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Structural Transformation and the role of Foreign Direct Investment in Portugal: a descriptive analysis for the period 1990-2005

Miguel Lebre de Freitas

Ricardo Paes Mamede

Av. da República nº. 79 1050 – 243 Lisboa

Telf: (351) 217998150

Fax: (351) 217998154

Web Site: www.gee.min-economia.pt

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Miguel Lebre de Freitas

UA, GEE, NIPE

Ricardo Paes Mamede

ISCTE, GEE, Dinâmia

Classificação JEL codes: C14, F14

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Abstract

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[1] Corresponding author. Av. República 79 – 1º, 1050-243 Lisboa, Portugal. Tel: 351-21-7998150. Fax: 351-234-370215. E-mail: afreitas@egi.ua.pt. A previous version of this paper was presented in the second Workshop on *Portugal and the Challenge of Globalization*, held at the Ministry of Economy and Innovation, Lisbon, November 3, 2008. The authors acknowledge Paulo Inácio, Walter Marques and Luis Florindo for helpful assistance with the data and João Amador and David Haugh for helpful comments.

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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 shift is more evident in sectors with a high presence of FDI.

The view that a country's economic performance is to a large extent linked to international trade has a long tradition in economic thinking, backing from Adam Smith and David Ricardo. At the theoretical level, many authors have emphasized the type and the characteristics of the sectors wherein a country specializes (Prebisch 1950, Singer, 1950, Kaldor, 1966, Thirlwall, 1979, Grossman and Helpman, 1991)[2]. 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

[2] A different question is whether the *identity* of the trade partners matters. The rationale is that a country importing goods primarily from technological leaders receives more technology than a country importing primarily from follower countries (Eaton an Kortum, 1996, 1999). The empirical evidence of this hypothesis remains, however, mixed (see Keller, 2004, for a survey).

strong and robust predictor of subsequent economic growth, controlling for standard covariates[3].

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 this index to characterise the Portuguese export basket and to assess how well it has moved towards goods 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 structure of Portuguese exports following the OECD classification of R&D intensities[4].

We then investigate the extent to which foreign direct investment (FDI) has played a key 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

[3] Other relevant contributions include Dalum et al. (1999) and Feenstra and Rose (2000). Dalum et al. (1999) focused on 11 manufacturing sectors in the OECD area for the period 1965-1988, and found that the characteristics of the specialization pattern are important to explain growth differentials. However, the impact seems to be gradually wearing off during the 1980s and their results are sensitive to alternative classifications of sectors into different technological categories that the authors consider. Feenstra and Rose (2000) develop a procedure to rank-order countries and commodities according to the "product-cycle" hypothesis, using disaggregated data on US imports. They find a strong relation between what they dubbed "advanced export structure" and high productivity levels and fast growth rates.

[4] Monthly updates using this methodology are available at the GEE homepage, in "Balança de Produtos Industriais Transformados por Grau de Intensidade Tecnológica" (http://www.gee.min-economia.pt/).

from multinationals to domestic firms[5]. Accordingly, governments all over the world spend large amounts of resources to attract subsidiaries of multinational firms to their jurisdiction. Empirically, however, the literature has not being able to confirm the existence of positive externalities from FDI to host countries[6]. 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 in the 1990s, as measured by the effect of FDI on domestic firm' labour productivity. Guimarães et al. (2000), analysing the role of agglomeration effects in the 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.

This paper abstracts from spillovers and other indirect effects of FDI. Simply, we examine whether there is a tendency for foreign affiliated firms to operate in fast growing, non-traditional and income content export sectors, thus having a significant direct contribution to the process of structural transformation in Portugal.

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[5] 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 (1996) and Markusen and Venables (1999) examine the linkage effects between multinationals and domestic firms: the entry of multinationals may raise the demand for intermediate products which would not develop otherwise, triggering the supply of downstream industries and eventually creating the conditions for related upstream industries to develop (a similar reasoning in Trindade, 2005). Other theories pointing to inertia in the specialization patterns (which FDI may help disrupt) include learning-by-doing (Jovanovic and Nyarko, 1996, Hausmann and Klinger, 1997, and Hausmann and Rodrik, 2006) and information externalities (Hausmann and Rodrik, 2003).

