The Evolution of Brazilian Production and Exportation of Agro-based Products from 1990 thru 2013

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Abstract:

This paper presents an analysis of the main determinants for the increase in Brazilian production and exportation of agro-based products from 1990 through 2013. The analysis led to some interesting conclusions. First, Brazil did not follow a predetermined 'model' calibrated for success in the international agricultural and agro-processed markets. Rather, it altered its budget to support market-oriented agricultural policies in a responsive manner that reflected the constraints and opportunities arising in both the domestic and international markets while taking advantage of abundant agricultural land, a favourable climate, and a willingness to invest by farmers and larger agribusiness companies. Second, increasing agricultural production and capacity facilitated increasing exports of both agricultural and agro-processed products. Third, Brazilian exports of agro-based products were increasing before and after the 2002 through 2008 international surge in food prices. Our econometric model revealed that increased Brazilian agricultural and agro-processed food production and overall world GDP growth, rather than international prices, have been the main drivers of Brazilian agricultural and agro-processed exports.

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Keywords: Brazil, agriculture, agricultural policy, agribusiness, exports, production

1. Introduction

Since its colonial period, Brazil has been a major global supplier of primary goods, such as mineral and agricultural products; and this has continued into 21st century despite the fact that Brazil is no longer an essentially agricultural country. While agriculture alone accounted for 5.3% of Brazilian GDP in 2013, agribusiness - encompassing agricultural support activities, agriculture itself, agro-industries and trading of agricultural and agro-processed products - contributed for 20.2% of the country's GDP in the same year. A wide range of agricultural and agro-processed products typically makes up at least one-third of Brazilian exports. Brazil continues to be the world's major coffee exporter, but more recently it has become one of the top ten soybean, sugar, wood pulp, orange juice, and meat exporting countries.

In the period from 1960 through 2013, three main factors shaped the trajectory of Brazilian agriculture and the related agribusiness sector. First, a shift in agricultural production growth from Brazil's South and Southeast regions to the Central-West region from the 1970´s thru the 1990´s; and since 2000 extreme agricultural production growth has taken place in the country's Cerrado (savannah) which encompasses parts of the states of Maranhão, Tocantins, Piauí and Bahia more to the Northeast. This "new agricultural frontier" is often referred by the acronyms MATOPIBA or BAMAPITO. It should be emphasized that productivity has increased in both traditional and new farming areas and the agricultural development continues in the former areas (Bacha, 2011). Second, the basic basket of crops has also grown from coffee and sugar in the 1960s to now include grains, meat and agro-processed products, such as orange juice, processed meats, and pulp, for example (Bacha, 2012). Third, Brazil has increased and diversified its agricultural and agro-processed exports, shifting from traditional crops such as coffee and cocoa to more value-added products, such as orange juice, processed meats, vegetables oils, pulp, and mechanically processed wood among several others (Graham et al, 1987).

This evolution is related to changes to both international markets and domestic agricultural policy. For instance, from 1990 to 2013 the share of world agricultural and agro-processed product exports enjoyed by the United States and European Union countries declined from 60.5% to 51.9% respectively despite the world demand for these products had increased. In the same period, Brazil's share jumped from 2.4% to 5.5%. Meanwhile, the guidance and grants of the Brazilian Government's agricultural policy changed. During the 1970s and 1980s, Brazilian domestic agricultural policy was premised on a division between export-oriented crops and domestic-oriented crops, with the former being produced by medium and large farms in the South and Southeast regions, which received the bulk of public policy subsidies (Bacha, 2012). Since the 1990s, government assistance programs have focused more on the distinction between family and non-family farmers, with the former

group tending to receive more direct government assistance whereas the latter was more indirectly assisted through policy changes encouraging private sector support for agriculture. Nevertheless, both small and large farms have played a significant role in the growth of Brazilian agricultural production and exportation (Bacha and Stege, 2015).

The fast-growing foreign markets purchasing Brazilian goods have also changed, with Brazilian agricultural and agro-industrial exports shifting from the USA and the EU towards Asia (specifically China), Africa and the Middle East. As the United States' and the European Union's shares of the global market for agricultural and agro-processed products have diminished, Brazil's share has increased.

Despite increasing productivity, Brazilian agribusiness, and specifically agriculture, has been hampered by infrastructure bottlenecks, particularly those relating to storage, domestic transportation and port facilities. The Brazilian Ministry of Agriculture, Livestock and Food Supply estimates that losses due to infrastructure deficiencies range between 10% and 15% of total production (Sou Agro 2011). There does not currently exist an adequate Brazilian public policy addressing these important issues specifically as issues for agriculture. Rather, the agricultural sector is typically obliged to feed off advances in infrastructure created for industrial and urban development.

In this context, this paper aims to analyse Brazil's increasing production and exports of agricultural-based products over the 1990 through 2013 period focusing on domestic and foreign conditions that have stimulated agro-based production and examining the determinants of both agricultural and agro-processed exports. The analysis can be divided into two segments: (a) identifying and qualifying both domestic and foreign stimulus behind the increase and diversification of agricultural and agro-processed production in Brazil, paying particular attention to changes at the international market level, the availability of agricultural land, and the roles of agricultural policies, larger agribusiness companies and market-oriented

farmers; and (b) quantifying the main determinants of both agricultural and agro-processed product exportation by running a supply-demand econometric model for these exportations.

The paper contains three main assumptions. First, Brazil did not follow a predetermined 'model' calibrated for success in international agricultural markets; instead, it has taken advantage of domestic and foreign circumstances to enlarge agro-based production and exportation. Second, Brazil's export success cannot be fully explained by the surge in world food prices from 2002 to 2008. In fact, production and exports were on the rise before this price boom and continue increasing after it was over. Third, rising production causes rising exports but not the inverse.

A large body of literature addresses changes in Brazilian agricultural and agro-processed production and exportation. For example, Albuquerque and Nicol (1987), Graham et al. (1987), Szmarecsányi (1990), Taglialegna et. al. (2000) and Barros (2014) provided an overview of Brazil's agricultural evolution and the sector's relationship with other sectors. Barros (1979), Goldin and Rezende (1993), Coelho (2001) and Rezende (2003) analysed the evolution of Brazilian agricultural policies, paying special attention to policy shifts conditioned by macroeconomic and political restrains but without emphasizing that it has preserved its market-orientation.

Carvalho and Leite (2008) analyzed the evolution and diversification of Brazil´s exportation of agro-based products and they did not verify the "Dutch Disease" in the Brazilian Economy in recent years. Almeida and Bacha (1998), Reis and Crespo (1998), Maia (2003), Pimentel et al. (2005) and Fraga and Bacha (2012) used different econometric methods to explain Brazilian agricultural and agro-industrial exportation, running supply equations to identify the main variables influencing the segment. To varying degrees, their results emphasized the importance of world GDP, exchange rates, domestic production, export prices and, most recently, the accumulation of human capital on Brazilian agricultural

exports. However, their studies did not differentiate between agricultural and agro-processed exports neither they did simultaneously estimate both demand and supply equations.

Our paper addresses agricultural and agro-processed exports separately and estimates changes in their supply and demand as a reaction to international prices, among other factors. In this way, it addresses both goals noted earlier: a) identifying and qualifying both domestic and foreign causes for the increase and diversification of agricultural and agro-processed production in Brazil, and b) quantifying the main determinants of both agricultural and agro-processed product exportation. Concerning to this latter issue, we will compare the role of international prices on Brazil´s agricultural and agro-processed exports with other drivers of these exports. This issue is particularly important because some studies have emphasized the lower economic growth (Gruss, 2014) or negative fiscal impact (Mariscal and Powell, 2014) over some Latin American countries after the end of 2002-2008 commodity price boom.

