Incorporating Import Coefficients into a Structural Decomposition Analysis: An Empirical Investigation on Brazilian Growth Sources

Guilherme Riccioppo Magacho[1]

This paper extends the Structural Decomposition Analysis (SDA) in order to consider the substitution between domestic and imported inputs. The aim of this new approach is to provide a detailed investigation of the consequences of changes in countries' supply chains for economic growth. The method is applied to Brazilian and other countries data. It suggests that the substitution of imported for national inputs is a key factor on SDA, once the impact of technological change is underestimated if this substitution is not taken into account.

Furthermore, the paper also shows that the substitution of imported inputs is essential to understand Brazilian growth path in the 2000s, once the positive impacts of exports growth on total output is compensated by the increase in imported inputs, especially regarding the high technological sectors. Brazilian results contrast with Korea, China and Germany, which were the most benefited from the integration of global supply chains.

Key words: Structural Decomposition Analysis, Input-Output, Open Economies Growth, Deindustrialisation, Structural Changes

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[1] Ph.D. student at Department of Land Economy – University of Cambridge, UK.

1. Introduction

The process of economic openness which started in the 1990s had significant impacts on Brazilian production chains. From a global perspective, Brazil was integrated into global supply chains, and this permitted an increase in exports not witnessed in decades. On the other hand, these changes may have resulted in the substitution of imported inputs for domestic suppliers. As a result, the potential for growth in demand to precipitate economic growth may have declined, provided that domestic absorption of demand has fallen.

In order to analyse this complex process a relevant aspect which should be taken into account is which sectors have changed more substantially, and what implications it has on economic growth. In contrast to Asian economies, where economic growth in the last two decades was led by the increase of high-tech exports, in Brazil, the wealth effect of primary product exports was one of the most important variable in the recent economic growth. An economic growth led by primary sectors, however, may result in a relevant constraint for economic growth in the long-run. Although one can argue that expansion based on the production and exports of primary goods did not have a negative effect in the economy, there is a large (and growing) literature which is attempting to demonstrate the limitations in promoting growth based on these sectors.

Kaldorian and structuralist approaches, for example, show that primary sectors do not present dynamic increasing returns to scale (McCombie, Pugno & Soro, 2002[2]; Angeriz, McCombie & Roberts, 2008) and they present low income elasticities of demand for exports (Gouvea and Lima, 2010). Hence, exports of primary goods may constraint growth in the long run. Moreover, the argument in favour of production of sophisticated goods is increasing even in approaches grounded in the neoclassical growth models. It is argued that these sectors hold vast amount of productive knowledge (Hausmann, Hidalgo et al, 2011) and that they are fundamental to the convergence of productivity levels among countries (Rodrik, 2013).

Thereby, decomposing Brazilian structural changes during this period is relevant to understand how it affected the demand absorption and thus the country's growth rate. Furthermore, it also important to analyse the decomposition of changes in industrial chains to determine the sectors in which the substitution of imported inputs for domestic

[2] See McCombie, Pugno & Soro (2002) for a review of empirical evidences in this topic.

inputs is more intense and those in which export growth have compensated for its negative impacts on output.

The Structural Decomposition Analysis (SDA) considers that shifts in total output essentially depend on changes in final demand and in intermediate consumption. Changes in final demand affect total output directly, and, as intermediate consumption depends on input-output coefficients, total output is also affected by shifts in them. In this paper, however, we develop a method to decompose these changes in intermediate consumption into two: technlogical changes and substitution of imported inputs. The aim of this decomposition is to identify to what extent output growth across sectors is affected by the substitution between domestic and imported inputs. This analytical tool is relevant to provide a detailed investigation of the consequences of changes in countries' supply chains for economic growth. From this decomposition it is possible to compare negative effects of the substitution between domestic and imported inputs and its positive effects on export growth among sectors and countries.

This paper is divided into six sections after this introduction. First, we discuss the evolution of SDA and its limitations, as well as its applications for Brazil. After that, we extend this method to incorporate substitution between national inputs and imports. Section 3 applies this analytical tool to the Brazilian data, and Section 4 compares these results to the contribution of exports in order to evaluate the net impacts of the substitution between national inputs and imports on output. Section 5 applies this analytical tool to other economies with the aim of comparing Brazil with other countries. Finally, the last section discusses the relevance and limitations of this approach we purpose.

2. SDA method and its applications

Leontief (1936, 1941) was the first to conduct economic structural analysis using Input-Output (I-O) methods. Following his work, this method has been widely used in such analyses and to analyse the effects of economic conditions on political outcomes, e.g., through the use of backward and forward linkages (Hirschman, 1958; 1968). Nevertheless, the use of decomposition methods to analyse the sources of structural changes was only introduced in the 1970s by Skolka's inaugural paper (Skolka, 1977).

Many studies have applied this methodology to different countries, such as Feldman, McClain & Palmer (1987) for the United States and Skolka (1989) for

Austria. Feldman, McClain & Palmer (1987) decomposed industry output changes in the United States in 1963 and 1978 into changes in final demand (level and mix of products) and changes in input-output coefficients. Skolka (1989), alternatively, analysed the composition of net output in terms of the contributions of technological shifts, domestic final demand, foreign trade, and labour productivity.

In the 1980s and 1990s, SDA methods became an important analytical tool in structural studies and different methods were developed. As a result, Rose & Casler (1996) and Dietzenbacher & Los (1998) developed critiques of the methodology. Rose & Casler (1996) described the fundamental principles behind alternative SDA methods, while Dietzenbacher & Los (1998) discussed the problems caused by the application of different SDA methods.

Despite being used widely to understand structural changes in different economies, this method was not applied to analyse the effects of changes in coefficients due to substitution between imports and domestic suppliers on output growth. Recently, Pei et al. (2011) analysed the effect of Chinese import growth regarding its vertical specialisation. The authors, however, did not use this method to evaluate the demand that was not absorbed domestically as a consequence of substitution between domestic suppliers and imports. From a Kaldorian perspective, it is crucial to understand why countries' growth rates may decline in the long-run.

In the case of the Brazilian economy, Guilhoto et al. (2001) decomposed the changes in economic structure between 1959 and 1980 and compared them with those in the United States. The authors confirmed prior findings regarding the role of changes in final demand in determining the growth rate of sectoral output in Brazil during the 1960s and 1970s.

More recently, Messa (2012) and Moreira & Ribeiro (2012) applied SDA methods to Brazilian data to decompose structural changes in the 2000s. Although Messa (2012) showed that declines in the intermediate consumption of domestic industrial output is the most important determinant of the growth differential between services and industry, the author did not decompose changes in input coefficients between technical change and domestic supply substitution. Moreover, Moreira & Ribeiro (2012) performed a similar analysis and concluded that output growth was primarily explained by changes in final demand, while technical progress (measured by input coefficients) had less of an impact.

Thus far, however, studies have failed to account for the effect of substitution between domestic suppliers and imports. Therefore, an analytical decomposition of recent Brazilian growth is necessary to verify the extent to which this country has been achieving low growth rates due to substitution between imported and domestic inputs in sectors that have the potential to increase the country's growth rate.

3. Incorporating substitution between domestic inputs and imports to SDA

Initially, changes in gross output by sectors is decomposed into the impacts of final demand growth and changes in Leontief coefficients (the coefficients on direct and indirect inputs). The SDA method is applied following Miller & Blair (2009) approach. Considering the basic Leontief model for two distinct years (0 and 1), the vector of gross output *x* in year *t* = 0, 1 is given by:

$$x^1 = L^1 f^1 \text{ and } x^0 = L^0 f^0 \quad (1)$$

where *L* is the Leontief matrix of direct and indirect production coefficients, and *f* is the vector of final demand. So, the observed change in gross output is:

$$\Delta x = x^1 - x^0 = L^1 f^1 - L^0 f^0 \quad (2)$$

Some possible re-arrangements may be employed to decompose the changes in *L* and *f*, and it effects on Δx. Two alternatives methods are presented:

$$\Delta x = L^1(f^0 + \Delta f) - (L^1 - \Delta L)f^0 = (\Delta L)f^0 + L^1(\Delta f) \quad (3)$$

$$\Delta x = (L^0 + \Delta L)f^1 - L^1(f^1 - \Delta f) = (\Delta L)f^1 + L^0(\Delta f) \quad (4)$$

Here, I will focus on the average approach of these two methods. According to Dietzenbacher and Los (1998) this approach is often an acceptable method for SDA. Addicting (3) and (4)

$$2\Delta x = (\Delta L)f^0 + L^1(\Delta f) + (\Delta L)f^1 + L^0(\Delta f) \quad (5)$$

and so

$$\Delta x = \frac{1}{2}(\Delta L)(f^0 + f^1) + \frac{1}{2}(L^0 + L^1)(\Delta f) \quad (6)$$

where the first term is the effects of the change in Leontief coefficients over the change in gross output, and the second term is the effects of change in final demand.

