Green growth possibilities and current economic patterns in Brazil and Latin America

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Abstract

Latin American countries are concentrating their exports in natural resources or industrial goods characterized by relatively high degree of pollution in their production processes. However, this paper shows that an alternative pattern of economic growth is possible: higher expansion of clean economic activities, "greening the economy", would bring better effects to employment and income generation. This is proved by an input-output model that compares alternative economic growth options. The results show that spurious growth based on natural resource depletion or degradation bring worse results than alternative economic options that concentrate output in higher value added products that are less harmful to the environment: employment and wage creation are higher in the scenarios where the dependence on natural resources depletion and degradation are reduced. More pollution and resource depletion would lead to less, rather than more, inclusive growth, the opposite result expected from the "Environmental Kuznets Curve".

Keywords:
Green growth; green trade; input-output; Latin America

JEL Codes: Q5; F1

1. The Green Economy Initiative as a new pattern for Latin American development

The Green Economy Initiative (GEI) "is designed to assist governments in "greening" their economies by reshaping and refocusing policies, investments and spending towards a range of sectors, such as clean technologies, renewable energies, water services, green transportation, waste management, green buildings and sustainable agriculture and forests. Greening the economy refers to the process of reconfiguring businesses and infrastructure to deliver better returns on natural, human and economic capital investments, while at the same time reducing greenhouse gas emissions, extracting and using less natural resources, creating less waste and reducing social disparities" (http://www.unep.org/greeneconomy).

The GEI is a new opportunity to reconcile the determinants of economic policy making, measured mainly by growth and employment indicators, with the social and environmental objectives of sustainable development: a strategy to overcome the development trap based on the endogenous capacity of generating and incorporating technical progress, at the same time that social issues – including environmental protection - receive the same importance as economic objectives.

Hence, investments in "clean" economic activities is a way to revert the existing trend that Latin American countries have being adopted, especially in this decade, of supplying primary goods and industrial goods that are intensive in pollution during their production process. This reversal will require well planned investment programs, encouraging technical progress and social inclusion, and avoiding the false objective of economic growth as an end in itself. This article presents empirical evidence that there is an involution in Latin America exports, with growing dependence on primary gods and pollution intensive manufactures. On the other hand, an "alternative model", based on the expansion of "clean" sectors, would bring better social and economic benefits than the current path of specialization on "dirty" activities.

2. Evolution of Latin American exports

a. Objective and methodology

The dependence upon exports based on natural resources or pollution intensive goods is a structural problem in developing countries, related to an inherent asymmetry in

international markets associated to the unequal appropriation of the benefits of technical progress. Previous studies have shown that Latin American countries were increasingly concentrating their exports in natural resources or industrial goods characterized by relatively high degree of pollution in their production processes (Young 1998, Young and Lustosa 2001, Malavasi et al. 2005). The objective of this section is to observe recent trends in Latin America (LA), verifying if exports remain getting more or less dependent on natural resources or pollution intensive goods.

Therefore, two sets of exercises are carried out to test trade trends in Latin America, using the TRADECAN 2009 databasis.[1] The first set of exercises examined the participation of natural resource based primary goods in total LA exports, and their evolution in recent years. "Natural resources" products were considered as unprocessed products from the agriculture and mining sector.

The period chosen for the analysis was 1985-2007, and the analysis was carried out for the following groups and countries: Latin America; Mercosur (Argentina, Brazil, Paraguay and Uruguay); Argentina; Brazil; Chile; Mexico.

The second set of exercises measured the specialization on pollution intensive industrial goods. For that, the industrial exports statistics from TRADECAN 2009 were combined with potential pollution indices from the Industrial Pollution Projection System – IPPS (Hettige et al. 1994), an initiative of World Bank and researchers in order to evaluate the potential contamination from industrial activities. The IPPS was created using production and emissions data from 200,000 factories in the United States (base year 1987) obtained by the US Environmental Protection Agency (EPA) merged to obtain estimates of sector pollution intensity (pollution per unit of activity).

The use of IPPS coefficients assumes that there were no significant technical differences between the production sectors in the USA and Latin American countries (at least in terms of average emission per unit of output). Therefore, since the effective degree of emission treatment in Latin America is unknown, it is very likely that errors result from the application of the IPPS coefficients. Moreover, since the denominator is expressed in monetary terms (value of production), an additional assumption is that the relative price structures in both countries are the same, which is very unlikely to happen in real terms. Finally, there is the problem of translating the classification of IPPS coefficients to the Tradecan classification - specific adjustments were

[1] Tradecan 2009 is a set of computational tools to analyzed international trade data, developed by CEPAL and the World Bank. The access to Tradecan 2009 was kindly supplied by CEPAL for this study.

necessary for that, but our interpretation is that errors induced by these changes are very minor, not affecting the main trends.

In spite of all of these problems, the IPPS coefficients can be an useful guideline order to rank industrial sectors in terms of their potential emissions[2]. Because of its simplicity and the lack of alternative systems to classify industrial pollution according to economic activities, IPPS has been used frequently as a proxy for industrial pollution intensity in developing countries.[3]

The IPPS index expresses the pollutant output intensity for six types of air pollutants (SO_2, NO_2, CO, VOC, PM10, TP), three types of water pollution (BOD, TSS and metal) and metals disposed in landfills. There is also an aggregate Linear Acute Human Toxic Intensity (ILITHA), used in this analysis as a synthesis of the pollution parameters. Pollution intensity coefficients are expressed as pollutant output (*shipment value*) divided by total manufacturing.

