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ESTIMATING TRADE FLOWS BETWEEN PORTUGUESE REGIONS USING AN INPUT-OUTPUT APPROACH

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ABSTRACT

The paper we intend to present aims to estimate the trade flows existing between the seven Portuguese regions, considering 49 distinct commodities. This estimation is based on the construction of a multi-regional model that requires the elaboration of an Input-Output table for each one of the regions. These tables were achieved by using non-survey methods, having the Portuguese table as a starting point. However, it was possible to work, on a great part of the estimation procedure, with a considerable high level of detail: 291 commodities and 276 industries. The first proxy to the trade flows was obtained considering that the interregional net exports corresponded to the difference between total resources (supply) and total employment (demand) of the 49 commodities. These values were then modified in order to consider the existence of crosshauling. Finally, gravitational models were used to get to the final values of the trade flows between the seven regions.

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1. INTRODUCTION

There are not many studies related to the external trade of the regions, whether we consider external trade as being international exchanges or interregional trade. This gap is mainly due to the frail statistical coverage of this issue; in fact, interregional trade is not covered by official statistics in most countries, which results in it having to be estimated by whoever has an interest in it. The situation is however different regarding to international trade since, in many countries, national surveys on these trade flows allow for a regional distribution[1]. Besides the lack of statistical information related to the external trade of the regions, there is indeed a little interest on behalf of regional economics on this subject. In the 80's, when an important majority of economists believed that exportation could play a major role in the economy's growth, some authors transcribed this idea at a regional level[2]. Later, when theories on economic growth based on the availability and efficiency of resources became predominant in literature, interest also declined at a regional level in regard to demand, exports included.

The analysis of the region's external trade may however be important in other perspectives beyond regional economic growth. A deficit in the trade balance (including goods as well as services in this concept) means that the region relies on income transfer and/or granting of savings from other regions, within the country or from the rest of the world. In a more detailed perspective, knowledge about regional external trade, segmented by commodities, allows us to characterize productive specialization, foresee eventual productive weaknesses as well as determine the region's dependency on the exterior (or in some cases the exterior's dependency on the region) regarding to the supply of different commodities.

This paper, which refers to the year 1995, aims at analysing the trade balance of the Portuguese regions. This balance is made up of 3 essential parts: international trade of goods and services, the balance between the consumption of non-residents in Portugal

and international consumption by residents[3] and finally, interregional trade. Interregional trade, which was estimated by us, includes the balance of consumption by households on other regions, when they travel within the country. This paper also focuses on, but in less detail, the main commodities that make up these parts of the trade balance. The analysis of the regional trade balances is performed in section 3.

The estimation of interregional trade is obviously a very essential part of this work. This estimation was elaborated through the input-output tables obtained for the 7 Portuguese regions that resulted from the regional decomposition of the national input-output table. Interregional trade of each region is the residue between supply and demand of 49 groups of commodities that correspond to the same number of columns and rows in the regional input-output table. The above-mentioned supply and demand already include the amounts corresponding to international trade of goods and services as well as consumption associated to tourism flows or other reasons for travelling abroad. This input-output approach on interregional trade had already been undertaken by the authors in previous studies (Sargento, 2002; Sargento e Ramos, 2002; Ramos e Sargento, 2002), referring then to only one Portuguese region, *Região Centro*. Other studies for other Portuguese regions, also used similar approaches to the one now consistently used for all regions, namely the CCRN / MPAT (1995), for *Região Norte* referring to 1990, as well as CIDER / CCRA (2001) for the *Algarve* referring to 1994[4]. One outstanding aspect in our paper is that in simultaneously estimating the input-output tables for all Portuguese regions, and despite sometimes using a simpler method than others aimed at only one region, it was possible to preserve the consistency between the regional tables estimated and the Portuguese input-output table. Section 2, which follows this introduction, enumerates some strong points of the input-output approach used in estimating interregional trade. This paper includes an Annex with a short description of the process followed in constructing the regional input-output tables.