After that, changes in Leontief coefficients have to be partitioned into technological changes and substitution between national and imported inputs. Given $L^1 = (I - A_n^1)$ and $L^0 = (I - A_n^0)$, where A_n is the national direct coefficients matrix, postmultiply L^1 through by $(I - A_n^1)$

$$L^1(I - A_n^1) = I = L^1 - L^1 A_n^1 \quad (7)$$

and premultiply L^0 through by $(I - A_n^0)$

$$(I - A_n^0)L^0 = I = L^0 - A_n^0 L^0 \quad (8)$$

Rearrange (7) and postmultiply by L^0

$$L^1 - I = L^1 A_n^1 \Rightarrow L^1 L^0 - L^0 = L^1 A_n^1 L^0 \quad (9)$$

Similarly, rearrange (8) and premultiply by L^1

$$L^0 - I = A_n^0 L^0 \Rightarrow L^1 L^0 - L^1 = L^1 A_n^0 L^0 \quad (10)$$

Subtract (10) from (9)

$$\Delta L = L^1 A_n^1 L^0 - L^1 A_n^0 L^0 = L^1(\Delta A_n)L^0 = L^1(A_n^1 - A_n^0)L^0 \quad (11)$$

Since A_n^t is the difference between total direct coefficient matrix (A^t) and direct coefficient matrix of imported goods (A_m^t), the change in Leontief matrix can be written alternatively as

$$\Delta L = L^1[(A^1 - A_m^1) - (A^0 - A_m^0)]L^0 \quad (12)$$

Rearranging, the decomposition of change in Leontief matrix into technological changes and substitution between national and imported goods is given by

$$\Delta L = L^1(\Delta A)L^0 + L^1(-\Delta A_m)L^0 \quad (13)$$

where the first term is the contribution of the changes in total direct coefficients (technological change[3]) to changes in Leontief coefficient, and the second term is the contribution of change in imported direct coefficients (substitution of national inputs).

Finally, substituting (13) in (6) the total output growth can be partitioned into the contribution of (i) technological change, (ii) substitution between national inputs and imports, and (iii) final demand growth:

$$\Delta x = \underbrace{\frac{1}{2}[L^1(\Delta A)L^0](f^0 + f^1)}_{technological\ change} + \underbrace{\frac{1}{2}[L^1(-\Delta A_m)L^0](f^0 + f^1)}_{substitution\ of\ national\ inputs} + \underbrace{\frac{1}{2}(L^0 + L^1)(\Delta f)}_{final\ demand\ growth} \quad (14)$$

4. Applying this analytical tool for Brazil

The method developed in this paper was applied to Brazilian data from 1995 to 2008 and to a set of comparison countries[4]. These data are available in The World Input-Output Database (WIOD). This database covers most of the major world economies (including Brazil) between 1995 and 2008, and the data are available in both current and previous years' prices. Thus, changes in prices and quantities may be analysed separately, which reduces the bias caused by volatility in exchange rates and relative price changes.

The equation (14) was carried out year-by-year from 1995-96 to 2007-08 aiming to compare tables valued in the same year prices, and then growth rates were accumulated to obtain changes in quantities. Therefore, the percentage changes ($\Delta\%$) obtained are Chain-Laspeyres *quantum* indices. For example, to obtain changes between

[3] In SDA technological changes mean changes in input-output coefficients, which do not necessarily imply on technological growth, once the total output per worker may not change over time. The result will be positive for output growth if the production of other sectors is using more of the sector under consideration's output as its input.

[4] The World International Input-Output Database (WIOD) presents data from 1995 to 2009. However, data for the last year were not obtained from Brazilian National Accounts System (SCN, in Portuguese) and it was excluded from analysis to avoid bias the final results.

1995 and 1997, changes from 1995 to 1996 (in 1995 prices) were accumulated with changes from 1996 to 1997 (in 1996 prices), as follow:

$$\Delta\%x^{1995-1997} = \left[\left(1+\frac{\Delta x^{1995-1996}}{x^{1995}}\right)\left(1+\frac{\Delta x^{1996-1997}}{x^{1996}}\right)-1\right]\cdot 100 \quad (15a)$$

$$\Delta\%A^{1995-1997} = \left[\frac{\Delta A^{1995-1996}}{x^{1995}}+\left(1+\frac{\Delta x^{1995-1996}}{x^{1995}}\right)\frac{\Delta A^{1996-1997}}{x^{1996}}\right]\cdot 100 \quad (15b)$$

$$-\Delta\%A_m{}^{1995-1997} = \left[\frac{-\Delta A_m{}^{1995-1996}}{x^{1995}}+\left(1+\frac{\Delta x^{1995-1996}}{x^{1995}}\right)\frac{-\Delta A_m{}^{1996-1997}}{x^{1996}}\right]\cdot 100 \quad (15c)$$

$$\Delta\%f^{1995-1997} = \left[\frac{\Delta f^{1995-1996}}{x^{1995}}+\left(1+\frac{\Delta x^{1995-1996}}{x^{1995}}\right)\frac{\Delta f^{1996-1997}}{x^{1996}}\right]\cdot 100 \quad (15d)$$

The same method was applied from 1995 to 2008, which means that 1995 is the base-year for all results. Table 1 presents the main findings for Brazil[5]:

Table 1 – Decomposition of Brazilian output growth (1995-2008)

	Δ% A	*–Δ% Am*	*Δ% f*	*Δ% X*
Total	***10.0%***	***-9.0%***	***45.1%***	***46.0%***
Agriculture and Mining	**29.2%**	**-22.6%**	**64.9%**	**71.4%**
Manufacturing	**4.7%**	**-13.5%**	**41.8%**	**32.9%**
Low/Med-Low Tech Manufacturing	-0.9%	-8.5%	34.7%	25.4%
High/Med-High Tech Manufacturing	15.1%	-23.2%	55.0%	46..9%
Chemicals and Chemical Products	22.3%	-28.8%	33.2%	26.7%
Machinery, Nec	2.7%	-12.4%	80.8%	71.2%
Electrical and Optical Equipment	24.4%	-34.3%	31.8%	22.0%
Transport Equipment	7.7%	-13.5%	90.8%	85.0%
Services	**10.6%**	**-4.7%**	**44.7%**	**50.6%**

Authors' elaboration based on WIOD

From Table 1 it is possible to assess the relevance of the decomposition of changes in the Leontief coefficient into changes in technology (*Δ% A*) and substitution of imported inputs for domestic inputs (*–Δ% Am*). For the economy as a whole, nearly all of the positive effects of changes in technology on total output are compensated by the increase in imported inputs. Although final demand growth was responsible for 45.1% of the total 46.0% growth in the period 1995-2008, the inclusion of substitution

[5] See in the appendix the results for all sectors and years.

between imported and domestic inputs permitted by the SDA method allows us to conclude that technological change also has a relevant impact (10.0%). However, this impact is compensated by the increase in import coefficients (-9.0%), and thus technological change had limited effects on total output.

