0.002		-0.064	-0.001						-0.012	
RNF			-0.002	-0.001		-0.009	-0.001						-0.002	
ROA	-0.001		-0.002	-0.001	-0.002	-0.029	-0.001						-0.005	
EUR	-0.001	-0.002	-0.003			-0.011	-0.001			-0.001			-0.002	
CHN		-0.001	-0.002	-0.002	-0.001		-0.001							
ROW		-0.001	-0.002	-0.001		-0.023	-0.001						-0.004	

	Scenario 1B							Scenario 2B						
	pdr	Gro	Osd	c_b	Oap	rmk	Agr	Pdr	Gro	osd	c_b	Oap	rmk	agr
N	-0.306	-0.005	-0.008	-0.078	0.021	-0.792	-0.018	-0.038			-0.009	-0.01	-1.081	-0.003
NE	-0.299		0.001	-0.073	-0.033	-3.904	-0.004	-0.04		-0.001	-0.01	-0.004	-0.288	-0.002
MW	-0.193	0.035	0.013	-0.068	0.005	-0.347	0.034	-0.013	0.007	0.002	-0.008	0.005	0.072	0.006
SE	-0.071	0.033	0.044	0.053	0.021	0.81	0.076	-0.001	0.007	0.008	0.016	0.006	0.293	0.016
S	0.231	0.031	0.01	0.078	0.055	0.449	0.003	0.025	0.004	0.003	0.01	0.007	-0.191	
RMS	-0.15	-0.002	-0.006		-0.002	-0.053	-0.009	-0.02		-0.001			-0.01	-0.002
USA	-0.001	-0.001	-0.005	-0.004	-0.001	-0.127	-0.001			-0.001	-0.001		-0.024	
RNF	-0.001	-0.001	-0.003	-0.001	-0.001	-0.018	-0.002			-0.001			-0.004	
ROA	-0.002	-0.001	-0.003	-0.002	-0.005	-0.057	-0.002			-0.001		-0.001	-0.011	
EUR	-0.001	-0.003	-0.006	-0.001	-0.001	-0.022	-0.002		-0.001	-0.001			-0.004	
CHN	-0.001	-0.001	-0.004	-0.004	-0.001		-0.001			-0.001	-0.001			
ROW	-0.001	-0.001	-0.004	-0.002	-0.001	-0.047	-0.001			-0.001			-0.009	

Source: Developed by the authors. Research results (2015).

Note: The sectors under analysis in the table are: Rice (pdr); Maize and other grain cereals (gro); Sugarcane, sugar beet, sugar ind.(c_b); Meat and live animals (oap); Milk and Milk products (rmk); Other agricultural products (agr). In addition, the aggregated regions in the model are: Rest of Mercosur (RMS); United States (USA); Rest of Nafta (RNF); Rest of America (ROA); European Union (EUR); China (CHN); And Rest of the World (ROW).

Table 5 – Change in total imports by region (%)

	Scenario 1A							Scenario 2A						
	Pdr	gro	Osd	c_b	oap	rmk	Agr	Pdr	Gro	Osd	c_b	Oap	rmk	agr
N	0.047	0.003	0.003	0.01	0.003	0.294	0.004	0.006			0.001	0.001	0.216	0.001
NE	0.053	0.004	0.004	0.031	0.012	0.902	0.008	0.007	0.001	0.001	0.005	0.002	0.105	0.002
MW	0.037	-0.002	0.002	0.009	0.004	0.099	-0.003	0.004	0.001	0.002	0.002	0.001		0.001
SE	0.035	0.008	0.006	0.009	0.012	-0.062	-0.002	0.005	0.002	0.002	0.001	0.002	-0.069	
S	-0.056	0.006	0.013	-0.019	0.002	-0.005	0.009	-0.006		0.001	-0.002		0.032	0.001
RMS		0.001		-0.001	0.003	0.005	0.002						0.001	0.001
USA						0.01	0.001						0.002	
RNF						0.002							0.002	
ROA					0.001	0.007								
EUR		0.001	0.001			0.002								
CHN			0.001			0.001	0.001							
ROW					0.001	0.007							0.001	

	Scenario 1B							Scenario 2B						
	Pdr	gro	Osd	c_b	oap	rmk	Agr	Pdr	Gro	Osd	c_b	Oap	rmk	agr
N	0.094	0.006	0.006	0.02	0.005	0.59	0.008	0.011	0.001		0.003	0.002	0.434	0.001
NE	0.106	0.008	0.008	0.062	0.023	1.808	0.016	0.015	0.002	0.002	0.01	0.004	0.21	0.004
MW	0.074	-0.004	0.004	0.019	0.008	0.198	-0.005	0.008	0.002	0.003	0.004	0.002	0.001	0.001
SE	0.069	0.015	0.012	0.018	0.024	-0.123	-0.004	0.009	0.003	0.003	0.002	0.005	-0.138	-0.001
S	-0.113	0.012	0.026	-0.039	0.003	-0.009	0.018	-0.012	0.001	0.003	-0.005		0.064	0.002
RMS		0.001	-0.001	-0.001	0.006	0.009	0.005					0.001	0.002	0.001
USA	0.001					0.02	0.002						0.004	
RNF						0.003							0.001	
ROA					0.001	0.015	0.001						0.003	
EUR		0.001	0.001			0.005	0.001						0.001	
CHN			0.001			0.002	0.001						0.003	
ROW			0.001	0.003	0.001	0.014	0.001							

Source: Developed by the authors. Research results (2015).

Note: The sectors under analysis in the table are: Rice (pdr); Maize and other grain cereals (gro); Sugarcane, sugar beet, sugar ind.(c_b); Meat and live animals (oap); Milk and Milk products (rmk); Other agricultural products (agr). In addition, the aggregated regions in the model are: Rest of Mercosur (RMS); United States (USA); Rest of Nafta (RNF); Rest of America (ROA); European Union (EUR); China (CHN); And Rest of the World (ROW).