Key sectors in the Moroccan economy: an application of input-output analysis

TOUNSI, Said and EZZAHIDI, Elhadj and El Alaoui, Aicha and NIHOO, Abdelazziz

Mohammed V-Agdal University, Rabat, High School of Technologie, BeniMellal

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Said Tounsi
Mohammed V-Agdal University, Rabat, Morocco
El hadj Ezzahid
Mohammed V-Agdal University, Rabat, Morocco
Aicha El Alaoui
Sultan Moulay Slimane University, Béni Mellal, Morocco
Abdelaziz Nihou
High Planning Commission, Rabat, Morocco

Abstract

The exploration of the structural features and sectoral interdependences of and in an economy is fundamental for the understanding of its modes of functioning and of its transformations over time. Input-output analysis is largely used to fulfill this objective. Furthermore, information provided by the Leontief inverse matrix is useful for the identification of key sectors. This identification may guide policy makers in setting an adequate industrial strategy. In this paper, the classification of productive sectors is performed by using the Unweighted Rassmussen Approach. The ordering of sectors depends on the intensity of their links with other sectors. Two results ought to be highlighted. First, key sectors of the Moroccan economy (sectors that are classified in category II) reduced to two sectors in 2007 instead of four sectors in 1998. Second, the ordering of sectors is highly sensitive to the precision of the data and to the year in which the classification is realized.

Keywords: Input-output analysis; Backward linkages; Forward linkages; Unweighted Rassmussen Approach; Morocco.
JEL Classification: C67, D57.

1. Introduction

Morocco is a developing economy classified by the World Bank as a lower medium income country (World Bank 2010 and 2011). The Moroccan economy is less diversified than developed countries, but compared to the Middle East and North Africa (MENA) economies, it is relatively more diversified and continues to improve its diversification (OCDE, 2008, p. 460).

Since 1998, Moroccan authorities introduced important legal and institutional reforms to increase the competitiveness and the flexibility of the economy. In this same period, many structural projects have been undertaken to promote investment, employment, and growth. These reforms are designed to meet the major challenges of the Moroccan economy which are: dependence of agriculture on rainfall, high rate of unemployment, and insufficient and volatile growth.

In this paper, we will adopt an aggregate view of the Moroccan economy with the objective to identify some of its structural features using input-output analysis (IOA). The discussion will be completed by providing an identification of the key sectors of the economy using some well established criteria.

The IOA is one of the earlier applications of linear programming in the area of economics (Gass 1975). It is adapted to the objective of exploring the interdependencies of the different sectors of the economy and to the running of simulations to gauge the impact of increases in final demand on the output of different sectors. New uses of IOA recently emerged such as the decomposition of growth into the parts attributable to changes in expenditures and the parts due to change in the productive technology captured by the matrix of technical coefficients[1] A.

This paper is organized as follows. In the second section, we introduce the input-output framework and the Leontief inverse matrix used to estimate the backward and the forward linkages according to the Unweighted Rasmussen Approach. The third section is reserved to the discussion of the overall structure of the Moroccan economy and to the

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[1] For an example of these applications see (Voyvoda, 2008).

presentation of some results provided by the intersectoral matrix of flows. In the fourth section, we identify the key sectors of the Moroccan economy. The last section serves to conclude.

2. Input-output analysis and the methodology of identifying key sectors

We present IOA in the first subsection. In the second subsection we present the Leontief inverse matrix and the backward and forward linkages indices that will be used to establish an ordering of productive sectors in Morocco.

2.1. Input-output analysis

Input-output analysis (IOA) describes the flows of services and products in the economy. The refinement of the analysis depends on the available data and the objectives of the study. The validity and the use of IOA in forecasting stand on some hypotheses. First the technology used in production is supposed to be linear and homogeneous of degree 1; that means that returns to scale are constant. Second, the supply of factors for production is supposed to be fully elastic.

The Input Output Table (IOT) is a table that traces, in rows, the intermediate and final uses of products and, in columns, the cost structure of productive sectors. For this, the economy is divided into n sectors. Each sector supplies an output x_i. This supply is used as inputs by the ith sector and by the other n-1 sectors. This part is called intermediate consumption (IC). The following table summarizes the flows between sectors.

