

High Employment Generating Sectors in Portugal: an Interindustry Approach

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Abstract - An increase in the unemployment rate is one of the most serious consequences of macroeconomic crises. In Portugal, the impact of the recent recession has been particularly strong. In this paper, after quantifying this macroeconomic problem, an interindustry approach is used in order to identify the high employment generating (or destructing) sectors. This approach is particularly interesting because it considers not only the direct flows of job creation and destruction, but also the employment changes attributable to the indirect and induced effects of interindustry connections (the flows of intermediate inputs supply and demand). Using the so-called hypothetical extraction (or “shut-down of industry”) method and the employment and interindustry data of the Portuguese economy, the key sectors in terms of multipliers, elasticities and the creation of jobs are identified. The empirical results of this paper can be useful in improving the policy responses to the crisis and carrying out the most appropriate measures to stimulate the economy.

Keywords: Input-output analysis; hypothetical extraction; employment.

1. Introduction

The significant rise of the unemployment rate is one of the most serious consequences of macroeconomic crises. In Portugal, the impact of the recent recession has been particularly strong, putting unemployment at the center stage of policy makers' concerns. Unfortunately, after a brief period of anti-cycle, expansionary measures in 2009, the serious deterioration of budget imbalances (public deficit and debt as a percentage of GDP) and the instability of financial markets (e.g., Greece and Ireland cases), obliged the Portuguese Government to launch in 2010 an austerity program in successive rounds (*Programas de Estabilidade e Crescimento*¹ - *PECs 1, 2 and 3*) that have seriously deteriorated the macroeconomic context. After the refusal of *PEC4* in the Portuguese *Parlamento*, the minority government fall and the new government is implementing the strong austerity program negotiated with the so called *troika* (EU, ECB and IMF) as a requisite for financial

support. The main result of all these political and economic events is a double dip recession of consequences not yet fully quantifiable, with the last official previsions pointing to a GDP decay of 2,8% and an unemployment rate

The first purpose of this paper, after quantifying the macroeconomic imbalances of the Portuguese economy with a focus on real variables, such as economic growth, employment and unemployment, is to make a descriptive analysis of its employment structure by industries, and the main changes between 1995 and 2005.

The second purpose is to shed more light on this subject, using an interindustry approach in order to identify the high employment generating (or destructing) sectors. This approach is particularly interesting because it considers not only the direct flows of job creation and destruction, but also the employment changes attributable to the indirect and induced effects of interindustry connections (the flows of intermediate inputs supply and demand). Using the so-called hypothetical extraction (or “shut-down of industry”) method and the employment and interindustry data of the Portuguese economy, the key sectors in terms of multipliers, elasticities and the (direct plus indirect) jobs creation are identified.

The empirical results of this paper can be useful in improving the policy responses to the crisis and carrying out the most appropriate measures to stimulate the economy, using the (limited) instruments and resources available (e.g., EU structural and cohesion funds; fiscal benefits; public-private R&D partnerships, etc.) in supporting the industries with strong growth potential and jobs creation capability.

The paper is organized as follows. Section 2 surveys the main macroeconomic trends (1990-2010) of economic growth, employment and unemployment in Portugal and other European countries (EU-27) and provides a descriptive analysis of the structure of employment in Portugal and its changes between 1995 and 2005. Section 3 presents the theoretical

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framework of the interindustry approach used to assess the relative importance of sectors for employment creation, namely the hypothetical extraction method. The empirical results are shown and discussed in section 4 and Section 5 ends the paper with some concluding remarks.

2. Macroeconomic trends and sectoral employment structure

The macroeconomic performance has deteriorated in the European countries both in terms of real GDP growth as in employment creation, in the first decade of the XXI century (OECD, 2011). In Table 2.1 we can see that this trend is particularly clear in Portugal, with average annual GDP growth decaying from 4,22% in 1995-2000 to a mere 0,5% in 2001-2010, leaving many observers to pessimistically talking of “the lost decade”.

