Artigos

External dependency, value added generation and structural change: an inter-industry approach*

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resumo

A dependência externa de muitos sectores e o baixo valor acrescentado gerado na sua produção, combinados com um relativamente fraco potencial exportador, criam elevados *deficits* externos e crescentes rácios de dívida externa no PIB em diversas economias abertas. Neste artigo, propomos um método empírico para avaliar a evolução destas vulnerabilidades, baseado num tratamento novo dos multiplicadores de produção intersectoriais. O potencial de crescimento do VBP dado pelas somas das colunas da matriz inversa de Leontief (indicadores de interdependência a montante) resulta de três componentes: consumos intermédios, valor acrescentado e inputs importados. Depois de um conveniente arranjo destas três componentes, a evolução dos indicadores de interdependência pode servir para detectar alterações estruturais, particularmente quantificando um efeito (líquido) de crescimento (maior valor acrescentado) e um efeito de dependência externa (mais inputs importados), e para classificar os sectores produtivos de acordo com estes resultados. É feita uma aplicação ao caso português, usando os Quadros Input--Output de 1980, 1995 e 2005. Este método pode também ser útil enquanto um simples, mas sugestivo, instrumento para comparar a evolução de duas ou mais economias, ao longo dos seus processos de desenvolvimento no tempo.

résumé / abstract

The external dependency of many industries and the corresponding low value added generated in production, combined with a relatively weak export potential, create high external deficits and growing debt to GDP ratios in several open economies. In this paper we propose an empirical method to assess the evolution of these vulnerabilities, based on a new treatment of interindustry production multipliers. The (gross) output growth potential given by the column sums of the Leontief inverse matrix (backward linkage indicators) results from three terms: interindustry consumptions, value added and imported inputs. After a convenient arrangement of these terms, the evolution of backward linkage indicators can be used to detect structural changes, particularly quantifying a (net) growth effect (more value-added generation) and an external dependency effect (more imported inputs), and to classify the productive sectors accordingly. An application to the Portuguese Economy is made, using input-output tables for the years 1980, 1995 and 2005. This method can also be useful as a simple, but suggestive, device to compare the evolution of two or more economies, along their development processes in time.

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1. Introduction

The external dependency of many industries (strong reliance on imported inputs) and the associated low value added generated in domestic production are important vulnerabilities in several developed and developing open economies. When associated with a relatively high level of personal consumption and a weak export potential, they tend to create high external deficits and a rapidly growing debt to GDP ratio that request very demanding financial efforts and disturbing macroeconomic imbalances.

In this paper we propose an empirical method to evaluate the changes in the external dependency of the production system of an economy (here measured in a narrow sense by the relative weight of imported inputs in gross output) and its capacity to generate value added, based on a new treatment of interindustry production multipliers.

The column sums of the Leontief inverse matrix (backward linkage indicators) give the output growth of all sectors when the final demand directed to each (correspondent) sector increases by one unity, and this growth potential can be divided in three terms: interindustry flows, value-added and imported inputs (a good exposition of the basic structure and results of the Leontief model is made in Miller and Blair, 2009).

After a convenient arrangement of these terms, the evolution of backward linkage indicators can be used to detect structural changes, particularly quantifying a (net) growth effect (more value-added) and an external dependency effect (more imported inputs), and to classify the productive sectors accordingly.

An application to the Portuguese economy is made for the period 1980-2005, divided in two sub-periods: 1980-1995, with data for 49 industries, based on the United Nations System of National Accounts, SNA1968 – Portuguese version: 1977; and 1995-2005, with data for 60 sectors, based on the European System of Accounts – ESA1995. This method can also be useful as a simple, but suggestive, device to compare the evolution of two or more economies.

Since the pioneering work of Rasmussen (1956) and Hirschman (1958), the concepts of backward and forward linkages have been widely discussed and applied (for an interesting survey and discussion see Drejer, 2002).

More recently, sophisticated methods to deal with structural change have been proposed (Sonis *et al* (1996), Dietzenbacher and van der Linden (1997), Dridi and Hewings (2002), are, among others, very interesting examples).

The strategy in this work is different, and based on the conviction that sometimes, “back to basics” and simplicity enriched with easy visualisation ways to look at the data can play an important role in our understanding of how an economy evolves in time.

2. Interindustry linkages indicators

The Rasmussen traditional method of using compact indicators from the production multipliers matrix (Leontief inverse) is one of the classical references for the analysis of intersectoral relations.

It is well known that this matrix is obtained by solving an n equations system that equates sector productions to possible uses: intermediate and final demand.

This system can be represented as follows:

$$x = A\,x + y, \qquad (2.1)$$

with: A – (domestic) technical coefficients matrix; x – sectoral production vector; y – (domestic) sectoral final demand vector.

The solution of this system is:

$$x = B\,y, \qquad (2.2)$$

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

Each element of B is a production multiplier that gives the total (direct and indirect) effect in one's sector production of a unity increase in domestic final demand of a given sector. That is, b_{ij} is the global impact on the sector i production when the domestic final demand of sector j increases by one unity.

Particular interest in this context has the notion of backward linkage indicators:

$$b_{0j} = \sum_{i=1}^{n} b_{ij} \qquad (j = 1, \ldots, n) \qquad (2.3)$$

This indicator results from summing up the n values of column j and gives the effect on total production (of all sectors) of a unitary change in the final demand directed to j sector. The larger the value of this coefficient, the larger will be the impact of this increase of the final demand on the sector concerned and on all the others. For the method we propose in the next section and its empirical application to the Portuguese economy, this is the most interesting multiplier.

3. Net growth (or efficiency) and external dependency effects

The backward linkage indicators can be used to evaluate the gains in the capacity of an economy to generate value added and the changes in external dependency of an economy from one year to another.

The overall effect of a unity change of final demand is the sum of three terms: interindustry flows, value added and imported inputs.

Moreover, an important property applies: the second and last terms sum up unity, exactly the value of the initial (exogenous) stimulus, and this is so because in equilibrium the total value of sectoral final demand equals the gross value added plus imported inputs of all sectors.

Using this property, and after a convenient arrangement of terms, the evolution of backward linkage indicators, value added and imported input coefficients over time can be used to detect structural changes in the economy.

Particularly, we can quantify the capacity to generate more (or less) value-added by unity of final demand (what in some sense we can call an "efficiency effect", although a peculiar one[1]), and the need to import more (or less) intermediate inputs (a certain kind of "external dependency effect"). And we can classify the productive sectors according to the particular combination of both effects, finding a new kind of "key sectors", those presenting a positive "efficiency" change and a negative "dependency" change.

One way to express formally these ideas is as follows. Considering a unitary increase in j sector's final demand, $\Delta y_j = 1$, its effects on total production are:

1 In order to avoid terminological confusion we call this "efficiency effect" a "net growth effect".

$$\sum_i \Delta x_i = \sum_i b_{ij} = b_{0j} \quad (3.1)$$

By the equilibrium condition between total sectoral final demand and total primary inputs, we have:

$$\Delta y_i = 1 \Rightarrow \Delta\left(\sum_i v_i + \sum_i m_i\right) = 1, \quad (3.2)$$

where v_i and m_i are the value added[2] and the value of imported inputs used by sector i.

Defining, and assuming as constants, the value-added coefficients ($a_i^v = v_i / x_i$) as well as the imported inputs coefficients ($a_i^m = m_i / x_i$), we have:

$$1 = \sum_i b_{ij} a_i^v + \sum_i b_{ij} a_i^m \quad (3.3)$$

Dividing both sides of (3.3) by b_{0j}:

$$1 / b_{0j} = \sum_i (b_{ij} a_i^v) / \sum_i b_{ij} + \sum_i (b_{ij} a_i^m) / \sum_i b_{ij}, \quad (3.4)$$

and, representing by v_j^* and m_j^* the terms in the right hand side of (3.4) (the weighted average of value-added and imported inputs coefficients, respectively), we arrive finally at:

$$1 = b_{0j}(v_j^* + m_j^*). \quad (3.5)$$

This expression can be used in a dynamic (or, as in the present paper, in a comparative static) exercise to detect and quantify the changes in the productive structure of an economy.

Suppose that, for each sector j, we have, between two given years, a **decrease in b_{0j}**. This means that, in order to satisfy a unitary increase in sector j final demand it is necessary a smaller increase in the global production of the economy.

It is also true that, in this case, we must have $\Delta m_j^* + \Delta v_j^* > 0$, and so four situations are possible, in a two dimensional space with axes Δv_j^* and Δm_j^*:

– when $\Delta v_j^* > 0$ **and** $\Delta m_j^* < 0$, the decrease in b_{0j} goes with a larger capacity to generate value added (a beneficial "net" growth effect) and a lower necessity of imported inputs (a reduced external dependency effect) – let's call this **area A**, the most virtuous one;

– if $\Delta v_j^* > 0$, $\Delta m_j^* > 0$ **and** $\Delta v_j^* / \Delta m_j^* > 1$, there is a simultaneous increase in "net growth effect" and "external dependency", with the first dominating the second (**area B**);

– with $\Delta m_j^* > 0$, $\Delta v_j^* > 0$, **but** $\Delta m_j^* / \Delta v_j^* > 1$, the increase in "external dependency" is relatively more significant than the increase in "net growth effect" (**area C**);

2 In order to simplify the formal treatment of final demand (exogenous) impacts on the endogenous variables (value added, net taxes on inputs and imported inputs), we include in value added the net taxes on inputs, along with the other net taxes on production already included in this item, according to the SNA 1968 and ESA1995 methodologies; for more details see Eurostat, 2008.

– finally, with $\Delta m_j^* > 0$ **and** $\Delta v_j^* < 0$, the decrease in b_{0j} is totally due to an increase in "external dependency", with a simultaneous decrease in the capacity to generate value added (**area D**, the most disadvantageous situation).

For the case of a b_{0j} **increase** we must have $\Delta m_j^* + \Delta v_j^* < 0$, a worse situation for the economy, at least from the "capacity to generate more value added" point of view. The four possible areas now are (in a descending order):

– **Area A':** $\Delta v_j^* > 0$ **and** $\Delta m_j^* < 0$, **with** $\Delta v_j^* < |\Delta m_j^*|$
– **Area B':** $\Delta v_j^* > 0$ **and** $\Delta m_j^* < 0$, **with** $|\Delta v_j^*| < |\Delta m_j^*|$
– **Area C':** $\Delta v_j^* < 0$ **and** $\Delta m_j^* < 0$, **with** $|\Delta v_j^*| > |\Delta m_j^*|$
– **Area D':** $\Delta v_j^* < 0$ **and** $\Delta m_j^* > 0$, **with** $|\Delta v_j^*| > \Delta m_j^*$

In practical terms, a suggestive way of analysis is the graphical presentation of Δv_j^* and Δm_j^* values in the two-dimensional space above described, distributing the position of the sectors in the possible areas A, B, C, D (for a b_{0j} decrease) and A', B', C', D' (for a b_{0j} increase). The structural change is more beneficial to an economy when more sectors concentrate on A and A' areas and less on areas D and D'.

4. Application to the Portuguese Economy

We have applied the method presented above to the Portuguese economy in two periods: 1980--1995 and 1995-2005, using the Domestic Input-Output Tables with 49 sectors (SCNP1977) and 60 sectors (SEC1995), respectively. In both cases the data sources are Statistics Portugal (INE) and *Departamento de Prospectiva e Planeamento* (DPP).

The main conclusion drawn from the results is the apparent global deterioration of the Portuguese productive system between 1980 and 2005.

For the first sub-period we can see in tables 1 and 2 that there are in both sub-periods more sectors with b_{0j} increasing than with b_{0j} decreasing.

Table 1 – Negative variation of b_{0j}, 1980-95

	Δb_{oj}	Δm_j^*	Δv_j^*	sp	sm	sv	Sector
	-0.365	-0.038	0.147	1.6	1.7	0.8	21 Cereals and Vegetables
	-0.337	-0.022	0.147	0.8	0.2	0.8	23 Drinks
	-0.289	-0.209	0.390	0.1	0.3	0.1	24 Tobacco
	-0.286	-0.105	0.189	2.5	0.4	2.0	6 Electricity, Gas and Water
	-0.189	-0.002	0.034	3.4	0.2	0.8	17 Meat Industry
A	-0.180	-0.171	0.281	1.8	3.4	1.7	32 Recovery and Repairing
	-0.099	-0.027	0.078	0.6	0.4	0.7	45 Other Com. Services
	-0.073	-0.056	0.097	0.3	0.0	0.5	43 Com. Serv. of Education.
	-0.063	-0.014	0.050	0.8	1.6	0.8	14 Non Electrical Machinery
	-0.059	-0.020	0.050	4.0	0.7	5.9	46 N. C. Serv. Of Pub. Adm.

Table 1 – Negative variation of b_{0j}, 1980-95 (cont.)

	Δb_{oj}	Δm_j^*	Δv_j^*	sp	sm	sv	Sector	
	-0.048	-0.091	0.105	1.2	0.3	0.9	11	Other Const. Materials
A	-0.046	-0.009	0.036	0.9	0.0	1.6	41	Real Estate Services
	-0.006	-0.029	0.030	2.1	1.2	1.7	28	Paper, etc.
				20.1	**10.4**	**18.3**		
	-0.513	0.055	0.144	0.5	0.6	0.2	19	Fish Products
	-0.218	0.029	0.058	0.9	1.2	0.8	26	Tanning and Leather
B	-0.171	0.018	0.040	8.3	8.8	6.3	25	Textile and Clothing
	-0.130	0.011	0.034	8.6	2.6	8.3	31	Construction
	-0.046	0.003	0.023	1.3	0.5	1.8	48	N. C. Serv. Of Health
				19.6	**13.7**	**17.4**		
C	-0.118	0.039	0.002	0.6	0.2	0.5	20	Oils and Fats, …
	-0.032	0.010	0.007	0.8	0.1	1.3	49	Other N. C. Services
				1.4	**0.3**	**1.8**		
D	-0.028	0.016	-0.008	3.6	0.4	3.8	34	Restaurants and Hotels

Notes: Columns sp. sv and sm give the percentage of each sector in total production, gross value-added and imports in 1980.

Table 2 – Positive variation of b_{0j}, 1980-95

	Δb_{oj}	Δm_j^*	Δv_j^*	sp	sm	sv	Sector	
	0.020	-0.107	0.098	3.61	0.6	1.6	12	Chemical Products
	0.052	-0.132	0.108	0.6	1.7	0.4	30	Other Transf. Industries
	0.062	-0.095	0.073	1.7	3.6	0.9	7	Metal Ores
	0.069	-0.067	0.043	0.4	0.2	0.3	10	Glass
	0.077	-0.063	0.025	0.7	0.1	1.0	3	Fishing
A'	0.128	-0.058	0.011	0.3	0.2	0.3	9	Porcelains, etc.
	0.140	-0.074	0.009	2.0	0.6	2.7	35	Land Transports
	0.166	-0.192	0.072	3.92	3.8	-0.1	5	Petroleum
	0.177	-0.206	0.135	2.4	8.6	0.7	22	Other Food Products
	0.244	-0.153	0.019	0.1	0.3	0.0	4	Coal
	0.317	-0.186	0.089	1.6	3.1	0.6	36	Sea and Air Transports
				17.3	**52.8**	**8.4**		
B'	0.052	-0.018	-0.015	0.7	0.1	1.1	44	Com. Serv. Of Health
	0.078	-0.027	-0.010	1.0	2.7	0.7	29	Rubber, Plastic Materials

Table 2 – Positive variation of b_{0j}, 1980-95 (cont.)

	Δb_{oj}	Δm_j^*	Δv_j^*	sp	sm	sv	Sector
B'	0.102	-0.035	-0.017	1.6	3.6	1.3	15 Electrical Machinery
	0.164	-0.056	-0.001	6.0	1.5	6.8	1 Agriculture and Hunting
				9.3	**7.9**	**9.9**	
C'	0.068	-0.009	-0.046	1.1	0.0	2.2	2 Forestry
	0.075	-0.001	-0.059	1.6	0.1	3.2	47 N. C. Serv. Of Education
	0.194	-0.026	-0.048	2.3	2.9	2.2	13 Metal Products
	0.200	-0.049	-0.061	2.5	7.4	2.0	16 Transport Equipment
	0.237	-0.004	-0.101	0.7	0.0	1.0	37 Transport Services
	0.322	-0.031	-0.035	1.0	0.3	0.6	18 Dairy Products
				9.2	**10.7**	**11.2**	
D'	0.073	0.050	-0.076	2.4	1.7	1.9	27 Wood and Cork
	0.079	0.009	-0.061	0.9	0.1	1.6	38 Communications
	0.137	0.002	-0.0681	0.7	1.01	6.4	33 Trade
	0.172	0.020	-0.134	2.4	0.2	4.5	39 Banks, Fin. Institutions
	0.234	0.013	-0.128	2.1	0.3	3.4	42 Auxiliary Serv. To Firms
	0.330	0.111	-0.221	0.4	0.1	0.5	40 Insurance
	0.500	0.019	-0.234	0.5	0.2	0.8	8 Non Metal Ores
				19.4	**3.6**	**29.1**	

For the sectors with decreasing b_{0j} only 13 are located in the most virtuous area A (more "net growth effect" and lower external dependency). Moreover, the majority of these sectors are services, utilities or protected sectors.

