Imports contents, value added generation and structural change in morocco: input output analysis

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Abstract

Our main goal in this paper is to classify productive sectors according to the combination of two effects. The first effect lies in the change of their external dependency on imported inputs. The second effect is related to the change of their ability to generate value-added by unit of final demand. To perform this ordering of productive sectors, we use an input-output model after domesticating inter-industries tables of flows for the period 1999-2009. The domestication of the available matrix of intermediate consumption is necessary because the statistical authority in Morocco does not distinguish between imported and domestically produced inputs. Two of our results worth to be highlighted. First, the imports elasticity with respect to growth is superior to unity. This means that 1% increase of Gross Domestic Product produces an increase of imports of more than 1%. The second result is that there are no productive sectors belong to the most virtuous classes of sectors characterized by an increase of their ability to generate more value added and to reduce their reliance on imports. The higher imports dependency (leakages) is the consequence of increased openness of the Moroccan economy, but also from lower linkages between domestic productive sectors.

JEL classification: C67, D57

Keywords: Input-output analysis, Backward linkages, Leakages, Structural change, Value added, imports Morocco.

1. Introduction

Most previous studies of economic structural change using input-output analysis have paid little attention to the distinction between imported and domestically produced inputs. They have simply compared backward and forward linkages over time without domesticating the technical coefficients matrix (Guo and Planting, 2000, p.7).

Indeed, in an increasingly integrated World economy, where intercountries ties have become more and more important, measuring the leakages for individual sectors and for the economy, as a whole, is obviously a relevant question. This is especially true for small open economies such as the Moroccan one.

The analysis of the sources of economic growth in Morocco in recent years brings out two important facts. The first is the strong reliance of growth on domestic demand and the negative contribution of the external one. This is due to both the weight of incompressible imports (energy notably) and the low competitiveness of exportable supply. The second fact shows that the process of the Moroccan economy's openness and its greater integration into its regional and international environment benefits mostly to the partner countries and it has not yet allowed a rebalancing of growth toward external demand. The result is, in particular, a high domestic production's content in imports and limited links between domestic productive sectors. This may affects the process of structural change of the Moroccan economy.

In this paper, we use an input-output model to assess external dependency of Moroccan productive sectors on imported inputs (leakages) and their associated ability to generate value-added by unit stimulation of final demand. Precisely, after certain amendments of the basic input-output model, we use a decomposition of the total effect of a unit increase of final demand addressed to sector j to classify productive sectors and thereby to propose a new kind of "key sectors" according to the combination of these two effects. The dominance of the one or other effect permits, consequently, to appreciate the extent of structural change in the Moroccan economy.

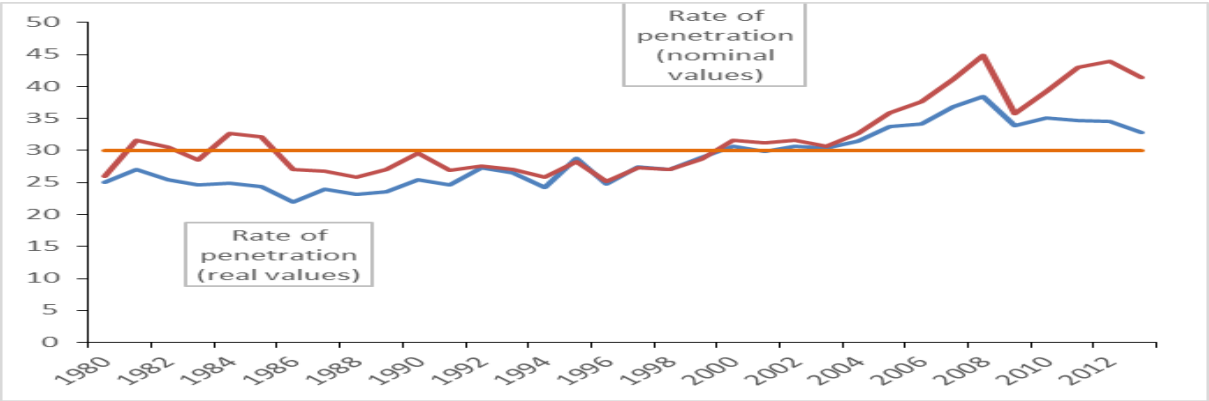
The remainder of the paper is as follows. The second section discusses some stylized facts about the Moroccan economy especially related to the importance of imports. The third section presents the methodology. We showed that the overall

effect of a unit change of final demand derived from the Leontief inverse matrix must be the sum of three terms: interindustry flows, distributed value added, and imported inputs. The fourth section presents data and the methodology of domestication of the Moroccan Input-output tables. This domestication is necessarily in order to separate imported and domestically produced inputs. The empirical results are exposed and discussed in the fifth section. The last section summarizes the results and concludes.

2. Stylized facts on the Moroccan economy: increasing dependency on imports

The Moroccan economy is a small and an open one. Imports include strategic items such as equipment, other investment and energy products. The Moroccan productive sectors use intensively imported inputs. Recently, apprehensions were raised on the growing dependency of the Moroccan economy on imports. The rate of penetration, calculated as the part of domestic demand satisfied by imported goods, is depicting a growing trend since the mid-1990s (figure 1).

Figure 1. Evolution penetration's rate



Source: Our elaboration from HCP data

In all over the world, GDP dynamics are highly instrumental in the evolution of imports. In empirical literature, imports (M) are frequently, and mainly, explained by GDP and their relative price compared to domestically produced goods price (price of imports/price of GDP- denoted P_M/P_Y). The first variable captures the income effect and the second variable captures the terms of trade effect. The responsiveness of imports to GDP evolution is measured by the

elasticity of imports to GDP. To measure this elasticity, we can use the arc definition of elasticity[1] or complicate a bit and run the following equation.

$$lnM_t=\alpha_1+ \alpha_2 lnGDP_t+ \alpha_2 log(PM/PY)+ u_t \qquad (1)$$

The elasticity of imports is $dlnM_t/dlnGDP_t$. Remark that we have not used a full specification of the demand equation of M. The objective is to gauge the magnitude of the responsiveness of Moroccan imports to GDP. It is worth to signal the scarcity of research done on the elasticity of imports to GDP in the case of Morocco even if this issue is at the heart of the current account sustainability. The Conseil National du Commerce Extérieur (2013, p. 5) estimated econometrically this elasticity to be about 1.5. That means that a 1% growth rate of GDP induces a 1.5% increase of imports. For the CNCE, this is due to the incompressibility of Moroccan imports and the increasing rate of penetration (imports divided by domestic demand).