Table 2.1 Economic and employment (annual) growth rates, Portugal and EU27

| Years | Real GDP | | Employment | |
|------------------|-------------|-------------|--------------|-------------|
| | Portugal | UE27 | Portugal | UE27 |
| 1995 | 2,31 | 2,65 | -0,75 | 0,61 |
| 1996 | 3,66 | 1,83 | 1,68 | 0,54 |
| 1997 | 4,38 | 2,73 | 2,62 | 0,63 |
| 1998 | 5,05 | 2,98 | 2,81 | 1,27 |
| 1999 | 4,08 | 3,06 | 1,37 | 0,73 |
| 2000 | 3,93 | 3,90 | 2,09 | 1,48 |
| 2001 | 1,97 | 1,98 | 1,82 | 0,90 |
| 2002 | 0,71 | 1,25 | 0,58 | -0,10 |
| 2003 | -0,93 | 1,35 | -0,59 | 0,35 |
| 2004 | 1,56 | 2,51 | -0,08 | 0,68 |
| 2005 | 0,76 | 1,96 | -0,33 | 0,94 |
| 2006 | 1,44 | 3,21 | 0,51 | 1,66 |
| 2007 | 2,39 | 2,98 | -0,04 | 1,81 |
| 2008 | 0,03 | 0,53 | 0,45 | 0,95 |
| 2009 | -2,58 | -4,23 | -2,58 | -1,82 |
| 2010 | 1,26 | 1,84 | -0,93 | -0,55 |
| 1995-2010 | 1,82 | 1,84 | 0,62 | 0,63 |
| 1995-2000 | 4,22 | 2,90 | 2,11 | 0,93 |
| 2001-2010 | 0,50 | 1,24 | -0,34 | 0,43 |

This had a significant effect in unemployment rates, as expected. Portugal was until 2000 a relatively low unemployment country, well below the average of EU-27 (see Table 2.2). However, the weak growth since 2001 and above all the devastating effect of the 2009 recession has completely changed the situation, with a more than doubling unemployment rate between 2001 and 2010, from 4% to 10,5%, whereas the EU27

unemployment rate has augmented only slightly from 8,7% to 9,6%.

So, unemployment is nowadays the main macroeconomic problem of the Portuguese economy, with its pernicious social and political effects, albeit the other great imbalances the country is currently facing, namely the huge public and external debts.

Table 2.2 Unemployment rates in Portugal and in the EU27

| Years | Unemployment rate | |
|-------|-------------------|------|
| | Portugal | EU27 |
| 2000 | 4,00 | 8,70 |
| 2001 | 4,10 | 8,50 |
| 2002 | 5,10 | 8,90 |

| | | |
|-------------|-------|------|
| 2003 | 6,40 | 9,00 |
| 2004 | 6,70 | 9,10 |
| 2005 | 7,70 | 8,90 |
| 2006 | 7,80 | 8,20 |
| 2007 | 8,10 | 7,20 |
| 2008 | 7,70 | 7,00 |
| 2009 | 9,60 | 8,90 |
| 2010 | 10,50 | 9,60 |

In this context, it is important to study in more detail the employment changes in the economy, namely the structure of employment by sectors. Unfortunately, for data availability restrictions, we must limit the period covered to 1995-2005. The data sources are the National Accounts from Statistics Portugal (INE) and the *Departamento de Prospectiva e Planeamento* (DPP, 2004; 2008).

In Table 2.3 we present several employment indicators by sector, namely the structure in 1995 and 2005, and the absolute and relative employment growth. The most significant sectors in terms of employment weight in 1995 are Trade and Repair Services, Agriculture, Construction, Public Administration, Textiles, Education and Health Services, reflecting a long standing problematic specialization in low value added and non tradable industries.

Table 2.3 Employment indicators by sector in Portugal

| NS | Sectors | E_i/E_T 1995 | E_i/E_T 2005 | E_i Abs. Growth | E_i Rel. Growth |
|-----------|---------------------------------------|---------------------------------------------|---------------------------------------------|--------------------------------------|--------------------------------------|
| 01 | Agriculture | 12,26% | 9,45% | -71,895 | -13,69% |
| 02 | Fishing | 0,53% | 0,35% | -6,091 | -26,73% |
| 03 | Mining | 0,34% | 0,33% | 1,319 | 8,98% |
| 04 | Food products and beverages | 2,71% | 2,42% | 0,098 | 0,08% |
| 05 | Textiles | 6,50% | 4,58% | -58,817 | -21,12% |
| 06 | Wearing apparel | 1,80% | 1,19% | -19,708 | -25,63% |
| 07 | Wood and products of wood and cork | 1,49% | 1,18% | -7,21 | -11,33% |
| 08 | Pulp, paper and paper products | 1,21% | 1,04% | -1,685 | -3,25% |
| 09 | Coke, refined petroleum products | 0,03% | 0,02% | -0,4 | -28,57% |
| 10 | Chemicals | 0,60% | 0,46% | -3,551 | -13,90% |
| 11 | Rubber and plastic products | 0,51% | 0,55% | 4,428 | 20,15% |
| 12 | Other non-metallic mineral products | 1,63% | 1,35% | -4,952 | -7,11% |
| 13 | Fabricated metal products | 2,07% | 2,02% | 8,473 | 9,56% |
| 14 | Machinery and equipment n.e.c. | 1,02% | 0,92% | 0,162 | 0,37% |
| 15 | Electrical machinery | 1,22% | 0,96% | -6,125 | -11,71% |
| 16 | transport equipment | 0,81% | 0,75% | 1,032 | 2,96% |
| 17 | other manufactured goods | 1,47% | 1,46% | 7,112 | 11,33% |
| 18 | Electrical energy, gas and hot water | 0,70% | 0,46% | -7,985 | -26,54% |
| 19 | Construction work | 9,67% | 11,06% | 116,655 | 28,17% |
| 20 | Trade and repair services | 16,53% | 17,87% | 149,463 | 21,12% |
| 21 | Hotel and restaurant services | 4,78% | 6,13% | 89,186 | 43,54% |
| 22 | Transports and communication services | 3,87% | 4,05% | 28,532 | 17,20% |
| 23 | Financial services | 2,30% | 1,78% | -13,272 | -13,46% |
| 24 | Real estate services | 4,97% | 6,47% | 97,547 | 45,81% |
| 25 | Public administration | 7,18% | 7,50% | 52,425 | 17,06% |
| 26 | Education services | 5,93% | 6,32% | 48,975 | 19,27% |
| 27 | Health and social work services | 5,35% | 6,34% | 75,099 | 32,81% |
| 28 | Other services | 2,50% | 3,00% | 36,449 | 33,98% |

