

The Brazilian export profile by technological intensity¹

Abstract: The aim of this study is to analyze the Brazilian export profile, by technological intensity, between 2000 and 2012. Data were extracted from the Ministry of Development, Industry and Foreign Trade (MDIF), classified according to the Mercosur Common Nomenclature (MCN) to six digits. The identification of categories of technological intensity followed the classification proposed by the taxonomy of Pavitt (1984). It was found that there was a tendency towards the reprimarization of the exports, and this process was recognized through greater representation of primary goods and intensive in natural resources over the period. Most of this scenario is due to the increase in international commodity prices, resulted from the growth of demand from emerging markets, especially China.

Key-words: Exports; Technological intensity; Commodities.

Resumo: O objetivo deste estudo é analisar o perfil exportador brasileiro, por intensidade tecnológica, entre 2000 e 2012. Os dados analisados foram extraídos do Ministério do Desenvolvimento, Indústria e Comércio Exterior (MDIC), classificados segundo a Nomenclatura Comum do Mercosul (NCM) a seis dígitos. A identificação das categorias de intensidade tecnológica seguiu a classificação proposta pela taxonomia de Pavitt (1984). Constatou-se que houve uma tendência de reprimarização da pauta exportadora e esse processo foi percebido através da maior representatividade dos produtos primários e intensivos em recursos naturais ao longo do período. Grande parte deste cenário se deve ao aumento dos preços internacionais das commodities, devido ao grande crescimento da demanda de países emergentes, especialmente a China.

Palavras-chave: Exportações; Intensidade Tecnológica; Commodities.

JEL: F14; F15; Q17

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1. Introduction

The 2000s were characterized by a significant increase in international commodity prices - primary products and intensive in natural resources. The evolution of prices, which began in the middle of 2001, was influenced by the acceleration of economic activity in major economies of the world, especially in Asian countries, particularly in China. This major role played by the Chinese economy resulted in a strong increase of its participation in the world Gross Domestic Product (GDP), nearly tripling their representation between the years 2000 and 2010 (AVILA, 2012). In 2012, according to IMF (2013), China's GDP reached US\$ 8.2 trillion, representing 11.5% of world GDP, consolidating its position as the world's second largest economy, only behind of the United States (USA). However, the country was unable to produce food and energy as its fast urbanization process demanded, thus, contributing to the rise in international commodity prices and the growing of participation of these products in the world trade.

The performance of the international economy has strongly influenced the outcome of the Brazilian export profile in recent years, but would the commodity exports from Brazil be broadening according to the intense worldwide demand for these products? Thus, the objective of this study is to analyze the Brazilian export profile, by technological intensity between 2000 and 2012. To this end, were investigated the development in exports to selected destinations, and the technological intensity was considered, seeking to identify the exports of Brazil in the period.

The exports of Brazil are relevant and timely in the present research, given the strong global growth from the early 2000s and the rising in commodity prices boosted by the China-effect is causing changes in Brazilian exports. It is relevant to investigate the composition of these exports in recent years, therefore, in spite of not being necessarily bad to have a line strongly composed by commodities. Depending more and more on primary products and intensives in natural resources may represent more restricted impact to employment generation and multiplication of income in the supply chain.

This article is structured in four sections, besides this introduction. The second section discusses, through literature review, on a possible reprimarization of the Brazilian exports. The third section presents the methodology applied for classification of the technological intensity of products exported, as well as the source of the collected data. The fourth section analyzes the evolution of Brazilian exports and its technological profile. The fifth, and final section, presents the main conclusions from the study.

2. Debate on the process of reprimarization

In this section is presented the debate on the possible structural change that Brazil exports would be through, where evidence shows that products of the primary sector have assumed a greater importance. The section deals with the rise in commodity prices resulted from the growth of major economies, especially the Chinese one, which eventually led to a reprimarization process of the world exports. Moreover, it demonstrates how high commodity prices affected exports from Brazil in the recent period.

The uptrend in international commodity prices began in the middle of 2001. Developments in prices over the decade were influenced by the acceleration of economic activity in major economies of the world, especially Asian countries, particularly in China (BCB, 2012). With the accelerated process of urbanization, the country was unable to produce food and energy this process demanded, thus, having strong contribution to the rising of international commodity prices and wing participation of these products in world trade. As a result, commodities, which accounted for 11.6% of world exports in 2000, increased its participation to over 13% of the total in 2010. However, the largest participation

of international trade throughout the period continued to be composed of industrial products of high and medium technological intensity (NEGRI; ALVARENGA, 2011).