Table 1. A typical Input-output table

Sector	Intermediate Consumption				Final Demand	Total outputs
	S_1	S_2	…	S_n		
S_1	x_{11}	x_{12}	…	x_{1n}	y_1	X_1
S_2	x_{21}	x_{22}	…	x_{2n}	y_2	X_2
⋮	⋮	⋮	…	⋮	⋮	⋮
S_n	x_{n1}	x_{n2}	…	x_{nn}	y_n	X_n
Primary inputs	V_1	V_2	…	V_n		
Total inputs	X_1	X_2	…	X_n		

The overall intermediate consumption is either produced locally or imported. Consequently the global supply of a sector i denoted x_i will be the sum of the local production x_i^d and imported production x_i^m. For local production, it is supposed that the

quantity of locally produced output of sector i used by sector j x^d_{ij} is proportional to x_j. The coefficients of proportion are a_{ij}. These elements are called domestic technical coefficients and provide the structure of local production of the economy. They are computed as follows.

$$a^d_{ij} = \frac{x^d_{ij}}{x_j} \tag{1}$$

The matrix A^d of domestic technical coefficients a^d_{ij} describes the flows of products between the sectors of the economy. These coefficients quantify the inter-industries transactions. Otherwise A^d is describing the technology of local production of the economy which will be considered constant over a certain period of time in order to make simulations. The second part of the local production of each sector is dedicated to final consumption Y formulated by households, foreigners, firms, and the government. We must signal that total final demand Y is satisfied by the part produced locally Y^d and by the part imported Y^m So we will have: $Y = Y^d + Y^m$.

Remark also that the output of any sector j is used to buy inputs x_{ij} (for i=1, 2, .., n) from other sectors, to buy imported inputs x^m_{ij}, and to make payments to primary factors of production such as labor, capital, and so on. These payments are wages, dividends, and interests; and constitute the value added generated by the jth sector. It is expressed as:

$$VA_j = x_j - \sum_{i=1}^{n} x^d_{ij} - \sum_{i=1}^{n} x^m_{ij} \tag{2}$$

If we focus on the uses of local production, we will find that for a sector i there is equilibrium between its production and the quantity of this production used by productive sectors plus the quantity used as final demand y^d_i.

$$x_i = x^d_{i1} + x^d_{i2} + ... + x^d_{in} + y^d_i \quad For \; i = 1, ..., n \tag{3}$$

Equation (3) may be written in matrix form by considering the vector X of the outputs of the n sectors, the $n \times n$ matrix of domestic technical coefficients A^d, and the vector of final consumption of the outputs of the n sectors Y^d. So we will have: $X^d = A^d X^d + Y^d$. Let M be the $(n, 1)$ vector of importations of the n sectors from abroad and Y^m the vector of consumed importations by final users. In matrix terms, this can be written

as follow: $M=A^m X+Y^m$. This equation states that the total importations M are used as inputs by the n productive sectors and the remaining part is consumed by final users (households, governments, reexport …). The overall equilibrium between available resources and their uses may be written when we add the two sides of the above equations as follows:

$$X + M = A^m X + A^d X + Y^m + Y^d \qquad \qquad \textbf{(4)}$$

Importations constitute leakages that reduce the productions multipliers (Reis and Rua, 2006). This is especially true because domestically produced goods and imported goods are generally not substitutable. We must remark that initial works, undertaken to apply IOA, assumed that domestically produced and imported goods are " equivalent so that any demand or want can be satisfied by either the one or the other kind of goods" (Johansen 1960, p. 16). In the following, we will not distinguish between locally and imported production. The objective is to present a general view about the linkages between sectors. In the application (section 4) we will use A^d which is the matrix of domestic technical coefficients.

