

## Linkages and Interdependence in Moroccan Regions

By Eduardo Amaral Haddad<sup>1</sup>

### Summary

Input-output tables provide a rich source of information about the structure of economies that is not available from other frameworks. In addition to providing key information for the analysis of linkages between activities (and regions), the tables also provide the underlying core database used in a range of economic models. If used appropriately, these more sophisticated models can meaningfully assess the impact of economic change, at the national and regional levels. They can also be used to assess the distributional effects of change across the industries and regions included in the input-output table. When linked to household consumption and income data, the distributional effects of economic policy change on households can also be assessed. In what follows, we discuss some of the structural features of the Moroccan economy derived from the interregional input-output matrix for Morocco. The focus is on the role of the linkages embedded in the productive structure of the country and its implications for the design of regional policies.

### Introduction

As part of an ongoing project that aims to develop an interregional computable general equilibrium model for Morocco, we have developed a fully specified interregional input-output matrix for the country (IIOM-MOR) [1]. 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, and the OCP Policy Center and the DEPF – Ministère de l'Économie et des Finances, 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.

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from other frameworks. In addition to providing key information for the analysis of linkages between activities (and regions), the tables also provide the underlying core database used in a range of economic models. If used appropriately, these more sophisticated models can meaningfully assess the impact of economic change, at the national and regional levels. They can also be used to assess the distributional effects of change across the industries and regions included in the input-output table. When linked to household consumption and income data, the distributional effects of economic policy change on households can also be assessed. [2]

In what follows, we discuss some of the structural features of the Moroccan economy derived from the IIOM-MOR. The focus is on the role of the linkages embedded in the productive structure of the country and its implications for the design of regional policies.

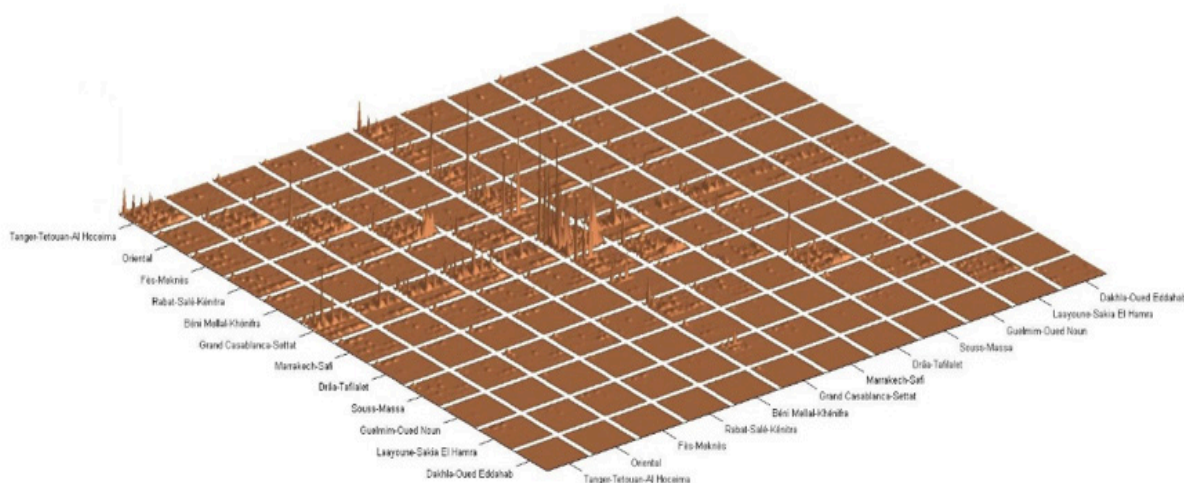
1. We are grateful to Denise Imori for research assistance.

## Basic structure

The IIO-MOR is calibrated for 2013 and consists of 12 regions and 20 sectors. Figure 1 shows, in monetary terms, how the flows of goods and services for production take place among the Moroccan regions: columns refer to the buying sectors and regions, and rows refer to the selling sectors and regions. The figure shows that, in productive

terms, five relatively more integrated regions concentrated most of the flows: Casablanca, Rabat, Marrakech, Fès-Meknès and Tanger. As Table A1 indicates, these regions were responsible for more than 75% of the total output value of the Moroccan economy in 2013. For the remaining regions, there is practically little integration among them, with the production linkages taking place mainly inside each one of them, with some trade with Casablanca.

