International engagement of Brazilian agribusinesses: a comparative analysis

Rebecca Lima Albuquerque Maranhão
and José Eustáquio Ribeiro Vieira Filho

Abstract

Urban population growth in developing countries, together with the expansion of the middle class and increase in per capita income worldwide, have increased the demand for food. This article uses the method of constant market share analysis (CMSA) to identify the drivers of agricultural export growth among the main countries operating in the market. Two periods are analysed: (i) 1992–2001 and (ii) 2002–2013. The countries studied were Argentina, Brazil, China, France, Germany, India and the United States. The results reveal the increasing representation of emerging countries with natural resource potential (Argentina, Brazil and India), while developed economies (the United States and European countries) and China (owing to its particular internal dynamics) are losing ground in the international market.

Authors

Rebecca Lima Albuquerque Maranhão is a PhD candidate in Geography in the Department of Geography and Geospatial Sciences at Kansas State University, United States. Email: rebeccaflm25@ksu.edu.

José Eustáquio Ribeiro Vieira Filho is a Senior Researcher in the Division of Agricultural Studies (DEA) of the Directorate of Regional Urban and Environmental Studies and Policies (DIRUR) of the Institute for Applied Economic Research (IPEA). Email: jose.vieira@ipea.gov.br.

I.   Introduction

The increase in per capita income and urbanization in developing countries, the growth of a middle class with new cultural habits and demands, and the major impact of technological innovation on the production system are some of the key changes that have occurred in the international economy during the last 20 years. These transformations have had an impact on the distribution of economic power in different regions of the world and have altered international relations and world trade.

The 1990s were characterized by a high degree of economic openness, with less interventionist and more market-based development that stimulated integration between countries through bilateral and multilateral agreements (free trade areas, customs unions and common markets). International commodity prices rose sharply between 2004 and 2011, which has become known as a commodity-boom period (Barros, 2016).

The rise in prices was driven by several factors: the growth in food demand that outpaced production, the depletion of grain reserves to historically low levels, the impact of climate change on crop yields and the high price of crude oil, which encouraged the use of food commodities for the production of biofuels (World Bank, 2011). Since 2011, price indicators have fallen both in agriculture and in the minerals sector.

For regions or countries with a competitive agriculture sector, such as Brazil, the growth of international commodity trade has boosted economic growth. According to projections by the Organisation for Economic Co-operation and Development (OECD) and the Food and Agriculture Organization of the United Nations (FAO) (OECD/FAO, 2015), in 2024 the United States, the European Union and Brazil will continue to be the world's leading exporters of agricultural products.

Maranhão and Vieira Filho (2016) analysed the sources of Brazil's agricultural export growth between 1992 and 2013. In the 1990s, global growth was relatively weak. However, Brazilian exports grew, driven by composition and destination factors. From 2000 onwards, world trade grew vigorously, fuelled by demand from emerging countries. The strong performance of Brazilian agricultural exports reflected not only world growth but also gains in competitiveness, which have slackened in recent years.

This study seeks to identify the sources of export growth in the leading agricultural goods-exporting countries, using the method of constant market share analysis (CMSA). The following countries were studied: Argentina, Brazil, China, France, Germany, India and the United States. The article is divided into four sections, including this brief introduction. Section II describes the methodology, the period of analysis and the data source used. Section III provides an overview of international trade and makes a comparative analysis of the countries evaluated; and the last section offers final remarks.

II.   Method of analysis

As in Maranhão and Vieira Filho (2016), this study uses the CMSA method. According to Richardson (1971), this instrument examines the country's export growth (favourable or unfavourable), by analysing the structure and competitiveness of its exports. Leamer and Stern (1970) argue that the factors that cause a country's exports to fall below the world average are: (i) exports concentrated in products for which demand grows more slowly than average; (ii) exports destined for stagnant regions; and (iii) the country's lack of interest, stimulus or conditions to compete in the international market.

Constant market share analysis specifies that a country's market share is given by the value exported divided by total value of global exports, which itself is a function of relative competitiveness (equation (1)):

$$S \equiv \frac{q}{Q} = f\left(\frac{c}{C}\right) \text{ with } f'(\,\cdot\,) > 0 \tag{1}$$

where S denotes the market share of the country in question; q the total quantity exported by the country; Q the total quantity exported by the world; c the country's competitiveness; and C global competitiveness.

Differentiating with respect to time, and given that the growth of market share depends on the increase in the country's relative competitiveness, gives:

$$\frac{dq}{dt} \equiv S\frac{dQ}{dt} + Q\frac{dS}{dt} = S\frac{dQ}{dt} + Qf'\left(\frac{d(c/C)}{dt}\right) \tag{2}$$

Equation (2) states that the total variation in the country's export quantity $(\dot{q})$ is described by the growth of world exports $(S\dot{Q})$ and the competitiveness effect $(Q\dot{S})$.

According to Richardson (1971), the observation that a country's exports structure affects its total export growth, even without changes in relative competitiveness, leads to a more complex CMSA model. For example, a country should specialize in the production of goods for which demand is expanding; or else it should concentrate on selling to more dynamic geographic markets. From this standpoint, for a given commodity (or traded good) i, destined for a specific market j:

$$S_{ij} \equiv \frac{q_{ij}}{Q_{ij}} = f_{ij}\left(\frac{c_{ij}}{C_{ij}}\right) \text{ with } f_{ij}'(\,\cdot\,) > 0 \tag{3}$$

Analogously to the general case, and given that the effect of world export growth $\left(\sum_i \sum_j S_{ij}\dot{Q}_{ij}\right)$ can be decomposed into three different effects that take product and destination into account, total export growth can be expressed as follows:

$$\dot{q} \equiv S\dot{Q} + \left[\sum_i S_i\dot{Q}_i - S\dot{Q}\right] + \left[\sum_i \sum_j S_{ij}\dot{Q}_{ij} - \sum_i S_i\dot{Q}_i\right] + \sum_i \sum_j Q_{ij}\dot{S}_{ij} \tag{4}$$
$$\quad\ \text{(i)} \qquad\qquad \text{(ii)} \qquad\qquad\qquad \text{(iii)} \qquad\qquad\qquad \text{(iv)}$$

The right-hand side of the foregoing identity shows four effects: (i) world trade growth; (ii) the composition of exports; (iii) the destination of exports; and (iv) a residual effect representing competitiveness. The decomposition is obtained based on the growth of world exports, favourable or unfavourable, associated with the structure of products or markets and changes in relative competitiveness.

Mathematically, in the discrete case, it is necessary to consider the initial period (denoted by 0) and the final period (denoted by 1). Thus, differentiation with respect to product i and destination j, gives the following identity:

$$\varDelta q_{ij} \equiv \left(\frac{q_{ij}^1 - q_{ij}^0}{q_{ij}^0}\right) q_{ij}^0 + \left[q_{ij}^1 - q_{ij}^0 - \left(\frac{q_{ij}^1 - q_{ij}^0}{q_{ij}^0}\right) q_{ij}^0\right] \text{ with } \left(\frac{q_{ij}^1 - q_{ij}^0}{q_{ij}^0}\right) = g_{ij} \tag{5}$$

This expression can be grouped as follows, to show the four effects mentioned above:

$$\varDelta q \equiv gq^0 + \sum_i (g_i - g)q_i^0 + \sum_i \sum_j (g_{ij} - g_i)q_{ij}^0 + \sum_i \sum_j \left(q_{ij}^1 - q_{ij}^0 - g_{ij}q_{ij}^0\right) \tag{6}$$
$$\quad\ \text{(i)} \qquad\qquad \text{(ii)} \qquad\qquad\qquad \text{(iii)} \qquad\qquad\qquad \text{(iv)}$$

where g is the increase in global exports from period 0 to period 1.

Identity 6 expresses the variation in the exports of the country or region in question, from the initial to the final period, and makes it possible to decompose the country's export growth rate into four effects. The first two, (i) and (ii), are related to external factors, while (iii) and (iv) reflect the influence of domestic factors. These effects are described below:

(i)   World trade growth: increase observed if the exports of the country under study have grown at the same pace as world trade.

(ii)   Export composition: changes in the structure of exports with concentration in products with a more or less rapid growth in demand. The export composition effect indicates that if world exports of product i increase more than the world average for all products exported, then $(g_i - g)$ is positive.

