

Integration of a Regional Input-output Model With a Spatial Interaction Model For Localities. An Application to the Azores

Integração de um modelo regional de input-output com um modelo de interação espacial para as localidades. Uma aplicação aos Açores

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Abstract/Resumo

The aim of this paper is to analyze the economic interdependencies between the regional and the local scale through the use of an economic model that integrates an Input-Output Model for the regional scale with a spatial interaction model for the local scale. Furthermore it is possible to show that multiplier effects vary considerably between areas if we consider the spatial disaggregation of income and the spatial distribution of consumption.

O objetivo deste artigo é analisar as interdependências económicas entre a escala regional e a escala local através de um modelo económico que liga um Modelo Input-Output à escala regional com modelos de interação espacial à escala local. É assim possível explicitar que os efeitos multiplicadores variam consideravelmente entre zonas, caso se desagregue o rendimento e o consumo por várias zonas.

Keywords: Input-Output; Spatial Interaction; Island; Azores

Palavras-Chave: Input-Output; Interação Espacial; Ilha; Açores

JEL Codes: R15, R58, R42

Códigos JEL: R15, R58, R42

1. INTRODUCTION

Applicable modelling techniques for small regions can vary from the effective simplicity of the base models (Hoyt, 1939; North, 1955; and Tiebout, 1956); passing through the generally diffused Input Output Models (Isard, 1951; Moses, 1955; Leontief and Strout, 1963) to the illustrative possibilities of the Spatial Interaction Models (Reed, 1967; Chisholm and O'Sullivan, 1973; Ashtakala and Murthy, 1988); continuing through the interesting and challenging implementation of more complex, actual and still operational tools like the Multiregional Economic Models (Haddad, 1999; Brocker, 2002; Kim et al., 2004).

The interest of the application of these operational tools to small localities result not only from the empowering of regional actors through the highlighting of locally controllable policy tools, but also to the creative exercise of most adaptations, quite often allowing interconnections with technological, social, regulatory and environmental issues. The challenge we like to address in this essay is the integration of a regional input-output model with a spatial interaction model for localities.

This creates one problem and one opportunity: the problem is that tradable activities are not easily reproducible both for large and small places and being so it does not make sense to try to adopt the same type of economic structure for the region and for the localities; the opportunity is that non tradable activities like shopping, commuting and residence, although not sufficiently considered in regional economic models but can be easily dealt with spatial interaction models. Being so, it makes sense to integrate an Input-Output Model suitable to represent all economic activities of a region, with a spatial interaction model adapted to the scale of smaller localities for which environmental and regulatory issues can be better characterized and where non tradable activities are better analyzed.

The aim of this essay is to formulate a Regional Input-Output model with a Spatial Interaction models for Localities (RIOSIL). Beyond the introduction (Point 1), the essay is divided into four parts. Point 2 explains the traditional input-output model. Point 3 presents a spatial interaction in a input-output format. And, Point 4 shows the regional input-output

model with a spatial interaction model for localities. There is also some concluding remarks in point 5.

2. REGIONAL INPUT-OUTPUT MODEL

The construction and application of Input-Output models is generalized all over the world. Input-Output models are very important to analyze the structure of the economy and to evaluate how the different sectors interact with each other. The integration of Input-Output models into the national accounts system allows the detection of information inconsistencies, the validation of different forms of economic information and a good basis to design statistical enquiries. Nevertheless it is on economic analysis that these models perform best. They quantify direct, indirect and induced impacts due to changes in final demand, assuming there are no changes on relative prices and also that production functions are linear. Therefore they are used to simulate the effects of economic scenarios and policies. They can also serve to support Computable General Equilibrium Models that add to the Input-Output models the assumption of equilibrated markets through the adaptation of product and factor prices. Finally, it is also common to find Input-Output models connected to areas like the environment and used to estimate the effects of the economy on CO2 emissions, or on the consumption of water or energy resources (Hewings et al. 2003).

Input-Output analysis is based on the organization of the economic information of a particular region during a certain period of time (Leontief, 1951; Leontief et al., 1953). Input-Output models assume a causal link between the exogenous variables of the Final Demand to the endogenous variables that includes the total production per sector and the primary inputs also per sector. The assumptions of input-output models are: i) constant returns on scale; ii) the existence of one product by sector; iii) no substitution between production factors; iv) constant technical coefficients; v) unlimited supply of resources; and vi) efficient resource utilization.

The input output model assumes that sales x_{ij} of each sector (i) to other sector (j) are constant percentages a_{ij} of the total production X_j of sector (j); similarly, sales F_{kj} of primary products of type (k) to sector (j) are constant

percentages f_{kj} of the total production X_j ; finally, sales from the external economy (m) to sector (j) M_j are also a constant percentage m_j of production X_j of sector (j). Being so it is possible to formulate the linear production function of input-output models for each sector (j):

$$X_j = \sum_i a_{ij} X_i + \sum_k f_{kj} X_k + m_j X_j \text{ for all sectors } (j), \text{ where } \sum_i a_{ij} + \sum_k f_{kj} + m_j = 1 \quad (1)$$

Furthermore, it is also possible to formulate the linear consumption function (C) that combines the consumption of all the sectors and equals to the total income applied to consumption Y_c

$$C = \sum_i c_i Y_c, \text{ where } \sum_i c_i = 1 \quad (2)$$

Then, for each sector (i), one can add up the sales $\sum_j a_{ij} X_j$ of sector (i) to all the other sectors (j), plus the sales to final demand, being it consumption $C_i = c_i Y_c$, exports E_i , public expenditure G_i or private investment H_i .

$$X_i = \sum_j a_{ij} X_j + c_i Y_c + E_i + G_i + H_i \text{ for all sectors } (i), \quad (3)$$

Also for the primary products (F_{kj}) of sector (j) applied to consumption ($k=c$) it is possible to define an equilibrium equation so that the total sum of the incomes applied to consumption ($f_{ic} X_j$) for each sector (j) is equal to the total income applied to consumption.

$$Y_c = \sum_j f_{cj} X_j, \quad (4)$$

If we assume that Matrix A' is defined as follows:

$$A' = \begin{bmatrix} a_{ij} & c_i \\ f_{cj} & 0 \end{bmatrix} \quad (5)$$

And vector X' is defined to include X and Y_c .

$$X' = \begin{bmatrix} X \\ Y_c \end{bmatrix} \quad (6)$$

Then equations (3) and (4) can be written

$$X' = A' X' + (E+G+H) \quad (7)$$

And, so, the total output vector X' can be explained by the final demand vector ($E+G+H$) provided $(I-A')$ is a regular matrix that can thus be inverted.

$$X' = (I-A')^{-1}(E+G+H) \quad (8)$$

Table 1: Input Output Model Coefficients with Endogenized Consumption

	I	J	N	C	Ex	H	G	T
I	a_{i1}	a_{ij}	a_{in}	c_i	Ex_i	H_i	G_i	X_i
J	a_{ij}	a_{ij}	a_{jn}	c_j	Ex_j	H	G_j	X_j
N	a_{ni}	a_{nj}	a_{nn}	c_n	Ex_n	H_n	G_n	X_n
W_c	fc_1	fc_j	fc_n	0				Y_c
W_o	fo_1	fo_j	fo_n					W_o
M	m_1	m_j	m_n	cm				M
T	X_i	X_j	X_n	Y_c	Ex	F	G	Tot

Being so, the total output vector X' , and all the other vectors of endogenous variables ($\sum_i a_{ij} X_j$; $\sum_k f_{kj} X_k$ and $m_j X_j$) can be explained by the final demand vector ($E+G+H$) provided $(I-A')$ is a regular matrix.

Table 1 presents the traditional input-output model with endogenized consumption. In the present paper we assume that the technological structure at the regional scale stay the same. In other words the technological coefficients a_{ij} are similar for the whole region no matter the locality where each sector is located.