**Figure 1. Interregional Flows of Goods and Services for Production in Morocco, 2013**



Source: Calculations by the author

Table 1 presents the regional output shares for the regions in Morocco. Casablanca dominates the national production, with a share of 35.7% in total output, followed by Rabat (13.0%), Marrakech (9.9%), Fes-Meknes (9.2%) and Tangier (8.8%). The regional output shares by sectors in Morocco reveal some evidence of spatial concentration of specific activities: agriculture in Fes-Meknes, Marrakech, Rabat, Casablanca, and Beni Mellal (69.7% of total output); fishing in Souss-Massa, Dakhla-Oued Eddahab, Guelmin-Oued Noun and Laayoune-Sakia Le Hamra (79.0%); mining in Beni Mellal and Marrakech (78.0%), manufacturing in Casablanca, where at least 50% of the output is generated for each of the sectors. Some regions play an important role in the production of specific manufacturing sectors, such as the food industry in Souss-Massa (12.6%) and Fes-Meknes (9.9%); textile and leather in Tangier (21.3%) and Fes-Meknes (11.3%); and mechanical, metal and electrical products in Tangier (26.4%). Services, in general, are concentrated in Rabat and Casablanca. However, Marrakech and Souss-Massa concentrate the major part of tourism services (36.8% and 26.4%, respectively).

Table 2 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), Beni Mellal (25.6%) and Fès-Meknès (21.7%); fishing in Dahla-Oued Eddahab (38.6%); mining in Beni Mellal (21.0%); 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 Le 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 3. 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 1. Regional Structure of Sectoral Output: Morocco, 2013**

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	TOTAL
A00 Agriculture, forêt et services annexes	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 Pêche, 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 Industrie d'extraction	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 Industries alimentaires et tabac	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 Industries du textile et du cuir	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 Industrie chimique et parachimique	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 Industrie mécanique, métallurgique et électrique	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 Autres industries manufac. hors raffinage pétrole	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 Raffinage de pétrole et autres produits d'énergie	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 Electricité et eau	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 Bâtiment et travaux publics	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 Commerce	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 Hôtels et 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 Transports	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 Postes et télécommunications	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 Activités financières et assurances	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 Immobilier, location et serv. rendus entreprises	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 Administration publique et sécurité sociale	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
MNO Education, santé et action sociale	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 Autres services non financiers	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: Haddad et al. (2016)

**Table 2. Sectoral Structure of Regional Output: Morocco, 2013**

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	TOTAL
A00 Agriculture, forêt et services annexes	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 Pêche, 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 Industrie d'extraction	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 Industries alimentaires et tabac	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 Industries du textile et du cuir	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 Industrie chimique et parachimique	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 Industrie mécanique, métallurgique et électrique	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 Autres industries manufac. hors raffinage pétrole	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 Raffinage de pétrole et autres produits d'énergie	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 Electricité et eau	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 Bâtiment et travaux publics	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 Commerce	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 Hôtels et 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 Transports	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 Postes et télécommunications	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 Activités financières et assurances	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 Immobilier, location et serv. rendus entreprises	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 Administration publique et sécurité sociale	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
MNO Education, santé et action sociale	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 Autres services non financiers	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: Haddad et al. (2016)

**Table 3. Location Quotients: Morocco, 2013**

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12
A00 Agriculture, forêt et services annexes	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 Pêche, 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 Industrie d'extraction	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 Industries alimentaires et tabac	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 Industries du textile et du cuir	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 Industrie chimique et parachimique	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 Industrie mécanique, métallurgique et électrique	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 Autres industries manufac. hors raffinage pétrole	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 Raffinage de pétrole et autres produits d'énergie	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 Electricité et eau	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 Bâtiment et travaux publics	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 Commerce	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 Hôtels et 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 Transports	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 Postes et télécommunications	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 Activités financières et assurances	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 Immobilier, location et serv. rendus entreprises	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 Administration publique et sécurité sociale	0.565	1.129	1.069	2.347	0.888	0.423	0.947	1.356	0.706	3.681	3.634	2.715
MNO Education, santé et action sociale	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 Autres services non financiers	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: Haddad et al. (2016)