2.2. Leontief inverse Matrix and the methodology of ordering sectors

Input-output analysis provides a demand driven view of the economy. The links between final demand Y and the sectors' outputs X can be more explicitly presented by the relationship:

$$X = (I - A)^{-1}Y \quad \Leftrightarrow \quad \Delta X = (I - A)^{-1}\Delta Y \qquad \qquad (5)$$

The matrix I is a $n \times n$ unit matrix. We pose $(I\text{-}A)^{-1}=B$. B is the Leontief inverse matrix[2] with generic element b_{ij}. By the IO model, we can depict the impact of an increase of final demand addressed to a sector j on the output of other productive sectors. Extensively, we can write (5) as follows:

$$x_i = b_{i1}y_1 + b_{i2}y_2 + .. + b_{ij} + ... + b_{in}y_n \ \text{ for each } i = 1,...,n \qquad \qquad (6)$$

Consequently to equation (6), we will have:

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[2] $(I\text{-}A)^{-1}$ exists if $(I\text{-}A)$ is nonsingular which is the case if A satisfies the condition $\sum_{i=1}^{n} a_{ij} < 1$ for each

$j=1,2,..., n$ (Gass, 1975, p. 290).

$$\frac{\partial x_i}{\partial y_j} = b_{ij} \qquad (7)$$

The Leontief inverse matrix *B* provides the direct and indirect necessary materials to produce a supplementary unit by a given sector to respond to an increase of final demand. To get a thorough view about the functioning of the economy and evaluate the indirect effects we will study sectoral multipliers. Two cases are distinguished. The first is a unitary increase of the final demand addressed to a specified sector j. The second case is the uniform unitary increase of final demand addressed to all productive sectors.

The backward linkages of a sector are measured by the intensity of its links with sectors providing inputs. The strength of these relationships is gauged by output multipliers. The demand addressed to sector j increase its output by one unit; this is a direct effect. To produce an extra unit by sector j, the output of sector *i* must increase by a quantity x_i. The induced effect in the ith sector will have an effect on the output of the kth sector and so on.

If we are interested by the effect of an increase by one unit in the final demand addressed to the jth sector we will suppose that the elements of Y are zeros except the jth element where we have 1. The output multiplier is "defined as the change in gross output resulting from unit change in final demand in a given sector" (Matallah 2006, p. 288). By its definition the output multiplier of the jth sector is equal to[3]:

$$B\Delta Y = \begin{pmatrix} b_{11} & b_{12} & ... & b_{1n} \\ : & & ... & : \\ b_{n1} & b_{n2} & ... & b_{nn} \end{pmatrix} \begin{pmatrix} 1_{1=j}(i) \\ : \\ 1_{i=j}(i) \\ : \\ 1_{n=j}(i) \end{pmatrix} = \sum_{i=1}^{n} b_{ij} = b_{\bullet}j \ , \forall i = 1,2,...,n \qquad (8)$$

Remark that the output multiplier of a sector *j* "can be decomposed between the effects occurring within the sector (intra-sector effects) and those that spread to all other sectors (inter-sector effects)" (Kweka et al. 2001, p. 7).

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[3] In this paper, we note a one unit increase of the final demand for the output of the jth sector by $1_{i=j}(i)$. This is an indicative function which is equal to 1 if i=j and 0 otherwise.

Now we are interested by the impact of a uniform unit increase[4] of final demand addressed to all productive sectors. In this case, the increase in final demand is represented by a unitary vector $Y_l=(1\ 1\ ...\ 1)^T$. Remark that because we discuss in terms of MAD[5] the increase in final demand Y is equal to n MAD. The induced increases in the output of all sectors are given by this equation:

$$\begin{pmatrix} b_{11} & b_{12} & ... & b_{1n} \\ b_{21} & b_{22} & ... & b_{2n} \\ \vdots & \vdots & ... & \vdots \\ b_{n1} & b_{n2} & ... & b_{nn} \end{pmatrix} \begin{pmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{pmatrix} = \begin{pmatrix} b_{11}+b_{12}+...+b_{1n} \\ b_{21}+b_{22}+...+b_{2n} \\ \vdots \\ b_{n1}+b_{n2}+...+b_{nn} \end{pmatrix} = \begin{pmatrix} \sum_{j=1}^{n} b_{1j} \\ \sum_{j=1}^{n} b_{2j} \\ \vdots \\ \sum_{j=1}^{n} b_{nj} \end{pmatrix} = \begin{pmatrix} b_{1\bullet} \\ b_{2\bullet} \\ \vdots \\ b_{n\bullet} \end{pmatrix} \qquad (9)$$