Note that the EPA data used to calculate the IPPS coefficients only cover facilities releasing pollutants over a threshold level of emissions. Consequently, pollution intensities based on these data are biased, since industrial units with relatively low pattern of emissions were excluded from the sample. The IPPS offers two sets of coefficients to overcome this problem:

- Interquartile: considers only the information for industrial units placed in the second and third quartile, ordered by the volume of emissions.
- Lower bound: the hypothesis that non-reporting facilities had no emissions (i.e., they were assigned with zero emissions).

In this study, the *lower bound* coefficients were considered as more appropriate to estimate the Region's industrial environmental performance. The reason is that the bias in the lower bound coefficients is known - the emissions are always underestimate the true level of emissions -, while it is not possible to oversee if the *interquartile* coefficients overestimate or underestimate actual emissions, bringing even more complicated problems of results interpretation. For the industrial pollution exercises, the same period and groups/countries described previously were considered for the analysis.

b. Results

Figure 1 shows the evolution of the share of primary goods in total exports and the average ILITHA for industrial exports considering all Latin American countries.

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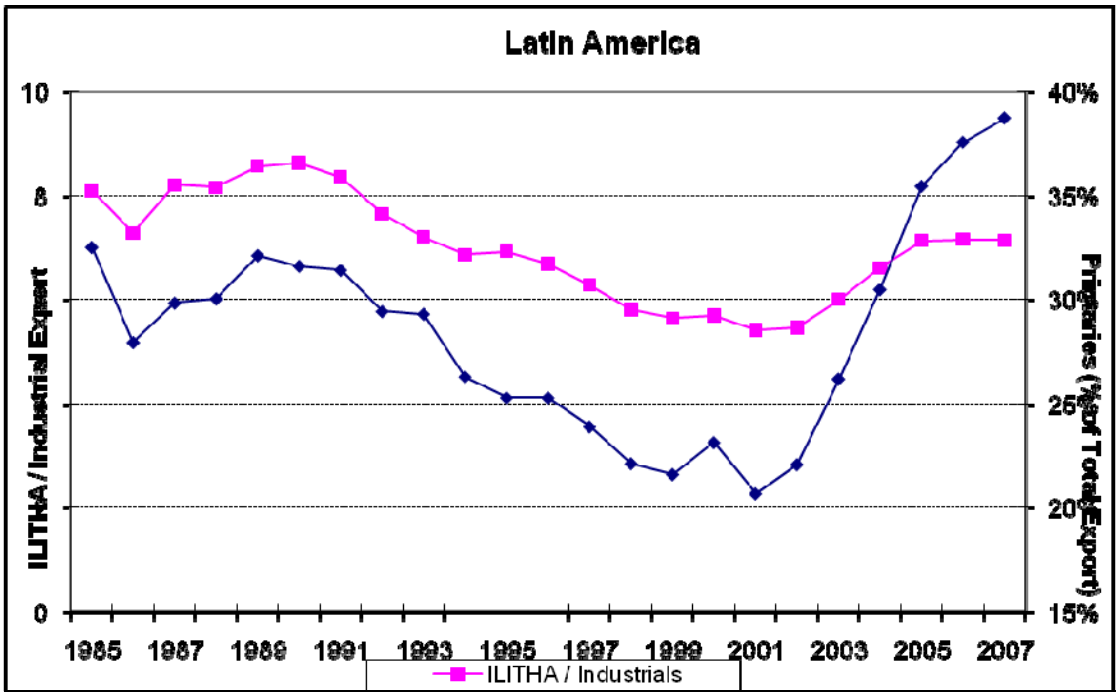
2 For more detail on the construction of the IPPS database see Hettige *et.al.* (1994).

3 For example, see Young et al. (2002) for the Brazilian experience.

Figure 1. Share of primaries in total exports and average ILITHA for industrial exports, Latin America, 1985/2007



Source: Own elaboration, based on Tradecan 2009 and IPPS

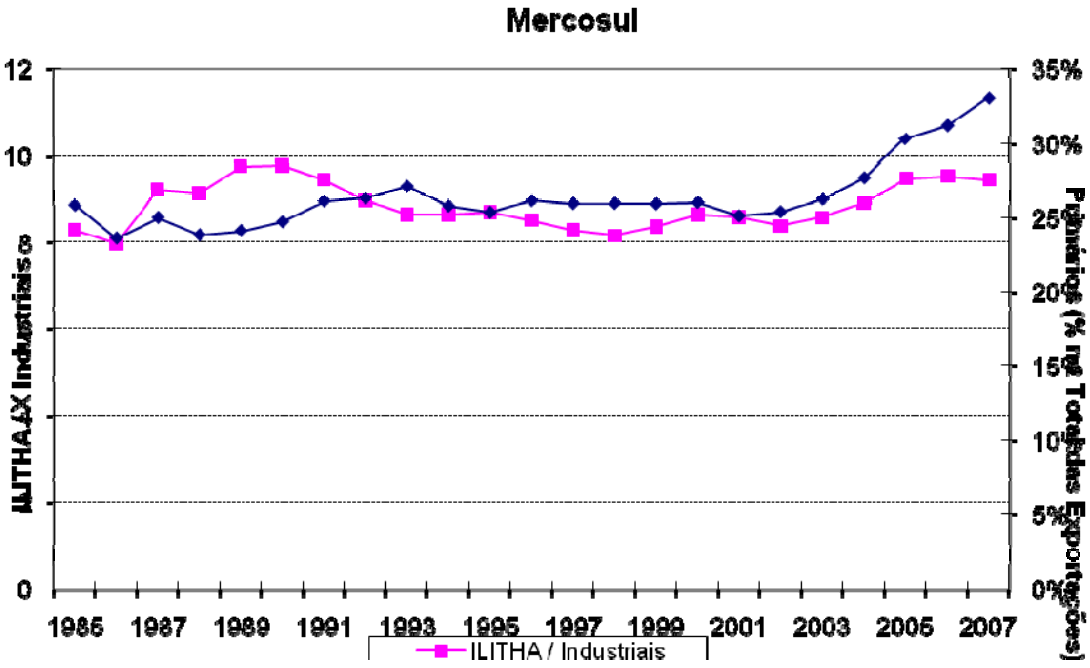
There is a clear trend of increasing dependence on primary goods exports that has accelerated quickly in the 2000s. This result is associated with the deindustrialization hypothesis, showing that the liberalization process started in the 1990s, together with the boom in commodities prices in the 2000s, have left a structural change in the Region, returning to a position where the dynamism in external markets is based upon direct sales of natural resources.

