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# A Practitioner's Guide for Building the Interregional Input-Output System for Morocco, 2013

**EDUARDO AMARAL HADDAD**
**FATNA EL-HATTAB**
**ABDELAAZIZ AIT ALI**

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OCP Policy Center

Ryad Business Center – South, 4th Floor – Mahaj Erryad - Rabat, Morocco
Email : contact@ocppc.ma / Phone : +212 5 37 27 08 08 / Fax : +212 5 37 71 31 54
Website: www.ocppc.ma

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Department of Economic Studies and Financial Forecast

Quartier administratif, Gate D, Rabat-Chellah
Phone : 212.37.67.74.15/16
Fax : 212.37.67.75.33
Web : www.finances.gov.ma/depf.htm
Email : depf@depf.finances.gov.ma

## About the Authors

### Eduardo Amaral Haddad

Eduardo Amaral Haddad is Full Professor at the Department of Economics since 2008 at the University of São Paulo, Brazil and is the Director of Research of FIPE, a research foundation at the same University since October 2005. Prof. Haddad also holds a position as Adjunct Associate Professor at the Regional Economics Applications Laboratory (REAL) since January 1998 at the University of Illinois at Urbana-Champaign, USA. He is the author of the book "Regional Inequality and Structural Changes: Lessons from the Brazilian Experience" (Ashgate, 1999), and has published on regional and interregional input-output analysis, general equilibrium modeling, and various aspects of regional economic development in Brazil, in both national and international journals; he has also contributed with chapters in international books in the fields of regional science and economic development. Prof. Haddad has also acted as a consultant for the World Bank, the Inter-American Development Bank, UNDP, OECD, the Joint Africa Institute, and many other public and private organizations, national and international.

### Fatna El-Hattab

Fatna El-Hattab is state Engineer in Statistics and a graduate of the National Institute of Statistics and Applied Economics. She is the Service Chief of Data Analysis at the Direction of Studies and Financial forecasts at the Ministry of Economics and Finance. She is in charge of the analysis of territorial information serving the direction's missions of structural and conjunctural analysis, development of modeling instruments and examination of social and economic impacts.

### Abdelaaziz Ait Ali

Abdelaaziz Ait Ali is a resident Economist who joined OCP Policy Center after five years' experience at The Central Bank of Morocco. He worked as an economist at the Economics and International Relations Department. He was in charge of analysing the Real Estate Price Index and was assigned to monitor several assets prices, including stocks markets, for monetary policy and financial stability objectives. Abdelaaziz is interested also in energy challenges for the global and national economy and long term growth. Abdelaaziz holds a Master degree in econometrics from the University of Hassan II in Casablanca.

# Abstract

This paper reports on the recent developments in the construction of an interregional input-output matrix for Morocco (IIOM-MOR). As part of an ongoing project that aims to specify and calibrate an interregional CGE (ICGE) model for the country, a fully specified interregional input-output database was developed under conditions of limited information. Such database is needed for future calibration of the ICGE model. We conduct an analysis of the intraregional and interregional shares for the average total output multipliers. Furthermore, we also show detailed figures for the output decomposition, taking into account the structure of final demand.

# A Practitioner's Guide for Building the Interregional Input-Output System for Morocco, 2013

## 1. Introduction

This paper reports on the recent developments in the construction of an interregional input-output matrix for Morocco (IIOM-MOR). As part of an ongoing project that aims to develop an interregional CGE (ICGE) model for the country, a fully specified interregional input-output database was developed under conditions of limited information. Such database is needed for future calibration of the ICGE model. This research venture is part of a technical cooperation initiative involving researchers from the Regional and Urban Economics Lab at the University of São Paulo (NEREUS), in Brazil, the OCP Policy Center and Studies and Financial Forecasts Department[1], in Morocco.

The IIOM-MOR provides the opportunity to better understand the spatial linkage structure associated with the Moroccan economy in the context of its 12 regions, and 20 different sectors/products (Figure 1).[2]

This report describes the process by which the IIOM-MOR was constructed under the conditions of limited information for the regions in Morocco. In what follows, we will summarize the main tasks and working hypotheses involved in the treatment of the initial database that was used in the construction process of the system.

### Figure 1. Schematic Structure of the IIOM-MOR

| | | ABSORPTION MATRIX | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| | | Producers | Investors | Household | Export | Government |
| | Size | J x Q | J x Q | Q | 1 | Q |
| Basic Flows | I x S | BAS1 | BAS2 | BAS3 | BAS4 | BAS5 |
| Margins | I x S x R | MAR1 | MAR2 | MAR3 | MAR4 | MAR5 |
| Taxes | I x S | TAX1 | TAX2 | TAX3 | TAX4 | TAX5 |
| Labor | 1 | LABR | | | | |
| Capital | 1 | CPTL | | | | |
| Other costs | 1 | OCTS | | | | |

J sectors; Q regions; I products; S sources; R margins

# 2. Initial Data Treatment

In this section we present the main hypotheses and procedures applied to estimate the interregional input-output matrix for Morocco (IIOM-MOR). As mentioned before, the IIOM-MOR was estimated under conditions of limited information. We used data of national and regional accounts provided by the following sources:

- High Commission for Planning for national accounts which consist mainly in the Supply and Use Tables (SUT), employement and final consumption of households at the regional level.
- Studies and Financial Forecasts Department from Ministry of Economy and Finance for data on sectoriel value added and production at the regional level.
- Ministry of Industry, Investment, Trade, and Digital Economy for data on exports of the industrial sector at the regional level.
- Exchange Office for data on exports at the regional level.

The first step was to estimate an input-output matrix for the whole country from the SUT. The main aspect in this procedure is to transform the economic flows of the SUT, which are valued at market prices, into economic flows valued at basic prices. We adapted the methodology developed by Guilhoto and Sesso Filho (2005) for a similar exercise applied for Brazil. There are at least two main advantages of this method: (i) first, it requires only data from the SUT; and (ii) second, the production multipliers are not significantly affected by these procedures when compared with the "real" input-output matrix. The procedure used in this work is described as follows:

**1.** The allocation of margins and indirect taxes for all users (intermediate consumption, investment demand, household consumption, government consumption, and exports) was estimated based on shares calculated from the sales structure of the Use Table. The underlying hypothesis is that margins coefficients and tax rates on products are the same for all users.

**2.** Similarly, the allocation of imports for all users (except exports) was also estimated based on shares calculated from the sales structure of the Use Table.

**3.** These values were then deducted from the Use Table originally evaluated at market prices to obtain a new Use Table now evaluated at basic prices.

**4.** The structure of the Make Table was then used to transform the new Use Table from a commodity by sector into a sector by sector system of information.

All these economic flows can then be organized in the form of an Absorption (Use) Matrix as presented in Figure 2.

## Figure 2. Structure of the National Input-Output System for Morocco: Summary Results, 2013 (in million DHS)

| | | Dim. | Intermediate consumption 1 2 ... 20 | Investment demand 1 | Household consumption 1 | Exports 1 | Government consumption 1 | Statistical discrepancies 1 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| Basic flows | Domestic | 1 2 ... 20 | 384,216 | 180,257 | 416,546 | 209,975 | 174,771 | 51,478 | 1,417,242 |
| | Imported | 1 2 ... 20 | 252,210 | 60,248 | 117,216 | 0 | 1,951 | 0 | 431,626 |
| Margins | Trade | 1 2 ... 20 | 42,594 | 9,859 | 28,566 | 15,142 | 411 | 0 | 96,572 |
| | Transport | 1 2 ... 20 | 3,967 | 610 | 1,506 | 1,159 | 31 | 0 | 7,273 |
| Ind. taxes | Total | 1 2 ... 20 | 16,244 | 22,418 | 24,570 | 7,386 | 1,145 | 0 | 71,763 |
| Labor payments | | | 293,755 | 0 | 0 | 0 | 0 | 0 | 293,755 |
| Capital payments | | | 517,364 | 0 | 0 | 0 | 0 | 0 | 517,364 |
| Other costs | | | 10,737 | 0 | 0 | 0 | 0 | 0 | 10,737 |
| Total | | | 1,521,087 | 273,392 | 588,404 | 233,662 | 178,309 | 51,478 | 2,846,332 |

The second step was to disaggregate the national data into the 12 regions of Morocco. The details of such procedures are described in the technical appendix. We focus the subsequent discussion on some of the relevant summary figures embedded in the IIOM-MOR.

Given the regional macroeconomic identity, the components of the Gross Regional Product (GRP) are the usual components of GDP (at the national level) plus the interregional trade balance. In the case of Morocco, the information at the regional level consists only of sectoral activity level variables, such as gross output, value added, final household consumption and employment. The components of the regional macroeconomic identity had to be estimated.

**GRP = C + I + G + (X − M)$_{ROW}$ + (X − M)$_{DOM}$** $\qquad$ (1)

where

C = household consumption
I = investment demand
G = government consumption
(X − M)$_{ROW}$ = international trade balance with the rest of the world
(X − M)$_{DOM}$ = interregional trade balance with the domestic economy

We used shares calculated from specific variables to estimate the regional value of some components of equation (1): household consumption, investment demand and government consumption. For each component, the variables used to calculate the shares were the following:

**1. Household consumption:** *Household final consumption expenditure (by 12 regions)*

**2. Investment demand:** *Production of building and public works (In millions of dirhams)*

**3. Government consumption:** *Employed labor force by branch and for general administration*

The values for international exports for manufactured products were obtained directly from the *Ministry of Industry, Investment, Trade, and Digital Economy*. For the remaining products/sectors, we have relied on the location quotient approach to distribute exports across regions.

Table 1 presents these shares, including those for international exports. A general result is the spatial concentration of aggregate demand, which is very likely influenced by the distribution of economic activity and population over the regions. Grand Casablanca-Settat, together with Rabat-Salé-Kénitra, Tanger-Tetouan-Al Hoceima and Marrakech-Safi, concentrate almost 60% of the national household consumption and investment demand. Export demand is concentrated in Grand Casablanca-Settat (close to 50% of national exports) while government demand is concentrated in Rabat-Salé-Kénitra (about 30% of the total).

### Table 1. Shares used to Estimate the Components of the GRP of Morocco, 2013

|  |  | Investment demand | Household demand | Exports | Government demand |
|---|---|---|---|---|---|
| R1 | Tanger-Tetouan-Al Hoceima | 0.1207 | 0.1189 | 0.1639 | 0.0499 |
| R2 | Oriental | 0.0959 | 0.0802 | 0.0393 | 0.0635 |
| R3 | Fès-Meknès | 0.0890 | 0.1171 | 0.0482 | 0.0984 |
| R4 | Rabat-Salé-Kénitra | 0.1276 | 0.1291 | 0.0787 | 0.3046 |
| R5 | Béni Mellal-Khénifra | 0.0670 | 0.0614 | 0.0670 | 0.0518 |
| R6 | Grand Casablanca-Settat | 0.2005 | 0.2234 | 0.4915 | 0.1511 |
| R7 | Marrakech-Safi | 0.1470 | 0.1176 | 0.0461 | 0.0934 |
| R8 | Drâa-Tafilalet | 0.0587 | 0.0392 | 0.0075 | 0.0338 |
| R9 | Souss-Massa | 0.0593 | 0.0759 | 0.0257 | 0.0451 |
| R10 | Guelmim-Oued Noun | 0.0093 | 0.0116 | 0.0071 | 0.0398 |
| R11 | Laayoune-Sakia El Hamra | 0.0228 | 0.0114 | 0.0129 | 0.0558 |
| R12 | Dakhla-Oued Eddahab | 0.0022 | 0.0143 | 0.0120 | 0.0128 |
|  | TOTAL | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

Source: Calculations by the authors.

In order to regionalize the national IO table, we have relied on an adapted version of the Chenery-Moses approach (Chenery, 1956; Moses, 1955), which assumes, in each region, the same commodity mixes for different users (producers, investors, households and government) as those presented in the national input-output tables. For sectoral cost structures, if data availability allows, value added generation may be different across regions. Trade matrices for each commodity are used to disaggregate the origin of each commodity in order to capture the structure of the spatial interaction in the Moroccan economy. In other words, for a given user, say agriculture sector, the mix of intermediate inputs will be the same in terms of its composition, but it will differ from the regional sources of supply (considering the 12 regions of the model and foreign imports).

The strategy for estimating the trade matrices (one for each sectoral commodity in the system) included the following steps.

**1.** We have initially estimated total supply (output) of each sectoral commodity by region, excluding exports to other countries. Thus, for each region, we obtained information for the total sales of each commodity for the domestic markets such that:

*Supply(c,s)* = supply for the domestic markets of commodity c by region s

**2.** Next, we have estimated total demand, in each region, for each sector. To do that, we have assumed the respective user's structure of demand followed the national pattern. With the regional levels of sectoral production, investment demand, household demand and government demand, we have estimated the initial values of total demand for each commodity in each region, from which the demand for imported commodities were deducted. The resulting estimates, which represent the regional total demand for Moroccan goods, were then adjusted so that, for each commodity, demand across regions equals supply across regions, i.e.:

$$\sum_s Supply(c,s) = \sum_d Demand(c,d) \tag{2}$$

where Demand(c,d) = demand of commodity c by region d

**3.** With the information for Supply(c,s) and Demand(c,d), the next step was to estimate, for each commodity c, matrices of trade (12x12) representing the transactions of each commodity between origin and destination, SHIN(c,s,d). We have relied on the methodology described in Dixon and Rimmer (2004). The procedure considered the following steps:

a) For the diagonal cells, equation (3) was implemented, while for the off-diagonal elements, equation (4) is the relevant one:

$$SHIN(c,d,d) = Min\left\{ \frac{Supply(c,d)}{Demand(c,d)}, 1 \right\} * F(c) \tag{3}$$

$$SHIN(c,o,d) = \left\{ \frac{1}{(Time(s,d))^\beta} \cdot \frac{Supply(c,s)}{\sum_{k=1}^{12} Supply(c,k)} \right\} * \left\{ \frac{1 - SHIN(c,d,d)}{\sum_{j=1,j\neq d}^{12} \left[ \frac{1}{(Time(s,d))^\beta} \cdot \frac{Suply(c,j)}{\sum_{k=1}^{12} Suply(c,k)} \right]} \right\} \tag{4}$$

where c refers to a given commodity, and s and d represent, respectively, origin and destination regions.