Among the sectors with increasing b_{0j}, only 11 are in the area with positive variation of the capacity to generate more value-added (A').

These results can be better visualised in Figures 1 and 2. It could be expectable that, as an economy develops over time most sectors should be concentrated in virtuous areas A and A'.

In fact, it is not what we get in this case and it is difficult to explain these findings for the evolution of the Portuguese productive structure between 1980 and 1995. It was a period of normalisation of political, economic and social conditions, of economic integration in the (then) European Economic Community (since 1986) and of relatively strong growth and real convergence at macroeconomic level. However, it is important to note that this analysis was made using data at current prices and therefore the methodology used does not allow us to reach conclusions about the breakdown of the effects between price effects and technological or other real effects.

Although we have not in Portugal domestic flows input-output data at constant prices, there are nonetheless good reasons to support the view that the kind of effects that we tried to measure should in fact be measured at current prices as we have actually done.

Figure 1 – Negative variation of b_{0j}, 1980-95

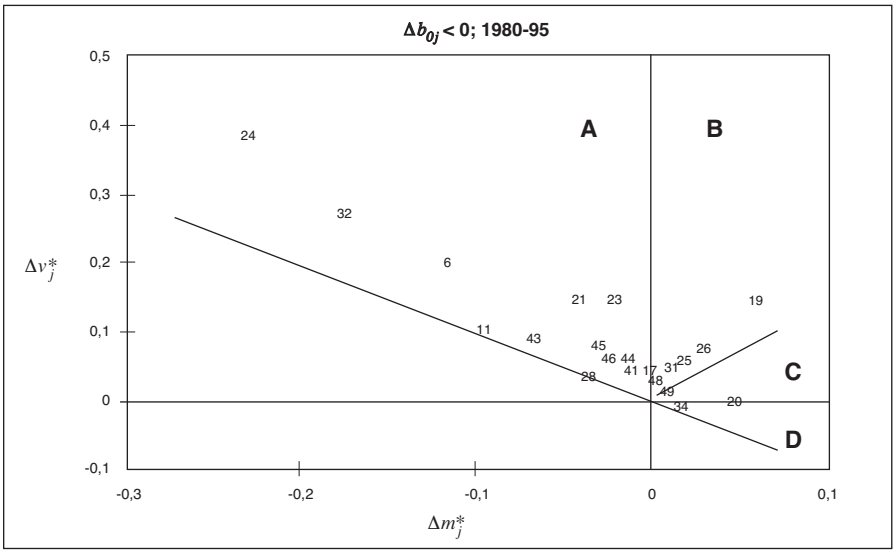
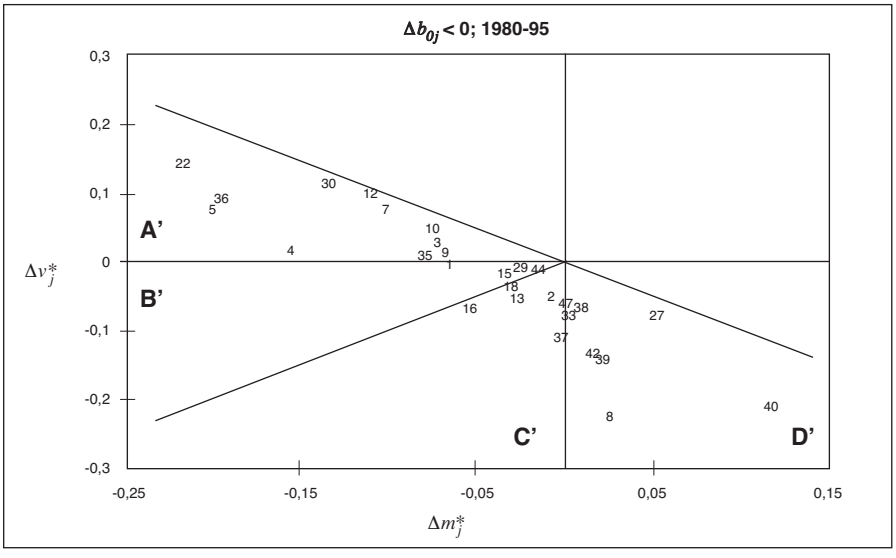


Figure 2 – Positive variation of b_{0j}, 1980-95



For the second and more recent sub-period, 1995-2005, the tendency for more sectors with b_{0j} increasing than decreasing remains (see Tables 3 and 4), and the percentage of sectors in virtuous areas (A and A') is even smaller (see Figures 3 and 4), representing around 20% of gross output (against 37,4% in 1980-95) and value added (26,7% in 1980-95). On the other hand, there is a great reinforcement of sectors in the most disadvantage areas (D + D'), from 23% to 51% in terms of production, and from 33% to 48% in terms of value added.

Table 3 – Negative variation of b_{0j}, 1995-2005

	Δb_{oj}	Δm_j^*	Δv_j^*	sp	sm	sv	Sector	
	-0.237	-0.018	0.126	0.2	0.0	0.2	73	Research and development services
	-0.226	-0.006	0.069	3.7	2.6	2.7	55	Hotel and restaurant services
	-0.153	-0.002	0.053	1.1	1.6	0.8	22	Printed matter and recorded media
A	-0.033	-0.002	0.025	3.6	0.4	6.3	80	Education services
	-0.030	-0.064	0.077	0.1	0.4	0.1	30	Office machinery and computers
	-0.023	-0.002	0.009	2.6	4.5	1.5	18	Wearing apparel; furs
	-0.008	-0.015	0.019	0.7	0.2	0.8	66	Insurance and pension funding services
				12.0	**9.71**	**2.4**		
	-0.149	0.009	0.058	0.5	0.2	0.7	93	Other services
B	-0.098	0.007	0.026	1.6	3.3	1	19	Leather and leather products
				2.1	**3.5**	**1.7**		
	-0.148	0.03	0.004	0.4	0.2	0.2	91	Membership organisation services n.e.c.
C	-0.034	0.014	0.002	4.2	2.1	5.4	85	Health and social work services
	-0.02	0.004	0.003	0.9	0.2	1.1	63	Supp./ aux. transport serv.; travel agency serv.
				5.5	**2.5**	**6.7**		
	-0.226	0.195	-0.04	1	7.4	-0.1	23	Coke, refined petrol. prod. and nuclear fuels
	-0.116	0.152	-0.113	0.1	0	0.1	37	Secondary raw materials
D	-0.1	0.065	-0.034	1.6	1.8	1.1	2	Pulp, paper and paper products
	-0.094	0.061	-0.018	1.6	7	0.5	34	Motor vehicles, trailers and semi-trailers
	-0.045	0.119	-0.094	0.8	3.8	0.3	32	Radio, televi., comm. equip. and apparatus

Table 3 – Negative variation of b_{0j}, 1995-2005 (cont.)

	Δb_{oj}	Δm_j^*	Δv_j^*	sp	sm	sv	Sector
	-0.035	0.016	-0.008	6.8	9.3	2.9	15 Food products and beverages
D	-0.012	0.02	-0.015	3	5.3	2.3	17 Textiles
	-0.01	0.036	-0.031	0.4	0.7	0.4	35 Other transport equipment
				15.3	**35.3**	**7.5**	

Notes: Columns sp. sv and sm give the percentage of each sector in total production, gross value-added and imports in 1995.

Table 4 – Positive variation of b_{0j}, 1995-2005

	Δb_{oj}	Δm_j^*	Δv_j^*	sp	sm	sv	Sector
	0.007	-0.019	0.017	5.8	3.4	5.5	74 Other business services
A'	0.013	-0.079	0.074	1.2	4.1	0.5	29 Machinery and equipment n.e.c.
	0.041	-0.043	0.030	1.0	3.0	0.4	28 Fab. metal prod., except mach. and equip.
				8.01	**0.5**	**6.4**	
B'	0.034	-0.013	-0.002	2.8	2.6	3.4	50 Trade, maint., repair serv. of motor vehicles
				2.8	**2.6**	**3.4**	
	0.008	-0.002	-0.003	4.1	0.3	6.5	70 Real estate services
	0.114	-0.015	-0.036	0.3	0.1	0.4	67 Services auxiliary to financial intermediation
	0.120	0.000	-0.043	6.0	2.8	7.0	51 Wholesale trade
C'	0.120	0.000	-0.048	3.1	0.9	4.0	52 Retail trade services
	0.143	-0.003	-0.050	2.1	5.9	1.3	24 Chemicals, chemical products
	0.161	-0.005	-0.068	0.1	0.0	0.2	90 Sewage, refuse disposal services, sanitation
	0.179	-0.008	-0.089	2.8	0.7	4.5	65 Financial interm. services, except insurance
				18.51	**0.72**	**3.9**	
	0.036	0.028	-0.038	1.9	1.5	1.5	26 Other non-metallic mineral products
	0.052	0.006	-0.025	0.9	2.2	0.5	25 Rubber and plastic products
D'	0.056	0.028	-0.050	0.3	0.0	0.4	41 Collected and purified water, distr. water
	0.058	0.001	-0.022	1.5	0.7	1.7	92 Recreational, cultural and sporting services

Table 4 – Positive variation of b_{0j}, 1995-2005 (cont.)

	Δb_{oj}	Δm_j^*	Δv_j^*	sp	sm	sv	Sector
	0.067	0.009	-0.031	1.1	2.2	0.8	36 Furniture; other manufactured goods n.e.c.
	0.073	0.010	-0.066	0.5	0.0	0.9	2 Forestry
	0.077	0.024	-0.063	0.3	0.1	0.4	5 Fish
	0.084	0.027	-0.063	1.1	2.9	0.8	31 Electrical machinery and apparatus n.e.c.
	0.086	0.006	-0.027	9.3	5.4	7.2	45 Construction work
	0.087	0.031	-0.068	0.2	0.4	0.2	33 Medical, precision, optical instrum.
	0.095	0.128	-0.167	0.8	1.6	0.7	27 Basic metals
	0.105	0.026	-0.060	3.2	1.1	3.7	1 Agriculture, hunting
	0.141	0.020	-0.079	0.4	0.1	0.6	72 Computer and related services
	0.142	0.004	-0.095	4.5	0.9	7.8	75 Public admin., defence, social security
D'	0.145	0.019	-0.056	1.3	1.3	0.9	20 Wood, cork
	0.150	0.065	-0.134	0.1	0.1	0.1	16 Tobacco
	0.165	0.025	-0.073	0.3	0.2	0.3	61 Water transport services
	0.177	0.025	-0.122	0.1	0.0	0.2	13 Metal ores
	0.192	0.041	-0.105	0.3	0.1	0.3	14 Other mining and quarrying
	0.247	0.075	-0.164	0.6	0.9	0.6	62 Air transport services
	0.260	0.093	-0.166	3.2	1.9	3.1	40 Electrical energy, gas, steam and hot water
	0.265	0.006	-0.114	1.7	1.0	2.2	64 Post and telecommunication services
	0.270	0.026	-0.161	0.7	0.1	1.1	71 Renting services of mach. and equipment
	0.288	0.046	-0.167	1.5	0.4	2.1	60 Land transport; transport via pipeline
				35.82	**5.13**	**8.1**	

However, there is at least one positive tendency in the structural evolution of the Portuguese productive system concerning the sectoral composition of virtuous areas A and A'. In 1980-95 there is a clear predominance of services, nontradables or low technology sectors (Tobaco, Electricity, gas and water, Recovery and repairing, Cereals and vegetables, Drinks, Commercial Services of Education, Other Commercial Services, etc.). In 1995-2005 enter in these areas of great value added creation and lower external dependency several medium and high technology

Figure 3 – Negative variation of b_{0j}, 1995-2005

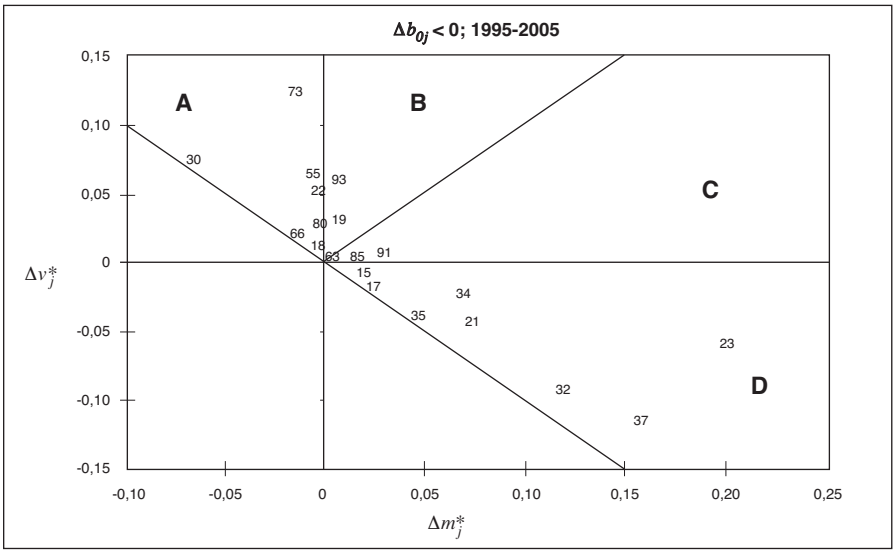
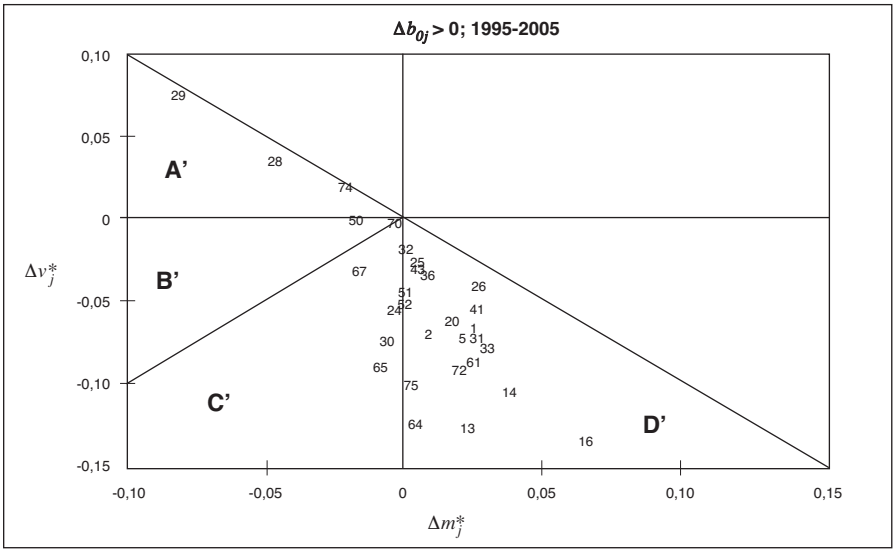


Figure 4 – Positive variation of b_{0j}, 1995-2005



sectors as Office machinery, R&D services, Machinery and equipment, Fabricated metal products, Wearing apparel, Other business services. Considering the strong export potential and innovation dynamics of these sectors, it would be very important to keep them in virtuous areas and reinforce significantly its weight in the Portuguese productive system. However, assessing the potential macroeconomic gains of reinforcing these sectors is of course well beyond the scope of this paper, based as it is on a demand led, constant technical coefficients, static input--output model.

5. Concluding remarks

In this paper we have proposed a simple method to study the structural changes of an economy, using the traditional Rasmussen indicators based on the production multipliers matrix or Leontief inverse. This method is appropriate to assess the external dependency of industries (strong reliance on imported inputs) and the associated low value added generated in domestic production, an important vulnerability in several open economies.

We used the method to analyse the evolution of the Portuguese productive structure between 1980 and 2005, divided in two sub-periods, until and post-1995. Our results point to a mixed pattern, with the positive gains in the capacity to generate value added and importing less intermediate inputs overcome by many losses and an increased external dependency for the majority of sectors, particularly in more recent years. However, our results also point to an apparent upgrade of the Portuguese productive system with more medium and high technology sectors entering in the virtuous areas of value added generation and less dependency.

External dependency is not necessarily bad. It may be the result of increased benefits from international division of labour. What is not *a priori* desirable is that the decrease in production needed to satisfy an increase in domestic demand should be a consequence of domestic production being supplanted by imports.

One of the possible explanations for the results obtained is the great variation in the structure of domestic final demand. One natural extension of our method is to deal with a concept of multiplier that is immune to that variation: the singular value decomposition method proposed in Ciaschini (1993).

It is important to emphasise that, although conditioned by the well-known limitations of the traditional gross multipliers (Oosterhaven and Stelder, 2002), the method we propose can be used as a simple, but (visually) suggestive, device to quantify the structural changes of an economy. And with some refinements it can also be useful to compare the evolution of two or more economies along their development paths.