The uniform increase of final demand by a unitary vector induces increases in the outputs of all sectors. The increase in the ith sector is equal to the horizontal summing of the elements of the ith row of the Leontief inverse matrix $B=(I-A)^{-1}$. The monetary value of the total induced increase in the outputs of the n productive sectors consequently to the uniform unitary impulse in final demand addressed to the n sectors is:

$$Total\ effect = \sum_{i=1}^{n}\sum_{j=1}^{n} b_{ij} = \sum_{j=1}^{n} b_{\bullet j} = \sum_{i=1}^{n} b_{i\bullet} \qquad (10)$$

We will use the indices of linkages identified accordingly to the approaches of Rasmussen (1956) and Hirschman (1958) to classify the aggregate sectors of the Moroccan economy into those with above average effect on the remaining sectors and those with below average effect. For this, we define the average element $\bar{b}$ of the Leontief inverse matrix $B=(I-A)^{-1}$ as follows:

$$\bar{b} = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} b_{ij}}{n^2} = \frac{\sum_{j=1}^{n} b_{\bullet j}}{n^2} = \frac{\sum_{i=1}^{n} b_{i\bullet}}{n^2} \qquad (11)$$

The detection of the propulsive sectors in the economy may help policy makers to target, in an industrial policy, the sectors that are most likely to have important effects on the economy. The backward linkage index or power of dispersion index BL_j of a sector j

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[4] We can term this a unitary vector increase in the demand addressed to the economy.
[5] Symbol of the Moroccan currency (Dirham).

and the forward linkage index or sensitivity of dispersion index FL_i of a sector[6] i are measured as follows (see Guilhoto et al., 2005):

$$BL_j = \frac{\dfrac{b_{\bullet j}}{n}}{\dfrac{1}{n^2}\sum_{j=1}^{n}b_{\bullet j}} = \frac{b_{\bullet j}}{n\bar{b}} \qquad (12)$$

and

$$FL_i = \frac{\dfrac{1}{n}b_{i\bullet}}{\dfrac{1}{n^2}\sum_{i=1}^{n}b_{i\bullet}} = \frac{b_{i\bullet}}{n\bar{b}} \qquad (13)$$

We use these indices even if they have limits as observed by Sonis et al. (1995). Indeed, "one of the criticisms of above indices (BL_j and FL_i) is that they do not take into consideration the different levels of production in each sector of the economy" (Sonis et al., 1995, p. 235).

To compare sectors according to their backward and forward effects we must normalize by 1 (Shuja et al., 2008). According to the values BL_j and FL_i, the productive sectors are classified into four categories (Boucher 1976, p. 456-7). If both BL_j and FL_i of a sector are above 1 then the sector is of category II. These sectors are considered by Hirschman (1958) as key sectors. Backward linkages are judged more interesting, for this reason category III is composed of sectors with BL_j above 1 and below 1 FL_i. Sectors with BL_j low (below 1) and FL_i above 1 are classified in category I. Sectors having neither BL_j or FL_i above 1 are classified in category IV.

3. Overall structure of the Moroccan economy

The contributions of the main sectors in Moroccan GDP hadn't drastically changed from 1998 to 2007[7]. Taking into account the impact of climate on the part of agriculture in GDP, we observe globally a decline of the contribution of this sector and an increase of the contribution of services. The following table provides the contributions of the aggregate sectors in GDP in 1998 and in 2007.

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[6] "Backward linkages are the relationships of a sector with the sectors providing inputs. Forward linkages are the relationships between the activity in a sector and its sales" (Matallah, 2006, p. 290).

[7] During the period 1998-07 the real GDP increased by an average annual rate of 4.1% (HCP 2009, p. 29).