In 2005, some progress in the pattern of specialization was detected with the decaying weight of some traditional sectors (Agriculture, Fishing, Textiles and Wearing) and the positive absolute and relative growth of Rubber and Plastic Products, Fabricated Metal Products, Machinery and Equipment, Transport Equipment and Other Manufactured Products. This slight improvement is also documented for the capacity to generate value added and diminishing external vulnerability in Lopes et al (2011).

However, this evolution was overcome by the significant (absolute and relative) progression of Non Tradable Services (Real Estate, Hotels and Restaurants, Construction, Health and Other Services). So, we can conclude that much remains to be done in the upgrading of the specialization pattern of Portuguese economy, in the context of the globalization challenges and the ambitious Strategy 2020 recently launched by the European Union in the way of a smart, sustainable and cohesive growth.

3. Theoretical framework

In this section we present the methodology of interindustry analysis that will be used to assess the relative importance of sectors for employment generation in Portugal. We start by presenting the traditional framework in this context, the (open) Leontief input-output model (for a detailed presentation of this model, see Miller and Blair (2009); an interesting empirical study of the Portuguese economy with this kind of model, comparing its structure with the Spanish one, is Amaral et al, 2011).

This Leontief system can be represented as follows:

$$(1) \quad x = \mathbf{A}x + y,$$

where: x means the gross output vector of the n sectors of the economy; \mathbf{A} is the (domestic) technical coefficients matrix (intermediate input requirements per unity of gross output) and y is the sectoral final demand vector (final consumption + gross investment + exports).

The well known solution of this system is

$$(2) \quad x = \mathbf{B}y,$$

with $\mathbf{B} = (\mathbf{I} - \mathbf{A})^{-1}$

Each element of the matrix \mathbf{B} , the so called Leontief inverse, is a production multiplier that gives the total (direct and indirect) effect in one's sector

production of a unity increase in the domestic final demand directed to a given sector. That is, b_{ij} is the global impact on sector's i production when the domestic final demand of sector j increases by one unity.

Considering that the labour coefficients (the requirements of labour, in total hours or number of equivalent workers, per unit of production of each sector, $ec_i = l_i/x_i$) are fixed (a strong hypothesis for a long period of time but reasonable enough in the short run), the traditional (Leontief) employment multipliers can be calculated as (generic case of sector j , with $j = 1, \dots, n$):

$$(3) \quad Em_j = \sum_{i=1}^n ec_i b_{ij}$$

These multipliers give additional information about the employment potential of the different sectors of an economy, considering not only direct flows of job creation in the own sector, but also the indirect and induced effects generated by the interrelatedness of sectors. Generally speaking, more (domestic) interrelatedness means more complexity of the corresponding economy and more employment growth potential (see Amaral et al, 2007). The general case of multiplier Em_j gives the total amount of employment created in the economy (own sector j and all the others) when the final demand directed to sector j augments one monetary unit. Parallel to Rasmussen (1957)-Hirshman(1958) linkage indicators we can consider key sectors those that have an above average employment multiplier.

However, as (traditional) employment multipliers can be misleading because do not take into account the relative (employment and production) weight of each sector, it is useful to complement the analysis with what Valadkhani (2005) calls Type I employment multipliers, or Relative employment multipliers, Rm_j , calculated as:

$$(4) \quad Rm_j = \frac{\sum_{i=1}^n ec_i b_{ij}}{ec_j}$$

This multiplier overcomes the problem of units of measurement, and it means that for each additional person directly employed in sector j , a further Rm_j are employed in the economy due to the multiplier and forward effects of sector j .