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Structural transformation of Portuguese exports and the role of foreign-owned firms: A descriptive analysis for the period 1995-2005*

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resumo

Neste artigo, utilizamos uma medida de "conteúdo de rendimento das exportações de um país" recentemente proposta por Hausmann e outros (2007) para caracterizar a estrutura das exportações portuguesas, a sua evolução recente e o papel das empresas de capital maioritariamente estrangeiro nessa evolução. Os resultados sugerem que, entre 1995 e 2005, o "conteúdo de rendimento" das exportações portuguesas cresceu acima da média mundial, para o que terá contribuído um "efeito de ajustamento estrutural" superior à média, que mais do que terá compensado um desempenho abaixo da média decorrente do facto de uma parte significativa das exportações portuguesas ocorrer em sectores sujeitos a uma concorrência crescente por parte das economias emergentes. Também verificamos que o peso das exportações de "elevado" e "muito elevado" conteúdo de rendimento aumentou consideravelmente no período, com essas duas classes a explicar mais de metade do crescimento das exportações portuguesas. Analisando a presença de empresas de capital estrangeiro nos diferentes sectores, encontramos um peso acima da média nos produtos de "elevado" e "muito elevado" conteúdo de rendimento. Estes e outros resultados sugerem que as empresas de capital estrangeiro têm desempenhado um papel relevante, quer no crescimento das exportações portuguesas, quer no aumento do seu conteúdo de rendimento.

résumé / abstract

In this paper we use a recent measure of the "income level of a country's exports" proposed by Hausmann et al. (2007) to characterize the structure of the Portuguese export basket, its recent evolution and the role of foreign-owned firms in this process. We find that between 1995 and 2005 the improvement in the "income content" of the Portuguese export basket relative to the world average was achieved through an above-average "structural transformation effect" that more than offset a bellow-average effect of having a significant share of products exposed to an increasing competition from emerging economies. We find that the weight of exports with "high" and "very high" income content increased considerably in this period, with these two classes explaining more than one half of the total export growth. Analysing the presence of foreign-owned firms in different industries, we find a higher than average share of foreign affiliated firms in products with "High" and "Very High" income content. These and other pieces of evidence suggest that foreign-owned firms have played a relevant role both in the growth of Portuguese exports and in the increase of their income content.

Classificação JEL: C14, F14.

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1. Introduction

In the current debate on the Portuguese economy, there is a view that the country's specialization pattern, traditionally dominated by low-skilled labour intensive products, is a major obstacle to convergence. According to this view, with the emergence of new trading partners in the international arena, the future performance of the Portuguese economy will depend critically on its ability to shift its specialization pattern towards goods with higher productivity content. In this paper, we investigate the extent to which the Portuguese economy has indeed become increasingly specialized in more sophisticated goods and whether such a shift is more evident in sectors with a high presence of foreign-owned firms.

The view that a country's economic performance depends on the specialization pattern has a long tradition in economic thinking, backing from Adam Smith and David Ricardo[1]. Empirically, however, this idea has been difficult to test, because a measure of a country specialization pattern that reflects the quality of the goods being exported is not easy to define. In a recent contribution, Hausmann et al. (2007) propose a quantitative index that ranks traded goods in terms of their "implied income". This index (PRODY) is estimated as a weighted average of the per capita GDPs of the countries exporting a product, where the weights reflect the revealed comparative advantage of each country in that product. The authors then compute a measure of sophistication of a country export basket (EXPY) by calculating the export-weighted average PRODY for that country. The authors report a strong correlation between EXPY and per capita GDPs and also find that EXPY is a strong and robust predictor of subsequent economic growth, controlling for standard covariates.

In this paper, we compute a new vector of PRODY indexes, using 1995 and 2005 COMTRADE data for 1235 products and 81 countries. We then use these indexes to characterise the Portuguese export basket and to assess how well it has moved towards products with higher income content. We document that in the period from 1995 to 2005 there has been indeed an upscale move of the Portuguese specialization pattern. Though using a different methodology, our evidence accords with the recent findings of Caldeira Cabral (2008) and Amador et al. (2007) who analysed the changing pattern of the Portuguese exports, using the OECD classification of R&D intensities.

We then investigate the extent to which foreign-owned firms have played a role in this change. Portuguese governments have made significant efforts to support FDI inflows, either through financial incentives (EU funds and tax benefits) or by providing complementary infrastructure. Despite the high year-on-year volatility, FDI net flows to Portugal have a clear upward trend, from 0,43% of GDP in the 1970s to 1,03% in the 1980s, 1,085% in the 1990s and 3,65% in the period 2000-2006 (UNCTAD, 2007). An obvious question is, thus, whether such an effort has helped or impaired the process of structural transformation.

The relationship between FDI and economic performance is a topic of controversy in the economic literature. Policymakers and academics often argue that FDI can be a source of benefits to host countries, through knowledge spillovers or by creating linkages from multinationals to domestic firms[2]. Accordingly, governments all over the world spend large amounts of resources to attract subsidiaries of multinational firms to their jurisdiction.

1 Recent contributions emphasizing the type and the characteristics of the industries wherein a country specializes include Krugman (1987), Lucas (1988), Young (1991), Matsuyama (1992), Rodriguez-Clare (1996) and Rodrik (1996).

2 Fosfuri et al. (2001) discuss the spillover effects related to the flow of skilled workers trained by multinationals to other firms in the host country. Rodriguez-Clare (1996a) and Markusen and Venables (1999) examine the linkage effects between multinationals and domestic firms. Many authors remain, however, sceptical about the relationship between FDI and economic performance (e.g., Rodrik, 2007, pp.119-120).

Empirically, however, the evidence on FDI-related externalities is not free of controversy (see Keller, 2004 for a survey)[3].

This paper abstracts from spillovers and other external effects of foreign-owned firms. Simply, we examine whether there has been a tendency for foreign-owned firms to operate in fast growing non-traditional and high income content export sectors, thus having a direct impact in the process of structural transformation in Portugal. Our paper adds to the literature in that it examines the relationship between foreign-owned firms and the structure of Portuguese exports by income content, crossing information on export values at the product (SITC-4 rev 2) level and on the proportion of capital with foreign affiliation at the firm level. We assess whether foreign-owned firms have contributed to improve the specialization pattern of the Portuguese economy using the PRODY index as a measure of income content.

The paper proceeds as follows. In Section 2, we provide some comparative analysis, using PRODY indexes and indexes of Revealed Comparative Advantage (RCA)[4] at the product level from 1995 to 2005. In Section 3 we decompose the changes in the average income content of each country's exports into a "PRODY effect" and a "structural transformation effect". In Section 4 we investigate how the composition of the Portuguese export basket has evolved in terms of classes of PRODY. In Section 5 we evaluate the extent to which the sectors that most contributed to the Portuguese export growth have a large presence of foreign-owned firms and whether the presence of foreign-owned firms is more significant in products with higher income content. Section 6 concludes.

2. Income content and comparative advantages

In this paper, we use the Hausmann et al. (2007) PRODY index to assess the sophistication level of products. Formally, the index is defined, for each product, as the weighted average of per capita incomes of countries exporting that product, where the weights are proportional to the country's index of Revealed Comparative Advantage in that product (details in Appendix 1). Products with high PRODY values are, by construction, those typically exported by high income countries. The implied assumption is that the presence of higher wages is stronger where comparative advantages are determined by factors other than labour cost, such as know how, technology, public infrastructures, research centres and so on.

Our calculations use international trade data at the product level (SITC-4 rev 2), from the UN-COMTRADE database, as extracted in September 2007 and per capita GDP levels (in PPP) by the International Monetary Fund, World Economic Outlook Database, April 2008. Both variables refer to 1995 and 2005. Countries for which there was no consistent data for those two years were excluded. This leaves us with 81 countries and data for 1235 products. Table 1 displays the estimated PRODY values for some products, the corresponding PRODY rank and the share in World exports, in 2005. As expected, agricultural commodities and raw materials appear at the bottom of the table.

3 In the specific case of Portugal, there is anecdotic evidence of training spillovers and quality improvement effects on domestic suppliers (OECD, 2008, pp. 86-87). However, Flores et al. (2007) found no robust evidence of intra-sectoral spillover effects, as measured by the effect of FDI on domestic firms' labour productivity. Guimarães et al. (2000), analysing the role of agglomeration effects in location decisions of establishments participated by foreign capital between 1982 and 1992, found a positive influence of industry-specific localization economies but no significant influence of foreign-specific agglomeration effects. This is suggestive of spillovers, but not necessarily related to the affiliation of capital.

4 Also known as Balassa index (Balassa, 1958). The index of revealed comparative advantage (RCA) for a given product in a given country is computed as the share of that product in the country' exports, divided by the share of the same product in world exports (see Appendix 1 for details).

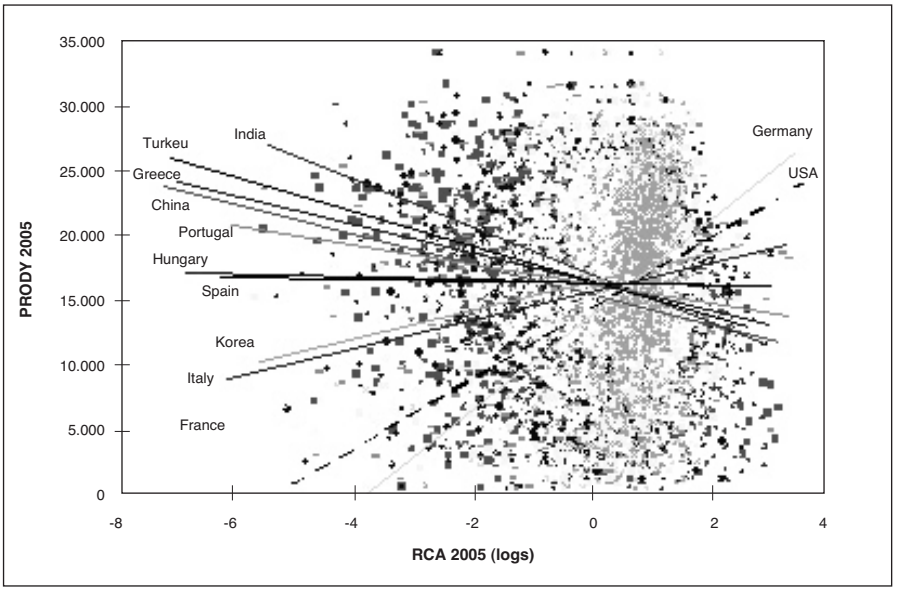
Table 1 – PRODY values for a sample of products

Code	Commodity	PRODY 05	Rank	Share of World exports (per cent)
2933	Heterocyclic compounds with nitrogen hetero-atom(s) only	33.408	4	0.47
8411	Turbo-jets, turbo-propellers and other gas turbines	27.010	82	0.71
3004	Medicaments (excluding goods of heading 30.02, 30.05 or 30.06)	26.024	108	2.13
8525	Transmission apparatus for radio-telephony, radio-broadcasting	24.156	196	1.89
8542	Electronic integrated circuits and microassemblies	24.047	201	2.81
9018	Instruments and appliances used in medical, surgical, dental or veterinary …	23.486	229	0.61
8473	Parts and accessories for use with machines of heading 84.69 to 84.72	23.244	240	1.89
8703	Motor cars and other motor vehicles principally designed for the transport …	22.951	255	5.15
8471	Automatic data processing machines and units thereof	22.355	292	2.78
8802	Other aircraft (for example, helicopters, aeroplanes); spacecraft	21.886	330	0.88
8414	Air or vacuum pumps, air or other gas compressors and fans	21.457	344	0.43
8708	Parts and accessories of the motor vehicles of headings 87.01 to 87.05	20.802	382	2.34
8536	Electrical apparatus for switching or protecting electrical circuits, or fo …	20.455	401	0.59
8541	Diodes, transistors and similar semiconductor devices	18.685	512	0.47
8901	Cruise ships, excursion boats, ferry-boats, cargo ships, barges and similar …	17.586	584	0.48
2701	Coal; briquettes, ovoids and similar solid fuels manufactured from coal	17.237	610	0.44
8704	Motor vehicles for the transport of goods	16.900	624	0.87
8528	Reception apparatus for television	16.114	664	0.58
7102	Diamonds, whether or not worked, but not mounted or set	15.347	702	0.85
2709	Petroleum oils, crude	11.549	914	5.05
6204	Women's or girls' suits, ensembles, jackets, blazers, dresses, skirts	7.977	1069	0.46
2401	Unmanufactured tobacco; tobacco refuse	2.407	1235	0.07
801	Coconuts, Brazil nuts and cashew nuts, fresh or dried	2.230	1236	0.02
1801	Cocoa beans, whole or broken, raw or roasted	2.097	1238	0.03
5203	Cotton, carded or combed	1.414	1242	0.00
2612	Uranium or thorium ores and concentrates	1.211	1243	0.01
5304	Sisal and other textile fibres of the genus Agave, raw or processed but not …	1.146	1244	0.00
905	Vanilla	1.075	1245	0.00

Sources: Own estimates, based on COMTRADE and IMF data.

For illustrative purposes, Figure 1 assesses the linear relationship between our estimated PRODY and RCA indexes for 12 countries, as of 2005 (China, France, Germany, Greece, Hungary, India, Italy, Korea, Portugal, Spain, Turkey and USA)[5]. Despite the high dispersion of the data, plotting a linear regression line helps assessing the sign of the correlation between the two indexes. When significant, a negative correlation indicates a general tendency for a country to be specialized in goods with low income content. A positive correlation, in turn, indicates a general tendency for a country to be increasingly specialized in goods with higher income content.

Figure 1 – PRODY and Revealed Comparative Advantage in 2005 (China, France, Germany, Greece, Hungary, India, Italy, Korea, Portugal, Spain, Turkey, USA)



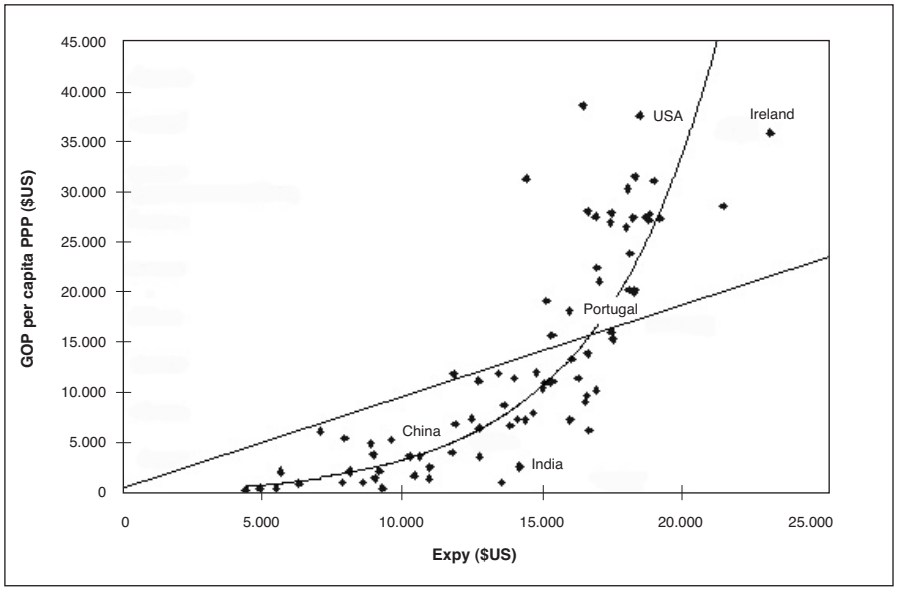
Sources: Own estimates, based on COMTRADE and IMF data.

According to the figure, by 2005 India was the country in this sub-sample with a more negative correlation between RCAs and PRODY values, followed by Turkey, Greece, and China. The Portuguese specialization pattern was more favourable than in these countries, but less than those of Hungary and Spain. On the other hand, Korea, Italy, France, USA and Germany exhibited positive correlations between RCA and PRODY values, suggesting a tendency to be more specialized in "rich country goods".

Moving from a negative correlation towards a positive correlation involves the country becoming increasingly specialized in products with higher income content. This is what is meant by *structural transformation*.

5 The Balassa RCA index is in Logs. Null coefficients of RCA became missing values.

Figure 2 – EXPY and GDP per capita at PPP (2005, $US)



Sources: Own estimates, based on COMTRADE and IMF data.

The data in Figure 1 is silent in respect to absolute sizes (the RCA index actually measures sizes, but relative to the world average). To account for a country total export mass, Hausmann et al. (2007) proposed the EXPY index. This is the average PRODY in a country export basket, where the weights are the share of each product in a country exports (details in Appendix 1). Figure 2 mimics Figure 3 in Hausmann et al. (2007), relating EXPY values with GDP per capita for the countries in our sample. The figure confirms the positive relation between the two variables, with GDP per capita growing exponentially with EXPY. This supports the idea that rich countries export products that tend to be exported by rich countries, while poor countries export products that tend to be exported by other poor countries. Hausmann et al. (2007) also found that EXPY is a strong and robust predictor of subsequent economic growth, controlling for standard covariates[6]. These findings suggest that the type of goods in which a country specializes has important implications for subsequent economic performance.