Moreover, the analysis of total output is significantly influenced by the results of service sector. As the inputs of this sector are predominately domestic, the substitution effect was limited to 4.7%. If the substitution effect in the other sectors is considered the results are more relevant. In the primary sectors (agriculture and mining) the impact of substitution of imported inputs on output is 22.6%, which means that the impact of technological change in these sectors has been significantly compensated by the increase of imports.

The most important results, however, are observed in the high- and medium-high tech manufacturing sectors. The effects of technological change are responsible for 15.1% of output growth in these sectors. Nevertheless, the substitution of imported inputs compensated for these effects: it reduced overall output growth by 23.2%, and the effects were particularly pronounced in the chemical sector and electrical and optical equipment, in which the negative impacts were 28.8% and 34.3%, respectively.

More relevant insights may be extracted from the results through the analysis of these effects from a historical perspective. Table 2 presents the results according to the three distinct periods in Brazilian macroeconomic policies: from 1995 to 1999, from 1999 to 2003 and, finally, from 2003 to 2008.

Table 2 – Impact on output of substitution between imported and domestic inputs

	1995-99	1999-2003	2003-08	1995-2008
Total	***-0.4%***	***-0.1%***	***-8.6%***	***-9.0%***
Agriculture and Mining	**2.0%**	**-1.6%**	**-23.0%**	**-22.6%**
Manufacturing	**-1.5%**	**0.1%**	**-12.2%**	**-13.5%**
Low/Med-Low Tech Manufacturing	0.0%	0.7%	-9.2%	-8.5%
High/Med-High Tech Manufacturing	-4.4%	-1.1%	-17.7%	-23.2%
Chemicals and Chemical Products	-3.7%	-0.4%	-24.8%	-28.8%
Machinery, Nec	-1.5%	-0.9%	-10.0%	-12.4%
Electrical and Optical Equipment	-8.1%	-4.6%	-21.6%	-34.3%
Transport Equipment	-3.6%	0.8%	-10.7%	-13.5%
Services	**-0.4%**	**-0.1%**	**-8.6%**	**-9.0%**

Authors' elaboration based on WIOD

Between 1995 and 1999 there were relevant substitutions of imported inputs for national inputs in high and medium-high tech manufacturing. This substitution was responsible for 4.4% decrease in total output. During these years the *Plano Real* was adopted to reduce the inflation. It was based on the reduction of tariffs with the aim of opening the economy to imported goods, as well as on real exchange rate appreciation. As a result, the productive chains of the most innovative and technologically advanced sectors were significantly affected.

In contrast with this period, from 1999 to 2003 the Brazilian economy experienced a period of subsequent balance-of-payment crisis and exchange rate depreciation. The inflation target regime was implanted with the aim of controlling inflation, and thus high interest rates were necessary to maintain the capital inflows and control the demand growth. As a consequence, although the substitution of imported inputs had not significantly affected output growth, Brazilian growth rates were very low.

The process of substitution between imported and national inputs picked up between 2003 and 2008. For the economy as a whole, the increase of imported input decreased total output by 8.6% during these five years. Again, high tech sectors were significantly affected. Their total output was 17.7% lower owing to the increase in imported inputs. In chemical and electrical sectors the impact on total output was 24.8% and 21.6%, respectively.

This period, however, is characterised by a high real exchange rate appreciation and high growth rates. Thus the net impact of this substitution is very controversial. On the one hand, it reduced the positive impacts of final demand growth on total output by 8.6%. On the other, it may have been essential for the increase of these final demand effects, once it may be relevant to reduce costs and increase exports.

Therefore, it is important to consider that despite contributing negatively for total output, this process of substitution is not necessarily negative. The positive results for primary sectors suggest that the increase in exports in these sectors was related with the substitution of imported inputs, as a result of reducing prices. The following section will evaluate what are those sectors in which growth of exports compensated for negative impact of the domestic inputs substitution in order to assess its net impact.

5. Exports and substitution of imports for national inputs: the net impact

To evaluate the impacts of the substitution between imports and domestic suppliers on economic growth we shall analyse the contribution of exports. As we have seen, this substitution may have reduced economic growth because the final demand is not absorbed by domestic suppliers. However, it may have increased exports, once it reduces the prices of production. Thereby, we will analyse its net impact to evaluate the real consequences of this substitution on output.

Starting from equation (6), final demand is divided into the contribution of exports and other its components:

$$\Delta x = \frac{1}{2}(\Delta L)(f^0 + f^1) + \frac{1}{2}(L^0 + L^1)(\Delta f') + \underbrace{\frac{1}{2}(L^0 + L^1)(\Delta Exp)}_{contrib.\ of\ exports} \qquad (16)$$

where ΔExp is the vector of export growth, and $\Delta f'$ is the vector of final demand growth (excluding exports)[6].

The contribution of exports to output growth (ΔExp_{tot}) can be divided into two: the direct contribution of the analysed sector export growth (ΔExp), and the indirect contribution of other sectors' export growth to the analysed sector output growth (ΔExp_{ind})[7], which is given by the difference between the total contribution and the direct contribution. Table 3 presents a comparison between the contribution of export growth and substitution of imported inputs on output.

Table 3 – Impact of exports on output growth (1995-2008)

	Δ% *Exp*	Δ% Exp_{ind}	Δ% Exp_{tot}	$-\Delta$% *Am*
Total	***5.6%***	***5.0%***	***10.6%***	***-9.0%***
Agriculture and Mining	**24.9%**	**13.3%**	**38.2%**	**-22.6%**
Manufacturing	**9.7%**	**6.1%**	**15.7%**	**-13.5%**
Low/Med-Low Tech Manufacturing	7.9%	6.0%	13.9%	-8.5%
High/Med-High Tech Manufacturing	13.1%	6.2%	19.3%	-23.2%
Chemicals and Chemical Products	2.7%	7.8%	10.4%	-28.8%
Machinery, Nec	15.3%	4.9%	20.2%	-12.4%
Electrical and Optical Equipment	8.8%	5.1%	13.9%	-34.3%
Transport Equipment	27.4%	6.2%	33.5%	-13.5%
Services	**1.6%**	**3.7%**	**5.2%**	**-4.7%**

Authors' elaboration based on WIOD

[6] $\Delta f' = \Delta f - \Delta Exp$

[7] The indirect impact considers, for example, the impact of cars exports on tires output growth. Since cars production demands indirectly tires, cars export growth will increase the production of tires.

The results show that despite being neutral for the economy as a whole, the net impact of the domestic suppliers' substitution has controversial effects considering the sectors separately. The impacts were positive for some sectors, such as agriculture and mining, but they were negative for others, such as chemicals and electrical/optical equipment.

The last two columns show the positive contribution of exports growth (direct and indirect) and the negative contribution of the substitution of imported inputs. From these data we can conclude that high-tech sectors were the most affected by this process. Between 1995 and 2008 the substitution of imported inputs for national suppliers contributed negatively to agriculture and mining and to high-tech sectors output growth by around 23%. However, export growth contributed to agriculture and mining by 38.2%, while it contributed to high-tech sectors only by 19.3%. Thereby, although the direct impact of the substitution (not considering exports) was negative for agriculture and mining, the net contribution of this substitution process was negative only for high-tech sectors.

Analysing the sectors of high technology, some other relevant results can be seen from Table 3. The net results were negative in chemical products and electrical/optical equipments (low contribution of exports to growth *vis-à-vis* high contribution of substitution of imports for domestic suppliers). However, in machinery and transport equipment the results were positive.

Exports contributed to machinery sector output growth by 20.2% (15.3% directly and 4.9% indirectly), while its output decreased by 12.4% due to the substitution for domestic inputs. In transport equipments sector the results are even better. Exports impacted by increasing transport equipment output by 33.5% (27.4% directly, and 6.2% indirectly), while the negative direct impact of national suppliers' substitution was only of 13.5%.