Table 2. Aggregate sectors contributions to GDP (%)

	1998	2007	Average 1998-2007
Agriculture and fisheries	19.3	13.0	15.5
Industry	16.5	14.2	15.8
Energy	3.4	2.8	3.2
Mining	2.4	2.3	2.1
Building and public works	4.1	6.5	5.5
merchant services	37.5	42.8	39.6
Non merchant services	16.8	18.4	18.3
Totals	**100**	**100**	**100**

Source: our estimates

We observe that despite the reforms undertaken by Moroccan authorities, the overall structure of the economy remains so much the same. The reduction of the part of agriculture in the economy is due, in part, to the fact that in 2007 there was a severe drought that adversely affected the production of Moroccan agriculture[8]. This situation attests the dependence of agricultural production on rainfall[9] and the dependence of overall GDP on agricultural output. Despite this fact, it is seeable that during the period 1998-2007 there was a small, regularly, and hesitant reduction of the part of agriculture in GDP and an increase of the part of services. Statistically, the part of agriculture in the GDP attained in 1998 is the maximum recorded during the period 1998-2007[10].

The Moroccan economy is one of the most open in the MENA region. The overall rate of openness measured by the traditional indicator $\frac{X + M}{GDP}$ was 81% in 2007. The European Union (with 27 countries) is the main commercial partner of Morocco. In 2008, 59% of the exportations of Morocco were realized with EU and 52% of its importations come from this region (World Bank 2010, p.12).

Aside the structural dependence on oil and natural gas, the Moroccan economy depends heavily on imports of equipments, machines, and other sophisticated products.

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[8] It is important to scrutinize the shift in the importance of agriculture in an economy since the experience of economic development is characterized by a strong decline in the part of agriculture in GDP and in employment. See for a discussion (Alvarez-Cuadrado and Poschke 2009).

[9] During the period 1998-2007, agricultural production recorded negative growth rates in 1999, 2000, 2005, and 2007 (HCP 2009, p. 31).

[10] It is important to compare with the data in (HCP 2009, p. 33).

Four indicators will be used to characterize the degree of openness of different sectors. The first is the rate of exportation which is the part of the ith sector's exportation z_i in the production generated by this sector ($rex_i=z_i/x_i$). The second indicator is the rate of penetration which is calculated as the part of the importation of a product in its apparent consumption defined as production and importation (demand of products) minus exportations ($rp_i=m_i/(x_i+m_i-z_i)$). The third indicator is the rate of exposedness also known as the rate of internationalization, calculated from the rate of exportation and the rate of penetration ($rexp_i = rex_i+(1- rex_i)rp_i$). The last indicator is the rate of coverage which measures the part of importations financed by exportations ($rc_i=z_i/m_i$). The following table summarizes these data.

Table 3. Links with the world economy (%)

	Rate of exportation		Rate of penetration		Rate of exposedness		Rate of coverage	
	1998	2007	1998	2007	1998	2007	1998	2007
Agriculture	11.5	13.6	9.9	17.3	20.2	28.6	66.1	40.8
Mining	68.5	61.5	53.0	74.7	85.2	90.2	72.2	23.7
Energy	10.3	25.1	11.4	31.7	20.6	48.8	40.1	18.2
Industries	92.6	120.7	35.2	50.7	95.2	110.2	59.7	51.2
Merchant services	5.9	15.5	6.4	8.8	11.8	22.9	68.5	135.2

Source: Our estimates for 2007 and Nihou and Khallef's estimates for 1998

Concerning external flows we remark some salient features. First, the part of importations in the overall supply is 21.5%. Second, importations of products by the sector of mining and the sector of mechanical, metallurgical and electrical industries exceed their domestic productions.

The structure of the costs of productive sectors provides the part of intermediate consumption of inputs (imported or produced locally) and the part of value added (distributed incomes) in the costs of the different sectors. The types of income taken into account are wages, taxes, subsidies and revenues of enterprises (Gross Operating Surplus, GOS). In 2008, value added represented 54% of production. Thus any produced 1 MAD will generate 0.54 MAD as income and the remaining part is absorbed by intermediate consumption produced locally or imported. The distribution of value added between social partners had exhibited a stable pattern during the period 1998-2007. Approximately two thirds of value added was distributed as revenues to proprietors (GOS). The remuneration of workers (labor suppliers) accounted for 32.5% of GDP in 1998 and 34.9% in 2007. The remaining part is other taxes less subsidies on products (HCP 2009, p. 38).