The remainder of this paper is organized into four more sections. In Section 2, we analyse the evolution of Brazilian agriculture and broadly consider the principle factors that have allowed Brazil to expand its role as a major world supplier of agricultural sector products. Section 3 charts the evolution of Brazilian agricultural and agro-processed product exports, highlighting varying patterns of product diversification and export destination. Section 4 then presents an econometric analyses of the determinants of Brazilian agricultural and agro-processed product exportation, and Section 5 offers our main conclusions.

2. The evolution of Brazilian agriculture from 1990 to 2013[1]

[1]**A note on the data:** the dataset was collected from the Brazilian Institute of Geography and Statistics (IBGE), the Ministry of Development, Industry and Foreign Trade (MDIC) and from the Food and Agriculture Organization (FAO). These three sources all cover roughly the same variables, but are each stronger in different areas, leading us to use them in different ways: (a) An IBGE dataset from its Municipal Agricultural and Livestock Production archives are used to evaluate the evolution of Brazil's main crops and meat production and productivity from 1990 to 2012. (b) The IBGE's 2006 Agricultural Census dataset is employed to analyse the agricultural production structure, particularly to reveal the regional distribution of agricultural production. (c) FAO and MIDC datasets on Brazil's agricultural and agro-processed exports are used to run supply equations in Section 4 to find the main determinants of these exports.

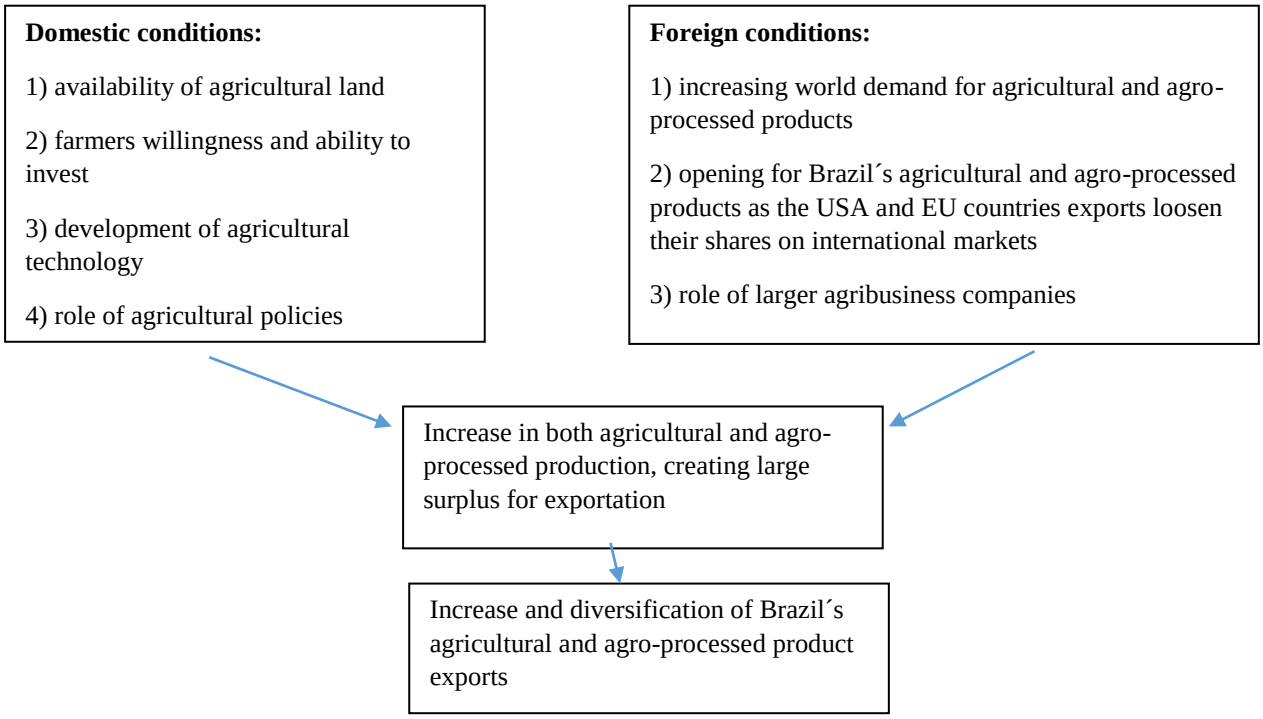
Brazilian production of both agricultural products and livestock has increased enormously since the 1990s, with particular intensity since 2000. Production of the 63 main Brazilian crops totalled 384 million tons in 1990, 485 million tons in 2000, and reached 1,036 million tons in 2013 according to the Brazilian Institute of Geography and Statistics (IBGE)´s Municipal Agricultural and Livestock Production dataset. The annual geometric rate of agricultural production during the 1990s was 3.2% and rose to 6.5% from 2000 through 2013. This growth was partially achieved by increasing productivity, which went up 3.97% per year during the 1990s and by 3.94% per year from 2000 through 2013. There has also been an impressive increase in meat production, jumping from 5.17 million MT in 1990, to 10.33 million MT by 2000 and 22.35 million MT by 2012. The annual geometric rate of growth for meat production was 7.29% during the 1990s and 6.6% from 2000 through 2012.

It is important to emphasize that both Brazilian agricultural and meat production increased before and after the international boom in food prices from 2002 through 2008. The annual geometric rate of growth for crop production from 2002 thru 2008 was 7.7% compared to 2.3% from 2009 through 2013. The geometric rates of growth for meat production over basically the same two periods were 7.9% and 4.5% (meat production data went through 2012), respectively. Although prices stimulated production growth, other factors played also important roles.

According to Graham (1987), Schlesinger and Noronha (2006), Bacha (2011, 2012), and Campos (2010), several factors support the increase in Brazilian agricultural production such as: (a) the easy availability of arable land, especially with the development of new agricultural frontiers in the country's Centre-West region from the 1970s to the 1990s and in the MATOPIBA region post-2000; (b) the introduction of modern farming technology stimulated by a network that encompasses the Brazilian Enterprise for Agricultural Research (EMBRAPA), public universities, State funded agricultural research institutes and privately funded organizations; (c) State funded agricultural policies and programs; (d) the presence of

both family and non-family market-oriented farmers; (e) the availability of international markets for Brazilian production, and (f) the role of large multinational agribusiness companies financing and buying domestic agricultural production. Figure 1 emphasizes the way that the above factors have impacted Brazilian agricultural production and the later has determined Brazilian exports of agricultural and agro-processed exports.

Figure 1: the analytical framework summarizing the paragraph above, which also provides an organizational format for this paper.



As opposed to the normal Keynesian framework that exports determines GDP, we make an argument that the factors noted in the preceding paragraph were the principal forces driving the large increase in Brazil's agricultural and agro-processed production geared for international markets and that increased production led to increased exportation. The econometric model presented in Section 4 supports this position as does the common sense notion that you need to produce to be able to export a share of that production, and as production increases the exportable volume can also enlarges.

Brazil has eco-climatic features favourable to the raising of cattle and the cultivation of crops. In many parts of the country, two or three crops can be sequentially planted in the same

area every year, leaving no fallow arable land. In the state of Paraná, for example, soybeans can be planted in September and harvested in March, beans from March to April and corn from late April to August: a continuous cycle. Different crop combinations are also possible in other areas, such as planting and harvesting soybeans from September to March and corn from late March to August. These procedures are viable due to factors in addition to climate, including the available technology and extensive use of agricultural inputs, such as fertilizers, improved seeds and irrigation. Moreover, Brazil still has considerable arable land available for agriculture (excluding conservation areas). In 2010, there were 85.3 million hectares of arable land available for new plantations, an expanse that, if planted, would double the area currently under cultivation (Table 1) without encroaching on legally established conservation areas.

