THE BILATERAL TRADE BRAZIL-EUROPEAN UNION: LIMITS FOR THE TRANSITION TO A GREEN ECONOMY?

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Abstract

The bilateral trade between Brazil and European Union in the period 1989-2009 shows more of the same, indicating no structural changes especially in environmental profile here evaluated by applying the methodology based on the scale, composition and technological effects (Grossman and Krueger, 1995). These results corroborate previous empirical studies which pointed out the environmental vulnerability of this trade pattern, that is, a considerable inertia to promote trade relations more favorable to the transition to a green economy toward Brazilian sustainable development.

Keywords: trade, environment, Brazilian exports, natural resources, sustainable development, environmental vulnerability

Introduction

Studies on the Brazilian foreign trade bring out the evidence of strengthening of the country's trade specialization in exports of basic commodities and semi-manufactured goods and imports of manufactured products with higher added value (IPEA, 2009).

The environmental vulnerability of this trade pattern - based on sectors intensive in natural resources, energy and pollution - was pointed out by several empirical studies (Veiga *et al.* 1995; Schaper, 1999; Young and Pereira, 2000; Young and Lustosa, 2002; Almeida and Mazzero, 2011). The term *environmental vulnerability* is used here in the same sense originally proposed by Schaper (1999) for expressing environmental problems on the supply side (specialization in productive sectors with high potential for

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environmental impact) and on the demand side (increasing environmental restrictions for international market access).

This paper, focused on the trade relations between Brazil and European Union, draws on the lessons of previous empirical studies, particularly those briefly described as follows.

Veiga *et al.* (1995), with data for the period 1975-1993, identified a pattern of Brazilian export specialization characterized by environmental vulnerability associated with comparative advantages based on intensive use of natural resources and energy. This study also pointed out evidence that the most dynamic export sectors were high pollution potential ones.

The environmental vulnerability of Latin America and the Caribbean exports was corroborated by Schaper (1999) in a study for 1980-1995 applied to nine countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Jamaica, Mexico and Peru. The methodology was based on the scale, composition and technology effects (Grossman and Krueger, 1995), which are defined below. The main conclusion of this study is that the export structure of Latin America and the Caribbean that emerged in the 90s was more environmentally vulnerable than in the 80s. In the period 1980-1995, the volume of exports from sectors with recognized environmental impact, such as commodities and products from industries with high pollution potential, was multiplied by three or more times in most of the nine countries studied, particularly Brazil.

A similar conclusion was reached by Young and Pereira (2000) on the environmental profile of the Brazilian export industry in the period 1981-1999. The authors concluded that industrial production for export was more emissions intensive than the production for the domestic market. On the other hand, they found that companies more concerned with environmental issues and that had invested in environmentally efficient production processes were companies directed to the foreign market. In short, two contradictory effects were observed - composition and technological - in defining the environmental profile of the Brazilian industry.

Young and Lustosa (2002) strengthened the thesis on the environmental vulnerability of Latin American export, based on data for the period 1978-97. In the context of trade liberalization, they observed the reinforcement of the primary export pattern and an increase of the potential contaminant of Latin America exports directed to developed countries. This tendency was seen more clearly in the trade flow with the EU, one of the most environmentally sensitive markets.

1. The Environmental Profile of Brazilian Exports to EU

The methodology used here for the analysis of the environmental profile of the Brazil-EU bilateral trade follows closely Schaper (1999), making use of selected indicators for expressing scale, composition and technological effects explained as follows.

Despite the limitations of this methodology to highlight environmental impacts of trade, especially because it does not include biophysical indicators associated with each productive activity, at least it is useful to indicate trends in environmental pressure arising from the country's export specialization, and it is a way to divert from the lack of environmental data to conduct empirical studies.

1.1 Scale Effect

Trade growth increases environmental pressures demanding environmental inputs (energy and materials) and generating environmental outputs (wastes) resulting from a higher level of production and consumption (Grossman and Krueger, 1995).