## Total linkages

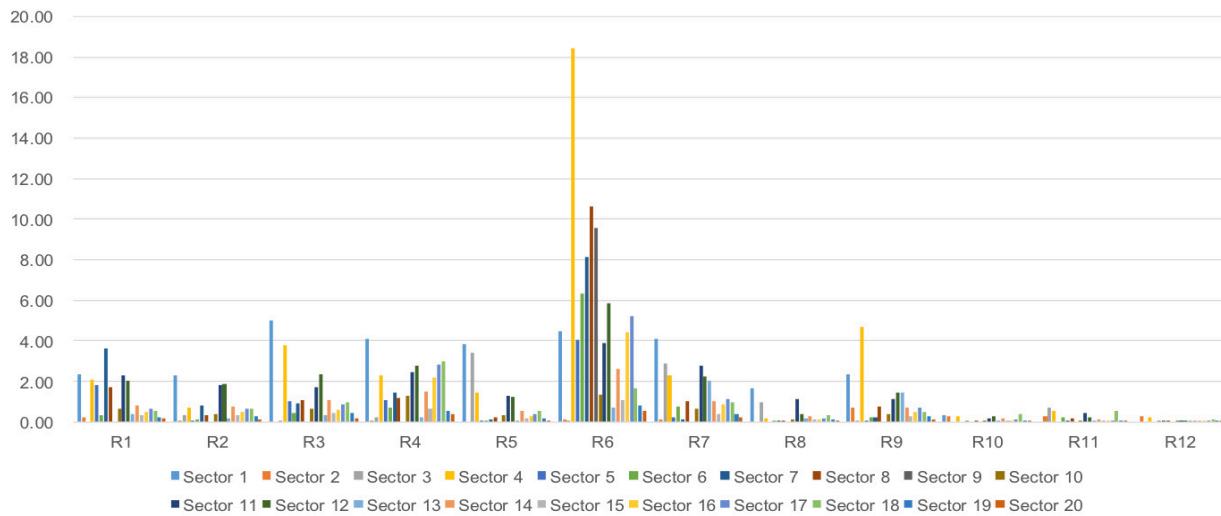
The indicators described above are based on sectoral and regional shares of the IOM-MOR, which only measure the regional distribution of economic activity in the country. In this section, a comparative analysis of regional economic structures is carried out. Production linkages between sectors are considered through the analysis of the intermediate inputs portion of the interregional input-output database. The purpose remains the comparison of economic structures rather than an evaluation of the methods of analysis themselves.

We can measure the importance of the sectors in terms of production generation in the economy using the pure linkage approach.[3][4] The Pure Total Linkage Index in Figure 2 takes into consideration the productive structure – both direct and indirect production linkage are captured

– and the relative size of the sectors in each one of the Moroccan regions. The values are normalized by dividing the pure linkage in each sector by the average value of the pure linkage for the whole economy. The values provide useful information to rank the sectors and regions in groups by their order of importance.

Figure 2 reveals that the most important group of sectors is dominated by Grand Casablanca-Settat (R6). There is a second cluster of sectors that follows in their relative importance for the Moroccan economy, located mainly in Tangier-Tetouan-Al Hoceima (R1), Fes-Meknes (R3), Rabat-Sale-Kenitra (R4) and Marrakech-Safi (R7). Even though the remaining regions are less integrated, the clusters located in Drâa-Tafilalet (R8), Guelmim-Oued Noun (R10), Laayoune-Sakia El Hamra (R11), and Dakhla-Oued Eddahab (R12) seem to require special attention in terms of economic development and integration policies.