Table 1: Use of land in Brazil, year of 2010

Land use	Area (million hectares)	Share of Brazil´s territory
Arable land	157.2	18.5%
With permanent crops[(a)]	6.3	0.74%
With temporary crops[(a)]	59.1	6.94%
With planted forests[(b)]	6.5	0.76%
Available to plant	85.3	10.02%
Pastures[(c)]	158.8	18.7%
Area occupied with native forests and conservation units [(d)]	509.0	59.8%
Conservation units	133.0	15.6%
Indigenous land	108.0	12.7%
legal reserve and permanent preservation areas inside the farms	268.0	31.5%
Urban areas, roads, power plants and other construction[(d)]	26.0	3.1%
BRAZILIAN TERRITORY (total)	851	100%

Source: (a) IBGE´s 2010 Municipal Agricultural Production Research; (b) ABRAF´s 2010 report, (c) Brazil´s 2006 Agricultural Census, (d) EMBRAPA. The latter was presented by José Garcia Gasques in his speech at the 50th Congress of SOBER, in Vitória, state of Espírito Santo, from July 22 to 26 2012.

Over the last four decades, the advancing agricultural frontier has caused major shifts in Brazilian agriculture. Although, the South and Southeast regions have been, and remain, the country's main agriculturally productive areas, their share of overall agricultural production is falling while the Central-West region's share has increased largely due the availability of arable lands covered with Cerrado vegetation. According to the Brazil´s Agricultural Census, the South and Southeast regions accounted for 71.1% of the gross value produced by the

agriculture in 1970, which decreased to 62.2% by 2006. Over this period, the Central-West region's share rose from 7.5% to 13.8% respectively. The Central-West held 8.7% of Brazil's temporary cropland in 1970, rising to 18.5% by 1985 and 23.8% by 2006. At the end of 1996, the Central-West contained 6% of the country's poultry and 8.1% of its swine; by 2006 those figures had grown to 12% and 11.8%, respectively.

Most of the currently available arable Brazilian land is located in the more central northeast and northen states of the country's Cerrado: shares of Maranhão, Tocantins, Piauí, and Bahia (the MATOPIBA states). In 1996, these states accounted for 7.3% of the gross value of Brazilian agricultural production, 11.2% of total temporary cropland and 21.2% of total permanent cropland; ten years latter, those percentages had risen to 9.1%, 12% and 23% respectively.

Portugal and Contini (1997), Bonneli and Pessôa (1998), and Beintema, Avila and Fachini (2010) have emphasized the role of the Brazilian Agricultural Research Corporation (EMBRAPA in Portuguese), public universities, other state-funded research agencies, and privately-funded research centres in generating technology for use by Brazilian agriculture. EMBRAPA, for instance, has had an important role in developing new soybean seeds tailored for planting in the Brazilian Cerrado. The sugar and ethanol company Copersucar, the state of São Paulo's publicly funded universities, and the former federally funded Sugar and Alcohol Institute (IAA) have all contributed to generate technology designed to assist sugarcane plantations in the state of São Paulo. Up until the 1970s, the Campinas Agronomy Institute (IAC, a 125-year-old São Paulo state-funded research institute) was the main agency responsible for crucial innovations in the cultivation of crops such as coffee and cotton. During the 1970s and 1980s, the Federal Government-supported Brazilian Institute of Coffee (IBC) conducted research into coffee plantation; and Rio Grande do Sul´s Rice Institute (IRGA) conducted important research focused on the rice crop.

During the 1990s, and especially during the 2000s, EMBRAPA has focused on practical research and has expended a great deal of energy to widely disseminate their findings. This perhaps explains the tendency of some publications to assume that the spread of agriculture through the Cerrado is entirely due to EMBRAPA research (e.g. The Economist 2010, 3). However, while EMBRAPA performs an important role coordinating a large range of crop and livestock research, it is only one among a large network of agencies undertaking agricultural research in Brazil. Beintema, Avila and Fachini (2010, 2) noted that EMBRAPA accounted for 57% of the total amount spent on agricultural research in 2006, while other State funded institutions accounted for 21% and universities accounted for 16%. In the same year, EMBRAPA was responsible for 41% of the number of personnel involved in this research while 38% came from other State funded institutions and 16% from universities.

Mueller (1982, 1983, 2010), Helfand (2000), and Lamounier (1994) determined that five variables have been very important in shaping Brazilian agricultural policies: (a) the nation's political and institutional direction (for instance, whether the government is authoritarian or democratic); (b) the view of the "good society" advocated by the dominant elements within government; (c) political alliances established within the government; (d) macroeconomic targets in place at a given time (such as increasing the GDP growth rate, reducing inflation, reducing unemployment, etc.); and (e) domestic and international political and economic circumstances

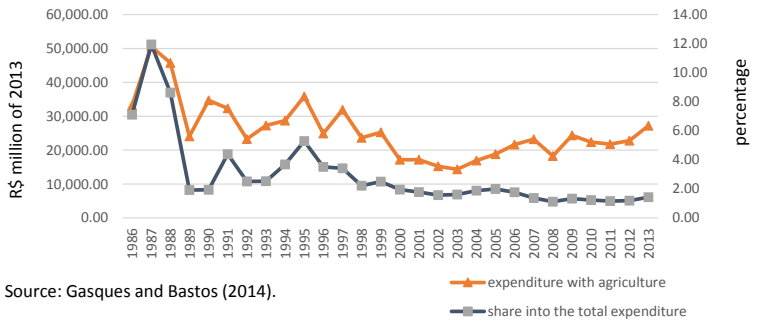
Over the last five decades, Brazilian agricultural policy has been backed by a surprisingly constant set of economic instruments, which include rural credit, minimum prices guarantees, federal and state-funded agricultural research, rural extension services, and subsidized insurance. Despite the need to reflect prevailing macroeconomics constraints, policy has been predominantly market-oriented, aiming to encourage farmers to produce tradable goods rather than producing for self-consumption alone. However, the specific amount of support given to further different agriculturally related policies and their programs changes due to interplay

among the five variables noted in the previous paragraph, as shown by Kageyama and Silva (1983), Goldin and Rezende (1993), Rezende (2001), Verde (2001) and Bacha (2012).

Figure 2 shows that since the mid 1980s there has been a significant decline in government spending on agriculture relative to the total government budget; although, recent spending has increased in absolute terms. In 1986, agriculture was responsible for 7.1% of Federal Government expenditures but only 1.4% by 2013, with many of the current programs directed toward specific groups of farmers (e.g., family farmers). These figures indicate that Brazil's government does not operate from predetermined agricultural development model designed to make it a giant in the international food market. However, consistency in the government's agricultural policies can be found in its focus on market-oriented farmers, and it can be argued that the performance of family and non family farming units has been similar because of this focus (Bacha and Stege, 2014).

Large Brazilian and multinational agribusiness companies have backed medium and large farming units in Brazil, encouraging them to produce exportable agricultural products. During the 1970s and 1980s, these companies funded farmers to plant grains in Cerrado areas using the "Green" soybeans contract. The Green soybean contract was an unregulated forward contract in which agribusiness companies lent money and/or agricultural inputs to farmers and later received reimbursements in the form of agricultural products (soybeans). In the 1990s, this type of contract became regulated, referred to as a "Note of Agricultural Product" ('Cédula de Produto Rural') and has continued to be widely used by the larger agribusiness companies. Over the years, these companies have bought a large share of Brazil's agricultural production, with foreign markets being an important destination for a sizeable proportion of their purchases.

Figure 2 - Evolution of Federal Government expenditures with agriculture (R$ millions of 2013) and their share into the total Federal Government expenditures



Source: Gasques and Bastos (2014).