These results bring an important issue to the debate of industrial policies. The Brazilian National Development Bank (BNDES) provides many benefits for national producers of machinery and transport equipments, such as funding with very low interest rates[8] and some benefits to stimulate exports (especially for those producers which use domestic inputs). Furthermore, the two Brazilian industrial plans launched in the 2000s (PINTEC and PDP) were focused in these sectors, providing many tax

[8] Because Brazilian financial markets provide funding with high interest rates, the BNDES funding with low interest rates is a key factor on these sectors growth.

reductions and other benefits to promote exports[9]. Thereby, although high-tech sectors were the most affected by the increase of imported inputs, within this group the sectors which the Brazilian industrial policies are mainly focused were those which took advantage of this substitution process and its net contribution was positive.

6. Comparison between Brazil and other economies

The substitution of imported inputs for domestic suppliers was an important aspect of Brazilian output growth in the last two decades, especially for high technological sectors. However, it is necessary to evaluate this process in comparison with other economies in order to understand whether Brazil may be characterised as a special case or, alternatively, whether it is a world trend and this country is following this trend.

We applied the methodology developed in Section 4 to some developing countries (China, India, Mexico and Korea) and also to the three biggest developed countries (Germany, Japan and United States). Results for developing countries are presented in Tables 4 and 5, and for developed countries in Table 6.

Table 4 – Impact of substitution between imported and domestic inputs (1995-2008)

	Brazil	China	India	Mexico	Korea
Total	***-9.0%***	***-46.0%***	***-12.9%***	***-9.2%***	***-11.8%***
Agriculture and Mining	**-22.6%**	**-51.1%**	**-11.0%**	**-12.9%**	**-121.2%**
Manufacturing	**-13.5%**	**-57.4%**	**-21.5%**	**-19.2%**	**-8.2%**
Low/Med-Low Tech Manufacturing	-8.5%	-29.3%	-18.7%	-11.6%	-10.8%
High/Med-High Tech Manufacturing	-23.2%	-119.0%	-29.6%	-31.7%	-0.6%
Chemicals and Chemical Products	-28.8%	-71.4%	-43.1%	-31.7%	-4.9%
Machinery, Nec	-12.4%	-99.0%	-18.2%	-3.6%	-6.0%
Electrical and Optical Equipment	-34.3%	-208.9%	-65.4%	-47.2%	26.6%
Transport Equipment	-13.5%	-72.9%	-13.8%	-17.8%	-6.4%
Services	**-4.7%**	**-28.8%**	**-6.0%**	**-2.1%**	**-7.1%**

Authors' elaboration based on WIOD

Considering these five countries, it is possible to conclude that developing economies have experienced a process of increasing in imported inputs which affected negatively almost every sector. China was the most affected country (its output was 46.0% lower due to the substitution for domestic suppliers), which corroborates the

[9] For a brief review of these industrial plans and the BNDES policies for machinery and transport equipments see Magacho (2012).

hypothesis that this country's industrial chains were strongly integrated into global supply chains during the analysed period.

The high-tech sectors were the most affected in four of these five economies (Brazil, China, India and Mexico). Korea, however, is an exception. The most affected sectors in this country were agriculture and mining. The impacts of substitution between domestic and foreign suppliers had limited impacts on high-tech sectors, especially regarding electrical/optical equipments (in which the contribution was positive).

As suggested before, these results shall be analysed considering also the positive impacts of export growth. Hence, table 5 presents the exports contribution to output growth within developing countries.

Table 5 – Contribution of exports to output growth (1995-2008)

	Brazil	China	India	Mexico	Korea
Total	***10.6%***	***83.3%***	***27.4%***	***22.4%***	***55.3%***
Agriculture and Mining	**38.2%**	**51.5%**	**17.0%**	**21.8%**	**10.2%**
Manufacturing	**15.7%**	**112.0%**	**39.9%**	**47.0%**	**92.0%**
Low/Med-Low Tech Manufacturing	13.9%	88.5%	38.0%	20.2%	45.3%
High/Med-High Tech Manufacturing	19.3%	147.5%	44.6%	83.9%	136.4%
Chemicals and Chemical Products	10.4%	103.8%	45.4%	13.8%	84.4%
Machinery, Nec	20.2%	107.4%	41.1%	66.1%	92.4%
Electrical and Optical Equipment	13.9%	195.1%	52.8%	134.7%	176.2%
Transport Equipment	33.5%	98.1%	45.1%	81.4%	121.1%
Services	**5.2%**	**49.2%**	**20.2%**	**6.2%**	**20.3%**

Authors' elaboration based on WIOD

From China data we can see that the contribution of exports has compensated for the decrease caused by the substitution of imports for domestic inputs. Considering the economy as a whole, the net contribution was high. Exports growth increased output by 83.3% and the substitution of imports decreased it by 46.0%. The net contribution was neutral only for mining and agriculture. In this sector, exports increased the output by 51.5%, but the substitution for domestic inputs decreased its output by 51.1%.

Similar results are verified for the other developing economies, but in a lower scale. Mexican and Indian export growth have compensated for the negative contribution of domestic suppliers' substitution in all analysed sectors. In Korea it happened in all other sectors than agriculture and mining. Furthermore, although in Mexico and India the substitution for domestic suppliers have decreased the high-tech

sectors output by an average of 20%, the net impact was positive, contrasting to Brazilian results in these sectors.

Thereby, Brazil and Korea are the only analysed countries in which some sectors were affected positively and others negatively. Nevertheless, while in Korea mining and agriculture was the negatively affected sector, in Brazil the high-tech sectors were those where the net impact of substitution of imports for domestic inputs had a negative contribution.

In order to complement this analysis, Table 6 presents the contribution of exports and substitution between imported inputs and national suppliers to developed countries' output growth.

Table 6 – Contribution of exports and substitution between imported and domestic inputs to output growth (1995-2008) – developed countries

	USA		Japan		Germany	
	$-\Delta\%Am$	$\Delta\%Exp_{tot}$	$-\Delta\%Am$	$\Delta\%Exp_{tot}$	$-\Delta\%Am$	$\Delta\%Exp_{tot}$
Total	***-5.6%***	***7.9%***	***-5.9%***	***13.8%***	***-8.1%***	***33.2%***
Agriculture and Mining	**-48.0%**	**8.0%**	**-108.8%**	**7.3%**	**-47.7%**	**30.1%**
Manufacturing	**-9.2%**	**17.1%**	**-6.4%**	**30.6%**	**-12.8%**	**58.3%**
Low/Med-Low Tech Manufacturing	-7.8%	9.3%	-5.5%	16.4%	-10.8%	44.7%
High/Med-High Tech Manufacturing	-11.2%	26.6%	-7.2%	45.9%	-14.7%	70.9%
Chemicals and Chemical Products	-16.4%	15.4%	-8.4%	21.4%	-15.8%	71.0%
Machinery, Nec	-9.4%	21.4%	-4.0%	31.7%	-9.6%	61.2%
Electrical and Optical Equipment	-14.1%	43.8%	-10.4%	55.0%	-21.7%	81.2%
Transport Equipment	-6.3%	22.4%	-4.9%	59.4%	-12.6%	70.1%
Services	**-2.5%**	**4.9%**	**-2.3%**	**5.1%**	**-4.5%**	**18.6%**

Authors' elaboration based on WIOD

For these three developed countries the results show that the negative impact of the national suppliers' substitution was compensated for the positive impact of export growth. Although the difference between positive and negative impacts is not large for the USA and Japan, it is very positive for Germany. The substitution of imported inputs impacted negatively on German output by 8.3%. However, exports increased its output by 33.2%, which shows that, such as China, Germany was strongly benefitted by this process.

Analysing sectors separately the results are very similar to those presented by Korea. Only mining and agriculture did not present a positive net impact in all the developed countries analysed. In all other sectors, especially those of high technology,

exports impacted positively on output, and it has compensated for the negative impact of imported inputs growth.

7. Conclusion

This paper has analysed the sources of Brazilian growth during the 2000s in comparison with other economies. The impacts of changes in countries' production structures and in demand absorption were investigated through the use of Structural Decomposition Analysis (SDA). Although this method has been widely applied to understand the contribution of particular sources of demand to countries' growth patterns, these applications did not consider the substitution between domestic suppliers and imports. Owing to this, we extended the SDA method to provide a detailed investigation of the sources of countries' growth from a sectoral perspective, as this substitution may have important consequences for long-term economic growth.