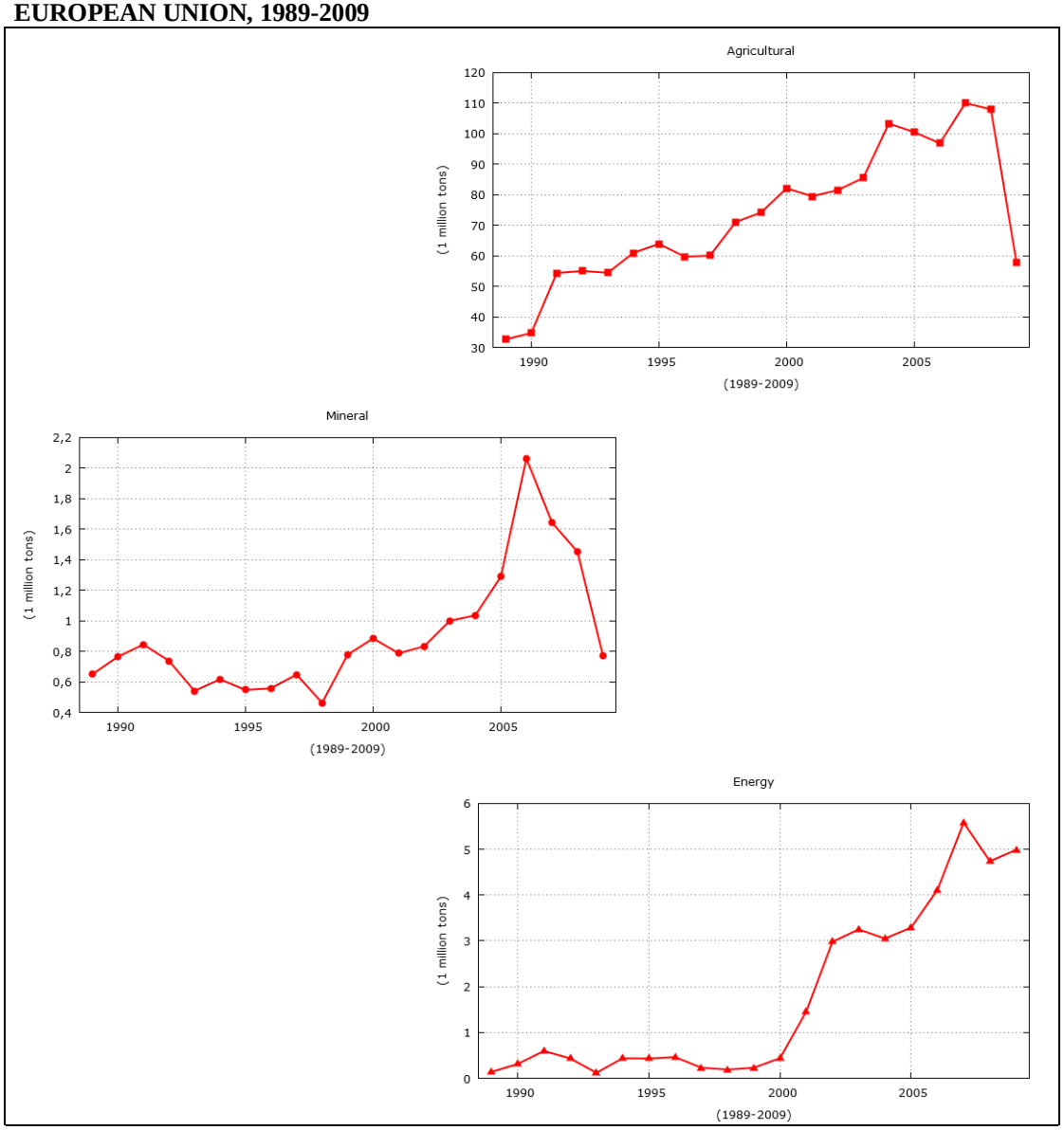
The indicator used here for the scale effect is the volume of exports of primary products (agricultural, mineral and energy) which are intensive in natural resources. Figure 1 shows a trend of significant increase in agricultural exports from Brazil to EU in the last decade (218.97% on average over the previous decade), showing a decline only in 2008, the outbreak of the world economic crisis, but coming soon to recover in the following year. Exports of minerals and energy products also increased significantly in 2000s over 1990s (94.30% and 374,141,255.80%, respectively, on average over the previous decade), although mineral exports decreased from 2006 to 2009 while energy exports accused a cyclical downturn in 2008 recovering its impressive growth trend soon after.