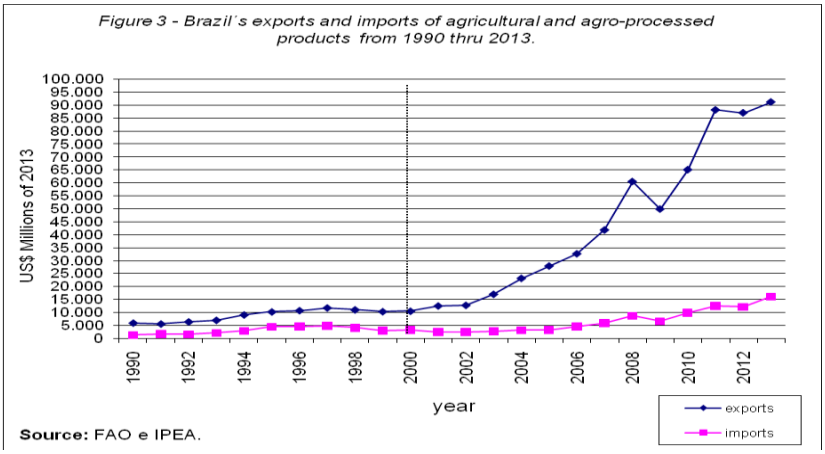
According to the Brazilian Minister of Development, Industry and Foreign Trade, six agribusiness companies were among the 10 largest exporting companies in Brazil in 2013; four were well-known international corporations, Bunge, Cargill, ADM and Louis Dreyfus, and two were large Brazilian companies (BRFoods and JBS). In the same year, of the 50 companies exporting the most Brazilian products in terms of value, 20 were agribusiness companies and 13 of those were Brazilian. It is reasonable to infer from these data that larger agribusiness companies are most responsible for linking higher Brazilian agricultural production with increasing agricultural exports.

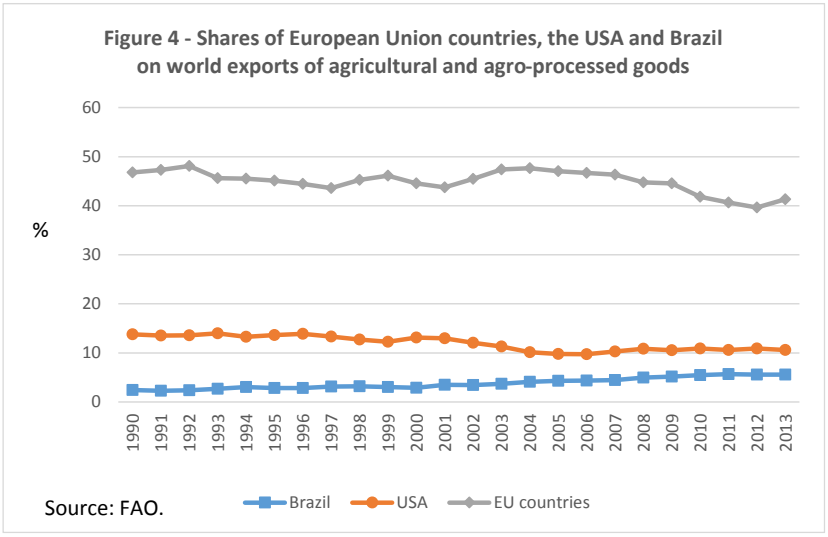
Next section analyses the evolution of Brazil´s exportation of agricultural and agro-processed products, paying attention to their diversification and destination.

3 – Evolution and diversification of Brazilian agricultural and agro-processed product exports

Figure 3 illustrates the evolution of Brazilian agricultural and agro-processed product exportation and importation, and the values were deflated by IPA at 2013 prices. The Figure shows that exports rose from US$ 5.8 billion in 1990 to almost US$ 91.2 billion in 2013, a fifteen fold increase in twenty-three years. A particularly large increase has taken place since 2000, which contrasts to a decrease of the USA's and European countries' shares of the world agricultural and agro-processed product markets (as seen in Figure 4). In 1990, EU countries accounted for 46.8% of world exports of agricultural and agro-processed products; but by

2013 that percentage had fallen to 41.3%. US exports of the same products comprised 13.8% of the world total in 1990 and 10.6% by 2013. Meanwhile, Brazilian exports rose from 2.4% to 5.5% of the world total of agricultural and agro-processed products from 1990 to 2013 (according to FAO database).





It is worth to emphasize that Brazilian exports of both agricultural and agro-processed products increased before and after the 2002-2008 world commodity price soaring, showing that factors other than higher prices had a significant hand in the rise of Brazilian agro-based product exports. The annual geometric rate of growth of the country's agro-based exports from 1990 to 2001 was 6.1%, from 2002 to 2008 it was 20.2%, and from 2009 to 2013 it was 11.4% per year.

Brazil is the world's largest producer and exporter of coffee, sugar and orange juice; the second largest exporter of soybeans, and holds the third and the fourth ranks as an exporter of corn and cotton, respectively (according to FAO database). The country is also the largest exporter of beef and poultry and contains the largest commercial cattle herd.

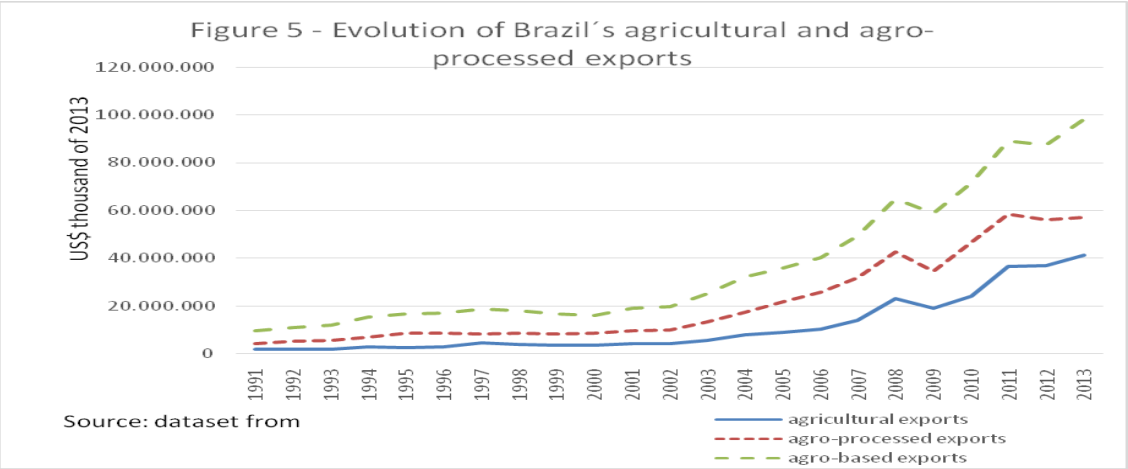
During the first thirteen years of the 21st century, Brazil exported an increasing quantity of agricultural and agro-processed goods to both established and, particularly, emerging markets (see Table 2). From 2000 to 2013, Brazil´s exports of agricultural and agro-processed products to European Union countries increased 261.2%, despite the fact that the share of overall Brazilian agricultural/agro-processed exports represented by these countries actually decreased from 47.85% in 1997 to 21.92% in 2013. African, Asian and Middle Eastern countries, especially China, have increased their imports of agricultural and agro-processed products made in Brazil. In 1997, countries from these regions bought 27.5% of Brazil's agricultural and agro-processed exports; by 2013 this percentage was 56.26%. China alone accounted for 23% of Brazil´s exports of agricultural and agro-processed goods in 2013. From 2000 through 2013, these Brazilian exports to China increased 5,025% (considering current values).