Using, data of national accounts we find that imports elasticity to growth are much higher than CNCE estimates. For the period 1990-2013, 1% increase of GDP induced a 2.19% increase of imports, taking only the period 1998-2013, the nominal elasticity of imports to GDP jumped to 2.57%. It is necessary to warn readers that the Moroccan imports recorded important increases in the period 2002-2008 mainly because of the unusual increases of the price of commodities (energy, metals, and foods). Therefore, it appears that the bulk of Moroccan imports' increases are due to price effect and not to a volume effect.

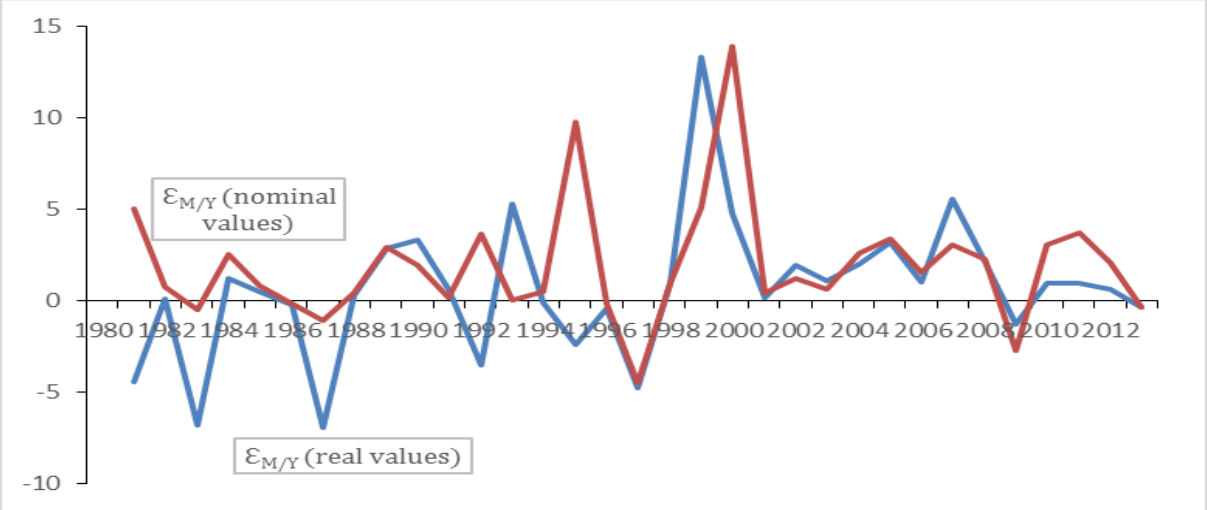
The running of the equation provides evidence that real GDP (RGDP) is instrumental in the evolution of Moroccan imports. It appears that 1% growth of GDP produced 1.32% growth of imports. Remark that in the equation we introduced only the two major variables commonly used as drivers of imports of a country. This is the full estimated equation:

$$lnM_t = \underset{(-9.77)}{-5.37} + \underset{(31.03)}{1.32}\ lnRGDP_t + \underset{(0.29)}{0.054}\ log(PM/PY)+ u_t \qquad (2)$$

R^2=0.96 (between parentheses are t-statistics)

[1] The arc definition of elasticity of imports with respect to GDP ($\varepsilon_{M/GDP}$) is defined as follows: $\varepsilon_{M/GDP}= g_M/g_{GDP}$; g_M and g_{GDP} are, respectivelly, proportional growth rates of M and of Real GDP.

Figure 2. Evolution of GDP elasticity of imports

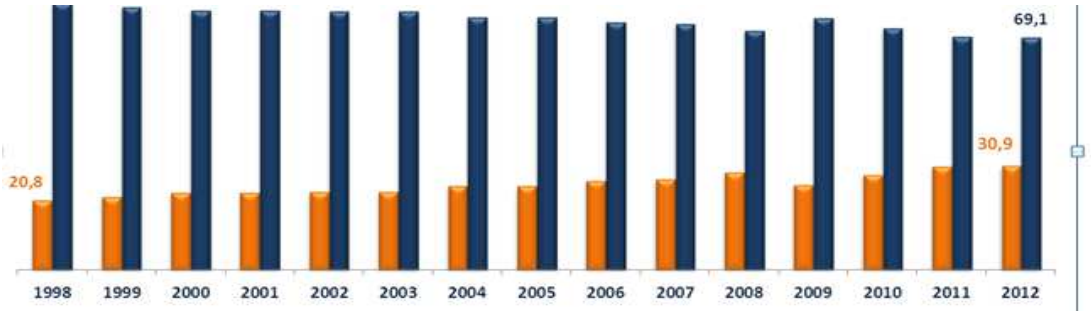


Source: Our elaboration (HCP data)

The increased penetration's rate implies that the representative consumed basket by Moroccan consumers (households, government, …) includes an increasing share of imported goods. Focusing over the period spanning from 1998 to 2012 shows that households' demand is increasingly satisfied by imports. Thus, the share of households' demand satisfied by imports increases from an average of 11.4% over the period 1998-2006 to an average of 15.8% over the period 2007-2012. Over the same period, the share of imported investment goods in total gross fixed capital formation passed from 17.9% to 21.4% (Chafiki, 2014). Beside this, the share of imported inputs increased in the intermediate consumption of productive sectors. Thus, if imported inputs represented 16.9% of productive sectors' intermediate consumption in 1998 they jumped to 30% in 2012 (Chafiki, 2014).

The growing content of Moroccan exports in imported inputs is clearly noticeable from figure n° 3. The share of imported inputs in exports increased by 10% during the period 1998-2012. This is a result of the growing use of imported products as inputs in the production of exported products in sectors such as cars making, electric and metallurgical industries. Furthermore, the Moroccan economy relies heavily on imported products destined to investment in sectors such as "Agriculture" and "Building and Public Works".