The factors that led to the cycle of valuation of commodities can be sustained for a long period, since this cycle is associated with an imbalance in supply and global demand for food, which tends to remain in the coming years. Besides, the increased costs of agricultural production due to growth in energy prices, the expansion of biofuels production in the USA and in Europe, and the dollar weakening are factors that also contribute to the appreciation of commodities on the world market (NEGRI; ALVARENGA, 2011).

Rich in natural resources, Brazil has benefited from the rise in commodity prices, greatly increasing the participation of these products in its exports. According to Negri and Alvarenga (2011), this contribution, which fluctuated around 40% during the 1990s, reached 51% of the country's total exports in 2010, indicating market share gains for Brazilian commodities on the international market, once they grew by 11 percentage points in the period, compared to the growth of 1.4 percentage points presented by global exports of the same product category.

Still, according to Negri and Alvarenga (2011), the reprimarization of Brazilian exports became worse with the financial crisis in 2009, and this is due to the fact that countries, such as China, continue to grow at higher rates than those in developed countries. The lowest slowdown in Chinese imports - main Brazilian trade partner - in relation to the rest of the world, contributed significantly to the growth of the participation of commodities in Brazilian total exports. However, only China is the most significant example of the movement that occurred with the Brazilian exports. Brazil has been gaining participation in world exports, but these gains are highly concentrated in primary commodities and, more recently, also in oil.

According to Lamoso (2010), the participation of commodities on the Brazilian total exports in the years of 2006, 2007, and 2008 was, respectively, 29.2%, 32.1% and 36.9%. For manufactured exports, in the same period, the percentages were 54.4%, 52.3%, and 46.8%. For the author, this movement may be understood as a reflection of the loss of international competitiveness of manufactured products and, also, as an expression of the change in the structure of exports, with a higher participation of agricultural products and lower participation of manufactured goods.

The concentration of foreign sales on commodities in Brazil and the weakening of the industry, as in Batista and Oliveira (2010), have been gaining strength. In 2009, only six basic products accounted for practically one-third (32.2%) of Brazilian exports: soy, iron ore, oil, sugar, poultry, and soybean meal. In the previous year, this group accounted for 27.7% of Brazilian sales to other nations, and in 2004, for only 20.7%. The year of 2009 was the first in which there was no industrialized item among the six most exported products. Among the ten most exported products only two - airplanes, in seventh place; and automobiles, in tenth place ranking - were manufactured. It was the first time in 20 years that the export of primary products exceeded 40% of total exports - in 2008 was 36.9%. On the other hand, manufactured goods, which accounted for 46.8% of sales in 2008, have begun to represent only 44.0% in 2009.

The excellent export performance of commodities in Brazil is explained, not only by increasing the price of the exported products, but also by increasing the quantity exported. However, it is important to emphasize that the increase in prices leads to increased quantum upon making the remuneration of such products more attractive (SOUZA; VERÍSSIMO 2013).

Between 2000 and 2009, Brazil lost market share in the world exports of all products, with the exception of commodities and manufactured goods with low technological intensity. This behavior of the economy is not just a result of good performance of exports of commodities, but also reflects the loss of competitiveness of the industrial sector in

the international market, especially in relation to more intensive technological products (NASSIF, 2012).

A concentration in a small number of markets implies risks for the exporter, which ends up being vulnerable to the *spread* of crises that could occur in the purchasing markets. Also, the concentration on a few products, particularly in commodities, means greater instability and volatility in revenues, given that their prices are more sensitive to cyclical variations (MOREIRA, 2007).

In 2000, Brazil accounted for 0.88% of world trade in goods and arrived, in 2009, with a participation of 1.26%. These gains were concentrated in commodities, in which Brazil represented 4.66% of world exports, compared to 2.77%, in 2000 (NEGRI; ALVARENGA, 2011). This trade integration, concentrated mostly on primarized goods and its deepening in recent years, has brought concerns for the future performance of the Brazilian economy.

Much has been spoken about a supposed deindustrialization process (AZEVEDO *et al.*, 2013). For Negri and Alvarenga (2011), it is premature to defend this theory, as growth in domestic demand would be sustained by the increasing in industrial production of the country, even because of loss of international market share in products with higher added value. However, they reinforce a scenario of international valuation that commodity booms and appreciated exchange rate may cause considerable risk to the Brazilian economy. Exports heavily based on commodities can be seen positively, while prices of this group of goods are on the rise. On the other hand, a fall in prices of these products, in the short term, may adversely affect the trade balance. According to Avila (2012), a slowdown in Asia, more than affect the quantum exported, may also adversely affect the price of commodities, which brings concern.