The empirical investigation suggests that the substitution of imported for national inputs is a key factor on SDA, once the impact of technological change is underestimated if this substitution is not taken into account. Therefore, the extension of SDA purposed in this paper is very relevant to analyse the structural changes in countries' production chains.

From the results presented in the paper it is possible to conclude that global supply chains are significantly more integrated in the late 2000s than in the early 1990s. All analysed countries presented substitution of imported inputs for domestic suppliers, and this fact is verified in almost every sector.

This process, however, had positive impacts for many sectors in the great majority of countries, but it had negative impacts in some case. The net impact for Brazil (considering also the impact of exports growth in sectoral output) was positive for mining and agriculture, but it was negative for high-tech sectors, especially regarding chemicals and electrical equipments. For the other analysed countries, only the agriculture and mining sectors were negatively affected, while the positive impacts were seen in all other sectors.

In short, Brazilian potential for growth in demand to precipitate economic growth have declined for the most technological advanced sectors and increased in

agriculture and mining, while this relation is exactly the opposite in other countries. Thereby, an important constraint to Brazilian long-term growth emerged in the last decades, once high-tech sectors are the ones which present higher increasing returns to scale, higher positive spillovers on production and those that are able to boost productivity growth.

Finally, the paper shows that China, Korea and Germany were the most positively affected countries. Although the substitution of imports for domestic suppliers has contributed negatively for economic growth, it was significantly compensated by the increase of exports in all sectors other than mining and agriculture. These results suggest that these countries were the most benefited from the integration of global supply chains, while Brazilian high-tech production was not able to take advantages of this process.

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Appendices

Table A.1 – Brazil: Structural Decomposition Analysis (Impact in %) 1995-1999

	$\Delta\% A$	$-\Delta\% Am$	$\Delta\% f$	$\Delta\% X$
Agriculture, Hunting, Forestry and Fishing	1.7%	0.2%	13.6%	15.4%
Mining and Quarrying	-8.4%	8.8%	15.4%	15.8%
Food, Beverages and Tobacco	-1.4%	0.7%	8.8%	8.0%
Textiles and Textile Products	-5.3%	1.7%	-2.9%	-6.5%
Leather, Leather and Footwear	-7.6%	0.2%	-5.8%	-13.1%
Wood and Products of Wood and Cork	-27.1%	-0.5%	19.2%	-8.4%
Pulp, Paper, Paper , Printing and Publishing	-0.9%	1.3%	9.7%	10.2%
Coke, Refined Petroleum and Nuclear Fuel	4.2%	0.3%	11.2%	15.6%
Chemicals and Chemical Products	7.2%	-3.7%	12.1%	15.6%
Rubber and Plastics	-2.6%	-1.6%	8.9%	4.7%
Other Non-Metallic Mineral	-3.4%	0.0%	12.1%	8.7%
Basic Metals and Fabricated Metal	-10.9%	-3.1%	5.6%	-8.4%
Machinery, Nec	-1.4%	-1.5%	-5.5%	-8.4%
Electrical and Optical Equipment	1.4%	-8.1%	-1.7%	-8.4%
Transport Equipment	-12.8%	-3.6%	8.0%	-8.4%
Manufacturing, Nec; Recycling	-4.2%	-0.4%	-3.8%	-8.4%
Electricity, Gas and Water Supply	8.7%	-0.4%	11.3%	19.6%
Construction	4.6%	0.0%	8.0%	12.5%
Sale, Mainten. and Repair of Motor Vehicles/cycles	-0.1%	-0.3%	7.1%	6.7%
Wholesale Trade and Commission Trade (others)	-0.1%	-0.2%	7.2%	7.0%
Retail Trade (others)	-2.5%	-0.4%	4.5%	1.6%
Hotels and Restaurants	-2.5%	0.7%	8.3%	6.5%
Inland Transport	3.3%	0.3%	9.9%	13.6%
Water Transport	3.9%	-0.2%	9.9%	13.6%
Air Transport	4.0%	-0.3%	9.9%	13.6%
Other Supporting and Auxiliary Transport Activities	3.8%	-0.1%	9.9%	13.6%
Post and Telecommunications	20.0%	-1.5%	22.1%	40.6%
Financial Intermediation	0.7%	-0.3%	7.1%	7.5%
Real Estate Activities	0.7%	0.2%	9.9%	10.8%
Renting of M&Eq and Other Business Activities	0.3%	-0.2%	6.5%	6.5%
Public Admin and Defence; Compulsory Social Security	0.7%	0.0%	5.8%	6.5%
Education	0.1%	0.1%	6.3%	6.5%
Health and Social Work	0.1%	0.0%	6.5%	6.5%
Other Community, Social and Personal Services	0.0%	0.0%	6.5%	6.5%
Agriculture and Mining	***-0.3%***	***2.0%***	***14.0%***	***15.7%***
Manufacturing	***-2.9%***	***-1.5%***	***5.9%***	***1.5%***
Low/Med-Low Tech Manufacturing	***-3.7%***	***0.0%***	***6.4%***	***2.8%***
High/Med-High Tech Manufacturing	***-1.4%***	***-4.4%***	***4.8%***	***-1.0%***
Services	***1.4%***	***-0.1%***	***7.7%***	***9.1%***
Total	***0.0%***	***-0.4%***	***7.5%***	***7.2%***

Authors' elaboration based on WIOD

Table A.2 – Brazil: Structural Decomposition Analysis (Impact in %) 1999-2003

	$\Delta\% A$	$-\Delta\% Am$	$\Delta\% f$	$\Delta\% X$
Agriculture, Hunting, Forestry and Fishing	5.6%	0.1%	19.4%	25.1%
Mining and Quarrying	76.8%	-68.2%	81.1%	89.7%
Food, Beverages and Tobacco	-1.5%	-1.2%	39.8%	37.1%
Textiles and Textile Products	-9.5%	-3.1%	10.9%	-1.7%
Leather, Leather and Footwear	-6.6%	0.3%	-5.6%	-11.9%
Wood and Products of Wood and Cork	-29.4%	-3.6%	22.8%	-10.2%
Pulp, Paper, Paper , Printing and Publishing	-2.2%	-4.2%	50.8%	44.4%
Coke, Refined Petroleum and Nuclear Fuel	16.1%	-19.2%	36.3%	33.2%
Chemicals and Chemical Products	22.3%	-28.8%	33.2%	26.7%
Rubber and Plastics	-5.6%	-14.5%	40.6%	20.6%
Other Non-Metallic Mineral	4.7%	-6.9%	35.1%	32.9%
Basic Metals and Fabricated Metal	-1.2%	-20.0%	44.9%	23.7%
Machinery, Nec	2.7%	-12.4%	80.8%	71.2%
Electrical and Optical Equipment	24.4%	-34.3%	31.8%	22.0%
Transport Equipment	7.7%	-13.5%	90.8%	85.0%
Manufacturing, Nec; Recycling	-5.9%	-2.5%	27.0%	18.7%
Electricity, Gas and Water Supply	24.4%	-7.7%	44.5%	61.3%
Construction	4.6%	-0.9%	31.1%	34.7%
Sale, Mainten. and Repair of Motor Vehicles/cycles	-12.5%	-3.7%	14.4%	-1.7%
Wholesale Trade and Commission Trade (others)	22.9%	-8.6%	59.1%	73.4%
Retail Trade (others)	9.4%	-5.7%	42.5%	46.2%
Hotels and Restaurants	0.1%	-3.5%	52.9%	49.5%
Inland Transport	12.1%	-8.1%	45.2%	49.1%
Water Transport	-16.6%	-5.2%	19.1%	-2.7%
Air Transport	-13.8%	-4.5%	21.7%	3.4%
Other Supporting and Auxiliary Transport Activities	15.1%	-7.2%	49.4%	57.2%
Post and Telecommunications	61.6%	-16.3%	99.7%	145.0%
Financial Intermediation	23.8%	-5.7%	55.4%	73.6%
Real Estate Activities	16.1%	-9.2%	47.0%	53.9%
Renting of M&Eq and Other Business Activities	13.7%	-6.6%	46.6%	53.8%
Public Admin and Defence; Compulsory Social Security	1.7%	-0.3%	43.5%	44.9%
Education	0.3%	0.0%	26.5%	26.8%
Health and Social Work	0.5%	-0.1%	41.6%	42.0%
Other Community, Social and Personal Services	7.4%	-6.0%	42.5%	43.9%
Agriculture and Mining	***10.0%***	***-1.6%***	***18.0%***	***26.4%***
Manufacturing	***4.7%***	***-13.5%***	***41.8%***	***32.9%***
Low/Med-Low Tech Manufacturing	***-0.9%***	***-8.5%***	***34.7%***	***25.4%***
High/Med-High Tech Manufacturing	***15.1%***	***-23.2%***	***55.0%***	***46.9%***
Services	***10.6%***	***-4.7%***	***44.7%***	***50.6%***
Total	***10.0%***	***-9.0%***	***45.1%***	***46.0%***