Figure 3. Evolution of the share of imported inputs in Moroccan exports



Source: Chafiki, 2014

Morocco followed an expansionist Moroccan fiscal policy during the first decade of the 2000s. This policy was designed to boost the economy and to satisfy social demand. It manifested by public projects aiming to increase the stock of public infrastructure and to fill in social gaps. Unfortunately, this policy revealed a structural reliance on imported inputs and this raise worries concerning the sustainability of current account deficits

3. Methodology

3.1 Input-Output model and production's multipliers

The input-output methodology provides a useful tool to quantify intersectors' relationships in the economy (Miller and Blair, 2009). It shows how a sector *i* output x_i is used by other productive sectors as intermediate input and by final consumers as final consumption. For clarity, consider an economy consisting of *n* sectors. Let x_i be the total output of sector *i,* and z_{ij} be the i^{th} sector production used as input by the j^{th} sector and y_i be the total final demand of goods produced by this sector[2]. We can represent the way in which sector *i* distributes its product through sales to other productive sectors and to final consumers as follows:

$$x_i = \sum_{j=1}^{n} z_{ij} + y_i \qquad (3)$$

[2] It contains sales of goods that would not normally reappear in the economy in the same form. They are either used by domestic final users of goods as households (consumers) (C) private investors (I) and governments (G) or exported abroad (E). That is why these sales are regarded as final demand. Final demand is decomposed into domestic final demand (C+I+G) and foreign final demand (E).

It should be noted that the I-O model relies on some strong assumptions (Bess and Ambargis, 2011, pp. 8-9). One of these fundamental assumptions is that the production process operates under constant returns to scale. In addition, in a given period, the interindustry flow from sector *i* to sector *j* depends entirely on the total output of the j^{th} sector. It assumes also that inputs are used in fixed proportion, without any possible substitution. The fixed relationships between sectors outputs and their respective inputs are measured by technical coefficients[3]. These coefficients a_{ij} are obtained by dividing the inputs z_{ij} associated with the production x_j of a given industry *j* ($a_{ij}=z_{ij}/x_j$ and consequently $z_{ij}=a_{ij}x_j$). Thus, the distribution of a sector *i* production, as intermediate input to all productive sectors and as final consumption, may be represented by the following equation:

$$x_i = \sum_{j=1}^{n} a_{ij}\, x_j + y_i \qquad (4)$$

Thus, this latter equation serves to clarify the dependency of interindustry flows on total output of each sector. If we denote[4] the matrix of technical coefficients by $\boldsymbol{A}$, the vector of total output by X, and the vector of final demand by Y, the matrix form of that system is $X=\boldsymbol{A}X+Y$. Traditionally, within the I-O framework, the final demand is considered as exogenous to the production process. Then, the model is used to determine the vector of production that is necessary to satisfy a given final demand vector. Indeed, equation (4) can be re-written as:

$$Y=(\boldsymbol{I}-\boldsymbol{A})X \qquad (5).$$

If the matrix $\boldsymbol{I}-\boldsymbol{A}$ is invertible then this is a linear system of n equations with a unique solution. In this case, we can find the output necessary from each sector and the economy as whole to supply a given increase of final demand of the exogenous sectors (consumers). Indeed, the solution of the system is $X=(\boldsymbol{I}-\boldsymbol{A})^{-1}Y$. The matrix $(I-\boldsymbol{A})^{-1}$ is the Leontief inverse matrix denoted by $\boldsymbol{L}=(\boldsymbol{I}-\boldsymbol{A})^{-1}$.

The matrix $\boldsymbol{L}$ is also known as the total requirements matrix. It gives valuable information to assess the effect on the economy of changes in elements that are exogenous to our model. Each element of it (l_{ij}) presents the total direct and indirect effect on the production of sector *i* of a unit increase in final demand of a given sector *j*. The sum of terms of the j^{th} column of the total requirements

[3] Called also input–output coefficients, direct input coefficients or direct requirements

[4] As a notationnel convention, we denote a scalar by a lowercase letter (x) a vector by a no bold uppercase letter (X) and a matrix by a bold uppercase letter ($\mathbf{X}$).

matrix gives the total effect (direct and indirect) on overall domestic production of a unitary change in the final demand adressed to the j^{th} sector. This is the so called (simple) output multiplier of sector *j*. It is measured as follows:

$$l_{.j} = \sum_{i=1}^{n} l_{ij} \qquad (6)$$

3.2. Measuring leakages and structural change

The simple output multiplier (showed by equation 6) for a given sector gives the well known backward linkages between this sector and others productive sectors. In fact, within input-output framework, there are two kinds of economic linkages between productive sectors: backward-linkages[5] and forward-linkages[6].

Backward and forward linkages indicators measure and quantify economic "connectedness"[7]. Thereby, comparisons of the strengths of sectors' backward and forward linkages (absolute or normlized) in any single economy provide an interesting tool for identifying "key" or "leading" sectors in that economy[8]. In addition, the evolution of these indicators is valuable to unveil possible structural change in the economy (Guo and Planting, 2000, p.7).

Our main goal in this paper is to find "key productive sectors" by classifying productive sectors according to two dimensions. The first is their ability to generate more value-added by unit of final demand. The second effect is their need of less imported intermediate inputs in response to the same shock. In other words, our objective is to classify sectors according to the combination of these effects: those sectors presenting a positive "efficiency" change and those recording a negative "dependency" change (Amaral and al. 2011). This permits, consequently,

[5] If an industry *i* increases its production, there will be increased demand for the industries whose products are used as inputs by that industry. Models that measure impacts based on this type of relationship are called backward models. An industry with higher backward linkages than other industries means that expansion of its production is more beneficial to the economy in terms of causing other induced productive activities.

[6] Increased output in sector *i* also means that additional amounts of product *i* are available to be used as inputs to other sectors for their own production – that is, there will be increased supplies from sector *i* (as a seller) for the sectors that use good *i* in their production. Models that measure impacts based on this type of relationship are called forward-linkage models.

[7] Since the seminal and pioneering works of Rasmussen (1956) and Hirschman (1958), several more sophisticated measures have been proposed in the literature, especially for advanced economies, where the objective is not to reinforce the linkages with existent activities, but to explore new emerging activities. For more details on this question, see for example (Drejer, 2002)

[8] Those sectors that are most connected and therefore, in some sense, most "important"

to appreciate the structural change of the economy as a whole. Indeed, if more and more sectors record a positive efficiency change, one can deduce that resources are used where they are most productive (McMillan and Rodrik, 2011, p. 13).