The variable Time(s,d) refers to the travel time between two trading regions.[3] The factor F(c) gives the extent of tradability of a given commodity. For the non-tradables (usually services), typically assumed to be locally provided goods, we have used values close to unity for F(c), adopting a usual assumption (0.90), while for tradables, the value of F(c) was set to 0.5.

It can be shown that the column sums in the resulting matrices add to one. What these matrices show are the supply-adjusted shares of each region in the specific commodity demand by each region of destination.

Once these share coefficients are calculated, we then distribute the demand of commodity c by region d

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**3.** See "Technical Note 1: Morocco GIS Data".

(Demand(c,d)) across the corresponding columns of the SHIN matrices. Once we adopt this procedure, we have to further adjust the matrices to make sure that supply and demand balance out. This is done through a RAS procedure (for specific details of this method, see Miller and Blair, 2009).

Tables 2 to 4 show the resulting structure of trade in the IIOM-MOR (aggregated across commodities). We have also included regional demand for imported commodities (last row), estimated considering the structure of demand according to the national pattern, and the international exports by region (last column).

In the next section, we continue to evaluate the general structure of the IIOM-MOR, described in terms of summary indicators. An evaluation of the production linkages follows, based on the intermediate consumption flows, providing a brief comparative analysis of the economic structure of the regions. Traditional input-output methods are used in an attempt to uncover similarities and differences in the structure of the regional economies.

### Table 2. Interregional Trade in Morocco, 2013 (in DHS millions)

| | | DESTINATION | | | | | | | | | | | | | TOTAL |
| | | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | R10 | R11 | R12 | EXP | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ORIGIN | R1 | 69,980 | 2,187 | 3,537 | 3,911 | 1,218 | 12,832 | 2,171 | 1,224 | 1,479 | 282 | 565 | 414 | 20,098 | 119,898 |
| | R2 | 2,681 | 54,731 | 3,813 | 2,401 | 995 | 7,686 | 1,414 | 1,335 | 1,068 | 225 | 583 | 409 | 8,447 | 85,785 |
| | R3 | 5,956 | 5,656 | 81,361 | 6,755 | 2,346 | 18,203 | 2,860 | 2,768 | 1,956 | 408 | 904 | 636 | 9,157 | 138,967 |
| | R4 | 7,778 | 3,291 | 6,460 | 111,369 | 2,753 | 37,929 | 4,284 | 2,065 | 2,505 | 625 | 1,117 | 686 | 17,403 | 198,266 |
| | R5 | 2,018 | 1,189 | 2,394 | 2,673 | 39,855 | 18,271 | 4,089 | 997 | 2,038 | 270 | 537 | 359 | 15,242 | 89,932 |
| | R6 | 34,753 | 18,362 | 27,080 | 52,858 | 19,104 | 215,240 | 35,012 | 10,375 | 16,944 | 3,220 | 4,212 | 2,862 | 120,080 | 560,102 |
| | R7 | 3,899 | 2,319 | 3,308 | 5,759 | 4,330 | 25,670 | 85,581 | 1,774 | 4,588 | 832 | 1,360 | 839 | 10,513 | 150,771 |
| | R8 | 1,056 | 810 | 1,655 | 1,131 | 693 | 4,768 | 1,080 | 23,678 | 835 | 113 | 287 | 198 | 1,466 | 37,769 |
| | R9 | 2,974 | 2,088 | 2,540 | 3,767 | 2,187 | 12,059 | 5,128 | 1,421 | 55,014 | 1,923 | 1,732 | 983 | 5,838 | 97,655 |
| | R10 | 295 | 175 | 257 | 376 | 188 | 1,094 | 430 | 131 | 943 | 10,547 | 342 | 152 | 1,742 | 16,670 |
| | R11 | 438 | 269 | 365 | 437 | 209 | 2,729 | 497 | 179 | 540 | 201 | 14,457 | 314 | 2,847 | 23,483 |
| | R12 | 80 | 63 | 89 | 79 | 43 | 236 | 80 | 38 | 96 | 23 | 90 | 3,730 | 2,609 | 7,257 |
| | IMP | 48,842 | 26,748 | 37,534 | 47,529 | 21,206 | 160,187 | 41,340 | 12,627 | 23,625 | 3,651 | 5,759 | 2,579 | 0 | 431,626 |
| TOTAL | | 180,749 | 117,887 | 170,393 | 239,045 | 95,127 | 516,904 | 183,965 | 58,612 | 111,628 | 22,321 | 31,946 | 14,161 | 215,444 | 1,958,182 |

Source: Calculations by the authors.

### Table 3. Interregional Trade in Morocco: Purchases Shares, 2013

| | | DESTINATION | | | | | | | | | | | | | TOTAL |
| | | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | R10 | R11 | R12 | EXP | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ORIGIN | R1 | 0.387 | 0.019 | 0.021 | 0.016 | 0.013 | 0.025 | 0.012 | 0.021 | 0.013 | 0.013 | 0.018 | 0.029 | 0.093 | 0.061 |
| | R2 | 0.015 | 0.464 | 0.022 | 0.010 | 0.010 | 0.015 | 0.008 | 0.023 | 0.010 | 0.010 | 0.018 | 0.029 | 0.039 | 0.044 |
| | R3 | 0.033 | 0.048 | 0.477 | 0.028 | 0.025 | 0.035 | 0.016 | 0.047 | 0.018 | 0.018 | 0.028 | 0.045 | 0.043 | 0.071 |
| | R4 | 0.043 | 0.028 | 0.038 | 0.466 | 0.029 | 0.073 | 0.023 | 0.035 | 0.022 | 0.028 | 0.035 | 0.048 | 0.081 | 0.101 |
| | R5 | 0.011 | 0.010 | 0.014 | 0.011 | 0.419 | 0.035 | 0.022 | 0.017 | 0.018 | 0.012 | 0.017 | 0.025 | 0.071 | 0.046 |
| | R6 | 0.192 | 0.156 | 0.159 | 0.221 | 0.201 | 0.416 | 0.190 | 0.177 | 0.152 | 0.144 | 0.132 | 0.202 | 0.557 | 0.286 |
| | R7 | 0.022 | 0.020 | 0.019 | 0.024 | 0.046 | 0.050 | 0.465 | 0.030 | 0.041 | 0.037 | 0.043 | 0.059 | 0.049 | 0.077 |
| | R8 | 0.006 | 0.007 | 0.010 | 0.005 | 0.007 | 0.009 | 0.006 | 0.404 | 0.007 | 0.005 | 0.009 | 0.014 | 0.007 | 0.019 |
| | R9 | 0.016 | 0.018 | 0.015 | 0.016 | 0.023 | 0.023 | 0.028 | 0.024 | 0.493 | 0.086 | 0.054 | 0.069 | 0.027 | 0.050 |
| | R10 | 0.002 | 0.001 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.008 | 0.473 | 0.011 | 0.011 | 0.008 | 0.009 |
| | R11 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.005 | 0.003 | 0.003 | 0.005 | 0.009 | 0.453 | 0.022 | 0.013 | 0.012 |
| | R12 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.003 | 0.263 | 0.012 | 0.004 |
| | IMP | 0.270 | 0.227 | 0.220 | 0.199 | 0.223 | 0.310 | 0.225 | 0.215 | 0.212 | 0.164 | 0.180 | 0.182 | 0.000 | 0.220 |
| TOTAL | | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

Source: Calculations by the authors.

**Table 4. Interregional Trade in Morocco: Sales Shares, 2013**

| | | DESTINATION | | | | | | | | | | | | | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | R10 | R11 | R12 | EXP | |
| ORIGIN | R1 | 0.584 | 0.018 | 0.030 | 0.033 | 0.010 | 0.107 | 0.018 | 0.010 | 0.012 | 0.002 | 0.005 | 0.003 | 0.168 | 1.000 |
| | R2 | 0.031 | 0.638 | 0.044 | 0.028 | 0.012 | 0.090 | 0.016 | 0.016 | 0.012 | 0.003 | 0.007 | 0.005 | 0.098 | 1.000 |
| | R3 | 0.043 | 0.041 | 0.585 | 0.049 | 0.017 | 0.131 | 0.021 | 0.020 | 0.014 | 0.003 | 0.007 | 0.005 | 0.066 | 1.000 |
| | R4 | 0.039 | 0.017 | 0.033 | 0.562 | 0.014 | 0.191 | 0.022 | 0.010 | 0.013 | 0.003 | 0.006 | 0.003 | 0.088 | 1.000 |
| | R5 | 0.022 | 0.013 | 0.027 | 0.030 | 0.443 | 0.203 | 0.045 | 0.011 | 0.023 | 0.003 | 0.006 | 0.004 | 0.169 | 1.000 |
| | R6 | 0.062 | 0.033 | 0.048 | 0.094 | 0.034 | 0.384 | 0.063 | 0.019 | 0.030 | 0.006 | 0.008 | 0.005 | 0.214 | 1.000 |
| | R7 | 0.026 | 0.015 | 0.022 | 0.038 | 0.029 | 0.170 | 0.568 | 0.012 | 0.030 | 0.006 | 0.009 | 0.006 | 0.070 | 1.000 |
| | R8 | 0.028 | 0.021 | 0.044 | 0.030 | 0.018 | 0.126 | 0.029 | 0.627 | 0.022 | 0.003 | 0.008 | 0.005 | 0.039 | 1.000 |
| | R9 | 0.030 | 0.021 | 0.026 | 0.039 | 0.022 | 0.123 | 0.053 | 0.015 | 0.563 | 0.020 | 0.018 | 0.010 | 0.060 | 1.000 |
| | R10 | 0.018 | 0.010 | 0.015 | 0.023 | 0.011 | 0.066 | 0.026 | 0.008 | 0.057 | 0.633 | 0.021 | 0.009 | 0.104 | 1.000 |
| | R11 | 0.019 | 0.011 | 0.016 | 0.019 | 0.009 | 0.116 | 0.021 | 0.008 | 0.023 | 0.009 | 0.616 | 0.013 | 0.121 | 1.000 |
| | R12 | 0.011 | 0.009 | 0.012 | 0.011 | 0.006 | 0.032 | 0.011 | 0.005 | 0.013 | 0.003 | 0.012 | 0.514 | 0.360 | 1.000 |
| | IMP | 0.113 | 0.062 | 0.087 | 0.110 | 0.049 | 0.371 | 0.096 | 0.029 | 0.055 | 0.008 | 0.013 | 0.006 | 0.000 | 1.000 |
| TOTAL | | 0.092 | 0.060 | 0.087 | 0.122 | 0.049 | 0.264 | 0.094 | 0.030 | 0.057 | 0.011 | 0.016 | 0.007 | 0.110 | 1.000 |

Source: Calculations by the authors.

# 3. Structural Analysis

In this section, some of the main structural features of the economy of Morocco are revealed through the use of indicators derived from the IIOM-MOR. An analysis of output composition, and sales and purchases shares is presented, considering intermediate demand, final demand, and value added transactions.

## 3.1. Output Composition

Table 5 presents the regional output shares for the regions in Morocco. Grand Casablanca-Settat dominates the national production, with a share of 35.7% in total output, followed by Rabat-Salé-Kénitra (13.0%), Marrakech-Safi (9.9%), Fès-Meknès (9.2%) and Tanger-Tetouan-Al Hoceima (8.8%).

The regional output shares by sectors in Morocco reveal some evidence of spatial concentration of specific activities: agriculture in Fès-Meknès, Marrakech-Safi, Rabat-Salé-Kénitra, Grand Casablanca-Settat, and Béni Mellal-Khénifra (69.7% of total output); fishing in Souss-Massa, Dakhla-Oued Eddahab, Guelmin-Oued Noun and Laayoune-Sakia El Hamra (79.0%); mining in Béni Mellal-Khénifra and Marrakech-Safi (78.0%), manufacturing in Grand Casablanca-Settat, where at least 50% of the output is generated for each of the sectors. Some regions play important role in the production of specific manufacturing sectors, such as food industry in Souss-Massa (12.6%) and Fès-Meknès (9.9%); textile and leather in Tanger-Tetouan-Al Hoceima (21.3%) and Fès-Meknès (11.3%); and mechanical, metal and electrical products in Tanger-Tetouan-Al Hoceima (26.4%). Services, in general, are concentrated in Rabat-Salé-Kénitra and Grand Casablanca-Settat. However, Marrakech-Safi and Souss-Massa concentrate the major part of tourism services (36.8% and 26.4%, respectively).

Table 6 shows the sectoral shares in regional output, revealing the important role of some activities in relatively specialized regions: the dominant role of agriculture in Drâa-Tafilalet (27.5% of total regional output), Béni Mellal-Khénifra (25.6%) and Fès-Meknès (21.7%); fishing in Dahla-Oued Eddahab (38.6%); mining in Béni Mellal-Khénifra (21.%); food industry in Souss-Massa (21.1%); and the relevance of the public administration in the more remote regions of the south: Guelmin-Oued Noun (28.0%), Laayoune-Sakia El Hamra (27.7%) and Dakhla-Oued Eddahab (20.7%).