The results summarized in this paper are part of a much larger project entitled as OIKOMATRIX II[5], which involves researchers from 3 Portuguese universities (Aveiro, Coimbra and Lisbon) as well as one polytechnic institute (Leiria). This project aims at assembling a multi-regional input-output model[6] and uses it mainly in evaluating the environmental impact of gases with greenhouse effect (mainly CO_2). Due to this we could not be satisfied with the mere characterization of the trade balances of the regions,

rather we need to estimate interregional trade matrixes for the different groups of commodities, displaying the trade flows for each commodity between the region of origin and the region of destination. Section 4 describes an attempt in accessing these types of tables for two groups of commodities ("Textiles and Clothing" and "Other Construction Materials"), in a context of very little basis information to start with. These interregional trade matrixes should ideally consider gross imports and exports of the different regions, but our method of estimating interregional trade only provides net values: exports minus imports. In other words, we were faced with the well-known crosshauling problem. In order to deal with it we assumed some hypotheses that allowed us to obtain values for gross imports and exports of the 2 commodities for the 7 regions. But in relation to "Textiles and Clothing" it was not possible to converge our interregional trade estimating model through gross exports and imports. Therefore we had to apply the model starting with the net values (exports subtracted from imports).

Section 5 presents the main conclusions of this paper.

2. SOME STRONG AND WEAK POINTS OF THE INPUT-OUTPUT APPROACH IN ESTIMATING INTERREGIONAL TRADE

The main alternative usually presented to the input-output approach in estimating interregional trade is the Location Quotient (LQ) method. The confrontation between our approach, known as the input-output method, and the LQ is the fundamental purpose of Sargento (2002) and Sargento and Ramos (2002). The LQ method can, in fact, be used to estimate external trade as a whole, or solely interregional trade, being international trade known in another manner. Estimation of external trade (or merely of interregional trade) through the LQ method can be inserted into a regional input-output table. In this case the residue between supply and demand, in the different commodities, must be included in another variable, or can be distributed through the different sources of supply and demand[7].

However the main idea of the LQ method constitutes as well (paradoxically) its most relevant limitation. The LQ assumes that the demand structure in the regions is similar to that of the country, allowing it to be assessed by any proxy variable (for example, employment). Therefore, if a region, in contrast to the country, is specialised in a certain

commodity, it is a net exporter of that commodity. On the other hand, if a certain commodity has a low production in the region, then that region is forced to import it in net terms. The problem however is that if the regions are specialised in a certain commodity *k* then they should also deviate their demand towards the commodities *l* that are used as intermediate consumption to the production of commodity *k*. Thus, any similarity between the regional demand structure and the national demand structure may not be truthful.

An example for *Região Centro* allows us to enlighten this problem. The importance that paper pulp production assumes in this region causes for great demand of forestry products. Therefore, *Região Centro,* which is said to possess the largest forest area in Europe, is a net importer of these commodities (following our estimation by the input-output method). The LQ suggested however that this region exports forestry products.

Besides this problem we can also prove[8] that the LQ implies that:

- the sum over the regions of the exports of each commodity, subtracted from imports, shall equal to zero (which is only an excessive outcome if the method is used to estimate total external trade, being a desired result if the intention is that of estimating interregional trade);
- the sum over the commodities of net exports of each region shall equal to zero (this means that the method forces the equilibrium of the trade balance in each region, which is obviously constraining).

The weak points of the LQ are, by opposition, the strong points of the input-output approach in estimating regional trade. However, the input-output approach does also have its drawbacks, of which we point out the following:

- In assuming that external trade is calculated through a residue between supply and demand of the different commodities, we accept the tainting of these estimates by mistakes made in determining internal supply and demand of the commodities (this problem is however less relevant if the determining of supply and demand is done with greater precision; bearing this in mind, we proceeded to estimate supply and demand considering a degree of segmentation, which in some components reached 291 commodities and 276 sub-industries)

- Secondly, the input-output approach only allows for the calculation of the value of exports subtracted from imports, that means net exports, and never the gross value of these two flows.

A different approach in estimating external regional trade, specifically interregional trade, is proceeded in Ramos (2001). The main objective here is to observe interregional trade through transport surveys. The problem, in this case, arises from the fact that Portuguese statistics only account for physical quantities transported and not the actual value of the transported merchandises. This fact prevents a global analysis of regional trade since it is not possible to mingle the different commodities in a trade balance. On the other hand, and even in a commodity by commodity analysis, transport statistics suggest that the main flows take place in raw materials and commodities with low level of transformation, which have high weight but low value, in detriment of the most transformed products, which end up having a greater per unit value. A second problem is that of the products classification used in those statistics, which is very different from the classification of external trade, or others, used by the National Accounts, when referring to industries or commodities.

3. THE TRADE BALANCE OF THE PORTUGUESE REGIONS

Table nº 1 shows our estimative of the trade balance of the Portuguese regions referent to 1995. We also emphasize the main components of this trade balance, which are: international trade, consumption by non-residents on national territory (subtracted from consumption by residents on foreign territory), as well as interregional trade.