The production of the j^{th} sector output requires intreindustry inputs z_{1j}, z_{2j}, … and z_{nj} from other productive sectors, inputs from payment sectors; represented by distributed value added (v_j)[9]; and imported inputs (m_j)[10]. Thus, the total j^{th} sector output can be written as follows:

$$x_j = \sum_{i=1}^{n} z_{ij} + v_j + m_j \qquad (7)$$

Consequently, one can deduce, as observed by Amaral, Lopez, and Dias (2011) that the overall effect of a unit change of final demand is the sum of three terms: interindustry flows, value added and imported inputs. On the other hand, given equations (3) and (7), one can deduce that, from a macro-economic point of view, total final demand is equivalent to the sum of value added and imports. Thus, given the value of an exogenous stimulus (a unit) in a sector final demand, we can write: $\Delta Y = \Delta Y_j = \Delta(\sum_{i=1}^{n} v_i + \sum_{i=1}^{n} m_i) = 1$. If we assume that value added coefficients $vc_i = v_i/x_j$ and imports coefficients $mc_i = m_i/x_i$ are constant, we can write:

$$1 = \sum_{i=1}^{n} l_{ij} * vc_i + \sum_{i=1}^{n} l_{ij} * mc_i \qquad (8)$$

And if normalized:

$$\frac{1}{\sum_{i=1}^{n} l_{ij}} = \frac{\sum_{i=1}^{n} l_{ij} * vc_i}{\sum_{i=1}^{n} l_{ii}} + \frac{\sum_{i=1}^{n} l_{ij} * mc_i}{\sum_{i=1}^{n} l_{ij}} \qquad (9)$$

This equation, representing the weighted average of value-added and imported inputs coefficients, can also be expressed as follows:

$$1 = \sum_{i=1}^{n} l_{ij} * (V_i + M_i) \qquad (10)$$

V_i and M_i represent the normalized values $vc_i/l_{.j}$ and $mc_i/l_{.j}$. In comparative static, equation (10) permits to detect the change in the productive structure of an

[9] The value added is the sum of incomes disturbed as compensation of services offered by primary sectors (labor and capital, notably) and used by productive sectors as inputs.

[10] The second payment sector concerns imported goods used as inputs by productive sectors.. This is what we call foreign intermediate consumption.

economy. Precisely, it permits to evaluate the gain in the capacity of an economy to generate value added (growth effect) and its associated propensity to increase or to decrease external dependency (external dependency effect) from one point of time to another. For each productive sector, two situations are possible.

The first is the case where the total effect of a unitary change of sector *j* final demand decreases between two given years ($\Delta l.j < 0$). In this case, as the increase in the global production of the economy in order to satisfy a unitary increase in final demand must be smaller, the sum $\Delta V_i + \Delta M_i$ must be positive. The sector's performance can thereby be located in one of the four following areas, which are classified bellow from the most advantageous to the worst one.

- **Area A**: the most virtuous area, where are located sectors with a larger capacity to generate value added ($\Delta V_i > 0$) and decreased need of imported inputs ($\Delta M_i < 0$). Of course, in this situation, we have $\Delta V_i > |\Delta M_i|$.
- **Area B:** where are located sectors whose efficiency effect, i.e. increase of distributed value added ($\Delta V_i > 0$), dominates the increase of imported inputs ($\Delta M_i > 0$). In this situation, we have $\Delta V_i > \Delta M_i$.
- **Area C:** where are located sectors whose value added and imports increase ($\Delta V_i > 0$, $\Delta M_i > 0$), but external dependency effect dominates net efficiency effect ($\Delta M_i > \Delta Vi$).
- **Area D**: the disadvantageous area, where are located sectors with a decreased capacity to generate value added ($\Delta Vi < 0$) and a larger need of imported inputs ($\Delta Mi > 0$). Of course, in this situation we have $|\Delta Vi| < \Delta Mi$.

The second situation occurs when the total effect on the output of a final demand increases between two given years. In this case, as the increase in the total output of the economy in order to satisfy a unitary increase in final demand must be higher, the sum $\Delta V_i + \Delta M_i$ must be negative. Here also, productive sectors can be located in one of the four following areas, classified bellow in a descending order.

- **Area A*:** grouping sectors, with $\Delta V_i > 0$ and $\Delta M_i < 0$ and $\Delta V_i < |\Delta M_i|$
- **Area B*:** grouping sectors, with $\Delta V_i < 0$ and $\Delta M_i < 0$ and $|\Delta V_i| < |\Delta M_i|$
- **Area C*:** grouping sectors, with $\Delta V_i < 0$ and $\Delta M_i < 0$ and $|\Delta V_i| > |\Delta M_i|$
- **Area D***: grouping sectors, with $\Delta V_i < 0$ and $\Delta M_i > 0$ and $|\Delta V_i| > \Delta M_i$

The table below summarizes, for each situation, the features of every area.

Table n°1: Sectors' classification on the basis of changes in their imports and value added

SITUANTION 1	SITUATION 2
Area A: $\Delta V_i > 0$ and $\Delta M_i < 0$ and $\Delta V_i > \|\Delta M_i\|$	Area A*: $\Delta V_i > 0$ and $\Delta M_i < 0$ and $\Delta V_i < \|\Delta M_i\|$

Area B: $\Delta V_i > 0$ and $\Delta M_i > 0$ and $\Delta V_i > \Delta M_i$	Area B*: $\Delta V_i < 0$ and $\Delta M_i < 0$ and $\lvert\Delta V_i\rvert < \lvert\Delta M_i\rvert$
Area C: $\Delta V_i > 0$ and $\Delta M_i > 0$ and $\Delta V_i < \Delta M_i$	Area C*: $\Delta V_i < 0$ and $\Delta M_i < 0$ and $\lvert\Delta V_i\rvert > \lvert\Delta M_i\rvert$
Area D: $\Delta V_i < 0$ and $\Delta M_i > 0$ and $\lvert\Delta V_i\rvert < \Delta M_i$	Area D*: $\Delta V_i < 0$ and $\Delta M_i > 0$ and $\lvert\Delta V_i\rvert > \Delta M_i$

The changing distribution of productive sectors of an economy between those areas permits to appreciate the extent of its structural change. Precisely, if there is a tendency of the net gain on efficiency effect to dominate the external dependency effect (more sectors in area A for instance), we can conjecture that there is an ongoing structural change and that the concerned economy develops over time. According to the areas described below, the structural change is operating in an economy if the majority of sectors are (tend to be) located in Areas A and A* and, to a lesser extent, in Area B.

4. Data and domestication of Moroccan input output tables

The application of the method described above for the Moroccan case is hampered by two major problems related to the construction of the Moroccan input-output tables. The first problem lies in the fact that Moroccan I-O tables provide data on production and imports on the basis of the basic price, while their distribution to intermediate and final uses is given on the basis of the purchase price.

Given our objective in this paper, it is necessary to express the vector of imports on the basis of the **purchase price**. This requires allocating different costs between internally generated resources and those of external origin. Some costs are easily and entirely allocated to one or the other resources. This is the case of the VAT where we can distinguish VAT on imports and domestic VAT. For the allocation of other costs and margins, we use **the import coefficient**, i.e. the share of imports in total resources, as a distribution key.