3. SPATIAL INTERACTION MODEL FOR LOCALITIES.

There are three major modeling approaches that focus spatial interaction: interregional input-output, interregional linear programming and spatial interaction models (Isard, 1960). Nevertheless, input-output models and their interregional and interregional linear programming design, tend to be more applicable to a regional scale or larger, where technological coefficients are more stable, where as

spatial interaction models, in their spatial interaction models, usually deals with town areas where work, shopping, residence and commuting are the main activities (Hewings et al., 2003). Spatial interaction models are built to describe and predict the flows of people, goods and information across space. The adoption of spatial interaction models to analysis flows between regions exists for a long time (Carrothers, 1956). They are analytical tools, with challenging theoretical interpretations (Coelho, 1983; Sen e Smith, 1995; Roy, 2003), very much used in planning, geography and regional science [(Wilson, 1970, 1974; McFadden (1978); Haynes and Fotheringham (1984), in demography [Plane and Rogerson (1994)], in commerce and marketing [Bergstrand (1985)].

A spatial interaction model uses the structure of a basic model according to which exports, or basic activities, are the propulsive factors of the economy, demarcating not only its dimension but also the pattern of local production. The spatial interaction model distributes employment (or income) and residents (or consumption) by different zones of the region taking into account the distances between those zones and their attractiveness. A Spatial Interaction Model can be represented by Equations (9) to (12).

The endogenous variables, Residents (P_k) per zone (k) and Employment (E_{kj}) per zone

and sector (j) is obtained from the exogenous variable, basic employment ($E_{b_{ik}}$) through the use of flow matrices [q] – Employment-Residence and [c] – Residence – Non Basic Employment

$$[P_k] = [q] \{I - [c] [q]\}^{-1} [E_{b_{kj}}] \tag{9}$$

$$[E_{kj}] = \{I - [c] [q]\}^{-1} [E_{b_{kj}}] \tag{10}$$

Where:

$$[q_{(kl)j}] = \{r \cdot \exp(-\mu_k - \alpha_j d_{kl}) / \sum_j [r \cdot \exp(-\mu_k - \alpha_j d_{kl})]\} \tag{11}$$

$$[c_{(kl)j}] = \{s_j \cdot \exp(-\mu_k - \beta_j d_{kl}) / \sum_j [s_j \cdot \exp(-\mu_k - \beta_j d_{kl})]\} \tag{12}$$

$[E_{kj}]$ is employment of sector j of zone k;

$[E_{b_{kj}}]$ is the basic employment of sector j of zone k;

$[P_k]$ are the residents in zone k.

r is the inverse of the employment rate, thus the ratio of population over employment;

μ_k is the bid rent for zone k;

α_j is the distance friction parameter for commuters of sector (j);

β_j is the distance friction parameter for shoppers of sector (j);

d_{kl} is the distance between zone k and zone l

s_i is the ratio of non-basic employment of activity i over the total population;

Table 2: Spatial Interaction Model in Input-Output format

	I	J	N	C ₁	C ₂	C ₃	C _e	Ex	T
I	0	0	0	C _{(11)I}	C _{(12)I}	C _{(13)I}	C _{(1e)I}	E _{b_I}	E _I
J	0	0	0	C _{(11)J}	C _{(12)J}	C _{(13)J}	C _{(1e)J}	E _{b_J}	E _J
N	0	0	0	C _{(11)N}	C _{(12)N}	C _{(13)N}	C _{(1e)N}	E _{b_N}	E _N
Q ₁	Q _{(11)I}	Q _{(11)J}	Q _{(11)N}	0	0	0	0		P ₁
Q ₂	Q _{(21)I}	Q _{(21)J}	Q _{(21)N}	0	0	0	0		P ₂
Q ₃	Q _{(31)I}	Q _{(31)J}	Q _{(31)N}	0	0	0	0		P ₃
Q _e	Q _{(e1)I}	Q _{(e1)J}	Q _{(e1)N}						
T	E _I	E _J	E _N	P ₁	P ₂	P ₃		E _b	

There are two integrated calibration processes involved in the Economic Spatial Interaction Model. First, the calibration of the attri-

tion parameters α_i and β_i estimated so that the average transportation cost of the model, from work to residence and from residence to ser-

vices, are close to the real transportation costs. Second, the calibration of bid-rents (μ_k) estimated to fulfill spatial constraints. All these calibrations must be done iteratively until the estimated parameters converge to stable values.

Table 2 highlights matrices [Q] [C] in an input-output framework where the basic employment per sector [Eb] is the exogenous vector and the total employment [E] is the endogenous vector. Notice that it is possible to include one extra row for commuters coming from outside the region [Q_e] and one extra column for non-residents that shop inside the region [C_e]. This procedure is one way to solve the overestimation of the induced effects when there is no perfect mobility of labour (Oosterhaven and Dewhurst, 1990).

4. REGIONAL INPUT-OUTPUT INTEGRATED WITH A SPATIAL INTERACTION MODEL FOR LOCALITIES

The interest of linking regional economic input output model with town spatial interaction models comes not only from the need to integrate physical and economic flows but also from the requirement to attend the demand for economic models for small places like islands where most of the perceivable economic activity is associated with the physical flows: travel to work, travel to shopping, location of jobs and locations of residences.

Table 3: Regional input-output integrated with spatial interaction model for localities

	I	J	N	C ₁	C ₂	C ₃	C _e	Ex	H	G	T
I	A ₁₁	A _{1j}	A _{1n}	C ₍₁₁₎₁	C ₍₁₂₎₁	C ₍₁₃₎₁	C _{(1e)1}	Ex _i	H _i	G _i	X _i
J	A _{1j}	A _{ij}	A _{jn}	C _{(11)j}	C _{(12)j}	C _{(13)j}	C _{(1e)j}	Ex _j	H _j	G _j	X _j
N	A _{n1}	A _{nj}	A _{nn}	C _{(11)n}	C _{(12)n}	C _{(13)n}	C _{(1e)n}	Ex _n	H _n	G _n	X _n
Q ₁	Q _{(11)I}	Q _{(11)J}	Q _{(11)N}	0	0	0	0				Yc1
Q ₂	Q _{(21)I}	Q _{(21)J}	Q _{(21)N}	0	0	0	0				Yc2
Q ₃	Q _{(31)I}	Q _{(31)J}	Q _{(31)N}	0	0	0	0				Yc3
Q _e	Q _{(e1)I}	Q _{(e1)J}	Q _{(e1)N}	0	0	0	0				
W _o	FO ₁	FO _j	FO _n								
M	M ₁	M _j	M _n	CM ₁	CM ₂	CM ₃					
T	X _i	X _j	X _n	Yc1	Yc2	Yc3		Ex	F	G	Tot

Besides input-output technological coefficients are not stable at small scales and, therefore it is not advisable to rescale regional input-output models to local input-output models but, as we propose, to integrate regional input-output models with spatial interaction models for localities.

The construction of regional input-output models with spatial interaction models for localities results from the combination of the matrix of technological coefficients with endogenized consumption [A'] presented

in Table 1 with the combined matrices [Q] [C] of the Spatial Interaction Model presented in Table 2

From Table 3 is then possible to derive the formulation of the Regional input - output model integrated with a spatial interaction model for localities.

The linear production and demand functions of regional input-output models with spatial interaction models for localities model are:

$$X_j = \sum_i a_{ij} X_i + \sum_k q_{(k)j} X_k + fo_j X_j + mj X_j$$

for all sectors (j) (13)

$$X_i = \sum_j a_{ij} X_j + \sum_k c_{(kl)i} Yc_k + E_{il} + G_{il} + H_{il} \text{ for all sectors (i)} \quad (14)$$

Where $\sum_i a_{ij} + \sum_k q_{(kl)j} + fo_j + m_j = 1$, and $Yc_k = \sum_j f_{ckj} X_j$, implying that technological coefficients $[a_{ij}]$ are the same for all the localities (k), commuter coefficients $[q_{(kl)j}]$ must be calibrated so that $\sum_k Q_{(kl)j} = F_{jl}$ for all l and j, and consumption coefficients $[c_{(kl)i}]$ must also be calibrated so that $\sum_{li} C_{(kl)i} = Yc_k$ for all k.