**Figure 2. Pure Total Linkage for the Moroccan Interregional System, 2013**



Source: Calculations by the author

### Output and value added decomposition

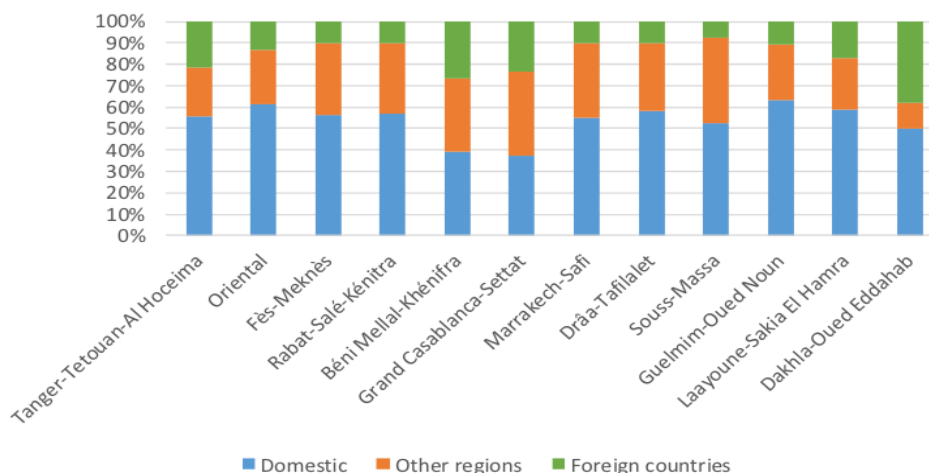
We decompose regional output by considering not only the multiplier structure, but also the structure of final demand in the 12 domestic and the foreign regions. [5] We also calculate the contributions of the components of final demand from different areas (Table 4). On average, the self-generated component of output in each region, i.e. the share of output generated by demand within the region, is lower in those regions that represent higher dependency upon the rest of the world (Casablanca, Tanger, Béni and Dakhla-Oued Eddahab). The demand for foreign exports is very relevant not only for Casablanca but also for other resource-based economies. Its contribution to the regional output 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 (33.8%).

There are also some cases of stronger dependency upon the rest of the country, as it is the case of the dependency of Marrakech, Rabat, Souss-Massa and Beni Mellal on Casablanca’s demand, and the dependency of Casablanca on Rabat’s demand.

Taking a different focus, we can decompose value added by region according to the source of the final demand. The overall picture is slightly different from that of the output decomposition, especially for the share of international exports in the generation of regional value added, which tend to be systematically lower than the correspondent share in gross output (Figure 3).

**Figure 3. Decomposition of Regional Value Added According to its Absorption by Final Users in the Regions of Morocco and Abroad, in %, 2013**



Source: Calculations by the author

## Spatial linkages

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 4. The results illustrated in Figure 4 provide an attempt to reveal the

spatial patterns of output dependence upon specific sources of final demand. Figure 4 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.

**Table 4. 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

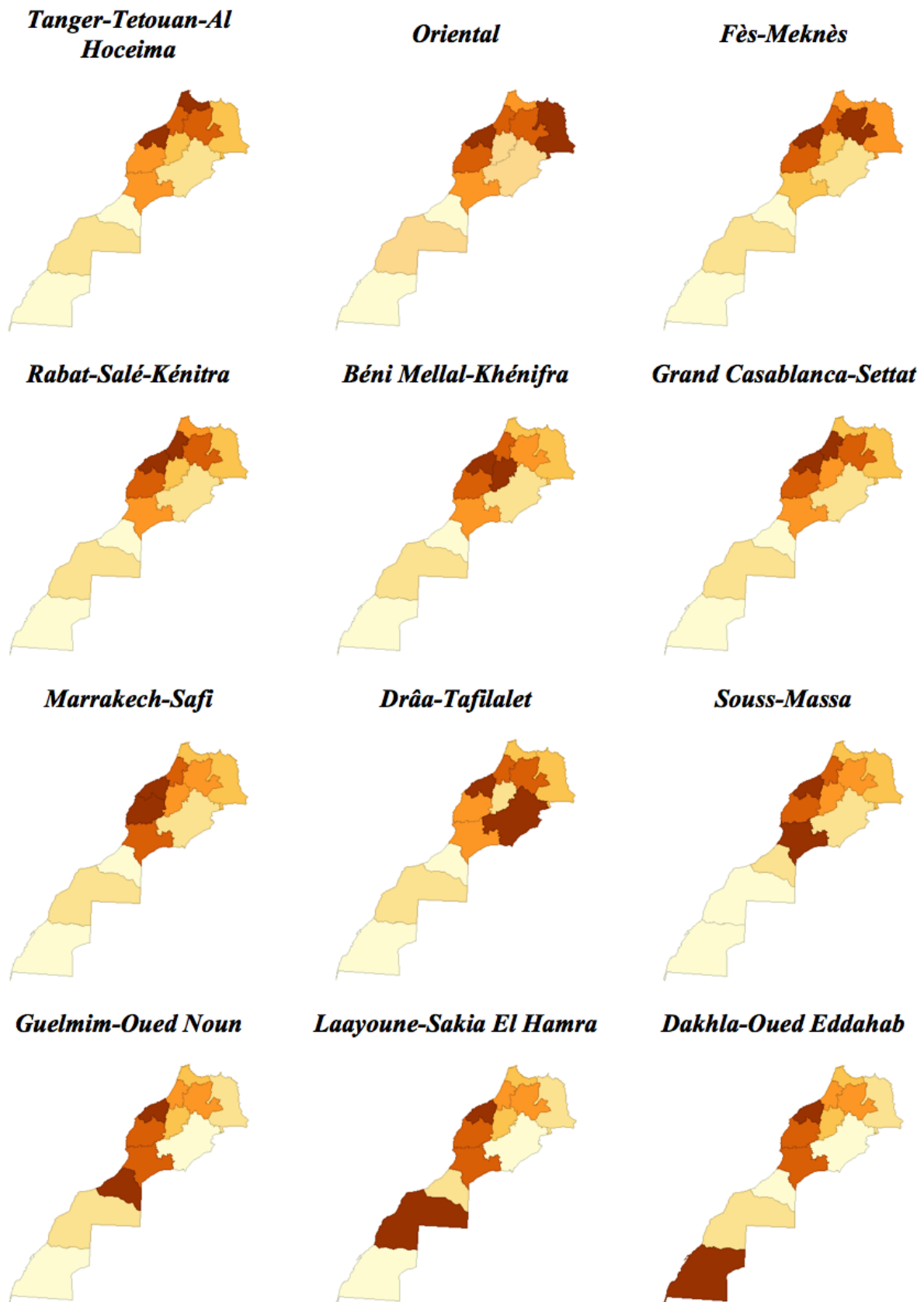
Source: Haddad et al. (2016)