(iii)   Export destination: changes resulting from exports of products to markets with more or less dynamic growth. The export destination effect will be positive if the country has concentrated its exports in faster-growing markets and negative if it has concentrated them in stagnant regions.

(iv)   Residual, a proxy for competitiveness: related to changes in relative prices, importers tend to replace the consumption of goods whose prices have increased with relatively lower-priced substitutes. When a country loses market share in world trade, the competitiveness term is negative.

The study was divided into two subperiods:

(i)   1992–2001: characterized by open trading arrangements, involving a less interventionist development stance. This model made it possible to use an exchange rate anchor to control inflation and contributed to the spread of privatization programmes. This period is also characterized by the integration of countries through bilateral and multilateral agreements (free trade areas, customs unions and common markets).

(ii)   2002–2013: characterized by rising commodity prices driven by the growth of the Chinese economy. China's accession to the World Trade Organization (WTO) in 2001 boosted world trade between 2002 and 2008. Key developments include the 2008 financial crisis, the slowdown in economies across the world and the slow resumption of growth after 2010.

Statistical information was obtained from FAO (2013) on agricultural products (soybeans, maize, oranges, sugar, wheat, cotton, roasted coffee, coffee beans, pork, beef and chicken meat) from the following countries: Argentina, Brazil, China, France, Germany, India and the United States. For the purposes of the analysis, the destination markets were South America, North America, Central America, Europe, Africa, Asia and Oceania.

III. Analysis and discussion of the findings

1.   Overview of the agriculture sector

Table 1 reports the share of the agriculture, manufacturing and services sectors in gross domestic product (GDP) for the countries analysed. While the share of agriculture is decreasing, the services sector is trending upwards. Despite the decline in the agriculture share, there are positive spillover effects to the rest of the economy (Vieira Filho and Silveira, 2016). In other words, the value generated by agriculture-based systems tends to be captured by the input, capital intensive, manufacturing and processing, and distribution sectors (Zylbersztajn, 2014).

Table 1
Selected countries and country groupings: GDP share of the agriculture, manufacturing and services sectors and geometric growth rate, 1992–2013
(Percentages of total value added)

Value added (percentage of GDP)	Regions and countries	Years				Geometric growth rate (GGR)	
		1992	2001	2002	2013	1992–2001	2002–2013
Agriculture	World	..	5.2	5.0	4.0	..	-2.2
	Middle-income countries	17.1	12.5	12.4	9.4	-3.4	-2.4
	Low-income countries	42.4	34.0	32.9	31.8	-2.4	-0.3
	High income countries	..	1.9	1.7	1.5	..	-1.1
	Brazil	7.7	5.6	6.4	5.3	-3.4	-1.7
	Argentina	6.0	4.9	10.8	7.2	-2.2	-3.7
	Germany	1.1	1.2	0.9	0.8	0.9	-1.6
	France	2.9	2.3	2.2	1.6	-0.8	-2.8
	United States	..	1.2	1.0	1.5	..	3.4
	India	28.7	22.9	20.7	18.3	-2.5	-1.1
	China	21.4	14.1	13.4	9.4	-4.6	-3.2
Industry	World	..	29.6	29.1	27.9	..	-0.4
	Middle-income countries	37.7	36.2	36.1	35.5	-0.4	-0.2
	Low-income countries	17.1	20.1	20.9	20.7	1.8	-0.1
	High income countries	..	26.7	26.1	24.9	..	-0.5
	Brazil	38.7	26.6	26.4	24.9	1.7	-9.1
	Argentina	30.7	27.0	32.4	28.5	-1.4	-1.2
	Germany	35.9	30.1	29.4	30.3	-1.9	0.3
	France	26.2	22.9	22.6	19.8	-1.5	-1.2
	United States	..	22.1	21.3	20.6	..	-0.3
	India	25.8	25.1	26.2	30.8	-0.3	1.5
	China	43.0	44.7	44.3	43.7	0.4	-0.1
Services	World	..	65.3	65.9	68.1	..	0.3
	Middle-income countries	45.2	51.3	51.5	54.9	1.4	0.6
	Low-income countries	40.5	45.4	45.6	47.3	1.3	0.3
	High income countries	..	71.4	72.1	73.6	..	0.2
	Brazil	53.6	67.8	67.2	69.8	2.6	0.3
	Argentina	63.3	68.1	56.8	64.5	0.8	1.1
	Germany	63.0	68.7	69.7	68.9	1.0	-0.1
	France	70.9	74.7	75.2	78.5	0.6	0.4
	United States	..	76.7	77.7	77.9	..	0.0
	India	45.5	52.0	53.1	50.9	1.5	-0.4
	China	35.6	41.3	42.3	46.9	1.7	0.9

Source: World Bank, "Indicators", 2016 [online] https://data.worldbank.org/indicator.

Table 2 displays the per capita GDP growth rate, the urbanization rate and total population. In 2002–2013, middle-income countries achieved a per capita GDP growth rate of 5%, which was above the world average. The developing countries analysed are China, India, Argentina and Brazil, which posted growth rates of 9.6%, 6.1%, 4.2% and 2.6%, respectively. Urbanization rates grew worldwide, especially in China, where urban dwellers surpassed the rural population. Moreover, population growth rates were higher in developing countries than in developed ones (Vieira Filho and Fishlow, 2020). This points to a greater concentration in large urban centres, rising per capita income, the expansion of the middle class and the growing importance of the emerging economies —factors driving the increase in food demand (OECD/FAO, 2013).

Table 2
Selected countries and country groupings: GDP per capita growth rate,
urbanization rate and total population, 1992–2013
(Dollars at constant 2010 prices, percentages and millions of people)

Indicators	Regions and countries	Years				Geometric growth rate (GCR)	
		1992	2001	2002	2013	1992–2001	2002–2013
GDP per capita *(dollars at constant 2010 prices)*	World	7 127.2	8 166.1	8 239.3	9 891.3	1.5	1.7
	Middle-income countries	2 074.3	2 503.8	2 573.9	4 391.5	2.1	5.0
	Low-income countries	414.6	423.1	420.9	558.8	0.2	2.6
	High income countries	29 732.5	35 739.5	36 068.0	39 968.1	2.1	0.9
	Brazil	7 735.5	8 743.9	8 880.2	11 797.4	1.4	2.6
	Argentina	7 304.9	7 756.1	6 834.9	10 758.2	0.6	4.2
	Germany	34 132.9	38 580.0	38 515.2	43 433.6	1.4	1.1
	France	33 271.1	38 992.6	39 143.0	41 268.4	1.8	0.5
	United States	36 566.2	45 047.5	45 428.6	49 849.2	2.3	0.8
	India	572.0	818.5	835.4	1 603.7	4.1	6.1
	China	883.3	1 893.5	2 051.8	5 652.4	8.8	9.6
Urbanization rate *(percentage of total)*	World	43.6	47.0	47.5	52.9	0.8	1.0
	Middle-income countries	37.7	41.1	42.8	49.6	1.2	1.4
	Low-income countries	23.3	25.7	26.0	29.9	1.1	1.3
	High income countries	79.9	77.1	77.5	80.7	0.3	0.4
	Brazil	75.4	81.6	81.9	85.2	0.9	0.4
	Argentina	87.5	89.3	89.5	91.5	0.2	0.2
	Germany	73.4	73.1	73.2	74.9	1.8	0.5
	France	74.4	30.0	34.9	46.5	3.2	3.0
	United States	76.1	79.2	79.4	81.3	0.4	0.2
	India	26.0	27.9	28.2	32.0	0.8	1.1
	China	28.2	37.1	38.4	53.2	3.1	3.0
Total population *(millions)*	World	5 453.4	6 195.5	6 274.7	7 176.0	1.4	1.2
	Middle-income countries	4 096.9	4 677.8	4 737.5	5 396.5	1.5	1.2
	Low-income countries	340.3	435.3	447.5	604.6	2.8	2.8
	High income countries	1 016.1	1 082.3	1 089.6	1 174.9	0.7	0.7
	Brazil	155.4	178.4	181.0	204.2	1.5	1.1
	Argentina	33.6	37.4	37.8	42.5	1.2	1.1
	Germany	80.6	82.3	82.4	82.1	0.2	0.0
	France	58.8	61.3	61.8	65.9	0.5	0.6
	United States	256.5	284.9	287.6	316.4	1.2	0.9
	India	906.4	1 071.8	1 090.1	1 279.4	1.9	1.5
	China	1 164.9	1 271.8	1 280.4	1 357.3	1.0	0.5

Source: World Bank, "Indicators", 2016 [online] https://data.worldbank.org/indicator.