If we assume that Matrix B is defined as follows:

$$B = \begin{bmatrix} A & C \\ Q & 0 \end{bmatrix} \quad (15)$$

And vector X' is defined to include X and Yc.

$$X' = \begin{bmatrix} X \\ Yc \end{bmatrix} \quad (16)$$

Then equations (7) and (8) can be written

$$X' = B X' + (E+G+H) \quad (7')$$

And, so, the total output vector X' can be explained by the final demand vector (E+G+H) provided (I-B) is a regular matrix that can thus be inverted.

$$X' = (I-B')^{-1}(E+G+H) \quad (8')$$

Being so the total output vector X', and all the other vectors of endogenous variables can be explained by the final demand vector (E+G+H) provided (I-B') is a regular matrix.

5. DATA AND RESULTS

The input output Tables for the Azores Economy with 16 sectors and with disaggrega-

tion of the Consumption and the Income for Consumption by Municipality (Annex 1) and the respective coefficients matrix (Annex 2) was obtained from the work of Pedro Ferreira (2006) that produced a matrix with 45 sectors based on the Input-Output matrix for Portugal and on the employment and production per sector for the Azores, using cross entropy methods to generate the Employment and Production Tables for 45 sectors and the Method of Almond [2000] to generate the Input-Output matrix for the Azores. The multiplier effects that result from the Input-Output for the Azores Economy with 16 sectors and with disaggregation of the Consumption and the Income for Consumption by Municipality are presented in Annex 3, without endogenized expenditure, and in Annex 4 with endogenized consumption expenditure.

The commuter coefficients $[Q_{(kl)j}]$ and consumption coefficients $[C_{(kl)i}]$ were calibrated so that, respectively, $\sum_{li} C_{(kl)i} = Yc_k$ for all k and $\sum_k Q_{(kl)j} = F_{jl}$; and also taking into account that the average travel cost per commuter and consumer and sector is equal to the average travel cost actually verified in the travel to work journeys and in the consumption journeys. To assess the actual average commuters travel cost per sector we used journey to work data of the 2001 census data and the distances between the municipalities (Annex 5). To estimate the average consumers travel cost per sector we undertook a small survey on Terceira population and also the distances between the municipalities.

Table 4: Travel to Work and to Shopping Average Distances and Calibrated Attrition Parameters

Km	Average Travel to Work	Attrition Parameters Travel to Work	Average Travel to Shop	Attrition Parameters Travel to Shop
A – Agriculture and Animals Farming	4,1	0,544	7,1	0,140
B – Fishing	7,5	0,143	6,9	0,168
C- Mining and Quarrying	4,6	0,338	6,9	0,159
DA – Processed Food, Beverages and Tobacco	5,4	0,290	5,1	0,287
D-DA – Other Manufacturing Activities	5,1	0,315	6,8	0,163
E- Electricity, Gas and Water	5,8	0,222	5,4	0,246
F – Construction	5,7	0,229	9,1	0,096
G – Trade and Commerce	5,0	0,360	11,2	0,066
H – Hotels and Restaurants	4,8	0,374	8,3	0,114
I – Transport and Communications	5,9	0,208	25,2	0,025
J – Banks & Insurance	5,4	0,308	6,6	0,172
K – Real Estate and Business Services	5,6	0,277	6,0	0,207
L – Public Administration	5,4	0,247	13,5	0,045
M – Education	5,8	0,222	7,0	0,158
N – Health and Social Work	5,3	0,289	6,5	0,184
O,P – Social and Personal Services; Domestic Staff	5,4	0,251	6,5	0,200

Table 5: Cross Income Multiplier per Municipality

	GRA	CAL	VEL	ANG	PRA	COR	HOR	LFE	SCF	LAP	MAD	SRP	VPO	LAG	NOR	PDL	POV	RGR	VFR	TOTAL
GRA	1.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.006	0.005	0.005	0.005	0.006	0.005	0.004	0.005	0.004	0.005	0.005	1.096
CAL	0.004	1.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.004	0.004	0.004	0.004	1.076
VEL	0.007	0.006	1.006	0.007	0.006	0.006	0.007	0.007	0.007	0.006	0.006	0.006	0.007	0.006	0.006	0.006	0.006	0.006	0.006	1.119
ANG	0.051	0.045	0.044	1.049	0.048	0.044	0.049	0.050	0.051	0.046	0.045	0.043	0.051	0.048	0.041	0.049	0.041	0.047	0.044	1.885
PRA	0.042	0.035	0.034	0.039	1.038	0.033	0.039	0.040	0.041	0.035	0.035	0.032	0.042	0.038	0.030	0.039	0.030	0.036	0.033	1.693
COR	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.006
HOR	0.022	0.019	0.019	0.021	0.021	0.019	1.021	0.021	0.022	0.020	0.020	0.019	0.022	0.021	0.018	0.021	0.018	0.020	0.019	1.382
LFE	0.002	0.002	0.002	0.002	0.002	0.002	0.002	1.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	1.036
SCF	0.003	0.003	0.002	0.003	0.003	0.002	0.003	0.003	1.003	0.003	0.003	0.002	0.003	0.003	0.002	0.003	0.002	0.003	0.002	1.049
LAF	0.006	0.005	0.005	0.006	0.006	0.005	0.006	0.006	0.006	1.005	0.005	0.005	0.006	0.006	0.005	0.006	0.005	0.006	0.005	1.106
MAD	0.010	0.009	0.009	0.009	0.009	0.009	0.010	0.010	0.010	0.009	1.009	0.008	0.010	0.009	0.008	0.009	0.008	0.009	0.008	1.173
SRP	0.004	0.003	0.003	0.004	0.004	0.003	0.004	0.004	0.004	0.003	1.003	0.003	0.004	0.004	0.003	0.004	0.003	0.003	0.003	1.065
VPO	0.008	0.007	0.007	0.007	0.007	0.007	0.007	0.008	0.008	0.007	0.007	0.007	1.008	0.007	0.007	0.007	0.007	0.007	0.007	1.139
LAG	0.046	0.040	0.040	0.044	0.043	0.040	0.044	0.045	0.046	0.041	0.041	0.039	0.046	1.043	0.037	0.044	0.038	0.042	0.039	1.798
NOR	0.004	0.003	0.003	0.004	0.004	0.003	0.004	0.004	0.004	0.003	0.003	0.003	0.004	0.004	1.003	0.004	0.003	0.004	0.003	1.068
PDL	0.084	0.075	0.074	0.081	0.079	0.073	0.081	0.082	0.084	0.076	0.076	0.072	0.085	0.080	0.069	1.081	0.070	0.078	0.074	2.473
POV	0.008	0.007	0.007	0.007	0.007	0.007	0.007	0.008	0.008	0.007	0.007	0.007	0.008	0.007	0.006	0.007	1.006	0.007	0.007	1.134
RGR	0.025	0.022	0.021	0.024	0.023	0.021	0.024	0.024	0.025	0.022	0.022	0.021	0.025	0.023	0.020	0.024	0.020	1.022	0.021	1.428
VFR	0.010	0.009	0.009	0.010	0.009	0.009	0.010	0.010	0.010	0.009	0.009	0.009	0.010	0.010	0.008	0.010	0.008	0.009	1.009	1.175
TOTAL	1.343	1.299	1.295	1.326	1.318	1.292	1.327	1.332	1.338	1.304	1.301	1.286	1.344	1.322	1.273	1.324	1.276	1.310	1.292	