The Moroccan economy will be divided into 20 sectors. This level of refinement is adapted for the exploration of the overall functioning of the economy. The table in appendix gives the matrix of domestic technical coefficients of the Moroccan economy in 2007. By examining the diagonal elements of that matrix, the a_{ii}, we observe some salient features. For example, the sectors that use intensively their outputs as inputs are the sector of agriculture, textile and leather, the sector of mechanical, metallurgical and electrical industries, and the sector of other manufacturing industries outside petroleum refining.

Two types of sectors are to be distinguished; those that are linked to the remaining sectors as providers of inputs and those that are linked with other sectors as users of their outputs. Naturally, the sector of general public administration and social security is an absolute user of inputs provided by other sectors. This sector is the most linked with productive sectors as demander. The sector of other manufacturing industries (outside petroleum refining) and the sector of commerce and repair are also significantly linked as users of inputs with more than ten sectors. The sector of real estate, rental and services to companies, the sector of electricity and water, the sector of refined petroleum and other energy products, the sector of other manufacturing industries (outside petroleum refining), and the sector of mechanical, metallurgical and electrical industries are very linked with almost all sectors as providers of inputs.

Some sectors are intensive users of other sectors' outputs. As an example food and tobacco industry uses 0.37 unit of the output of the sector of agriculture, forestry, hunting and exploitation to produce each unit of its output. The sector of buildings and public works depends heavily on the inputs provided by the sector of other manufacturing industries (outside petroleum refining) and the sector of mechanical, metallurgical and electrical industries. To produce a unit of output, the sector of building and public works uses 0.25 and 0.16 units of products provided by these two respective sectors.

The vertical totals S_c of the matrix A^d ($\sum_{i=1}^{n} a_{ij} = a_{.j}$) provide the share of domestic intermediate consumption in the output of the j$^{\text{th}}$ sector. The horizontal totals S_r ($\sum_{j=1}^{n} a_{ij}$) estimate the relative contribution of domestic output to cover the domestic intermediate

consumption of productive sectors (Dobrescu et al. 2010, p. 179-180). The quantities *1-Sc* for *j=1,...,n* provide an idea about the proportion of the production of each sector that is distributed as income to domestic and foreign factors. *1-Sr* provides the part of final consumption in the supply of each sector. The following table provides the *Sr* and *Sc* of each sector.

Table 4. Vertical (Sc) and Horizontal (Sr) Summing of the coefficients of A^d

Sector' code	Sc	Sr	Sector' code	Sc	Sr
A00	0.260	0.618	F45	0.559	0.020
B05	0.213	0.090	G00	0.246	0.054
C00	0.291	0.295	H55	0.374	0.080
D01	0.629	0.395	I01	0.507	0.190
D02	0.277	0.177	I02	0.273	0.096
D03	0.399	0.252	J00	0.193	0.216
D04	0.268	0.593	K00	0.046	0.625
D05	0.388	0.567	L75	0.260	0.000
D06	0.035	0.912	MN0	0.063	0.009
E00	0.183	0.328	OP0	0.109	0.056

Sources: our estimates.

Table 4 shows that 63% of the production of the sector of food and tobacco industry is used to purchase domestically produced intermediate items. The sector of real estate, rental and services to companies and the sector of education, health and social action are the sectors that use less of domestic materials as intermediate consumption. Production of the sector of refined petroleum and other energy products and the sector of real estate, rental and services to companies cover respectively 91.2% and 62.5% of intermediate consumption.

4. Ordering of sectors in the case of Morocco

We will use the BL_j and FL_i to identify the key sectors in the Morocco economy. We must remark that to refine and precise the ordering of productive sectors other investigations must be undertaken to take into account employment, income, and taxes impacts. The proposed classification is based on production/output multipliers. The average element $\bar{b}$ of *B* is equal to 0.07. The following table provides the BL_j and the FL_i, the category of each sector and its rank.