Authors' elaboration based on WIOD

Table A.3 – Brazil: Structural Decomposition Analysis (Impact in %) 2003-2008

	$\Delta\% A$	$-\Delta\% Am$	$\Delta\% f$	$\Delta\% X$
Agriculture, Hunting, Forestry and Fishing	2.7%	-3.6%	25.4%	24.5%
Mining and Quarrying	58.8%	-68.5%	51.6%	41.9%
Food, Beverages and Tobacco	2.3%	-2.6%	18.0%	17.8%
Textiles and Textile Products	-4.5%	-5.6%	22.4%	12.3%
Leather, Leather and Footwear	-1.1%	-0.7%	-3.4%	-5.2%
Wood and Products of Wood and Cork	-1.9%	-3.1%	-8.2%	-13.3%
Pulp, Paper, Paper , Printing and Publishing	1.0%	-8.4%	31.2%	23.8%
Coke, Refined Petroleum and Nuclear Fuel	8.4%	-18.4%	25.7%	15.7%
Chemicals and Chemical Products	12.6%	-24.8%	24.2%	12.0%
Rubber and Plastics	3.1%	-13.7%	30.3%	19.6%
Other Non-Metallic Mineral	6.1%	-6.6%	29.4%	28.9%
Basic Metals and Fabricated Metal	6.4%	-17.9%	27.3%	15.8%
Machinery, Nec	6.4%	-10.0%	60.3%	56.7%
Electrical and Optical Equipment	18.8%	-21.6%	38.1%	35.4%
Transport Equipment	15.0%	-10.7%	70.0%	74.3%
Manufacturing, Nec; Recycling	-0.7%	-2.5%	23.1%	19.9%
Electricity, Gas and Water Supply	6.3%	-7.2%	34.1%	33.1%
Construction	2.4%	-0.9%	28.4%	29.9%
Sale, Mainten. and Repair of Motor Vehicles/cycles	8.4%	-3.4%	28.5%	33.4%
Wholesale Trade and Commission Trade (others)	7.0%	-8.3%	43.7%	42.4%
Retail Trade (others)	5.5%	-5.3%	37.5%	37.6%
Hotels and Restaurants	6.0%	-8.9%	34.9%	32.0%
Inland Transport	10.2%	-8.9%	29.1%	30.5%
Water Transport	-8.5%	-5.9%	10.8%	-3.6%
Air Transport	-12.6%	-5.1%	8.2%	-9.5%
Other Supporting and Auxiliary Transport Activities	12.9%	-7.9%	33.2%	38.3%
Post and Telecommunications	7.8%	-11.7%	43.5%	39.7%
Financial Intermediation	25.3%	-4.1%	41.3%	62.5%
Real Estate Activities	11.1%	-8.4%	23.2%	25.9%
Renting of M&Eq and Other Business Activities	12.5%	-6.3%	33.1%	39.3%
Public Admin and Defence; Compulsory Social Security	1.0%	-0.3%	26.0%	26.7%
Education	-0.2%	-0.3%	6.6%	6.1%
Health and Social Work	0.3%	-0.1%	20.7%	20.9%
Other Community, Social and Personal Services	6.1%	-6.0%	28.5%	28.5%
Agriculture and Mining	***19.4%***	***-23.0%***	***33.0%***	***29.3%***
Manufacturing	***6.7%***	***-12.2%***	***30.1%***	***24.6%***
Low/Med-Low Tech Manufacturing	***3.1%***	***-9.2%***	***22.1%***	***16.0%***
High/Med-High Tech Manufacturing	***13.4%***	***-17.7%***	***45.0%***	***40.7%***
Services	***7.4%***	***-4.6%***	***29.8%***	***32.6%***
Total	***8.0%***	***-8.6%***	***30.2%***	***29.5%***

Authors' elaboration based on WIOD

Table A.4 – Brazil: Structural Decomposition Analysis (Impact in %) 1995-2008

	$\Delta\% A$	$-\Delta\% Am$	$\Delta\% f$	$\Delta\% X$
Agriculture, Hunting, Forestry and Fishing	10.0%	-3.3%	58.3%	65.0%
Mining and Quarrying	76.8%	-68.2%	81.1%	89.7%
Food, Beverages and Tobacco	-1.5%	-1.2%	39.8%	37.1%
Textiles and Textile Products	-9.5%	-3.1%	10.9%	-1.7%
Leather, Leather and Footwear	-6.6%	0.3%	-5.6%	-11.9%
Wood and Products of Wood and Cork	-29.4%	-3.6%	22.8%	-10.2%
Pulp, Paper, Paper , Printing and Publishing	-2.2%	-4.2%	50.8%	44.4%
Coke, Refined Petroleum and Nuclear Fuel	16.1%	-19.2%	36.3%	33.2%
Chemicals and Chemical Products	22.3%	-28.8%	33.2%	26.7%
Rubber and Plastics	-5.6%	-14.5%	40.6%	20.6%
Other Non-Metallic Mineral	4.7%	-6.9%	35.1%	32.9%
Basic Metals and Fabricated Metal	-1.2%	-20.0%	44.9%	23.7%
Machinery, Nec	2.7%	-12.4%	80.8%	71.2%
Electrical and Optical Equipment	24.4%	-34.3%	31.8%	22.0%
Transport Equipment	7.7%	-13.5%	90.8%	85.0%
Manufacturing, Nec; Recycling	-5.9%	-2.5%	27.0%	18.7%
Electricity, Gas and Water Supply	24.4%	-7.7%	44.5%	61.3%
Construction	4.6%	-0.9%	31.1%	34.7%
Sale, Mainten. and Repair of Motor Vehicles/cycles	-12.5%	-3.7%	14.4%	-1.7%
Wholesale Trade and Commission Trade (others)	22.9%	-8.6%	59.1%	73.4%
Retail Trade (others)	9.4%	-5.7%	42.5%	46.2%
Hotels and Restaurants	0.1%	-3.5%	52.9%	49.5%
Inland Transport	12.1%	-8.1%	45.2%	49.1%
Water Transport	-16.6%	-5.2%	19.1%	-2.7%
Air Transport	-13.8%	-4.5%	21.7%	3.4%
Other Supporting and Auxiliary Transport Activities	15.1%	-7.2%	49.4%	57.2%
Post and Telecommunications	61.6%	-16.3%	99.7%	145.0%
Financial Intermediation	23.8%	-5.7%	55.4%	73.6%
Real Estate Activities	16.1%	-9.2%	47.0%	53.9%
Renting of M&Eq and Other Business Activities	13.7%	-6.6%	46.6%	53.8%
Public Admin and Defence; Compulsory Social Security	1.7%	-0.3%	43.5%	44.9%
Education	0.3%	0.0%	26.5%	26.8%
Health and Social Work	0.5%	-0.1%	41.6%	42.0%
Other Community, Social and Personal Services	7.4%	-6.0%	42.5%	43.9%
Agriculture and Mining	***29.2%***	***-22.6%***	***64.9%***	***71.4%***
Manufacturing	***4.7%***	***-13.5%***	***41.8%***	***32.9%***
Low/Med-Low Tech Manufacturing	***-0.9%***	***-8.5%***	***34.7%***	***25.4%***
High/Med-High Tech Manufacturing	***15.1%***	***-23.2%***	***55.0%***	***46.9%***
Services	***10.6%***	***-4.7%***	***44.7%***	***50.6%***
Total	***10.0%***	***-9.0%***	***45.1%***	***46.0%***