Table 6: Income Multiplier Effects of Final Demand of Sectors on Municipalities

	GRA	CAL	VEL	ANG	PRA	COR	HOR	LPI	SCF	LAF	MAD	SRP	VPO	LAG	NOR	PDL	POV	RGR	VFR	TOTAL
A - Agriculture	0.141	0.117	0.112	0.131	0.126	0.112	0.131	0.136	0.138	0.119	0.117	0.117	0.108	0.141	0.129	0.100	0.100	0.122	0.110	2.322
B - Extraction	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.004	0.004	0.004	0.003	0.005	0.004	0.004	0.004	0.004	0.003	0.075
C - Manufacturing	0.259	0.222	0.212	0.240	0.232	0.215	0.241	0.250	0.253	0.224	0.217	0.217	0.204	0.259	0.236	0.238	0.191	0.223	0.204	4.314
DA - Electricity	0.144	0.101	0.095	0.112	0.108	0.102	0.120	0.125	0.134	0.104	0.091	0.085	0.145	0.106	0.083	0.110	0.080	0.097	0.082	2.022
F - Construction	0.009	0.008	0.008	0.009	0.009	0.008	0.009	0.009	0.009	0.008	0.008	0.008	0.009	0.009	0.008	0.009	0.008	0.009	0.009	0.167
E - Water & Sanitation	0.032	0.030	0.030	0.031	0.031	0.029	0.031	0.031	0.031	0.030	0.030	0.030	0.029	0.032	0.030	0.029	0.031	0.029	0.029	0.574
G - Trade and Comm	0.378	0.419	0.444	0.430	0.440	0.427	0.417	0.402	0.396	0.424	0.457	0.457	0.380	0.446	0.439	0.446	0.434	0.456	0.480	8.194
I - Tourism	0.158	0.227	0.215	0.138	0.151	0.266	0.151	0.159	0.148	0.207	0.182	0.223	0.151	0.139	0.262	0.139	0.235	0.157	0.185	3.492
H - Transport	0.157	0.144	0.145	0.162	0.159	0.141	0.138	0.159	0.159	0.147	0.155	0.145	0.157	0.163	0.132	0.162	0.139	0.159	0.154	2.896
J - Communications	0.093	0.071	0.068	0.086	0.081	0.066	0.086	0.089	0.091	0.074	0.072	0.064	0.064	0.094	0.083	0.085	0.058	0.077	0.067	1.462
K - Banks & Insurance	0.025	0.019	0.018	0.022	0.021	0.017	0.022	0.023	0.024	0.019	0.018	0.016	0.026	0.026	0.021	0.015	0.022	0.015	0.016	0.378
L - State	0.166	0.218	0.228	0.193	0.202	0.214	0.192	0.178	0.174	0.215	0.220	0.237	0.166	0.198	0.256	0.196	0.255	0.213	0.235	3.956
M - Consultancy	0.073	0.065	0.065	0.072	0.070	0.064	0.071	0.072	0.073	0.067	0.067	0.064	0.074	0.071	0.060	0.072	0.061	0.069	0.065	1.296
N - Administration	0.011	0.008	0.007	0.010	0.009	0.007	0.010	0.010	0.010	0.008	0.008	0.007	0.011	0.009	0.009	0.009	0.009	0.008	0.007	0.161
O,P - Education, Health	0.272	0.198	0.187	0.242	0.227	0.179	0.244	0.254	0.263	0.206	0.198	0.173	0.274	0.235	0.153	0.239	0.153	0.212	0.178	4.088
TOTAL	1.923	1.850	1.838	1.882	1.871	1.849	1.887	1.902	1.910	1.855	1.844	1.823	1.923	1.874	1.805	1.878	1.804	1.855	1.824	

The estimation of the distances were done assuming that the real distance (d_{ij}) is transformed into a distance associated with travel cost (c_{ij}) considering loading and unloading costs (δ) and the transportation between the island as a proportion (σ) of the same cost by road [$c_{ij} = \delta + \sigma d_{ij}$]. In a recent study Dentinho (2008) estimated that, for air transportation between the islands, ($\delta = 125$) and ($\sigma=0,12$). The distances inside each municipality are taken as half of the average radius [$d_{ii} = (\text{Area}/\pi)^{0,5}$]. The estimated distances are presented in Annex 5. The actual average distances per sector and for commuters and consumers are presented in Table 4.

As expected, with the understandable exception of the extraction activities, the travel to work distances are much more stable across sectors than the travel to shop distances, where the Christaller/Losch hierarchy of places, and implicit scale economies of the different sectors, influences the “travel to shop” average distances.

Table 5 presents the Cross Income Multiplier Effects per Municipality that shows the impact of an increase in income for consumption in one municipality on the income for consumption in the others. Such impact can be associated, for instance, with an external transference to the families of each municipality. As expected the direct effect stays in the municipality but the induced effect tends to occur also outside the municipality and attracted to the major cities of the region namely Ponta Delgada. On the other hand, the effect of an extra income allocation in major cities would have a much bigger impact than a similar extra income allocation in any other municipalities. Summing up the technological and distributional distances seems to be more important than the physical distances.

Table 6 presents the income multiplier effects of the Final Demand per Sector on the income for consumption in each municipality. The sectors that have major effects are Commerce, Real State and Education. The impact of Final Demand per Sector in the various Municipalities is quite similar being slightly bigger in smaller islands and central municipalities of bigger islands than in less central municipalities of bigger islands. This shows the effect of some level of economic protection created by remoteness.

6. CONCLUSION

Model implementation results from the interaction between, on the one hand, the demand for models pushed by the existence of policy makers or researchers and, on the other hand, the modelling capacity that can be assessed by the computing power, by the available data, and by the existing knowledge of modelling techniques.

The Integration of a regional input-output model with a spatial interaction model developed in the present exercise have a great potential for policy makers:

a) First, the disaggregation of existing Input-Output models for smaller spatial units is quite easy to implement, based on existing data on commuting employment and shopping behaviours that, jointly with the distance matrices and the attraction factors, feeds the spatial interaction model that is then used to spatialize consumption in the Final Demand of the pre-existent Input-Output Model and to spatialize income for consumption, in the Primary Inputs of the same pre-existent Input-Output Model;

b) Second, policy makers can test the impact of changes in localized changes on the Final Demand by disaggregating the absolute values of the changes between, on the one hand, the share of income for consumption by locality and, on the other hand, the share of change in final demand by sector net of the share of income for consumption by locality.

c) Finally, policy makers can test the impact of changes in the Spatial Interaction Model, namely changes in accessibility and attraction factors that influence commuting employment and shopping behaviours.

In the present model applied to the Azores Region and its municipalities it was possible to establish the connections between regional economic models spatial interaction models. Furthermore, it was possible to show that multiplier effects vary considerably between areas if we consider the spatial disaggregation of income and the spatial distribution of consumption.

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Annex 3: Multipliers Without Endogenized Expenditure

Production Multipliers	A	B	C	DA	F	E	G	I	H	J	K	L	M	N	O,P	TOTAL
A-Agriculture	1,082	0,004	0,250	0,003	0,013	0,041	0,010	0,092	0,004	0,003	0,003	0,002	0,009	0,004	0,013	1,532
B-Extraction	0,003	1,040	0,011	0,018	0,002	0,010	0,001	0,003	0,001	0,000	0,000	0,000	0,000	0,001	0,001	1,092
C-Manufacturing	0,262	0,016	1,149	0,011	0,049	0,186	0,029	0,226	0,012	0,011	0,009	0,008	0,026	0,015	0,035	2,043
DA-Electricity	0,033	0,118	0,033	1,524	0,051	0,013	0,022	0,039	0,014	0,009	0,015	0,004	0,009	0,026	0,018	1,929
F-Construction	0,002	0,001	0,005	0,001	1,096	0,001	0,002	0,003	0,002	0,001	0,001	0,001	0,002	0,002	0,003	1,122
E-Water & Sanitation	0,009	0,020	0,016	0,037	0,065	1,295	0,019	0,011	0,022	0,023	0,010	0,042	0,009	0,008	0,009	1,594
G-Trade and Commerce	0,034	0,030	0,095	0,023	0,028	0,066	1,035	0,109	0,028	0,066	0,006	0,009	0,018	0,011	0,019	1,577
I-Tourism	0,005	0,011	0,008	0,006	0,014	0,004	0,021	1,009	0,020	0,004	0,015	0,003	0,020	0,010	0,012	1,162
H-Transport	0,046	0,131	0,065	0,024	0,082	0,031	0,104	0,045	1,302	0,024	0,007	0,006	0,042	0,037	0,018	1,964
J-Communications	0,005	0,009	0,008	0,012	0,014	0,004	0,019	0,008	0,010	1,178	0,023	0,002	0,025	0,004	0,020	1,339
K-Banks & Insurance	0,002	0,005	0,004	0,003	0,003	0,004	0,004	0,003	0,003	0,002	1,002	0,001	0,005	0,001	0,002	1,044
L-State	0,016	0,016	0,020	0,011	0,034	0,015	0,078	0,033	0,029	0,029	0,055	1,017	0,015	0,010	0,023	1,402
M-Consultancy	0,016	0,031	0,033	0,037	0,027	0,019	0,055	0,031	0,020	0,020	0,068	0,011	1,151	0,021	0,030	1,569
N-Administration	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	1,000	0,000	1,000
O,P-Education, Health and Other	0,009	0,004	0,007	0,004	0,007	0,003	0,009	0,010	0,004	0,023	0,006	0,001	0,030	0,008	1,050	1,176
TOTAL	1,525	1,438	1,704	1,714	1,486	1,692	1,407	1,621	1,469	1,393	1,219	1,106	1,359	1,158	1,252	