Between 2002 and 2008, Chinese trade expanded, and the growing demand for natural resources and commodities drove up oil and commodity prices (WTO, 2015). Rapidly growing countries proved unable to respond with a matching increase in supply and tended to buy products from regions such as South America and Oceania and certain former Soviet Union countries (Piñeiro, 2015). Latin America became the world's largest net food exporting region (FAO, 2015).

Table 3 reports the economic indicators of the agriculture sector. A comparison of the countries shows that, in Brazil and Argentina, arable land expanded, and Argentine growth was stronger in the second period. Brazil has a total area of 851 million hectares, 278 million of which are used for agriculture. In 2013, approximately 196 million hectares were classified as land under permanent meadows and pastures, 76 million hectares as arable land, and 7 million hectares as land under permanent crops (FAO, 2013).

Table 3
Selected countries and country groupings: economic indicators
for the agriculture sector, 1992–2013

Indicators	Regions and countries	Years				Geometric growth rate (GCR)	
		1992	2001	2002	2013	1992–2001	2002–2013
Arable land *(millions of hectares)*	Brazil	51.8	59.1	61.5	76.0	1.5	1.9
	Argentina	26.8	27.7	27.9	39.7	0.4	3.3
	Germany	11.5	11.8	11.8	11.9	0.3	0.1
	France	17.8	18.3	18.4	18.5	0.3	0.0
	United States	184.0	175.4	173.0	151.8	-0.5	-1.2
	India	162.7	160.3	160.4	157.0	-0.2	-0.2
	China	122.9	116.1	114.5	105.7	-0.6	-0.7
Agricultural production index *(2004–2006 = 100)*	World	72.5	84.9	89.7	125.1	2.4	3.1
	Middle-income countries	66.9	87.2	88.8	130.8	3.0	3.6
	Low-income countries	71.1	89.0	91.2	135.3	2.4	3.6
	High income countries	90.1	96.3	92.5	106.1	0.7	1.3
	Brazil	63.9	86.2	87.5	140.3	2.9	4.4
	Argentina	58.0	86.2	86.1	126.0	4.5	3.5
	Germany	85.2	104.5	96.2	97.7	2.3	0.1
	France	102.0	95.7	104.1	94.0	-0.7	-0.9
	United States	87.0	92.2	85.5	108.7	0.7	1.9
	India	77.2	95.0	84.7	141.9	2.3	4.8
	China	57.8	86.9	90.8	133.6	4.6	3.6
Livestock production index *(2004–2006 = 100)*	World	76.0	91.0	93.5	117.1	2.0	2.1
	Middle-income countries	67.0	86.4	89.3	125.1	2.0	2.8
	Low-income countries	70.4	83.8	90.9	123.5	2.0	2.8
	High income countries	90.4	98.4	100.0	104.4	0.9	0.4
	Brazil	51.6	80.4	85.7	127.5	5.1	3.7
	Argentina	81.1	87.3	83.0	110.7	0.8	2.7
	Germany	98.7	99.3	99.3	110.4	0.1	1.0
	France	103.7	104.9	106.2	100.2	0.1	-0.5
	United States	82.9	96.8	98.8	107.7	1.7	0.8
	India	63.9	87.8	89.5	135.2	3.6	3.8
	China	48.0	85.3	88.0	126.5	6.6	3.3
Land productivity *(kilograms per hectare)*	World	2 776.9	3 130.6	3 074.1	3 897.1	1.3	2.2
	Middle-income countries	2 444.0	2 842.0	2 834.2	3 678.5	1.7	2.4
	Low-income countries	1 061.0	1 150.6	1 159.4	1 466.7	0.9	2.2
	High income countries	4 284.5	4 682.6	4 489.1	5 685.5	1.0	2.2
	Brazil	2 142.5	3 149.6	2 846.0	4 826.4	4.4	4.9
	Argentina	3 057.3	3 206.8	3 240.8	4 724.7	0.5	3.5
	Germany	5 335.6	7 052.0	6 251.5	7 318.0	3.1	1.4
	France	6 488.2	6 739.1	7 468.3	7 079.3	0.4	-0.5
	United States	5 360.6	5 891.5	5 547.5	7 340.4	1.1	2.6
	India	2 024.8	2 423.1	2 187.3	2 963.4	2.0	2.8
	China	4 362.5	4 800.3	4 885.3	5 889.4	1.1	1.7
Labour productivity *(dollars at constant 2005 prices)*	World	1 258.7	1 577.3	1 603.7	2 124.7	2.5	2.6
	Middle-income countries	1 047.6	1 244.4	1 274.9	1 837.0	1.9	3.4
	Low-income countries	381.3	406.2	412.0	499.7	0.7	1.8
	High income countries	..	22 131.8	23 205.5	36 201.1	..	4.1
	Brazil	3 219.9	4 885.7	5 322.1	9 893.1	4.7	5.8
	Argentina	13 885.4	18 284.0	17 903.1	23 165.4	3.1	2.4
	Germany	22 407.8	22 602.1	23 470.3	38 051.9	0.1	4.5
	France	28 698.6	46 312.0	50 798.2	79 962.5	5.5	4.2
	United States	..	42 801.6	43 714.5	74 464.7	..	5.0
	India	749.8	891.7	822.9	1 116.3	1.9	2.8
	China	590.0	793.6	814.1	1 332.6	3.3	4.6

Source: World Bank, "Indicators", 2016 [online] https://data.worldbank.org/indicator.

Brazilian agriculture reveals productive potential in the temperate and tropical zones, with the South and Centre-West regions of the country having higher rainfall, better soils and moderate infrastructure. Properties in these regions are technology-intensive (OECD/FAO, 2015). Research undertaken by the Brazilian Agricultural Research Corporation (Embrapa) and universities produced technological packages that were adapted and responsible for the "tropicalization" of agriculture in Brazil (Mendonça de Barros, 2014; Vieira Filho and Silveira, 2016; Vieira Filho and Fishlow, 2020).

Argentina has land available to expand production, along with abundant water and excellent agricultural soils. It has a total area of 278 million hectares, of which 149 million are used for agriculture. In 2013, approximately 108 million hectares were classified as land under permanent meadows and pastures, 39 million as arable land, and 1 million hectares as land under permanent crops (FAO, 2013). The country is a world leader in the adoption of no-tillage agriculture. According to PwC Argentina (2014), the area dedicated to no-tillage almost tripled in the last decade, to nearly 27 million hectares (almost 80% of the country's agricultural area).

Argentina, Brazil, India and China have posted rising agricultural production indices over time and have the highest relative rates of growth. International comparisons (OECD/FAO, 2015) identified Brazil as one of the countries in which total factor productivity (TFP) has grown the most. Between 2006 and 2010, TFP grew by 4.3% per year in Brazil, 2.7% in Argentina, 1.9% in the United States and 3.3% in China. According to Binswanger-Mkhize and d'Souza (2012), productivity growth in India was 2.4% between 2006 and 2009.

Crop and livestock production and land indicators trended negatively in the case of France. Between 1992 and 2002, the French TFP index was 1.6%, but it dropped to 0.9% between 2003 and 2011. The 2008 crisis undermined economic growth, which had a knock-on effect on agricultural productivity (Boussemart, Butault and Ojo, 2012). Between 2002 and 2013, Germany's productivity index grew by 1.0% (Kijek and others, 2015).

2. Performance of the countries in the global marketplace

Brazil became the world's third largest exporter of agricultural products, behind the European Union and the United States. Its largest trading partners were the European Union, China, the United States, Japan, the Russian Federation and Saudi Arabia (OECD/FAO, 2015). As shown in table 4, agribusiness plays a very important role in the Brazilian trade balance in generating foreign exchange. A comparison between 1997 and 2013 shows that while the trade balance of the other sectors of the economy remained negative, with few exceptions, agribusinesses grew throughout the historical series. There were significant changes in the structure agricultural exports. Soybeans, meat and products from the sugar and alcohol sector became very important, which meant a qualitative improvement.