Another indicator for the scale effect is the volume of exports of Environmentally Sensitive Industries (IAS, *Indústrias Ambientalmente Sensíveis* - see Table 1), which are those with high pollution potential and identified by the criterion proposed by Low and Yeats (1992)[4]. All over the period 1989-2009, except 2008 the global economic crisis year, there was a persistent growth of Brazilian exports of IAS,

[4] The authors identified as Environmentally Sensitive Industries those presenting the highest costs of reduction and control of pollution in the United States based on 1988 data.

which in 2008 reached a volume about four times higher than that recorded in 1989 (Figure 2). By contrasting exports *versus* imports of IAS in the Brazil-EU bilateral trade, the difference in favor of the expansion of Brazilian exports in the last decade is quite evident (Figure 2).

FIGURE 1: VOLUME OF EXPORTS OF PRIMARY PRODUCTS FROM BRAZIL TO EUROPEAN UNION, 1989-2009



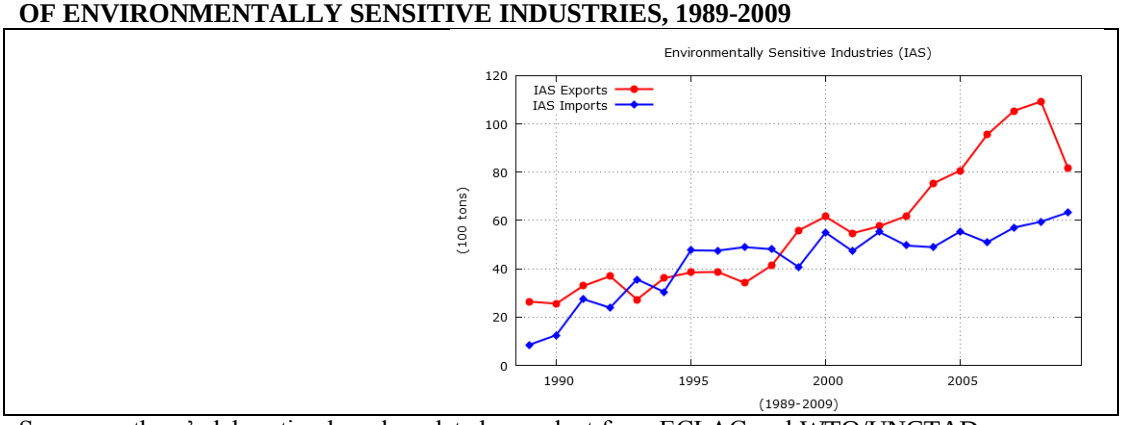
Source: authors' elaboration based on data from UN COMTRADE.
Note: A) 27 EU member states: Germany, Austria, Belgium, Bulgaria, Cyprus, Denmark, Slovakia, Slovenia, Spain, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, United Kingdom, Czech Republic, Romania and Sweden.

TABLE 1: ENVIRONMENTALLY SENSITIVE INDUSTRIES

Classification	Description		Classification	Description
251	Waste paper and pulp		678	Tubes of iron or steel
332	Petroleum products		679	Pipe fittings of iron or steel
512	Organic chemicals		681	Silver and platinum
513	Inorganic chemicals		682	Copper
514	Other inorganic chemicals		683	Nickel
515	Radioactive materials		684	Aluminum
521	Mineral tar		685	Lead
561	Manufactured fertilizers		686	Zinc
599	Insecticides, fungicides etc.		687	Tin
631	Sheets and plywood		688	Uranium
632	Articles of wood and others		689	Other non-ferrous minerals
641	Paper and paperboard		691	Finished structural parts
642	Articles of pulp, paper and cardboard		692	Metal containers for transport
661	Lime, cement and other building materials		693	Articles and wire fences
671	Pig iron		694	Nails, screws, nuts etc.
672	Ingots of pig iron or steel		695	Tools
673	Bar iron or steel		696	Cutlery
674	Sheets of iron or steel		697	Household goods
676	Belts of iron or steel		698	Base metals manufacturing and others
677	Wire of iron or steel			

Source: adapted from Schaper (1999).
Note: A) products classified according to SITC Rev. 1.

FIGURE 2: VOLUME OF BILATERAL TRADE BRAZIL-EU (IMPORTS AND EXPORTS) OF ENVIRONMENTALLY SENSITIVE INDUSTRIES, 1989-2009



Source: authors' elaboration based on data by product from ECLAC and WTO/UNCTAD.
Note: A) 27 EU member states: Germany, Austria, Belgium, Bulgaria, Cyprus, Denmark, Slovakia, Slovenia, Spain, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, United Kingdom, Czech Republic, Romania and Sweden.