Annex 5: Code of Municipalities

Code	Municipalities	Island
GRA	Santa Cruz da Graciosa	Graciosa
CAL	Calheta	São Jorge
VEL	Velas	São Jorge
ANG	Angra do Heroísmo	Terceira
PRA	Praia da Vitória	Terceira
COR	Corvo	Corvo
HOR	Horta	Faial
LPF	Lajes das Flores	Flores
SCF	Santa Cruz das Flores	Flores
LAP	Lajes do Pico	Pico
MAD	Madalena	Pico
SRP	São Roque do Pico	Pico
VPO	Vila do Porto	Santa Maria
LAG	Lagoa	São Miguel
NOR	Nordeste	São Miguel
PDL	Ponta Delgada	São Miguel
POV	Povoação	São Miguel
RGR	Ribeira Grande	São Miguel
VFR	Vila Franca do Campo	São Miguel

Annex 6: Distances Between Municipalities of the Azores in Equivalent Terrestrial Kilometers

Municipalities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1 STA CRUZ GRACIOSA	3	153	137	154	143	160	142	161	164	166	141	154	172	167	209	163	199	174	181
2 CALHETA	153	4	19	168	158	178	53	179	182	65	48	52	184	180	223	176	213	188	194
3 VELAS	137	19	4	155	145	161	30	161	165	50	25	32	171	167	210	163	199	174	181
4 ANGRA DO HEROISMO	154	168	155	5	16	183	160	184	187	181	159	171	176	171	213	167	203	178	184
5 VILA PRAIA VITORIA	143	158	145	16	4	172	150	173	177	171	149	161	163	158	200	154	190	165	172
6 CORVO	160	178	161	183	172	1	159	26	19	187	159	175	200	196	238	192	228	203	210
7 HORTA	142	53	30	160	150	159	4	159	162	53	13	37	175	171	214	167	204	179	185
8 LAJES DAS FLORES	165	182	165	187	177	26	162	3	6	191	163	179	203	200	242	196	232	207	214
9 STA CRUZ FLORES	161	169	144	184	173	19	129	6	3	174	133	156	200	196	239	192	229	204	210
10 LAJES DO PICO	166	65	50	181	171	187	53	187	191	4	29	16	195	191	234	187	224	199	205
11 MADALENA	141	48	25	159	149	159	13	159	163	29	4	18	174	170	213	166	203	178	184
12 SAO ROQUE DO PICO	154	52	32	171	161	175	37	175	179	16	18	4	186	182	225	178	214	189	196
13 VILA DO PORTO	172	185	171	176	164	200	175	200	203	195	174	186	3	148	187	145	176	156	159
14 LAGOA	167	180	167	171	158	196	171	196	200	191	170	182	148	2	39	8	29	9	13
15 NORDESTE	209	223	210	213	200	238	214	239	242	234	213	225	187	39	3	47	13	33	29
16 PONTA DELGADA	163	176	163	167	154	192	167	192	196	187	166	178	145	8	47	5	37	16	21
17 POVOACAO	199	213	199	203	190	228	204	229	232	224	203	214	176	29	13	37	3	26	17
18 RIBEIRA GRANDE	174	188	174	178	165	203	179	204	207	199	178	189	156	9	33	16	26	4	14
19 VILA FRANCA CAMPO	181	194	181	184	172	210	185	210	214	205	184	196	159	13	29	21	17	14	3

Annex 7: Movements Residence Employment between municipalities by sector (Azores, 2001)

A Agriculture and Animals Farming (1)

Municipalities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	AZORES
1 STA CRUZ GRACIOSA	455	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	455
2 CALHETA	0	569	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	570
3 VELAS	0	0	541	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	541
4 ANGRA DO HEROISMO	0	0	0	1555	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1572
5 VILA PRAIA VITORIA	0	0	0	38	884	0	0	0	0	0	0	0	0	0	0	0	0	0	0	922
6 CORVO	0	0	0	0	0	53	0	0	0	0	0	0	0	0	0	0	0	0	0	53
7 HORTA	0	0	0	0	0	0	720	0	0	1	0	1	0	0	0	0	0	0	0	722
8 LAJES DAS FLORES	0	0	0	0	0	0	0	176	4	0	0	0	0	0	0	0	0	0	0	180
9 STA CRUZ FLORES	0	0	0	0	0	0	0	0	187	0	0	0	0	0	0	0	0	0	0	187
10 LAJES DO PICO	0	0	0	0	0	0	0	0	0	502	2	0	0	0	0	0	0	0	0	504
11 MADALENA	0	0	0	0	0	0	0	0	0	0	517	20	0	0	0	0	0	0	0	537
12 SAO ROQUE DO PICO	0	0	0	0	0	0	0	0	0	1	3	236	0	0	0	0	0	0	0	240
13 VILA DO PORTO	0	0	0	0	0	0	0	0	0	0	0	0	246	0	0	0	0	0	0	246
14 LAGOA	0	0	0	0	0	0	0	0	0	0	0	0	0	703	1	44	0	3	3	754
15 NORDESTE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	683	0	0	1	0	684
16 PONTA DELGADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2406	3	10	2	2422
17 POVOACAO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	513	0	1	514
18 RIBEIRA GRANDE	0	0	0	0	0	0	0	0	0	0	0	0	0	2	49	13	1750	0	1814	
19 VILA FRANCA CAMPO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	1013	1021	
20 AZORES	455	569	542	1593	901	53	720	176	191	504	522	257	246	703	687	2502	531	1767	1019	13938

B Fishing (2)

Municipalities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	AZORES	
1 STA CRUZ GRACIOSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 CALHETA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 VELAS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 ANGRA DO HEROISMO	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
5 VILA PRAIA VITORIA	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
6 CORVO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 HORTA	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
8 LAJES DAS FLORES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9 STA CRUZ FLORES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10 LAJES DO PICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11 MADALENA	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
12 SAO ROQUE DO PICO	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	5
13 VILA DO PORTO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14 LAGOA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	3
15 NORDESTE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
16 PONTA DELGADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	3
17 POVOACAO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18 RIBEIRA GRANDE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	5	0	0	7
19 VILA FRANCA CAMPO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20 AZORES	0	0	0	9	1	0	2	0	0	0	2	5	0	0	1	4	1	7	1	0	33

C Mining and Quarrying (3)