Table 4
Brazil: trend of the trade balance, agribusiness and other sectors of economic activity, 1997–2013
(Trillions of dollars)

Years	Exports			Imports			Balance		
	Agribusiness	Other sectors	Total	Agribusiness	Other sectors	Total	Agribusiness	Other sectors	Total
1997	23.4	29.6	53.0	8.2	51.5	59.7	15.2	-21.9	-6.8
1999	20.5	27.5	48.0	5.7	43.6	49.3	14.8	-16.1	-1.3
2001	23.9	34.4	58.3	4.8	50.8	55.6	19.1	-16.4	2.7
2003	30.7	42.6	73.2	4.8	43.6	48.3	25.9	-1.0	24.9
2005	43.6	74.9	118.5	5.1	68.5	73.6	38.5	6.4	44.9
2007	58.4	102.2	160.6	8.7	111.9	120.6	49.7	-9.7	40.0
2009	64.8	88.2	153.0	9.9	117.8	127.7	54.9	-29.6	25.3
2011	95.0	161.1	256.0	17.5	208.7	226.2	77.5	-47.7	29.8
2013	100.0	142.1	242.0	17.1	222.7	239.7	82.9	-80.6	2.3

Source: Ministry of Agriculture, Livestock and Supply, *Projeções do agronegócio: Brasil 2017/18 a 2027/28, projeções de longo prazo*, Brasilia, 2018.

In 1997, agribusiness exports totalled US$ 23.4 billion, while the corresponding imports were just US$ 8.2 billion. This produced an agribusiness trade surplus of US$ 15.2 billion. In 2013, sector exports amounted to US$ 100 billion, while imports were US$ 17.1 billion, implying a surplus of US$ 82.9 billion. When analysing the other sectors of economic activity, a trade deficit of US$ 21.9 billion was recorded in 1997, and the balance remained negative and widened to US$ 80.6 billion in 2013. Consequently, the aggregate trade balance for the economy as a whole, including agribusiness, was in deficit in 1997 (around minus US$ 6.8 billion) and in surplus in 2013 (around plus US$ 2.3 billion).

According to the data presented in table 5, Brazil is the world's leading exporter of soybeans, coffee beans, raw and refined sugar, orange juice, beef and chicken meat; and it is also the second largest maize exporter. Brazil's agricultural growth is attributed to the expansion of production in the Brazilian Cerrado region and, recently, to the growing production in the Matopiba region (Vieira Filho, 2016).[1] The country's cotton exports have also increased considerably: whereas Brazil ranked thirty-second in the 1992 export ranking, by 2013 it had risen to fourth place.

According to Fuglie, Wang and Ball (2012), countries that have built national research systems capable of developing and adapting a continuous flow of technologies in local production systems tend to achieve higher productivity rates over time. Technologies that have had positive effects on Brazilian food production systems include no-tillage, biological nitrogen fixation, productive integration techniques, genetic improvement of animals, and forage improvement through hybridization and biotechnology (CGEE, 2014; Vieira Filho and Fishlow, 2020). According to Vieira Filho (2014), the adoption of biotechnology both increases the productivity of varieties and also reduces production costs.

Argentina is the world's sixth largest exporter of agricultural products, behind the European Union, the United States, Brazil, China and Canada. Its agricultural exports totalled US$ 7.5 billion in 1990, and had grown to US$ 41.5 billion by 2013 (WTO, 2014). In that year, the most important export complexes were oilseeds, especially soybean and cereal production (INDEC, 2014). In 2014, agricultural products accounted for 60% of total exports; and in 2013 Argentina was the world's third largest soybeans and maize exporter, the eighth largest exporter of poultry and the ninth largest beef exporter. Its share of wheat exports decreased, as the country slipped from being the fifth largest exporter in 2001 to the twelfth in 2013. According to the Secretariat of Agriculture, Livestock, Fisheries and Food of Argentina (2009), low rainfall reduced agricultural yield potential between 2008 and 2009.

In 2013, France was the largest agricultural producer in the European Union, with an output of € 75 million, representing an 18.6% of the bloc's total. It was followed by Germany (13.8%), Italy (11.9%) and Spain (10.5%) (Eurostat, 2013). The data show that, in 2013, France was the world's second largest exporter of refined sugar; and it was ranked third in wheat, fifth in maize and roasted coffee and sixth in chicken. Fifty-four percent of the country's land area is used for agriculture, and more than half of the cereal production was wheat. This makes France the world's fifth largest cereal producer, behind China, India, the Russian Federation and the United States. It also has the largest livestock herd in the European Union. Cattle account for 22% of animal production, followed by chickens (14%) and pigs (13%) (Ministry of Agriculture, Agrifood and Forestry of France, 2016).

---

[1] Matopiba = the States of Maranhão, Tocantins, Piauí and Bahia.

Table 5
Selected countries: position in the world ranking of agricultural exports, 2013

Products	Argentina			Brazil			China			France			Germany			India			United States		
	1992	2001	2013	1992	2001	2013	1992	2001	2013	1992	2001	2013	1992	2001	2013	1992	2001	2013	1992	2001	2013
Beef	7	13	9	8	4	1	20	21	30	5	10	19	9	6	8	-	-	-	2	2	3
Coffee beans	-	-	-	2	1	1	87	36	17	23	22	38	8	7	5	12	11	10	19	18	20
Cotton	17	18	31	32	8	4	6	17	40	38	45	44	26	27	37	18	43	2	1	1	1
Chicken meat	43	25	8	4	2	1	7	5	11	3	4	6	9	10	7	43	25	8	2	1	2
Maize	4	3	3	52	5	2	3	4	35	2	2	5	9	7	15	66	18	6	1	1	1
Orange juice	7	15	21	1	1	1	-	22	40	15	10	11	8	26	15	-	-	61	2	2	4
Pork	24	45	53	-	9	6	-	12	12	47	7	13	14	8	2	-	37	-	-	2	1
Raw sugar	17	27	33	5	1	1	23	56	54	30	32	21	14	48	40	34	10	8	39	53	36
Refined sugar	38	38	34	1	2	1	3	8	48	1	1	2	3	3	4	11	5	6	8	21	27
Roasted coffee	65	51	61	21	24	30	39	77	27	8	11	5	1	2	3	22	38	53	5	3	4
Soybeans	3	3	3	2	1	1	4	7	10	14	26	22	12	15	25	-	27	11	1	1	2
Wheat	7	5	12	-	62	17	40	21	63	3	4	3	5	6	6	34	8	7	2	2	1

Source: Food and Agriculture Organization of the United Nations (FAO), Corporate Database for Substantive Statistical Data (FAOSTAT), 2016 [online] http://www.fao.org/faostat/en/#country.

Germany has 81 million of the world's wealthiest consumers and is by far the largest market in the European Union (Rehder, 2014). Half of its total land area is used for agriculture; and its average farm size increased from 36.6 hectares in 1999 to 45.3 hectares in 2007 (Federal Ministry of Food, Agriculture and Consumer Protection of Germany, 2009 and 2016). German agricultural exports have doubled since 1990 and quadrupled since 1980. With 8% of exports and 68% of imports, the European Union was the largest destination for German sales. In addition to the European bloc, the country's main trading partners are Brazil, China and the United States (Federal Ministry of Food, Agriculture and Consumer Protection of Germany, 2009). In 2013, the country ranked fifth among the world's largest exporters of coffee beans and third as an exporter of roasted coffee. The German economy is also a leading meat exporter, ranking eighth in beef, seventh in chicken and second in pork in 2013.

In the United States, agricultural exports grew from US$ 59.4 billion in 1990 to US$ 172 billion in 2013 (WTO, 2014). This country was the world's largest exporter of maize, cotton, wheat and pork; and it ranked second in chicken and soybeans, third in beef and fourth in orange juice and roasted coffee. Agricultural modernization in the United States began in the 1950s with improvements in the quality of inputs, such as machinery and chemicals. In livestock production, larger scale and integration between rural producers, input suppliers and processors enhanced the efficiency of production practices (Vieira Filho and Fornazier, 2016). The largest importers of agricultural products from the United States are China, Canada, Mexico, Japan and the European Union (Westcott and Trostle, 2014).