The most outstanding point in Table nº 1 is the deficit recorded in the total trade balance of almost all regions. This fact is however natural given the global deficit of the Portuguese trade balance. In fact, data suggest that international imports are deemed to be made mainly through *Lisboa e Vale do Tejo* region, which then reexports the commodities, possibly after some kind of transformation, to the other regions[9]. The result is a significant surplus on interregional trade observed in this region.

TABLE Nº1 – Trade Balance of the Portuguese Regions

	International Trade	Net consumption by non-resid.	Interregional Trade	Total	% GDP
Região Norte	227598	-18563	-279390	-70355	-1.4
Região Centro	27353	39069	-276736	-210314	-9.0
Lisboa e V. Tejo	-1870608	135963	966995	-767650	-11.6
Alentejo	78418	19682	117784	215884	31.2
Algarve	7315	198298	-294921	-89308	-16.3
Açores	-5971	409	-71865	-77427	-28.7
Madeira	18982	67011	-161859	-75866	-23.8

Unit: 10^6 escudos

There is however one region that is an exception to the general situation of the trade deficit: the *Alentejo.* This is a very curious fact since the *Alentejo* is a relatively poor region; it possesses the lowest GDP *per capita* of all regions in mainland Portugal. In fact, this surplus noticed in *Alentejo* may be related to the causes of its relative underdevelopment, rather than be a symptom of economic vitality. Indeed, trade surplus is the counterpart of deficit positions in other components of the balance of payments, presumably in the capital account and in the capital income balance. The deficit in capital income is probably due to the fact that this region harbours a significant number of capital-intensive industries, which distribute their surpluses to other regions within the country or even abroad. However, we believe that this drainage of income is not sufficient to explain the trade surplus. Hence we may presume, concerning the year 1995, and possibly other recent years, that the development of the *Alentejo* might have been jeopardized due to capital outflows, which, very likely, have been directed at the richest regions of the Portuguese territory.

An opposite situation to that of the *Alentejo* might have occurred in regions like *Lisboa e Vale do Tejo* and the *Algarve.* The trade deficit of these regions – an huge absolute value in the case of *Lisboa* but also very significant in the *Algarve,* bearing in mind this region's small size – might have been financed due to the capability these regions have in attracting capital from other regions as well as from abroad (Portugal was, during this

period, a receiver of a significant inflow of capital). Remittances of emigrants in *Região Centro* as well as in *Açores* and *Madeira* may also have played a very significant role in financing their trade deficits. The latter two regions – the islands – also benefited from a favourable redistributive process taken up by general government.

Table nº 2 shows the main import and export commodities (net balances) at international level as well as at interregional level.

TABLE Nº 2 – The major trade imbalances of the Portuguese Regions

	Net Exports		**Net Imports**	
	International	**Interregional**	**International**	**Interregional**
Região Norte	1. Textiles and clothing 2. Leather goods and theirs substitutes	1. Textiles and clothing 2. Beverages	1. Extraction and transformation of ferrous and non-ferrous minerals 2. Chemical products	1. Business services 2. Extraction and refining of oil products
Região Centro	1. Paper and graphic arts and edition of publications 2. Porcelain, earthenware and pottery	1. Slaughtering and preserving of meat 2. Canned fish and other fishing products	1. Non-electrical machinery 2. Chemical products	1. Extraction and refining of oil products 2. Business services
Lisboa e Vale do Tejo	1. Maritime and aerial transport 2. Services related to transportation	1. Business services 2. Chemical products	1. Transport material 2. Extraction and refining of oil products	1. Textiles and clothing 2. Electricity, gas and water
Alentejo	1. Extraction and transformation of ferrous and non-ferrous minerals 2. Chemical products	1. Extraction and refining of oil products 2. Agriculture and hunting	1. Agriculture and hunting 2. Non-electrical machinery	1. Textiles and clothing 2. Transport material
Algarve	1. Canned fish and other fishing products 2. Maritime and aerial transport	1. Restaurants and hotels 2. Agriculture and hunting	1. Non-electrical machinery 2. Textiles and clothing	1. Textiles and clothing 2. Extraction and refining of oil products
R. A. Açores	1. Canned fish and other fishing products 2. Dairy products	1. Agriculture and hunting 2. Dairy products	1. Agriculture and hunting 2. Transport material	1. Chemical products 2. Textiles and clothing
R. A. Madeira	1. Maritime and aerial transport 2. Services related to transportation	1. Maritime and aerial transport 2. Banking and other financial services	1. Business services 2. Slaughtering and preserving of meat	1. Textiles and clothing 2. Extraction and refining of oil products