It is also possible to assess the relative importance of the different sectors in terms of employment potential using as indicators the employment elasticities (see Mattas and Shrestha, 1991), calculated as follows:

$$(4) \quad Ee_j = \frac{\partial L}{\partial y_j} \cdot \frac{y_j}{L}$$

where L represents total employment in the economy, y_j is final demand directed to sector j and $\frac{\partial L}{\partial y_j}$ is the employment multiplier for sector j .

Using Equation (3) the employment elasticity corresponding to sector j is:

$$(5) \quad Ee_j = \left[\sum_{i=1}^n ec_i b_{ij} \right] \cdot \frac{y_j}{L}$$

The analysis with employment multipliers and elasticities can be complemented with the so called hypothetical extraction method, originally proposed by Paelinck et al (1965) and later employed by many authors, e.g. Strassert (1968), Schultz (1977), Meller and Marfán (1981), Milana (1985), Heimler (1991), Valadkhani (2003) and Kay et al (2007). This method, that Groenewold et al (1993) also called “shut-down of industry”, has been recently improved and extended in Dietzenbacher and Lahr (2008).

The basic idea is to solve the Leontief system after extracting one (or a group of) sector(s), and compare the results, for instance, gross output, value added, employment of the economy and of each other sector with the usual solution (before extraction). Technically, this can be performed with the algebra of partitioned matrices. Suppose we begin by extracting sector one (after this, we can compute the results permuting all and every sector to position one, of course). The algebra is as follows:

Starting by the matrix of technical coefficients A , the first column and the first row are substituted by full zero vectors.

$$(6) \quad \bar{A} = \begin{bmatrix} 0 & 0 \\ 0 & A_{22} \end{bmatrix}$$

The Leontief inverse is now:

$$(7) \quad \bar{L} = \begin{bmatrix} I & 0 \\ 0 & \alpha_{22} \end{bmatrix}$$

$$\text{with } \alpha_{22} = (I - A_{22})^{-1}$$

The solution of the system is given by:

$$(8) \quad \begin{bmatrix} \bar{x}_1 \\ \bar{x}_2 \end{bmatrix} = \begin{bmatrix} I & 0 \\ 0 & \alpha_{22} \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \end{bmatrix}$$

and so, the impact on the sectors' gross output of extracting sector one is measured by:

$$(9) \quad \Delta x^1 = \begin{bmatrix} x_1 - \bar{x}_1 \\ x_2 - \bar{x}_2 \end{bmatrix}$$

and the impact on total gross output is given by:

$$(10) \quad i' \Delta x^1 = i' \Delta x_1^1 + i' \Delta x_2^1$$

As sector one completely “disappears”, the direct impact is its own production. The interesting indicator of this method is the indirect effect of this “disappearing”, the consequences for the other sectors' output, due to backward and forward linkages of sector one and given by the second term on the right of equation (10).

This quantification of impacts on sector' gross output can be used to assess the impacts on sectors' employment, considering the hypothesis of constancy of labour coefficients, previously mentioned. The total relative importance of each sector can be split in two components: the direct effect given by the volume of employment “lost” in the own sector (of straightforward calculation) and the indirect and induced change in the employment of other sectors due to the “shut down” of the sector.

4. Empirical results

Using data on employment by sector from INE and the input-output tables (domestic flows) provided by DPP (2008), we started by calculating the (absolute) employment multipliers and the (relative) Type I employment multipliers of Portuguese sectors in 1995 and 2005. These values are presented in Table 4.1, together with the corresponding sectoral ranks (relative importance of sectors by each criterion, in descending order).