Another result that causes concern is the reversal in the dependence on pollution intensive industrial goods. In the 1990s there was a clear trend of declining ILITHA for the average of Latin American industrial exports. However, in the early 2000s of the declining trend observed for share of primary goods in total exports: in the 2000s, there is a clear path of increasing proportion of primary goods in Latin American exports. Therefore, even though the total share of industrial exports has declined, the relative participation of pollution intensive goods has increased during the period. This is an indication that Latin America has been specialized in supplying pollution intensive industrial goods in recent periods, partially offsetting the positive gains in the 1990s.

Combining both results, the 2000s have been a period where Latin American exports seem to have moved towards spurious competitiveness based on depleting the natural resource basis, instead of a virtuous cycle where trade gains would be obtained from technical progress and innovation. This issue is particularly problematic because consumers in developed countries are getting more aware of the environmental footprints of the goods they purchase, and the position of Latin America seems to be increasingly more fragile if this awareness is reflected in trade bans or other restrictions against environmentally "bad" products. This result is, thus, compatible with the hypothesis that developing countries tend to concentrate "dirty" industries that become less competitive in developed countries because of tighter environmental controls

Figure 2 presents the results for Mercosur. Again, there is a clear trend of increasing dependence on primary and pollution intensive goods. The main difference to the overall Latin American figure is that the increase of the potential toxicity of industrial exports has been more accentuated. This is a strong evidence that Mercosur is specializing on industrial "dirty" exports.

Figure 2. Share of primaries in total exports and average ILITHA for industrial exports, Mercosur, 1985/2007

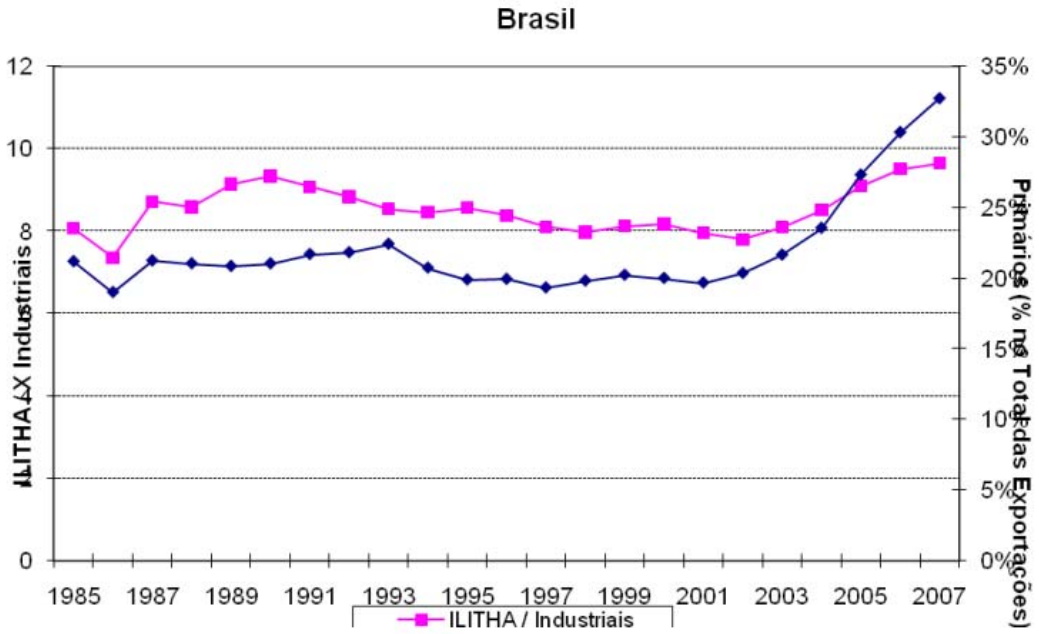


Source: Own elaboration, based on Tradecan 2009 and IPPS

The Mercosur results are strongly influenced by the evolution of Brazilian exports. Figure 3 shows that industrial exports are increasingly more emission intensive,

confirming a trend identified in previous empirical studies that have analyzed the same problem up to the mid-1990s (Young 1998; Young and Lustosa 2001).