We emphasize the importance that services have on the exports of various regions, like maritime and aerial transport for example. If this prominence in *Região Autónoma da Madeira* is associated to the existence of an offshore zone, in *Lisboa e Vale do Tejo* it is mostly due to reparation services. As for the "Textiles and Clothing" an enormous imbalance in interregional trade shall also be stressed, as one region has this commodity as its main (interregional and international) export, when five of the remaining six regions have "Textiles and Clothing" as their main interregional import. This is one of the reasons why we chose "Textiles and Clothing" as one of the commodities we will focus our attention on.

4. INTERREGIONAL TRADE MATRIXES AND THE CROSSHAULING PROBLEM

In the introductory part of this paper we explained that beyond our interest in the trade balances for the Portuguese regions, we mainly aim to develop a methodology which allows for the construction of interregional trade matrixes for the different commodities exchanged between regions. These tables have the following structure:

TABLE Nº 3 – Interregional Trade Matrix for Commodity *k*

Imports of / **Exports of**	**Total**	**Region 1**	**Region 2**	**Region 3**
Total	-	M_1	M_2	M_3
Region 1	X_1	-	x_{12}	x_{13}
Region 2	X_2	x_{21}	-	x_{23}
Region 3	X_3	x_{31}	x_{32}	-

in which X_i are the exports of region i, M_i the imports of i, and x_{ij} the exports of region i with region j as destination.

The problem in Portugal is that not only the x_{ij} but also the vectors X_i and M_i, referring to gross exports and imports of the regions, are unknown. Our input-output method in estimating interregional trade solely provides net exports of commodity k (X_i - M_i) for each region i. Estimating the gross values of X_i and M_i, having the differential X_i - M_i as

a starting point, leads to the crosshauling problem. After solving this problem, the next step is obtaining the whole interregional trade matrix, which consists of estimating the flows x_{ij}.

The preliminary nature of this paper led us to opt for concentrating our attention only on 2 groups of products in our input-output tables: "Textiles and Clothing" as well as "Other Construction Materials"[10]. The choice of these two commodities is partially justified by the different role that distance between regions should play in explaining the flows of interregional trade in each case. Whilst in the case of "Textiles and Clothing" we anticipated that distance would be of little relevance in determining an interregional trade pattern, in "Other Construction Materials" we expected the exact opposite (due to the fact of these commodities being heavy by nature, therefore making the cost of transportation more significant). A second reason, which led to choosing these commodities, is related to the existence in transport statistics (which gives information in physical quantities) of two commodity groups, according to specific classification of those statistics, not very different from the ones we used.

Firstly we surpassed the crosshauling problem by assuming the following hypothesis:

$$(1) \qquad \min (X_i, M_i) = b. \min (S_i, D_i)$$

in which S_i and D_i are, correspondingly, the total supply and demand of commodity *k* in region *i* (before accounting interregional net exports on either side). After knowing $\min (X_i, M_i)$ and the differential $X_i - M_i$ we can immediately calculate gross exports and imports. Parameter b, which was unknown, was assumed as being 30% for "Textiles and Clothing" and 10% for "Other Construction Materials". These values were settled through the examination of interregional trade compared to total intra and interregional trade (in physical quantities), recorded in transport statistics for similar commodities.

The interregional trade flows of commodity *k* – the x_{ij} found in the heart of the table – were derived from the following gravitational formula:

$$(2) \qquad x_{ij} = A_i \frac{(P_i P_j)^{\alpha}}{d_{ij}^{\beta}}$$

in which P_i and P_j are the weights of regions *i* and j – these weights were assessed through the total output of k in those regions – and d_{ij} is the distance in kilometers between the two regions. This distance corresponds to motorway or main road routes between the main cities of each region (Porto, Coimbra, Lisbon, Évora and Faro) in the case of the mainland. In the case of the islands this distance was measured as a straight line between Lisbon and each of the archipelagos, assumed as equal for all mainland regions[11]. A_i's, α and β are parameters.

We are however faced with a double problem in applying the above-mentioned gravitational formula:

- on one hand the parameters A_i, α and β are unknown and there is no information that allows us to estimate them.