Table 4.1 Employment (traditional and relative) multipliers, Portugal 1995-2005

| | | E_{mj} 1995 | rank | E_{mj} 2005 | rank | R_{mj} 1995 | rank | R_{mj} 2005 | rank |
|----|---------------------------------------|------------------|------|------------------|------|------------------|------|------------------|------|
| 01 | Agriculture | 0,1141 | 1 | 0,0889 | 1 | 1,2182 | 25 | 1,2532 | 25 |
| 02 | Fishing | 0,0601 | 4 | 0,0355 | 10 | 1,1980 | 26 | 1,2014 | 26 |
| 03 | Mining | 0,0344 | 18 | 0,0228 | 17 | 1,4236 | 21 | 1,5093 | 20 |
| 04 | Food products and beverages | 0,0578 | 5 | 0,0388 | 5 | 5,3068 | 2 | 4,3805 | 1 |
| 05 | Textiles | 0,0538 | 8 | 0,0415 | 3 | 1,6554 | 13 | 1,5514 | 18 |
| 06 | Wearing apparel | 0,0523 | 9 | 0,0378 | 6 | 1,6289 | 15 | 1,4845 | 21 |
| 07 | Wood and products of wood and cork | 0,0714 | 2 | 0,0463 | 2 | 2,2822 | 5 | 2,5513 | 5 |
| 08 | Pulp, paper and paper products | 0,0321 | 19 | 0,0221 | 19 | 2,6201 | 3 | 2,1366 | 6 |
| 09 | Coke, refined petroleum products | 0,0059 | 28 | 0,0007 | 28 | 6,7248 | 1 | 3,5735 | 2 |
| 10 | Chemicals | 0,0185 | 26 | 0,0115 | 26 | 2,3654 | 4 | 2,6351 | 4 |
| 11 | Rubber and plastic products | 0,0285 | 21 | 0,0189 | 20 | 1,7313 | 12 | 1,8222 | 9 |
| 12 | Other non-metallic mineral products | 0,0429 | 15 | 0,0248 | 16 | 1,7985 | 10 | 1,7237 | 13 |
| 13 | Fabricated metal products | 0,0482 | 12 | 0,0252 | 15 | 1,5073 | 18 | 1,6958 | 14 |
| 14 | Machinery and equipment n.e.c. | 0,0390 | 17 | 0,0224 | 18 | 1,6110 | 16 | 1,6419 | 15 |
| 15 | Electrical machinery | 0,0251 | 22 | 0,0138 | 23 | 1,6323 | 14 | 1,7538 | 12 |
| 16 | transport equipment | 0,0241 | 23 | 0,0128 | 24 | 2,1717 | 6 | 1,9085 | 8 |
| 17 | other manufactured goods | 0,0547 | 7 | 0,0359 | 8 | 1,5585 | 17 | 1,6126 | 16 |
| 18 | Electrical energy, gas and hot water | 0,0123 | 27 | 0,0071 | 27 | 2,1691 | 7 | 3,2404 | 3 |
| 19 | Construction work | 0,0550 | 6 | 0,0359 | 9 | 1,9009 | 8 | 1,9261 | 7 |
| 20 | Trade and repair services | 0,0503 | 10 | 0,0366 | 7 | 1,3054 | 24 | 1,2596 | 24 |
| 21 | Hotel and restaurant services | 0,0648 | 3 | 0,0390 | 4 | 1,7868 | 11 | 1,5396 | 19 |
| 22 | Transports and communication services | 0,0315 | 20 | 0,0183 | 21 | 1,4834 | 19 | 1,7574 | 11 |
| 23 | Financial services | 0,0230 | 25 | 0,0117 | 25 | 1,3439 | 22 | 1,6056 | 17 |
| 24 | Real estate services | 0,0231 | 24 | 0,0146 | 22 | 1,8628 | 9 | 1,7972 | 10 |
| 25 | Public administration | 0,0480 | 13 | 0,0294 | 12 | 1,0863 | 27 | 1,1428 | 27 |
| 26 | Education services | 0,0491 | 11 | 0,0307 | 11 | 1,0844 | 28 | 1,0713 | 28 |
| 27 | Health and social work services | 0,0465 | 14 | 0,0280 | 13 | 1,3147 | 23 | 1,3507 | 23 |
| 28 | Other services | 0,0400 | 16 | 0,0275 | 14 | 1,4797 | 20 | 1,4552 | 22 |

The top 5 key (absolute) multiplier sectors in 2005 are Agriculture, Wood and cork, Textiles, Hotels and restaurants and Food products. In relative terms (Type I multipliers) Agriculture decay from the first to the 25th position in the rank and Textiles from third to 18th, that is to say, these sectors have mainly a great weight in direct employment. Top 5 sectors are in this second case Food products, Coke and

refined petroleum products, Electricity, gas and water, Chemicals and Wood and cork products.

Next, we have calculated sectoral employment elasticities, shown in Table 4.2.