Authors' elaboration based on WIOD

Table A.5 – Brazil: Structural Decomposition Analysis (Impact in %) 1995-2008

	$\Delta\%\ Exp_{dir}$	$\Delta\%\ Exp_{ind}$	$\Delta\%\ Exp_{tot}$
Agriculture, Hunting, Forestry and Fishing	14.7%	11.5%	26.2%
Mining and Quarrying	49.2%	18.0%	67.2%
Food, Beverages and Tobacco	13.3%	4.4%	17.7%
Textiles and Textile Products	1.2%	2.2%	3.4%
Leather, Leather and Footwear	-0.2%	0.2%	0.0%
Wood and Products of Wood and Cork	3.7%	2.6%	6.3%
Pulp, Paper, Paper , Printing and Publishing	6.2%	6.7%	12.8%
Coke, Refined Petroleum and Nuclear Fuel	12.7%	8.8%	21.5%
Chemicals and Chemical Products	2.7%	7.8%	10.4%
Rubber and Plastics	4.9%	11.9%	16.8%
Other Non-Metallic Mineral	4.7%	4.2%	8.9%
Basic Metals and Fabricated Metal	5.5%	11.7%	17.2%
Machinery, Nec	15.3%	4.9%	20.2%
Electrical and Optical Equipment	8.8%	5.1%	13.9%
Transport Equipment	27.4%	6.2%	33.5%
Manufacturing, Nec; Recycling	2.7%	1.9%	4.6%
Electricity, Gas and Water Supply	0.1%	7.7%	7.8%
Construction	0.1%	0.8%	1.0%
Sale, Mainten. and Repair of Motor Vehicles/cycles	0.1%	6.3%	6.4%
Wholesale Trade and Commission Trade (others)	0.5%	7.1%	7.6%
Retail Trade (others)	0.3%	6.2%	6.6%
Hotels and Restaurants	9.4%	0.7%	10.2%
Inland Transport	3.2%	6.6%	9.8%
Water Transport	1.3%	6.3%	7.7%
Air Transport	1.6%	6.5%	8.0%
Other Supporting and Auxiliary Transport Activities	3.5%	6.6%	10.2%
Post and Telecommunications	6.7%	9.6%	16.3%
Financial Intermediation	1.0%	4.5%	5.5%
Real Estate Activities	1.1%	2.0%	3.1%
Renting of M&Eq and Other Business Activities	3.4%	6.2%	9.5%
Public Admin and Defence; Compulsory Social Security	0.3%	0.3%	0.6%
Education	0.0%	0.1%	0.1%
Health and Social Work	0.1%	0.1%	0.2%
Other Community, Social and Personal Services	3.0%	6.2%	9.3%
Agriculture and Mining	***24.9%***	***13.3%***	***38.2%***
Manufacturing	***9.7%***	***6.1%***	***15.7%***
Low/Med-Low Tech Manufacturing	***7.9%***	***6.0%***	***13.9%***
High/Med-High Tech Manufacturing	***13.1%***	***6.2%***	***19.3%***
Services	***1.6%***	***3.7%***	***5.2%***
Total	***5.6%***	***5.0%***	***10.6%***

Authors' elaboration based on WIOD

Table A.6 –Substitution between imported and national inputs (*–Δ% Am*) 1995-2008

	China	*India*	*Mexico*	*Korea*
Agriculture, Hunting, Forestry and Fishing	-12.1%	-1.9%	-11.6%	2.6%
Mining and Quarrying	-164.5%	-105.0%	-14.8%	-1501.8%
Food, Beverages and Tobacco	-22.0%	-2.4%	-3.1%	0.1%
Textiles and Textile Products	10.6%	-1.8%	-16.7%	7.7%
Leather, Leather and Footwear	4.5%	-2.4%	-8.0%	2.1%
Wood and Products of Wood and Cork	-23.3%	-7.0%	-20.5%	12.1%
Pulp, Paper, Paper , Printing and Publishing	-40.2%	0.2%	-2.2%	3.4%
Coke, Refined Petroleum and Nuclear Fuel	-77.2%	-7.6%	-17.4%	-25.9%
Chemicals and Chemical Products	-71.4%	-43.1%	-31.7%	-4.9%
Rubber and Plastics	-65.3%	-12.0%	-1.0%	-9.5%
Other Non-Metallic Mineral	-19.7%	-11.6%	-0.8%	-9.6%
Basic Metals and Fabricated Metal	-45.6%	-29.5%	-30.1%	-22.2%
Machinery, Nec	-99.0%	-18.2%	-3.6%	-6.0%
Electrical and Optical Equipment	-208.9%	-65.4%	-47.2%	26.6%
Transport Equipment	-72.9%	-13.8%	-17.8%	-6.4%
Manufacturing, Nec; Recycling	-68.5%	-115.9%	-4.5%	-0.2%
Electricity, Gas and Water Supply	-76.4%	-13.7%	-5.4%	-15.3%
Construction	-2.3%	-1.6%	-0.2%	-0.2%
Sale, Mainten. and Repair of Motor Vehicles/cycles		-10.2%	-3.3%	-1.9%
Wholesale Trade and Commission Trade (others)	-23.9%	-10.9%	-4.1%	-14.7%
Retail Trade (others)	-17.6%	-9.2%	-3.9%	-1.8%
Hotels and Restaurants	-34.7%	-6.4%	-1.1%	-2.4%
Inland Transport	-45.7%	-7.6%	-2.4%	-31.6%
Water Transport	-106.7%	-3.6%	-4.1%	-83.1%
Air Transport	-163.8%	-4.5%	5.1%	-2.1%
Other Supporting and Auxiliary Transport Activities	-15.9%	-1.3%	-3.1%	-15.1%
Post and Telecommunications	-105.8%	-50.9%	-1.3%	-13.5%
Financial Intermediation	-24.6%	-22.0%	-3.3%	-10.1%
Real Estate Activities	-7.8%	4.6%	-0.9%	-2.0%
Renting of M&Eq and Other Business Activities	-97.5%	-16.7%	-4.0%	-18.4%
Public Admin and Defence; Compulsory Social Sec.	-11.1%	0.3%	-0.4%	0.9%
Education	-5.7%	0.0%	0.0%	2.0%
Health and Social Work	-6.4%	-0.2%	0.0%	-0.5%
Other Community, Social and Personal Services	-42.2%	6.5%	1.3%	-2.8%
Agriculture and Mining	***-51.1%***	***-11.0%***	***-12.9%***	***-121.2%***
Manufacturing	***-57.4%***	***-21.5%***	***-19.2%***	***-8.2%***
Low/Med-Low Tech Manufacturing	***-29.3%***	***-18.7%***	***-11.6%***	***-10.8%***
High/Med-High Tech Manufacturing	***-119.0%***	***-29.6%***	***-31.7%***	***-0.6%***
Services	***-28.8%***	***-6.0%***	***-2.1%***	***-7.1%***
Total	***-46.0%***	***-12.9%***	***-9.2%***	***-11.8%***

Authors' elaboration based on WIOD

Table A.8 – Contribution of exports to output growth ($\Delta\%\ Exp_{tot}$) 1995-2008