Municipalities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	AZORES	
1 STA CRUZ GRACIOSA	65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65
2 CALHETA	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24
3 VELAS	0	0	62	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	65
4 ANGRA DO HEROISMO	0	0	0	211	16	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	228
5 VILA PRAIA VITORIA	0	0	0	0	135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	135
6 CORVO	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
7 HORTA	0	0	0	0	0	0	124	0	0	0	1	0	0	0	0	0	0	0	0	0	125
8 LAJES DAS FLORES	0	0	0	0	0	0	0	10	1	0	0	0	0	0	0	0	0	0	0	0	11
9 STA CRUZ FLORES	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0	0	0	0	0	21
10 LAJES DO PICO	0	0	0	0	0	0	0	0	0	182	2	0	0	0	0	0	0	0	0	0	184
11 MADALENA	0	0	0	0	0	0	2	0	0	0	72	0	0	0	0	0	0	0	0	0	74
12 SAO ROQUE DO PICO	0	0	0	0	0	0	0	0	0	0	3	7	0	0	0	0	0	0	0	0	10
13 VILA DO PORTO	0	0	0	0	0	0	0	0	0	0	0	0	57	0	0	0	0	0	0	0	57
14 LAGOA	0	0	0	0	0	0	0	0	0	0	0	0	0	167	0	35	0	0	0	3	205
15 NORDESTE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	5
16 PONTA DELGADA	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	185	0	0	0	0	186
17 POVOACAO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	100	0	0	0	105
18 RIBEIRA GRANDE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	440	0	0	459
19 VILA FRANCA CAMPO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	111	125
20 AZORES	65	24	62	211	151	5	131	10	22	182	78	7	57	167	5	258	100	440	114	0	2089

DA Processed Food, Beverages and Tobacco (4)

Municipalities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	AZORES	
1 STA CRUZ GRACIOSA	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34
2 CALHETA	0	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54
3 VELAS	0	2	84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	86
4 ANGRA DO HEROISMO	0	0	0	462	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	465
5 VILA PRAIA VITORIA	0	0	0	36	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76
6 CORVO	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
7 HORTA	0	0	0	0	0	0	298	0	0	0	0	0	0	0	0	0	0	0	0	0	298
8 LAJES DAS FLORES	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
9 STA CRUZ FLORES	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	20
10 LAJES DO PICO	0	0	0	0	0	0	0	0	0	72	34	2	0	0	0	0	0	0	0	0	108
11 MADALENA	0	0	0	0	1	0	0	0	0	1	247	0	0	0	0	0	0	0	0	0	249
12 SAO ROQUE DO PICO	0	0	0	0	0	0	0	0	0	0	10	46	0	0	0	0	0	0	0	0	56
13 VILA DO PORTO	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	10
14 LAGOA	0	0	0	0	0	0	0	0	0	0	0	0	0	95	0	108	0	2	5	0	210
15 NORDESTE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	0	0	0	0	0	31
16 PONTA DELGADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1092	0	11	2	0	1105
17 POVOACAO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	0	0	0	34
18 RIBEIRA GRANDE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72	2	290	0	0	364
19 VILA FRANCA CAMPO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	70	81
20 AZORES	34	56	84	498	44	1	298	3	20	73	291	48	10	95	31	1283	36	303	77	0	3285

Integration of a Regional Input-output Model With a Spatial Interaction Model...

D-DA Other Manufacturing Activities (5)

Municipalities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	AZORES
1 STA CRUZ GRACIOSA	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28
2 CALHETA	0	51	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	52
3 VELAS	0	0	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60
4 ANGRA DO HEROISMO	0	0	0	478	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	490
5 VILA PRAIA VITORIA	0	0	0	33	283	0	0	0	0	0	0	0	0	0	0	0	0	0	0	316
6 CORVO	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
7 HORTA	0	0	0	1	0	0	186	0	0	0	0	0	0	0	0	0	0	0	0	187
8 LAJES DAS FLORES	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	5
9 STA CRUZ FLORES	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	7
10 LAJES DO PICO	0	0	0	0	0	0	0	0	0	28	0	1	0	0	0	0	0	0	0	29
11 MADALENA	0	0	0	0	0	0	0	0	0	0	75	2	0	0	0	0	0	0	0	77
12 SAO ROQUE DO PICO	0	0	0	0	0	0	0	0	0	0	8	55	0	0	0	0	0	0	0	63
13 VILA DO PORTO	0	0	0	0	0	0	0	0	0	0	0	0	48	0	0	0	0	0	0	48
14 LAGOA	0	0	0	0	0	0	0	0	0	0	0	0	0	227	0	65	0	13	0	305
15 NORDESTE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	0	0	1	0	30
16 PONTA DELGADA	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1012	0	48	1	1064
17 POVOACAO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	0	0	0	60
18 RIBEIRA GRANDE	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	71	0	382	0	456
19 VILA FRANCA CAMPO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	3	1	118	139
20 AZORES	28	51	61	512	295	1	186	5	7	28	83	58	48	231	31	1165	63	445	119	3417

E Electricity, Gas and Water (6)

Municipalities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	AZORES
1 STA CRUZ GRACIOSA	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28
2 CALHETA	0	26	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32
3 VELAS	0	3	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21
4 ANGRA DO HEROISMO	0	0	0	131	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	151
5 VILA PRAIA VITORIA	0	0	0	6	65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	71
6 CORVO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 HORTA	0	0	0	0	0	0	64	0	0	0	0	0	0	0	0	0	0	0	0	64
8 LAJES DAS FLORES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9 STA CRUZ FLORES	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	6
10 LAJES DO PICO	0	0	0	0	0	0	0	0	0	37	0	3	0	0	0	0	0	0	0	40
11 MADALENA	0	0	0	0	0	0	0	0	0	2	10	1	0	0	0	0	0	0	0	13
12 SAO ROQUE DO PICO	0	0	0	0	0	0	0	0	0	0	0	26	0	0	0	0	0	0	0	26
13 VILA DO PORTO	0	0	0	0	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	30
14 LAGOA	0	0	0	0	0	0	0	0	0	0	0	0	0	23	0	0	0	1	0	24
15 NORDESTE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4
16 PONTA DELGADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	349	0	13	0	362
17 POVOACAO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	41	0	0	43
18 RIBEIRA GRANDE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	1	51	0	91
19 VILA FRANCA CAMPO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	1	1	10	26
20 AZORES	28	29	24	137	85	0	64	0	6	39	10	30	30	23	4	404	43	66	10	1032

F Construction (7)

Municipalities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	AZORES
1 STA CRUZ GRACIOSA	298	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	298
2 CALHETA	0	163	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	165
3 VELAS	0	5	276	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	281
4 ANGRA DO HEROISMO	0	0	0	1521	76	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1598
5 VILA PRAIA VITORIA	0	0	0	143	863	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1006
6 CORVO	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	5
7 HORTA	0	0	0	0	0	0	544	0	0	1	1	1	0	0	0	0	0	0	0	547
8 LAJES DAS FLORES	0	0	0	0	0	0	0	89	6	0	0	0	0	0	0	0	0	0	0	95
9 STA CRUZ FLORES	0	0	0	0	0	0	0	4	137	0	0	0	0	0	0	0	0	0	0	141
10 LAJES DO PICO	0	0	0	0	0	0	0	0	0	180	3	0	0	0	0	0	0	0	0	183
11 MADALENA	0	0	0	0	0	0	1	0	0	4	236	0	0	0	0	0	0	0	0	241
12 SAO ROQUE DO PICO	0	0	1	0	0	0	0	0	0	10	16	142	0	0	0	0	0	0	0	169
13 VILA DO PORTO	0	0	0	1	0	0	0	0	0	0	0	0	245	0	0	0	0	0	0	246
14 LAGOA	0	0	0	0	0	0	0	0	0	0	0	0	0	353	0	230	5	13	5	606
15 NORDESTE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	161	10	0	7	2	180
16 PONTA DELGADA	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2527	1	57	14	2600
17 POVOACAO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	303	2	7	322
18 RIBEIRA GRANDE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	457	2	1126	6	1595
19 VILA FRANCA CAMPO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	242	10	11	668	931
20 AZORES	298	168	279	1665	939	5	546	93	143	195	256	143	245	353	166	3476	321	1216	702	11209

G Trade and commerce (8)