Relative regional specialization can also be assessed by the calculation of the sectoral location quotients, as presented in Table 7. The highlighted cells identify sectors relatively concentrated in specific regions, i.e. sectors for which their share in total regional output is greater than the respective shares in national output (location quotient greater than unit).

### Table 5. Regional Structure of Sectoral Output: Morocco, 2013

| | | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | R10 | R11 | R12 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A00 | Agriculture, forestry, hunting, related services | 0.078 | 0.083 | 0.178 | 0.123 | 0.134 | 0.130 | 0.131 | 0.061 | 0.070 | 0.011 | 0.000 | 0.000 | 1.000 |
| B05 | Fishing, aquaculture | 0.098 | 0.021 | 0.000 | 0.012 | 0.000 | 0.042 | 0.038 | 0.000 | 0.328 | 0.122 | 0.119 | 0.221 | 1.000 |
| C00 | Mining industry | 0.000 | 0.030 | 0.005 | 0.019 | 0.508 | 0.002 | 0.271 | 0.089 | 0.001 | 0.000 | 0.075 | 0.000 | 1.000 |
| D01 | Food industry and tobacco | 0.053 | 0.018 | 0.099 | 0.056 | 0.036 | 0.523 | 0.058 | 0.004 | 0.126 | 0.007 | 0.015 | 0.006 | 1.000 |
| D02 | Textile and leather industry | 0.213 | 0.008 | 0.113 | 0.101 | 0.000 | 0.540 | 0.022 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 1.000 |
| D03 | Chemical and para-chemical industry | 0.027 | 0.010 | 0.031 | 0.051 | 0.003 | 0.753 | 0.093 | 0.001 | 0.015 | 0.000 | 0.016 | 0.000 | 1.000 |
| D04 | Mechanical, metallurgical and electrical industry | 0.264 | 0.043 | 0.044 | 0.084 | 0.005 | 0.541 | 0.006 | 0.000 | 0.011 | 0.000 | 0.000 | 0.000 | 1.000 |
| D05 | Other manufacturing, excluding petroleum refining | 0.103 | 0.019 | 0.059 | 0.064 | 0.012 | 0.625 | 0.058 | 0.001 | 0.044 | 0.002 | 0.011 | 0.002 | 1.000 |
| D06 | Oil refining and other energy products | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 |
| E00 | Electricity and water | 0.114 | 0.069 | 0.110 | 0.208 | 0.053 | 0.219 | 0.110 | 0.023 | 0.070 | 0.010 | 0.013 | 0.003 | 1.000 |
| F45 | Construction | 0.121 | 0.096 | 0.089 | 0.128 | 0.067 | 0.201 | 0.147 | 0.059 | 0.059 | 0.009 | 0.023 | 0.002 | 1.000 |
| G00 | Trade | 0.096 | 0.107 | 0.117 | 0.133 | 0.062 | 0.250 | 0.116 | 0.022 | 0.070 | 0.013 | 0.011 | 0.003 | 1.000 |
| H55 | Hotels and restaurants | 0.071 | 0.028 | 0.064 | 0.041 | 0.009 | 0.120 | 0.368 | 0.028 | 0.264 | 0.002 | 0.002 | 0.002 | 1.000 |
| I01 | Transport | 0.084 | 0.086 | 0.109 | 0.151 | 0.048 | 0.291 | 0.101 | 0.027 | 0.070 | 0.016 | 0.013 | 0.004 | 1.000 |
| I02 | Post and telecommunications | 0.084 | 0.086 | 0.109 | 0.151 | 0.048 | 0.291 | 0.101 | 0.027 | 0.070 | 0.016 | 0.013 | 0.004 | 1.000 |
| J00 | Financial activities and insurance | 0.050 | 0.050 | 0.063 | 0.214 | 0.027 | 0.436 | 0.086 | 0.013 | 0.049 | 0.006 | 0.005 | 0.001 | 1.000 |
| K00 | Real estate, renting and services to enterprises | 0.050 | 0.050 | 0.063 | 0.214 | 0.027 | 0.436 | 0.086 | 0.013 | 0.049 | 0.006 | 0.005 | 0.001 | 1.000 |
| L75 | General public administration and social security | 0.050 | 0.064 | 0.098 | 0.305 | 0.052 | 0.151 | 0.093 | 0.034 | 0.045 | 0.040 | 0.056 | 0.013 | 1.000 |
| MN0 | Education, health and social action | 0.067 | 0.077 | 0.129 | 0.158 | 0.058 | 0.243 | 0.120 | 0.028 | 0.083 | 0.016 | 0.017 | 0.005 | 1.000 |
| OP0 | Other non-financial services | 0.086 | 0.062 | 0.088 | 0.211 | 0.047 | 0.269 | 0.143 | 0.018 | 0.060 | 0.007 | 0.007 | 0.002 | 1.000 |
| | TOTAL | 0.088 | 0.056 | 0.092 | 0.130 | 0.058 | 0.357 | 0.099 | 0.025 | 0.064 | 0.011 | 0.015 | 0.005 | 1.000 |

Source: Calculations by the authors.

## Table 6. Sectoral Structure of Regional Output: Morocco, 2013

|  |  | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | R10 | R11 | R12 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A00 | Agriculture, forestry, hunting, related services | 0.099 | 0.166 | 0.217 | 0.106 | 0.256 | 0.041 | 0.149 | 0.275 | 0.122 | 0.115 | 0.000 | 0.000 | 0.112 |
| B05 | Fishing, aquaculture | 0.009 | 0.003 | 0.000 | 0.001 | 0.000 | 0.001 | 0.003 | 0.000 | 0.042 | 0.093 | 0.064 | 0.386 | 0.008 |
| C00 | Mining industry | 0.000 | 0.013 | 0.001 | 0.004 | 0.219 | 0.000 | 0.069 | 0.090 | 0.000 | 0.000 | 0.122 | 0.000 | 0.025 |
| D01 | Food industry and tobacco | 0.063 | 0.033 | 0.115 | 0.046 | 0.065 | 0.156 | 0.062 | 0.017 | 0.211 | 0.067 | 0.106 | 0.130 | 0.107 |
| D02 | Textile and leather industry | 0.086 | 0.005 | 0.044 | 0.028 | 0.000 | 0.054 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.036 |
| D03 | Chemical and para-chemical industry | 0.012 | 0.006 | 0.013 | 0.015 | 0.002 | 0.079 | 0.035 | 0.001 | 0.009 | 0.000 | 0.038 | 0.000 | 0.037 |
| D04 | Mechanical, metallurgical and electrical industry | 0.210 | 0.054 | 0.034 | 0.046 | 0.007 | 0.106 | 0.004 | 0.001 | 0.012 | 0.000 | 0.002 | 0.000 | 0.070 |
| D05 | Other manufacturing, excluding petroleum refining | 0.055 | 0.016 | 0.030 | 0.023 | 0.010 | 0.083 | 0.028 | 0.003 | 0.032 | 0.009 | 0.034 | 0.016 | 0.047 |
| D06 | Oil refining and other energy products | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.088 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.031 |
| E00 | Electricity and water | 0.027 | 0.026 | 0.025 | 0.034 | 0.019 | 0.013 | 0.024 | 0.020 | 0.023 | 0.019 | 0.018 | 0.012 | 0.021 |
| F45 | Construction | 0.112 | 0.139 | 0.079 | 0.080 | 0.094 | 0.046 | 0.122 | 0.193 | 0.076 | 0.070 | 0.121 | 0.039 | 0.082 |
| G00 | Trade | 0.084 | 0.148 | 0.098 | 0.079 | 0.083 | 0.054 | 0.091 | 0.068 | 0.085 | 0.092 | 0.054 | 0.049 | 0.078 |
| H55 | Hotels and restaurants | 0.017 | 0.010 | 0.015 | 0.007 | 0.003 | 0.007 | 0.079 | 0.023 | 0.088 | 0.004 | 0.003 | 0.010 | 0.021 |
| I01 | Transport | 0.040 | 0.064 | 0.049 | 0.048 | 0.035 | 0.034 | 0.043 | 0.045 | 0.046 | 0.062 | 0.034 | 0.033 | 0.042 |
| I02 | Post and telecommunications | 0.021 | 0.035 | 0.027 | 0.026 | 0.019 | 0.018 | 0.023 | 0.024 | 0.025 | 0.033 | 0.019 | 0.018 | 0.022 |
| J00 | Financial activities and insurance | 0.023 | 0.037 | 0.028 | 0.067 | 0.019 | 0.050 | 0.035 | 0.022 | 0.031 | 0.021 | 0.014 | 0.013 | 0.041 |
| K00 | Real estate, renting and services to enterprises | 0.041 | 0.065 | 0.050 | 0.120 | 0.034 | 0.089 | 0.063 | 0.039 | 0.055 | 0.038 | 0.024 | 0.023 | 0.073 |
| L75 | General public administration and social security | 0.043 | 0.086 | 0.081 | 0.179 | 0.068 | 0.032 | 0.072 | 0.103 | 0.054 | 0.280 | 0.277 | 0.207 | 0.076 |
| MN0 | Education, health and social action | 0.045 | 0.081 | 0.083 | 0.072 | 0.059 | 0.041 | 0.072 | 0.067 | 0.077 | 0.088 | 0.064 | 0.060 | 0.059 |
| OP0 | Other non-financial services | 0.011 | 0.012 | 0.011 | 0.018 | 0.009 | 0.009 | 0.016 | 0.008 | 0.011 | 0.008 | 0.005 | 0.005 | 0.011 |
| | **TOTAL** | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

Source: Calculations by the authors.

## Table 7. Location Quotients: Morocco, 2013

| | | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | R10 | R11 | R12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A00 | Agriculture, forestry, hunting, related services | 0.882 | 1.482 | 1.939 | 0.951 | 2.290 | 0.363 | 1.332 | 2.457 | 1.093 | 1.031 | 0.000 | 0.000 |
| B05 | Fishing, aquaculture | 1.111 | 0.365 | 0.000 | 0.089 | 0.000 | 0.116 | 0.390 | 0.000 | 5.139 | 11.275 | 7.737 | 46.896 |
| C00 | Mining industry | 0.000 | 0.529 | 0.056 | 0.148 | 8.713 | 0.005 | 2.753 | 3.573 | 0.012 | 0.000 | 4.854 | 0.000 |
| D01 | Food industry and tobacco | 0.596 | 0.312 | 1.081 | 0.432 | 0.613 | 1.464 | 0.584 | 0.158 | 1.978 | 0.631 | 0.999 | 1.217 |
| D02 | Textile and leather industry | 2.414 | 0.149 | 1.230 | 0.782 | 0.008 | 1.513 | 0.227 | 0.000 | 0.011 | 0.000 | 0.000 | 0.000 |
| D03 | Chemical and para-chemical industry | 0.310 | 0.171 | 0.337 | 0.395 | 0.050 | 2.110 | 0.938 | 0.026 | 0.242 | 0.000 | 1.026 | 0.002 |
| D04 | Mechanical, metallurgical and electrical industry | 2.995 | 0.762 | 0.479 | 0.649 | 0.094 | 1.514 | 0.063 | 0.019 | 0.176 | 0.000 | 0.027 | 0.003 |
| D05 | Other manufacturing, excluding petroleum refining | 1.171 | 0.342 | 0.637 | 0.492 | 0.212 | 1.751 | 0.584 | 0.059 | 0.683 | 0.192 | 0.711 | 0.334 |
| D06 | Oil refining and other energy products | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.800 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| E00 | Electricity and water | 1.286 | 1.218 | 1.193 | 1.601 | 0.902 | 0.612 | 1.120 | 0.943 | 1.093 | 0.880 | 0.866 | 0.586 |
| F45 | Construction | 1.368 | 1.704 | 0.968 | 0.983 | 1.149 | 0.562 | 1.491 | 2.357 | 0.928 | 0.857 | 1.485 | 0.473 |
| G00 | Trade | 1.089 | 1.905 | 1.267 | 1.022 | 1.069 | 0.701 | 1.177 | 0.879 | 1.100 | 1.188 | 0.697 | 0.630 |
| H55 | Hotels and restaurants | 0.810 | 0.495 | 0.694 | 0.316 | 0.152 | 0.337 | 3.735 | 1.108 | 4.138 | 0.174 | 0.148 | 0.473 |
| I01 | Transport | 0.956 | 1.536 | 1.183 | 1.164 | 0.828 | 0.814 | 1.024 | 1.077 | 1.097 | 1.488 | 0.827 | 0.794 |
| I02 | Post and telecommunications | 0.956 | 1.536 | 1.183 | 1.164 | 0.828 | 0.814 | 1.024 | 1.077 | 1.097 | 1.488 | 0.827 | 0.794 |
| J00 | Financial activities and insurance | 0.567 | 0.897 | 0.682 | 1.648 | 0.466 | 1.220 | 0.870 | 0.541 | 0.760 | 0.527 | 0.334 | 0.314 |
| K00 | Real estate, renting and services to enterprises | 0.567 | 0.897 | 0.682 | 1.648 | 0.466 | 1.220 | 0.870 | 0.541 | 0.760 | 0.527 | 0.334 | 0.314 |
| L75 | General public administration and social security | 0.565 | 1.129 | 1.069 | 2.347 | 0.888 | 0.423 | 0.947 | 1.356 | 0.706 | 3.681 | 3.634 | 2.715 |
| MN0 | Education, health and social action | 0.759 | 1.365 | 1.402 | 1.218 | 0.989 | 0.682 | 1.214 | 1.128 | 1.299 | 1.475 | 1.085 | 1.018 |
| OP0 | Other non-financial services | 0.973 | 1.104 | 0.956 | 1.628 | 0.798 | 0.754 | 1.447 | 0.739 | 0.932 | 0.685 | 0.444 | 0.417 |

Source: Calculations by the authors.