[6] Many authors remain sceptical about a positive relationship between FDI and economic performance of host countries (e.g., Rodrik, 2007, pp.119-120). Empirically, the evidence has been ambiguous (see Keller, 2004 for a survey). Still, some positive results were found. At the aggregate level, a commonly cited article is Borenztein et al. (1998), who found an important role for FDI in a cross-country growth regression, but only when the host economy has a minimum threshold stock of human capital. This suggests that FDI contributes to economic growth only when a sufficient absorptive capability of the advanced technologies is available in the host economy. Recent evidence with micro-data is also suggestive of important spillovers associated to FDI (Kugler, 2006). In general, empirical assessments face a basic problem of endogeneity: because multinationals are attracted to high-productivity industries and high-performance countries, in the absence of adequate instrumental variables, the direction of causality is difficult to assert (Aitken and Harrison, 1999).

The role of FDI in Portuguese exports was examined by Cabral (1996) and Magalhães and Africano (2007). Cabral (1996), using a panel of 1174 firms between 1986 and 1992 report that foreign firms tend to export more than domestic firms, everything else constant. Magalhães and Africano (2007), using data on bilateral trade and FDI flows for the period from 1995 to 2000, found a positive correlation between the presence of foreign affiliated capital in the Portuguese economy and the volume of exports to the affiliation country. Gonçalves and Guimarães (1997) do not examine export data, but report a significant difference between the production patterns of domestic and foreign firms operating in Portugal, thus concluding that FDI helps increase the diversification level of the economy[7]. Our paper adds to the previous analysis in that it examines the relationship between FDI and the structure of Portuguese exports, 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 then assess whether FDI has 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 analyse the relationship between RCA and PRODY at the product level from 1995 to 2005, in Portugal and in some other countries. 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 FDI and whether the presence of FDI is more significant in products with higher income content. Section 6 concludes.

[7] Other relevant studies addressing FDI in Portugal include Barbosa and Louri (2005), who investigate whether the profitability of foreign firms operating in Portugal differs from that of domestic firms; Barbosa et. al (2004), who examined the determinants of FDI; Mata and Portugal (2004), who compare the patterns of entry, survival and growth of domestic and foreign owned firms operating in Portugal; and Barbosa and Louri (2002), who analyse the determinants of ownership decisions.

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 good (details in Appendix 1). Products with high values of PRODY are, by construction, those where high income countries play a major role with respect to the other trading partners. 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, and 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.

Table 1: PRODY values for a sample of products

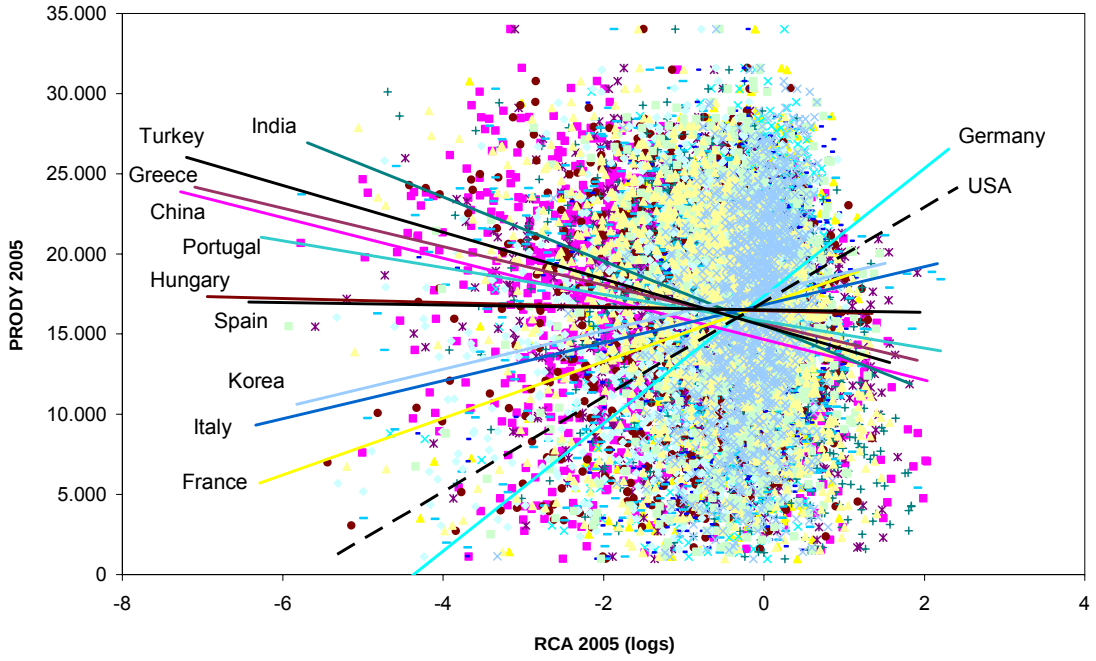
Code	Commodity	PRODY 05	Rank	Share of World exports (per cent)
2933	Heterocyclic compounds with nitrogen hetero-atom(s) only.	33.408	4	0,47
8411	Turbo-jets, turbo-propellers and other gas turbines.	27.010	82	0,71
3004	Medicaments (excluding goods of heading 30.02, 30.05 or 30.06)	26.024	108	2,13
8525	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: UN, COMTRADE database; IMF, World Economic Outlook Database