In contrast, Palma (2005) points out that the simultaneous occurrence of loss of importance of industry in GDP and an increase in the trade deficit of this sector is a strong symptom of occurrence of deindustrialization caused by the “Dutch Disease”. This situation occurs when the abundance of natural resources generates comparative advantages for the region that owns them, leading the region to specialize in producing those goods, and not to industrialize or even to deindustrialize. By analyzing the Brazilian foreign trade in the period of 1991 to 2003, Carvalho e Silva (2008) identified that the gains in competitiveness of the agricultural sector were followed by a worsening of the quality of these exports. For the authors, deindustrialization affected the national agribusiness while focusing on the exports with lower added-value products. According to Rubin and Waquil (2013), the sophistication of the agricultural exports promotes development for countries and, therefore, should be a strategy of the economic policy.

In Sonaglio (2011), although evidence indicates the existence of a process of transformation in the Brazilian economy, it is not possible to say that this change has a structural character and that economy is suffering from “Dutch Disease”. However, it is clear that the industrial sector has been affected by the economic situation of an appreciated exchange rate conjuncture in exports of commodities. This is reflected in the volume of investment and the consequent loss of momentum in the economic growth process, as it induces to a process of transferring resources to sectors that remain competitive in this setting.

For Negri and Alvarenga (2011), the expansion of the world demand and the consequent cycle of commodity booms must not be exhausted in the short term, as well as it will not cease the impacts of this cycle on the Brazilian productive structure. The long process of urbanization, by which China will still undergo, migrating significant part of its population from rural to urban areas, tends to increase the country's needs for food and energy, needs that, in a large extent, will be supported by Brazilian exports. Thus, as the participation of commodities in total exports has significantly grown, it is also expected the increase in a forthcoming time, the participation of these sectors in the productive structure of

Brazil. As Negri and Alvarenga (2011, p. 12) state, “It is clear that the good performance of commodities is an important window of opportunities for the Brazilian economy”.

Although exports of commodities have played an important role in supporting the Brazilian trade surplus in recent years, the effects of the primarization of the exports may be harmful to the productive structure of the country, in the long-term. Avila (2012) points out that commodities have smaller threads than finished products, thus, having more limited impact on the generation of employment and multiplication of income for other sectors.

In the same line of thinking, Caldas (2012) discusses that technology is a key factor in promoting growth and competitiveness⁴. Companies with higher technology innovate more, expand and have more chances to enter new markets, use resources more productively, and, in general, offer better remuneration for their employees.

However, there are several discussions on the contribution to the economic growth of a productive structure intensive in technology *versus* a productive structure specialized in natural resources, as Souza and Verissimo (2013). Oreiro and Feijó (2010), Bresser-Pereira and Marconi (2008), and Gala (2006) claimed that industrial activity generates higher rate of economic growth. Moreover, countries that export industrial products achieve higher levels of economic growth, as Rodrik (2006), Dalum *et al.* (1999), and Sachs and Warner (1995). Though, according to Brahmabhatt and Canuto (2010), economies held in the export of commodities may get out of contexts of crisis faster, than countries facing international trade in industrial products.

After analyzing the studies on reprimarization exports, it is found there is some authors who does not consider it as a relevant process, since a unit of added value, for long-term growth, has the same meaning if generated in industry, agriculture or in the service sectors. Hence, another group of authors believe that the industry is responsible for long-term growth of economies and that the loss of participation of manufactured products in exports would reduce the generation of increasing returns, decrease the rate of technical progress, and increase external constraint on growth.

After exposing here major considerations on reprimarization process, it is essential to analyze the evolution of Brazilian exports in order to determine the presence or absence of a reprimarization process in the exports in this economy. Therefore, it is necessary to evaluate the composition of products exported per added factor, as the analysis of the participation of each technological intensity is the determinant for the identification of structural dependence of these exports by products with low technological content.

3. Methodology

3.1 Sources of data

The data presented in this article were selected from the base of the Analysis of Foreign Trade Information System (AliceWeb), the Bureau of Foreign Trade (SECEX) and the Ministry of Development, Industry and Foreign Trade (MDIF). These data follow the Mercosur Common Nomenclature (MCN), which classifies through a code structure, the goods traded in international trade.