Table 4.2 Employment Elasticities, Portugal 1995-2005

| | | Ee , 1995 | rank | Ee , 2005 | rank |
|----|------------------------------------|-------------|------|-------------|------|
| 01 | Agriculture | 0,0440 | 9 | 0,0342 | 10 |
| 02 | Fishing | 0,0041 | 24 | 0,0032 | 26 |
| 03 | Mining | 0,0023 | 27 | 0,0017 | 27 |
| 04 | Food products and beverages | 0,0861 | 3 | 0,0688 | 6 |
| 05 | Textiles | 0,0704 | 6 | 0,0496 | 8 |
| 06 | Wearing apparel | 0,0218 | 13 | 0,0143 | 14 |
| 07 | Wood and products of wood and cork | 0,0146 | 17 | 0,0127 | 18 |

| | | | | | |
|----|---------------------------------------|--------|----|--------|----|
| 08 | Pulp, paper and paper products | 0,0115 | 19 | 0,0098 | 21 |
| 09 | Coke, refined petroleum products | 0,0012 | 28 | 0,0000 | 28 |
| 10 | Chemicals | 0,0064 | 22 | 0,0071 | 22 |
| 11 | Rubber and plastic products | 0,0037 | 25 | 0,0057 | 24 |
| 12 | Other non-metallic mineral products | 0,0083 | 21 | 0,0070 | 23 |
| 13 | Fabricated metal products | 0,0089 | 20 | 0,0132 | 17 |
| 14 | Machinery and equipment n.e.c. | 0,0116 | 18 | 0,0122 | 19 |
| 15 | Electrical machinery | 0,0157 | 16 | 0,0142 | 15 |
| 16 | transport equipment | 0,0159 | 15 | 0,0135 | 16 |
| 17 | other manufactured goods | 0,0163 | 14 | 0,0163 | 13 |
| 18 | Electrical energy, gas and hot water | 0,0036 | 26 | 0,0038 | 25 |
| 19 | Construction work | 0,1253 | 2 | 0,1269 | 2 |
| 20 | Trade and repair services | 0,1358 | 1 | 0,1559 | 1 |
| 21 | Hotel and restaurant services | 0,0709 | 5 | 0,0767 | 5 |
| 22 | Transports and communication services | 0,0268 | 12 | 0,0331 | 11 |
| 23 | Financial services | 0,0064 | 23 | 0,0098 | 20 |
| 24 | Real estate services | 0,0381 | 10 | 0,0484 | 9 |
| 25 | Public administration | 0,0780 | 4 | 0,0857 | 3 |
| 26 | Education services | 0,0584 | 8 | 0,0654 | 7 |
| 27 | Health and social work services | 0,0670 | 7 | 0,0777 | 4 |
| 28 | Other services | 0,0272 | 11 | 0,0326 | 12 |

The most important sectors in 2005, along this indicator are: Trade and repair services, Construction work, Real estate services, Health and social services and Hotels and restaurants.

These results are a good indication of the current dilemma of Portuguese decision makers of fighting unemployment with measures to support traditional low value added sectors or facilitating the upgrade of productive structure supporting medium and high technological sectors with low employment.

In fact, in terms of the evolution of employment indicators between 1995 and 2005, there are no substantial changes both in multipliers (absolute and relative) and elasticities, with some minor exceptions. For instance, Textiles sector goes up 5 positions in

the rank of absolute multipliers but comes down in the relative case and the same occurs in

Wearing apparel. The opposite tendency occurs in the case of Fabricated metal products. Fishing has been losing importance only in the absolute multipliers ranking whereas Hotels and restaurants loose in relative multipliers.

On the other side, Transport and Financial services improve significantly the position in the relative multipliers rank. The constancy of relative positions in elasticity rankings between 1995 and 2005 is remarkable with only 3 sectors changing 3 positions (the maximum change in the period): Financial and Health and social services improving; Food products descending. This can be a further sign of the relatively low structural changes in the Portuguese productive structure.

The results obtained with the more sophisticated method of hypothetical extraction or "shut down of industry" hypothesis are shown in tables 4.3 (year 1995) and 4.4 (year 2005).

Table 4.3 Hypothetical extraction - sectoral employment results: 1995

| NS | Sectors | DE | IE | TE | Rank (TE) | IE/TE |
|----|-----------------------------|-------|-------|-------|-----------|-------|
| 01 | Agriculture | 525,2 | 126,8 | 652,0 | 3 | 0,194 |
| 02 | Fishing | 22,8 | 87,1 | 109,9 | 26 | 0,793 |
| 03 | Mining | 14,7 | 90,8 | 105,5 | 27 | 0,861 |
| 04 | Food products and beverages | 116,2 | 455,5 | 571,7 | 4 | 0,797 |