	China	*India*	*Mexico*	*Korea*
Agriculture, Hunting, Forestry and Fishing	35.6%	11.7%	6.3%	7.3%
Mining and Quarrying	99.2%	63.7%	35.9%	51.3%
Food, Beverages and Tobacco	34.6%	14.9%	5.4%	9.8%
Textiles and Textile Products	103.3%	36.7%	28.3%	-3.8%
Leather, Leather and Footwear	76.6%	14.5%	12.4%	-30.3%
Wood and Products of Wood and Cork	58.5%	39.9%	13.1%	19.0%
Pulp, Paper, Paper , Printing and Publishing	83.4%	11.3%	19.9%	46.0%
Coke, Refined Petroleum and Nuclear Fuel	93.2%	38.3%	11.7%	73.7%
Chemicals and Chemical Products	103.8%	45.4%	13.8%	84.4%
Rubber and Plastics	122.3%	26.7%	45.5%	77.9%
Other Non-Metallic Mineral	44.7%	-3.0%	15.3%	44.1%
Basic Metals and Fabricated Metal	106.4%	47.2%	44.0%	71.5%
Machinery, Nec	107.4%	41.1%	66.1%	92.4%
Electrical and Optical Equipment	195.1%	52.8%	134.7%	176.2%
Transport Equipment	98.1%	45.1%	81.4%	121.1%
Manufacturing, Nec; Recycling	194.8%	118.2%	31.9%	17.4%
Electricity, Gas and Water Supply	88.5%	28.2%	12.9%	38.3%
Construction	2.9%	3.7%	0.4%	1.3%
Sale, Mainten. and Repair of Motor Vehicles/cycles		12.8%	10.5%	7.7%
Wholesale Trade and Commission Trade (others)	103.5%	18.6%	11.6%	62.8%
Retail Trade (others)	90.5%	16.1%	10.7%	15.9%
Hotels and Restaurants	46.1%	39.8%	3.4%	16.9%
Inland Transport	73.1%	18.1%	4.7%	23.8%
Water Transport	125.9%	11.6%	8.5%	93.3%
Air Transport	152.6%	16.9%	4.0%	68.3%
Other Supporting and Auxiliary Transport Activities	28.9%	13.7%	11.8%	53.8%
Post and Telecommunications	94.3%	67.5%	10.4%	35.1%
Financial Intermediation	65.5%	31.6%	14.3%	29.5%
Real Estate Activities	20.6%	-3.7%	2.9%	10.5%
Renting of M&Eq and Other Business Activities	100.7%	138.5%	11.2%	46.6%
Public Admin and Defence; Compulsory Social Sec.	0.8%	0.0%	0.1%	2.1%
Education	5.3%	0.8%	0.1%	1.1%
Health and Social Work	8.6%	1.5%	0.0%	1.4%
Other Community, Social and Personal Services	42.6%	25.6%	0.7%	6.7%
Agriculture and Mining	***51.5%***	***17.0%***	***21.8%***	***10.2%***
Manufacturing	***112.0%***	***39.9%***	***47.0%***	***92.0%***
Low/Med-Low Tech Manufacturing	***88.5%***	***38.0%***	***20.2%***	***45.3%***
High/Med-High Tech Manufacturing	***147.5%***	***44.6%***	***83.9%***	***136.4%***
Services	***49.2%***	***20.2%***	***6.2%***	***20.3%***
Total	***83.3%***	***27.4%***	***22.4%***	***55.3%***

Authors' elaboration based on WIOD

Table A.9 – Contribution of exports and substitution between imported and domestic inputs to output growth (1995-2008)

	USA		Japan		Germany	
	$-\Delta\%Am$	$\Delta\%Exp$	$-\Delta\%Am$	$\Delta\%Exp$	$-\Delta\%Am$	$\Delta\%Exp$
Agriculture, Hunting, Forestry and Fishing	-3.6%	9.3%	-3.3%	3.5%	-10.6%	32.3%
Mining and Quarrying	-92.5%	7.2%	-518.8%	25.0%	-122.9%	21.9%
Food, Beverages and Tobacco	-1.1%	2.4%	-0.9%	2.4%	-4.1%	27.1%
Textiles and Textile Products	-3.8%	2.2%	-0.7%	5.1%	1.9%	25.6%
Leather, Leather and Footwear	16.7%	6.0%	-0.9%	4.8%	-2.5%	32.1%
Wood and Products of Wood and Cork	1.4%	3.0%	-0.9%	5.7%	-0.8%	39.8%
Pulp, Paper, Paper , Printing and Publishing	-2.2%	6.6%	-1.5%	12.3%	-7.6%	46.3%
Coke, Refined Petroleum and Nuclear Fuel	-16.9%	10.4%	-17.3%	16.1%	-17.7%	53.0%
Chemicals and Chemical Products	-16.4%	15.4%	-8.4%	21.4%	-15.8%	71.0%
Rubber and Plastics	-11.7%	13.1%	-7.5%	35.4%	-19.5%	61.3%
Other Non-Metallic Mineral	-9.6%	6.0%	-5.3%	17.4%	-6.0%	34.7%
Basic Metals and Fabricated Metal	-18.8%	19.9%	-7.8%	24.5%	-21.2%	58.4%
Machinery, Nec	-9.4%	21.4%	-4.0%	31.7%	-9.6%	61.2%
Electrical and Optical Equipment	-14.1%	43.8%	-10.4%	55.0%	-21.7%	81.2%
Transport Equipment	-6.3%	22.4%	-4.9%	59.4%	-12.6%	70.1%
Manufacturing, Nec; Recycling	-9.2%	13.6%	1.2%	14.2%	-4.7%	43.6%
Electricity, Gas and Water Supply	-4.5%	4.5%	-5.0%	10.2%	-12.2%	34.3%
Construction	-0.8%	0.6%	-0.5%	1.0%	-0.5%	4.6%
Motor Vehic./cycles Sale, Mainten/ Repair	-0.7%	0.9%	-9.6%	7.6%	-4.0%	12.9%
Wholesale Trade and Com. Trade (others)	-5.5%	17.0%	-5.0%	14.1%	-5.6%	31.5%
Retail Trade (others)	-0.6%	0.8%	-0.9%	2.5%	-4.3%	19.0%
Hotels and Restaurants	-0.9%	1.7%	-2.5%	6.0%	-2.1%	6.3%
Inland Transport	-8.1%	10.1%	-6.2%	9.0%	-8.3%	27.5%
Water Transport	-1.4%	14.8%	-8.0%	27.6%	-31.8%	147.0%
Air Transport	-3.2%	7.8%	10.5%	15.3%	-3.3%	32.1%
Other Supporting and Aux. Transp. Activ.	-3.5%	15.4%	-2.9%	13.6%	-11.4%	51.6%
Post and Telecommunications	-2.9%	9.0%	-4.1%	8.4%	-11.2%	28.4%
Financial Intermediation	-6.5%	9.3%	-3.5%	7.2%	-6.8%	23.7%
Real Estate Activities	-0.8%	1.5%	-0.6%	1.5%	-3.1%	9.2%
M&Eq Renting and Other Business Activ.	-6.3%	10.1%	-5.6%	10.3%	-10.9%	37.7%
Public Admin and Defence; Social Sec.	-0.2%	0.8%	-0.1%	0.3%	-0.4%	3.0%
Education	-0.3%	0.6%	-0.1%	0.4%	-0.6%	2.4%
Health and Social Work	0.0%	0.0%	-0.2%	0.4%	0.0%	0.2%
Other Community, Social and Pers. Services	-1.4%	3.4%	-0.8%	1.3%	-1.1%	9.6%
Agriculture and Mining	***-48.0%***	***8.0%***	***-108.8%***	***7.3%***	***-47.7%***	***30.1%***
Manufacturing	***-9.2%***	***17.1%***	***-6.4%***	***30.6%***	***-12.8%***	***58.3%***
Low/Med-Low Tech Manufacturing	***-7.8%***	***9.3%***	***-5.5%***	***16.4%***	***-10.8%***	***44.7%***
High/Med-High Tech Manufacturing	***-11.2%***	***26.6%***	***-7.2%***	***45.9%***	***-14.7%***	***70.9%***
Services	***-2.5%***	***4.9%***	***-2.3%***	***5.1%***	***-4.5%***	***18.6%***
Total	***-5.6%***	***7.9%***	***-5.9%***	***13.8%***	***-8.1%***	***33.2%***

Authors' elaboration based on WIOD