The MCN is based on the Harmonized Commodity Description and Coding System (HS), which constitutes a classification adopted internationally. Thus, in the eight digits in MCN, the first six are formed by the HS, while the digits seventh and eighth correspond to specific unfolded within the Southern Common Market (Mercosur). The database collected, covers the period between 2000 and 2012 and includes developments in value (US\$ FOB) of Brazilian exports, and the technological level of the exported products.

In order to monitor the evolution of exports by product in the selected period, it was necessary to adopt a corresponding to correlate the versions of MCN (MCN 1996, HS 2002,

⁴ Robson *et al.* (1988), when analyzing the sectoral patterns of production and use of innovation in the United Kingdom, observed the importance of increasing sectoral interdependence in technology at the center of national policies of technological development.

HS 2007, and HS 2012). New versions of the nomenclature are published every four years, on the recommendation of the Customs Cooperation Council, a bureau linked to the World Customs Organization (WCO), responsible for managing the International Nomenclature of which derives from the MCN. Correlation tables were consulted at MDIF.

3.2 Technological intensity

The technological intensity of products listed in the six digits of HS followed Keith Pavitt's taxonomy⁵, which classifies sectors according to the degree of technological development and subdivided them into groups, from those with lower technological intensity to those with larger technological increments in processes of production. The classification proposed by Pavitt (1984) aggregates industries in six major groups, as shown by Hermida and Xavier (2012), Nunes (2010), and Holland and Xavier (2004):

- I. primary products: agricultural, minerals and energy;
- II. intensive industry in natural resources: food industry, intensive industry in other agricultural resources, intensive industry in mineral resources, and intensive industry in energy resources;
- III. intensive industry in labor: concentrates the most traditional industrial non-durable consumer products, such as textiles, clothing, leather and footwear, ceramics, editorial and graphic, basic metal products, among others;
- IV. intensive industry in scale: includes the automotive industry, the steel industry, and electronic consumer products;
- V. specialized suppliers: includes capital goods under order and engineering equipment;
- VI. intensive Research and Development Industry (R&D): this group consists of the fine chemical sectors (pharmaceutical goods, etc), electronic components, telecommunications, and aerospace industry.

The classification by technological intensity was only possible due to a translator developed by Laplane *et al.* (2001), which allowed the aggregation of divided groups in accordance with the technological parameters of Pavitt (1984). It is significant to mention that some products were not able to be classified, as there was no corresponding category for some NCM's. Therefore, in each table presented it was created an item titled "not classified", containing the sum of the values of the products with no correspondence, as well as its participation in the value of total exports of Brazil.

4. Results and discussion

The performance of Brazilian exports, in recent years, was strongly influenced by the international economy. As mentioned before, among the main factors are the strong growth of the world economy since the early 2000s, the China-effect, and the rising in commodity prices. This section analyzes the evolution of exports from Brazil to the world and to selected destinations - China, USA, European Union (EU) and Mercosur - showing the value of exports and its technological intensity in the last years.

Brazilian exports grew, on average, between 2000 and 2012, at an annual rate of 14.2%, from US\$ 55.1 billion to US\$ 237.3 billion, accumulating in the total of the period an increasing of 330,6%. Between 2000 and 2002, exports remained relatively stable, showing a strong growth from the following year, which was only interrupted in 2008, with the outbreak of the international financial crisis. From that point, there was a drastic reduction in economic activity in practically all the world, especially in the most developed countries,

⁵ For more information on the taxonomy of Pavitt, see the study of Archibugi (2001), which presents its features and proposes some reviews, and Kristensen (1999), who employs a modified version of this methodology for the analysis of Denmark.

such as the USA, Japan and the EU. This contraction of the world trade affected Brazil, reducing exports by 22.7% between 2008 and 2009, from US\$ 197.9 billion to US\$ 153.0 billion (MDIF, 2013).

The crisis was intense between the last quarter of 2008 and the first quarter of 2009 although, gradually, it was slowing down, and the end of 2009 came with a process of recovery of the world economy and, also, of the international trade. This heating of the economy was, again, reflected on Brazil, which recovered the growth in exports in 2010, with an increase of 32.0% over the previous year, reaching US\$ 201.9 billion. In 2012, Brazil's total exports started to fell again, reaching US\$ 237.3 billion, 7.3 % less than in 2011. Such a result is due to lower international demand caused by the global economic slowdown, mainly derived from the crisis faced by the EU countries (MDIF, 2013).