Figure 3. Share of primaries in total exports and average ILITHA for industrial exports, Brazil, 1985/2007

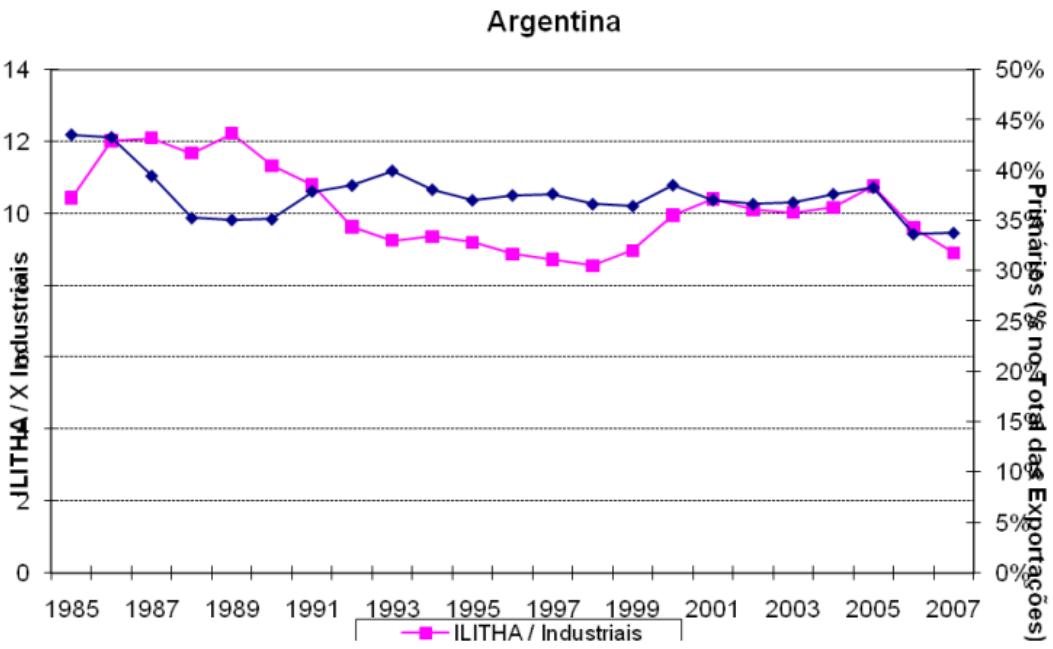


Source: Own elaboration, based on Tradecan 2009 and IPPS

This process could have been counterbalanced by the emissions "savings" created by the fast expansion of imports since the 1990s. Because they are produced abroad, there was the avoidance of emissions associated with the expansion of import goods. Note, however, that this counterbalancing effect was much attenuated by the composition of the import goods basket, compared to the exports: the growth in industrial imports was concentrated in relatively clean activities, particularly those with higher intensity in technology (electronics, for example), while the structure of industrial exports remained associated with more emission intensive sectors. Therefore, the overall reduction in the (potential) emission of pollutants in the Brazilian industry caused by imports growth was smaller than it could have been if these imports were concentrated in "dirtier" activities (intermediate goods, for example).

Figure 4 presents the results for Argentina. They differ from the previous results since there is a declining potential toxicity for industrial exports. This is probably associated to the liberalization process, which has resulted in a basket of export goods that is less intensive in the intermediate goods, ranked among the most pollutant. Another interesting feature is that the dependence on primary exports has declined, indicating a different pattern from the other countries.

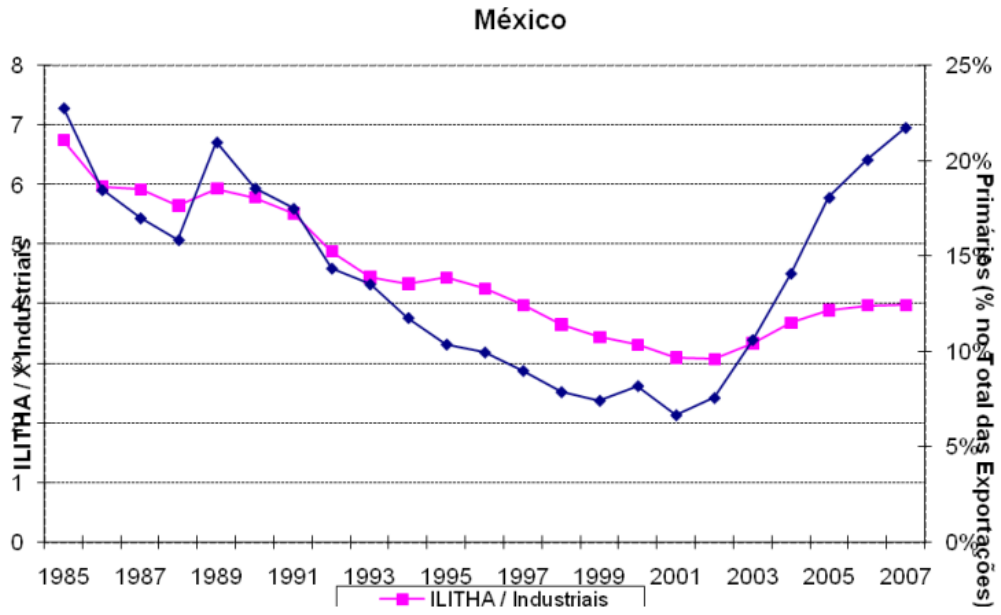
Figure 4. Share of primaries in total exports and average ILITHA for industrial exports, Argentina, 1985/2007



Source: Own elaboration, based on Tradecan 2009 and IPPS

Figure 5 shows the results for Mexico. Up to the 1990s, the Mexican case presents a similar pattern to the Argentine, since there is a clear declining trend for both the industrial toxicity and share of primary exports. This is certainly related to the increasing share of maquiladoras in industrial exports, combined to the retraction of the "heavy" (intermediate and capital goods). However, it is interesting to note that in the 2000s there is a clear reversal for both parameters, indicating a structural change in Mexican exports and a strong dependence on both primary goods and potential contaminant industrial exports.