| | | | | | | |
|-----------|---------------------------------------|---------------|---------------|---------------|----|---------------|
| 05 | Textiles | 278,5 | 135,5 | 414,0 | 7 | 0,327 |
| 06 | Wearing apparel | 76,9 | 102,4 | 179,3 | 17 | 0,571 |
| 07 | Wood and products of wood and cork | 63,6 | 130,5 | 194,2 | 14 | 0,672 |
| 08 | Pulp, paper and paper products | 51,8 | 138,2 | 190,0 | 16 | 0,727 |
| 09 | Coke, refined petroleum products | 1,4 | 92,5 | 93,9 | 28 | 0,985 |
| 10 | Chemicals | 25,6 | 113,3 | 138,8 | 22 | 0,816 |
| 11 | Rubber and plastic products | 22,0 | 99,3 | 121,3 | 25 | 0,819 |
| 12 | Other non-metallic mineral products | 69,7 | 120,8 | 190,5 | 15 | 0,634 |
| 13 | Fabricated metal products | 88,6 | 113,6 | 202,2 | 13 | 0,562 |
| 14 | Machinery and equipment n.e.c. | 43,7 | 108,4 | 152,1 | 21 | 0,713 |
| 15 | Electrical machinery | 52,3 | 110,8 | 163,2 | 19 | 0,679 |
| 16 | transport equipment | 34,9 | 121,1 | 156,0 | 20 | 0,776 |
| 17 | other manufactured goods | 62,8 | 115,5 | 178,3 | 18 | 0,648 |
| 18 | Electrical energy, gas and hot water | 30,1 | 96,7 | 126,8 | 23 | 0,763 |
| 19 | Construction work | 414,0 | 263,4 | 677,5 | 2 | 0,389 |
| 20 | Trade and repair services | 707,7 | 231,4 | 939,1 | 1 | 0,246 |
| 21 | Hotel and restaurant services | 204,8 | 240,1 | 444,9 | 5 | 0,540 |
| 22 | Transports and communication services | 165,9 | 129,9 | 295,7 | 11 | 0,439 |
| 23 | Financial services | 98,6 | 27,8 | 126,4 | 24 | 0,220 |
| 24 | Real estate services | 213,0 | 188,5 | 401,4 | 8 | 0,469 |
| 25 | Public administration | 307,4 | 111,3 | 418,7 | 6 | 0,266 |
| 26 | Education services | 254,1 | 104,9 | 359,0 | 10 | 0,292 |
| 27 | Health and social work services | 228,9 | 148,8 | 377,7 | 9 | 0,394 |
| 28 | Other services | 107,3 | 124,3 | 231,6 | 12 | 0,537 |
| 99 | Total | 4282,3 | 3929,2 | 8211,6 | | 0,4785 |

In these tables, the first column corresponds to direct effect (suppression of own employment), the second represents indirect effect (suppression of other sectors' employment due to backward and forward

linkages with the extracted sector) and the third is total (direct + indirect) effect. The rank of sectors is based on total effect and the fifth column is the ratio of indirect to total effect.

Table 4.4 Hypothetical extraction - sectoral employment results: 2005

| NS | Sectors | DE | IE | TE | rank (TE) | IE/TE |
|----|-------------------------------------|-------|-------|-------|-----------|-------|
| 01 | Agriculture | 453,3 | 41,1 | 494,4 | 3 | 0,083 |
| 02 | Fishing | 16,7 | 5,9 | 22,6 | 27 | 0,261 |
| 03 | Mining | 16,0 | 10,8 | 26,8 | 26 | 0,403 |
| 04 | Food products and beverages | 116,3 | 314,5 | 430,8 | 6 | 0,730 |
| 05 | Textiles | 219,7 | 39,5 | 259,2 | 11 | 0,152 |
| 06 | Wearing apparel | 57,2 | 15,8 | 73,0 | 20 | 0,216 |
| 07 | Wood and products of wood and cork | 56,4 | 51,7 | 108,1 | 15 | 0,478 |
| 08 | Pulp, paper and paper products | 50,1 | 45,5 | 95,6 | 18 | 0,476 |
| 09 | Coke, refined petroleum products | 1,0 | 2,6 | 3,6 | 28 | 0,720 |
| 10 | Chemicals | 22,0 | 30,6 | 52,6 | 23 | 0,582 |
| 11 | Rubber and plastic products | 26,4 | 23,4 | 49,8 | 24 | 0,470 |
| 12 | Other non-metallic mineral products | 64,7 | 40,6 | 105,3 | 17 | 0,385 |
| 13 | Fabricated metal products | 97,1 | 40,7 | 137,8 | 13 | 0,295 |
| 14 | Machinery and equipment n.e.c. | 43,9 | 26,4 | 70,3 | 21 | 0,375 |
| 15 | Electrical machinery | 46,2 | 34,1 | 80,3 | 19 | 0,425 |
| 16 | transport equipment | 35,9 | 33,2 | 69,1 | 22 | 0,480 |
| 17 | other manufactured goods | 69,9 | 37,0 | 106,9 | 16 | 0,346 |