## 3.2. Interregional linkages

The indicators described above are based on sectoral and regional shares of the IIOM-MOR, which only measure the regional distribution of economic activity in the country. In this section, a comparative analysis of regional economic structure is carried out. Production linkages between sectors are considered through the analysis of the intermediate inputs portion of the interregional input-output database. Both the direct and indirect production linkage effects of the economy are captured by the adoption of different methods based on the evaluation of the Leontief inverse matrix. The purpose remains the comparison of economic structures rather than an evaluation of the methods of analysis themselves.

The conventional input-output model is given by the system of matrix equations:

$$x = Ax + f \tag{5}$$

$$x = (I - A)^{-1}f = Bf \tag{6}$$

Where *x* and *f* are respectively the vectors of gross output and final demand; *A* consists of input coefficients $a_{ij}$ defined as the amount of product *i* required per unit of product *j* (in monetary terms), for *i, j* = 1,…, n; and *B* is known as the Leontief inverse.

Let us consider systems (5) and (6) in an interregional context, with *R* different regions, so that:

$$x = \begin{bmatrix} x^1 \\ \vdots \\ x^R \end{bmatrix}; A = \begin{bmatrix} A^{11} & \cdots & A^{1R} \\ \vdots & \ddots & \vdots \\ A^{R1} & \cdots & A^{RR} \end{bmatrix}; f = \begin{bmatrix} f^1 \\ \vdots \\ f^R \end{bmatrix}; \text{and } B = \begin{bmatrix} B^{11} & \cdots & B^{1R} \\ \vdots & \ddots & \vdots \\ B^{R1} & \cdots & B^{RR} \end{bmatrix} \tag{7}$$

and

$$x^1 = B^{11}f^1 + \cdots + B^{1R}f^R$$

$$\vdots$$

$$x^R = B^{R1}f^1 + \cdots + B^{RR}f^R \tag{8}$$

Let us also consider different components of *f*, which include demands originating in the specific regions, $v^{rs}$, *s* = 1,…, R, and abroad, *e*. We obtain information of final demand from origin *s* in the IIOM-MOR, allowing us to treat *v* as a matrix which provides the monetary values of final demand expenditures from the domestic regions in Morocco and from the foreign region.

$$v = \begin{bmatrix} v^{11} & \cdots & v^{1R} \\ \vdots & \ddots & \vdots \\ v^{R1} & \cdots & v^{RR} \end{bmatrix}; e = \begin{bmatrix} e^1 \\ \vdots \\ e^R \end{bmatrix}$$

Thus, we can re-write (7) as:

$$x^1 = B^{11}(v^{11} + \cdots + v^{R1} + e^1) + \cdots + B^{1R}(v^{1R} + \cdots + v^{RR} + e^R)$$

$$\vdots$$

$$x^R = B^{R1}(v^{11} + \cdots + v^{R1} + e^1) + \cdots + B^{RR}(v^{1R} + \cdots + v^{RR} + e^R) \tag{9}$$

With (9), we can then compute the contribution of final demand from different origins on regional output. It is clear from (9) that regional output depends, among others, on demand originating in the region and, depending on the degree of interregional integration, also on demand from outside the region.

In what follows, interdependence among sectors in different regions is considered through the analysis of the complete intermediate input portion of the interregional input-output table. The Leontief inverse matrix, based on the system (8), will be considered, and some summary interpretations of the structure of the economy derived from it will be provided.

### 3.2.1. Multiplier Analysis

The column multipliers derived from B were computed (see Miller and Blair, 2009). An output multiplier is defined for each sector j, in each region r, as the total value of production in all sectors and in all regions of the economy that is necessary in order to satisfy a dirham's worth of final demand for sector j's output. The multiplier effect can be decomposed into intraregional (internal multiplier) and interregional (external multiplier) effects, the former representing the impacts on the outputs of sectors within the region where the final demand change was generated, and the latter showing the impacts on the other regions of the system (interregional spillover effects).

Table 8 shows the intraregional and interregional shares for the average total output multipliers in the 12 regions in Morocco as well as the equivalent shares for the direct and indirect effects of a unit change in final demand in each sector in each region net of the initial injection, i.e., the total output multiplier effect net of the initial change. The entries are shown in percentage terms, providing insights into the degree of dependence of each region on the other regions. Grand Casablanca-Settat, Fès-Meknès, Marrakech-Safi, Souss-Massa and Oriental are the most self-sufficient regions; the average flow-on effects from a unit change in sectoral final demand is among the highest. The average net effect exceeds 40% for Grand Casablanca-Settat, Fès-Meknès, Marrakech-Safi, Souss-Massa (it exceeds 55% for Grand Casablanca-Settat). For some regions, such as Guelmin-Oued Noun, Laayoune-Sakia El Hamra and Dakhla-Oued Eddahab, in the south of the country, the degree of regional self-sufficiency is much lower, and the intraregional flow-on effects, on the average, are much lower than the total interregional effects. Lower degree of self-sufficiency also appears in more specialized regions, such as Drâa-Tafilalet and  Béni Mellal-Khénifra.

**Table 8. Regional Percentage Distribution of the Average Total and Net Output Multipliers: Morocco, 2013**

|  |  | Total output multiplier | | Net output multiplier | |
|---|---|---|---|---|---|
|  |  | Intra-regional share | Interregional share | Intra-regional share | Interregional share |
| R1 | Tanger-Tetouan-Al Hoceima | 82.9 | 17.1 | 34.2 | 65.8 |
| R2 | Oriental | 83.7 | 16.3 | 38.6 | 61.4 |
| R3 | Fès-Meknès | 84.8 | 15.2 | 40.6 | 59.4 |
| R4 | Rabat-Salé-Kénitra | 83.5 | 16.5 | 37.5 | 62.5 |
| R5 | Béni Mellal-Khénifra | 82.6 | 17.4 | 31.6 | 68.4 |
| R6 | Grand Casablanca-Settat | 87.8 | 12.2 | 55.6 | 44.4 |
| R7 | Marrakech-Safi | 83.9 | 16.1 | 39.1 | 60.9 |
| R8 | Drâa-Tafilalet | 83.1 | 16.9 | 28.8 | 71.2 |
| R9 | Souss-Massa | 84.2 | 15.8 | 40.6 | 59.4 |
| R10 | Guelmim-Oued Noun | 84.2 | 15.8 | 31.2 | 68.8 |
| R11 | Laayoune-Sakia El Hamra | 84.1 | 15.9 | 32.6 | 67.4 |
| R12 | Dakhla-Oued Eddahab | 80.0 | 20.0 | 14.1 | 85.9 |

Source: Calculations by the authors.

### 3.2.2. Output Decomposition

A complementary analysis to the multiplier approach is presented in this section. Regional output is decomposed by taking into account not only the multiplier structure, but also the structure of final demand in the 12 domestic and the foreign regions (Sonis et al., 1996).

According to equation (9), regional output (for each region) was decomposed, and the contributions of the components of final demand from different areas were calculated. The results are presented in Table 9. On average, the self-generated component of output in each region, i.e. the share of output generated by demand within the region, is lower in those regions that present higher dependency upon the rest of the world (Grand Casablanca-Settat, Tanger-Tetouan-Al Hoceima, Béni Mellal-Khénifra and Dakhla-Oued Eddahab). The demand for foreign exports is very relevant not only for Grand Casablanca-Settat but also for other resource-based economies. Its contribution to the regional ouput can reach more than one-third of the regional output (20.9% for the country as a whole), as is the case of Dakhla-Oued Eddahab (39.9%) and Tanger-Tetouan-Al Hoceima (33.8%). There are also some cases of stronger depenceny upon the rest of the country, as it is the case of the dependency of Marrakech-Safi, Rabat-Salé-Kénitra, Souss-Massa and Béni Mellal-Khénifra on Grand Casablanca-Settat's demand, and the depency of Grand Casablanca-Settat on Rabat-Salé-Kénitra's demand.

A more systematic approach to look at the influence of final demand from different areas is to map the column original estimates that generated Table 9. The results illustrated in Figure 3 provide an attempt to reveal the spatial patterns of output dependence upon specific sources of final demand. Figure 3 presents for each demanding region, the distribution of their influence on output of all other regions in Morocco. The 12 regions are grouped in six different categories in each map, so that darker colors represent higher values.

Moreover, one can also look at the data that originated Table 9 from a row perspective. That is, one may be interested in evaluating the main sources of domestic demand that affect the output of a specific region. The results are illustrated in Figure 4.

**Table 9. Components of Decomposition of Regional Output Based on the Sources of Final Demand: Morocco, 2013 (in %)**

| | | ORIGIN OF FINAL DEMAND | | | | | | | | | | | | |
| | | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | R10 | R11 | R12 | ROW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REGIONAL OUTPUT | R1 | 44.3 | 2.1 | 2.9 | 3.6 | 1.2 | 6.4 | 2.2 | 1.2 | 1.2 | 0.3 | 0.5 | 0.4 | 33.8 |
| | R2 | 3.5 | 59.2 | 4.5 | 3.7 | 1.4 | 5.9 | 2.3 | 1.9 | 1.3 | 0.3 | 0.7 | 0.6 | 14.6 |
| | R3 | 5.0 | 4.8 | 51.3 | 6.1 | 2.1 | 9.4 | 3.0 | 2.5 | 1.6 | 0.4 | 0.7 | 0.6 | 12.5 |
| | R4 | 4.8 | 2.4 | 4.0 | 52.1 | 1.9 | 13.1 | 3.2 | 1.5 | 1.6 | 0.4 | 0.7 | 0.5 | 13.6 |
| | R5 | 3.6 | 2.5 | 3.6 | 4.8 | 39.4 | 9.8 | 5.5 | 1.8 | 2.5 | 0.5 | 0.7 | 0.6 | 24.7 |
| | R6 | 6.3 | 4.0 | 5.2 | 10.0 | 3.6 | 28.5 | 6.9 | 2.4 | 3.2 | 0.7 | 0.9 | 0.7 | 27.8 |
| | R7 | 3.7 | 2.4 | 3.1 | 5.3 | 3.3 | 10.0 | 52.2 | 1.7 | 3.0 | 0.7 | 1.0 | 0.7 | 12.8 |
| | R8 | 3.6 | 2.9 | 4.4 | 4.0 | 2.1 | 6.2 | 3.6 | 59.4 | 2.1 | 0.4 | 0.8 | 0.7 | 9.8 |
| | R9 | 4.1 | 3.0 | 3.5 | 5.3 | 2.8 | 10.7 | 6.1 | 2.0 | 47.2 | 2.2 | 1.9 | 1.2 | 10.0 |
| | R10 | 2.4 | 1.6 | 2.0 | 3.2 | 1.4 | 5.3 | 3.2 | 1.1 | 4.3 | 59.1 | 2.0 | 0.9 | 13.5 |
| | R11 | 2.4 | 1.8 | 2.2 | 2.9 | 1.3 | 4.8 | 2.8 | 1.2 | 2.2 | 0.9 | 57.8 | 1.3 | 18.4 |
| | R12 | 1.3 | 1.1 | 1.4 | 1.5 | 0.7 | 2.6 | 1.3 | 0.7 | 1.0 | 0.3 | 1.1 | 47.1 | 39.9 |
| | MOROCCO | 8.4 | 6.4 | 8.5 | 12.7 | 4.8 | 16.2 | 9.5 | 3.4 | 5.3 | 1.3 | 1.8 | 0.9 | 20.9 |

Source: Calculations by the authors.