Table 5. Ordering of sectors by the Hirschman-Rasmussen approach

Codes of sectors	Sectors	BL_j	FL_i	Class (2007)	Rank (2007)	Class (1998)	Rank (1998)
D01	Food and tobacco industry	1.389	1.091	II	1	II	1
D05	Other manufacturing industries (outside petroleum refining)	1.094	1.246	II	2	II	3
F45	Building and public works	1.299	0.746	III	3	III	5
H55	Hotels and restaurants	1.182	0.798	III	4	III	6
I01	Transport	1.155	0.911	III	5	III	8
D03	Chemical and Para-chemical industries	1.129	0.986	III	6	II	2
A00	Agriculture, forestry, hunting and exploitation	0.996	1.449	I	7	I	9
C00	Extractive industry (Mining)	0.995	1.027	I	8	II	4
D04	Mechanical, metallurgical and electrical industries	0.990	1.316	I	9	I	10
E00	Electricity and Water	0.883	1.055	I	10	I	11
K00	Real estate, rental and services to companies	0.771	1.294	I	11	I	12
D06	Refined petroleum and other energy products	0.763	1.612	I	12	I	13
D02	Textile and leather industries	0.999	0.888	IV	13	III	7
I02	Posts and Telecommunications	0.984	0.813	IV	14	IV	19
L75	General Public Administration and Social Security	0.976	0.729	IV	15	IV	15
G00	Commerce and repair	0.961	0.771	IV	16	IV	16
B05	Fishing and aquaculture	0.912	0.814	IV	17	IV	14
J00	Financial activities and insurance	0.906	0.929	IV	18	IV	17
OP0	Other non-financial services	0.826	0.786	IV	19	IV	18
MN0	Education, health and social action	0.791	0.738	IV	20	IV	20

Source: Our estimates for 2007 and Nihou and Khallef's estimates for 1998.

We note that the rank of the sector of chemical industries has deteriorated. This sector passed from the second rank in 1998 to the sixth rank in 2007. The same thing is observed for the sector of mining industries (extractive industries) (rank 4 in 1998 and rank 8 in 2007). As a consequence, the key sectors of the Moroccan economy (sectors that are classified in category II) were reduced to two sectors in 2007 instead of four sectors in 1998. The two sectors that have the most important BL_j are, respectively, the sector of food and tobacco industries and the sector other manufacturing industries (outside petroleum refining). The three sectors that have the most important FL_i are respectively the sector of refined petroleum and other energy products, the sector of agriculture, forestry, hunting, and exploitation and the sector of mechanical, metallurgical and electrical industry.

The sector of agriculture, forestry, hunting, and exploitation is weakly integrated as purchaser of inputs from other sectors. The correspondent coefficient of backward linkages is 0.996 which is insignificantly different from 0.93 found by Nihou and Khellaf (2005) for the year 1998. Concerning the intensity of forward linkages of the sector of agriculture, forestry, hunting, and exploitation, it is equal to 1.449. The results let us suppose that agriculture is more linked to other sectors as provider of inputs comparatively to its integration to the productive sectors as user of inputs. This is highly plausible because Moroccan agriculture uses intensively imported products such as equipments and selected seeds. It is paradoxical to observe that even if Morocco is the first producer and exporter of phosphates, the quantity of this product used by farmers is very low and ironically small ones don't find the derivatives of this product in the market.

The results show that the sector of fishing and aquaculture has backward and forward linkage indices under unity. That means that the links of this sector as purchaser of outputs from productive sectors are low and its impact as provider of inputs to other sectors is low. This result is concordant with the findings of Boudhar and Belaid (2009) who found that "… the fishery products system remains poorly integrated into the Moroccan economy".

The sectors that are the least integrated to the economy as users of inputs from the productive sectors are the sector of refined petroleum and other energy products, the sector of real estate, rental and services to company, the sector of other non-financial services and the sector of fishing and aquaculture. The sectors that have the least effect on other sectors as providers of inputs are the sector of general public administration and social security, the sector of education, health and social action, the sector of commerce and repair, the sector of hotels and restaurants, the sector of posts and telecommunications, and the sector of fishing and aquaculture. The values of BL_j and FL_i for more aggregate sectors are summarized in table 7.