- On the other hand, it is mathematically impossible to exactly calculate the x_{ij} through the gravitational formula and, at the same time, verify the summing up constraints: $\sum_j x_{ij} = X_i$ and $\sum_i x_{ij} = M_j$. Considering the seven Portuguese regions, this would constitute a system of 14 equations for only 9 unknowns.

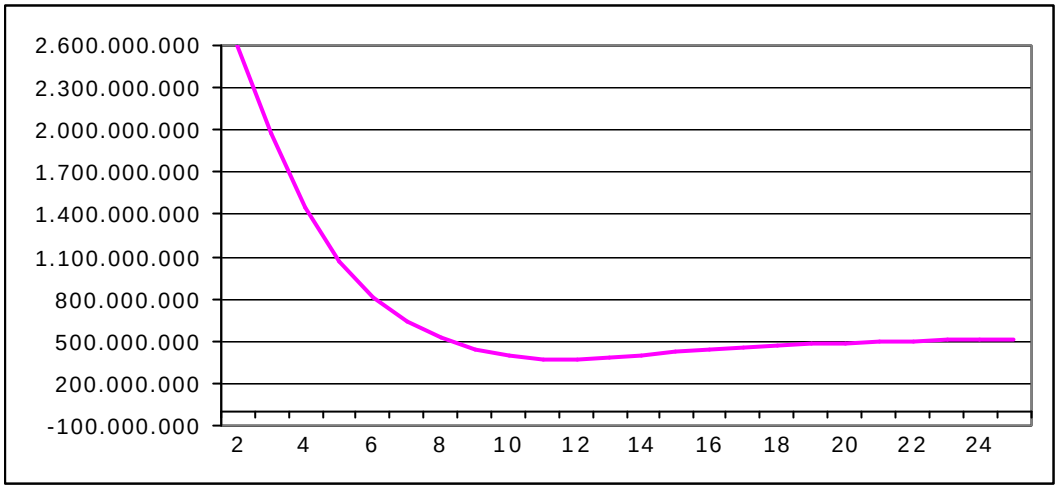
The adopted solution consisted in the following procedure:

1) Parameter α was arbitrarily assumed as being equal to 1.
2) Parameters A_i were chosen to guarantee the exact observance of the row summing up constraints $\sum_j x_{ij} = X_i$. This is $A_i = X_i \left(\sum_j \frac{(P_i P_j)}{d_{ij}^{\beta}}\right)^{-1}$
3) Parameter β was chosen by way of minimizing the following error indicator in the column constraints:

(3) $$I = \sum_j \left(\sum_i x_{ij} - M_j \right)^2$$

Parameter β was in reality assessed by a process of direct search through a grid of values. Diagram 1 gives the values of I depending on β, for commodity "Other Construction Materials".

DIAGRAM 1 – Distribution of indicator I depending on parameter b



We found then that I was minimized when β = 10,64. In the case of "Textiles and Clothing" I was minimized when β = 0, demonstrating the irrelevance of distance in explaining interregional trade for this commodity.

This was however only the first step in the process of estimating the interregional trade tables, which allowed for obtaining initial values for the x_{ij}. The second step consisted of forcing the simultaneous observance of the summing up constraints $\sum_j x_{ij} = X_i$ and $\sum_i x_{ij} = M_j$ by means of an iterative process similar to the RAS technique.

The results obtained for "Other Construction Materials" are shown in Table nº 4. As for "Textiles and Clothing" the problem was that the iterative process did not converge. Faced with this issue (and also because our solution to the crosshauling problem was obviously arbitrary), we tried then to adjust an interregional trade matrix to the net trade flows. This is, the exports column X_i was filled in with exports subtracted from imports when this differential was positive, and in other cases a zero was put down. In the imports row M_i, net imports were filled in, or zero was assumed when this differential was negative. The x_{ij} are in this case also net export flows, which indicate the trade

surplus of each region in superavit with each of the regions in deficit. In this version we obtained an interregional trade matrix for "Textiles and Clothing" which is shown in Table nº5. In this case, parameter β was also estimated as being equal to zero.

TABLE Nº 4 – INTERREGIONAL TRADE MATRIX

"Other Construction Materials"

	Norte	Centro	LVT	Alentejo	Algarve	Açores	Madeira	Total
Norte	0	2028	1212	0	0	6	16	**3262**
Centro	46099	0	4585	0	0	0	0	**50685**
LVT	16251	2706	0	4868	1067	1797	5004	**31693**
Alentejo	0	0	257	0	0	0	0	**257**
Algarve	0	0	4202	0	0	5	14	**4220**
Açores	0	0	0	0	0	0	0	**0**
Madeira	0	0	0	0	0	0	0	**0**
Total	**62351**	**4734**	**10256**	**4868**	**1067**	**1808**	**5034**	

Unit: 10^6 escudos.