**Figure 3. Identification of Regions Relatively More Affected by a Specific Regional Demand, by Origin of Final Demand**
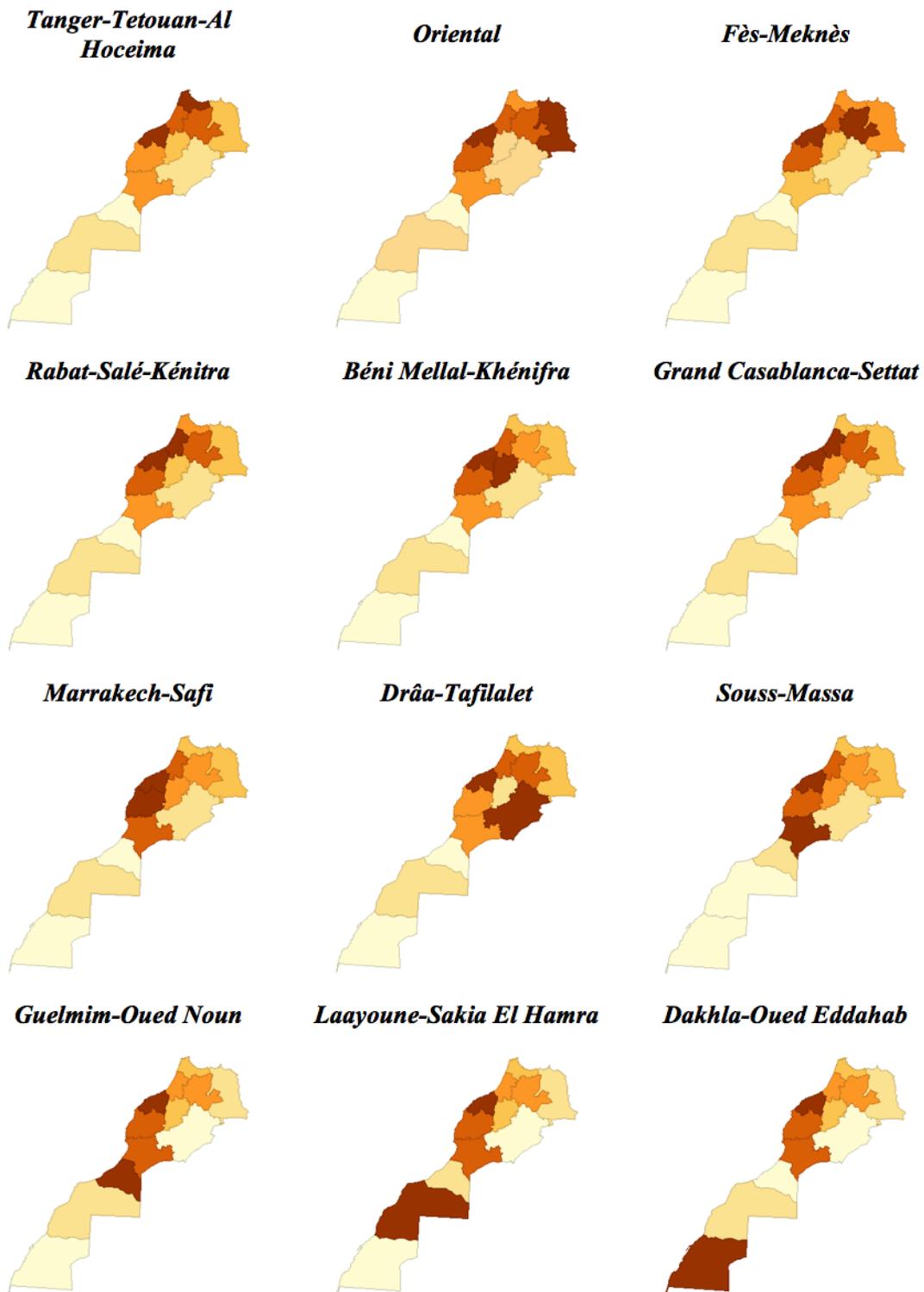


Source: Calculations by the authors.

## Figure 4. Identification of Regions whose Demands Affect Relatively More a Specific Regional Output, by Regional Output
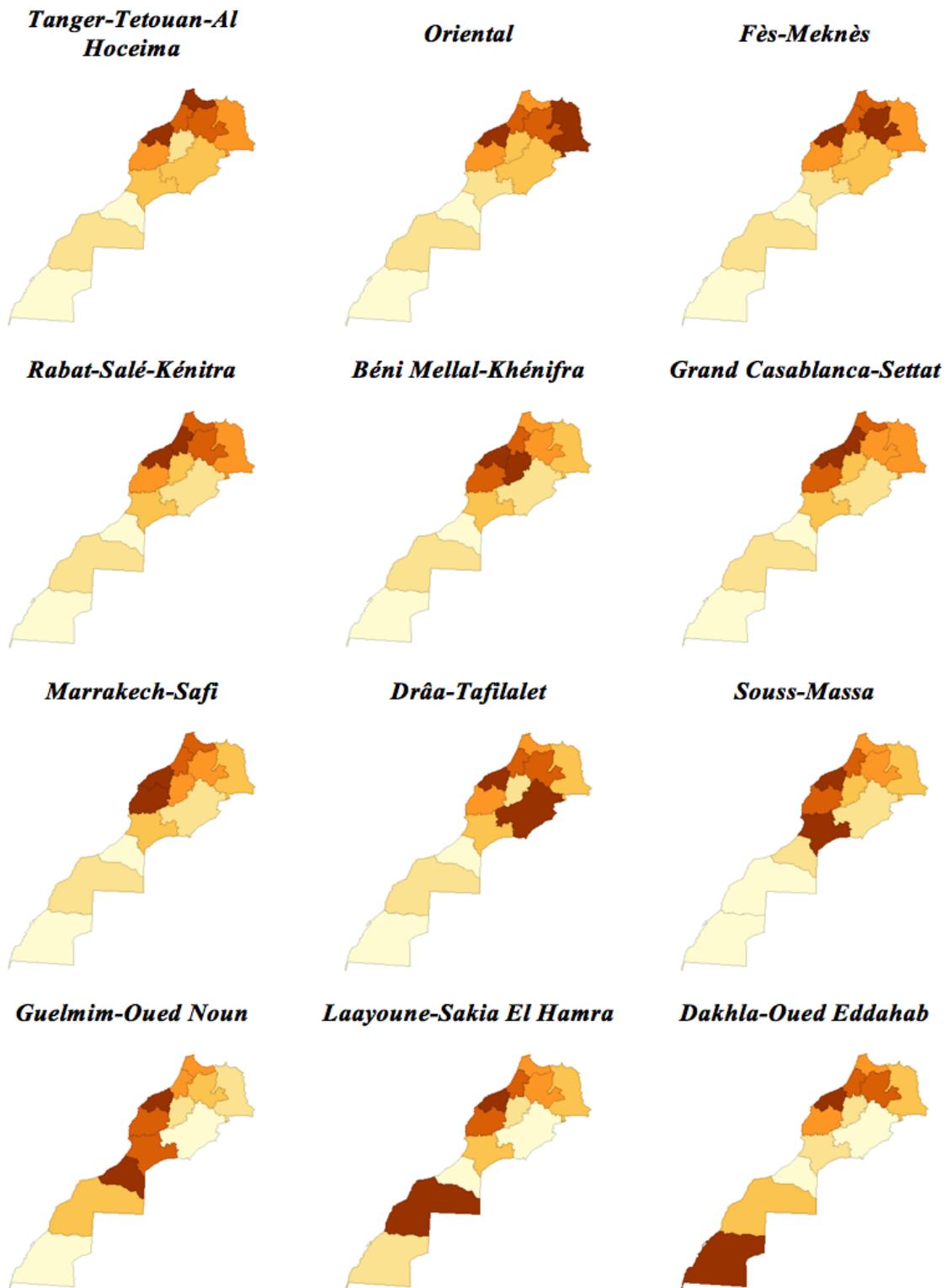


Source: Calculations by the authors.

# 4. Final Remarks

The main goal of this report is to present the recent developments in the construction of an interregional input-output matrix for Morocco (IIOM-MOR). The understanding of the functioning of the Moroccan regional economies within an integrated system is one of the main goals of the joint project involving NEREUS in Brazil, and the OCP Policy Center, in Morocco. By exploring different methods of comparative structure analysis, it is hoped that this initial exercise benefited from the complementarity among them, resulting in a better appreciation of the full dimensions of differences and similirarities that exist among the regions in Morocco.

The analysis suggests that there are some important differences in the internal structure of the regional economies in Morocco and the external interactions among their different agents. Since the absorption matrix used throughout the structural analysis will serve as the basis for the calibration of the ICGE model, knowing the relationships underlying it is fundamental for a better understanding of the model's results.

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# Technical Appendix

In this appendix, the methodology used to generate the interregional input-output system for Morocco is provided. The description is organized around the TABLO Input file, used for data manipulation in GEMPACK.[4] As the final goal of the project is to re-calibrate an interregional CGE model for the country to be implemented using GEMPACK, the choice of the language for the code for generating the IIOM-MOR was straightforward. In fact, aAttention is directed to the different steps undertaken and their underlying assumptions. We present the complete text of the TABLO Input file divided into a sequence of excerpts and supplemented by tables and explanatory text. The presentation draws on the document "ORANI-G: A Generic Single-Country Computable General Equilibrium Model", by Mark Horridge, March 2006.

## A1. Dimensions of the IIOM-MOR

Excerpt 1 of the TABLO Input file begins by defining logical names for input and output files. Initial data are stored in the BDATA input file. The RIODATA output file is used to store results for the manipulation of the initial information. Note that BDATA and RIODATA are logical names. The actual locations of these files (disk, folder, filename) are chosen by the user.

The rest of Excerpt 1 defines sets: lists of descriptors for the components of vector coefficients. Set names appear in upper-case characters. For example, the first Set statement is to be read as defining a set named 'COM' which contains commodity descriptors. The elements of COM (a list of commodity names) are read from the input file REGSETS (this allows the model to use databases with different numbers of sectors). By contrast the two elements of the set SRC – dom and imp – are listed explicitly.

! Excerpt 1 of TABLO input file: !
! Files and sets !

FILE BDATA # Data File #;
FILE(NEW) RIODATA # Regional IO data #;
FILE REGSETS # Sets file #;

**SET**
COM # Commodities #
READ ELEMENTS FROM FILE REGSETS HEADER «COM»;
MARGCOM # Margin Commodities #
READ ELEMENTS FROM FILE REGSETS HEADER «MAR»;
SUBSET MARGCOM IS SUBSET OF COM;
**SET**
MARGCOM1 # Margin Commodity 1 #
READ ELEMENTS FROM FILE REGSETS HEADER «MAR1»;
MARGCOM2 # Margin Commodity 2 #
READ ELEMENTS FROM FILE REGSETS HEADER «MAR2»;
SUBSET MARGCOM1 IS SUBSET OF COM;

---

**4.** The TABLO language is essentially conventional algebra, with names for variables and coefficients chosen to be suggestive of their economic interpretations. It is no more complex than alternative means of setting out a CGE model and undertaking calculations from an original set of data.

SUBSET MARGCOM2 IS SUBSET OF COM;
SUBSET MARGCOM1 IS SUBSET OF MARGCOM;
SUBSET MARGCOM2 IS SUBSET OF MARGCOM;
**SET**
NONMARGCOM # NonMargin Commodities #
READ ELEMENTS FROM FILE REGSETS HEADER «NMAR»;
SUBSET NONMARGCOM IS SUBSET OF COM;
**SET**
SRC # Source of Commodities # (dom,imp);
IND # Industries #
READ ELEMENTS FROM FILE REGSETS HEADER «IND»;
REGDEST # Regional destinations #
READ ELEMENTS FROM FILE REGSETS HEADER «REG»;
ALLSOURCE # Origin of goods #
READ ELEMENTS FROM FILE REGSETS HEADER «ASRC»;
REGSOURCE # Domestic origin of goods #
READ ELEMENTS FROM FILE REGSETS HEADER «REG»;
SUBSET REGSOURCE IS SUBSET OF ALLSOURCE;
SUBSET REGSOURCE IS SUBSET OF REGDEST;
SUBSET REGDEST IS SUBSET OF REGSOURCE;

The commodity and industry classifications of the IIOM-MOR described here are based on aggregates of the classifications used in the national IO tables published by the High Commission for Planning in Morocco, which considers 20 industries and 20 commodities. Multiproduction is not considered in the 12 domestic regions of the system, since we have built the national absorption matrix based on the sector by sector approach.

Table A1 lists the elements of the set COM which are read from file. GEMPACK uses the element names to label the rows and columns of results and data tables. The element names cannot be more than 12 letters long, nor contain spaces. The IND elements are presented in Table A2 and the ALLSOURCE elements in Table A3.

Elements of the set MARGCOM are margins commodities, i.e., they are required to facilitate the flows of other commodities from producers (or importers) to users. Hence, the costs of margins services, together with indirect taxes, account for differences between basic prices (received by producers or importers) and purchasers' prices (paid by users). In the IIOM-MOR system, we considered two commodities as margin, namely "G00" and "I01".

TABLO does not prevent elements of two sets from sharing the same name; nor, in such a case, does it automatically infer any connection between the corresponding elements. The Subset statement which follows the definition of the set MARGCOM is required for TABLO to realize that the two elements of MARGCOM, "G00" and "I01", are the same as the elements of the set COM.

The statement for NONMARGCOM defines that set as a complement. That is, NONMARGCOM consists of all those elements of COM which are not in MARGCOM. In this case TABLO is able to deduce that NONMARGCOM must be a subset of COM.

## Table A2. Industry Classification

| Elements of Set Industries | Description |
|---|---|
| A00 | Agriculture, forestry, hunting, related services |
| B05 | Fishing, aquaculture |
| C00 | Mining industry |
| D01 | Food industry and tobacco |
| D02 | Textile and leather industry |
| D03 | Chemical and para-chemical industry |
| D04 | Mechanical, metallurgical and electrical industry |
| D05 | Other manufacturing, excluding petroleum refining |
| D06 | Oil refining and other energy products |
| E00 | Electricity and water |
| F45 | Construction |
| G00 | Trade |
| H55 | Hotels and restaurants |
| I01 | Transport |
| I02 | Post and telecommunications |
| J00 | Financial activities and insurance |
| K00 | Real estate, renting and services to enterprises |
| L75 | General public administration and social security |
| MN0 | Education, health and social action |
| OP0 | Other non-financial services |

## Table A3. Regional Classification

| Elements of Set ALLSOURCE | Description |
|---|---|
| R1 | Tanger-Tetouan-Al Hoceima |
| R2 | Oriental |
| R3 | Fès-Meknès |
| R4 | Rabat-Salé-Kénitra |
| R5 | Béni Mellal-Khénifra |
| R6 | Grand Casablanca-Settat |
| R7 | Marrakech-Safi |
| R8 | Drâa-Tafilalet |
| R9 | Souss-Massa |
| R10 | Guelmim-Oued Noun |
| R11 | Laayoune-Sakia El Hamra |
| R12 | Dakhla-Oued Eddahab |
| FOR | Imports |

## A2. Initial Data

The next excerpts of the TABLO file contains statements indicating data to be read from file. The data items defined in these statements appear as coefficients in the initial database. The statements define coefficient names (which all appear in upper-case characters), and the locations from which the data are to be read.