3. PRODY effect versus structural adjustment effect

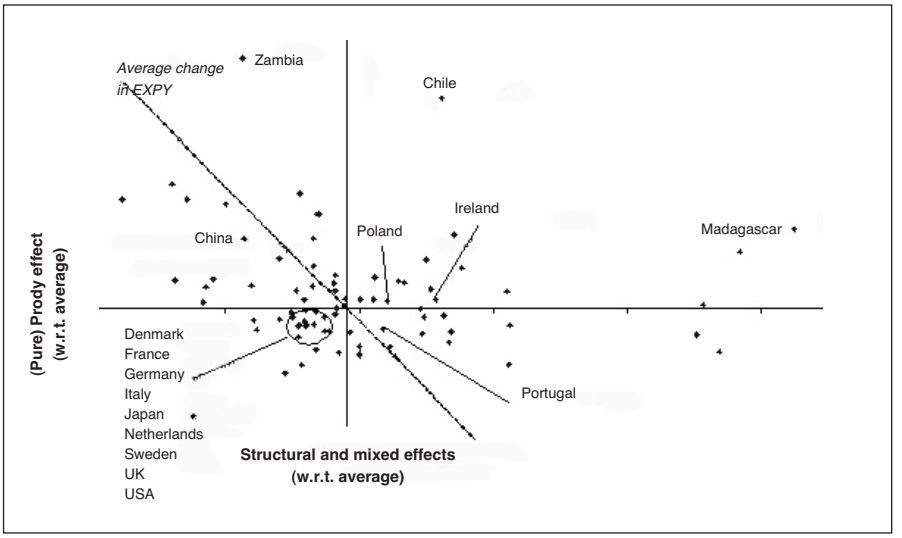
PRODY indexes change over time, reflecting the changes in the world structure of trade and the changes in per capita GDP levels. Hence, EXPY indexes in two different points in time can either

6 In their central case, the estimation results imply that a 10 percent increase in EXPY boosts growth by half a percentage point (p. 15 and Table 8, in the original). Because these results are not significantly affected by the presence of other variables, such as physical capital, human capital and institutional quality, the authors concluded that EXPY exerts an *independent* force on economic growth.

be computed at current PRODY or at base-year PRODY levels. Changes in EXPY at *current* PRODYs will, therefore, reflect changes in the country's structure of exports and changes in the implied value of exports.

Figure 3 describes how the changes in EXPY at current PRODYs break down into a "pure PRODY effect" (i.e., the change in EXPY that would have been observed if the PRODY values of the different products had changed the way they did, while the export structure remained unchanged) and other effects (this includes a "pure structural transformation effect" – i.e., the value of EXPY which would have been observed had the PRODY values remained unchanged while the structure of exports evolve the way it did – and a mixed effect). The technical details and the figures for 81 countries are in Appendix 2.

Figure 3 – Decomposing the changes in EXPY at current PRODYs between 1995 and 2005



Sources: Own estimates, based on COMTRADE and IMF data.

The horizontal and vertical axes in Figure 3 represent the sample average "pure PRODY effect" and the sample average "pure structural and mixed effects" (respectively) underlying the changes in EXPY values between 1995 and 2005. The dashed diagonal in the figure represents the average growth in EXPY across countries (weighted by GDP per capita in PPP in 2005). Dots to the right of this line represent countries whose EXPY value has increased above the average; dots to the left of the diagonal correspond to countries whose exports have experienced a decrease in income content in relative terms.

The figure reveals that the Portuguese EXPY level has increased slightly above the average, while the reverse happen to most OECD countries (other exceptions include Australia, Canada, Ireland and Poland). Portugal is located in the lower-right quarter of the graph, meaning that the change in the income content of its exports is accounted for by an above-average structural

transformation (plus mixed) effect, which was big enough to offset a bellow-average PRODY effect. A bellow average PRODY effect means that, had the Portuguese export basket remained stuck, its average income content would have grown less than the average. The reason is that a significant fraction of the Portuguese exports basket corresponds to traditional products, where competition by emerging economies has been increasing. The above-average structural transformation effect more than offset this effect, allowing the EXPY level in Portugal to grow slightly above the average[7].

The Portuguese pattern contrasts with what was observed in other OECD countries: most developed countries have registered below average PRODY and structural and mixed effects[8]. In contrast, Chile and Madagascar, for example, have improved significantly their EXPY values, due to both positive structural adjustment and income effects.

4. Income content, export shares and export growth in Portugal

Having established the relative importance of the structural transformation effect in the case of Portugal, we now focus on this component, abstracting from changes in EXPY caused by changes in PRODY values. Hence, the analysis proceeds at constant PRODYs[9]. In this section and in the following, we use a database from the Portuguese National Institute of Statistics (INE) not hiding confidential positions. It is, therefore more accurate than the COMTRADE database[10]. The corresponding estimates of EXPY and export shares by classes of PRODY are displayed in Table 2. The table reveals that the average sophistication level of the Portuguese export basket (EXPY) has increased over time, from 15.063 USD in 1995 to 16.603 USD in 2005.

To get a sense on how this change came about, export volumes at constant PRODY values are split into 5 classes of PRODY. The 5 classes considered range from the 20% products with higher PRODY values to the 20% products with lower PRODY values (figures for 81 countries based on COMTRADE data are displayed in Appendix 3).

7 This evidence contrasts with Amador et al. (2007), who report a high persistent specialization pattern in Portugal, as compared to Spain and Ireland. However, their analysis does not take into account income contents. Weighting the exports shares with PRODY indexes, our analysis suggests that the structural adjustment effect was more significant in Portugal than in the cases of Ireland and Spain (see Appendix 2). Lebre de Freitas and Salvado (2008) discuss, on a comparative basis, how valuable the current productive experience is in preparing the country for upscale moves.

8 The analysis for Italy confirms Di Maio and Tamagni (2007). The authors found that the low performance of that country in the last two decades was mainly explained by the fact that Italy remained stuck in a number of products which PRODY values have declined, due to the entry of emerging economies in these markets. In the figure, Italy is on the lower-left corner, meaning lack of structural adjustment and specialization in products of declining value.

9 Restricting attention to 2005 PRODY values, we are no longer constrained with the need to have a consistent sample of countries for the years 1995 and 2005. Therefore, from this point forward the PRODY values are computed using a larger sample of countries (93 instead of 81). This allows the PRODY index to reflect more accurately the world structure of international trade.

10 A major drawback of COMTRADE is the presence of a sizeable category of miscellaneous products, “9999-Commodities not specified according to kind”, which accounted for 2,9% of the world trade in 2005. This category cannot be ignored while computing RCA indexes, but there is no point in computing its PRODY value. Because this category differs significantly over time and across countries, its presence complicates international and inter-temporal comparisons. In the case of Portugal, a major change in the statistical treatment of confidentiality has occurred in 2005, causing a large number of products previously classified elsewhere to be moved to the class 9999. As a result, the share of exports in this category jumped from nearly zero to 8.7%.

Table 2 – The structure of Portuguese Exports by classe of PRODY[11]

PRODY Class	1995			2005			Growth of exports 1995-2005	
	Exports (10^6 euro)	Share of exports	EXPY	Exports (10^6 euro)	Share of exports	EXPY	% change	contribution (p.p.)
very high (20% highest)	1479	8	2117	3668	12	3081	148	18
high	4429	25	5320	9292	32	6688	110	40
median	2551	15	2435	4879	17	2748	91	19
low	5422	31	3674	7534	26	3049	39	18
very low (lowest 20%)	3566	20	1517	4083	14	1037	14	4
Total	17448	100	15063	29456	100	16603	69	100

Sources: Own calculations, based on INE and COMTRADE data.

The table shows that there has been a steady increase in the share of products with "High" and "Very High" income content (from a total weight of 33% in 1995 to 44% in 2005), at the cost of the classes "Low" and "Very Low" (from 51% to 40%). This suggests that the increase in the average sophistication of the Portuguese export basket was achieved through a re-allocation of resources from products with low and very low implied productivity to products with higher implied productivity.

Table 2 also displays the contributions of the different classes of PRODY to the growth rate of Portuguese exports between 1995 and 2005. According to these data, the growth rate of exports (at current prices) between 1995 and 2005 was of 69%. The classes growing above the average were those with "Very High" (148%), "High" (110%) and "Average" (91%) income content. In terms of contributions, the first two classes, which represented about 1/3 of the exports in the beginning of the period, accounted for 58% of total export growth. This confirms a trend towards a specialization pattern more based on "rich country goods".

5. Foreign-owned firms, export growth and structural transformation in Portugal

In this section, we assess the extent to which foreign-owned firms had a role in the process of structural transformation of the Portuguese Economy, in the period from 1995 to 2005. For this purpose, we estimate the share of foreign-owned firms in the Portuguese exports, by product category, using data collected by the Portuguese Ministry of Labour and Social Solidarity on the composition of firms' capital by nationality of owners. By "foreign-owned firms", we mean those firms in which the proportion of capital owned by non-nationals is equal or greater than 50% (details in Appendix 4)[12].

We first assess the extent to which foreign-owned firms have contributed to the growth of Portuguese exports. In Table 3, product categories are split into 5 groups of similar dimensions, according to their contribution to the growth of Portuguese exports in the period from 1995 to

11 In this and in the following tables, EXPY is calculated with 2005 PRODY values, and export shares are calculated at current prices.

12 Due to data limitations, in this section we restrict the analysis to 1.094 product categories (representing 96% of the Portuguese exports in 2005).

2005. Here, we see that the top 20% products in terms of contribution to export growth concentrate 83% of the estimated exports by foreign-owned firms in 2005. Table 3 also reveals that 12% of the estimated foreign-owned firms exports are related to products which exports have declined between 1995 and 2005. Coincidently, this is the only group of products in which the share of foreign-owned firms in total exports has diminished (from 32% in 1995 to 25% in 2005). This is suggestive of a strong impact of foreign firms on the variation of Portuguese exports, both positively and negatively[13] [14].

Table 3 – Share of foreign-owned firms in Portuguese exports by contribution to export growth

Contribution to export growth between 1995 and 2005	number of product classes	share of exports (%)		contribution to export growth (%)	share of foreign firms in total exports (%)		share of exports by foreign firms (%)	
		1995	2005		1995	2005	1995	2005
very high (20% highest)	218	49	72	106	35	40	53	83
high	219	5	5	6	23	27	4	4
median	219	1	1	1	22	28	1	1
low	219	0	0	0	18	34	0	0
very low (lowest 20%)	219	42	17	-20	32	25	43	12
All products	1094	97	96	93	33	36	100	100

Sources: Own calculations, based on INE and GEP/MTSS, Quadros de Pessoal.
Notes: The table does not include data on 140 product classes, for wich there is not data available on the presence of foreign-owned firms; the share of foreign-owned firms in each group is calculated as the weighted average of the foreign-owned firms shares in the exports in each product, with the weights given by the share of each product in the exports of the group.

We next cross information on foreign-ownership and on the change of Portuguese specialization pattern, the later evaluated by organizing the export products according to their revealed comparative advantage (RCA) in 1995 and in 2005. In Table 4 we consider four types of products: the “classics” (i.e., products in which Portugal had a revealed comparative advantage both 1995 and in 2005); the “rarities” (products in which Portugal did not have a RCA in none of the years); the “emerging” (products in which Portugal gained a RCA between 1995 and 2005); and finally the “decaying” (products in which Portugal had a RCA in 1995 but not in 2005)[15].

13 Actually, the direction of causality cannot be disentangled on the basis of the available data: multinational companies also tend to be attracted by fast exporting sectors. In a formal investigation, Magalhães and Africano (2007) find a significant correlation between the stock of (inward) FDI inflows and exports, suggesting at least a causality running from FDI to export growth.
14 It should be noted that these results are influenced by the bigger scale of foreign controlled firms with respect to the nationally controlled ones. To have an idea of the disproportion, in 2005 the average turnover of foreign-controlled firms in Portugal was about 24 times bigger than the average turnover of the remaining firms (source: Quadros de Pessoal database, GEP/MTSS). This figure considers all firms, independently of their involvement in international trade. If we were to consider only exporting firms, the contrast in the scales of foreign-dominated and other firms would surely be lower. Still, if we only consider firms with 50 employees or more, the average turnover of foreign-controlled firms in Portugal in 2005 was about 3.4 times higher than the average turnover of the remaining firms.
15 We partially borrow these expressions from Boccardo et al. (2007).

Table 4 – Share of foreign-owned firms in Portuguese exports by RCA change

Types of products	number of product classes	share of exports (%)		contribution to export growth (%)	share of foreign firms in total exports (%)		share of exports by foreign firms (%)	
		1995	2005		1995	2005	1995	2005
classics	175	67	54	35	26	26	54	41
rarities	682	12	15	19	33	46	12	20
emerging	110	10	24	45	64	52	21	36
decaying	51	8	2	-5	52	46	13	3
All products	1094	97	96	93	33	36	100	100

Sources: Own calculations, based on INE and GEP/MTSS, Quadros de Pessoal.
Notes: The table does not include data on 140 product classes, for wich there is not data available on the presence of foreign-owned firms; the share of foreign-owned firms in each group is calculated as the weighted average of the foreign-owned firms shares in the exports in each product, with the weights given by the share of each product in the exports of the group; firms are considered "foreign" if the percentage of capital held by non-nationals is greater or equal to 50%.

According to Table 4, the "emerging" was the group that contributed the most to the increase in exports (45%), reflecting the role of non-traditional products to the expansion of Portuguese exports. As far as the role of foreign-owned firms is concerned, we observe that the "emerging" group is also the one in which the share of foreign-owned firms in total exports was larger, both in 1995 (64%) and in 2005 (52%). The last column in the right hand side of Table 4 examines the distribution of

Table 5 – The role of foreign-owned firms in Portuguese exports by classes of PRODY[16]

Prody Class in 2005	number of product classes	share of exports (%)		contribution to export growth (%)	share of foreign firms in total exports (%)		share of exports by foreign firms (%)	
		1995	2005		1995	2005	1995	2005
very high (20% highest)	217	8	10	13	34	43	9	13
high	235	25	31	40	50	56	40	50
median	216	14	16	19	33	33	14	16
low	215	30	25	17	25	17	23	12
very low (lowest 20%)	211	20	13	4	23	24	14	9
All products	1094	97	96	93	33	36	100	100

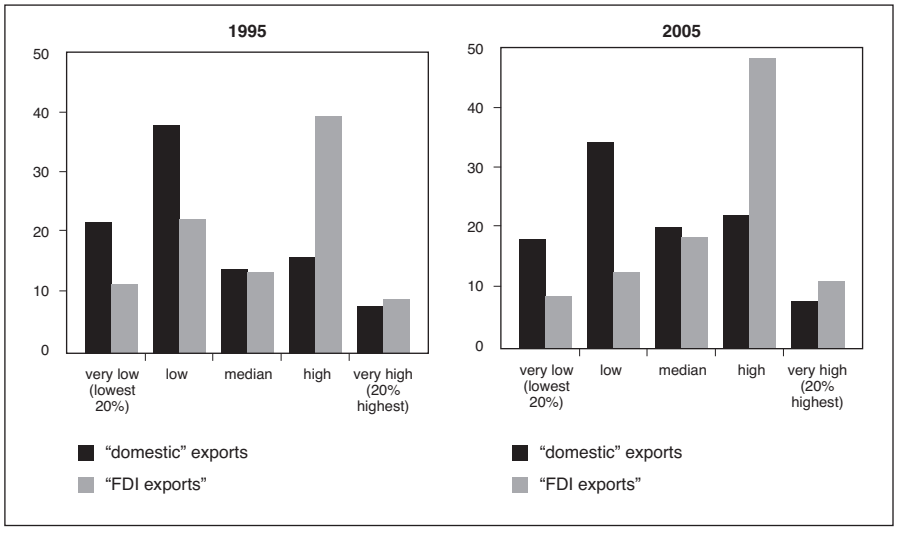
Sources: Own calculations, based on INE, COMTRADE and GEP/MTSS, Quadros de Pessoal.
Notes: The table does not include data on 140 product classes, for wich there is not data available on the presence of foreign-owned firms; the share of foreign-owned firms in each group is calculated as the weighted average of the foreign-owned firms shares in the exports in each product, with the weights given by the share of each product in the exports of the group; firms are considered "foreign" if the percentage of capital held by non-nationals is greater or equal to 50%.

16 In this and in the following tables, the share of foreign-owned firms in each group is calculated as the weighted average of the foreign-owned firms shares in the exports in each product, with the weights given by the share of each product in the exports of the group (for further details see appendix 4).

foreign-owned firms' exports. The table reveals that the group of "classics" is dominant in foreign--owned firms' exports, but with a loosing weight (41% in 2005, as compared to 54% in 1995). The non-traditional products ("emerging" plus "rarities"), in turn, are of increasing importance and, taken together, already accounted for 56% of the foreign-commanded exports in 2005 (33% in 1995).

We now investigate the role of foreign-owned firms in the upscale move of the Portuguese specialization pattern. Table 5 analyses the presence of foreign-owned firms in exports per class of income content. According to these estimates, the share of those firms in total exports increased from 33% in 1995 to 36% in 2005. In 2005, the classes of PRODY with higher presence of foreign-owned firms were, respectively, the "High" and "Very High" (weights equal to 56% and 43%, respectively). Moreover, in that year, 63% of exports by foreign firms were accounted for by these two classes.

Figure 4 – Share of exports of different PRODY classes



Sources: Own calculations based on INE, COMTRADE and GEP/MTSS.

In Figure 4, we compare the distributions of exports by classes of PRODY, for domestic firms and foreign firms, in 1995 and in 2005. We observe that the distribution of foreign-owned firms – led exports is more biased towards products with higher income content than the corresponding distribution of domestic firms (a simple Chi-square test rejects the hypothesis of equal distributions, at a 1% significance level). Furthermore, while in the case of "domestic" exports the shape of the distribution is approximately the same in 1995 and in 2005 (though with an increase in the weight of products with higher income content), in the case of foreign-owned firms there is a visible change in the shape of the distribution (also confirmed by the Chi-square test). In particular, the distribution of foreign-commanded exports by class of PRODY has changed from a bi-modal to a one-modal one, with half of exports concentred in the class of "High" PRODY value.