TABLE Nº 5 – INTERREGIONAL TRADE MATRIX (NET FLOWS)

"Textiles and Clothing"

	Norte	Centro	LVT	Alentejo	Algarve	Açores	Madeira	Total
Norte	0	0	236290	31942	53450	13670	26014	**361365**
Centro	0	0	15145	2047	3426	876	1667	**23161**
LVT	0	0	0	0	0	0	0	**0**
Alentejo	0	0	0	0	0	0	0	**0**
Algarve	0	0	0	0	0	0	0	**0**
Açores	0	0	0	0	0	0	0	**0**
Madeira	0	0	0	0	0	0	0	**0**
Total	**0**	**0**	**251435**	**33989**	**56875**	**14546**	**27681**	

Unit: 10^6 escudos.

5. CONCLUSIONS

The method proposed in this paper for the estimation of interregional trade, namely the input-output approach, allows for estimates of values of exports, net of imports, for each

region and commodity. This estimative of interregional trade, when attached to international trade balance, and to the difference between consumption by non-residents on national territory and consumption abroad by residents, allows for the construction of trade balances for the various Portuguese regions. The analysis of these trade balances is interesting in itself, inasmuch as the counterpart of these balances are savings flows, income or other kind of transfers, to or from the region, coming from or directed to the rest of the world, this is, the remainder of national territory or abroad.

However, these estimates of net interregional exports do not fully fit our last resort purpose, namely the construction of a multi-regional input-output model. It is therefore necessary to obtain interregional trade matrixes that clearly identify the region of origin and the region of destination of each export flow. This paper rehearses a practical methodology for assessing these types of matrixes, even when almost no basis information to start from is available. The proposed method was however only applied to two groups of products: "Textiles and Clothing" and "Other Construction Materials". The results obtained are mildly satisfactory, but it is still necessary to apply this endeavour to other commodities, as well as evaluate and introduce various improvements to increase reliability of the estimates.