### A2.1. National input-output data

This excerpt groups the data according to the information contained in the national input-output system organized as illustrated in Figure A1. Thus, Excerpt 2 begins by defining coefficients representing the basic commodity flows corresponding to the flows of Figure A1 for each user except exports and inventories, i.e., the basic flow matrices for intermediate consumption, investment demand, household consumption and government consumption, and the associatred margins and indirect taxes flows. Preceding the coefficient names are their dimensions, indicated using the "all" qualifier, and the sets defined in Excerpt 1. For example, the first 'COEFFICIENT' statement defines a data item LABAS(c,i) which is the basic value of a flow of intermediate inputs of commodity c to user industry i, aggregated by source (domestic and imported). The first 'READ' statement indicates that this data item is stored on file BDATA with header 'ABAS'. (A GEMPACK data file consists of a number of data items such as arrays of real numbers. Each data item is identified by a unique key or 'header').

### Figure A1. Structure of the National Flows Database

| | | | Intermediate consumption | Investment demand | Household consumption | Exports | Government consumption |
|---|---|---|---|---|---|---|---|
| | | Dim. | 1  2  …  20 | 1  2  …  20 | 1 | 1 | 1 |
| Basic flows | Domestic | 1 2 … 20 | LABAS (DOM) | LIBAS (DOM) | LCBAS (DOM) | LXBAS (DOM) | LGBAS (DOM) |
| Basic flows | Imported | 1 2 … 20 | LABAS (IMP) | LIBAS (IMP) | LCBAS (IMP) | LXBAS (IMP) | LGBAS (IMP) |
| Trade Margins | Domestic | 1 2 … 20 | LAMR1 (DOM) | LIMR1 (DOM) | LCMR1 (DOM) | LXMR1 (DOM) | LGMR1 (DOM) |
| Trade Margins | Imported | 1 2 … 20 | LAMR1 (IMP) | LIMR1 (IMP) | LCMR1 (IMP) | LXMR1 (IMP) | LGMR1 (IMP) |
| Transport Margins | Domestic | 1 2 … 20 | LAMR2 (DOM) | LIMR2 (DOM) | LCMR2 (DOM) | LXMR2 (DOM) | LGMR2 (DOM) |
| Transport Margins | Imported | 1 2 … 20 | LAMR2 (IMP) | LIMR2 (IMP) | LCMR2 (IMP) | LXMR2 (IMP) | LGMR2 (IMP) |
| Indirect taxes | Domestic | 1 2 … 20 | LATX1 (DOM) | LITX1 (DOM) | LCTX1 (DOM) | LXTX1 (DOM) | LGTX1 (DOM) |
| Indirect taxes | Imported | 1 2 … 20 | LATX1 (IMP) | LITX1 (IMP) | LCTX1 (IMP) | LXTX1 (IMP) | LGTX1 (IMP) |
| Labor payments | | | LABR | 0 | 0 | 0 | 0 |
| Capital payments | | | CPTL | 0 | 0 | 0 | 0 |
| Other costs | | | OCTS | 0 | 0 | 0 | 0 |
| Total | | | MAKE_I | ITOT | CTOT | XTOT | GTOT |

! Excerpt 2 of TABLO input file: !
! Initial data !

**COEFFICIENT**
(all,c,COM)(all,i,IND)
LABAS(c,i) # Technical level matrix - national #;
(all,c,COM)(all,i,IND)
LIBAS(c,i) # Investnent level matrix - national #;
(all,c,COM)
LCBAS(c) # Consumption level matrix - national #;
(all,c,COM)
LGBAS(c) # Government level matrix - national #;
(all,c,COM)(all,i,IND)
LAMR1(c,i) # MAR1 1 level matrix - national #;
(all,c,COM)(all,i,IND)
LIMR1(c,i) # MAR2 1 level matrix - national #;
(all,c,COM)
LCMR1(c) # MAR3 1 level matrix - national #;
(all,c,COM)
LGMR1(c) # MAR5 1 level matrix - national #;
(all,c,COM)(all,i,IND)
LAMR2(c,i) # MAR1 2 level matrix - national #;
(all,c,COM)(all,i,IND)
LIMR2(c,i) # MAR2 2 level matrix - national #;
(all,c,COM)
LCMR2(c) # MAR3 2 level matrix - national #;
(all,c,COM)
LGMR2(c) # MAR5 2 level matrix - national #;
(all,c,COM)(all,i,IND)
LATX1(c,i) # TAX1 1 level matrix - national #;
(all,c,COM)(all,i,IND)
LITX1(c,i) # TAX2 1 level matrix - national #;
(all,c,COM)
LCTX1(c) # TAX3 1 level matrix - national #;
(all,c,COM)
LGTX1(c) # TAX5 1 level matrix - national #;
(all,i,IND)
CITO(i) # Total intermediate consumption - national #;
CTOT # Total household consumption - national #;
ITOT # Total investment demand - national #;
GTOT # Total government demand - national #;

**READ**
LABAS FROM FILE BDATA HEADER «ABAS»;
LIBAS FROM FILE BDATA HEADER «IBAS»;
LCBAS FROM FILE BDATA HEADER «CBAS»;
LGBAS FROM FILE BDATA HEADER «GBAS»;

LAMR1 FROM FILE BDATA HEADER «AMR1»;
LIMR1 FROM FILE BDATA HEADER «IMR1»;
LCMR1 FROM FILE BDATA HEADER «CMR1»;
LGMR1 FROM FILE BDATA HEADER «GMR1»;
LAMR2 FROM FILE BDATA HEADER «AMR2»;
LIMR2 FROM FILE BDATA HEADER «IMR2»;
LCMR2 FROM FILE BDATA HEADER «CMR2»;
LGMR2 FROM FILE BDATA HEADER «GMR2»;
LATX1 FROM FILE BDATA HEADER «ATX1»;
LITX1 FROM FILE BDATA HEADER «ITX1»;
LCTX1 FROM FILE BDATA HEADER «CTX1»;
LGTX1 FROM FILE BDATA HEADER «GTX1»;
CITO FROM FILE BDATA HEADER «CITO»;
CTOT FROM FILE BDATA HEADER «CTOT»;
ITOT FROM FILE BDATA HEADER «ITOT»;
   GTOT FROM FILE BDATA HEADER «GTOT»;

## A2.2. National input-output shares

The use of the national aggregates presente in Excerpt 2, disregarding domestic and foreign sources, will allow us to assume the same national technolology of production, and the same composition of investment demand and household expenditures in each region (similarly for government demand). However, the associated regional compositions will be region-specific, including the share of foreign imports. Excerpt 3 presents the coefficients that make explicit the national structures.

! Excerpt 3 of TABLO input file: !
! Initial data !

**COEFFICIENT**
(all,c,COM)(all,i,IND)
ABAS(c,i) # Technical coefficient matrix - national #;
(all,c,COM)(all,i,IND)
IBAS(c,i) # Investnent coefficient matrix - national #;
(all,c,COM)
CBAS(c) # Consumption coefficient matrix - national #;
(all,c,COM)
GBAS(c) # Government coefficient matrix - national #;
(all,c,COM)(all,i,IND)
AMR1(c,i) # MAR1 1 coefficient matrix - national #;
(all,c,COM)(all,i,IND)
IMR1(c,i) # MAR2 1 coefficient matrix - national #;
(all,c,COM)
CMR1(c) # MAR3 1 coefficient matrix - national #;
(all,c,COM)
GMR1(c) # MAR5 1 coefficient matrix - national #;
(all,c,COM)(all,i,IND)
AMR2(c,i) # MAR1 2 coefficient matrix - national #;

(all,c,COM)(all,i,IND)
IMR2(c,i) # MAR2 2 coefficient matrix - national #;
(all,c,COM)
CMR2(c) # MAR3 2 coefficient matrix - national #;
(all,c,COM)
GMR2(c) # MAR5 2 coefficient matrix - national #;
(all,c,COM)(all,i,IND)
ATX1(c,i) # TAX1 1 coefficient matrix - national #;
(all,c,COM)(all,i,IND)
ITX1(c,i) # TAX2 1 coefficient matrix - national #;
(all,c,COM)
CTX1(c) # TAX3 1 coefficient matrix - national #;
(all,c,COM)
GTX1(c) # TAX5 1 coefficient matrix - national #;
TINY # A very small number #;

**FORMULA**
(all,c,COM)(all,i,IND)
ABAS(c,i)=LABAS(c,i)/CITO(i);
(all,c,COM)(all,i,IND)
IBAS(c,i)=LIBAS(c,i)/ITOT;
(all,c,COM)
CBAS(c)=LCBAS(c)/CTOT;
(all,c,COM)
GBAS(c)=LGBAS(c)/GTOT;
(all,c,COM)(all,i,IND)
AMR1(c,i)=LAMR1(c,i)/CITO(i);
(all,c,COM)(all,i,IND)
IMR1(c,i)=LIMR1(c,i)/ITOT;
(all,c,COM)
CMR1(c)=LCMR1(c)/CTOT;
(all,c,COM)
GMR1(c)=LGMR1(c)/GTOT;
(all,c,COM)(all,i,IND)
AMR2(c,i)=LAMR2(c,i)/CITO(i);
(all,c,COM)(all,i,IND)
IMR2(c,i)=LIMR2(c,i)/ITOT;
(all,c,COM)
CMR2(c)=LCMR2(c)/CTOT;
(all,c,COM)
GMR2(c)=LGMR2(c)/GTOT;
(all,c,COM)(all,i,IND)
ATX1(c,i)=LATX1(c,i)/CITO(i);
(all,c,COM)(all,i,IND)
ITX1(c,i)=LITX1(c,i)/ITOT;
(all,c,COM)

CTX1(c)=LCTX1(c)/CTOT;
(all,c,COM)
GTX1(c)=LGTX1(c)/GTOT;
TINY = 0.00000000000000001;

### A2.3. Commodity trade matrices

The coefficients of excerpt 4 are associated with commodity trade matrices, i.e., the intra-regional and the interregional flows, for each commodity, from every possible origin-destination pair (including foreign origin). Tables 2 to 4 in the main text present a synthesis of the aggregate flows for Morocco in 2012.

! Excerpt 4 of TABLO input file: !
! Initial data !

**COEFFICIENT**
(all,s,ALLSOURCE)(all,q,REGDEST)
P1(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P2(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P3(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P4(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P5(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P6(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P7(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P8(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P9(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P10(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P11(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P11(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P13(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P14(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P15(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P16(s,q) # Trade matrix - flows #;

(all,s,ALLSOURCE)(all,q,REGDEST)
P17(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P18(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P19(s,q) # Trade matrix - flows #;
(all,s,ALLSOURCE)(all,q,REGDEST)
P20(s,q) # Trade matrix - flows #;

**READ**
P1 FROM FILE BDATA HEADER «P1»;
P2 FROM FILE BDATA HEADER «P2»;
P3 FROM FILE BDATA HEADER «P3»;
P4 FROM FILE BDATA HEADER «P4»;
P5 FROM FILE BDATA HEADER «P5»;
P6 FROM FILE BDATA HEADER «P6»;
P7 FROM FILE BDATA HEADER «P7»;
P8 FROM FILE BDATA HEADER «P8»;
P9 FROM FILE BDATA HEADER «P9»;
P10 FROM FILE BDATA HEADER «P10»;
P11 FROM FILE BDATA HEADER «P11»;
P12 FROM FILE BDATA HEADER «P12»;
P13 FROM FILE BDATA HEADER «P13»;
P14 FROM FILE BDATA HEADER «P14»;
P15 FROM FILE BDATA HEADER «P15»;
P16 FROM FILE BDATA HEADER «P16»;
P17 FROM FILE BDATA HEADER «P17»;
P18 FROM FILE BDATA HEADER «P18»;
P19 FROM FILE BDATA HEADER «P19»;
P20 FROM FILE BDATA HEADER «P20»;

### A2.4. Mapping commodity trade matrices

The bi-dimensional coefficients from the initial database related to the original commodity trade matrices (excerpt 4) are mapped into tri-dimensional coefficients. This is necessary only because of the way the initial data were prepared in order to make the calculations more efficient.

! Excerpt 5 of TABLO input file: !
! Initial data !

**COEFFICIENT**
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TRADE(c,s,q) # Trade matrices, by commodity, regional #;
(all,s,ALLSOURCE)(all,q,REGDEST)
TRADE_C(s,q) # Trade matrices, regional #;

**FORMULA**

| | | | |
|---|---|---|---|
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«A00»,s,q)= | P1 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«B05»,s,q)= | P2 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«C00»,s,q)= | P3 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«D01»,s,q)= | P4 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«D02»,s,q)= | P5 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«D03»,s,q)= | P6 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«D04»,s,q)= | P7 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«D05»,s,q)= | P8 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«D06»,s,q)= | P9 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«E00»,s,q)= | P10 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«F45»,s,q)= | P11 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«G00»,s,q)= | P12 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«H55»,s,q)= | P13 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«I01»,s,q)= | P14 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«I02»,s,q)= | P15 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«J00»,s,q)= | P16 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«K00»,s,q)= | P17 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«L75»,s,q)= | P18 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«MNO»,s,q)= | P19 | (s,q); |
| (all,s,ALLSOURCE)(all,q,REGDEST) | TRADE(«OP0»,s,q)= | P20 | (s,q); |

## A2.5. Regional information

The last piece of information from the initial database is related to regional aggregates. Regional information on sectoral intermediate consumption and value added, as well as on regional aggregates on total investment, total household consumption and total government consumption is also part of the initial database. Finally, the regional distribution of exports by manufactured commodities was made available by the official statistics agency in Morocco, while for the other sectors we have used the location quotient to disaggregate the national values.