Table 2: Destination for Brazilian agricultural and agro-processed exports for selected years

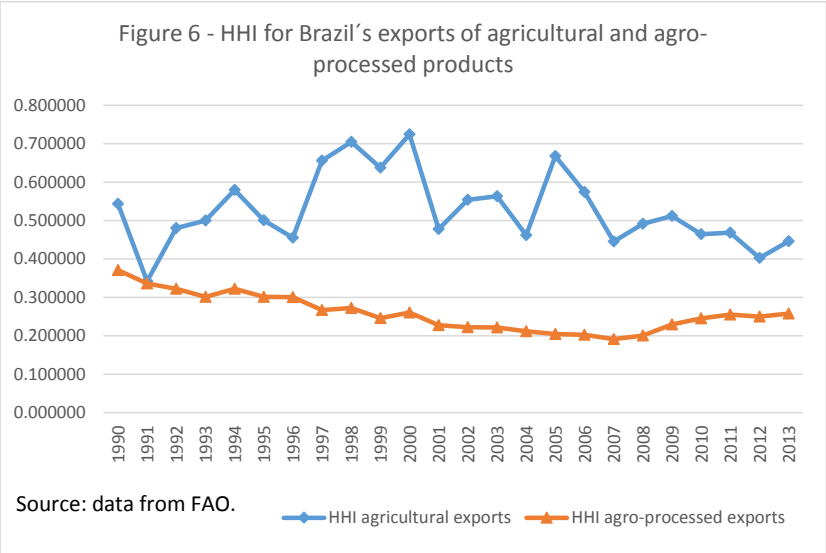
Region or country	**Exported value (agricultural and agro-processed products) – US$ millions and share in percentage**								**2000 thru 2013 Growth rate (1)**
	1997		**2000**		**2007**		**2013**		
	Value	**%**	value	**%**	Value	**%**	Value	**%**	%
European Union	5,965	**47.85**	5,171	**43.60**	17,016	**37.22**	21,549	**21.92**	261.20
Latin America	1,231	**9.88**	1,298	**10.95**	3,457	**7.56**	7,731	**7.87**	527.66
Mercosur	907	**7.28**	796	**6.71**	1,145	**2.51**	1,919	**1.95**	111.36
Africa	551	**4.43**	393	**3.31**	3,149	**6.89**	7,389	**7.52**	1,239.22
Asia	2,208	**17.71**	1,787	**15.07**	9,128	**19.97**	39,661	**40.35**	1,696.11
Middle East	669	**5.37**	612	**5.16**	3,948	**8.64**	8,243	**8.39**	1,131.68
USA	1,387	**11.13**	1,523	**12.84**	4,443	**9.72**	6,658	**6.77**	379.92
Japan	741	**5.95**	600	**5.06**	1,425	**3.12**	3,418	**3.48**	360.99
China	441	**3.54**	365	**3.08**	3,909	**8.55**	22,646	**23.04**	5,025.35
Russia	430	**3.45**	268	**2.26**	2,861	**6.26**	2,721	**2.77**	532.11
India	34	**0.28**	56	**0.47**	199	**0.44**	757	**0.77**	2,089.61
Total exported (2)	**12,467**		**11,860**		**45,717**		**98,287**		**688.36**

Source: Secex/MDIC and FAO, notes: (1) Growth rate = (FV - IV) /IV where FV is the year 2013 value and IV is the year 1997 value. (2) Total exported value of agricultural and agro-processed products produced in Brazil.

Figure 5 shows the growth of Brazil's agricultural, agro-processed and total agro-based product exportation since 1991. The latter have increased from US$ 9.6 billion in 1991 to US$ 98.2 billion in 2013. Agro-processed products have been responsible for almost two thirds of total agro-based exports. At first glance, the evolution of agro-processed exports is similar to that of agricultural exports, however, differences do appear. In 1997, agricultural exports increased more than agro-processed exports; and in 2012 the former were stable and the later decreased.



Although certain products have remained predominant among Brazil's agro-based exports, an examination of the Herfindal-Hirschman index (HHI) for the sector shows that diversification is taking place, particularly in agro-processed segment. Figure 6 shows that the HHI for agro-processed exports decreased from 0.37 in 1990 to 0.26 in 2013, a decrease of 30%, with a steady downward trend from 1990 to 2007. Although in an uptrend from 1991 to 2000, the Index for agricultural product exports also decreased over the 1990 to 2013 period, declining from 0.54 in 1990 to 0.45 in 2013, a decrease of 17%,. Notably, the diversification is higher for agro-processed product exports than for agricultural product exports.



We now turn to an econometric analysis of Brazilian agricultural and agro-processed products exports to explain the drivers of these significant trends.

4. An econometric analysis of Brazilian agricultural and agro-processed exports

Almeida and Bacha (1998), Reis and Crespo (1998), Maia (2003), Pimentel et al. (2005), and Fraga and Bacha (2012) have estimated supply equations for agricultural exports, agro-processed exports, or both together. Their analyses emphasize the importance of world GDP, the exchange rate, domestic production and export prices on Brazilian exportation. However, none of these authors used simultaneous equations (supply and demand curves together) to analyze the determinants of those exports, which were conducted as part of the current study. Zini (1988) did estimate simultaneous equations for exports and imports of some groups of products traded by Brazil, mainly mineral, agricultural and industrial products. The author considered the period from 1970 through 1985 but did not separate agricultural and agro-processed products as our paper does. Moreover, our paper analyses a more recent period (from 1991 through 2013) and includes all the explanatory variables addressed by the studies noted above, while evaluating the possible impact of production costs on the supply curve and adding the price of substitute products to the demand curve.

Prices are represented in the slope of the supply and demand curves; however, the curves' shifting is caused by other factors. For example, increasing World GDP would shift demand curves to the right, causing an increase in the Brazil´s exports of agro-based products. The same impact would result from an increase in competitor prices. On supply side, increasing production and devaluation of the Brazilian currency would cause increased exports, shifting the supply curve again to the right; but higher production costs would cause reduced exports and produce a shift to the left of the supply curve.

Our econometric model is comprised of the explanatory variables shown in Chart 1. Supply and demand equations are run separately for agricultural, agro-processed and total agro-based products. The equations are:

Supply equation

Quantity supplied = f(international price, exchange rate, total production, cost of production) (1)

Demand equation

Quantity demanded = g(international price, international income, price of substitute good) (2)

Chart 1: explanatory variables used in the econometric model

Explanatory variable	**Description**	**Source**
Brazil´s agricultural and agro-processed exports	Agricultural and agro-processed goods are considered separately while all agricultural and agro-processed exports are considered together as agro-based exports. The original data measure is in MT and we transform that into an index with 1990 = 100. Agricultural products encompasses crop, meat, forest products, milk, etc.	FAO
Total agricultural production	An index with 1990 = 100	IBGE
Exchange rate	Purchasing power of the Brazilian Real in relation to 16 major Brazilian trade partner currencies, an index with 1990 = 100. An increase of this index indicates Real devaluation.	IPEA
International Price Index	Index of agricultural and agro-processed product prices. Calculated by dividing value of exports over quantity exported	FAO
World GDP	Sum of all countries' GDPs (US$ million) and alternatively the amount of imports.	FAO
Production cost	FGV index of prices paid by farms for agricultural inputs and IGP-DI (general index of prices) for agro-processed products. An average of the above index was used for total agro-based exports.	FGV
Competitor prices	Argentinean prices for agricultural and agro-processed products	FAO

Source: elaborated by the authors.

In order to assess the differences between agricultural and agro-processed exportation, three versions of equations (1) and (2) are run: one for all agro-based product exports, one for only agricultural product exports, and one for only agro-processed product exports. Table 3 displays the dataset used in the regressions.

Before running equations (1) and (2), the Wald test for Exogeneity was applied to some blocks of variables. The null hypothesis here is that the missed variable does not affect the dependent variable or the model's results (Enders, 1995). In this way, the test is able to capture the endogeneity among some of the variables, especially between production and exports. Table 4 presents the results of the Wald test for agricultural exports, agro-processed exports, total agro- based exports and total production. At a 10% level, we cannot accept that total production is an endogenous variable. See at top left side of Table 4 that Wald´s test is not statistically significant when total production is assumed as an endogenous variable. However, we can accept that agricultural and total agro-based exports are endogenous variables (see right side of Table 4). Export of agro-processed products is endogenous at a 21% level (bottom left side of Table 4). These results are in accordance with our analytical framework (see Figure 1) and with our econometric model.