India has become the world's seventh largest net exporter, having grown its agricultural exports from a total of US$ 3.6 billion in 1990 to US$ 46.9 billion by 2013 (WTO, 2014). Since 2004, Indian exports have outpaced those of all other countries, with an annual growth rate of 21%. In comparison, Brazilian exports grew by 15% in the last decade, while China, the United States and the European Union have posted growth rates of 12%, 9% and 10%, respectively. India's position in the world ranking of agricultural commodity exports has improved considerably. In 2013, it ranked the second largest exporter of cotton, sixth in refined sugar and maize, seventh in wheat, eighth in chicken meat and eleventh in soybeans. One of the factors driving export growth was government support for irrigation, energy use and fertilizer adoption, which stimulated export-oriented production of crops such as cotton, sugar, wheat and rice. In addition to the United States, countries with imports of at least US$ 1 billion from India in 2013 were Bangladesh, China, Indonesia, Malaysia, Pakistan, the Islamic Republic of Iran, Saudi Arabia, the United Arab Emirates and Viet Nam (Flake, 2014).

China's world ranking has dropped considerably in most agricultural exports, since its demand for food has outpaced domestic production, causing its agricultural trade surplus to shrink. Brazil is one of the countries that have benefited from burgeoning Chinese demand. In 2000, China was Brazil's eleventh largest import market, with a demand of less than US$ 500 million, equivalent to 3% of the latter's total agricultural exports. In 2013, it purchased almost US$ 22.5 billion of Brazilian agricultural products, and had become that country's largest importer (Scott and Bugang, 2014) (OECD/FAO, 2015).

3. Breakdown of the sources of growth of agricultural exports of the countries studied

Table 6 provides a breakdown of the export growth rate in the countries analysed, between global growth, export composition, destination market and competitiveness. In 1992–2001, global agricultural exports grew at an annual rate of 2.2%. Between 2002 and 2013, with the expansion of emerging markets, growth was 12% per year and affected the entire market. An assessment of each country is provided below.

Countries	Argentina		Brazil		China		France		Germany		India		United States	
Periods	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Annual growth rate														
Global agricultural exports	2.2	12.0	2.2	12.0	2.2	12.0	2.2	12.0	2.2	12.0	2.2	12.0	2.2	12.0
Agricultural exports	4.8	11.9	10.0	17.9	-5.5	-1.2	-4.3	8.1	3.0	13.2	11.7	23.5	1.8	9.8
Sources of growth														
(i) Global growth	41.0	100.6	15.8	48.4	-53.9	-1 890.7	-65.5	183.0	68.7	85.7	144.4	26.9	122.6	137.3
(ii) Composition of exports	0.9	16.3	5.8	6.4	12.8	36.6	28.9	-26.1	-20.5	-8.2	-22.8	-4.9	3.7	28.6
(iii) Export destination	2.8	23.5	-6.3	-1.8	-12.5	-162.7	64.2	0.1	-52.2	-2.9	21	4.8	68.0	-10.0
(iv) Competitiveness	55.1	-40.5	84.7	47.0	153.6	2 116.8	72.3	-57.0	104.0	25.5	-42.6	73.2	-94.4	-55.9

Source: Prepared by the authors.
Note: 1st period: 1992–2001; 2nd period: 2002–2013.

(a) Argentina

Between 1992 and 2001, Argentine exports grew faster than the global average, its exports being stimulated mainly by global growth (41%) and competitiveness (55.1%). The liberal policies adopted since the 1990s eliminated a number of export taxes and lowered tariffs on capital goods imports, thereby energizing international trade in agricultural products. A key feature of period was technological change, including more intensive input use, the adoption of no-till farming practices and gains in scale. In 1996, the first transgenic crop was introduced in Argentina: herbicide-tolerant soybean. Since then, herbicide-tolerant and insect-resistant transgenic varieties of maize and cotton have been approved (Trigo and others, 2002). The cultivated agricultural area has also expanded, replacing grazing land. The expansion of Argentina's agricultural production was concentrated in cereals, oilseeds and milk, with cereal production growing by 73% between 1990 and 1998, from 20 million tons to nearly 35 million tons. The largest increases occurred in maize (254%) and rice (142%) (Waquil, 2000). The composition factor had little influence on Argentina's export growth.

Between 2002 and 2013, Argentina's exports grew by 11.9%, a rate close to the global average. The drivers of this expansion were world growth, export destination and export composition, with competitiveness a negative factor. In 2000–2013, import substitution policies in agriculture, which used taxes and restrictions to prioritize domestic demand supplied by local production, had adverse effects on the agriculture sector. Inflation rates were higher than in the rest of the world, and public expenditure outpaced tax revenue. The destination market explained 25.3% of the export growth rate. Over 50% of Argentina's exports are sent to five markets: the European Union (20%), the Southern Common Market (MERCOSUR) (13%), China (10%), the United States (4%) and Chile (4%). The composition of exports had a smaller impact of 16.3%. As in the previous period, Argentina's export structure was concentrated in soybean products (Regúnaga and Tejeda, 2015).

(b) Brazil

Between 1992 and 2001, Brazil posted annual growth of 10%, while global exports expanded at a rate of 2.2%. Financial crises were a salient feature the international market in the 1990s. Nonetheless, global economic growth accounted for 15.8% of the increase in Brazilian exports. The most influential factor was the residual competitiveness effect, which accounted for 84.7%. Exports benefited from a more open economy and greater international integration —not only through trade flows, but also

through foreign direct investment (Pinheiro, Giambiagi and Gostkorzewicz, 1999). Agricultural exports helped improve the trade balance, which had slipped into deficit owing to the appreciation of the real in the second half of the 1990s.

Between 2002 and 2013, Brazil's agricultural exports outpaced the global average, the key drivers of growth being world trade (48.5%) and competitiveness (47%). The positive performance of exports in the last decade, especially since 2004, is associated with the commodity boom, which enabled the increase in export value (Pires and Santos, 2013). The rise in prices was driven by China's growth and, consequently, by its demand for commodities. Brazil became the largest supplier of soybeans to the Chinese market, increasing its export share to about 30% between 2000 and 2010 (Jenkins, 2012). Although competitiveness was also a significant factor, its importance declined from one period to the other, indicating the need to improve policies to foster productive efficiency.

(c) China

In a different scenario than that of the other countries, China posted a negative export growth in the two periods analysed, owing to competitiveness and composition factors. According to Fukase and Martin (2014), consumption is outpacing domestic production. Given the size of China's population and its income growth in recent years, food security has become a priority. Accordingly, the Government imposed export restrictions, lowered tariffs on imported goods and looked to the external market to source agricultural products. To this end, trade agreements were revised, foreign land was acquired and investments were made in transnational agribusiness firms (Figueiredo and Contini, 2013).

The demand for animal feed to sustain its growing livestock production had an impact on world trade (Gale, 2015). China has become the largest importer of soybeans, which contributed to the price increase of recent years. Increasing demand also drove up meat prices (Jenkins, 2012). According to Tong, Fulgitini and Sesmero (2012), while demand expanded, productivity also increased between 1993 and 2005, at an estimated 4% per year. In the 1990s, the rise in this indicator slackened, owing to the implementation of policies such as the governors' grain-bag responsibility system, which advocated self-sufficiency in grain production, but resulted in an inefficient reallocation of resources. Since 2000, productivity growth has resumed.

Chinese manufacturing exports have generated much of the demand for commodities, with the largest export sector, manufacturing, driving economic growth. Urban and industrial growth also increased competition for land and scarce resources (Roberts and Rush, 2012). The economic boom led to agricultural land being converted into housing complexes, industrial parks, power plants and other projects. Competition for land intensified; and increased domestic production of meat, milk, fruit and vegetables competed directly with cereal crops.

(d) France

In the first period analysed, French agricultural exports declined in absolute terms (growth of minus 4.3%). The competitiveness factor was the main contributor to this result, while global growth was the least detrimental. At the end of the 1990s, when Germany increased its exports by cutting the prices of final products, France did the opposite by hiking prices in response to depreciation of the euro.

In terms of market structure and income support for farmers, France belongs to a regional economic organization, the European Union, which has fostered the continuous strengthening of an internationally competitive trade market since 1985 (Coleman and Chiasson, 2000). In 2001, the Doha Round of trade negotiations confirmed the liberalization of agricultural and food markets. This opening-up process,

which began in Marrakesh in 1994, elicited a considerable reduction in protectionism. Nonetheless, France still maintained a high degree of protection for its agricultural products —estimated at 36% in 1997 (Chevassus-Lozza and Daniel, 2006).