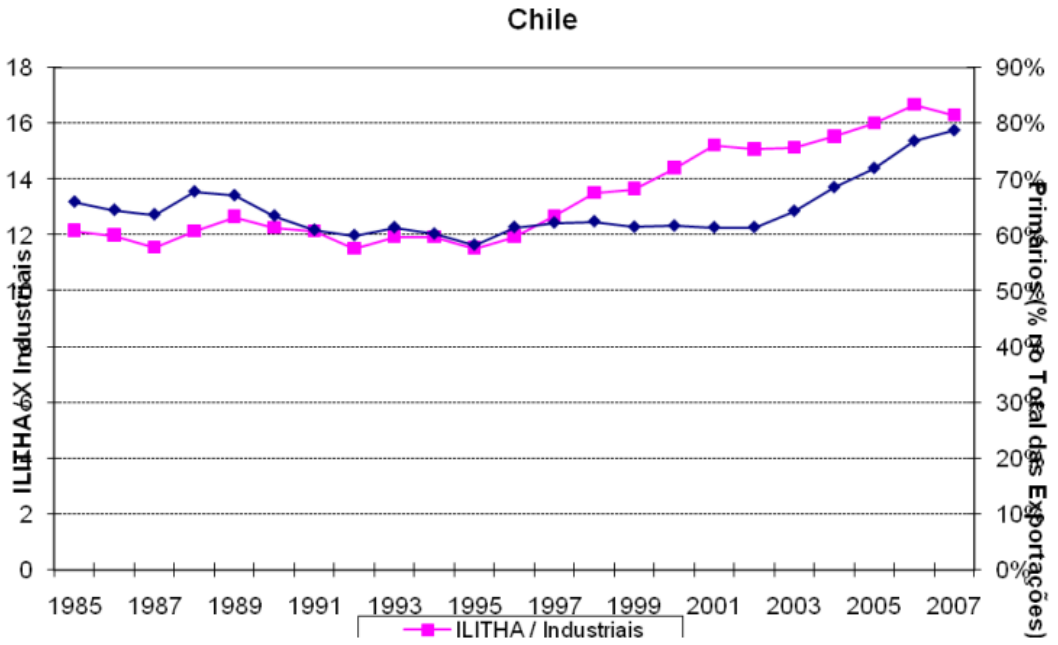
Figure 5. Share of primaries in total exports and average ILITHA for industrial exports, Mexico, 1985/2007



Source: Own elaboration, based on Tradecan 2009 and IPPS

Figure 6 presents the results for Chile, which is the case that has shown the strongest dependence on primary goods: a strong rising trend, reaching 80% of total export in 2007, much more than in the other countries. It is also the case where the highest values for the Linear Acute Human Toxic Intensity (ILITHA) had been estimated. This is a consequence of the specialization of the Chilean economy in certain niches of commodities markets (minerals, fisheries, fruits) and also the strong dependence of industrial exports on the copper productive chain.

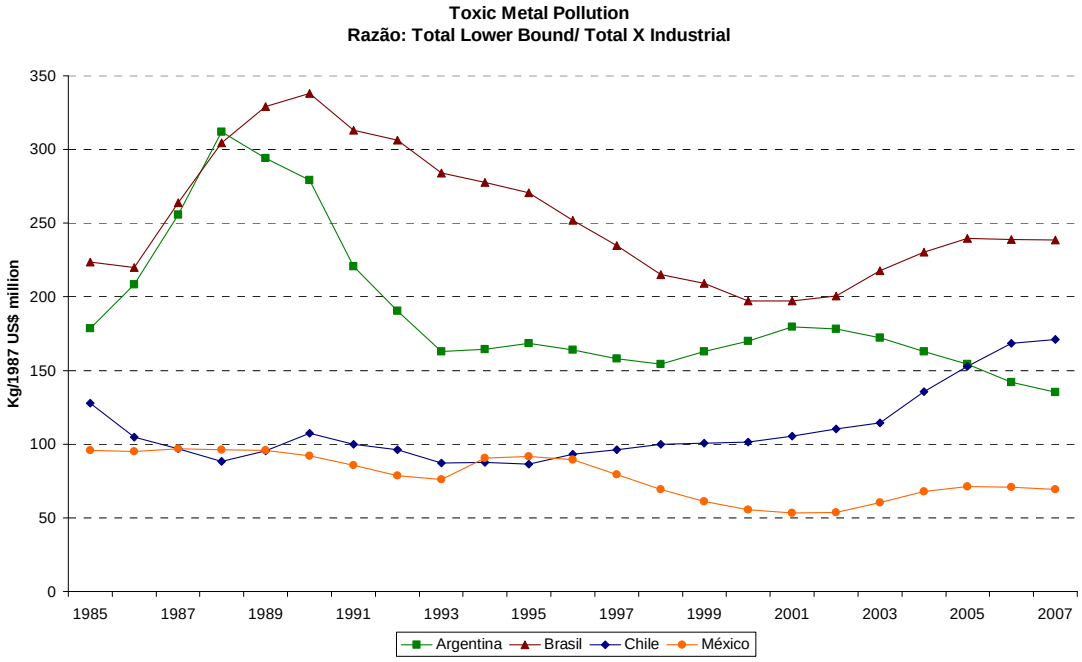
Figure 6. Share of primaries in total exports and average ILITHA for industrial exports, Chile, 1985/2007