Table 4 – Wald´s test for exogeneity considering group of variables

Dependent variable: Total Production				Dependent variable: Agricultural Exports			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
agricultural exports	0. 149930	2	0.9278	Total production	2.568073	2	0.2769
Agro-processed exports	0.069154	2	0.9660	Agro-processed exports	5.870356	2	0.0531
Total agro-based exports	0.224667	2	0.8937	Total agro-based exports	7.117007	2	0.0285
All	1.112173	6	0.9810	All	15.32224	6	0.0179
Dependent variable: Agro-processed Exports				Dependent variable: Agro-based Exports			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
TP	2.665131	2	0.2638	TP	3.093547	2	0.2129
Agricultural exports	2.623315	2	0.2694	EXPAGRIC	2.477090	2	0.2898
Agro-based exports	1.700500	2	0.4273	EXPAGROIND	3.354951	2	0.1868
All	8.382761	6	0.2114	All	12.01996	6	0.0615

Source: Research results from the use of E-Views.

Table 3 – Dataset used in regressions

year	exports – index 1990 = 100			total production index 1990 = 100	Exchange rate index 1990 = 100 higher = weaker R$	Production cost index ago/94 = 100			International prices index 1990 = 100[j]			World GDP (US$)	World imports of agro-based products (US$)	competitor prices (substitute good prices)		
	agricultural products	agro-processed products	total agro-based products			agricultural products	agro-processed products	total agro-based products	agricultural products	agro-processed products	total agro-based products			agricultural products	agro-processed products	total agro-based products
1991	70,08	102,89	96,75	93,83	119,56	88,12	71,55	73,79	141,41	90,88	98,32	23,64	0,353	89,35	94,13	91,21
1992	98,89	126,20	121,09	93,50	135,62	84,12	68,29	70,71	100,88	89,15	89,86	25,31	0,386	84,05	93,73	87,53
1993	107,84	148,34	140,77	96,48	130,51	83,61	76,15	77,22	96,42	82,72	83,31	25,75	0,355	89,50	98,59	93,84
1994	127,23	170,34	162,28	102,46	123,15	97,17	94,47	94,86	120,08	87,78	92,72	27,64	0,403	106,11	110,34	109,14
1995	89,49	194,07	174,51	99,31	110,85	123,23	115,08	115,86	148,77	92,09	94,83	30,59	0,461	110,35	118,90	115,36
1996	98,48	174,13	159,98	102,35	105,82	128,83	116,69	118,09	143,89	101,59	104,19	31,25	0,480	140,29	122,80	131,81
1997	183,20	181,57	181,87	108,11	105,58	127,43	117,43	119,31	119,51	91,65	99,87	31,15	0,468	102,65	127,85	115,05
1998	196,37	200,77	199,94	103,75	107,64	123,70	113,36	115,26	98,05	87,75	90,49	31,03	0,457	88,01	103,25	94,09
1999	199,41	222,16	217,91	101,52	158,94	89,02	80,90	82,29	85,59	75,72	77,52	32,18	0,444	85,70	86,41	88,39
2000	239,83	200,23	207,63	96,55	150,61	98,20	91,02	92,57	69,74	82,74	80,01	33,23	0,433	74,83	85,29	80,37
2001	426,67	241,60	276,22	100,03	177,93	83,61	78,81	80,20	46,13	77,51	68,80	33,03	0,442	76,70	77,90	76,63
2002	386,30	276,52	297,05	103,66	170,98	80,92	72,80	74,78	51,83	71,37	66,72	34,32	0,465	78,11	80,55	81,02
2003	479,17	309,55	341,27	107,48	170,35	98,18	83,78	87,56	54,08	81,77	74,68	38,54	0,552	88,74	90,65	92,09
2004	521,86	347,62	380,21	112,39	166,47	112,95	95,98	100,33	65,96	89,23	84,18	43,42	0,638	93,96	107,71	104,74
2005	495,34	398,06	416,25	107,86	141,29	144,83	122,48	127,45	72,76	90,94	86,85	46,98	0,680	85,25	102,84	96,62
2006	605,87	386,67	427,67	111,49	128,90	164,66	138,88	145,71	65,64	105,73	94,84	50,89	0,754	100,47	104,27	108,34
2007	693,44	395,44	451,17	116,93	121,99	191,02	163,81	171,63	75,72	121,10	109,11	57,35	0,913	122,02	124,99	127,33
2008	639,76	389,32	436,16	117,78	128,94	235,14	195,74	206,54	122,42	150,70	147,58	62,88	1,119	168,65	172,70	174,24
2009	732,02	408,53	469,03	111,73	129,05	228,37	182,09	195,59	96,69	128,20	123,05	59,56	0,988	155,90	165,88	175,43
2010	805,26	433,42	502,97	116,99	115,72	255,05	215,87	227,60	103,39	152,11	141,07	65,24	1,107	150,16	160,81	160,08
2011	888,82	424,30	511,18	115,14	128,66	270,71	246,43	254,33	130,95	178,96	171,50	72,66	1,357	199,02	190,44	198,65
2012	1.060,99	416,72	537,21	113,05	167,99	232,83	223,84	227,16	110,81	173,76	159,17	74,22	1,370	174,95	206,09	192,77
2013	1.333,48	444,55	610,80	112,77	200,53	242,36	215,27	226,33	97,80	164,78	147,07	76,34	1,430	194,15	212,63	208,36

Source FAO, IBGE, IMF and World Bank. See chart 1.

Results from the first run of regression equations (1) and (2) were arrived at using data as they appear in Table 3. In the hope of improving the econometric results, the regression equations were run a second time using the Neperian logarithms of Table 3 data, but these regressions did not show better results than from the first run with unmodified Table 3 data. The equations were run several more times with manipulated data: World Imports were substituted for World GDP; data was input in the first difference; some explanatory variable data (such as total production and exchange rate) were run using lags; and dependent variable data was lagged one year as a new explanatory variable. In the end, the first set of regressions using the data shown in Table 3 was found to give the best results, which are detailed in Tables 5, 6, and 7.

Table 5 – Econometric results from equations (1) and (2) for agricultural product exports

Supply equation	constant	International price	Exchange rate	Total production	R^2	F-statistic	Durbin Watson
Coefficient	-4822.452	3.871231	8.339076	35.23182	0.843833	35.18544	1.836569
t-statistic	-8.729149	2.603644	5.241177	8.521972			
Probability	0.0000	0.0174	0.0000	0.0000			
Elasticity		0.8195	2.544	8.2203			

Demand equation	constant	International price	World GDP	Competitor price	R^2	F-statistic	Durbin Watson
Coefficient	8.624343	-6.012864	8.57E-09	5.636389	0.946248	114.0461	1.310104
t-statistic	0.076307	-3.463290	1.847215	2.386410			
Probability	0.9400	0.0026	0.0803	0.0276			
Elasticity		-1.2729	0.8236	1.4301			

Source: equations run using data as they appear at Table 3.

Table 6 – econometric results from equations (1) and (2) for agro-processed product exports

Supply equation	Constant	International price	Exchange rate	Total production	R^2	F-statistic	Durbin Watson
Coefficient	-1112.978	0.750043	1.140539	10.91704	0.891292	52.60395	1.734858
t-statistic	-7.180401	1.935793	3.454576	6.513140			
Probability	0.0000	0.0679	0.0027	0.0000			
Elasticity		0.2808	0.5531	4.0488			

Demand equation	constant	International price	Ln(World GDP)	Competitor price	R^2	F-statistic	Durbin Watson
Coefficient	-9556.898	-1.132991	409.6123	-0.343102	0.983515	372.2378	1.070660
t-statistic	-18.48374	-1.822550	18.45545	-0.866177			
Probability	0.0000	0.0841	0.0000	0.3972			
Elasticity		-0.4242	1.4289	-0.1477			

Source: equations run using data as they appear at Table 3, except for world GDP what was taken in neperian logarithm.