! Excerpt 6 of TABLO input file: !
! Initial data !

**COEFFICIENT**
(all,i,IND)(all,q,REGDEST)
CINT(i,q) # Total regional intermediate consumption, by sector #;
(all,q,REGDEST)
INV(q) # Total investment demand - regional #;
(all,q,REGDEST)
CONS(q) # Total household demand - regional #;
(all,q,REGDEST)
GOV(q) # Total government demand - regional #;
(all,c,COM)(all,q,REGDEST)
BAS4_S(c,q) # Total export demand - regional #;
(all,s,ALLSOURCE)(all,q,REGDEST)

SHIND(s,q) # Diagonal trade share matrix #;
(all,i,IND)(all,q,REGDEST)
CPTL(i,q) # Total regional capital payments, by sector #;

**READ**
CINT from file BDATA header «CINT»;
INV from file BDATA header «INV»;
CONS from file BDATA header «CONS»;
GOV from file BDATA header «GOV»;
BAS4_S from file BDATA header «EXP»;
SHIND from file BDATA header «SHND»;
CPTL from file BDATA header «CPTL»;

## A3. The Chenery-Moses Approach

### A3.1. Interregional coefficients

As the basic data are prepared, we can proceed with the application of the adaptation of the Chenery-Moses approach to generate the IIO coefficients for Morocco. The SHIN(c,s,q) coefficient corresponds to showing the proportions of a commodity c in region q that come from within the region and from each one of the other regions (including the rest of the world – s is an element of the set ALLSOURCE). It is assumed that all users in each region share the same importing pattern for a given commodity.

The SHIN coefficients are applied to the national aggregate coefficients for the following users: intermediate consumption, investment demand, household consumption and government consumption. The treatment adopted for exports and changes in inventories are explained later.

! Excerpt 7 of TABLO input file: !
! Regionalization of the national coefficients !

**COEFFICIENT**
(all,c,COM)(all,q,REGDEST)
TOTDEM(c,q) # Total regional demand, by commodity #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
SHIN(c,s,q) # Import trade share matrices, by commodity, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RABAS(c,s,i,q) # Technical coefficient, commodity usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RIBAS(c,s,i,q) # Investment coefficient, commodity usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCBAS(c,s,q) # Consumption coefficient, commodity usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGBAS(c,s,q) # Government coefficient, commodity usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RAMR1(c,s,i,q) # Technical coefficient, margin 1 usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)

RIMR1(c,s,i,q) # Investment coefficient, margin 1 usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCMR1(c,s,q) # Consumption coefficient, margin 1 usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGMR1(c,s,q) # Government coefficient, margin 1 usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RAMR2(c,s,i,q) # Technical coefficient, margin 2 usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RIMR2(c,s,i,q) # Investment coefficient, margin 2 usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCMR2(c,s,q) # Consumption coefficient, margin 2 usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGMR2(c,s,q) # Government coefficient, margin 2 usage, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RATX1(c,s,i,q) # Technical coefficient, tax 1, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RITX1(c,s,i,q) # Investment coefficient, tax 1, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCTX1(c,s,q) # Consumption coefficient, tax 1, regional #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGTX1(c,s,q) # Government coefficient, tax 1, regional #;

**Formula**
(all,s,ALLSOURCE)(all,q,REGDEST)
TRADE_C(s,q)=sum(c,COM,TRADE(c,s,q));
(all,c,COM)(all,q,REGDEST)
TOTDEM(c,q)=sum(s,ALLSOURCE,TRADE(c,s,q));
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
SHIN(c,s,q)=TRADE(c,s,q)/(TINY+TOTDEM(c,q));
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RABAS(c,s,i,q)=SHIN(c,s,q)*ABAS(c,i);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RIBAS(c,s,i,q)=SHIN(c,s,q)*IBAS(c,i);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCBAS(c,s,q)=SHIN(c,s,q)*CBAS(c);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGBAS(c,s,q)=SHIN(c,s,q)*GBAS(c);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RAMR1(c,s,i,q)=SHIN(c,s,q)*AMR1(c,i);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RIMR1(c,s,i,q)=SHIN(c,s,q)*IMR1(c,i);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCMR1(c,s,q)=SHIN(c,s,q)*CMR1(c);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGMR1(c,s,q)=SHIN(c,s,q)*GMR1(c);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RAMR2(c,s,i,q)=SHIN(c,s,q)*AMR2(c,i);

```
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RIMR2(c,s,i,q)=SHIN(c,s,q)*IMR2(c,i);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCMR2(c,s,q)=SHIN(c,s,q)*CMR2(c);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGMR2(c,s,q)=SHIN(c,s,q)*GMR2(c);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RATX1(c,s,i,q)=SHIN(c,s,q)*ATX1(c,i);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
RITX1(c,s,i,q)=SHIN(c,s,q)*ITX1(c,i);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RCTX1(c,s,q)=SHIN(c,s,q)*CTX1(c);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
RGTX1(c,s,q)=SHIN(c,s,q)*GTX1(c);
```

## A3.2. Structural flows

### A3.2.1. Basic flows

In exerpt 8, the basic flows are calculated for the various users in the system. For producers, investors, households and government, the interregional coefficients described above are transformed into monetary values according to the relevant levels provided by the information on regional aggregates (excerpt 6). Exports are organized in a bi-dimensional matrix according to the COM and ALLSOURCE sets.

Note that the coefficient S_CPTL(i,q) is calculated based on information for total capital payments by sector (excerpt 6). The coefficient is then used for disaggregating investors demand by sector.

! Excerpt 8 of TABLO input file: !
! Basic flows !

**COEFFICIENT**
```
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
BAS1(c,s,i,q) # Intermdiate consumption - basic values #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
BAS2(c,s,i,q) # Investment demand - basic values #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
BAS3(c,s,q) # Household demand - basic values #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
BAS4(c,s,q) # Export demand - basic values #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
BAS5(c,s,q) # Government demand - basic values #;
(all,i,IND)(all,q,REGDEST)
S_CPTL(i,q) # Sectoral share in regional capital payments #;
```

**FORMULA**
```
(all,i,IND)(all,q,REGDEST)
S_CPTL(i,q)=CPTL(i,q)/(sum(j,IND,CPTL(j,q)));
```

```
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
BAS1(c,s,i,q)=RABAS(c,s,i,q)*CINT(i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
BAS2(c,s,i,q)=RIBAS(c,s,i,q)*INV(q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
BAS3(c,s,q)=RCBAS(c,s,q)*CONS(q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
BAS4(c,s,q)=SHIND(s,q)*BAS4_S(c,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
BAS5(c,s,q)=RGBAS(c,s,q)*GOV(q);
```

## A3.2.2. Margin flows

Margin demands in monetary terms are calculated here. For each basic flow, there is a corresponding margin demand in the system. The distribution of margins follows the same pattern as in the country.

! Excerpt 9 of TABLO input file: !
! Margin flows !

**COEFFICIENT**
```
(all,c,COM)
XMR1(c) # Exports - margin 1 #;
(all,c,COM)
XMR2(c) # Exports - margin 2 #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
MR11(c,s,i,q) # Intermdiate consumption - margin 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
MR12(c,s,i,q) # Investment demand - margin 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR13(c,s,q) # Household demand - margin 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR14(c,s,q) # Export - margin 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR15(c,s,q) # Government demand - margin 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
MR21(c,s,i,q) # Intermdiate consumption - margin 2 #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
MR22(c,s,i,q) # Investment demand - margin 2 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR23(c,s,q) # Household demand - margin 2 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR25(c,s,q) # Government demand - margin 2 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
X_SH(c,s,q) # Export share #;
```

**READ**
```
XMR1 FROM FILE BDATA HEADER «XMR1»;
```

XMR2 from file BDATA header «XMR2»;

**FORMULA**
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
X_SH(c,s,q)=BAS4(c,s,q)/(TINY+sum(r,ALLSOURCE,sum(t,REGDEST,BAS4(c,r,t))));
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
MR11(c,s,i,q)=RAMR1(c,s,i,q)*CINT(i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
MR12(c,s,i,q)=RIMR1(c,s,i,q)*INV(q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR13(c,s,q)=RCMR1(c,s,q)*CONS(q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR14(c,s,q)=X_SH(c,s,q)*XMR1(c);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR15(c,s,q)=RGMR1(c,s,q)*GOV(q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
MR21(c,s,i,q)=RAMR2(c,s,i,q)*CINT(i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
MR22(c,s,i,q)=RIMR2(c,s,i,q)*INV(q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR23(c,s,q)=RCMR2(c,s,q)*CONS(q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR24(c,s,q)=X_SH(c,s,q)*XMR2(c);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
MR25(c,s,q)=RGMR2(c,s,q)*GOV(q);

## A3.2.3. Indirect tax flows

Tax values associated with the basic flow are calculated here. For each basic flow, the corresponding national tax rate is applied.

! Excerpt 10 of TABLO input file: !
! Tax flows !

**COEFFICIENT**
(all,c,COM)
XTX1(c) # Exports - tax 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TX11(c,s,i,q) # Intermdiate consumption - tax 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TX12(c,s,i,q) # Investment demand - tax 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX13(c,s,q) # Household demand - tax 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX14(c,s,q) # Export - tax 1 #;
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)

TX15(c,s,q) # Government demand - tax 1 #;

**READ**
XTX1 FROM FILE BDATA HEADER «XTX1»;

**FORMULA**
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TX11(c,s,i,q)=RATX1(c,s,i,q)*CINT(i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TX12(c,s,i,q)=RITX1(c,s,i,q)*INV(q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX13(c,s,q)=RCTX1(c,s,q)*CONS(q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX14(c,s,q)=X_SH(c,s,q)*XTX1(c);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TX15(c,s,q)=RGTX1(c,s,q)*GOV(q);

## A3.2.4. Disaggregation of sectoral value added

This excerpt shows the procedure for the disaggregation of the sectoral value added. Since there is no information available for the regional sectoral aggregates, the specification below is kept only for the purpose of future development of the IIO-MOR.

In our case, we have implemented the system according to the code as shown here. The shortcut was to set the values for the coefficients LABR(i,q) and CPTL(i,q) using the national sectoral shares and using OCTS(i,q) as the residual.

! Excerpt 11 of TABLO input file: !
! Value added !

**COEFFICIENT**
(all,i,IND)(all,q,REGDEST)
LABR(i,q) # Total regional labor payments, by sector #;
(all,i,IND)(all,q,REGDEST)
OCTS(i,q) # Other costs, by sector #;
(all,i,IND)(all,q,REGDEST)
VA(i,q) # Total regional value added, by sector #;

**READ**
LABR from file BDATA header «LABR»;
OCTS from file BDATA header «OCTS»;

**FORMULA**
(all,i,IND)(all,q,REGDEST)
VA(i,q)=LABR(i,q)+CPTL(i,q)+OCTS(i,q);

## A3.2.5. Production aggregates

The coefficient MAKE(i,c,s) refers to the 12 regional make matrices. Given the transformation of the database into a sector by sector framework, the make matrix for each regional is a diagonal matrix. The code is general enough to be adapted for the commodity by sector framework.

This excerpt shows also specific aggregations of the make matriz to be used for balance checking purposes.

! Excerpt 12 of TABLO input file: !
! Gross output !

**COEFFICIENT**
(all,i,IND)(all,q,REGDEST)
MAKE_I(i,q) # Total regional output, by sector #;
(all,i,IND)(all,q,REGDEST)
MAKE_I2(i,q) # Total regional output, by sector, make version #;
(all,c,COM)(all,s,REGSOURCE)
MAKE_C(c,s) # Total regional output, by commodity #;
(all,i,IND)(all,c,COM)(all,s,REGSOURCE)
MAKE(i,c,s) # Make matrix, by region #;

**READ**
MAKE from file BDATA header «MAKE»;

**FORMULA**
(all,i,IND)(all,q,REGDEST)
MAKE_I(i,q)=VA(i,q)+CINT(i,q);
(all,i,IND)(all,q,REGDEST)
MAKE_I2(i,q)=sum(c,COM,MAKE(i,c,q));
(all,c,COM)(all,s,REGSOURCE)
MAKE_C(c,s)=sum(i,IND,MAKE(i,c,s));

## A3.2.6. Balancing checks

The first check was undertaken to assure that the information provided in the make matrix was consistent with the information on the absorption (use) matrix, i.e. MAKE_I(i,q) = MAKE_I2(i,q), for every i and q.

The second check refers to the commodity balance check. Changes in inventories are introduced and defined as the discrepancy needed to be inserted in the system for commodity balancing purposes between the use and make tables.

Finally, the third check confirms that total sectoral costs equal total sectoral output.

! Excerpt 13 of TABLO input file: !

! Check 1 - Sector output balance check !

**COEFFICIENT**
(all,i,IND)(all,q,REGDEST)
CHECKA(i,q) # Check MAKE_I = MAKE_I2 #;

**FORMULA**
(all,i,IND)(all,q,REGDEST)
CHECKA(i,q)=MAKE_I(i,q)-MAKE_I2(i,q);

! Check 2 – Commodity balance check !