The second and main problem lies in the treatment of imported inputs. Generally, there are two configurations in this respect. The first case is when a separate import matrix is available, in addition to the domestic one. In this case, the application of the traditional input-output analysis is straightforward and poses no additional problems. The second case, which is the most common one, both imports and domestically produced inputs are included in the intermediate transactions matrix. This is the case of Moroccan input-output tables, which do not give separate matrices for inputs produced locally and those imported. Only their sum is known[11]. In this situation, the multipliers derived from Leontief inverse

matrix tend to overestimate the impact of a change in final demand on domestic industry outputs (Dietzenbacher et al. 2005; Reis and Rua, 2006). In reality, imported inputs represent leakages that reduce industries' linkages and thereby the magnitude of multipliers.

One way to escape these problems is to separate domestic from imported inputs. We apply in this paper a domestication technique based on an assumption commonly referred to as **import similarity** where for each product the mix of imports and domestically produced goods is the same across all consuming sectors, but may be different for each product (see Miller and Blair, 2009, p. 151).

Let us suppose that the fraction of a given input supplied by imports is the same for each industry and that fraction also applies to final users, then that same fraction of total output is attributable to imports[12]. If we denoted that fraction by θ_i , so we can write $m_i=\theta_i * x_i$ and given the equation (3) below, we can deduce:

$$m_i = \theta_i * \sum_{j=1}^{n} z_{ij} + \theta_i * y_i \qquad (11)$$

On the other hand, we know that imported goods are used by productive or by final demand sectors. So, we can write $m_i = \sum_{j=1}^{n} z_{ij}^m + y_i^m$. Consequently, the estimated matrix of interindustry imports and the estimated vector of imports consumed directly by final consumers is obtained from the following equations $z_{ij}^m = \theta_i * z_{ij}$ and $y_i^m = \theta_i * y_i$.

Finally, we can domesticate the Moroccan I-O tables by subtracting the imported inputs and imports used by final users from the initial table, as follows:

$$z_{ij}^d = (1 - \theta_i) * z_{ij} \qquad (12)$$

$$y_i^d = (1 - \theta_i) * y_i \qquad (13)$$

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[11] It should be noted that in this model there is an interesting implicit assumption suggesting that substitution of imported and domestically produced intermediate inputs is allowed. Indeed, instead of assuming that both $\mathbf{A}^d$ (domestic inputs matrix) and $\mathbf{A}^m$ (imported inputs matrix) are constant, only **A** is required to be constant, which is a reasonable approximation for the short-run. It is straightforward that: $\mathbf{A}=\mathbf{A}^d+\mathbf{A}^m$.

[12] This assumption may not be very realistic in many developed economies as Moroccan one but is often necessary due to the limits of available data.

Where z_{ij}^{d} (respectively y^{d}_{i}) are goods produced locally by sector i and used as inputs by productive sectors (respectively used by final consumers for final consumption). Note that there are other alternatives for the methodology presented here to domesticate the I-O tables. One of them is to assume implicitly that there are no imports consumed directly by final demand, which is probably seldom the case (Dietzenbacher and al. 2005; Reis and Rua, 2006; and Miller and Blair, 2009).

5. Results and discussion

We have applied the method described above to the Moroccan economy in the period 1999-2009, after domestication of the national Input-Output Tables with 20 sectors. The data are from national statistics authority (Haut commissariat au plan). The table below shows the evolution of backward linkages of each industry over the period 1999-2009. It gives a rank of each sector according to the intensity of the backward linkages.

Table n°2: Evolution of backward linkages and ranking of productive sectors (1999-2009)

Code	Sector	1999		2000		2001		2002		2003		2004		2005		2006		2007		2008		2009	
		BL	Rank	BL	Rank	BL	Rank	BL	Rank	BL	Rank	BL	Rank	BL	Rank	BL	Rank	BL	Rank	BL	Rank	BL	Rank
D01	Food and tobacco industry	1,83	1	1,81	1	1,83	1	1,81	1	1,80	1	1,76	1	1,76	2	1,78	2	1,75	2	1,75	2	1,67	2
D02	Textile and leather industries	1,69	2	1,69	3	1,70	3	1,68	3	1,64	3	1,60	3	1,66	3	1,59	3	1,57	3	1,58	3	1,57	3
I01	Transport	1,66	3	1,75	2	1,73	2	1,71	2	1,69	2	1,74	2	1,84	1	1,87	1	1,82	1	1,77	1	1,67	1
H55	Hotels and restaurants	1,58	4	1,56	5	1,55	4	1,55	4	1,54	4	1,51	4	1,48	4	1,51	4	1,44	5	1,44	5	1,42	4
F45	Building and public works	1,57	5	1,53	6	1,51	6	1,50	6	1,47	5	1,43	6	1,43	6	1,42	6	1,40	6	1,40	6	1,36	7
D05	Other manufacturing industries	1,54	6	1,57	4	1,54	5	1,52	5	1,47	6	1,46	5	1,47	5	1,47	5	1,44	4	1,44	4	1,38	6
D03	Chemical and Para-chemical industries	1,52	7	1,50	7	1,48	7	1,50	7	1,46	7	1,40	7	1,40	7	1,39	7	1,37	7	1,37	7	1,34	9
D04	Mechanical, metallurgical and electrical industries	1,39	8	1,38	8	1,40	8	1,40	8	1,39	8	1,36	8	1,38	8	1,37	8	1,35	10	1,35	10	1,32	10
L75	General Public Administration and Social Security	1,36	9	1,38	9	1,36	9	1,37	9	1,34	9	1,34	9	1,34	10	1,35	9	1,35	9	1,35	9	1,34	8
C00	Extractive industry (Mining)	1,32	10	1,31	12	1,30	11	1,33	10	1,31	11	1,33	10	1,35	9	1,32	10	1,29	11	1,29	11	1,19	16
A00	Agriculture, forestry, hunting and exploitation	1,32	11	1,36	10	1,33	10	1,30	11	1,27	12	1,28	13	1,30	12	1,27	13	1,26	13	1,26	13	1,20	14
B05	Fishing and aquaculture	1,31	12	1,33	11	1,28	14	1,22	17	1,20	17	1,22	17	1,21	17	1,20	17	1,18	17	1,18	17	1,19	15
D06	Refined petroleum and other energy products	1,28	13	1,28	14	1,29	12	1,28	12	1,33	10	1,32	11	1,31	11	1,32	11	1,36	8	1,36	8	1,40	5
E00	Electricity and Water	1,27	14	1,26	15	1,26	15	1,26	14	1,24	15	1,24	15	1,23	16	1,25	14	1,24	14	1,24	14	1,18	17
G00	Commerce and repair	1,27	15	1,29	13	1,28	13	1,27	13	1,27	13	1,28	12	1,30	13	1,29	12	1,28	12	1,28	12	1,25	12
J00	Financial activities and insurance	1,25	16	1,23	17	1,23	17	1,23	16	1,26	14	1,26	14	1,24	15	1,23	16	1,24	15	1,24	15	1,25	11
OP0	Other non-financial services	1,16	17	1,15	18	1,13	18	1,13	18	1,11	18	1,11	18	1,10	18	1,09	17	1,09	18	1,09	18	1,08	19
I02	Posts and Telecommunications	1,12	18	1,24	16	1,25	16	1,26	15	1,24	16	1,24	16	1,24	14	1,24	15	1,23	16	1,23	16	1,22	13
MNO	Education, health and social action	1,09	19	1,10	19	1,08	19	1,07	19	1,07	19	1,07	19	1,06	19	1,06	19	1,06	19	1,07	19	1,08	18
K00	Real estate, rental and services to companies	1,07	20	1,07	20	1,07	20	1,07	20	1,07	20	1,06	20	1,06	20	1,05	20	1,04	20	1,04	20	1,04	20