Table 7 – econometric results of equations (1) and (2) for total exports of all agro-based products

Supply equation	Constant	International price	Exchange rate	Total production	R^2	F-statistic	Durbin Watson
Coefficient	-1534.582	1.702776	2.225279	12.85750	0.912259	67.34668	2.008804
t-statistic	-8.901216	3.392485	5.465690	6.736357			
Probability	0.0000	0.0031	0.0000	0.0000			
Elasticity		0.555	0.9719	4.2949			

Demand equation	constant	International price	World GDP	Competitor price	R^2	F-statistic	Durbin Watson
Coefficient	47.22133	-2.968930	1.22E-08	0.383461	0.991144	701.5146	1.431468
t-statistic	3.027122	-5.088542	29.62369	0.886628			
Probability	0.0069	0.0001	0.0000	0.3864			
Elasticity		-0.9677	1.6787	0.1468			

Source: equations run using data as they appear at Table 3

EViews was used to run the regressions. The instrumental variables were the explanatory variables. Most of the Durbin Watson statistics were found to be inconclusive, especially in regards to the demand curves. It was noted that the inclusion of production costs to the supply equation resulted in a positive coefficient (opposite to what was expected) and a high correlation between production costs and total production. Because of this, the variables listed in the "Production cost" columns on Table 3 were omitted from the supply equation.

With the exception of the coefficient for competitor prices (or substitute good prices), the coefficients shown in tables 5 through 7 have the expected signal and most of them is statistically significant, more so for the ones impacting the supply curve. The coefficient for competitor prices was not shown to be statistically significant (see: tables 6 and 7); although it did have the expected signal in regards to exports of both agricultural and agro-processed products but not in regards to the demand for agro-processed products.

Results from this study's supply and demand equations demonstrate that the increased exportation of Brazilian agricultural and agro-processed products over the studied period is mainly explained by an increase in total production, international income, the exchange rate fluctuation, and international prices, in that order of influence. Despite the initial expectation that the boom in agricultural and agro-processed exportation would be mainly explained by soaring world food prices found from 2002 through 2008, the elasticity values do not confirm

this. For example, our elasticity calculations show that a 1%-increase in international food prices would lead to increases of 0.82%, 0.28%, and 0.56% in the supply of Brazilian agricultural, agro-processed, and agro-based products for export, respectively. The same 1% increase in total production is found to lead to increases of 8.22%, 4.04%, and 4.29% in the aforementioned products' export supply, respectively, an enormous increase over the same percentage rise in international food prices. The impact of exchange rate devaluation on the supply of Brazilian agricultural, agro-processed, and total agro-based product for export is also larger than the impact of changes in international prices. The elasticities for a one percent exchange rate devaluation are 2.54%, 0.55% and 0.97% on Brazil´s agricultural, agro-processed and agro-based exports, respectively, which are close to double the international price elasticities derived from our supply-side equations.

After running the demand equations, it was found that a 1% increase in international income causes a 0.82% increase in Brazilian agricultural product exports, a 1.43% increase in agro-processed product exports, and a 1.68% increase in all agro-based product exports. These impacts are greater than the negative demand impact from a 1% increase in the prices of these products, which confirms the argument that Brazil's agricultural and agro-processed exports have increased because the country has been able to attend to new demand. It was also found that the demand for Brazilian agricultural exports alone increases 1.43% when competitor's prices increase 1%.

6. Conclusions

Brazil´s crop and livestock production increased dramatically from 1990 through 2013. In 1990, the combined output of Brazil's 63 major crops was 384 million MT at harvest, rising to 485 million MT by 2000 and reaching 1,036 million MT by 2013. In 1990 meat production was 5.17 million MT, rising to 10.3 million MT in 2000, and 22.3 million MT in 2012. Our

paper argues that these production increases are due to several primary factors: (1) good availability of arable land; (2) market-oriented agricultural policies that have oscillated according to macroeconomic constraints and been effective; (3) the presence of agricultural frontiers and business oriented farmers; (4) the presence of large domestic and foreign companies that have guaranteed the purchase of Brazilian agricultural products, thereby financing a large number of business-oriented farmers as well as agricultural exportation; and (5) an agricultural technology network encompassing federal and state-funded agencies, universities, private organizations, and individual companies.

In concert with these production increases, Brazil has experienced very high growth in the exportation of agricultural and agro-processed products. These rose from US$ 9.6 billion in 1990, to US$ 15.97 billion in 2000, and shot up to US$ 98.3 billion in 2013. Simultaneously, Brazil's share of worldwide food supply increased from 2.4% in 1990, to 2.9 % in 2000, and to 5.5% in 2013.

Several factors can explain the growth of Brazilian agro-based exportation; in particular, increasing domestic production, the growth of world consumption, exchange rate devaluation, and changes in international prices. According to the econometric model run in this study, the main determinants of the sharp rise in Brazil's agricultural and agro-processed exports since 1990 were the increase in total agricultural production and world economic growth, with the exchange rate also having a considerable influence. The surge in outward-oriented production has been led by both family and non-family farms that have been stimulated to increase productivity by a market-focused agricultural policy and an expanding agricultural frontier.

REFERENCES

ALBUQUERQUE, M.C.C.; NICOL, R. Economia Agrícola: o setor primário e a evolução da economia brasileira. São Paulo: McGraw-Hill, 1987.

ALMEIDA, C.O.; BACHA, C.J.C. Determinantes da balança comercial de produtos agrícolas e agroindustriais do Brasil: 1961/95. Revista Pesquisa e Planejamento Econômico, Rio de Janeiro, volume 28, number 1, p. 95-128, April 1998.

BACHA, C.J.C. "The evolution of Brazilian agriculture from 1987 to 2009." In Baer, W. and D. Fleischer, *The Economics of Argentina and Brazil: A Comparative Perspective*. pp. 97-129. Northampton, Mass.: Edward Elgar Publishing, 2011.

BACHA, C.J.C. *Economia e Política Agrícola no Brasil*. (2nd edition.) São Paulo: Editora Atlas, 2012.

BACHA, C.J.C., STEGE, A.L. *Spatial differences between family and non-family farming in Brazilian agriculture*, IRIBA Working Paper: 14, Manchester, 2014, available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2502031.

BARROS, G.S.C. Agricultura e indústria no desenvolvimento brasileiro. In Buainain, A.M. et al (editors) O mundo rural no Brasil do século 21. Embrapa, 2014, p. 79-116.

BARROS, J.R.M. Política e desenvolvimento agrícola no Brasil. In VEIGA, A. (coordenator) Ensaios sobre política agrícola brasileira. São Paulo, Secretaria da Agricultura, 1979.

BEINTEMA, N., AVILA, F., FACHINI, C. 2010. "Brasil – Inovações na Organização e Financiamento da Pesquisa Agropecuária Pública." *ASTI and EMBRAPA.* Available at http://www.pdfio.com/k-5354293.html . Accessed 24/01/16.

BONELLI, R., PESSÔA, E.P. 1998. "O Papel do Estado na Pesquisa Agrícola no Brasil." Texto para discussão no 576. Rio de Janeiro: IPEA.

CAMPOS, C.M. "Fatores da expansão do complexo sojicultor no território brasileiro." *Revista Eletrônica da Associação dos Geógrafos Brasileiros* 11 (7), pp. 6-34. Três Lagoas. Available at: http://www.cptl.ufms.br/geo/revista-geo/Revista/Revista11maio/1.pdf . Accessed 28/09/15, 2010.