For illustrative purposes, Figure 1 assesses the linear relationship between our estimated 2005 PRODYs and the Balassa indexes of revealed comparative advantage (RCA) for 12 countries (China, France, Germany, Greece, Hungary, India, Italy, Korea, Portugal, Spain, Turkey and USA)[8]. Despite the high dispersion of the data, plotting a linear regression line helps in assessing the sign of the correlation between the two indexes. If 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.

[8] The Balassa RCA index is in Logs. Null coefficients of RCA became missing values..

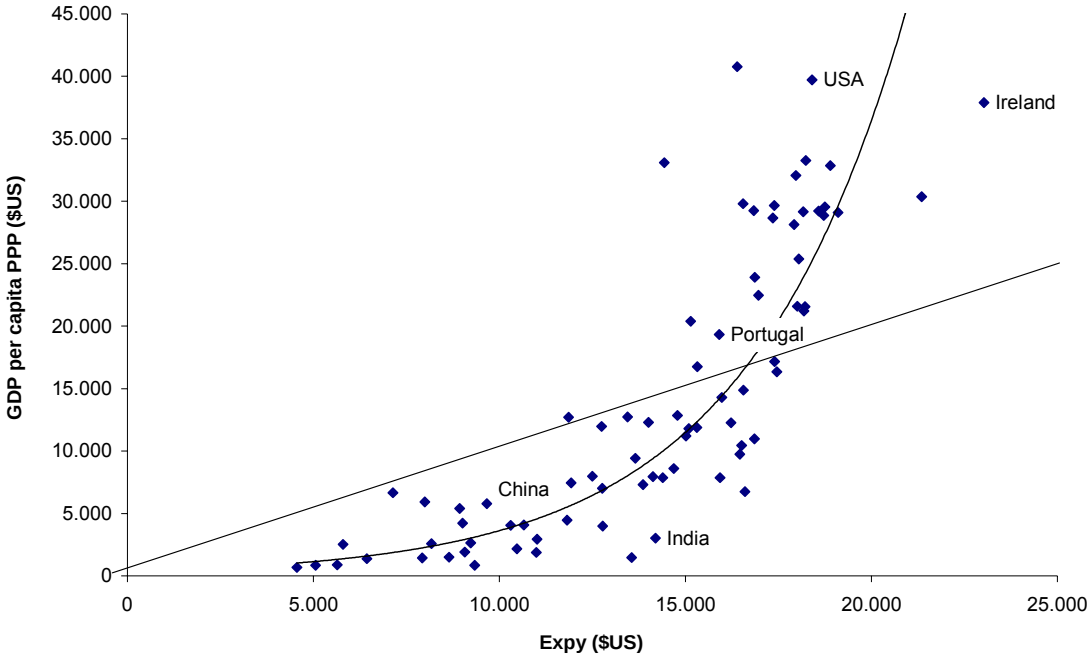
Figure 1: PRODY and Revealed Comparative Advantage in 2005 (China, France, Germany, Greece, Hungary, India, Italy, Korea, Portugal, Spain, Turkey, USA)



According to the figure, by 2005 India was the country in this sub-sample with a more negative correlation between comparative advantage 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*.

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



The data in Figure 1 is silent in respect to sector 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[9]. These findings suggest that the type of goods in which a country specializes has important implications for subsequent economic performance. That being so, structural transformation, e.g., the change in the specialization pattern towards products with higher income content, should be part of the agenda for economic growth.