Finally, we assess whether the increasing role of foreign-owned firms in exports with high income content refers to traditional or to non-traditional sectors. In Table 6, we cross the information on

exports by foreign affiliates per historical status (Table 4) with the information on exports by foreign affiliates per classes of PRODY (Table 5), for the year 2005. We observe that 31% of the foreign-owned firms exports correspond to "emerging" products with "High" income content and other 11% correspond to "rarities" with "Very High" income content.

Table 6 – Foreign-owned firms exports by evolution of RCA and PRODY class

Type of products	Prody Class in 2005					
	Very low (lowest 20%)	Low	Median	High	Very high (20% highest)	Total
classics	6	11	9	14	1	41
rarities	0	0	2	6	11	20
emerging	2	1	3	31	0	36
decaying	0	0	2	0	0	3
All products	9	12	16	50	13	100

Sources: Own calculations based on INE and GEP/MTSS, Quadros de Pessoal.
Notes: The table does not include data on 140 product classes, for wich there is not data available on the presence of foreign-owned firms; the share of foreign-owned firms in each group is calculated as the weighted average of the foreign-owned firms shares in the exports in each product, with the weights given by the share of each product in the exports of the group; firms are considered "foreign" if the percentage of capital held by non-nationals is greater or equal to 50%.

Table 7 illustrates the results discussed in this section by providing information on the 20 product categories that have contributed the most for the growth in Portuguese exports between 1995 and 2005 (these were responsible for 60% of the total increase in exports during this period). In the table we see that foreign-owned firms accounted for at least 2/3 of the exports in 2005 in 8 out of those 20 product categories. With two exceptions, the share of foreign-owned firms in these foreign-owned firms – dominated products was already significant in 1995. Only 3 of these 8 cases consist in "classic" exports, the others being non-traditional products. And in all but two of these products (namely, cigarrets and rubber tyres), the income content is either "High" or "Very High". This table also illustrates the relevance of the automotive and related industries in the processes discussed above: Motor cars and Parts and accessories of motor vehicles, both classified as products with high PRODY values, are responsible for 19% of the growth observed in Portuguese exports.

Table 7 – Top 20 products in terms of contribution to export growth

Code	Commodity	share of exports in 2005 (%)	contribution to export growth (%)	share of foreign firms in exports in 1995 (%)	share of foreign firms in exports in 2005 (%)	Prody value in 2005	RCA class
8 703	Motor cars and other motor vehicles principally designed for the transport…	7	11	99	84	High	emerging
8 708	Parts and accessories of the motor vehicles of headings 87.01 to 87.05.	4	8	56	66	High	emerging
8 473	Parts and accessories for use with machines of heading 84.69 to 84.72	2	5	28	n.a.	Very High	emerging
2 710	Petroleum oils, other than crude	4	5	0	0	Low	classics
9 401	Seats (other than those of heading 94.02), whether or not convertible into…	2	3	5	0	Median	classics
4 802	Uncoated paper and paperboard, of a kind used for writing	2	3	1	0	Very High	classics
8 527	Reception apparatus for radio-telephony, radio-telegraphy or radio-broadcas…	3	3	93	98	High	classics
8 542	Electronic integrated circuits and microassemblies	2	3	80	95	Very High	rarities
6 109	T-shirts, singlets and other vests, knitted or crocheted	2	3	31	33	Very low	classics
4 011	New pneumatic tyres, of rubber	1	3	75	93	Median	classics
7 601	Unwrought aluminium	1	2	0	12	Median	emerging
2 402	Cigars, cheroots, cigarillos and cigarettes	1	2	4	85	Very low	emerging
3 004	Medicaments (excluding goods of heading 30.02, 30.05 or 30.06)	1	2	38	36	Very High	rarities
8 481	Taps, cocks, valves and similar appliances for pipes, boiler shells	1	1	14	78	High	emerging
7 214	Other bars and rods of iron or non-alloy steel, not further worked than for…	1	1	0	0	Low	emerging
2 204	Wine of fresh grapes, including fortified wines	2	1	31	18	Low	classics
2 901	Acyclic hydrocarbons	1	1	5	73	High	classics
4 504	Agglomerated cork (with or without a binding substance)	1	1	8	8	High	classics
8 480	Molding boxes for metal foundry; mould bases; molding patterns	1	1	4	6	High	classics
4 503	Articles of natural cork	1	1	8	8	High	classics
Total of 20 products contributing most to export growth		**39**	**60**	**46**	**50**	**–**	**–**

Sources: Own calculations based on INE and GEP/MTSS.

6. Conclusions

In this paper, we document that the average income content of the Portuguese exports has grown above the world average between 1995 and 2005. This evolution is related to an above average "structural transformation effect" (that is, a shift in the specialization pattern towards products with higher income content). Given the increasing competition from emerging economies in the traditional segments, had the Portuguese export basket remained stuck, its average income content would have grown less than the world average.

Analysing in greater detail the evolution in the Portuguese export structure, we find an increasing role of the classes of products with "High" and "Very High" income content, both in terms of growth and in terms of contribution to growth. Between 1995 and 2005, these two classes accounted for 55% of the total export growth. Though using a different methodology, our evidence accords with the recent findings of Caldeira Cabral (2008) and Amador et al. (2007) who analysed the changing structure of Portuguese exports following the OECD classification of R&D intensities.

As far as the role of foreign-owned firms is concerned, we draw three main conclusions. First, foreign-owned firms have played a key role in the growth rate of Portuguese exports. In particular, we observe that the top 20% of products that most accounted for the growth in Portuguese exports concentrate 83% of the estimated exports by foreign firms in 2005. Second, we document that foreign-owned firms have contributed significantly to the change in the Portuguese specialization pattern. In particular, we find that the share of those firms in total exports is higher in the category of products in which Portugal recently achieved comparative advantage. Taken together, the non-traditional exports (e.g, those products in which Portugal had no revealed comparative advantage in 1995) accounted for 56% of the exports by foreign firms. Third, foreign affiliated firms have contributed to the upscale move of the Portuguese specialization pattern. For instance, we find that almost 2/3 of exports by foreign firms in Portugal in 2005 correspond to products with "High" and "Very High" income content. We also observe that the distribution of foreign-owned firms' exports is more biased towards products with higher income content than the corresponding distribution for domestic firms and that this bias has increased over time. Taken together, this evidence suggests that foreign-owned firms have played a relevant role in the Portuguese export performance, both in terms of growth, diversification and upscale movement.

The evidence found in this paper complements those of Cabral (1996) and Magalhães and Africano (2007), who found that foreign investment has contributed to the expansion of Portuguese exports. The evidence in this paper does not, support, however, the IMF (2008, pp 97-103) claim that foreign investment did not contribute to boosting export performance or to upgrade Portuguese exports. The IMF conclusion is formulated observing that: (i) the sectors which experienced an increase in the shares of FDI since the mid-1990s were typically those with a lower growth of international demand, and (ii) rising FDI flows to "high-tech" sectors were offset by increasing "low-tech FDI". A drawback in the IMF analysis is that the authors used a high level of aggregation and examined FDI financial flows, rather than exports by foreign affiliated firms, as we do in this paper.

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Appendix 1: Definitions of PRODY and EXPY

The PRODY index measures the "income content" of each product, as a weighted average of per capita incomes of the countries that export it. For each product i, the PRODY index is computed as:

$$PRODY_i = \sum_{c \in C} \sigma_{ci} Y_c, \text{ where } \sigma_{ic} = \frac{RCA_{ic}}{\sum_{d \in C} RCA_{id}}, RCA_{ic} = \frac{X_{ic} / X_c}{X_i / X}, \; C = \{1, 2, \ldots\ldots, M\},$$

where Y_c is real GDP per capita in the c-th country, M is the number of countries and the weights σ_{ic} normalize the Balassa (1958) index of Revealed Comparative Advantage (RCA) of the c-country with respect to all the countries exporting in the same sector.

The average income content of a country export basket, EXPY, is computed, for each country, according to:

$$EXPY_c = \sum_i S_i \, PRODY_i, \text{ where } S_i = \frac{X_{ic}}{X_c}, \text{ is the share of product i in the exports of country c.}$$

Appendix 2: Decomposing the growth of EXPY at current PRODY

Let E_i^t be the value of EXPY of country i in year t, s_{ij}^t the share of product j in the total exports of country i in year t, and Pj^t the PRODY value of product j in year t. The change in EXPY from t to $t + n$ can be decomposed as follows:

$$E_i^{t+n} - E_i^t = \sum_j s_{ij}^{t+n} . P_j^{t+n} - \sum_j s_{ij}^t . P_j^t$$

$$= \sum_j \left(s_{ij}^{t+n} . P_j^{t+n} - s_{ij}^t . P_j^t \right)$$

$$= \sum_j \left[\left(s_{ij}^{t+n} - s_i^t \right) . P_j^{t+n} + s_{ij}^t . \left(P_j^{t+n} - P_j^t \right) \right]$$

$$= \sum_j \left(s_{ij}^{t+n} - s_{ij}^t \right) . P_j^{t+n} + \sum_j s_{ij}^t . \left(P_j^{t+n} - P_j^t \right)$$

$$= \sum_j \left(s_{ij}^{t+n} - s_{ij}^t \right) . P_j^t + \sum_j \left(s_{ij}^{t+n} . P_j^{t+n} + s_{ij}^t . P_j^t - s_{ij}^{t+n} . P_j^t - s_{ij}^t . P_j^{t+n} \right) + \sum_j s_{ij}^t . \left(P_j^{t+n} - P_j^t \right)$$

The first component of this expression is the pure "structural transformation effect" (it tells how the EXPY would have changed if the PRODY values of the different products did not change between 1995 and 2005), the last component gives the pure "PRODY effect" (it shows how the EXPY of a country would have changed if there had been no transformation in its export structure), and the component in the middle is the "mixed effect" (which takes into account the fact that the impact of changes in PRODY values on the country's EXPY are amplified when they refer to products which have gained weight in the country's export basket and vice-versa).

Dividing both sides of the equation by the initial EXPY value, the decomposition appears in growth rates. The following table displays the results in the later form for 81 countries.

	EXPY 1995	EXPY 2005	EXPY growth		Pure Prody effect	Mixed effect	Pure structural effect
			rate	rank			
Argentina	9.909	12.964	31	73	29	2	-1
Australia	11.328	16.762	48	33	42	4	2
Austria	13.656	18.599	36	67	35	2	-1
Belize	5.731	7.150	25	81	42	-7	-10
Bolivia	6.825	11.038	62	13	29	-1	34
Brazil	10.231	15.063	47	35	39	1	6
Cameroon	6.681	11.054	65	12	45	-7	27
Canada	9.200	14.537	58	19	42	6	9
Chile	9.012	17.340	92	6	70	-20	42
China	6.875	9.736	42	47	49	-3	-4
Colombia	8.835	17.240	95	4	31	12	52
Costa Rica	10.981	13.794	26	80	39	-3	-10
Cote d'Ivoire	6.963	13.918	100	3	39	5	56
Croatia	10.800	15.478	43	44	37	-1	7
Cyprus	10.540	17.699	68	11	35	7	25
Czech Rep.	12.360	18.053	46	38	38	0	7
Denmark	13.468	18.578	38	61	36	2	0
Dominica	5.680	8.071	42	46	32	-13	23
Ecuador	7.418	12.810	73	8	41	7	25
Estonia	10.810	16.380	52	29	39	-2	14
Finland	14.324	19.569	37	66	35	-1	2
France	13.077	18.493	41	48	37	3	2
Germany	14.054	19.363	38	62	36	1	1
Greece	9.828	15.363	56	23	37	9	11
Guatemala	6.419	10.376	62	14	41	-5	26
Honduras	4.365	9.321	114	2	47	-2	69
Hong Kong SAR	11.293	17.337	54	26	34	3	16
Hungary	11.332	18.071	59	16	37	0	22
Iceland	13.440	18.952	41	52	31	6	4
India	9.322	14.455	55	25	43	4	8
Ireland	14.585	23.438	61	15	39	16	6
Israel	12.411	18.550	49	31	43	6	0
Italy	12.880	17.886	39	59	36	2	1
Japan	14.547	19.575	35	70	34	1	0
Jordan	8.314	11.962	44	43	46	-12	10
Kazakhstan	9.216	14.460	57	21	56	-9	11
Kiribati	4.527	5.854	29	77	55	-60	35
Kyrgyzstan	6.968	9.237	33	72	80	-62	14
Latvia	10.023	15.236	52	28	49	-5	8
Lithuania	10.177	15.041	49	34	45	-2	5
Madagascar	4.205	9.458	125	1	50	-5	80

	EXPY 1995	EXPY 2005	EXPY growth		Pure Prody effect	Mixed effect	Pure structural effect
			rate	rank			
Malawi	2.921	4.589	57	20	38	-5	24
Malaysia	12.387	17.095	38	60	31	0	7
Maldives	7.396	12.827	73	7	49	-13	37
Malta	13.293	18.710	41	53	31	5	5
Mauritius	7.582	11.988	58	18	34	1	23
Mexico	12.152	16.998	40	54	35	0	5
Morocco	6.791	10.775	59	17	42	-6	22
Mozambique	4.692	6.528	39	58	55	-86	70
Netherlands	13.044	17.928	37	63	35	1	1
New Zealand	11.848	17.120	44	40	41	0	3
Nicaragua	5.901	8.213	39	57	57	-31	13
Niger	3.985	5.159	29	76	35	-22	17
Norway	12.673	16.532	30	75	36	-3	-3
Oman	11.195	15.379	37	64	37	-4	4
Panama	6.111	10.357	69	9	44	-14	39
Paraguay	6.713	9.031	35	71	36	-10	8
Peru	6.233	8.984	44	42	54	-12	2
Poland	10.916	16.730	53	27	39	1	13
Portugal	11.058	16.394	48	32	35	5	9
Rep. of Korea	12.787	18.280	43	45	34	0	9
Rep. of Moldova	8.213	10.547	28	78	41	-15	2
Romania	10.241	14.465	41	50	39	-2	4
Saudi Arabia	10.863	15.360	41	49	41	-1	2
Singapore	13.903	18.792	35	69	32	3	1
Slovakia	11.472	17.148	49	30	39	2	8
Slovenia	12.629	18.561	47	36	41	3	4
Spain	12.507	17.475	40	55	38	1	1
Sweden	14.143	19.332	37	65	37	1	-1
Switzerland	15.117	21.842	44	41	38	6	0
TFYR of Macedonia	8.939	12.107	35	68	42	-8	2
Thailand	11.246	16.484	47	37	32	3	11
Togo	6.153	8.039	31	74	42	-40	28
Trinidad and Tobago	8.994	14.064	56	22	52	-9	13
Tunisia	8.683	12.668	46	39	31	4	12
Turkey	9.124	14.247	56	24	33	6	17
Uganda	4.493	8.732	94	5	34	-8	68
United Kingdom	13.689	19.312	41	51	38	2	2
Uruguay	10.645	13.523	27	79	28	2	-3
USA	13.700	19.078	39	56	35	2	2
Zambia	3.376	5.701	69	10	76	-87	80