Source: Own elaboration, based on Tradecan 2009 and IPPS

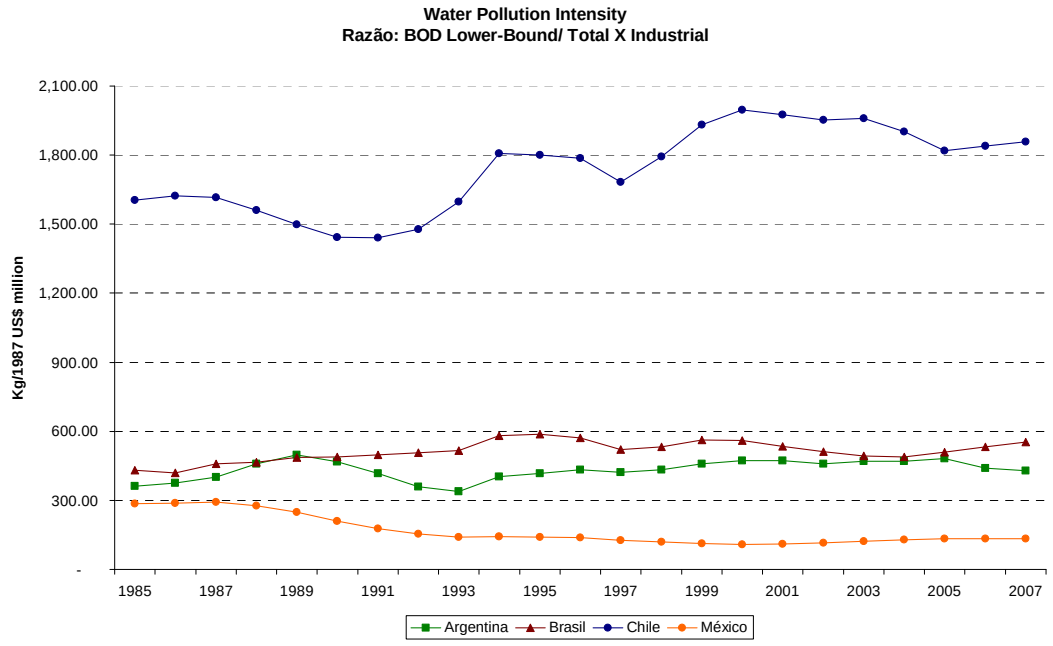
Similar exercises were carried out using other potential pollution parameters of the IPPS databasis in order to test the robustness of the results. Figure 7 present the results for toxic metal pollution, Figure 8 for organic matter in water emissions (measured by biochemical oxygen demand – BOD) and Figure 9 for total suspended solids (TSS) in the water. Even though some small differences are perceived (for example, Brazilian industrial exports are the most intensive on toxic metal pollution and TSS, while the Chilean industry has the highest value for BOD), no significant changes were perceived for the overall analysis: Brazil and Chile present worse results than Argentina and Mexico, and present a recent trend of growing specialization in relatively pollutant intensive industrial goods.

Figure 7. Intensity of toxic metal pollution in LA exports, 1985/2007



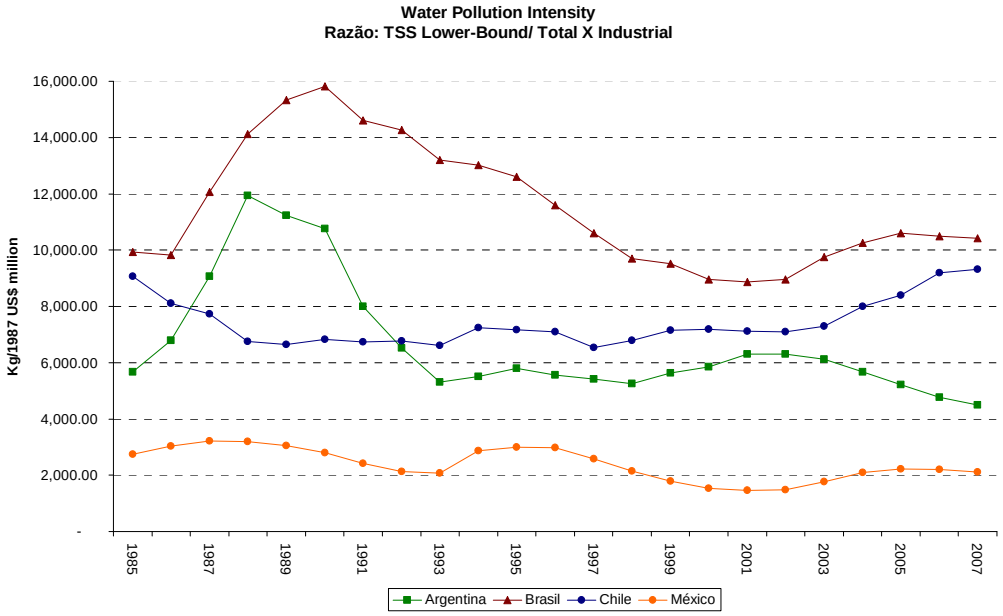
Source: Own elaboration, based on Tradecan 2009 and IPPS

Figure 8. Intensity of biochemical oxygen demand in LA exports, 1985/2007



Source: Own elaboration, based on Tradecan 2009 and IPPS

Figure 9. Intensity of total suspended solids in LA exports, 1985/2007



Source: Own elaboration, based on Tradecan 2009 and IPPS

3. Industrial pollution and social inclusion: scenarios for the future

In the previous section, it was shown that Latin America has faced a recent trend of increasing dependence on primary goods and pollution intensive exports. This has obvious negative consequences to the environment. However exports have been a main driver of economic growth, and it is often argued that environmental damages are a necessary price to pay for increasing economic activity.