Municipalities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	AZORES
1 STA CRUZ GRACIOSA	159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	159
2 CALHETA	0	142	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	144
3 VELAS	0	0	189	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	189
4 ANGRA DO HEROISMO	0	0	0	1784	57	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1842
5 VILA PRAIA VITORIA	0	0	0	70	732	0	0	0	0	0	0	0	0	0	0	0	0	0	0	802
6 CORVO	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	8
7 HORTA	0	0	0	0	0	0	818	0	0	0	0	0	0	0	0	0	0	0	0	818
8 LAJES DAS FLORES	0	0	0	0	0	0	0	40	4	0	0	0	0	0	0	0	0	0	0	44
9 STA CRUZ FLORES	0	0	0	0	0	0	0	0	99	0	0	0	0	0	0	0	0	0	0	99
10 LAJES DO PICO	0	0	0	0	0	0	0	0	0	133	2	0	0	0	0	0	0	0	0	135
11 MADALENA	0	0	0	0	0	0	1	0	0	1	240	0	0	0	0	0	0	0	0	242
12 SAO ROQUE DO PICO	0	0	0	0	0	0	0	0	0	5	3	102	0	0	0	0	0	0	0	110
13 VILA DO PORTO	0	0	0	0	0	0	0	0	0	0	0	0	226	0	0	0	0	0	0	226
14 LAGOA	0	0	0	0	0	0	0	0	0	0	0	0	0	392	0	253	1	9	3	658
15 NORDESTE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	116	2	0	1	0	119
16 PONTA DELGADA	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3891	0	30	1	3923
17 POVOACAO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	3	192	7	0	207
18 RIBEIRA GRANDE	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	250	0	709	0	940
19 VILA FRANCA CAMPO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	29	1	1	255	287
20 AZORES	159	142	191	1854	789	8	820	41	103	139	245	102	226	393	122	4408	194	757	259	10952

H Hotels and Restaurants (9)

Municipalities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	AZORES
1 STA CRUZ GRACIOSA	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27
2 CALHETA	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
3 VELAS	0	0	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46
4 ANGRA DO HEROISMO	0	0	0	330	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	339
5 VILA PRAIA VITORIA	0	0	0	8	199	0	0	0	0	0	0	0	0	0	0	0	0	0	0	207
6 CORVO	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
7 HORTA	0	0	0	0	0	0	182	0	0	0	0	0	0	0	0	0	0	0	0	182
8 LAJES DAS FLORES	0	0	0	0	0	0	0	7	1	0	0	0	0	0	0	0	0	0	0	8
9 STA CRUZ FLORES	0	0	0	0	0	0	0	0	31	0	0	0	0	0	0	0	0	0	0	31
10 LAJES DO PICO	0	0	0	0	0	0	0	0	0	14	1	0	0	0	0	0	0	0	0	15
11 MADALENA	0	0	0	0	0	0	0	0	0	0	68	0	0	0	0	0	0	0	0	68
12 SAO ROQUE DO PICO	0	0	0	0	0	0	0	0	0	0	2	17	0	0	0	0	0	0	0	19
13 VILA DO PORTO	0	0	0	0	0	0	0	0	0	0	0	0	69	0	0	0	0	0	0	69
14 LAGOA	0	0	0	0	0	0	0	0	0	0	0	0	0	81	0	41	0	4	12	138
15 NORDESTE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	9
16 PONTA DELGADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	724	0	1	9	734
17 POVOACAO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	127	0	3	132
18 RIBEIRA GRANDE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	0	98	1	128
19 VILA FRANCA CAMPO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	90	95
20 AZORES	27	7	46	338	208	3	182	7	32	14	71	17	69	81	9	801	127	103	115	2257

I Transport and Communications (10)

Municipalities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	AZORES
1 STA CRUZ GRACIOSA	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75
2 CALHETA	0	37	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41
3 VELAS	0	0	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	116
4 ANGRA DO HEROISMO	0	0	0	480	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	625
5 VILA PRAIA VITORIA	0	0	0	71	360	0	0	0	0	0	0	0	0	0	0	0	0	0	0	431
6 CORVO	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	7
7 HORTA	0	0	0	0	0	0	366	0	0	0	0	0	0	0	0	0	0	0	0	366
8 LAJES DAS FLORES	0	0	0	0	0	0	0	14	10	0	0	0	0	0	0	0	0	0	0	24
9 STA CRUZ FLORES	0	0	0	0	0	0	0	1	59	0	0	0	0	0	0	0	0	0	0	60
10 LAJES DO PICO	0	0	0	0	0	0	1	0	0	36	16	0	0	0	0	0	0	0	0	53
11 MADALENA	0	0	0	0	0	0	1	0	0	0	86	1	0	0	0	0	0	0	0	88
12 SAO ROQUE DO PICO	0	0	0	0	0	0	1	0	0	1	12	35	0	0	0	1	0	0	0	50
13 VILA DO PORTO	0	0	0	0	0	0	0	0	0	0	0	0	397	0	0	0	0	0	0	397
14 LAGOA	0	0	0	0	0	0	0	0	0	0	0	0	0	48	0	130	0	0	0	178
15 NORDESTE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	4	0	4	0	53
16 PONTA DELGADA	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	1689	0	5	0	1697
17 POVOACAO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	60	0	0	0	61
18 RIBEIRA GRANDE	0	0	0	0	0	0	0	0	0	0	0	0	0	2	144	1	171	0	0	318
19 VILA FRANCA CAMPO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58	0	2	55	115
20 AZORES	75	37	120	551	506	7	369	15	69	37	114	36	398	49	47	2027	61	182	55	4755

Integration of a Regional Input-output Model With a Spatial Interaction Model...

J Banks & Insurance (11)

Municipalities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	AZORES
1 STA CRUZ GRACIOSA	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27
2 CALHETA	0	28	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
3 VELAS	0	0	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35
4 ANGRA DO HEROISMO	0	0	0	237	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	247
5 VILA PRAIA VITORIA	0	0	0	8	70	0	0	0	0	0	0	0	0	0	0	1	0	0	0	79
6 CORVO	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
7 HORTA	0	0	0	0	0	0	91	0	0	0	0	0	0	0	0	0	0	0	0	91
8 LAJES DAS FLORES	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	4
9 STA CRUZ FLORES	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	15
10 LAJES DO PICO	0	0	0	0	0	0	0	0	0	28	2	3	0	0	0	0	0	0	0	33
11 MADALENA	0	0	0	0	0	0	0	0	0	1	36	2	0	0	0	0	0	0	0	39
12 SAO ROQUE DO PICO	0	0	0	0	0	0	0	0	0	1	4	17	0	0	0	0	0	0	0	22
13 VILA DO PORTO	0	0	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	21
14 LAGOA	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	47	0	1	4	63
15 NORDESTE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	25
16 PONTA DELGADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	772	1	9	1	783
17 POVOACAO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	24	0	0	25
18 RIBEIRA GRANDE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	26	0	75	0	102
19 VILA FRANCA CAMPO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	23	32
20 AZORES	27	28	37	245	80	1	91	3	16	30	42	22	21	11	26	856	25	85	28	1674

K Real Estate and Business Services (12)

Municipalities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	AZORES
1 STA CRUZ GRACIOSA	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17
2 CALHETA	0	37	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38
3 VELAS	0	0	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34
4 ANGRA DO HEROISMO	0	0	0	245	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	259
5 VILA PRAIA VITORIA	0	0	0	18	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	121
6 CORVO	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
7 HORTA	0	0	0	0	0	0	114	0	0	1	0	0	0	0	0	0	0	0	0	115
8 LAJES DAS FLORES	0	0	0	0	0	0	0	6	2	0	0	0	0	0	0	0	0	0	0	8
9 STA CRUZ FLORES	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	4
10 LAJES DO PICO	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	9
11 MADALENA	0	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	16
12 SAO ROQUE DO PICO	0	0	0	0	0	0	0	0	0	0	2	12	0	0	0	0	0	0	0	14
13 VILA DO PORTO	0	0	0	0	0	0	0	0	0	0	0	0	29	0	0	0	0	0	0	29
14 LAGOA	0	0	0	0	0	0	0	0	0	0	0	0	0	27	0	57	0	0	1	85
15 NORDESTE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0	2	0	18
16 PONTA DELGADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	670	0	3	0	673
17 POVOACAO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	20	0	0	22
18 RIBEIRA GRANDE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44	3	82	0	129
19 VILA FRANCA CAMPO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	13	21
20 AZORES	17	37	34	264	117	1	114	6	6	10	18	12	29	27	16	781	23	87	14	1613