Appendix 3: Exports shares by class of PRODY

	1990						1995						2000						2005					
	Very Low	Low	Median	High	Very High	Total	Very Low	Low	Median	High	Very High	Total	Very Low	Low	Median	High	Very High	Total	Very Low	Low	Median	High	Very High	Total
Argentina							39	25	20	12	4	100	35	27	20	13	4	100	36,8	26,1	22,7	10,7	3,8	100
Australia	26	20	33	14	7	100	24	18	33	15	11	100	20	22	33	13	13	100	17,5	18,6	42,4	11,7	9,8	100
Austria							6	16	20	34	24	100	5	14	18	37	24	100	4,3	17,1	18,6	35,3	24,7	100
Belize							69	27	2	3	1	100	62	36	1	1	0	100	67,8	29,4	1,3	0,7	0,7	100
Bolivia							64	23	11	2	0	100	61	11	14	12	1	100	42,3	18,1	37,9	1,1	0,5	100
Brazil	28	25	24	17	6	100	30	20	24	19	6	100	24	18	24	26	8	100	23,8	21,8	24,2	21,5	8,8	100
Cameroon							38	51	10	1	0	100	24	68	8	0	0	100	28,5	64,1	6,7	0,5	0,2	100
Canada	9	18	24	33	17	100	8	17	22	35	18	100	6	18	24	35	18	100	6,1	21,1	27,5	30,4	15,0	100
Chile	64	22	7	6	1	100	59	20	9	11	2	100	56	22	10	10	2	100	65,6	17,9	8,9	5,3	2,3	100
China							27	24	18	20	12	100	20	21	18	25	15	100	13,0	16,7	18,2	30,1	22,0	100
China HongKong SAR							15	17	18	25	24	100	13	15	17	27	29	100	9,7	11,0	13,4	25,0	40,9	100
Colombia							49	28	14	6	3	100	29	43	16	9	3	100	30,8	36,0	21,6	8,3	3,3	100
Costa Rica							64	19	9	5	3	100	32	13	10	5	40	100	30,5	14,0	13,7	7,5	34,2	100
Cote d'Ivoire																			54,8	37,8	3,2	3,4	0,8	100
Croatia							20	29	27	16	8	100	17	29	32	14	9	100	12,5	31,3	29,7	17,3	9,2	100
Cyprus	32	32	21	10	6	100	42	21	21	6	10	100	40	23	16	12	9	100	7,7	27,2	13,6	13,6	37,9	100
Czech Rep.							9	21	27	30	12	100	6	16	26	40	12	100	4,5	14,5	24,1	44,3	12,7	100
Denmark	10	17	27	20	26	100	9	16	27	21	27	100	9	19	21	21	30	100	7,7	19,6	19,7	22,5	30,6	100
Dominica							81	10	6	2	1	100	59	25	14	2	1	100	53,3	28,6	16,2	1,0	1,0	100
Ecuador							54	41	2	2	1	100	38	56	3	2	1	100	30,8	64,4	2,3	1,7	0,9	100
Estonia							21	29	21	15	14	100	13	26	20	11	30	100	8,9	28,6	20,1	17,1	25,2	100
Finland	6	15	14	24	41	100	4	14	15	25	42	100	3	13	12	21	51	100	3,7	13,5	11,5	22,1	49,2	100
France							7	17	22	35	19	100	6	15	20	35	25	100	5,4	15,9	19,2	36,0	23,6	100
Germany*	5	11	20	41	23	100	5	10	19	41	24	100	4	9	18	43	26	100	3,8	9,4	17,3	42,7	26,8	100
Greece	35	39	17	7	3	100	32	37	18	9	4	100	25	37	18	11	10	100	19,8	32,7	20,8	13,6	13,1	100
Guatemala							66	17	10	3	4	100	56	24	13	3	4	100	59,7	20,6	11,5	3,8	4,3	100
Honduras							86	9	3	1	0	100	72	18	7	3	0	100	61,4	23,4	8,2	4,8	2,2	100
Hungary							16	23	29	21	11	100	7	13	19	43	18	100	4,6	12,4	19,0	42,3	21,7	100
Iceland	46	37	12	4	1	100	49	32	12	4	2	100	43	29	21	3	3	100	38,7	27,2	20,8	6,7	6,6	100
India	48	13	27	7	5	100	44	15	26	9	6	100	37	20	25	10	8	100	27,2	26,7	26,2	12,1	7,8	100
Ireland							4	11	17	25	43	100	2	6	8	21	63	100	1,8	6,1	6,7	17,8	67,6	100
Israel							8	11	41	14	26	100	5	7	37	15	35	100	4,1	7,0	61,6	12,6	24,7	100
Italy							9	21	24	28	19	100	8	20	23	28	20	100	6,9	20,2	23,1	28,4	21,4	100
Japan	2	5	18	46	29	100	1	5	18	42	33	100	1	5	16	42	36	100	1,5	6,1	16,9	42,1	33,3	100
Jordan							42	24	11	11	11	100	29	22	25	15	10	100	43,1	24,1	16,6	7,2	9,0	100
Kazakhistan							27	38	23	7	4	100	18	67	12	2	1	100	14,9	74,5	8,9	1,4	0,3	100
Kiribati							79	21	0	0	0	100							81,2	11,5	6,6	0,2	0,5	100
Kyrgyztan							41	31	10	15	3	100	62	25	6	6	2	100	64,3	22,6	7,3	4,8	1,0	100
Latvia							19	44	17	11	9	100	18	48	19	7	7	100	12,5	46,0	19,9	12,9	8,7	100
Lithuania							15	40	26	12	7	100	18	43	22	12	5	100	10,9	44,9	23,6	15,2	5,4	100
Madagascar	86	9	3	1	1	100	85	10	4	2	0	100	64	29	3	3	1	100	70,7	20,8	3,9	2,4	2,1	100

Appendix 3: Exports shares by class of PRODY (cont.)

	1990						1995						2000						2005					
	Very Low	Low	Median	High	Very High	Total	Very Low	Low	Median	High	Very High	Total	Very Low	Low	Median	High	Very High	Total	Very Low	Low	Median	High	Very High	Total
Malawi	95	3	1	1	0	100	93	3	2	1	0	100	93	2	3	1	0	100	92,6	3,1	2,2	1,6	0,5	100
Malaysia	23	30	14	12	21	100	17	14	17	22	30	100	9	12	17	23	39	100	11,0	14,4	18,1	25,2	31,3	100
Maldives							61	39	0	0	0	100	65	35	0	0	0	100	19,3	75,2	2,5	2,3	0,8	100
Malta							13	6	42	9	31	100	7	8	7	10	68	100	5,4	4,2	56,4	20,3	13,7	100
Mauritius							72	17	5	2	4	100	74	15	4	3	3	100	60,0	13,1	5,9	4,2	16,9	100
Mexico	12	48	10	24	5	100	11	25	17	36	11	100	8	22	17	38	15	100	6,4	27,0	18,7	34,2	13,7	100
Morocco							64	26	6	4	1	100							51,6	32,5	11,0	3,5	1,3	100
Mozambique							79	12	4	4	1	100	52	27	19	1	1	100	75,8	13,5	8,3	2,1	0,3	100
Netherlands							11	18	22	26	23	100	9	17	16	28	30	100	8,7	18,5	18,1	25,0	29,7	100
New Zealand	9	28	25	28	10	100	11	26	27	26	10	100	10	25	28	26	12	100	8,5	24,4	29,8	24,9	12,4	100
Nicaragua							62	20	4	7	7	100	75	17	6	1	1	100	64,8	26,3	6,4	1,5	1,0	100
Niger							90	3	2	5	0	100	78	6	5	11	1	100	88,3	2,9	2,6	5,7	0,5	100
Noway							6	54	23	8	10	100	3	64	20	5	7	100	2,8	58,7	26,4	4,8	7,3	100
Oman	2	93	1	3	0	100	6	82	3	8	1	100	4	85	3	7	1	100	1,9	73,2	23,2	1,3	0,4	100
Panama							73	14	9	1	4	100	57	29	10	1	2	100	56,3	35,3	7,4	0,6	0,5	100
Paraguay	78	19	3	0	0	100	81	14	3	1	1	100	80	14	4	1	1	100	69,0	21,5	7,5	1,0	1,0	100
Peru							73	21	4	1	1	100	70	23	4	2	1	100	71,8	21,3	4,2	2,1	0,6	100
Poland							20	24	37	14	7	100	13	20	35	24	7	100	8,6	19,9	34,1	29,3	8,0	100
Portugal	26	32	15	21	6	100	20	31	15	25	8	100	16	27	15	32	9	100	14,4	26,5	16,9	31,5	10,7	100
Rep. of Korea	17	25	20	21	17	100	9	17	21	27	24	100	7	16	19	28	30	100	3,1	13,5	18,4	33,3	31,6	100
Rep. of Moldova							27	51	11	7	4	100	34	48	7	8	3	100	34,5	48,3	9,9	5,4	1,9	100
Romania	8	43	25	21	4	100	23	38	23	11	4	100	27	35	19	11	7	100	20,2	38,7	20,6	16,8	3,7	100
SaudiArabia							1	89	7	3	0	100	1	93	4	3	0	100	0,6	88,0	8,0	2,9	0,4	100
Singapore	10	24	13	31	22	100	6	12	12	36	34	100	4	12	10	29	44	100	2,7	15,2	10,2	23,0	48,9	100
Slovakia							11	30	28	23	8	100	8	25	23	37	7	100	5,3	26,9	23,1	36,4	8,3	100
Slovenia							9	13	31	32	15	100	6	11	32	36	16	100	4,6	11,5	28,7	38,2	17,0	100
Spain	8	26	20	37	9	100	8	20	19	41	11	100	8	20	20	40	12	100	7,4	20,1	20,8	37,4	14,3	100
Sweden							3	13	14	33	37	100	2	12	14	28	43	100	2,9	14,9	14,8	29,4	38,1	100
Switzerland	4	8	18	25	44	100	3	8	17	26	46	100	2	7	17	23	50	100	2,7	8,8	12,3	19,4	56,8	100
TFYR of Macedonia							39	33	14	11	3	100	38	47	7	6	2	100	42,7	43,2	6,1	5,3	2,7	100
Thailand	45	16	14	11	14	100	31	15	17	21	15	100	21	14	20	20	24	100	17,2	14,9	22,1	30,1	15,7	100
Togo							68	25	3	3	1	100	82	10	4	3	0	100	65,4	26,9	6,7	0,6	0,5	100
Trinidad and Tobago							6	67	24	2	1	100	3	62	33	1	0	100	1,6	52,1	44,6	0,9	0,8	100
Tunisia							53	32	6	6	2	100	48	36	6	9	2	100	38,6	38,7	7,5	12,7	2,5	100
Turkey	48	33	11	6	2	100	41	35	14	8	2	100	34	30	18	14	3	100	24,4	29,8	24,9	17,8	3,1	100
Uganda							94	3	2	1	0	100	75	10	12	1	2	100	80,0	12,6	2,2	2,5	2,7	100
United Kingdom							5	17	17	33	29	100	3	16	16	30	34	100	3,3	17,7	15,9	27,8	35,2	100
Uruguay							38	27	22	11	2	100	33	32	20	11	4	100	22,3	42,4	24,3	7,2	3,7	100
USA							10	10	16	35	30	100	7	9	15	36	34	100	6,5	9,3	16,3	35,8	32,1	100
Zambia							91	5	3	1	0	100	85	9	2	2	1	100	90,2	5,7	3,4	0,4	0,3	100

* Former Fed. Rep. of Germany in 1990.

Appendix 4: Estimating the role of foreign-owned firms in exports

Although we have data on exports at the product level (including confidential positions), we do not know how much of these exports are conducted by foreign-controlled firms. In order to estimate the share of foreign-owned firms in the total exports of each product category, we used the "Quadros de Pessoal" database, which is compiled by the Portuguese Ministry of Labour and Social Solidarity. This database includes information on every firm with employed labour in Portugal, and contains a variable measuring the proportion of each firm's capital held by non-nationals.

We start with the concordance tables between the Combined Nomenclature of goods (at the 4 digit level of desegregation) and NACE (the Classification of Economic Activities in the European Community, at the 4 digit level of desegregation) for 1995 and 2005. There is a bi-univocal relation for 84% of the CN codes, but some of the product categories have more than on corresponding NACE code, as shown in the following table:

	CN codes	
Number of NACE codes for each CN code	N.º	%
1	924	84
2	139	13
3 or more	24	3
Total	**1094**	**100**

Using the information in "Quadros de Pessoal", we computed the share of foreign-controlled firms (defined as those firms in which the proportion of capital owned by non-nationals is equal or greater than 50%) in the total sales turnover of each industry. Then, the share of foreign-owned firms in the exports of each CN category was computed as the weighted average of foreign-owned firms' shares each industry turnover, with weights given by the turnover of that industry. In those cases in which there is a bi-univocal relation between NC and NACE codes, we assume that the share of foreign-owned firms in the exports of a given product is simply the share of foreign-controlled firms in the corresponding industry (computed as above). In the other cases, the share of foreign-owned firms in the exports of each CN category was computed as the weighted average of the shares of foreign-owned firms in the turnover of each industry exporting that product, with weights given by the turnover of that industry. Formally,

$$FX_i = \sum_j a_{ij} FT_j \,,$$

where FX_i is the share of foreign-owned firms in the exports of product i; FT_j is the proportion of foreign-affiliated firms' turnover in the total turnover of industry j; and a_{ij} is the weight of industry j in the total turnover of industries associated with the product i (according the concordance tables), i.e.,

$$a_{ij} = T_{ij} \Big/ \sum_j T_{ij} \,,$$

$$\text{where } T_{ij} = \begin{cases} \text{turnover of industry } j & \text{if } j \text{ is associated with product } i \\ 0 & \text{otherwise.} \end{cases}$$

Understanding the transition to work for first degree university graduates in Portugal*

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resumo

Uma forma tradicional de aferir a importância das universidades assume que estas são fontes de efeitos positivos do ponto de vista dos *inputs*. De acordo com esta perspectiva, a importância de uma universidade pode ser medida pelos seus efeitos multiplicadores, a nível regional/nacional. Esta perspectiva pode ser complementada através da análise das questões associadas à transição para o emprego pelos seus diplomados. O artigo analisa os factores que poderão ser importantes para explicar o tempo de obtenção do primeiro emprego por parte dos estudantes de primeiro ciclo, para tal utilizando uma amostra de alunos de uma instituição de ensino superior portuguesa, a Universidade de Évora. Assim, estimam-se diversas especificações de modelos de duração a tempo discreto. Os resultados mostram que existem diferenças significativas entre os estudantes dos diversos cursos e destacam a importância da classificação final do curso. No entanto, em particular, pode concluir-se que não existem diferenças significativas entre a área de Economia e Gestão e a área de Engenharia, e que estas áreas de estudo são as mais bem sucedidas na transição para o mercado de trabalho. Também não encontram diferenças significativas, neste aspecto, entre estudantes do sexo masculino e feminino. Conclui-se, igualmente, que existem diferenças significativas na probabilidade de saída do desemprego, entre os vários anos considerados na amostra, o que reflecte o ciclo económico.

résumé / abstract

A traditional way of looking at the importance of universities assumes that these are sources of positive effects from the viewpoint of the inputs. In accordance to this perspective, the importance of a university can be measured by its regional/national multiplier effects. This perspective can be complemented with the analysis of the issues associated with the transition to work by their graduates. The paper thus analyses the factors that may be important to explain the time to obtain the first job by first degree students, using a sample of students from one university in Portugal. In doing so, we estimate several specifications of discrete-time duration models. The results show that there are significant differences among the students from the several courses and highlight the importance of the final mark in the course. Nevertheless, in particular, we conclude that there are no significant differences between the area of Economics and Management and the area of Engineering and that these study areas are the most successful ones. We also did not find any significant differences between male and female students. Finally, we also conclude that there are significant differences on the probability of leaving unemployment among the several years considered in the sample, which reflects the business cycle.

Classificação JEL: J64, I23, C41.

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1. Introduction

A traditional way of looking at the importance of universities assumes that these are sources of many positive effects from the point of view of the inputs, i.e. from a demand side perspective. In accordance to this perspective, the importance of a university can be measured by its multiplier economic effects, at a regional or national level (Thomas 1995; Brown and Heaney 1997). Plainly, this perspective can be complemented with the importance of the many outputs that result from the functioning of a university (Blackwell et al. 2002), in particular the level of knowledge that graduates acquire in their university degrees in order to face (a possible entrance in) the labour market (Drucker and Godstein 2007; Wilton 2008; see also Beeson and Montgomery 1993).

As a matter of fact, in the assessment of the quality or performance of universities, the issues associated with the graduates' success in finding a job are supposed to gain importance after developments made in the legal setup of universities (for a related matter see Herrington and Herrington 2004). For instance, van Nijlen and d'Hombres (2008) clearly point out for the increasing importance of the labour market outcomes of graduates, namely for the ranking of universities, which traditionally ignore these issues by considering only scientific outcomes (see also Smith et al. 2000, and Stock and Alston 2000).

Moreover, in the last few years, and particularly in the period of time that we analyse in this paper, it has been increasingly difficult for first-degree graduates to find their first job, following the worsening of the labour market conditions in general. In Portugal, according to Conselho Nacional de Avaliação do Ensino Superior (2004), the unemployment rate for new university graduates was 2.2% in 2001 and 4.9% in 2003. Since then unemployment rates have been increasing considerably, and by 2009, according to Eurostat (2010a), the unemployment rate for young (less than 25 years old) university graduates in Portugal was about 24,5%, much higher than the EU average (15,4%). The situation of University of Évora´ graduates seems to be no different from the rest of the country as the difficulties to find the first job have been growing in recent years[1]. Taking these figures into account, the importance and significance of the analysis of the process of transition into labour market for university graduates are to be increased.

The relevance of the issues related to the employability of the university graduates is clearly being also acknowledged by the agenda of institutions in charge of the Bologna process. Just as an illustration of this fact, the London Communiqué of May 2007, "Towards the European Higher Education Area: responding to challenges in a globalised world", of the Ministers responsible for Higher Education in the countries participating in the Bologna Process called the attention for[2]: "Building on our rich and diverse European cultural heritage, we are developing an EHEA based on institutional autonomy, academic freedom, equal opportunities and democratic principles that will facilitate mobility, *increase employability* and strengthen Europe's attractiveness and competitiveness."

In the particular case of small universities, such as it is the case of the University of Évora, which is located in an economically depressed region, the employability of its graduates also relates to social cohesion (Prokou 2008). In fact, social cohesion is to be achieved when graduates become employed in the region where the university is located and therefore contribute for a smaller unemployment rate in that particular region. This link between employability and social cohesion is an essential matter on the Bologna process. For instance, in the communiqué

1 Data from the European Student Barometer, available at http://www.qi.uevora.pt/, reveal an increase in the number of months to find the first job for both Engineering and Business students in Portugal and also in the University of Évora.

2 See http://www.ond.vlaanderen.be/hogeronderwijs/bologna/documents/MDC/London_Communique18May2007.pdf (accessed on 31/5/2010).