CARVALHO, M.A.; LEITE, C.R.S. Mudanças na pauta das exportações agrícolas brasileiras, *Revista de Economia e Sociologia Rural*, v. 46, n. 1, January-March, 2008, p. 53-73.

COELHO, C.N. 70 anos de Política Agrícola no Brasil (1931-2001), *Revista de Política Agrícola*, Ano X, n. 3, July-September, 2001, pp. 3-58.

ENDERS, W. *Applied econometric time series.* New York: John Wiley & Sons, 1995.

FAO (Food and Agriculture Organization of the United Nations) 2013. *FAOSTAT.* Available at: http://faostat3.fao.org/faostat-gateway/go/to/home/E . Accessed 10/04/15.

FRAGA, G.J.; BACHA, C.J.C. Nonlinearity of the Relationship between Human Capital and Exportation in Brazil, Economics Research International, volume 2012, p. 1-10, 2012 (available at http://www.hindawi.com/journals/ecri/2012/364715/).

GOLDIN, I., REZENDE, G.C. "A agricultura Brasileira na década de 80 - crescimento numa economia em crise." *Série IPEA*, 138. Rio de Janeiro: IPEA, 1993.

GRAHAM, D.H.; GAUTHIER, H.; BARROS, J.R.M. Thirty Years of Agricultural Growth in Brazil: crop performance, regional profile, and recent policy review, *Economic Development and Cultural Changes*, vol. 36, n. 1, October, 1987, p. 1-34.

GRUSS, B. After the Boom-Commodity Prices and Economic Growth in Latin America and the Caribbean, IMF Working Paper, August 2014, 42 pages (available at https://www.imf.org/external/pubs/ft/wp/2014/wp14154.pdf).

HELFAND, S.M. "Interest groups and the pattern of protection in the Brazilian agricultural sector." *Contemporary Economic Policy* 18 (4), pp. 462-476, 2000.

IBGE (Instituto Brasileiro de Geografia e Estatística) "Indústria - Produção Física – Agroindústria." Available at: http://www.ibge.gov.br/home/estatistica/indicadores/industria/pimpfagro_nova/default.shtm . Accessed 10/10/15.

IPEADATA *Sistema de Dados do Instituto de Pesquisa Econômica Aplicada*. Available at: http://www.ipeadata.gov.br/ . Accessed 10/04/15.

KAGEYAMA, A.A., SILVA, J.G. "Os resultados da modernização agrícola dos anos 70." *Estudos Econômicos* 13(3), pp. 537-559, 1983.

LAMOUNIER, B. "Determinantes Políticos da Política Agrícola: Um Estudo de Atores, Demandas e Mecanismos de Decisão." IPEA, Brasília, *Estudos de Política Agrícola* (9). Brasilia: IPEA. 1994

MAIA, S.F. "Determinantes das Exportações Agrícolas em Cenário de Macroeconomia Aberta: Abordagem por Modelos de Séries de Tempo." Anais do XXXI Encontro Nacional de Economia da Anpec, Rio de Janeiro, 2003. Available at: http://www.anpec.org.br/encontro2003/artigos/E56.pdf .Accessed 10/15/15.

MARISCAL, R.; POWELL, A. Commodity Price Booms and Breaks: Detection, Magnitude and Implications for Developing Countries, Inter-American Development Bank (IDB) working paper series, IDB-WP-444, 45 pages. Available at http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=38491805, checked on 08/17/2015.

MARREWIJK, C.V. *International Economics – Theory, Application, and Policy*, Oxford University Pressa, Second Edition, 2012.

MDIC/SECEX *System Of Analysis of Foreign Trade Information ('AliceWeb').* Ministério do Desenvolvimento Indústria e Comércio Exterior. Available at: http://aliceweb2.mdic.gov.br/> Accessed 10/14/15.

MUELLER, C. "Formulação de Políticas Agrícolas." *Revista de Economia Política* 2 (5), pp.89-122, 1982.

MUELLER, C. "A Racionalidade, o Poder e a Formulação de Políticas Agrícolas." *Revista de Economia e Sociologia Rural* (21) 2, pp.157-172, 1983.

MUELLER, C. “A política agrícola no Brasil – Uma visão de longo prazo.” In *Revista de Política Agrícola,* Ano XIX, Edição Especial, July 2010. pp 9-23.

PIMENTEL, E.A., ALMEIDA, L., SABBADINI, R. “Comportamento recente das exportações agrícolas no Brasil: uma análise espacial no âmbito dos estados.” NEREUS – Núcleo de Economia Regional e Urbana da Universidade de São Paulo, 2005. Available at: http://www.usp.br/nereus/wp-content/uploads/TDNereus_13_05.pdf . Accessed 10/16/15.

PORTUGAL, A.D., CONTINI, E. “O público e o privado na pesquisa agropecuária brasileira.” In *Congresso Brasileiro de Economia Rural* 35, pp.38-52. Natal, 1997.

REIS, J.N.P., CRESPO, J.E.Q. “Um modelo econométrico para as exportações de açúcar no Brasil.” *Agricultura em São Paulo* 45 (1), pp. 17-32, 1998. Available at: http://www.iea.sp.gov.br/OUT/verTexto.php?codTexto=947 . Accessed 10/18/15.

REZENDE, G.C. A Evolução da Política de Preços Mínimos na Década de 1990 In GASQUES, J.G.; CONCEIÇÃO, J.C.P.R. Transformações da Agricultura e Políticas Públicas. Brasília: IPEA, 2001, p. 303-314.

REZENDE, G.C. Estado, macroeconomia e agricultura no Brasil. Porto Alegre: Ed. Da UFRGS and IPEA, 2003.

SCHLESINGER, S., NORONHA, S. *O Brasil está nu! O avanço da monocultura da soja, o grão que cresceu demais*. (1st edition.) Rio de Janeiro: FASE. Available at: http://br.boell.org/downloads/soja_livro_rev_final_b1.pdf . Accessed 22/09/13.

SZMRECSÁNYI, T. Pequena história da agricultura no Brasil. São Paulo: Contexto, 1990.

SOU AGRO. “Infraestrutura logística deficiente custa caro para a população.” Available at: https://souagro.com.br/infraestrutura-logistica-deficiente-custa-caro-para-a-populacao/ Issued on August 3rd, 2011.

TAGLIALEGNA, G.H.F.; BRACALE, G.; MANDAI, K.; SOUZA, E.L.L. de. Papel da Agricultura no Plano Real: estabilização da moeda e modernização do setor, **Revista de Política Agrícola**, Brasília, ano IX, nº 03, julho/agosto/setembro de 2000. Available at: < http://www.agricultura.gov.br/arq_editor/Revista%203%2000.pdf> Accessed on October 10th, 2013.

THE ECONOMIST, Brazilian Agriculture: The miracle of the Cerrado, The Economist, August 26th, 2010, available at http://www.economist.com/node/16886442.

VERDE, C.M.V. Modificações Recentes na Política de Garantia de Preços Mínimos. In GASQUES, J.G.; CONCEIÇÃO, J.C.P.R. Transformações da Agricultura e Políticas Públicas. Brasília: IPEA, 2001, p. 315-336

WORLD BANK. 2013. *World Data Bank.* Available at: http://databank.worldbank.org/data/views/variableSelection/selectvariables.aspx?source=world-development-indicators . Accessed 10/04/15.

ZINI JR, A.A. Funções de Exportação e Importação para o Brasil. **Pesquisa e Planejamento Econômico**, Rio de Janeiro, n. 18, December 1988. Accessed 11/10/15. Available at < http://ppe.ipea.gov.br/index.php/ppe/article/viewFile/955/894 >2