Another relevant issue is the concentration of the exports. In 2000, the fifteen main products exported by Brazil accounted for 37.1% of total exports, representing, in 2012, 51.8% (MDIF, 2013). The concentration of exports in few commodities may indicate the specialization of the region in some specific sectors, which does not necessarily mean that this is something bad, and may even be an indicator of comparative advantage due to the presence of abundant factors in that region (RIBEIRO, 2009). Notwithstanding, the concentration in a small number of products may indicate vulnerability to adverse changes in price and volume, which might adversely affect the economy of a state, country or region

4.1 Exports to selected destinations

During the examined period, Brazilian exports showed considerable changes. As indicated in Table 1, China, the USA, the EU, and Mercosur were responsible for 69.1% of Brazil's exports in 2000, while in 2012, there was a lower concentration, receiving 60.9% of exports, although there was a significant increase of 279.5% in export value during the period. China received 2% of all the nation's exports in 2000, and 17.4% in 2012, with strong growth in absolute terms, of 3698.7% in the period, and the only one among the selected destinations with growth participation in exports at the end of the period. If China stands out for positive variation, the USA demonstrated, in reverse order, a reduction of 12.7 percentage points between the periods, accounting for 23.9% of exports in 2000, and only 11.3% in 2012. Mercosur, for which Brazil exported 15.4% of all goods in 2000, increased in absolute terms, but showed a smaller participation in exports of 11.7% in 2012. The same trend was also observed in the EU, which received 27.8% of all goods exported by Brazil in 2000, an increase in absolute terms, but showed a fall in the total export's participation of 20.6% in 2012.

Table 1. Exports from Brazil to selected destinations in US\$ and % - 2000/2012

Destination	2000		2012		In the Period	
	Amounts in US\$	Participation in Total Exports in %	Amounts in US\$	Participation in Total Exports in %	Variation Value US\$ in %	Variation of Participation in p.p.
(A) CHINA	1.085.301.597	2,0	41.227.540.253	17,4	3.698,72	15,4
(B) UNITED STATES	13.189.576.929	23,9	26.700.844.268	11,3	102,44	-12,7
(C) MERCOSUR	8.492.505.150	15,4	27.857.554.963	11,7	228,03	-3,7
(D) EUROPEAN UNION	15.346.022.583	27,8	48.859.641.610	20,6	218,39	-7,3
Subtotal (A + B + C + D)	38.113.406.259	69,1	144.645.581.094	60,9	279,51	-8,2
Total Exports	55.118.919.865	-	237.329.733.640	-	-	-

Source of raw data: MDIF (2013).

It was found, by analyzing the Brazilian exports to selected destinations, a lower concentration of the exports, which moved from the threshold of 67% of its total shipments being to China, USA, EU and Mercosur, in 2000, to a slightly greater level than 60% in 2012. Such diversification in terms of the place of destination reduces vulnerability of exports by allowing the markets to expand, generating better returns and increasing the export potential.

4.2 Exports by aggregate factor

Another way to assess exports is classifying them by technological intensity. The change in the participation of each level of technological intensity in the exports results in the relationship through total exports in each category and the total exports of the country.

Table 2 shows the composition of the Brazilian exports by technological level in 2000 and 2012. It is verified that, in absolute terms, with the exception of not classified products, all technology categories showed growth in total exports, however, in relative terms only items classified as primary and intensive in natural resources products had increased their participation in total exports from Brazil.

At the beginning of the studied period, the Brazilian exports had 11.4% of the total amount formed by items classified as intensive in R&D and 9.3% as specialized suppliers, while items classified as primary products (in raw form or commodities) accounted for only 19.6%. In 2012, there was a reduction in the participation of both the intensive category in R&D as in the specialized suppliers' category, by 7.1 and 2.0 percentage points respectively. On the other hand, the items classified as primary products or commodities, which were in a level of 19.6% in 2000, reached 44.7% of total exports of the country in 2012, that is, an increase of 25.1 percentage points. This result reinforces the hypothesis of reprimerization of the Brazilian exports with international integration based on commodity exports.