"Realising the European Higher Education Area" of the Conference of Ministers responsible for Higher Education in Berlin on 19 September 2003[3]: "Ministers reaffirm the importance of the social dimension of the Bologna Process. The need to increase competitiveness must be balanced with the objective of improving the social characteristics of the European Higher Education Area, aiming at *strengthening social cohesion* and reducing social and gender inequalities both at national and at European level."

Indeed, the impact of the Bologna process on several aspects of higher education institutions has already been acknowledged by some authors. For example, Cañibano (2008) analysed the evolution of the process of adaptation of Spanish universities to the Bologna principles. Concerning Portugal, Cardoso et al. (2008) concluded that the university programs that were restructured in order to follow the Bologna principles were subject to higher demand than comparable programs that did not restructure, as well as those that considered an integrated master degree (see also Vieira and Coimbra 2006 and Alexandre et al. 2009).

Having said that, this paper thus analyses the factors that may explain the time spent by first degree students of a small university in Portugal, the University of Évora, in order to enter the labour market. We employ a sample of 767 students, graduated between 2000 and 2004, and estimate discrete-time hazard models, considering several specifications, with and no control for unobserved heterogeneity.

The results reveal the existence of significant differences among the several subject areas of graduation, with economics, management and engineering being the most successful subjects. Moreover, the results highlight the importance of the final mark students obtain in the course to their success in the labour market. We also conclude that younger graduates seem to be in a disadvantageous situation in relation to more mature graduates, but that there are no significant differences between male and female students.

The rest of the paper is structured as follows. Some results of the previous literature are presented in Section 2. The data and the methodology used in the paper are presented in Section 3. This is followed by the analysis of the results, which is done in Section 4. Section 5 concludes by presenting the main results and some of possible avenues for further work.

2. Empirical findings in the literature

The transition to employment of university graduates is an issue that has deserved some attention from recent literature. The attention on graduates' success has risen given the increase in unemployment that characterizes many economies. In effect, according to Eurostat (2010a) the unemployment rate of university graduates is at worrying levels in Europe, particularly for some countries like Portugal, Italy or Greece, where the unemployment rate for young university graduates has been higher than for other educational levels. In this sense, it is of no surprise that authors turn their attention to the analysis of the issues related with the time (and its explanatory factors) that university graduates take in order to enter the labour market and obtain a job.

The literature has given special attention to certain (European) countries, which are somehow different in what concerns the institutional settings of universities and labour market functioning. In doing so, different methodologies have been used. These two facts make it difficult to compare the results. In this section we proceed by offering the results that are of interest for several countries.

Italy seems to be one of the countries where the employability of university graduates is attracting most interest from the literature[4]. Biggeri et al. (2001) consider the year of 1992, when

3 See http://www.ond.vlaanderen.be/hogeronderwijs/bologna/documents/MDC/Berlin_Communique1.pdf (accessed 0n 31/5/2010).
4 The Canadian case is also well documented (see Ferrall 1997, Finnie 1999, and Betts et al. 2000).

the unemployment rate for young graduates was around 33%, and use a three-level discrete time survival model in order to analyse the time to obtain the first job by graduates, taking into account not only the graduates' characteristics but also the characteristics of universities and course programmes. The authors conclude that the variability in the success in obtaining the first job depends much more on the course programmes than on the universities. In what concerns the characteristics of the graduates, the authors find out that: the military service is relevant in explaining the male pattern; the estimated hazard functions for females and males without military service have similar shapes although at a higher level for males – this gender difference in favour of males is more pronounced for those graduates with lower final marks (see Finnie 1999, Joy 2000 and McMillen and Singell 2001 for analyses of gender issues); that the final mark has a slightly positive effect on the probability of obtaining a job in a certain time; that students that take less time to graduate also take less time to obtain a job; that the occupational status and education level of the parents exert a significant effect; and that graduates with a previous working experience are more likely to obtain a job but also that mature graduates seem to be in a disadvantageous situation in relation to younger graduates.

Also, for the specific case of labour market performance of Italian university graduates see Quintano et al. (2004), who consider the case of the graduates in Economics at the University of Naples "Parthenope". Through the use of a multinomial logit model the authors do not find neither a gender nor a parents' professional condition effect but rather a strong cohort effect, which is compatible with the (expected) result that the entrance of the graduates in labour market increases as years from graduation increase. As an aside result, Quintano et al. (2004) also conclude that the probability of being unemployed is highly dependent upon the duration of the university degree.

The Italian case is again considered in Pozzoli (2009) by the use of non parametric discrete-time single risk models to study employment hazard. The author analysis Italian graduates in 1998, when Italy displayed one of the highest youth unemployment rates for university graduates in Europe (around 38%). The results indicate that, after a short initial period of negative duration dependence, there is a general evidence of true positive duration dependence, this being explained by the fact that graduates, as time goes by, become less selective as well as adjust their search effort and methods during the unemployment spell, which allows also for an increase in the level of information about job opportunities. With regards to the effects of covariates, older and female graduates, those who graduated in Humanities and Social Sciences, those who have parents with the lowest level of education and finally those who live in Southern and Central Italy are found to have particularly lower hazard of getting their first job.

The focus of van der Klaauw et al. (2005) is the process of job search that graduates undertake, sometimes even before the graduation date (see also Bowlus et al. 2001, Ferrall 1997, and Wolpin 1987). They use of a discrete-time job search model, for the Netherlands for the years 1995 to 2001, when the overall unemployment rates ranged from 7.1% to 2.5% (youth unemployment rate was higher – according to Eurostat it was around 11% in 1996). The authors' main finding relates to the common fact that a great share of graduates starts working immediately after the graduation, which is explained by a job search initiated before leaving the university.

Vanoverberghe et al. (2008) consider a duration model using data on Flemish school leavers. The speed of the transition process from the school-leaving date and the start of the first job is found to be a function of three kind of factors: (a) those that are controllable at relatively low cost, such as search intensity, (b) those that are manageable at large investments cost, such as the level of education, and (c) those that are outside of control, such as ethnicity.

Livanos (2009) ads up to the literature by calling the attention for the fact that the employability of higher education programmes depends upon the kind (i.e. private or public) of sector that usually absorbs the graduates. This fact allows the author to explain why (in Greece) graduates in areas that have high levels of private sector employment, such as Polytechnics and Computer Science,

enjoy higher employability rates than those, such as Sociology and Humanities, that are traditionally related to the needs of the public sector.

Jaunky and Khadaroo (2007) analyse the case of the graduates from the University of Mauritius during the period 1995-2000. Quite interestingly the authors show that the job search time, which is not significantly different among males and females, is positively related to the age of the graduate and to the education of the graduate's father whereas is negatively related to the education of the graduate's mother and to postgraduate training. Moreover, the place of residence seems to matter as graduates from urban areas have a lower job search time than their rural counterparts.

To sum up, as above mentioned, a comparison of the findings for the different countries and periods seems to be complicated, given the differences in the institutional settings of universities, in labour market functioning, as well as the different economic conjunctures throughout the different time periods. Nevertheless, in explaining the transition to work by graduates, differences among the students from the several courses, the importance of the final mark in the course as well as differences between male and female students emerge as important matters. This motivates our model, for a not so well documented case, i.e. Portugal.

3. Data and Methodology

3.1 The data

The University of Évora is a public institution of higher education whose origins date back to 1559. After being closed in the 18th century, the university reopened in 1979. At the present time, it is organized in departments which are grouped in three schools: (i) arts; (ii) social sciences; (iii) technological sciences. The São João de Deus School of Nursing, a public polytechnic institute of higher education, became part of the University of Évora in 2004.

The University of Évora has around 5760 students enrolled in graduate courses, 1588 in Master's courses and 277 in PhD courses[5]. Moreover, it has a teaching staff of 577, of whom more than half hold a PhD degree, and an administrative staff of 406.

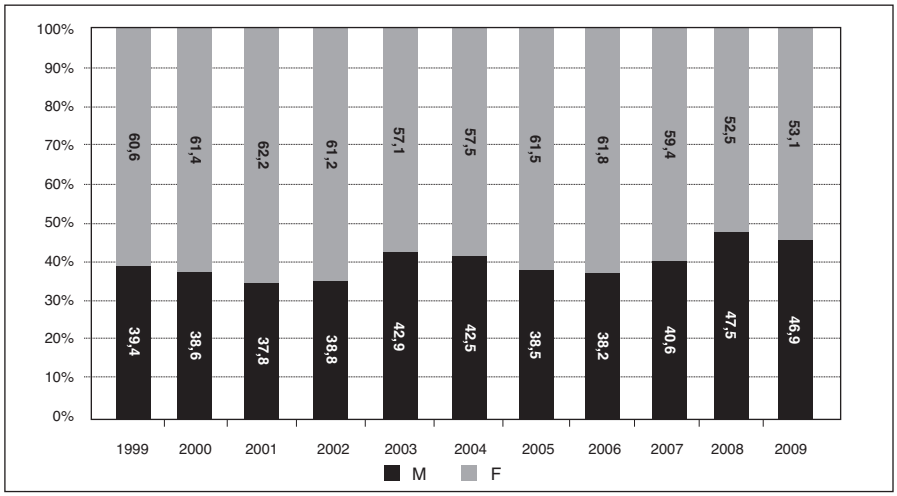
In what concerns the graduate students, in accordance to the general figures of the higher education in Portugal, females represent a greater share (around 60%) than males in all the sample period, despite a small decline in 2008 and 2009, allegedly due a marginal increase on entrances in courses where the share of males is traditionally higher (see figure 1).

As to the areas of study, in general, engineering is mostly attended by male students whereas areas such as education are mostly attended by female students. Most of the students are under 20 years despite being also evident an increase in the proportion of older students (over 30), in particular in the most recent years. In terms of the geographical origin of the students, the University of Évora attracts students essentially from the district of Évora (around 36%), as well as from the surrounding districts (of Alentejo). The Lisbon district also represents a relevant area of origin (around 10%).

Our data is from a previous survey which was developed for a different research project (see Table 1). The students who completed undergraduate education in the University of Évora were asked to fill up a written questionnaire containing questions on University education, job search behaviour, work history and personal characteristics. Unfortunately, the data set does not include information on the students' background prior to their entry in the University.

5 A rich source of updated information are the annual reports of the Pró-Reitoria para a Política da Qualidade e da Inovação (2008,2010), available at http://www.qi.uevora.pt/ (accessed on December 14, 2010).

Figure 1 – The share of students in the University of Évora by gender



Sources: Pró-Reitoria para a Política da Qualidade e da Inovação (2010).

Table 1 – Descriptive statistics

	Arts and Humanities	Engineering	Scientific	Economics and Management	Other Social Sciences	All Sample
N	143	183	214	143	87	767
% Search duration <= 6 months	74%	77%	73%	85%	69%	76%
% Search duration = 0 months	14%	45%	19%	24%	15%	25%
Age	20.57 (5.33)	18.51 (1.97)	18.48 (2.89)	18.54 (2.74)	19.33 (4.31)	18.98 (3.55)
Final Mark	13.94 (1.06)	13.15 (1.02)	14.25 (0.98)	12.42 (1.23)	13.50 (1.17)	13.50 (1.27)
Course duration above average = 1	0.497	0.454	0.149	0.306	0.227	0.326
Male = =1	0.124	0.432	0.242	0.458	0.205	0.302
Search in Alentejo = 1	0.745	0.622	0.674	0.667	0.784	0.684
year 2000 = 1	0.110	0.141	0.121	0.167	0.205	0.141
year 2001 = 1	0.172	0.157	0.112	0.201	0.125	0.151
year 2002 = 1	0.186	0.232	0.191	0.194	0.091	0.189
year 2003 = 1	0.221	0.228	0.298	0.229	0.307	0.257
year 2004 = 1	0.310	0.243	0.279	0.208	0.273	0.263

Note: Standard errors are in parenthesis.

In our paper we focus on the students who have completed their first degree between 2000 and 2004, in the several courses degrees in the University of Évora. Since our model describes individuals who enter the labour market for the first time, we exclude individuals who were working before graduation. Our sample thus comprises a total of 767 students.

The sample employed in the analysis has several fields of study which we have further grouped into 5 main categories[6]: Scientific, Engineering, Arts and Humanities, Economics and Management, Other Social Sciences. From table 1 we can see that graduates in Arts and Humanities and Economics and Management each represent nearly 19% of the whole sample, while graduates in Scientific areas constitute about 28%. Those graduating in Engineering subjects represent nearly 24%. Finally, those who graduated in Social sciences consist of only 11,2% of the all sample.

Table 1 displays the sample descriptive statistics for the variables used in the econometric analysis. A full description of the variables can be seen in the Appendix. Most of the students in the sample are female students, especially in Arts, Humanities and Social Sciences, which is in accordance to what we should expect considering the characteristics of the students in the University. In all course categories, the majority of students find a job within a period of six months, with Economics and Management displaying the highest rate (86%), followed by Engineering. A significant percentage of the students also start working immediately after graduation (about 25% of all students). Again, Engineering (45%) and Economics and Management (24%) areas seem to be more successful[7]. The econometric analysis in section 4 will provide a better understanding on the differences in labour market success among the several study areas.

The average final mark is very similar for all course categories, but those in scientific areas display higher final marks in average. These are also the ones that present a smaller percentage of students with a course duration above average (only about 15%, in opposition to almost 50% in Arts and Humanities). Students in Arts and Humanities also enter the University, in average, at an older age than in other courses and display a higher standard error. Finally, as the University attracts most of its students in the Alentejo region, it is not surprising that the majority of those in our sample search for a job in the Alentejo.

3.2 The econometric methodology

Theoretically, the duration variable of interest (time to obtain the first job) is a continuous random variable. However, as often occurs in many empirical studies, in our case the duration variable is measured in groups of months[8]. Therefore, the appropriate approach for modelling the duration is a discrete-time hazard model (grouped interval data). Several specifications can be used to estimate a discrete-time hazard model. In this paper in order to check for the robustness of the results we consider two specifications: a complementary log-log model and a discrete time logistic model. The complementary log-log model is a popular and convenient formulation, which

6 The grouping in particular is the following: Scientific (Physics, Chemistry, Biology, Agricultural, Maths, Veterinary Medicine); Engineering (Engineering, Architecture); Arts and Humanities (Theatre, Music, Philosophy, Literature, Foreign Languages, Education); Economics and Management (Economics and Management); Other Social Sciences (Sociology, History and Psychology). In this grouping we have followed closely previous studies.

7 We have estimated two logit models, one for the probability of students finding a job with no unemployment and another for the probability of finding a job within a period of 6 months. The results reveal that Engineering is significantly better than Economics and Management in the first case while the opposite happens in the second case. This suggests the use of a different econometric approach, like the durations models, to take into account all unemployment durations and, therefore, to allow for a better comparison of the different areas of study.

8 The following intervals are available in the survey: 0 months, 0 to 1 month, 2 to 6 months, 7 to 12 months, more than 12 months. However, in the econometric modelling we considered the last two intervals as one due to the fact that there are no transitions to work for those with more than 12 months of unemployment.

can be interpreted as the discrete time model corresponding to an underlying continuous time Proportional Hazards model. Representing discrete times (durations) by t_j, the hazard function is given by:

$$h(t_j \mid x) = 1 - \exp(-\exp[\gamma(t_j) + x'\beta]) \quad (1)$$

where $\gamma(t_j)$ corresponds to the baseline hazard and x is a vector of explanatory variables.

The discrete time logistic model can be interpreted as a proportional odds model. In fact, the logistic model approximates a proportional model quite closely if the hazard is sufficiently small. In this specification, the hazard function is given by:

$$h(t_j \mid x) = [1 + \exp(-\gamma(t_j) - x'\beta)]^{-1} \quad (2)$$

again, $\gamma(t_j)$ corresponds to the baseline hazard and x to the vector of explanatory variables.

In both models, the baseline hazard can be specified following a parametric approach, assuming a specific form for the hazard function, or a semi-parametric approach, where there is no assumption about its shape. In this paper, we consider a semi-parametric specification (piecewise constant) as it is a more flexible approach[9].

Supposing $d_i = 1$ if there is no censoring (that is if the student *i* made a transition into work within the period of observation) and $d_i = 0$ if there is censoring, the corresponding likelihood, is given by:

$$L = \prod_{i=1}^{N} [S(ti + h \mid x_i)^{1-di}[h(ti + si \mid x_i)S(ti + si \mid x_i)]^{di} \quad (3)$$

where $S(ti + h \mid x_i)$ represents the survivor function, measuring the probability of no transition in the interval $(t, t + h)$, and $h(ti + si \mid x_i)S(ti + si \mid x_i)$ is the probability that the student exits unemployment at t+s ($0 < s < h$).

Alternatively, one can consider each survival or exit in each interval as an observation. Then, each student in the sample contributes with s_i "observations", leading to a sample size of $\Sigma_i s_i$. Indexing these observations by k and considering y_{ik} as one if the spell was completed in the interval (that is if student *i* made a transition into work) and as zero if not, one can rewrite the likelihood function as:

$$L = \prod_{i=1}^{N} \prod_{k=ti}^{ti+si} [h_i(k \mid x_i)]^{yik}[1 - h_i(k \mid x_i)] \quad (4)$$

This form of the likelihood is exactly the form of the likelihood for a discrete-choice model. Therefore, one can easily estimate the parameters of the model with several software packages available, by rearranging the data in a proper way. See Jenkins (1995) for details on the organization of the data and on the estimation of these models.