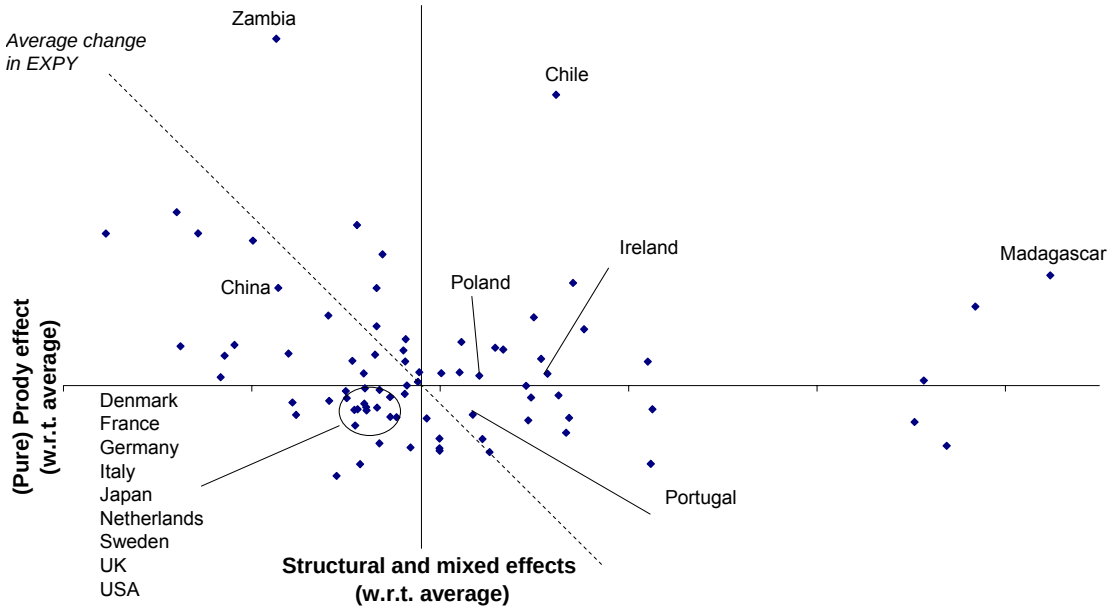
3. PRODY effect versus structural adjustment effect

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 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 the same) and other effects (this includes a "pure structural transformation effect" – i.e., the value of EXPY which would be observed had the PRODY values remained the same while the structure of exports evolve the way they did – and a mixed effect). The technical details and the figures for 81 countries are in Appendix 2.

[9] 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, leading them to conclude that "countries become what they export".

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



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 a positive structural transformation (plus mixed) effect, which was big enough to offset a negative PRODY effect. A negative PRODY effect means that, on average, the most important Portuguese exports in 1995 did not improve in terms of income content. In other words, had the Portuguese export basket remained stuck, its average income content would have grown less than the average. The reason is that a significant

component of the Portuguese exports basket corresponds to traditional segments, where competition by emerging economies has been increasing. The positive structural transformation effect more than offset this negative effect, allowing the EXPY level in Portugal to grow above the average.

The Portuguese pattern contrasts with what was observed in other OECD countries: most developed countries have registered negative PRODY and structural and mixed effects[10]. In other words, not only their exports became on average less exclusive, but also the change in the structure of exports has led to a less 'rich country goods' export profile[11]. In contrast, Chile and Madagascar, for example, have improved significantly their EXPY values, due to both positive structural adjustment and value 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[12]. In this section and in the following, we use trade data from the Portuguese National Institute of Statistics (INE), which includes data on confidential positions, thus

[10] This evidence contrasts with Amador et al. (2007), who report a high persistence of the Portuguese specialization pattern, 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 further upscale moves.

[11] 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.

[12] 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), allowing the PRODY index to reflect more accurately the world structure of international trade.

being more accurate than the COMTRADE database.[13] 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 steadily over time, from 14.041 USD in 1990 to 16.603 USD in 2005. This is suggestive of future growth.

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 in Appendix 3).