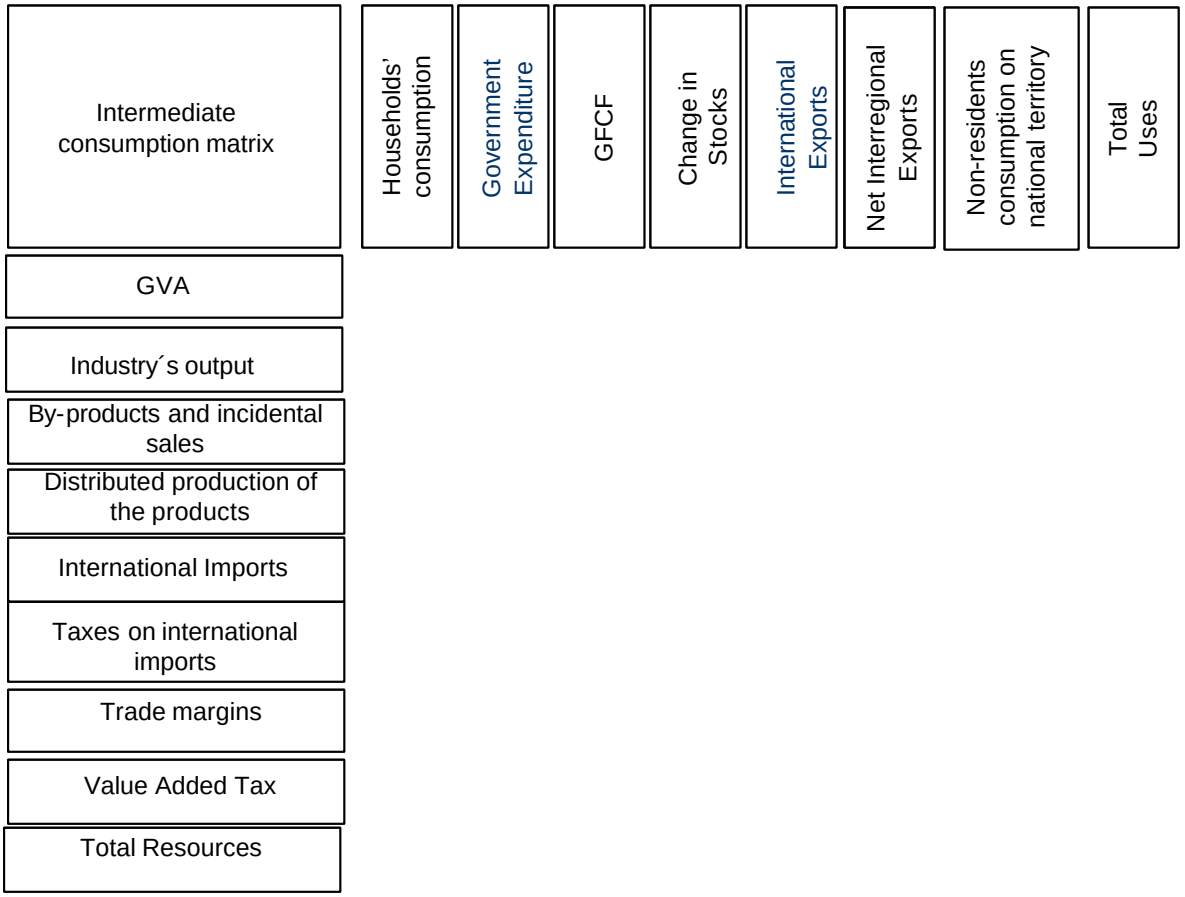
ANNEX

CONSTRUCTION OF THE INPUT-OUTPUT TABLES FOR THE PORTUGUESE REGIONS

The regional Input-Output tables considered in this paper refer to the year 1995 and are similar in their structure to the national Input-Output table provided by the Portuguese National Accounts, still in the form of the European System of Accounts of 1979. In these tables, the row and column sums equal respectively total demand and total supply of the commodities, being international imports accounted in the supply side. Intermediate consumption includes commodities interregionally and internationally imported and not exclusively those produced in the region. The values of total intermediate consumption by industries, gross value added (GVA) and the industry's output correspond to the official estimation of the Portuguese Regional Accounts. Total

input and output are at purchaser's prices. Figure A1 represents the standard structure of a Input-Output table of a Portuguese region.

Figure A1 – Structure of the Input-Output table



Intermediate Consumption Matrix

This table is achieved by assuming that the intermediate consumption coefficients of the region are equal to those of the country. The intermediate consumption coefficient is the weight of each commodity on the total intermediate consumption of the consuming industry, which is known beforehand for the regions. The hypothesis of "equal technology" is assumed at a segmentation level of 291 commodities and 276 sub-industries, making it compatible with different technical coefficients in the regions at a more aggregated level, reflecting different sub-industry structures within the industries considered. The exception to this methodology was "Electricity". In this case, the location within the different regions of hydroelectric and thermal power plants was taken into account.

Households' Consumption

Households' consumption on the economic territory results from the subtraction of consumption outside the national territory from the households' total consumption. The estimation of consumption outside the national territory by households of each region was based on information gathered by the Survey on Holidays – 1995, elaborated by INE (the Portuguese National Institute of Statistics). The structure by commodities of this consumption outside the economic territory was assumed as being equal in all regions, and supposedly also equal to the structure by commodities of non-residents' consumption on national territory (please, read ahead).

The total consumption of resident households (inside and outside the national territory) was obtained in two stages. Firstly, we calculated the total regional consumption – not segmented by commodities – by multiplying the households' income (known through the Regional Accounts) by an estimation of the average consumption propensity. The average consumption propensities used in this calculation is an average of those obtained through three methodologies: the regional propensities to consume shown in the Survey on Households' Budgets 1995, elaborated by INE; those deriving from another study by INE relating to regional purchasing power (EPCC, 1997); and finally the results of assuming that the savings structure by region is equal to the regional structure of private deposit interest. In a second stage, we decomposed households' consumption in each region by commodities, using the Survey on Households' Budgets 1995, as a starting point.

After segmenting by regions the total consumption of households as well as its consumption outside national territory, we calculated the consumption on national territory, by commodities, of resident households in each region. A problem arose in this process since the results obtained in adding up households' consumption on national economic territory, over regions, for each commodity, resulted in a different value from that in the Portuguese National Accounts. The adjustment of our estimates to the values in the National Accounts was done through an iterative method similar to the RAS technique. This was also done in order to maintain regional households' income values coherent to those in official statistics.