Table 6. Production multipliers of aggregate sectors

	$b_{.j}$	$b_{.j}/n$	BL_j	$b_{i.}$	$b_{i.}/n$	FL_i
Agriculture	1.307	0.065	0.954	1.551	0.078	1.131
Mining	1.364	0.068	0.995	1.408	0.070	1.027
Energy	1.128	0.056	0.823	1.828	0.091	1.334
Industry	1.536	0.077	1.120	1.515	0.076	1.105
Merchant Services	1.329	0.066	0.969	1.234	0.062	0.900
Non-merchant Services	1.211	0.061	0.884	1.006	0.050	0.734

Source: Our estimates.

When the final demand addressed to each of the n productive sectors increase by one unit the total final demand increases by n units. In our case, we have 20 sectors. This means that the uniform unit increase in the demand addressed to all productive sectors is equal to 20. The impact of this uniform increase of one unit is given by equation (11). The effect is equal to 27.42 MAD. Thus, on average each unit increase in final demand induces 1.37 increase in the production of sectors. That means that globally, an extra MAD in final demand produces approximately 1.37 MAD. This value of general multiplier is almost the same found by Nihou and Khallaf for the year 1998 (Nihou and Khallaf 2005, p. 12).

5. Conclusion

The discussion in this paper has attempted to determine the structural patterns of the Moroccan economy. Furthermore, we tried to detect whether there are any structural shifts in the Moroccan economy during the period 1998-2007. Indeed in such a period, it is likely to witness structural transformations especially for a country that introduced reforms and adopted policies in order to facilitate its integration to the world economy and modernize its economic structures. The available data does not reveal any structural change of the Moroccan economy.

In this paper, an ordering of sectors is performed using measures of the intensity of their links, as suppliers and users with other sectors. The results show some change of the ordering between 1998 and 2007. The sector of food and tobacco industries is ranked at the top of the key sectors in the two years.

The specialization of the Moroccan economy is a vertical integration with the world economy. This form of specialization rarely leads to the development of a web of dense domestic links between productive sectors. What is needed for Morocco is not just a passive integration with other economies but a strategic integration that is conducive to the development of a horizontal specialization that will lead to a strengthening of links between productive sectors.

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Appendix
Matrix of domestic technical coefficients of the Moroccan economy in 2007

Sectors	A00	B05	C00	D01	D02	D03	D04	D05	D06	E00	F45	G00	H55	I01	I02	J00	K00	L75	MN0	OP0
A00	0.16	0.01	0.00	0.37	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.01
B05	0.00	0.02	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C00	0.00	0.00	0.01	0.00	0.00	0.17	0.02	0.02	0.01	0.01	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D01	0.02	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D02	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
D03	0.03	0.00	0.00	0.01	0.02	0.08	0.01	0.03	0.00	0.003	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
D04	0.00	0.01	0.06	0.02	0.00	0.02	0.14	0.02	0.01	0.01	0.16	0.02	0.00	0.01	0.08	0.00	0.00	0.01	0.00	0.00
D05	0.00	0.01	0.01	0.02	0.01	0.02	0.02	0.10	0.00	0.00	0.25	0.03	0.00	0.01	0.03	0.01	0.01	0.02	0.01	0.01
D06	0.02	0.11	0.10	0.02	0.02	0.02	0.02	0.11	0.00	0.09	0.04	0.05	0.01	0.22	0.02	0.00	0.00	0.04	0.00	0.01
E00	0.01	0.00	0.04	0.01	0.02	0.01	0.02	0.04	0.01	0.04	0.00	0.01	0.02	0.01	0.02	0.01	0.00	0.03	0.01	0.01
F45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00
G00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
H55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.02	0.00	0.00	0.00
I01	0.01	0.00	0.03	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.02	0.00	0.05	0.01	0.01	0.00	0.01	0.00	0.00
I02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.02	0.01	0.00	0.02	0.00	0.00
J00	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.05	0.00	0.07	0.01	0.01	0.00	0.00
K00	0.00	0.01	0.02	0.01	0.03	0.02	0.02	0.02	0.01	0.01	0.02	0.04	0.03	0.14	0.08	0.06	0.02	0.04	0.01	0.04
L75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MN0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OP0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01

Source: our estimates.