1.2 Composition Effect

It depends on the contribution of different sectors for the country's export performance. Once the productive sectors differ in their potential environmental impact, changes in the composition of the export sectors can exacerbate or reduce

environmental effects. Therefore, the composition effect - also called sectoral composition effect - relates to changes in the pattern of productive specialization of the country (Grossman and Krueger, 1995).

In order to verify possible changes in export specialization in the bilateral trade Brazil-UE in the period 1989-2009, we apply three criteria and respective indicators as follows:

1) Contribution of each sector to Brazilian total exports to EU (Table 2).The data show that no significant change in the sectoral composition of bilateral trade according to the classification by type of product. In the 90s, Brazilian exports were predominantly of primary products and semi-manufactured goods (combined accounted for more than 50% of total exports) and held this performance over the next decade. Brazilian imports from the EU remained strongly concentrated in manufactured goods (on average 75.37% in the 90s and 77.16% in 2000s) while Brazilian manufactured exports to the EU remained very low throughout 1989-2009 (most of the manufactured goods exports accounted for less than 5% of Brazilian total exports).

2) Export Specialization Index (ESI) in bilateral trade Brazil-EU (Table 2). ESI is an indicator of competitiveness of each sector of a country in international markets. If its value is less than unity, it means that the country lacks a Revealed Comparative Advantage (RCA) in trade of the product in the relevant market; in the opposite case, if its value exceeds unity, it indicates that the country has a RCA in the trade of the product or industry (Schaper, 1999).

$$ESI = \frac{\frac{x_i^{BR\text{-}EU}}{X^{BR\text{-}EU}}}{\frac{m_i^{BR\text{-}EU}}{M^{BR\text{-}EU}}},$$

where: $x_i^{BR\text{-}EU}$ is equal to the exports of product *i* from Brazil to EU; $X^{BR\text{-}EU}$ is equal to Brazilian total exports to EU; $m_i^{BR\text{-}EU}$ is equal to Brazilian imports of product *i* from EU; $M^{BR\text{-}EU}$ is equal to Brazilian total imports from EU.

Table 2 shows ESI (indicated in parentheses) in bilateral trade Brazil-EU. Although Brazilian exports to EU are quite diversified by product type, the comparative advantages of our exports concentrate in primary products (all three, mainly agricultural) and semi-manufactured goods (in two categories: products based on

agricultural especially those intensive in labor but also those intensive in capital). Only one category of manufactured products (traditional industries) presents comparative advantage. Thus, the sectoral composition of our exports has not changed in 1989-2009. However, worth mentioning changes in the relative share of exports within the category of semi-manufactured products: those based on agricultural resources and labor intensive declined (31% to 18%); those based on agricultural resources and capital intensive increased (10.3% to 14.7%).