L Public Administration (13)

Municipalities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	AZORES
1 STA CRUZ GRACIOSA	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	200
2 CALHETA	0	129	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	132
3 VELAS	0	5	180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	185
4 ANGRA DO HEROISMO	0	2	0	1896	156	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2055
5 VILA PRAIA VITORIA	0	0	0	138	856	0	0	0	0	0	0	0	0	0	0	0	0	0	1	995
6 CORVO	0	0	0	0	0	47	0	0	0	0	0	0	0	0	0	0	0	0	0	47
7 HORTA	0	0	0	3	0	0	967	0	0	0	0	0	0	0	0	0	0	0	0	970
8 LAJES DAS FLORES	0	0	0	0	0	0	0	114	8	0	0	0	0	0	0	0	0	0	0	122
9 STA CRUZ FLORES	0	0	0	0	0	0	0	1	192	0	0	0	0	0	0	0	0	0	0	193
10 LAJES DO PICO	0	0	0	0	0	0	0	0	0	215	19	0	0	0	0	0	0	0	0	234
11 MADALENA	0	0	0	0	0	0	0	0	0	6	191	11	0	0	0	0	0	0	0	208
12 SAO ROQUE DO PICO	0	0	0	0	0	0	0	0	0	2	11	196	0	0	0	0	0	0	0	209
13 VILA DO PORTO	0	0	0	0	0	0	0	0	0	0	0	0	369	0	0	1	0	0	0	370
14 LAGOA	0	0	0	0	1	0	0	0	0	0	0	0	0	172	0	189	1	6	5	374
15 NORDESTE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	291	2	5	2	0	300
16 PONTA DELGADA	0	0	0	0	0	0	0	0	0	0	0	1	3	0	2	2935	1	27	4	2973
17 POVOACAO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	213	0	0	220
18 RIBEIRA GRANDE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	252	2	488	1	744
19 VILA FRANCA CAMPO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	56	1	3	170	231
20 AZORES	200	136	183	2037	1013	47	968	115	200	223	221	208	372	172	296	3441	223	526	181	10762

M Education (14)

Municipalities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	AZORES
1 STA CRUZ GRACIOSA	92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	92
2 CALHETA	0	79	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	82
3 VELAS	0	5	109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114
4 ANGRA DO HEROISMO	0	2	1	824	103	0	0	0	0	0	0	0	0	0	0	2	0	0	0	932
5 VILA PRAIA VITORIA	1	1	1	48	262	0	0	0	0	0	0	0	0	0	0	0	0	0	0	313
6 CORVO	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	5
7 HORTA	0	0	0	0	0	0	346	0	1	1	1	1	0	0	0	0	0	0	0	350
8 LAJES DAS FLORES	0	0	0	0	0	0	0	13	11	0	0	0	0	0	0	0	0	0	0	24
9 STA CRUZ FLORES	0	0	0	0	0	0	0	0	44	0	0	0	0	0	0	0	0	0	0	44
10 LAJES DO PICO	0	1	0	0	0	0	0	0	0	101	1	3	0	0	0	0	0	0	0	106
11 MADALENA	0	0	0	0	0	0	0	0	0	3	84	6	0	0	0	0	0	0	0	93
12 SAO ROQUE DO PICO	0	0	0	0	0	0	0	0	0	6	7	87	0	0	0	0	0	0	0	100
13 VILA DO PORTO	0	0	0	0	0	0	0	0	0	0	0	0	136	0	0	1	0	0	0	137
14 LAGOA	0	0	0	0	1	0	0	0	0	0	0	0	0	117	0	66	0	6	10	200
15 NORDESTE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	0	0	0	0	114
16 PONTA DELGADA	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1886	4	129	18	2038
17 POVOACAO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	103	1	0	110
18 RIBEIRA GRANDE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	66	0	340	0	411
19 VILA FRANCA CAMPO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	2	0	154	168
20 AZORES	93	88	113	873	366	5	347	13	56	111	93	97	136	117	120	2038	109	476	182	5433

N Health and Social Work (15)

Municipalities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	AZORES
1 STA CRUZ GRACIOSA	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
2 CALHETA	0	36	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38
3 VELAS	0	3	86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	89
4 ANGRA DO HEROISMO	0	0	0	962	14	0	0	0	0	0	0	0	0	0	0	1	0	0	0	977
5 VILA PRAIA VITORIA	0	0	0	62	147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	209
6 CORVO	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	5
7 HORTA	0	0	0	0	0	0	403	0	0	0	0	0	0	0	0	0	0	0	0	403
8 LAJES DAS FLORES	0	0	0	0	0	0	0	6	4	0	0	0	0	0	0	0	0	0	0	10
9 STA CRUZ FLORES	0	0	0	0	0	0	0	0	45	0	0	0	0	0	0	0	0	0	0	45
10 LAJES DO PICO	0	0	0	0	0	0	1	0	0	59	4	0	0	0	0	0	0	0	0	64
11 MADALENA	0	0	0	0	0	0	0	0	0	0	64	1	0	0	0	0	0	0	0	65
12 SAO ROQUE DO PICO	0	0	0	0	0	0	0	0	0	1	1	50	0	0	0	0	0	0	0	52
13 VILA DO PORTO	0	0	0	0	0	0	0	0	0	0	0	0	67	0	0	0	0	0	0	67
14 LAGOA	0	0	0	0	0	0	0	0	0	0	0	0	0	36	0	43	0	1	0	80
15 NORDESTE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	71	0	0	2	0	73
16 PONTA DELGADA	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	1237	0	24	5	1269
17 POVOACAO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	71	0	0	71
18 RIBEIRA GRANDE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	97	0	181	0	278
19 VILA FRANCA CAMPO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0	1	94	111
20 AZORES	50	39	88	1025	161	5	404	6	49	60	69	51	67	38	71	1394	71	209	99	3956

OP Social and Personal Services; Domestic Staff

Municipalities	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	AZORES
1 STA CRUZ GRACIOSA	93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	93
2 CALHETA	0	59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59
3 VELAS	0	0	93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	93
4 ANGRA DO HEROISMO	1	0	0	814	175	0	1	1	0	1	0	0	0	0	0	0	0	0	0	993
5 VILA PRAIA VITORIA	0	0	0	60	1234	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1295
6 CORVO	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
7 HORTA	0	0	0	0	0	0	299	0	0	0	0	0	0	0	0	0	0	0	0	299
8 LAJES DAS FLORES	0	0	0	0	0	0	0	39	3	0	0	0	0	0	0	0	0	0	0	42
9 STA CRUZ FLORES	0	0	0	0	0	0	0	1	49	0	0	0	0	0	0	0	0	0	0	50
10 LAJES DO PICO	0	0	0	0	0	0	0	0	0	55	1	2	0	0	0	0	0	0	0	58
11 MADALENA	0	0	0	0	0	0	1	0	0	0	59	1	0	0	0	0	0	0	0	61
12 SAO ROQUE DO PICO	0	0	0	0	0	0	0	0	0	0	1	51	0	0	0	0	0	0	0	52
13 VILA DO PORTO	0	0	0	0	0	0	0	0	0	0	0	0	130	0	0	0	0	0	0	130
14 LAGOA	0	0	0	0	0	0	0	0	0	0	0	0	0	124	0	169	1	2	1	297
15 NORDESTE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	0	50
16 PONTA DELGADA	0	1	0	0	0	0	2	0	0	0	0	0	1	0	0	1597	0	8	2	1611
17 POVOACAO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	105	0	0	108
18 RIBEIRA GRANDE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78	3	393	0	474
19 VILA FRANCA CAMPO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	1	1	1	76	93
20 AZORES	94	60	93	874	1409	3	303	42	52	56	61	54	131	124	50	1862	110	404	79	5861