Two main conclusions are drawn from it. The first concerns the hierarchy of sectors, which has not changed significantly over the studied period. Few key

sectors have emerged from this point of view[13]. The second conclusion is the weaknesses of backward linkages and the apparent global/general deterioration of integration of the Moroccan productive system between 1999 and 2009. Indeed, the intensity of backward linkages decreases for almost all sectors. This means that, in order to satisfy a unitary increase of final demand addressed to those sectors, a smaller increase in the global production of the economy is necessary[14]. This is not automatically a bad news provided that this decrease in production has not been substituted by imports in order to satisfy the initial increase in final domestic demand.

Table 3 shows, for each sector over the period 1999-2009, the changes of backward linkages, external dependency and value added generation. It gives also the localization of each sector in the eight areas described above (Table n°1 above).

Table n°3: Changes of sector's backward linkages, imports and of value added generation between 1999 and 2009

Code	Sector	ΔBL	ΔM	ΔV	Area
A00	Agriculture, forestry, hunting and exploitation	-0,12	0,00	0,07	Area B
B05	Fishing and aquaculture	-0,12	0,03	0,06	Area B
C00	Extractive industry (Mining)	-0,14	0,26	-0,16	Area D
D01	Food and tobacco industry	-0,16	0,06	0,01	Area C
D02	Textile and leather industries	-0,13	0,02	0,04	Area B
D03	Chemical and Para-chemical industries	-0,18	0,23	-0,13	Area D
D04	Mechanical, metallurgical and electrical industries	-0,08	0,37	-0,32	Area D
D05	Other manufacturing industries (outside petroleum refining)	-0,17	0,17	-0,08	Area D
D06	Refined petroleum and other energy products	0,12	1,10	-1,23	Area D*
E00	Electricity and Water	-0,09	0,10	-0,04	Area D
F45	Building and public works	-0,20	0,00	0,12	Area B
G00	Commerce and repair	-0,02	0,00	0,01	Area B
H55	Hotels and restaurants	-0,16	0,03	0,04	Area B
I01	Transport	0,02	0,11	-0,12	Area D*
I02	Posts and Telecommunications	0,11	-0,02	-0,07	Area C*
J00	Financial activities and insurance	0,00	0,01	-0,02	Area D*
K00	Real estate, rental and services to companies	-0,03	0,03	-0,01	Area D
L75	General Public Administration and Social Security	-0,02	0,00	0,01	Area B
MNO	Education, health and social action	-0,01	0,00	0,00	Area B

[13] This include in particular the sector of "Refined petroleum and other energy products" that would be related at least in part to the increase of international prices and some services as transport and the posts and telecommunications sector. In 2009, the sector of transport emerged as the leading sector, while it was ranked third in 1999, behind the food and tobacco and textile and leather industries. The posts and telecommunications sector gained five places, to the 13th place in 2009. The financial and insurance activities showed the same performance, to 11th place instead of 16th in 1999.

[14] The average of backward linkages dropped from 1.38 in 1999 to 1.31 in 2009.

OP0	Other non-financial services	-0,08	0,00	0,06	Area B

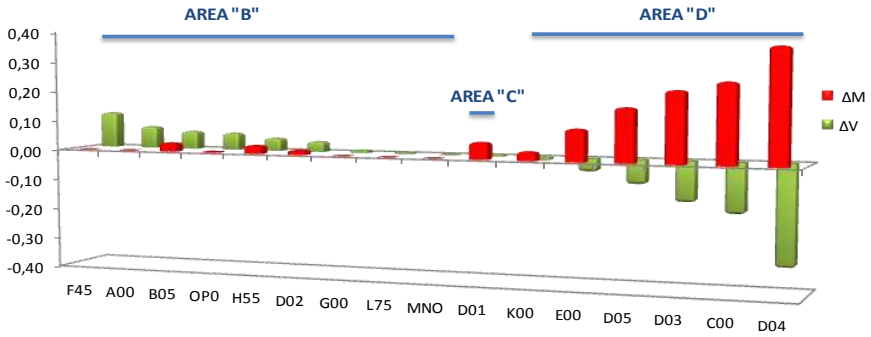
Our results show, that over the period studied, an increase of final demand addressed to domestic production generates leaks on imports and benefits to foreign agents. The striking result that emerges from this table is that no productive sector is located in the two most virtuous areas (areas A and A*) including, as described in the methodology before, sectors recording *an increase* in their ability to generate more *value added* and *a decrease* of their *propensity to import*. This confirms the weaknesses of the Moroccan economy and its increasing reliance on imported products and consequently the threats on its current account.

In addition, there are more sectors with decreasing backward linkages (16 sectors) than with increasing backward linkages (4 sectors). Does this result reflect improvement of economic efficiency or, conversely, increased leakage and a deepening of external dependency? Unfortunately, the available evidence suggests that external dependency is most likely occurring.