In the second period, the exports grew at less than the global average rate, but was positive at 8.1% —driven basically by world trade growth, while destination hardly had any effect. Both competitiveness and export composition had negative effects. After 2005, the return on agricultural assets increased by 34.6% in real terms across the European Union. While in Germany, the United Kingdom and the Netherlands, the increase was 50%, in France it was below average (Lubatti and Bernadeau, 2015). French growth potential was damaged by the 2008 crisis, which impacted productivity directly; and between 2000 and 2007, France lost 30% of its export market to Germany and emerging markets (Lacan, Lelievre and Mourier, 2013). Despite being the largest agricultural exporter in the European Union, its exports grew at an average rate of 5% between 2006 and 2012, while the Netherlands saw export growth of 7% and Germany 8% in the same period. The loss of competitiveness of French exports reflected labour costs, health issues and, in particular, the small size of farms, which are unable to compete on the world market (Journo, 2014).

(e)　Germany

In the 1990s, the German economy grew very little, with per capita GDP growth averaging 1.4% per year. As Ahearn and Belkin (2010) note, this weak performance is explained by several factors, including the high cost of integrating the East German economy since reunification in 1990, the high cost of social programmes, and the fact that the German economy has prioritized exports ahead of domestic investment. Between 1992 and 2001, German exports grew by 3% per year, compared to global export growth of 2.2%. Global economic growth (68.7%) and competitiveness (104%) were the main drivers of Germany's agricultural export growth. The openness of the economy and the stability of the currency contributed to imports of new technologies, which boosted agricultural activity. Despite the high cost of political and economic reintegration, reunification was positive for the agricultural export sector. Productivity in the east increased considerably, surpassing that of the west in the early 1990s (Koester and Brooks, 1997).

The composition and destination effects contributed negatively to German exports. The expansion of trade was significant between the emerging markets of Southeast Asia and Latin America and, above all, among the reforming economies of Central and Eastern Europe. Between 1990 and 1997, exports to Southeast Asia increased from 2,000,000,000 deutschmarks (DM 2 billion) to DM 4 billion, and sales to Latin America grew from DM 1 billion to DM 1.8 billion (Hinze, 1998). However, between 1997 and 1998, the economy was vulnerable to international shocks and was shaken by the crisis in Asian countries. Between 1999 and 2001, the negative impact was due to the rise in international oil prices (DG ECFIN, 2002); and between 1993 and 2000, Germany suffered an outbreak of classical swine fever. The main strains that spread throughout the European Union were caused by a virus originating in Asia, introduced via domestic pig feed (Penrith, Vosloo and Mather, 2011). The outbreak had an adverse impact, which may partly explain the result.

Between 2002 and 2013, German export growth outpaced the global average. About 85.7% of this was due to global growth and 25.5% due to competitiveness. German exports to North America, which totalled US$ 73 billion in 1991, increased to US$ 420 billion in 2013. For South America, the equivalent values were US$ 1.6 billion in 1992 and US$ 1.4 billion in 2013. For Central America, the figures were US$ 2 billion in 1992 and US$ 960 million in 2013. German exports to Asia, which totalled US$ 19 billion in 1992, amounted to US$ 1 trillion in 2013. Lastly, exports to European Union countries grew from US$ 2 trillion to US$ 10 trillion during the same period.

Although the European Union recorded an increase in agricultural exports in 2000 and 2001, its share of the world market has declined over time (Bojnec and Fertő, 2014). Destination continued to be a negative factor. Exports were mostly concentrated in the European Union (56%), followed by Asia (18%) and the Americas (13%) (Ministry of Foreign Affairs of Brazil, 2014). The composition of exports was also a negative factor, whereas competitiveness was the second largest driver of export growth, although less than before. Although food prices have fallen since 2008, farmers have continued to pay high prices for inputs such as fertilizers and machinery, which increased significantly in that period. In 2008, the agricultural input price index was 44.8% higher than in 2000 (Federal Ministry of Food, Agriculture and Consumer Protection of Germany, 2009). These factors undermined Germany's international agricultural competitiveness.

(f) India

In both the first and the second periods under analysis, the growth of India's agricultural exports outpaced the global average. The expansion of the external market played a major role in the first period, while competitiveness became more important in the second. In 1995, India became a member of the World Trade Organization (WTO); but, despite sustained productivity growth in the 1990s, the rate of return on agricultural products after liberalization was well below the rates seen in other regions of the world. Apart from the production of sugarcane, tea, coffee and jute, crop yields were below the world average. This scenario may explain the adverse effect of competitiveness in the first period. Since 2000, trade flows between emerging countries have expanded.

India's export growth rate exceeded that of all the other countries analysed, making India a major player in the world market, especially in the production of rice, cotton, sugar and buffalo meat. The United States is the largest market for Indian exports, followed by China, Iran, Viet Nam, Bangladesh and Saudi Arabia. Exports to developing countries were also particularly strong (Flake, 2014). While composition had a negative impact on the export growth rate, its outcome was less unfavourable than in the previous period. The export structure changed: traditional crops, such as tea (1.6% of the value of agricultural exports), coffee (1.8%), sugar (2.8%), spices (6.2%), nuts and seeds (4.6%), gave way to more dynamic sectors, such as guar gum (4.5%), rice (18.2%), meat and meat products (10.5%) and wheat (3.6%).

India's growth rate, labour productivity and TFP all declined between 1990 and 2000. Total factor productivity fell from 2.1% in the 1980s to 1.4% between 2000 and 2007. In contrast, Chinese TFP grew by 3% in the same period. Excessive agricultural subsidies in India hampered investments in research, extension and infrastructure. Low rates of investment lead to declining productivity, inefficiencies and hence higher production costs, and domestic food price inflation. Moreover, as irrigation and storage facilities are inadequate, Indian agriculture relies on the monsoon seasons, which makes its agricultural production a hostage to climatic disturbances (Dwivedy, 2011).

(g) United States

In the first period under review, agricultural exports from the United States grew positively, although at a slower pace than the global average. While world trade was a major driver of this growth, global competition increased, putting increasing pressure on the United States export sector and domestic market (Dimitri, Effland and Conklin, 2005).

Declining competitiveness was the main negative factor in the first period, and again in 2002–2013. According to Pardey (2009), productivity growth in the United States declined between 1990 and 2005, relative to 1961–1989. This slowdown responded to various factors, including climate change, reduced

investment and natural resource depletion. The slow growth of agricultural crop production between 1990 and 2000 fuelled concern about a possible slowdown in the sector (Wang and others, 2015).

Agricultural areas expanded in countries with larger amounts of available land. The fact that land is cheaper in Brazil than in the United States or Argentina, and soybean production cost are lower, gives Brazilian agriculture an advantage (Meade and McBride, 2016). Between 1992 and 2001, export destination exerted a 68% positive influence on the growth rate of United States agricultural exports; but in 2002–2013 its effect was negative. In the 1990s, the main destinations for its agricultural exports were Japan, the European Union, the Russian Federation, and the Republic of Korea. In contrast, in the last decade, the United States has concentrated its sales in China, which accounted for 16.7% of its exports in 2013, followed by Canada (15.2%) and Mexico (12.7%). Although exports grew positively throughout the period (9.8%), the growth rate remained below the world average. World trade was the main driver, fuelled by burgeoning demand from emerging countries, especially China. In 1995, the United States exported a total of US$ 4 billion to China, but by 2013 the value had risen to US$ 23 billion (Beckman, Dyck and Heerman, 2017).

Table 7 presents a comparative summary of the countries and the two periods analysed, showing the sources of agricultural export growth by their degree of importance, with a view to facilitating understanding of the information set out above.

Table 7
Selected countries: synthesis of the decomposition of the sources of agricultural export growth

Period	Countries	Global growth	Composition of exports	Destination of exports	Competitiveness
From 1992 to 2001	Brazil	XXX	XX	X	XXXX
	Argentina	XXX	X	X	XXXX
	Germany	XXX	X	X	XXXX
	France	X	XX	XXX	XXXX
	United States	XXXX	X	XXX	X
	China	X	XX	X	XXXX
	India	XXXX	X	XX	X
From 2002 to 2013	Brazil	XXXX	X	X	XXX
	Argentina	XXXX	XX	XXX	X
	Germany	XXXX	X	X	XX
	France	XXXX	X	X	X
	United States	XXXX	XXX	X	X
	China	X	XX	X	XXXX
	India	XX	X	X	XXXX

Source: Prepared by the authors.
Note: XXXX is very important; XXX is moderately important; XX is unimportant; and X is very unimportant.