TABLE 2: COMPOSITION AND EXPORT SPECIALIZATION INDEX OF BRAZILIAN EXPORTS TO EUROPEAN UNION, 1989-2009

	1989-1994		1995-1999		2000-2004		2005-2009	
	Relat. Share (%)	ESI	Relat. Share (%)	ESI	Relat. Share (%)	ESI	Relat. Share (%)	ESI
A. PRIMARY PRODUCTS								
A.1. Agricultural	22,0	(7,8)	27,4	(22,1)	27,5	(25,3)	24,3	(23,7)
A.2. Mineral	1,9	(1,2)	1,8	(1,8)	1,2	(1,5)	1,9	(2,1)
A.3. Energy	0,0	(0,0)	0,0	(0,0)	1,7	(2,5)	3,9	(12,7)
B. MANUFACTURED PRODUCTS								
B.1. Semi-manufactured								
B.1.1. Based on agricultural resources and labor intensive	31,0	(4,6)	25,3	(3,9)	21,5	(4,6)	18,0	(3,9)
B.1.2. Based on agricultural resources and capital intensive	10,3	(37,5)	11,7	(43,1)	12,3	(51,2)	14,7	(43,6)
B.1.3. Based on mineral resources	7,9	(0,5)	5,6	(0,5)	5,9	(0,5)	6,9	(0,5)
B.1.4. Based on energy resources	0,5	(0,3)	0,3	(0,2)	0,2	(0,1)	1,0	(0,4)
B.2. Manufactured								
B.2.1. Traditional industries	4,4	(2,1)	5,4	(2,9)	5,7	(3,4)	3,3	(2,4)
B.2.2. Manufacture of basic inputs	5,4	(0,8)	5,5	(0,8)	5,7	(0,8)	6,7	(0,7)
B.2.3. New labor intensive industries								
B.2.3.a. Low technological content	0,2	(0,3)	0,2	(0,3)	0,2	(0,3)	0,2	(0,3)
B.2.3.b. Medium technological content	4,4	(0,4)	5,5	(0,4)	3,3	(0,2)	4,5	(0,3)
B.2.3.c. High technological content	2,2	(0,3)	2,2	(0,2)	3,8	(0,3)	3,5	(0,3)
B.2.4. New capital intensive industries								
B.2.4.a. Low technological content	2,8	(1,2)	2,0	(0,6)	1,8	(0,5)	2,8	(0,6)
B.2.4.b. Medium technological content	4,2	(0,2)	5,1	(0,2)	6,5	(0,3)	5,9	(0,2)
B.2.4.c. High technological content	2,5	(0,2)	1,6	(0,1)	2,2	(0,1)	2,1	(0,2)
C. OTHERS	0,4	(3,3)	0,5	(1,5)	0,5	(5,2)	0,4	(0,6)
TOTAL	100,0		100,0		100,0		100,0	

Source: authors' elaboration based on data by product from ECLAC and WTO/UNCTAD.
Notes: A) the percentages were calculated from the sum of the exports between the periods demarcated; B) 27 EU member states: Germany, Austria, Belgium, Bulgaria, Cyprus, Denmark, Slovakia, Slovenia, Spain, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, United Kingdom, Czech Republic, Romania and Sweden.

3) Contribution of IAS in Brazilian exports to EU (Table 3). Industries with the largest share in the composition of Brazilian exports of IAS are: aluminum, organic chemicals, pig iron, ingots of pig iron or steel, pulp and waste paper and plate and plywood. Almost no significant change in this composition was observed from 1989 to

2009, except for pulp and waste paper which increased its share from 6% to 19% in this period. The participation of each IAS in Brazilian total exports to EU is negligible for the vast majority of product types (usually below 2%), except aluminum and pulp and waste paper. However, all IAS together represented, on average, 18% of Brazil's total exports to EU.

TABLE 3: SELECTED ENVIRONMENTALLY SENSITIVE INDUSTRIES' EXPORTS TO EUROPEAN UNION, RELATIVE SHARE 1989-2009

		1989-1994	1995-1999	2000-2004	2005-2009
(Contribution in the IAS sector)					
684	Aluminum	17,9%	17,5%	17,0%	8,7%
512	Organic chemicals	10,7%	9,3%	8,4%	13,3%
641	Paper and paperboard	9,7%	6,0%	4,8%	3,9%
671	Pig iron	8,2%	8,1%	6,3%	8,1%
672	Ingots of pig iron or steel	6,4%	6,6%	8,0%	6,5%
251	Waste paper and pulp	6,0%	13,0%	19,4%	19,0%
631	Sheets and plywood	4,4%	7,6%	8,7%	5,0%
(Contribution of 684, 512, 641, 671, 672, 251 and 631 in total exports)					
684	Aluminum	3,2%	2,9%	3,0%	1,7%
512	Organic chemicals	1,9%	1,5%	1,5%	2,7%
641	Paper and paperboard	1,7%	1,0%	0,9%	0,8%
671	Pig iron	1,5%	1,3%	1,1%	1,6%
672	Ingots of pig iron or steel	1,1%	1,1%	1,4%	1,3%
251	Resíduos de papel e celulose	1,1%	2,1%	3,5%	3,8%
631	Sheets and plywood	0,8%	1,2%	1,6%	1,0%
(Contribution of all IAS in total exports)					
All IAS of Table 1		17,8%	16,3%	17,9%	20,0%

Source: authors' elaboration based on data by product from ECLAC and WTO/UNCTAD.
Notes: A) percentages are average of each sub-period; B) products classified according to destination of consumption (SITC Rev.1); C) 27 EU member states: Germany, Austria, Belgium, Bulgaria, Cyprus, Denmark, Slovakia, Slovenia, Spain, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, United Kingdom, Czech Republic, Romania and Sweden.