## Trade in value added

Trade in value added is defined as the value added embodied in the goods and services that are imported and exported. It is possible to trace a region's participation in the domestic supply chain by adapting the methodology proposed in [6] to evaluate global supply chains. The method relies on "hypothetical extraction", a parsimonious mathematical technique based on an input-output representation of the economy. We compare actual GRP in a region with hypothetical GRP in case there are no production activities related to exporting. The difference is defined as domestic value added in interregional sales and international exports.

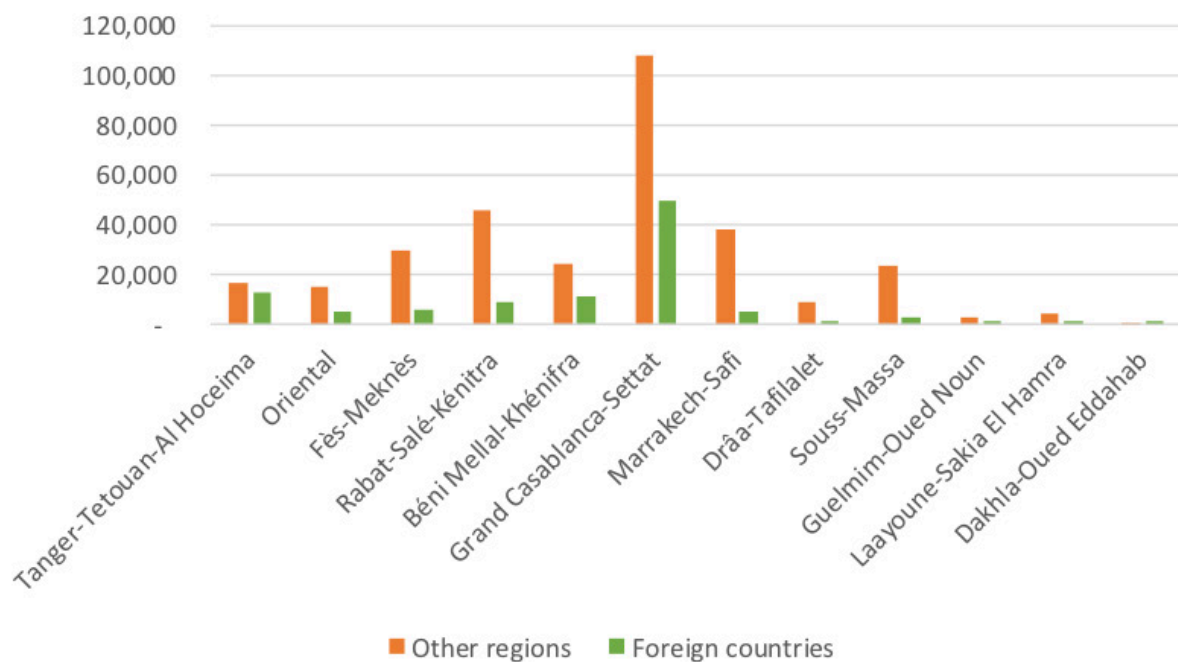
Figure 5 calculates which part of GRP in each of the 12 Moroccan regions can be attributed to production related to exporting in general (sales to domestic and international markets). We map the regional value added in exports, providing a measure of the degree of a region's dependence on trade. With the exception of Dakhla-Oued Eddahab, sales to other regions of the country embody more value added than sales to other countries. However, the relative importance of international exports vary across regions. The ratio of value added generated by interregional sales to value added generated by international exports ranges from 0.36 (Dakhla-Oued Eddahab) and 1.30 (Tangier-Tetouan-Al Hoceima) to 7.74 (Drâa-Tafilalet), 7.78 (Marrakech-Safi) and 8.09 (Souss-Massa).