IV. Final remarks

This study has successfully analysed the export performance of the leading countries in international agricultural trade, using constant market share analysis. Brazil, Argentina and India posted export growth rates in excess of the global average, both in the first period (1992–2001) and in the second (2002–2013). While the importance of competitiveness declined in Brazil and Argentina, both countries have advantages in terms of the availability of agricultural land and high rates of agricultural production. Is agribusiness growth in these two Latin American economies on the right track? In Brazil, competitiveness was a key driver in the two periods analysed, which indicates a positive performance. In Argentina, the importance of competitiveness declined in the second period, and export growth became dependent on the international situation. For this reason, Argentina's export performance is more fragile than that of Brazil.

The case of India is somewhat more complicated, especially with regard to productivity, which declined. Nonetheless, competitiveness improved significantly in the second period. In the case of Brazil, despite progress in agricultural policy and research, there are vulnerabilities in terms of health protection and infrastructure. In Argentina, the infrastructure problem was compounded by climate instability and protectionist policies that had adverse effects on grain prices.[2]

The United States is the world's second largest food exporter. Between 2002 and 2013, the expansion of world trade and the composition of exports were the main drivers of its export growth. However, productivity growth in that country has been slowing over time, possibly related to climate change and reduced investment. In terms of infrastructure, the United States economy has a major advantage over that of Brazil, since most of its agricultural production (about 60%) is transported through the waterway system, at a cost of US$ 9 per ton. In contrast, Brazil transports much of its production by road, at an average cost that is eight times higher (US$ 70 per ton).

The positive export performance of the countries analysed was stimulated mainly by the growth of world trade. China, in contrast, posted a negative result owing to domestic growth, which boosted the world economy but slowed the advance of Chinese international trade. Domestic demand exceeded its own production, and this brought forth policies to discourage the export of agricultural commodities.

In the case of Germany, agricultural exports performed well, whereas France has been losing competitiveness over time. In the German case, the openness of the economy together with currency appreciation helped to import new technologies, boosting production and yields. In the French case, protectionist policies harmed export performance, with growth rates below the world average. Composition, destination and competitiveness were all negative growth factors.

Given the lacklustre growth of the developed countries following the 2008 crisis and the expansion of China and India, countries such as Argentina and Brazil are displaying greater international engagement in the agricultural export scenario. South America enjoys a privileged position, as its agricultural land has not yet been fully exploited and its freshwater supply per capita is one of the most abundant in the world. From this perspective, Brazilian agriculture is superior to that of other countries, especially in terms of productivity gains and the incorporation of new agricultural frontiers —factors that require intensive use of knowledge and research.

Bibliography

Ahearn, R. and P. Belkin (2010), "The German economy and U.S.-German economic relations", *Congressional Research Service Reports*, Congressional Research Service (CRS), 27 January [online] https://digital.library.unt.edu/ark:/67531/metadc505431/.

Barros, G. (2016), "Medindo o crescimento do agronegócio: bonança externa e preços relativos", *Agricultura, transformação produtiva e sustentabilidade*, J. Vieira Filho and J. Garcia Gasques (coords.), Brasilia, Institute for Applied Economic Research (IPEA).

Beckman, J., J. Dyck and K. Heerman (2017), "The global landscape of agricultural trade, 1995-2014", *Economic Information Bulletin*, No. 181, Economic Research Service (ERS), United States Department of Agriculture (USDA)[online]https://www.ers.usda.gov/webdocs/publications/85626/eib-181.pdf?v=0.

Binswanger-Mkhize, H. and A. d'Souza (2012), "Structural transformation and agricultural productivity in India", *Productivity Growth in Agriculture: An International Perspective*, K. Fuglie, S. Wang and V. Ball (eds.), Wallingford, CAB International.

---

[2]   Although Argentina is more efficient than Brazil in terms of transportation, infrastructure is an obstacle in its agricultural marketing system. According to Pastor (2012), in certain periods of the year (harvest peaks), its road and rail networks tend to become overloaded, as 85% of transport is by road (using an inefficient and outdated fleet). Of the 25,000 rail cars available, only 65% are used, and barely 2% of production is transported by the waterway system.

Bojnec, S. and I. Fertő (2014), "Export competitiveness of dairy products on global markets: the case of the European Union countries", *Journal of Dairy Science*, vol. 97, No. 10, October.

Boussemart, J., J. Butault and O. Ojo (2012), "Generation and distribution of productivity gains in French agriculture: who are the winners and the losers over the last fifty years?", *Horticulture*, vol. 69, No. 2, Cluj-Napoca, University of Agricultural Sciences and Veterinary Medicine (USAMV).

CGEE (Center for Strategic Studies and Management) (2014), *Sustentabilidade e sustentação da produção de alimentos no Brasil, volume 1: o papel do país no cenário global*, Brasilia.

Chevassus-Lozza, E. and K. Daniel (2006), "Market openness and geographical concentration of agricultural and agro-food activities: the challenges for French regions", *Canadian Journal of Regional Science*, vol. 29, No. 1.

Coleman, W. and C. Chiasson (2000), "State power, transformative capacity and resisting globalization: an analysis of French agricultural policy, 1960-2000", paper presented at the Council for European Studies (CES) annual meeting, Chicago, March.

DG ECFIN (Directorate General for Economic and Financial Affairs) (2002), "Germany's growth performance in the 1990's", *Economic Papers*, No. 170, Brussels.

Dimitri, C., A. Effland and N. Conklin (2005), "The 20th century transformation of U.S. agriculture and farm policy", *Economic Information Bulletin*, No. 3, Economic Research Service (ERS), United States Department of Agriculture (USDA) [online] https://www.ers.usda.gov/publications/pub-details/?pubid=44198.

Dwivedy, N. (2011), "Challenges faced by the agriculture sector in developing countries with special reference to India", *International Journal of Rural Studies (IJRS)*, vol. 18, No. 2, October.

Eurostat (2013), *International Trade and Foreign Direct Investment: 2013 Edition*, Luxembourg.

FAO (Food and Agriculture Organization of the United Nations) (2015), *The State of Agricultural Commodity Markets 2015-16*, Rome.

___(2013), Corporate Database for Substantive Statistical Data (FAOSTAT) [online] http://www.fao.org/faostat/en/#country.

Federal Ministry of Food, Agriculture and Consumer Protection of Germany (2016), *Understanding Farming: Facts and Figures about German Farming*, Berlin.

___(2009), *German Agriculture Facts and Figures: Edition 2010*, Ostbevern.

Figueiredo, E. and E. Contini (2013), "China: gigante também na agricultura", *Revista de Política Agrícola*, vol. 22, No. 2.

Flake, L. (2014), "India's agricultural exports climb to record high", United States Department of Agriculture (USDA), 29 August [online] https://www.fas.usda.gov/data/india-s-agricultural-exports-climb-record-high.

Fuglie, K., S. Wang and V. Ball (eds.) (2012), "Introduction to productivity growth in agriculture", *Productivity Growth in Agriculture: An International Perspective*, Wallingford, CAB International.

Fukase, E. and W. Martin (2014), "Who will feed China in the 21st century? Income growth and food demand and supply in China", *Policy Research Working Paper*, No. 6926, Washington, D.C., World Bank, June.

Gale, F. (2015), "Development of China's feed industry and demand for imported commodities", *Feed Outlook*, No. FDS-15K-01, Economic Research Service (ERS), United States Department of Agriculture (USDA) [online] https://www.ers.usda.gov/publications/pub-details/?pubid=36930.

Hinze, J. (1998), "Regional development of German foreign trade in the 1990s", *Intereconomics: Review of European Economic Policy*, vol. 33, No. 2.

INDEC (National Institute of Statistics and Censuses) (2014), "Complejos exportadores", Buenos Aires, 6 May [online] https://www.indec.gob.ar/uploads/informesdeprensa/complejos_05_14.pdf.

Jenkins, R. (2012), "China and Brazil: economic impacts of a growing relationship", *Journal of Current Chinese Affairs*, vol. 41, No. 1.

Journo, L. (2014), "France: exporter guide, annual", *GAIN Reports*, No. FR9164, United States Department of Agriculture (USDA), 8 December [online] https://apps.fas.usda.gov/newgainapi/api/report/downloadreportbyfilename?filename=Exporter%20Guide_Paris_France_12-8-2014.pdf.