1.3 Technological Effect

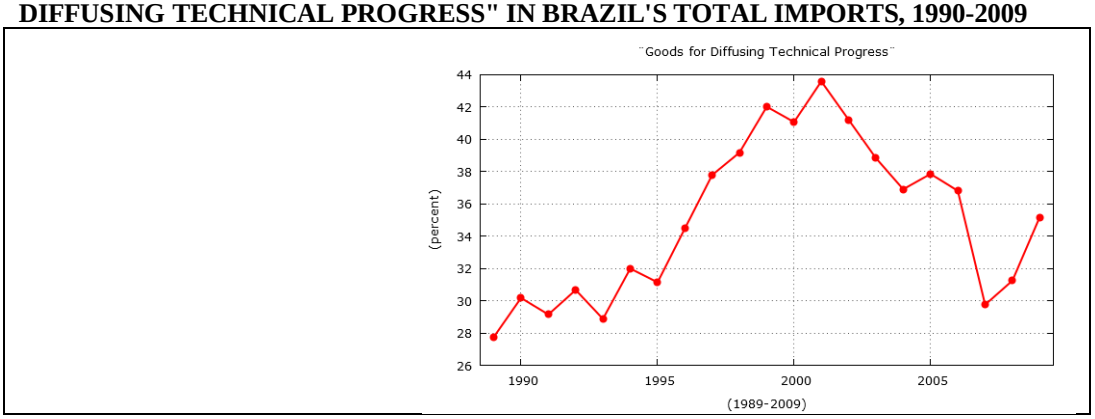
It refers to changes in the potential environmental damage of each sector. Technological innovations may reduce the resources used and emission level per unit of production. Thus, high environmental impact of export sectors may be offset by the introduction of new environmental technologies (Grossman and Krueger, 1995).

Concerning technological effect, difficulties are greater for relying on appropriate indicators. In line with Schaper's methodological approach, we apply two indicators as follows:

1) Relative share (%) of imports of 'goods for diffusing technical progress' in Brazil's total imports (Figure 3). By using the concept 'goods for diffusing technical

progress' we mean an aggregate measure, approximately, of capital goods. This indicator is based on the concept of technology embodied in capital goods and it is assumed therefore that the increase in their imports indicates a greater diffusion of technical progress in the country. According to Figure 3, imports of 'goods diffusers of technical progress' increased continuously over the 1990s reaching approximately 44% in 2001, since then showing a downward trend until 2007, returning to rise soon after (around 35% in 2009). Such imports followed the exchange rate in Brazil - valued in the 90s and devalued in the 2000s - indicating a slowdown in the pace of technical progress resulting in a very doubtful technological effect in the country.

FIGURE 3: RELATIVE SHARE (%) OF BRAZILIAN IMPORTS OF "GOODS FOR DIFFUSING TECHNICAL PROGRESS" IN BRAZIL'S TOTAL IMPORTS, 1990-2009



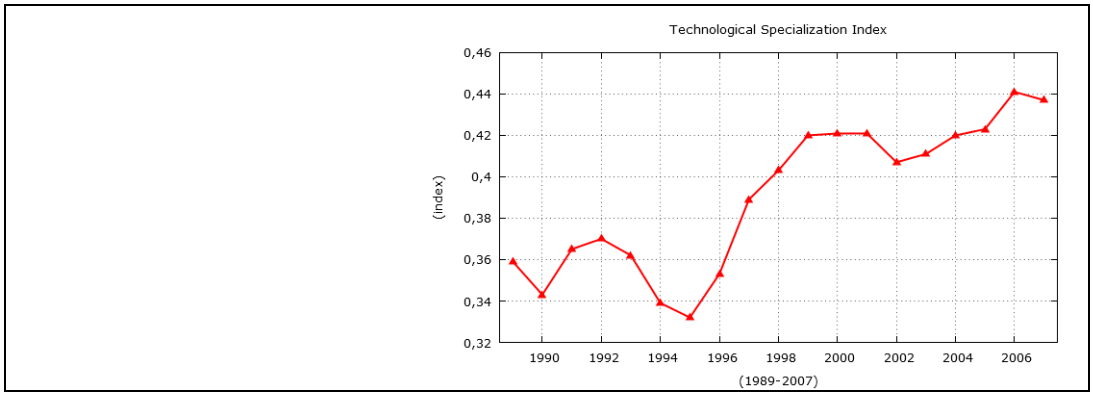
Source: authors' elaboration based on data from UN COMTRADE.
Notes: A) structure of the indicator: (mDPT/M)*100, where mDPT is Brazilian imports of "goods for diffusing technical progress" and M is Brazilian total imports; B) ECLAC's classification for "goods for diffusing technical progress", according to SITC Rev. 1: 541, 553, 7111, 7112, 7113, 7114, 7115, 7116, 7117, 7118, 712, 7141, 7142, 7143 , 7149, 715, 717, 718, 719, 722, 723, 7249, 726, 729, 734, 861, 862, 864, 9510.