Table 2. Exports from Brazil to the world by technological intensity in US\$ and % - 2000/2012

Degree of Technological Intensity	2000		2012		In the Period	
	Amounts in US\$	Participation in Total Exports in %	Amounts in US\$	Participation in Total Exports in %	Variation Value US\$ in %	Variation of Participation in p.p.
Primary Products	10.822.028.156	19,6	106.123.800.970	44,7	880,6	25,1
Intensives in Natural Resources	11.518.559.248	20,9	49.884.397.033	21,0	333,1	0,1
Intensive in Labor	5.946.844.242	10,8	8.748.265.658	3,7	47,1	-7,1
Intensives in Economy of Scale	14.370.994.053	26,1	44.831.039.175	18,9	212,0	-7,2
Specialized Suppliers	5.150.903.963	9,3	17.487.726.658	7,4	239,5	-2,0
Intensives in R&D	6.269.904.103	11,4	10.244.735.618	4,3	63,4	-7,1
Not Classified	1.039.686.100	1,9	9.768.528	0,0	-99,1	-1,9

Source of raw data: MDIF (2013). Technological classification: APEX Brazil.

Although the Brazilian exports are undergoing a process of reprimerization, it is observed that the categories of products with higher technological intensity also achieved positive growth in the period. However, the increasing of the participation of products with low technological intensity was superior to all others.

4.3 Exports by aggregate factor for selected destinations

Because of the decline of the USA participation, Mercosur and the EU in national exports, the rise of China and the confirmation of the relative increase in exports of primary products, it became suitable to research the participation of each category of technological intensity in exports. This subsection analyzes the exports from Brazil by technological intensity to selected destinations.

Brazilian exports to China were based, predominantly, throughout the period analyzed, on primary products, as previously indicated by Negri and Alvarenga (2011). In 2000, national exports to China were more diversified, compared to 2012. As seen in Table 3, the participation of primary products increased from 66.8 % to 82.8 % at the end of the period, that is, an increasing of 16 percentage points, while all other categories decreased participation in total exports.

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Table3. Participation of each level of technological intensity in exports from Brazil to China, in % - 2000-2012

Degree of Technological Intensity	Participation in the exports in %													Variation in p.p. in the period (2000/2012)
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
PP	66,8	60,6	61,5	50,0	59,4	68,6	73,7	73,7	77,7	77,7	83,5	85,0	82,8	16,0
INR	13,3	12,6	14,6	16,6	18,4	10,2	10,2	10,2	11,3	8,9	9,1	8,4	9,0	-4,3
IL	2,6	3,3	3,9	3,0	4,1	4,2	4,9	4,9	2,5	1,4	1,3	1,0	1,3	-1,2
IES	8,8	11,5	12,4	24,0	12,5	11,6	6,1	7,4	4,5	8,8	3,5	3,1	3,5	-5,4
SS	3,4	6,1	6,0	5,2	4,0	4,2	3,8	2,6	2,1	1,1	0,9	0,8	1,0	-2,4
R&D	5,2	5,9	1,6	1,3	1,6	1,2	1,2	1,2	1,9	2,1	1,6	1,7	2,4	-2,7
NC	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
PP – Primary Products					IES – Intensives in Economy of Scale					R&D – Intensives in R&D				
INR – Intensives in Natural Resources					SS – Specialized Suppliers					NC – Not Classified				
IL – Intensive in Labor														

Source of raw data: MDIF (2013). Technological classification: APEX Brazil.

The USA has lost importance as a trading partner in international trade with Brazil, surpassed by China, Mercosur and the EU in 2012. According to Table 4, the Brazilian exports to the USA showed fluctuations in the participation of each sector throughout the period. Primary products came from 6th most important in 2000, to the 1st most important in 2012, increasing its participation from 6.5% to 29.7%. Intensive products in R&D, however, increased from the 2nd to the 5th most important, with retraction of 14.2 percentage points in the period, from 20.5% to 6.3% of exports.

Table 4. Participation of each level of technological intensity in exports from Brazil to the USA, in % - 2000-2012

Degree of Technological Intensity	Participation in the exports in %													Variation in p.p. in the period (2000/2012)
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
PP	6,5	5,1	6,5	7,8	7,6	9,1	14,3	19,2	22,6	25,9	30,8	33,7	29,7	23,2
INR	17,5	18,0	15,9	20,5	17,3	15,6	17,7	17,3	17,8	19,9	20,3	18,6	20,6	3,1
IL	16,0	16,1	17,2	17,4	18,0	15,8	13,5	11,6	7,8	9,6	8,1	5,2	5,2	-10,7
IES	27,2	24,0	24,5	23,7	29,1	30,8	29,8	27,7	28,3	20,9	22,0	24,7	24,5	-2,7
SS	12,2	10,7	11,7	12,2	12,3	14,7	15,7	14,1	12,4	14,2	13,1	12,4	13,2	1,0
R&D	20,5	25,9	24,1	18,3	15,7	14,1	8,9	10,1	11,0	9,1	5,4	5,1	6,3	-14,2
NC	0,2	0,2	0,1	0,1	0,1	0,0	0,1	0,1	0,1	0,4	0,3	0,4	0,5	0,3
PP – Primary Products					IES – Intensives in Economy of Scale					R&D – Intensives in R&D				
INR – Intensives in Natural Resources					SS – Specialized Suppliers					NC – Not Classified				
IL – Intensive in Labor														