The implicit hypothesis behind this vision is that economic activity and environmental conservation are necessarily in opposition, thus policy makers have to decide in either to increase employment and income or to halt economic growth to preserve natural resources. The objective of this section is to show that an alternative pattern of economic growth is possible. Indeed, the argument behind GEI is that greening the

economy would bring positive effects to the level of employment and income in both short and long term.

This section examines this issue, testing if spurious growth based on natural resource depletion or degradation bring better or worse results than alternative economic options that concentrate output in higher value added products that are less harmful to the environment. To illustrate this argument, scenarios were built up using the 2005 Brazilian Input-Output table. These scenarios compare different economic growth options, using the generation of employment and wages as measurement of growth. Among other reasons, employment and wage generation are better indicators of "socially inclusive" growth, since they express welfare in better terms than the total expansion of value added (GDP) – considering the outstanding income concentration in Latin America, it is important to avoid measures of growth that do not consider the distribution of income.

Two exercises are made, trying to answer the following questions:

- What does generate more growth: expansion of natural resource based activities, manufacturing goods or services?
- Within the manufacturing sector, what does generate more growth: expansion of more or less pollution intensive goods?

The advantage of using the input-output model is that is it allows the perception of the entire production chain. In order to make the scenarios comparable, all of them are based in similar expansion of final demand, through an exogenous increase in exports.

There are many limitations in the use of the input-output model. Technical coefficients and relative prices are assumed to be constant, as if the economy remains statistic during the period of analysis. The use of Brazilian input-output tables to represent Latin American economies is also questionable since there are specificities in the Brazilian economy that are not repeated elsewhere. Moreover, there are no actual emission coefficients, but only potential estimates based on outdated models, such as the Industrial Pollution Projection System (IPPS) that bases this analysis.

In spite of all the problems related above, input-output exercises based on a real economy provide many important insights since they allow the consideration of inter-

sector chains and are a much more effective way to simulate alternative growth possibilities than purely speculative assumptions that are not tested about the consistency of their results.

a. Methodology

The exercises simulate an expansion of the exports in R$ 40 Billions (at 2005 prices), or approximately 18% of the Brazilian industrial exports in 2005. Each different scenario distributes this total amount according to different sectors.

The first question to be answered is to know which sector generates more growth, measured by the increase in jobs and wages. The economy was divided in three major sectors: expansion of natural resource based activities, manufacturing goods or services -, and the total expansion in exports (R$ 40 Billion) was distributed according to this:

- Scenario 1 assumes that this expansion is distributed between primary activities according to the same proportion as observed in 2005.
- Scenario 2 assumes that this expansion is distributed between manufacturing activities according to the same proportion as observed in 2005.
- Scenario 3 assumes that this expansion is distributed between services, industrial utilities and civil construction according to the same proportion as observed in 2005.

The second question to be answered is to know if there are differences between growth lead by “dirtier” and “cleaner” industries in terms of employment and wages generation. To answer that, Scenario 2 is divided in two sub-scenarios in which industrial activities are divided according to their potential pollution intensiveness according to the IPPS: the top 10 pollutant industries according to the IPPS were separated from the rest of the industry.

- In Scenario 2.1, it is assumed that most of the exports expansion (R$ 30 Billion) has been concentrated in the top 10 pollutant industries, while the exports

expansion of less pollutant industries has been restricted to only R$ 10 Billion. Within each sub-group, the total amount is distributed between manufacturing activities according to the same proportion as observed in 2005.

- Scenario 2.2 reverts the previous one, assuming that the top 10 pollutant industries have increased only R$ 10 Billion, and the less pollutant activities had their exports increased by R$ 30 Billion.

The top 10 pollutant industrial activities, according to the IPPS are (the IBGE 55-level classification is presented between parentheses):

- Wood products, excluding furniture (0306)
- Pulp and paper products (0307)
- Petroleum refineries and coke (0309)
- Chemical products (0311)
- Resins and elastomers (0312)
- Chemical products and prepares – diverse (0317)
- Cement (0319)
- Other non-metallic products (0320)
- Steel manufacturing (0321)
- Non-ferrous metallurgy (0322)

The total output associated to each of these scenarios was obtained by multiplying the Leontief matrix by the respective expansion in exports. Then, the increase in jobs (occupied personnel) was estimated by multiplying the job/output coefficient (ratio between employment and output value per activity) by the output expansion per sector. Equation 1 summarizes the procedure:

$$\Delta N_i = (N/VP) \, . \, (I - A)^{-1} \, . \, \Delta X_i \qquad (1)$$

Where:

ΔN_i: Employment expansion in scenario "i"

N/VP: Employment/Output Value

$(I - A)^{-1}$: Leontief Matrix

ΔX_i: Expansion of exports in scenario "i"

The increase in wages (including social contributions) was estimated in similar terms by multiplying the wages/output coefficient (ratio between wages, including social contributions, and output value per activity) by the output expansion per sector. Equation 2 summarizes the procedure:

$$\Delta W_i = (W/VP) \,.\, (I - A)^{-1} \,.\, \Delta X_i \qquad (2)$$

Where:

ΔW_i: Wages expansion in scenario "i"

W/VP: Wages/Output Value

b. Results

Table 1 presents the aggregate results for each scenario. It is very interesting that, even though the aggregate expansion in exports is the same in all scenarios (R$ 40 Billion), the results vary considerably both in terms of employment and wage generation.