2) Technological Specialization Index (TSI) (Figure 4). This is a specification of the exports specialization index to express technological content of exports. It partially reveals the technological capability of the country's productive sector, because it is

> "[...] an indicator of technological specialization of exports of a country or region and does not reflect the technological specialization of the total structure of its production. A country can develop technological capabilities in non-tradable goods or potentially tradable goods targeted mainly for the domestic market. However, as a country has a strong internal technological capacity, this should be reflected in its exports, at least in the long term." (Alcorta and Peres, (1998, p. 873)

According to Figure 4, Brazil's TSI is still very low (less than half unity) but it increased in 1989-2007 (data available until this year). This is evidence of a slight technological effect, that is, a slight reduction of environmental pressures imposed by trade growth (scale effect) and its export specialization (composition effect).

FIGURE 4: BRAZIL'S TECHNOLOGICAL SPECIALIZATION INDEX



Source: authors' elaboration based on information generated by the CAN-IET program of ECLAC.
Notes: A) main variables selected in the program CAN-IET: i) country: Brazil, ii) markets: World; B) database of the CAN-IET program follows the SITC Rev. 2.

Final Remarks

The bilateral trade between Brazil and the EU in the period 1989-2009 showed no significant structural changes especially in relation to its environmental profile, here evaluated the scale, composition and technological effects. Evidence of growth in volume of exports of sectors with high potential for environmental impact - identified as environmental inputs (resource and energy-based sectors) or environmental outputs (exports of environmentally sensitive industries) - indicates the increase of environmental pressures from trade. These are reinforced by the persistence of the Brazilian export specialization in sectors with high potential for environmental impact. On the other hand, there is some evidence of technological progress in the Brazilian production during this period time, however not enough to assure that the ongoing technological modernization effect can offset the environmental pressures arising out of scale and composition effects of these bilateral trade relations.

The bilateral trade between Brazil and the EU in twenty years (1989-2009) shows more of the same, indicating no structural change in the profile of the Brazilian foreign trade. These results corroborate previous empirical studies, that is, a

considerable inertia to promote trade relations more favorable to the transition to a green economy toward Brazilian sustainable development.

This evidence leads to a fundamental question: is possible to combine an intensive export specialization in primary and manufactured goods heavily based on natural resources and high potential for environmental damage with strategies of transition to a "green economy in the context of sustainable development and poverty eradication"?

According to the most optimistic views, yes, Brazil and other developing countries have the potential to lead the global economy in the near future – they will be soon the "locomotives of the world economy" (Canuto and Giugale, 2010). The idea behind this view is that Brazil is no longer just an ordinary exporter of commodities, but a *developer* of commodities, presenting technological progress and high productivity gains. But what about the potential for environmental damage of this trade specialization? *"The very definition of insanity is to keep doing the same thing over and over again, expecting different results"* (quotation often attributed to Einstein).

The main concern expressed here is that *if* the envisaged structural changes for the transition to a green economy in Brazil prioritize only the domestic market oriented sectors, without changing the country's trade specialization and its respective export production models, the Brazilian economy will probably be colored light green and sustainability commitments will be once again postponed.

In summary, these evidence converge to those of empirical studies carried out about ten years ago, indicating a reasonable inertia for the construction of the country's sustainable development.

Finally, it is worth emphasizing the importance of further empirical studies on the relationship between trade and environment in Brazil, especially with new methodological approaches using biophysical indicators to express clearly the environmental pressures.

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