**Figure 4. Identification of Regions Relatively More Affected by a Specific Regional Demand, by Origin of Final Demand**



Source: Haddad et al. (2016)

**Figure 5. Regional Value Added in Interregional Sales and International Exports, in DHS millions, 2013**



## Concluding remarks

It is clear from the preceding analysis that the impact of interregional trade on regional economies should not be relegated to a secondary place. 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, reaffirming the role played by Casablanca and the major regional economies in the polarization process observed in the country.

One should consider interregional interactions for a better understanding of how the regional economies are affected, both in the international and in the domestic markets, as for the smaller economies, the performance of the more developed regions also plays a crucial role.

As [7] observe, the usual region versus the rest of the world characterization of spatial interaction provides a convenient mechanism to generate demand-driven models, but it provides little insights into two properties associated with spatial interaction that have not featured prominently in regional models, namely, feedbacks and hierarchy. On one hand, interregional trade might generate the potential for the propagation of feedback effects that, in quantitative terms, could be larger than the effects generated by international trade. On the other hand, the impact of feedback effects will be determined, partly, by the hierarchical structure of the interregional system under consideration. Thus, in the Moroccan case, it is expected that the impacts of interregional trade related to Casablanca will differ from those from the other peripheral economies.



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**Table A1. Regional Classification**

<b>Regions</b>	
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

**Table A2. Industry Classification**

<b>Sectors</b>	
A00	Agriculture, forêt et services annexes
B05	Pêche, aquaculture
C00	Industrie d'extraction
D01	Industries alimentaires et tabac
D02	Industries du textile et du cuir
D03	Industrie chimique et parachimique
D04	Industrie mécanique, métallurgique et électrique
D05	Autres industries manufac. hors raffinage pétrole
D06	Raffinage de pétrole et autres produits d'énergie
E00	Electricité et eau
F45	Bâtiment et travaux publics
G00	Commerce
H55	Hôtels et restaurants
I01	Transports
I02	Postes et télécommunications
J00	Activités financières et assurances
K00	Immobilier, location et serv. rendus entreprises
L75	Administration publique et sécurité sociale
MNO	Education, santé et action sociale
OP0	Autres services non financiers

## About the author, 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.

## About OCP Policy Center

OCP Policy Center is a Moroccan policy-oriented Think Tank whose mission is to contribute to knowledge sharing and to enrich reflection on key economic and international relations issues, considered as essential to the economic and social development of Morocco, and more broadly to the African continent. For this purpose, the Think Tank relies on independent research, a network of partners and leading research associates, in the spirit of an open exchange and debate platform.

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OCP Policy Center

Ryad Business Center – South, 4<sup>th</sup> Floor – Mahaj Erryad - Rabat, Morocco  
Email : [contact@ocppc.ma](mailto:contact@ocppc.ma) / Phone : +212 5 37 27 08 08 / Fax : +212 5 37 71 31 54  
Website: [www.ocppc.ma](http://www.ocppc.ma)