Non-Residents Consumption on National Territory

The total value, without discriminating by commodities or by regions, was the only value known beforehand for this item. In estimating this value at a regional level we divided travellers into 2 groups, those who spent at least one night in Portugal, and those who entered and exited the country on the same day. These 2 groups were distributed per regions in distinct manners. In the first case we used a structure based on the night's lodging of non-residents in the regions. In the second, and due to the lack of suitable information, we used the weight of each region in the production of the "Restaurants" industry (presumably the most representative expense in this group) as a key. Bearing information from official statistics in mind, the distribution of consumption by commodities was done in a different manner for each of these two groups of travellers. But, for each group, this estimated structure was assumed to be equal in all regions.

Government Expenditure

It was assumed that Government Expenditure does not admit exports or imports; thus, the value of consumption was calculated based on the region's production of non-market services.

Gross Fixed Capital Formation (GFCF)

In what concerns the GFCF, a specific regionalising methodology was developed only for the most relevant commodities. The values per region for the remaining commodities were obtained through the simplified Change in Stocks methodology ahead. It was assumed that in the "Construction", the location of production is also the place of investment, which means that both international and interregional trade flows are equal to zero. Thus, the GFCF was supposedly equal to the difference between total supply and total demand of the product of this industry. The values corresponding to investment in machinery and tools were obtained in consideration with each region's weight on national imports of the above-mentioned commodities. Finally, it was assumed that investments made in "Recycling and Repairing Services" are complements of other investments; therefore, the weight of a region on this type of GFCF was considered equal to the weight of the total regional GFCF on the national one, excluding this kind of services.

Change in Stocks

In estimating change in stocks, it was assumed that the expended value, at a regional level, is a proportion of what is observed at a national level, having the weight of the commodity output in the region on the national commodity output as a segmenting by region key (this is, in fact, a very simplified hypothesis, to the extent that the change in stocks of raw materials should depend on the production of the consumer industry and not on the output of the raw material itself).

International Exports and Imports

International exports and imports of goods by regions were directly known through the surveys elaborated by INE. The exportation of services was assumed as being proportional to the production of the particular industry in the region, and the importation of these services assumed as proportional to the regional intermediate consumption of this service by other industries.

By-Products and Incidental Sales

The by-products and incidental sales were assumed as being proportional to the industry's output in which they are produced (those with a " – '' sign in the table), and distributed by industries according to the nature of their main commodities (those with a "+'' sign in the table). The latter procedure was done using the same structure in each region and in the country. The Distributed Production of the products is calculated by the algebraic sum of by-products and incidental sales with the industry's output.

VAT, Taxes on Imports and Trade Margins

It was assumed that the tax or margin rates implicit in the national table were also valid for the regions.

FOOTNOTES

[1]Which is the case of Portugal regarding to goods flows, but not the case when it comes to services. Please refer to the Annex on this topic.

[2] See, for example, Thirlwall (1980).

[3] These balances associated to tourism flows, or other purposes for travelling abroad, were distributed throughout the regions through various indicators, as described in the Annex.

[4] We must also point out a pioneer study, developed for a Portuguese sub-region – Beira Interior – for the year 1986 (Reigado, 1996), where, however, all external trade – international or interregional – is given by the input-output residue.

[5] Project financed by the Portuguese Science and Technology Foundation. The first OIKOMATRIX, whose final report is Castro *et al* (2002), was not at a regional level. OIKOMARIX II is currently under way.

[6] In other countries, the growing attention given to regional external trade and, specifically, to interregional trade, is also associated to regional input-output models (for example, Piispala, 1999).

[7] Harris and Liu (1998) admit this approach, in which the LQ estimation of external trade is included in an input-output table, as an alternative to the assessment of external or interregional trade by the supply/demand residue. For an analysis of the various methods used in estimating external trade, see also West (1990).

[8] Sargento (2002), p. 30.

[9] International imports should be registered in the destination region, and not in the regions where they solely go through, where there is not a significant addition of value. It is, however, extremely difficult, to make such perfect distinction between international and interregional trade. Another problem is related to the fact that in the case of trade with non-members of the European Union, exports (imports) are allocated to regions according to the location of the of the exporter's (importer's) headquarters, which, in most cases, is Lisbon, even when the activity is developed in other regions. Given the small relative importance of Portuguese trade with non-members states, we believe that the above-mentioned is not a major problem, except perhaps in the case of oil products.

[10] Mainly cement, but also clay products (brick and others), lime and plaster.

[11] Transport to the islands, if done by aerial transport, is certainly more expensive than transport by road between mainland regions. We considered, however, that the distance to the islands were substantially great to discourage interregional trade, even though not considering this added cost.

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