We showed that in the case where backward linkages decrease, the sum of the change in value added and the change of imports must be positive. In this situation, our results show that nine (9) sectors are located in the area B (value added higher than imports leakage). The composition of this area gives an idea about the "leading" sectors in Morocco. These sectors includes: 1. Utilities and low technological content sectors (Agriculture, Forestry, Hunting and Exploitation, Fishing and Aquaculture, Commerce and Repair, ...), 2. Protected and domestic oriented sectors (Building and public works, General Public Administration and Social Security, Education, Health and Social Action) and traditional productive sectors (Hotels and restaurants, Textile and leather industries).

However, the majority of industrial industries with some technological content, as Mechanical, metallurgical and electrical industries, Chemical and Para-chemical industries… are located in the most disadvantageous area (Area D), i.e. with great external dependency and lower value added generation. The figure below gives more details in this respect.

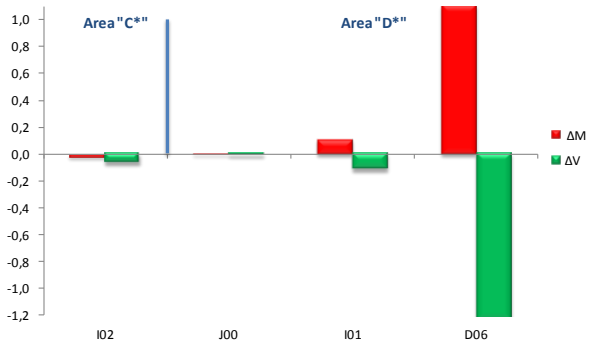
Figure 4: Localization of sectors with negative variation of backward linkage between 1999-2009



Another negative tendency in the Moroccan economy appeared when we analyze the performance of sectors that whose backward linkage indicators increase between 1999 and 2009. This positive variation means, to reiterate, that in order to satisfy a unitary increase in final demand of each sector for them, it is necessary a higher increase in the global production of the economy.

This is not necessarily good fact if this increase in production reflects a decline of its ability to generate value added or has also induced a rise of imports. We showed before that in this situation, the sum of generated value added and induced imports must be negative. The figure below shows, nevertheless, that no sector is located in the area A* (more value added and less imports) nor the area B* (lower decrease in value added than imports). This is an important concern to the extent that the sectors whose backward linkages increased over the period (Transport, Financial activities, Posts and Telecommunications and Refined Petroleum…) do not necessarily promote structural transformations in Morocco. Their apparent dynamism is more due to leaks they are undergoing to the economy without being able to generate more value added.

Figure 5: Localization of sectors with positive variation of backward linkage between 1999-2009



The table below summarizes the results and gives the shares of each area in total output, total value added, and total employment for the year 2009.

Table n°4: Share of each area in total output, total value added and total employment-2009

	Area A	Area A*	Area B	Area C	Area B*	Area C*	Area D*	Area D
Nb of sectors	0	0	9	1	0	1	3	6
% to total output	0	0	38,8	10,7	0	2,6	10,2	37,3
% to total value added	0	0	56,9	4,4	0	3,2	9,2	25,8
% to total employment	0	0	86,4	1,5	0	0,6	1,2	7,3

It shows in particular that almost half of Moroccan productive sectors (9 of 20) are located in the two most disadvantageous areas (D and D*) including sectors recording a decrease in their ability to generate more value added and an increase in their external dependency. These 9 sectors represent, at the end of 2009, 47,5% of total output, 35% of GDP and 8,5% of total employment. It is worth to note that the concerned sectors are those with significant capital intensity.

To refine our analysis, we have distinguished between two subperiods: 1999-2004 and 2004-2009, where the annual average growth rate of Moroccan real GDP was similar (respectively 4% and 4,5%). The results are given in appendix. Our previous conclusions remain broadly the same and confirm the negative impact of international trade on the integration of Moroccan productive sectors.

The backward linkages declined for most of productive sectors. This reinforces their external dependency. During the second subperiod (2004-2009), backward linkages increased only for three sectors (General public administration and social Security, Education, health and social action, Refined petroleum and other energy products) against six sectors on the first subperiod (Extractive industry-Mining, Commerce and repair, Transport, Posts and telecommunications,

Financial activities and insurance, Refined petroleum and other energy products). More importantly, over the two sub-periods, these sectors are included in the disadvantageous area (Area D*), where external dependency increases and ability to generate value added declines.

The increase of external dependency of the Moroccan economy and its dependency on sectors generating less value added is also noticeable when we analyze the performance of productive sectors with negative variation of backward linkages. In this case, the number of sectors included in the most disadvantageous area (area D) extended from three sectors during the period 1999-2004 (Chemical and Para-chemical industries, Mechanical, metallurgical and electrical industries, Other manufacturing industries) to eight sectors during the period 2004-2009. More importantly, the latter concern all branches of industry (except Textile and leather industries) and some services with reasonable technological content and high positive externalities (Telecommunications, financial activities, Real estate, rental and services to companies).

It is true that the sectors belonging to the most virtuous area (Area A) have also increased from two sectors (Electricity and Water, Hotels and restaurants) to five (Extractive industry-Mining, Agriculture, Transport, Textile and leather industries, other non-financial services). In fact, only the Extractive industry that really emerged, while others sectors value added increase only slightly. The dark side of this situation is that these sectors remained traditional with low technological content; the modern and higher productivity sectors are localized elsewhere.

The comparison of the shares of each area in total output, total value added, and total employment gives more evidence on the shortcomings recorded by the Moroccan economy in reducing its external dependency and of using its resources where they are most productive. For example, during the period 2004-2009, the productive sectors that induce more imports leakage and generate less value added represent on average of 57% of total output against 30% for the ones that generates more value and lower imports (36% against 4% during the period 1999-2004). The two tables below give more details in this respect.

Table n° 5 Average share of each area on total output, total value added and total employment during the period 1999-2004

	Area A	Area A*	Area B	Area C	Area B*	Area C*	Area D*	Area D
Nb of sectors	2	0	6	3	0	1	5	3
% to total output	4,33	0	30,9	26,6	0	1,9	13,9	22,4
% to total value added	5,24	0	30,6	28,8	0	2,8	24,4	8,2
% to total employment	2,05	0	22,2	53,2	0	0,3	17,8	4,3

Table n°6 Average share of each area in total output, total value added, and total employment in the period 2004-2009

	Area A	Area A*	Area B	Area C	Area B*	Area C*	Area D*	Area D
Nb of sectors	5	0	3	1	0	0	3	8
% of total output	29,9	0	11,0	2,2	0	0,0	13,3	43,5
% of total value added	24,6	0	18,5	2,5	0	0,0	18,5	35,9
% of total employment	57,8	0	22,9	2,0	0	0,0	8,8	8,6

Finally, it should be noted that in Morocco there is no domestic input-output flows at constant prices. The use of input output tables at current prices do not allow us to separate prices effects from quantity/real effects. Dietzenbacher and Temurshoev (2012) showed that the impact's analysis differs when current prices or constant prices are used.