Kijek, T. and others (2015), "Agricultural total factor productivity changes in the new and the old European Union members", *Proceedings of the 7th International Scientific Conference Rural Development 2015* [online] http://doi.org/10.15544/RD.2015.084.

Koester, U. and K. Brooks (1997), "Agriculture and German reunification", *World Bank Discussion Papers*, No. 355, Washington, D.C., World Bank, March.

Lacan, A., G. Lelievre and R. Mourier (2013), "France: where is growth going today? And tomorrow?", *Group Economic Research*, No. 38, November.

Leamer, E. and R. Stern (1970), *Quantitative International Economics*, Boston, Allyn and Bacon.

Lubatti, G. and A. Bernaudeau (2015), "L'agriculture en 2014 en France et en Europe", *INSEE Première*, No. 1560, Paris, National Institute of Statistics and Economic Studies, July.

Maranhão, R. and J. Vieira Filho (2016), "A dinâmica do crescimento das exportações do agronegócio brasileiro", *Texto para Discussão*, No. 2249, Brasilia, Institute for Applied Economic Research (IPEA).

Meade, B. and W. Mcbride (2016), "Production, transportation, and policy factors determine U.S. export competitiveness in world corn and soybean markets", Economic Research Service (ERS), United States Department of Agriculture (USDA), 5 July [online] https://www.ers.usda.gov/amber-waves/2016/july/production-transportation-and-policy-factors-determine-us-export-competitiveness-in-world-corn-and-soybean-markets/.

Mendonça de Barros, J. (2014), "O passado no presente: a visão do economista", *O mundo rural no Brasil do século 21: a formação de um novo padrão agrário e agrícola*, A. Buainan and others (eds.), Brasilia, Brazilian Agricultural Research Enterprise.

Ministry of Agriculture, Agrifood and Forestry of France (2016), "The Ministry of Agriculture, Agrifood and Forestry in action", February [online] https://agriculture.gouv.fr/sites/minagri/files/plaqmingb72_0.pdf.

Ministry of Foreign Affairs of Brazil (2014), "Alemanha: comércio exterior", December [online] https://docplayer.com.br/47716132-Alemanha-comercio-exterior.html.

OECD/FAO (Organisation for Economic Co-operation and Development/Food and Agriculture Organization of the United Nations) (2015), *OECD-FAO Agricultural Outlook 2015*, Paris, OECD Publishing.

___(2013), *OECD-FAO Agricultural Outlook 2013*, Paris, OECD Publishing.

Pardey, P. (2009), "Putting U.S. agricultural R&D and productivity developments in perspective", paper presented at the Agricultural Research and Productivity for the Future workshop, Washington, D.C., 28 April.

Pastor, C. (2012), "La infraestructura como soporte de la actividad agropecuaria en el país", Buenos Aires, Fondo para el Desarrollo de la Construcción (FODECO), June.

Penrith, M., W. Vosloo and C. Mather (2011), "Classical swine fever (hog cholera): review of aspects relevant to control", *Transboundary and Emerging Diseases*, vol. 58, No. 3.

Pinheiro, A., F. Giambiagi and J. Gostkorzewicz (1999), "O desempenho macroeconômico do Brasil nos anos 90", *A economia brasileira nos anos 90*, F. Giambiagi and M. Moreira (coords.), Rio de Janeiro, National Bank for Economic and Social Development (BNDES).

Piñeiro, M. (2015), "Tendencias globales y transformaciones agrícolas", *Agricultura e desenvolvimento rural sustentável: desafios da cooperação técnica internacional*, M. Otero y otros (eds.), Brasilia, Inter-American Institute for Cooperation on Agriculture (IICA).

Pires, M. and G. Santos (2013), "Modelo agroexportador, política macroeconômica e a supremacia do mercado: uma visão do modelo brasileiro de exportação de *commodities*", *Texto para Discussão*, No. 1817, Brasilia, Institute for Applied Economic Research (IPEA).

PwC Argentina (2014), "Agronegocios en Argentina: año 2014" [online] https://www.pwc.com.ar/es/agribusiness/publicaciones/assets/agribusiness-en-argentina-booklet-2014-ultimo.pdf.

Regúnaga, M. and A. Tejeda (2015), "Argentina's agricultural trade policy and sustainable development", *Issue Paper*, No. 55, Geneva, International Centre for Trade and Sustainable Development (ICTSD), March.

Rehder, L. (2014), "Germany: exporter guide", *GAIN Reports*, No. GM14044, United States Department of Agriculture (USDA), December [online] https://www.fas.usda.gov/data/germany-exporter-guide.

Richardson, D. (1971), "Constant-market-shares analysis of export growth", *Journal of International Economics*, vol. 1, No. 2, May.

Roberts, I. and A. Rush (2012), "Understanding China's demand for resource imports", *China Economic Review*, vol. 23, No. 3, September.

Scott, R. R. and W. Bugang (2014), "China's 2013 agricultural trade report", *GAIN Report*, No. 14017, Washington, D.C., Department of Agriculture.

Secretariat of Agriculture, Livestock, Fisheries and Food of Argentina (2009), "Estimaciones agrícolas mensuales: cifras oficiales al 21/01/09" [online] https://www.magyp.gob.ar/sitio/areas/estimaciones/_archivos/estimaciones/090000_2009/000100_Enero/090100_Informe%20Mensual%20de%20Estimaciones%20Enero%202009.pdf.

Tong, H., L. Fulgitini and J. Sesmero (2012), "Agricultural productivity in China: national and regional growth patterns, 1993-2005", *Productivity Growth in Agriculture: An International Perspective*, K. Fuglie, S. Wang and V. Ball (eds.), Wallingford, CAB International.

Trigo, E. and others (2002), *Los transgénicos en la agricultura argentina: una historia con final abierto*, Buenos Aires, Libros del Zorzal.

Vieira Filho, J. (2016), "A fronteira agropecuária brasileira: redistribuição produtiva, efeito poupa-terra e desafios estruturais logísticos", *Agricultura, transformação produtiva e sustentabilidade*, J. Vieira Filho and J. Garcia Gasques (coords.), Brasilia, Institute for Applied Economic Research (IPEA).

___(2014), "Difusão biotecnológica: a adoção dos transgênicos na agricultura", *Textos para Discussão*, No. 1973, Brasilia, Institute for Applied Economic Research (IPEA), March.

Vieira Filho, J. and A. Fishlow (2020), *Agriculture and Industry in Brazil: Innovation and Competitiveness*, New York, Columbia University Press.

Vieira Filho, J. and A. Fornazier (2016), "Agricultural productivity: closing the gap between Brazil and the United States", *CEPAL Review*, No. 118 (LC/G.2676-P), Santiago, Economic Commission for Latin America and the Caribbean (ECLAC), April.

Vieira Filho, J. and J. Silveira (2016), "Competências organizacionais, trajetória tecnológica e aprendizado local na agricultura: o paradoxo de Prebisch", *Economia e Sociedade*, vol. 25, No. 3.

Wang, S. and others (2015), "Agricultural productivity growth in the United States: measurement, trends, and drivers", *Economic Research Report*, No. 189, Washington, D.C., Economic Research Service (ERS), United States Department of Agriculture (USDA), July.

Waquil, P. (2000), "O setor agrícola argentino: transformações recentes e implicações", *Indicadores Econômicos FEE*, vol. 27, No. 3.

Westcott, P. and R. Trostle (2014), "USDA agricultural projections to 2023", *Long-term Projections Report*, No. OCE-2014-1, Washington, D.C., United States Department of Agriculture (USDA).

World Bank (2011), *Food Price Watch*, vol. 2, No. 6, April.

WTO (World Trade Organization) (2015), "International trade statistics 2015" [online] https://www.wto.org/english/res_e/statis_e/its2015_e/its15_toc_e.htm.

＿＿＿(2014), "International trade statistics 2014" [online] https://www.wto.org/english/res_e/statis_e/its2014_e/its14_toc_e.htm.

Zylbersztajn, D. (2014), "Coordenação e governança de sistemas agroindustriais", *O mundo rural no Brasil do século 21: a formação de um novo padrão agrário e agrícola*, A. Buainain and others (eds.), Brasilia, Brazilian Agricultural Research Enterprise.