Table 1. Employment and wage creation per scenario

	Scenario 1 Expansion in Primary Activities	Scenario 2 Expansion in Manufacturing Activities (linear)	Scenario 2.1 Expansion in Manufacturing Activities (more pollutant)	Scenario 2.2 Expansion in Manufacturing Activities (less pollutant)	Scenario 3 Expansion in Services, Utilities and Construction
Estimated employment creation	2,476,906	1,351,194	1,050,523	1,409,478	2,008,166

Estimated wages creation	11,182	13,186	11,747	13,464	15,220

Source: Own elaboration, based on IBGE 2005 Input-Output Tables.

At a first glance, it seems that the expansion of primary activities would have favored employment the most since Scenario 1 presents the highest value for jobs. However, two elements have to be considered.

First of all, the expansion in primary activities generates the smallest expansion in wages, indicating that the quality of jobs created by these sectors is the worst among all scenarios. The results from Scenario 3, characterized by activities identified with "dematerialized growth", shows that total wages would have been 36% more than in Scenario 1, even though employment would have increase 19% less.

The second element to be considered is the dynamic effect. As already pointed out, input-output models project current patterns to the future, keeping all technical parameters constant over time. However, rapid mechanization in agriculture production and the growing capital intensiveness in the mining sector have had the effect of displace labor. Therefore, these sectors are responsible for net unemployment, rather than employment. This can be proven looking at Brazilian National Accounts: the rapid expansion in these activities, increasing their share in the GDP from 7.2% to 8.4% in the 2000-2006 period, has been accompanied by a steady reduction in the total labor force, from 22.4% to 19.8% in the same period (Table 2).

Table 2. Primary Activities GDP and Employment as % of Total Brazilian Economy

	2000	2001	2002	2003	2004	2005	2006
% of Primary Activities in Total GDP	7.2 %	7.4 %	8.2 %	9.1 %	8.8 %	8.2 %	8.4 %
% of Primary Activities in Total Employment	22.4%	21.3 %	21.1 %	21.1 %	21.5 %	21.0 %	19.8 %

Source: Own elaboration, based on IBGE National Accounts

On the other hand, the expansion in Scenario 3 shows a good employment performance (the second highest volume of jobs created) and the largest increase in total wages. Note that Scenario 3 is the most identified with "greening" the economy, since it concentrates civil construction (investments in "cleaning" the economy require essentially civil construction) and services, the basis of a "dematerialized" growth based on knowledge, culture and technology.

Inside the manufacturing sector, a similar trend is perceived. The expansion of exports concentrated in the group of less pollutant industries (Scenario 2.2) would have generated 34% more jobs and 15% more wages than in the Scenario 2.1 where the dynamic sectors are the most pollutant. This is related to the fact that most of the sectors of high pollutant potential produce intermediate goods, being very capital intensive and demanding relatively few jobs.

The message of the scenarios analysis is clear: it is a fallacy to consider that developing countries have to decide between economic growth and environmental quality. The scenarios that have presented most consistent results for better economic activity, measured by employment and wage creation, are exactly the ones in which the dependence on natural resources depletion and degradation are reduced. Therefore, there is no reason to believe that an "Environmental Kuznets Curve" has to be pursued to achieve higher economic activity: more pollution and resource depletion would lead to less, rather than more, inclusive growth.

Conclusions

This paper has shown that the Green Economy Initiative is an opportunity to start a new development pattern based on the endogenous capacity of generating and incorporating technical progress, but being socially inclusive and environmentally responsible. In that sense, there are many similarities with the original concept of industrialization proposed in the Centre-Periphery Model: long-lasting development can only be achieved when the economy becomes more intensive in innovation and less dependent on the extensive exploitation of the natural resources basis,

However, empirical exercises have shown that there is a clear trend, since the late 1990s, of increasing dependence on primary goods exports and industrial goods that are intensive in pollution during their production process. This result is of great concern, since it shows that Latin American economies are doing the opposite of what is demanded by sustainable development principles. Moreover, there is a growing risk that punishment mechanisms could be established against "dirty" products in international trade, with obvious damage to the countries that have their exports associated to the degradation or depletion of natural resources.

The main argument for those who defend the status quo is that developing countries have to decide between economic growth and environmental quality. The implicit hypothesis behind this vision is that economic activity and environmental conservation are necessarily in opposition, thus policy makers have to decide in either to increase employment and income or to halt economic growth to preserve natural resources. This is known as the "Environmental Kuznets Curve", and, despite being commonly referred to in the literature, no undisputable evidence is presented that a "dirty" pattern of economic growth would bring better results than greening the economy .

In order to test the differences in terms of employment and wages creation under "dirty" and "clean" patterns, scenarios were created, using input-output techniques, to simulate employment consequences of different growth patterns. In each scenario, the same amount of final demand was considered, but with different sectoral distribution. Employment and wages were considered as measurement of growth because they are better indicators of social inclusion, expressing welfare in better terms than GDP.

The results are very consistent showing that spurious growth based on natural resource depletion or degradation may bring much worse results than alternative economic options that concentrate output in higher value added products that are less harmful to the environment. The scenarios with higher employment and wage creation are exactly the ones in which the dependence on natural resources depletion and degradation are reduced. More pollution and resource depletion would lead to less, rather than more, inclusive growth, the opposite result expected from the "Environmental Kuznets Curve".

Finally, it must be highlighted that the results presented in this report have important limitations concerning the methodology and hypotheses used, and that data quality is far from desirable. The improvement of data generation and production of environmental indicators are an important need to improve our understanding about the relationship between trade and competitiveness issues and the environment. Therefore, another policy recommendation is the implementation of an effective system of environmental information connected to the already existing economic indicators.

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