We are aware of possible existence of student specific unobserved characteristics, which may affect the duration of unemployment. Not controlling for unobserved heterogeneity could result in

9 We also estimated a parametric specification (cubic-polynomial). The coefficient estimates were quite similar which points to the robustness of our results. These estimates can be provided upon request.

inconsistent and downward biased estimates of the covariates' coefficients as well as in over-estimation of the degree of negative duration dependence, or under-estimation of the degree of positive duration dependence (Lancaster 1990; van den Berg 2001; Ridder 1987). Therefore, we also estimate the previous discrete time models considering the existence of unobserved heterogeneity. The most common method to deal with the problem of unobserved heterogeneity is to assume that the effect of omitted variables can be represented by a random disturbance. Following this approach, the complementary log-log model generalises to:

$$h(t_j \mid x) = 1 - \exp(-\exp[\gamma(t_j) + x'\beta + u]) \quad (5)$$

The logistic hazard regression model can be generalised in a similar way:

$$h(t_j \mid x) = [1 + \exp(-(\gamma(t_j) + x'\beta + e))]^{-1} \quad (6)$$

where the "error" term e (and u) represents the unobserved heterogeneity and is a random variable with mean zero and finite variance. In practice, the problem lies on the choice of the distribution of the random variable. In principle, any continuous distribution with positive support, mean one and finite variance, is a suitable choice. However, the choice of the distribution is limited to those that give a closed form expression for the survivor function. For the *discrete time* Proportional hazard model, the Gamma distribution has been the most used distribution. For these models it also straightforward to assume a Normal (Gaussian) distribution for u and e, respectively. In this work we assume a Normal (Gaussian) distribution.

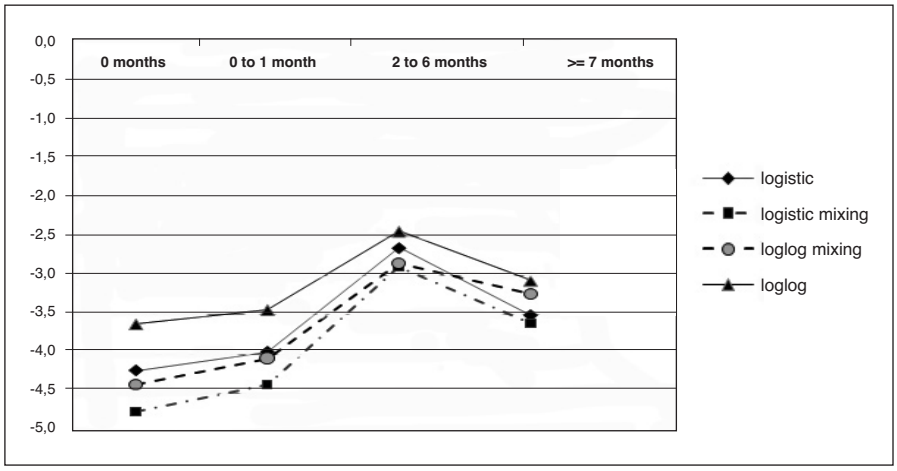
There has been much discussion in the literature about the extent of the effects of unobserved heterogeneity. In particular, the literature has focused on the choice of shape of the hazard function and on the choice of the distribution for the unobserved heterogeneity. The results from several papers (for example, Dolton and van der Klaauw 1995; Meye, 1990 and Trussell and Richards 1985) have suggested that if a flexible specification for the baseline hazard function is used (like the piecewise constant that we use in this paper), then the magnitude of the biases in the non-heterogeneity model are reduced.

4. Analysis of Results

Table 2 displays the estimates for the different specifications of the hazard function, with and without control for unobserved heterogeneity. The tests results reveal the existence of significant unobserved heterogeneity in both the logistic and the complementary log-log specifications. Therefore, as expected, those specifications with control for unobserved heterogeneity present a better fit (based on the value of the Log-Likelihood). Moreover, controlling for unobserved heterogeneity, the complementary log-log model seems to perform better, although the difference is small. Nevertheless, the results are quite stable in all specifications, as the sign and significance of the explanatory variables are very similar.

Referring to the baseline hazard in all cases the shape follows a similar pattern (see figure 2). In fact, the estimates of duration dependence suggest that an initial period of positive dependence is followed by the negative dependence. This indicates that after a period between 2 and 6 months it becomes more difficult for students to find a job as time goes by.

Figure 2 – Baseline Hazards



We considered as explanatory variables in this study several students´ characteristics as well as year dummies to capture possible business cycle effects. Among the students´ specific variables we included age at entrance in the University, final mark at graduation and several dummies representing the students´ gender, field of study, course duration and job search geographic location. As previously referred, we could not consider some other possible relevant variables like the students´ socioeconomic background or the students´ grade at entrance in the University, as these variables were not available in the data set we used.

In what concerns the effects of the explanatory variables, our results show the existence of significant differences among the several subject areas of graduation. In effect, we conclude that there are no significant differences between the area of Economics and Management and the area of Engineering, but these study areas are significantly more successful than the others. This result is in accordance to what happens at national level (see Inofor 2001 and Gonçalves et al. 2006). On the contrary, students in Arts and Humanities seem to be in the worst situation to find a job.

We do not find any statistically significant difference between male and female graduates. Nevertheless, the coefficient is positive indicating males to be marginally more successful. This is in accordance to previous studies which reveal women to face more difficulties in the labour market. In fact, in the particular case of Portugal, official statistics show the young female unemployment rates to be higher than those of young males (see, for example, Eurostat, 2010a).

As expected, the results highlight the importance of the final mark in the course to the success in the labour market: a higher final mark has a positive and significant effect on the probability of exiting unemployment. However, the time to graduate does not seem to affect the probability of finding a job, as the variable “course duration above average” does not display a significant effect in any of the specifications.

Younger graduates seem to be in a disadvantageous situation in relation to older graduates. This may be explained by the fact that older students signal themselves as more able to firms, due to higher maturity. On the other hand, it might be the case that younger students are more likely to be choosier with respect to job opportunities.

Table 2 – Hazard functions results – piecewise constant specification (All sample)

Duration dependence:	Logistic		Complementary log-log	
	no-heterogeneity	heterogeneity-normal mixing	no-heterogeneity	heterogeneity-normal mixing
0 months	-4.209* (0.714)	-4.734* (0.813)	-3.622* (0.544)	-4.387* (0.683)
0 to 1 month	-3.971* (0.710)	-4.385* (0.805)	-3.438* (0.541)	-4.053* (0,673)
2 to 6 months	-2.644* (0.701)	-2.890* (0.793)	-2.433* (0.534)	-2.846* (0,663)
≥ 7 months	-3.503 (0.709)	-3.603* (0.799)	-3.066* (0.542)	-3.236* (0.666)
Age	0.033** (0.015)	0.040** (0.017)	0.023** (0.011)	0.034** (0.014)
Male == 1	0.093 (0.114)	0.103 (0.129)	0.084 (0.089)	0.098 (0.109)
Final Mark	0.219* (0.050)	0.243* (0.056)	0.172* (0.038)	0.206* (0.047)
Course duration above average = 1	0.176 (0.118)	0.219 (0.133)	0.136 (0.093)	0.196 (0.123)
Search in Alentejo = 1	-0.353* (0.110)	-0.402* (0.124)	-0.276* (0.085)	-0.348* (0.105)
Arthum	-0.870* (0.193)	-0.968* (0.218)	-0.697* (0.150)	-0.818* (0.184)
Engineer	-0.137 (0.162)	-0.098 (0.184)	-0.165 (0.124)	-0.087 (0.153)
Scientific	-0.754* (0.177)	-0.824* (0.200)	-0.606* (0.137)	-0.696* (0.168)
Social	-0.681* (0.198)	-0.767* (0.224)	-0.533* (0.155)	-0.648* (0.189)
year 2000 = 1	0.687* (0.173)	0.775* (0.195)	0.541* (0.132)	0.661* (0.163)
year 2001 = 1	0.442* (0.167)	0.503* (0.188)	0.330** (0.129)	0.411* (0.158)
year 2002 = 1	0.113 (0.152)	0.133 (0.172)	0.089 (0.120)	0.110 (0.146)
year 2003 = 1	-0.306** (0.140)	-0.340** (0.158)	-0.253** (0.113)	-0.307** (0.136)
LR test: unobserved heterogeneity = 0	–	$\chi^2 = 6.35$ *	–	$\chi^2 = 11.35$*
Log likelihood	-1172.548	-1169.371	-1173.958	-1168.2827
N	2016	2016	2016	2016

Notes: (*), (**) significant at 1% and 5%, respectively. The estimation was performed using STATA 9.

Some findings do not seem to be in accordance with previous studies, namely for Italy, which typically conclude that older graduates and graduates with longer course durations seem to be in a weaker position. This divergence in the results might be a consequence of the differences in the labour market between the two countries.

One can also argue that these previous results are a consequence of some misspecification of the model. Therefore, we have estimated some alternative specifications checking for the robustness of our results[10]. In table 3 we present separate results for those students who have entered the University at regular age (less than 20 years old) and those who entered the University at an older age, considering the complementar log-log specification, with control for heterogeneity[11]. As we can see, in both cases the shape of the baseline hazard is according to the previous model estimates. As to the effect of the explanatory variables, they are in general similar to the results obtained for the all sample. For those students entering the university at an older age, there are very few significant variables, which may be due to the small sample size. Nevertheless, all the variables display the same signal as in the other sub-sample estimates. In particular, the effect of course duration above average is still positive and not significant for both sub-samples, whereas the effect of age is positive but no longer significant for those students entering the University at a younger age[12], but is significant for the older students.

Table 3 – Hazard functions results – piecewise constant specification (Sub-samples)

Duration dependence:	Complementary log-log		Complementary log-log	
	Students that enter at University at with age < 20		Students that enter at University at age >= 20	
	no-heterogeneity	heterogeneity-normal mixing	no-heterogeneity	heterogeneity-normal mixing
0 months	-4.396* (1.133)	-5.050* (1.366)	-1.696* (1.108)	-3.108* (2.068)
0 to 1 month	-4.133* (1.131)	-4.628* (1.360)	-1.758* (1.110)	-2.548* (2,027)
2 to 6 months	-3.142* (1.126)	-3.432* (1.353)	-0.643* (1.102)	-0.749 (2,009)
≥ 7 months	-3.694 (1.126)	-3.730* (1.352)	-1.598* (1.137)	-1.070 (2.042)
Age	0.026** (0.05)	0.027** (0.061)	0.029*** (0.016)	0.049** (0.024)
Male == 1	0.133 (0.099)	0.161 (0.122)	-0.011 (0.212)	-0.088 (0.301)
Final Mark	0.227* (0.045)	0.269* (0.055)	0.018 (0.084)	0.024 (0.0122)

10 Besides the results presented in table 3, we have also estimated other models by considering different sub-samples (separate regressions for those students entering the University at regular age and finishing their studies within a normal duration and for those who took extra time to finish their studies) and including different variables (with and without age, with and without course duration above average and with and without duration dependence). In all cases, the estimates were quite stable, including those for duration dependence.

11 The results for the log-logistic specification were very similar.

12 This is to be expected due to the small sample variation of the age variable in this sub-sample: we are only considering 18 and 19 years old students.

Table 3 – Hazard functions results – piecewise constant specification (Sub-samples) (cont.)

Duration dependence:	Complementary log-log		Complementary log-log	
	Students that enter at University at with age < 20		Students that enter at University at age >= 20	
	no-heterogeneity	heterogeneity-normal mixing	no-heterogeneity	heterogeneity-normal mixing
Course duration above average = 1	0.122 (0.108)	0.175 (0.133)	0.212 (0.203)	0.376 (0.289)
Search in Alentejo = 1	-0.303* (0.095)	-0.387* (0.118)	-0.141 (0.204)	-0.282 (0.294)
Arthum	-0.797* (0.178)	-0.939* (0.219)	-0.634** (0.315)	-0.809*** (0.451)
Engineer	-0.149 (0.139)	-0.053 (0.172)	-0.375 (0.288)	-0.421 (0.424)
Scientific	-0.690* (0.155)	-0.786* (0.188)	-0.742** (0.377)	-1.007*** (0.543)
Social	-0.541* (0.174)	-0.672* (0.213)	-0.498 (0.354)	-0.649 (0.516)
year 2000 = 1	0.505* (0.142)	0.612* (0.175)	0.784*** (0.412)	1.163*** (0.625)
year 2001 = 1	0.216 (0.147)	0.280* (0.181)	0.529*** (0.289)	0.823** (0.415)
year 2002 = 1	0.114 (0.136)	0.0003 (0.166)	0.364 (0.267)	0.597 (0.389)
year 2003 = 1	-0.280** (0.126)	-0.360** (0.153)	-0.226 (0.265)	-0.187 (0.374)
LR test: unobserved heterogeneity = 0	–	$\chi^2 = 10.69$*	–	$\chi^2 = 8.81$*
Log likelihood	-935.5501	-930.20624	-230.47505	-228.85475
N	1624	1624	392	392

Notes: (*), (**), (***) significant at 1%, 5% and 10%, respectively. The estimation was performed using STATA 9.

It is also of interest to note that, in all specifications, those students that search for a job in the Alentejo region are less successful on finding a job. This is certainly related to the characteristics of the region, which displays an underdeveloped industrial structure and poor labour market conditions, with rates of unemployment above the national ones (see, for example, the last figures for the regions of Portugal, provided by the Eurostat (2010b), which confirm the Alentejo as the Portuguese region with higher unemployment rates for 15-24 years old (20,7% in 2006 and 20,1% in 2007).

Finally, there are significant differences on the probability of leaving unemployment among the several years considered in the sample. This is a consequence of the differences in the labour market conditions in these years. In fact, in 2000 and 2001 the rate of unemployment was considerably lower than in following years. By 2002/2003 labour market conditions worsen considerably as a consequence of economic recession.

5. Conclusions

The relevance of the employability of university graduates is increasing, following the recent developments in the higher education area and in the youth labour market, in Europe in general and particularly in Portugal. In fact, the implementation of the Bologna process, the assessment of the universities performance, in consequence of recent reforms of the university system, as well as the worsening of the labour market conditions, turned the analysis of graduates' success in a crucial issue.

In this paper, we analyse the transition to work of first degree students in a small University in Portugal, the University of Évora, using a sample of 767 students. The focus is on the time to obtain the first job, considering the graduates' characteristics and the effect of the field of study. We estimate several different specifications of discrete-time hazard models and the results are quite robust. The results suggest the existence of negative duration dependence after an initial period of positive duration dependence. This implies that, after some period of time, the longer graduates stay unemployed, the less likely they find a job.

As for the effects of the explanatory variables, we conclude that there are significant differences among the several subject areas of graduation, with economics, management and engineering being the most successful subjects. Moreover, the final mark obtained in the course seems to be determinant to the students' success in the labour market. The results also reveal that younger graduates seem to be in a disadvantageous situation in relation to more mature graduates, but that there are no significant differences between male and female students. It is also obvious the regional influence in the probability of finding a job, as students that search in the Alentejo region take longer to find a job.

Some of our results are not in accordance to previous findings in similar studies for other countries, like Italy. Therefore, it seems there may be important differences among the countries on the graduates' process to find their first job that should be further analysed.

In terms of policy implications, our results call the attention for the fact that there are fields of study which are more likely to contribute for (structural) unemployment, thereby reinforcing the burden of state financing of universities. Despite this fact, one should not ignore all the demand multiplied effects associated with the existence of universities in economically depressed regions, such as the Alentejo. A cost-benefit analysis of the importance of universities, taking into account the objectives of regional cohesion, must consider the obvious costs of unemployment among their graduates, but also all the benefits (including the externalities, for instance in terms of diffusion of knowledge) for the region where the university is located.

In the particular case of Portugal, future research should also analyse the graduates' success in other Universities, both small and large Universities, in order to better understand the process of transition into the labour market for first degree graduates. As a matter of fact, a better understanding of that process also requires that the geographical (i.e. by regions) localisation of the universities must not be ignored. Besides, other measures of graduates' success should be considered, like the type of job graduates find or the wage levels. Also, future research should consider some other variables which might be important to analyse in the process of graduates´ transition into the labour market, like the socioeconomic background (see Blaskó and Róbert 2007).

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Appendix 1: Variables definition

Age	age in years at the time of entrance in the University
Male	dummy variable. Equal one if student is male
Final Mark	final course mark of the student at graduation (between 10 and 20)
Course duration above average	dummy variable. Equals one if the time to graduate is longer than average in each course.
Search in Alentejo	dummy variable. Equal one if the student search for a job in the Alentejo region
Arthum	dummy variable. Equal one if the course is in Arts or Humanities
Engineering	dummy variable. Equal one if the course is in Engineering or Architecture
Scientific	dummy variable. Equal one if the course is in Scientific areas
Economics and Management	dummy variable. Equal one if the course is in Economics or Management. (this is the reference category)
Social Sciences	dummy variable. Equal one if the course is in Social Sciences
year 200j j=1,2,3,4	dummy variable. Equal one if the student graduates at year j. 2004 is the reference category