**COEFFICIENT**
(all,c,COM)(all,s,REGSOURCE)
DIRSALES(c,s) # Direct usage #;
(all,r,MARGCOM)(all,s,REGSOURCE)
MARSALES1(r,s) # Margin 1 usage #;
(all,r,MARGCOM2)(all,s,REGSOURCE)
MARSALES2(r,s) # Margin 2 usage #;
(all,c,COM)(all,s,REGSOURCE)
SALES(c,s) # All usage #;
(all,c,COM)(all,s,REGSOURCE)
LOSTGOODS(c,s) # Discrepancy #;
(all,c,COM)(all,s,REGSOURCE)
BAS7(c,s) # Change in stocks - for balancing purposes #;

**FORMULA**
(all,c,COM)(all,s,REGSOURCE)
DIRSALES(c,s)=sum(i,IND,sum(q,REGDEST,BAS1(c,s,i,q)))
+sum(i,IND,sum(q,REGDEST,BAS2(c,s,i,q)))
+sum(q,REGDEST,BAS3(c,s,q))
+sum(q,REGDEST,BAS4(c,s,q))
+sum(q,REGDEST,BAS5(c,s,q));
(all,r,MARGCOM)(all,s,REGSOURCE)
MARSALES1(r,s)=sum(i,IND,sum(c,COM,sum(ss,ALLSOURCE,MR11(c,ss,i,s))))
+sum(i,IND,sum(c,COM,sum(ss,ALLSOURCE,MR12(c,ss,i,s))))
+sum(c,COM,sum(ss,ALLSOURCE,MR13(c,ss,s)))
+sum(c,COM,sum(ss,ALLSOURCE,MR14(c,ss,s)))
+sum(c,COM,sum(ss,ALLSOURCE,MR15(c,ss,s)));
(all,r,MARGCOM2)(all,s,REGSOURCE)
MARSALES2(r,s)=sum(i,IND,sum(c,COM,sum(ss,ALLSOURCE,MR21(c,ss,i,s))))
+sum(i,IND,sum(c,COM,sum(ss,ALLSOURCE,MR22(c,ss,i,s))))
+sum(c,COM,sum(ss,ALLSOURCE,MR23(c,ss,s)))
+sum(c,COM,sum(ss,ALLSOURCE,MR24(c,ss,s)))
+sum(c,COM,sum(ss,ALLSOURCE,MR25(c,ss,s)));
(all,c,NONMARGCOM)(all,s,REGSOURCE)
SALES(c,s)=DIRSALES(c,s);
(all,c,MARGCOM)(all,s,REGSOURCE)

SALES(c,s)=DIRSALES(c,s)+MARSALES1(c,s);
(all,c,MARGCOM2)(all,s,REGSOURCE)
SALES(c,s)=DIRSALES(c,s)+MARSALES2(c,s);
(all,c,COM)(all,s,REGSOURCE)
LOSTGOODS(c,s)=SALES(c,s)-MAKE_C(c,s);
(all,c,COM)(all,s,REGSOURCE)
BAS7(c,s)=-LOSTGOODS(c,s);

! Sector output balance !

**COEFFICIENT**
(all,i,IND)(all,q,REGDEST)
V1TOT(i,q) # Total cost by sector #;
(all,i,IND)(all,q,REGDEST)
STOK(i,q) # Total cost adjustment by sector #;
(all,i,IND)(all,q,REGDEST)
CHECKB(i,q) # Check MAKE_I = MAKE_I2 #;

**FORMULA**
(all,i,IND)(all,q,REGDEST)
STOK(i,q)=CHECKA(i,q);
(all,i,IND)(all,q,REGDEST)
V1TOT(i,q)=VA(i,q)+CINT(i,q)-STOK(i,q);
(all,i,IND)(all,q,REGDEST)
CHECKB(i,q)=V1TOT(i,q)-MAKE_I2(i,q);
Assertion # V1TOT = MAKE_I2 for sectors #
(all,i,IND)(all,q,REGDEST)
ABS(CHECKB(i,q))<SMALL;

## A3.2.7. Renaming arrays

This excerpt renames some of the arrays in order to be consistent with the notation adopted in the ICGE model code, as presented in Figure A2.

**COEFFICIENT**
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)(all,r,MARGCOM)
MAR1(c,s,i,q,r);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)(all,r,MARGCOM)
MAR2(c,s,i,q,r);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)(all,r,MARGCOM)
MAR3(c,s,q,r);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)(all,r,MARGCOM)
MAR4(c,s,q,r);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)(all,r,MARGCOM)
MAR5(c,s,q,r);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)

TAX1(c,s,i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TAX2(c,s,i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TAX3(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TAX4(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TAX5(c,s,q);

**FORMULA**
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)(all,r,MARGCOM)
MAR1(c,s,i,q,r)=MR11(c,s,i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)(all,r,MARGCOM)
MAR2(c,s,i,q,r)=MR12(c,s,i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)(all,r,MARGCOM)
MAR3(c,s,q,r)=MR13(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)(all,r,MARGCOM)
MAR4(c,s,q,r)=MR14(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)(all,r,MARGCOM)
MAR5(c,s,q,r)=MR15(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)(all,r,MARGCOM2)
MAR1(c,s,i,q,r)=MR21(c,s,i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)(all,r,MARGCOM2)
MAR2(c,s,i,q,r)=MR22(c,s,i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)(all,r,MARGCOM2)
MAR3(c,s,q,r)=MR23(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)(all,r,MARGCOM2)
MAR4(c,s,q,r)=MR24(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)(all,r,MARGCOM2)
MAR5(c,s,q,r)=MR25(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TAX1(c,s,i,q)=TX11(c,s,i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,i,IND)(all,q,REGDEST)
TAX2(c,s,i,q)=TX12(c,s,i,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TAX3(c,s,q)=TX13(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TAX4(c,s,q)=TX14(c,s,q);
(all,c,COM)(all,s,ALLSOURCE)(all,q,REGDEST)
TAX5(c,s,q)=TX15(c,s,q);

### A3.2.8. Writing the results to the output file

The final step is to write the relevant results for the output file RIODATA, which can then be used to prepare the consolidated IIOM-MOR in Excel format.

```
WRITE BAS1 TO FILE RIODATA HEADER «BAS1»;
WRITE BAS2 TO FILE RIODATA HEADER «BAS2»;
WRITE BAS3 TO FILE RIODATA HEADER «BAS3»;
WRITE BAS4 TO FILE RIODATA HEADER «BAS4»;
WRITE BAS5 TO FILE RIODATA HEADER «BAS5»;
WRITE BAS7 TO FILE RIODATA HEADER «BAS7»;
WRITE MAR1 TO FILE RIODATA HEADER «MAR1»;
WRITE MAR2 TO FILE RIODATA HEADER «MAR2»;
WRITE MAR3 TO FILE RIODATA HEADER «MAR3»;
WRITE MAR4 TO FILE RIODATA HEADER «MAR4»;
WRITE MAR5 TO FILE RIODATA HEADER «MAR5»;
WRITE TAX1 TO FILE RIODATA HEADER «TAX1»;
WRITE TAX2 TO FILE RIODATA HEADER «TAX2»;
WRITE TAX3 TO FILE RIODATA HEADER «TAX3»;
WRITE TAX4 TO FILE RIODATA HEADER «TAX4»;
WRITE TAX5 TO FILE RIODATA HEADER «TAX5»;
WRITE LABR TO FILE RIODATA HEADER «LABR»;
WRITE CPTL TO FILE RIODATA HEADER «CPTL»;
WRITE OCTS TO FILE RIODATA HEADER «OCTS»;
WRITE MAKE TO FILE RIODATA HEADER «MAKE»;
WRITE CHECKA TO FILE RIODATA HEADER «CHKA»;
WRITE CHECKB TO FILE RIODATA HEADER «CHKB»;
WRITE STOK TO FILE RIODATA HEADER «STOK»;
```

### Figure A2. Structure of the Interregional Flows Database: The Absorption (Use) Matrix

| | | | User 1 | | | User 2 | | | User 3 | | | User 4 | User 5 | | | User 7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Producers | | | Investors | | | Household | | | Export | Regional Govt. | | | Inventories |
| | | Size | 20 | 20 | 20 | 20 | 20 | 20 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Size | Source/ Destination | R1 | … | R12 | R1 | … | R12 | R1 | … | R12 | | R1 | … | R12 | |
| Basic Flows | 20 | R1 | BAS1 | | | BAS2 | | | BAS3 | | | BAS4 | BAS5 | | | BAS7 |
| | 20 | … | | | | | | | | | | | | | | |
| | 20 | R12 | | | | | | | | | | | | | | |
| | 20 | ROW | | | | | | | | | | | | | | |
| Margins | 20 | R1 | MAR1 | | | MAR2 | | | MAR3 | | | MAR4 | MAR5 | | | 0 |
| | 20 | … | | | | | | | | | | | | | | |
| | 20 | R12 | | | | | | | | | | | | | | |
| | 20 | ROW | | | | | | | | | | | | | | |
| Taxes | 20 | R1 | TAX1 | | | TAX2 | | | TAX3 | | | TAX4 | TAX5 | | | 0 |
| | 20 | … | | | | | | | | | | | | | | |
| | 20 | R12 | | | | | | | | | | | | | | |
| | 20 | ROW | | | | | | | | | | | | | | |
| Labor | 1 | | LABR | | | | | | | | | | | | | |
| Capital | 1 | | CPTL | | | | | | | | | | | | | |
| Other Costs | 1 | | OCTS | | | | | | | | | | | | | |

## Table A4. Data Sources Used to Calculate Regional Shares of Sectoral Output and Domestic Absorption

|  | Supply-use table | Variable used to calculate regional shares |
|---|---|---|
| A00 | Agriculture, forestry, hunting, related services | Agriculture production for 12 regions (in million dh) |
| B05 | Fishing, aquaculture | Fishing production for 12 regions (million dh) |
| C00 | Mining industry | Mines production for 12 regions (million dh) |
| D01 | Food industry and tobacco | Production in thousands dhs, Food Industry |
| D02 | Textile and leather industry | Production in thousands dhs, Textile and Leather Industry |
| D03 | Chemical and para-chemical industry | Production in in thousands dhs, Chemical and Para-chemical Industry |
| D04 | Mechanical, metallurgical and electrical industry | Production in thousands dhs, Electical and Electronics Industry + Metal and Mechanical Industry |
| D05 | Other manufacturing, excluding petroleum refining | Industry production for 12 regions (millions dh) |
| D06 | Oil refining and other energy products | Oil refining production for 12 regions (million dh) |
| E00 | Utilities | Electricity and Water production for 12 regions (in million dh) |
| F45 | Construction | Construction and Public works production for 12 regions (in million dh) |
| G00 | Trade | Employed population by industry, Trade |
| H55 | Hotels and restaurants | Hotels and Restaurents production for 12 regions (in million dh) |
| I01 | Transport | Employed population by industry, Transports, Storage and Communications |
| I02 | Post and telecommunications | Employed population by industry, Transports, Storage and Communications |
| J00 | Financial activities and insurance | Employed population by industry, Banks, Insurance and real estate operations |
| K00 | Real estate, renting and services to enterprises | Employed population by industry, Banks, Insurance and real estate operations |
| L75 | General public administration and social security | Employed population by industry, Public administration |
| MN0 | Education, health and social action | Employed population by industry, Social services for the population |
| OP0 | Other non-financial services | Employed population by industry, Personal and household services |
|  | Households | Household final consumption expenditure (breakdown by 12 regions) |
|  | GFCF + inventories changes | Construction production for 12 regions (in million dh) |
|  | GG | Employed population by industry, Public administration |

## Table A5. Data Sources Used to Calculate Regional Shares of Sectoral Foreign Exports

| | Supply-use table | Variable used to calculate regional shares |
|---|---|---|
| A00 | Agriculture, forestry, hunting, related services | Agricultural value added (in million dh) - LQ |
| B05 | Fishing, aquaculture | Fishing value added (in million dh) - LQ |
| C00 | Mining industry | Mining industry value added (in million dh) - LQ |
| D01 | Food industry and tobacco | Exports in thousands dhs, Food Industry |
| D02 | Textile and leather industry | Exports in thousands dhs, Textile and Leather Industry |
| D03 | Chemical and para-chemical industry | Exports in thousands dhs, Chemical and Para-chemical Industry |
| D04 | Mechanical, metallurgical and electrical industry | Exports in thousands dhs, Electical and Electronics Industry + Metal and Mechanical Industry |
| D05 | Other manufacturing, excluding petroleum refining | Industry exports for 12 regions (in million dh) |
| D06 | Oil refining and other energy products | Grand Casablanca - Settat - SAMIR |
| E00 | Electricity and water | Employed population by industry, Electricity, gas and water |
| F45 | Construction | Employed population by industry, Construction and public works - LQ |
| G00 | Trade | Employed population by industry, Trade - LQ |
| H55 | Hotels and restaurants | Employed population by industry, Catering and Hotel - LQ |
| I01 | Transport | Employed population by industry, Transports, Storage and Communications - LQ |
| I02 | Post and telecommunications | Employed population by industry, Transports, Storage and Communications - LQ |
| J00 | Financial activities and insurance | Employed population by industry, Banks, Insurance and real estate operations - LQ |
| K00 | Real estate, renting and services to enterprises | Employed population by industry, Banks, Insurance and real estate operations - LQ |
| L75 | General public administration and social security | Employed population by industry, Public administration - LQ |
| MN0 | Education, health and social action | Employed population by industry, Social services for the population - LQ |
| OP0 | Other non-financial services | Employed population by industry, Personal and household services - LQ |