6. Conclusion

The Input-Output Model (IO) provides a powerful tool for analyzing interindustry linkages and for identifying key sectors in a given economy. It is also increasingly used in the analysis of the structural change of economies (Sonis and al. (1995), Bureau of Economic Analysis (2000)) Dietzenbacher and van der Linden (1997)), Dridi and Hewings (2002). Our strategy here is simple and draws heavily on the work of Amaral, Lopez and Dias (2011).

We have attempted to assess the external dependency of Moroccan productive sectors and the associated low value added generated in domestic production, using the Leontief inverse matrix. The results reveal the reduced capacity to generate value added and to reduce external dependency of the majority of Moroccan productive sectors, particularly in recent years. During the period 1999-2009, backward linkages decreased for 16 of 20 Moroccan productive sectors.

This decrease in production needed to satisfy an increase in domestic demand (reduction of the output multiplier) does not reflect gains in efficiency but an increase of external dependency in that imported inputs have supplanted domestic ones. As a result, no Moroccan productive sector is located in the most virtuous areas that includes sectors recording an increase in their ability to generate more value added and to rely less on imports. This confirms the failure of the Moroccan economy to catch emerging countries, since it is expected that as an economy develops most sectors should be located in those virtuous areas. In addition, our results show that sectors with some content of technology, especially

industrial activities and some services, have entered in the disadvantageous areas of less value added generation and more external dependency.

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Appendix

Table n° 4. Changes of imports and value added for sectors with negative variation of backward linkages (1999 – 2004)

	ΔBL	ΔM	ΔV	AREA
A00	-0,04	0,02	0,00	AREA C
B05	-0,09	0,03	0,04	AREA B
D01	-0,06	0,01	0,02	AREA B
D02	-0,10	0,02	0,02	AREA C
D03	-0,11	0,20	-0,13	AREA D
D04	-0,03	0,02	-0,01	AREA D
D05	-0,08	0,05	-0,01	AREA D
E00	-0,03	-0,04	0,06	AREA A
F45	-0,13	0,00	0,08	AREA B
H55	-0,07	-0,01	0,04	AREA A
K00	-0,01	0,00	0,00	AREA C
L75	-0,02	0,00	0,02	AREA B
MNO	-0,03	0,00	0,02	AREA B
OP0	-0,05	0,01	0,03	AREA B

Figure n° 6. Localization of sectors with negative variation of backward linkage between 1999-2004

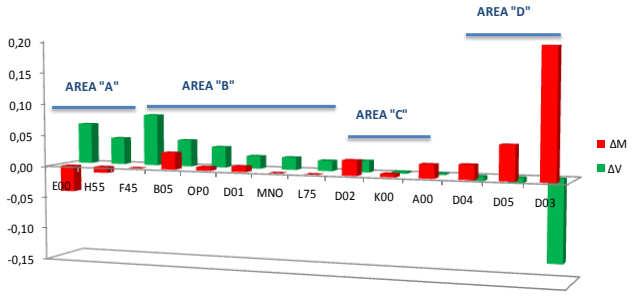


Table n° 5: Changes of imports and value added for sectors with negative variation of backward linkages (2004– 2009)

	ΔBL	ΔM	ΔV	AREA
C00	0,01	0,70	-0,71	Area D*
D06	0,05	0,31	-0,34	Area D*
G00	0,01	0,00	-0,01	Area D*
I01	0,08	0,12	-0,17	Area D*
I02	0,12	-0,03	-0,07	Area C*
J00	0,00	0,00	-0,02	Area D*

Figure n° 7: Localization of sectors with positive variation of backward linkage between 2004-2009

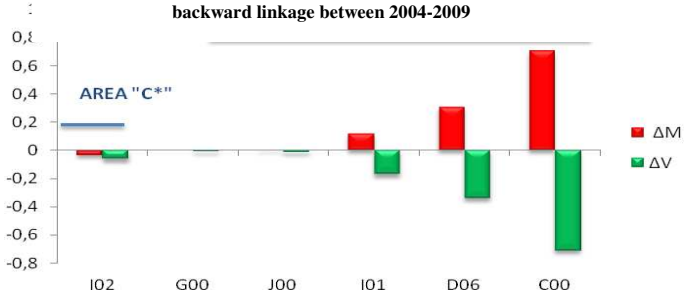
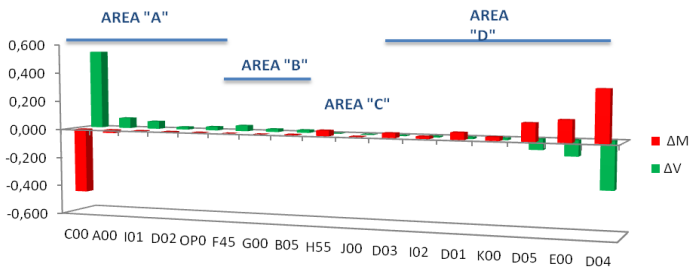


Table n° 6 : Changes of imports and value added for sectors with positive variation of backward linkages (2004– 2009)

	ΔBL	ΔM	ΔV	AREA
A00	-0,080	-0,021	0,071	AREA A
B05	-0,029	0,004	0,018	AREA B
C00	-0,147	-0,446	0,549	AREA A
D01	-0,095	0,048	-0,011	AREA D
D02	-0,030	-0,008	0,017	AREA A
D03	-0,062	0,032	-0,004	AREA D
D04	-0,047	0,343	-0,317	AREA D
D05	-0,084	0,120	-0,070	AREA D
E00	-0,057	0,145	-0,106	AREA D
F45	-0,072	0,000	0,038	AREA B
G00	-0,033	0,000	0,020	AREA B
H55	-0,083	0,038	0,001	AREA C
I01	-0,061	-0,004	0,052	AREA A
I02	-0,017	0,016	-0,007	AREA D
J00	-0,003	0,003	-0,002	AREA D
K00	-0,016	0,025	-0,013	AREA D
OP0	-0,029	-0,002	0,025	AREA A

Figure n° 8: Localization of sectors with positive variation of backward linkage between 2004-2009



	ΔBL	ΔM	ΔV	AREA
D06	0,0760	0,7963	-0,8892	AREA D*
L75	0,0047	0,0000	-0,0102	AREA D*
MNO	0,0158	0,0000	-0,0174	AREA D*