Source of raw data: MDIF (2013). Technological classification: APEX Brazil.

The EU presents itself as an important market position for Brazilian exports in the analyzed period. According to Table 5, with 38.9% of total exports in 2012, the category of

primary products is the main component of the Brazilian exports to the block. The second important group is that in intensive of natural resources, which rose its participation from 25.2% in 2000, to 30.1% in 2012. The negative representation is highlighted by the category of labor-intensive products, with a reduction of 5.8 percentage points in exports, from 9.7% in 2000 to 3.9% participation in 2012.

Table 5 Participation of each level of technological intensity in exports from Brazil to the EU, in % - 2000-2012

Degree of Technological Intensity	Participation in the exports in %													Variation in p.p. in the period (2000/2012)
PP	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
PP	33,3	37,1	37,6	38,9	37,1	39,7	37,7	38,4	38,3	36,6	40,4	42,7	38,9	5,6
INR	25,2	26,3	27,4	27,2	24,6	23,8	23,7	24,7	28,7	30,2	27,7	27,0	30,1	4,9
IL	9,7	9,3	10,0	9,6	9,2	8,5	8,4	7,8	6,6	5,9	5,5	4,3	3,9	-5,8
IES	16,2	12,7	14,0	13,3	16,7	15,4	17,7	18,5	16,5	14,4	14,0	14,7	14,3	-1,9
SS	6,5	7,1	7,6	8,2	8,0	8,6	8,2	6,6	6,3	6,2	6,8	6,9	7,3	0,7
R&D	8,7	7,2	3,3	2,6	4,2	4,0	4,3	3,9	3,5	6,5	5,5	4,3	5,4	-3,4
NC	0,3	0,3	0,2	0,1	0,1	0,1	0,1	0,1	0,1	0,2	0,1	0,1	0,2	-0,1
PP – Primary Products					IES – Intensives in Economy of Scale					R&D – Intensives in R&D				
INR – Intensives in Natural Resources					SS – Specialized Suppliers					NC – Not Classified				
IL – Intensive in Labor														

Source of raw data: MDIF (2013). Technological classification: APEX Brazil.

By analyzing exports to Mercosur, it was found full differentiation of other destinations. While the exports from Brazil to China, the USA and EU proved to be based mainly on primary products. Exports to Mercosur according to Table 6, were predominantly of products intensive in economy of scale, with 47.5% participation in the composition of the exports, in 2012.

Table 6. Participation of each level of technological intensity exports from Brazil to Mercosur, in % - 2000-2012

Degree of Technological Intensity	Participation in the exports in %													Variation in p.p. in the period (2000/2012)
PP	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
PP	5,6	6,1	7,4	6,4	5,1	4,9	4,9	5,8	9,1	8,0	10,5	11,0	11,2	5,6
INR	16,0	16,6	21,2	17,3	14,1	13,4	14,7	14,9	16,7	20,9	15,4	16,4	14,7	-1,3
IL	12,5	13,7	9,7	10,4	8,7	8,0	7,5	7,4	6,7	7,1	6,7	6,5	6,8	-5,7
IES	40,1	40,6	40,2	43,1	47,9	47,5	46,1	48,0	45,0	41,0	45,4	45,6	47,5	7,3
SS	13,5	14,0	11,8	13,9	14,8	13,7	13,3	13,4	13,4	12,7	13,3	13,5	13,8	0,3
R&D	12,2	8,9	9,6	8,9	9,4	12,5	13,5	10,5	9,0	10,1	8,6	7,0	5,9	-6,2
NC	0,1	0,1	0,1	0,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,0
PP – Primary Products					IES – Intensives in Economy of Scale					R&D – Intensives in R&D				
INR – Intensives in Natural Resources					SS – Specialized Suppliers					NC – Not Classified				
IL – Intensive in Labor														

Source of raw data: MDIF (2013). Technological classification: APEX Brazil.