| | | | | | | |
|-----------|---------------------------------------|---------------|---------------|---------------|----|---------------|
| 18 | Electrical energy, gas and hot water | 22,1 | 25,1 | 47,2 | 25 | 0,532 |
| 19 | Construction work | 530,7 | 173,4 | 704,1 | 2 | 0,246 |
| 20 | Trade and repair services | 857,2 | 172,8 | 1030,0 | 1 | 0,168 |
| 21 | Hotel and restaurant services | 294,0 | 157,1 | 451,1 | 4 | 0,348 |
| 22 | Transports and communication services | 194,4 | 83,8 | 278,2 | 10 | 0,301 |
| 23 | Financial services | 85,3 | 43,4 | 128,7 | 14 | 0,337 |
| 24 | Real estate services | 310,5 | 137,0 | 447,5 | 5 | 0,306 |
| 25 | Public administration | 359,8 | 54,9 | 414,7 | 7 | 0,132 |
| 26 | Education services | 303,1 | 23,1 | 326,2 | 9 | 0,071 |
| 27 | Health and social work services | 304,0 | 75,6 | 379,6 | 8 | 0,199 |
| 28 | Other services | 143,7 | 49,1 | 192,8 | 12 | 0,255 |
| 99 | Total | 4797,6 | 1788,5 | 6586,1 | | 0,2716 |

The (top 5) key sectors according to the total effect on employment (direct + indirect) in 1995 are: Trade and repair services; Construction work, Agriculture, Food products and beverages and Hotel and restaurant services. In 2005, the only change in this list is the substitution of Real estate services (5th) for Food products (6th).

It is also interesting to note that there are sectors with very low importance in the indirect effect induction of employment, such as Agriculture and Education services (under 10% of total employment effect) and Public Administration, Trade, Textiles and Health and social services (ratio under 20%).

On the other side, for Food products, Coke and refined petroleum products, Chemicals and Electricity, gas and water the indirect effect surpasses the direct effect on employment. In terms of economic policy measures directed to fighting unemployment and job promotion in the economy at large, these should be the priority sectors in Portugal.

4. Conclusions

Unemployment is one of the great problems in Portugal due to the weak growth performance of the economy since 2001, the restructuring of the business sector to respond to the globalization challenges and the efforts to consolidate the public finances affecting public employment creation. The macroeconomic crisis of 2009 has seriously deteriorated the situation along all these lines.

In this paper, after quantifying the deleterious macroeconomic trends of the past decade, a descriptive analysis of the Portuguese employment structure is made with the main conclusion that some upgrading has been achieved between 1995 and 2005 but maintaining a relatively high weight of traditional sectors (agriculture, textiles, construction).

The main purpose of the paper was to further reinforce the analysis with an interindustry approach based in the Leontief input-output model, starting with the traditional employment multipliers and elasticities, and the application of the more sophisticated “hypothetical extraction” or “shut down of industry” method. This approach was theoretically exposed in Section 3, and its empirical results are presented and discussed in section 4.

The most important sectors for employment creation (and so, unemployment fighting) using multiplier and elasticity indicators and the direct effect in hypothetical extraction quantifications are the traditional (low value added, and mainly non traded goods producing) sectors of Trade services, Construction works, Real estate, Public services, Agriculture and Textiles.

On the other side, if the indirect effects are taken into account (due to backward and forward linkages) the key sectors appear to be Food products, Coke and refined petroleum products, Chemicals and Electricity, gas and water, and several other manufacturing products. Unfortunately, although increasingly important along the decade here treated, these sectors still have a relatively weak weight in total employment.

So, the traditional dilemma persists for Portuguese policy makers of fighting unemployment with short run support of traditional low value added, high employment intensive, sectors or upgrade the productive structure with restructuring and supporting high value added, strong productivity, sectors with heavy costs of employment destruction.

Finally, it is important to recognize the limitations of the methodology used, first of all, the apparent lack of reasonability of the hypothetical extraction method, because it is non reasonable and in fact, for much cases, really impossible to “shut down a whole industry”. However, this exercise is

also valid for partial extractions, for instance, a great company of a certain sector, given the linearity of the model and supposing that its backward and forward linkages are “close to the average” of the sector. An interesting example is given in Valadkhani (2003) with the assessment of jobs lost with the collapse of Ansett (an Australian airline).

Other limitations are: the linear structure of the model; the constancy of labour coefficients; the absence of inputs availability restrictions and the non consideration of capital inputs or technological progress. But for a short run, static assessment and comparison, in the context of under utilization of factors as in the present economic crisis, this exercise can be valuable in helping to inform a strategy for employment creation and consequent unemployment reduction.

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