It is also observed in Table 6, that the categories of primary and specialized suppliers had increased by 5.6 and 0.3 percentage points, respectively, in the period. Against this flow, products intensive in natural resources, labor-intensive, and intensive R&D resources showed retraction in the participation of Brazil's exports to Mercosur.

In synthesis, at the end of 2012, among the selected destinations, the main participation in Brazilian exports of primary products was from exports to China, USA, and EU. The products intensive in natural resources had higher participation in the exports to the USA and the EU, while items classified as labor intensive had greater representation in exports

to Mercosur. Products intensive in economies of scale, specialized and intensive R&D suppliers had higher participation in the exports to the USA and Mercosur.

By this analysis it is possible to see that, the participation of products with high technological level in the Brazilian exports was not reduced by the decline in absolute terms of the exports in this category, but by the significant increase showed by the categories of products with lower technological level during the period. Thus exposed, this study confirms the hypothesis of reprimarization of the Brazilian exports, but it does not appear as conclusive evidence of a deindustrialization process.

Conclusions

The Brazilian international trade has grown significantly in recent years, as demonstrated by the data analyzed in this study. However, there is a concern about the evolution of the technological profile of the national exports, which became more based on primary and intensive in natural resource products.

The literature points to several benefits provided by the production of manufactured goods intensive in technology, such as increased employment generation, greater linkage with other sectors, and higher rates of economic growth, as highlighted by Avila (2012), Caldas (2012) and Nassif (2012). In contrast, other authors such as Ribeiro (2009) emphasize that this reprimarization of the Brazilian exports would not be so bad, because there would be a large diversification of exported products, besides being products in which the country has clear comparative advantages.

In the analyzed period, with the exception of the international financial crisis unleashed in the USA in 2008, which affected the Brazilian exports in 2009, the other years analyzed were favorable to international trade. This advantage is reflected on the exports of Brazil, which had increased in value by 330.6%, between 2000 and 2012, mainly due to the reflection of rising prices of commodities. It is noteworthy that there was a decrease in the absolute value of exports in 2009, but the growth of international trade was recovered in the following years.

Regarding the participation of the selected markets in the Brazilian exports, it is observed that all showed absolute growth; however, only China has expanded its participation in relative terms. It appears that, together, China, USA, EU, and Mercosur have received 60.9% of the Brazilian exports, in 2012, compared to 69.1%, in 2000, demonstrating a concentration of the exports to a few destinations.

Concerning the technological content of exports between 2000 and 2012, despite the increase in absolute terms of all categories, exports of primary and intensive in natural resources products stood up and, to the detriment of other technological intensities, which fell sharply from participation in exports of Brazil. This fall in the participation of products with higher technological level indicates the reprimarization of exports, as pointed out by Nassif (2012).

Evaluating the technological intensity of exports to China, in a national level, it is possible to observe a concentration in primary products, which assume more than 80% of total exports to that country. The USA, the former main destiny of the exports of the country, receives the most diverse lines in terms of levels of technological intensity among the assessed destinations. Among the exports to Mercosur, the category of products intensive in economies of scale is the one that rises in both levels, with over 45% of representativeness. In the meantime, Brazilian exports to the EU are based on primary and intensive in natural resource products.

The process of reprimarization of exports would not necessarily be a problem, as Ribeiro (2009) points out, as the reprimarization comes from current comparative advantages of

Brazil. Also, Brazilian economy would have a significant diversity of exports with many primary products, not only depending on one or a few items. However, the stability of this scenario could lead to a process of deindustrialization, which consists of persistent reduction of the industrial sector in the added value to the economy. This process would bring negative impact on the potential of long-term growth, since it would reduce the generation of increasing returns, decrease the rhythm of technical progress, and increase the external constraint on growth.

The evidence points to the need for policy of innovation that might keep away deindustrialization. It is evident that a country or region that does not produce competitively technology also may not export it. Therefore, as stated by Negri and Alvarenga (2011), policies of innovation are keys to add value to the productive structure in the long-term.

Current policies support sectors are already the most competitive and with better external performance, reinforcing the existing structure in the exports. Modifying these policies, turning non-traditional sectors into more attractive ones, could contribute to broaden profitability in sectors intensives in technology, which are hindered in today's scenario by the overvalued exchange rate and the external environment. Thus, studies on these subjects are made relevant.

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