Table 2 – The structure of Portuguese Exports by classes of PRODY

PRODY Class	1990		1995		2000		2005	
	Share on Exports	EXPY	Share on Exports	EXPY	Share on Exports	EXPY	Share on Exports	EXPY
Very High (top 20%)	6,2	1528	8,5	2118	9,4	2363	12,5	3097
High	21,6	4457	25,8	5392	32,8	6982	31,8	6727
Average	14,4	2390	14,2	2363	14,8	2460	16,3	2692
Low 32,	1	3743	31,1	3673	27,0	3202	25,6	3049
Very low (20% lowest)	25,8	1923	20,4	1517	15,9	1195	13,9	1036
Total	**100**	**14041**	**100**	**15063**	**100**	**16202**	**100**	**16603**

Sources: own calculations, based on INE data.

[13] 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 3: Structure of exports by classes of PRODY – Portugal

PRODY Class	1990		2005		Growth of exports 1990-2005	
	Exports (10^6 Euros)	Share on Exports	Exports (10^6 Euros)	Share on Exports	% Change	Contribution (percentage points)
Very High (top 20%)	718,1	6,2	3688,8	12,5	413,7	16,7
High	2508,6	21,6	9358,7	31,8	273,1	38,4
Average	1670,4	14,4	4792,1	16,3	186,9	17,5
Low 3737,	2	32,1	7534,2	25,6	101,6	21,3
Very low (20% lowest)	3001,0	25,8	4082,1	13,9	36,0	6,1
Total	**11635**	**100**	**29456**	**100**	**153,2**	**100**

Sources: own calculations, based on INE 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 27.8% in 1990 to 44.3% in 2005), at the cost of the classes "Low" and "Very Low" (from 57.9% to 39.5%). 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 3 examines the contributions of the different classes of PRODY to the growth rate of Portuguese exports between 1990 and 2005. According to these data, the growth rate of exports (at current prices) between 1990 and 2005 was of 153%. The classes growing above the average were those with "Very High" (413,7%), "High" (273,1%) and "Average" (186,9%) income content. In terms of contributions, these two classes, which represented little more than ¼ of the exports in the beginning of the period, accounted for 55% of total export growth. This confirms a trend towards a specialization pattern more based on "rich country goods".

5. FDI, export growth and structural transformation in Portugal

In this section, we assess the extent to which Foreign Direct Investment (FDI) 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 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 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).[14]

We first assess the extent to which FDI firms have contributed to the growth of Portuguese exports. In Table 4, 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 2005. Here, we see that the top 20% products in terms of contribution to export growth concentrate 83% of the estimated exports by foreign firms in 2005. Table 4 also reveals that 12% of the estimated FDI 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 FDI 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[15] [16].

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

[15] 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, thus suggesting at least a causality running from FDI to export growth.

[16] 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.

Table 4: The role o FDI 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 FDI 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 which there is no data available on the presence of FDI; the share of FDI in each group is calculated as the weighted average of the FDI 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 investigate the role of FDI in the change of Portuguese specialization pattern, by organizing the export products according to their revealed comparative advantage (RCA) in 1995 and in 2005. In Table 5 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 'marginal' (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)[17].

Table 5: The role o FDI in Portuguese exports by evolution of RCA

Types of products	number of product classes	share of exports (%)		contribution to export growth (%)	share of FDI in total exports (%)		share of exports by foreign frims (%)	
		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 which there is no data available on the presence of FDI; the share of FDI in each group is calculated as the weighted average of the FDI shares in the exports in each product, with the weights given by the share of each product in the exports of the group.

According to Table 5, the 'emerging' products was the group that contributed the most to the increase in exports (45%), reflecting the role of non-traditional products to the expansion of the Portuguese export sector. As far as the role of FDI is concerned, we observe that the "emerging" group is also the one in which the share of FDI in total

[17] We partially borrow these expression from Boccardo et al. (2007).

exports was larger, both in 1995 (64%) and in 2005 (52%). The last column in the right hand side of Table 5 examines the distribution of FDI-commanded exports. The table reveals that the group of "classics" is dominant in FDI 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 FDI in the upscale move of the Portuguese specialization pattern. Table 6 analyses the presence of FDI in exports per class of income content. According to these estimates, the share of FDI in total exports increased from 33% in 1995 to 36% in 2005. In 2005, the classes of PRODY with higher presence of FDI 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.

Table 6: The role of FDI in Portuguese exports by classes of PRODY[18]

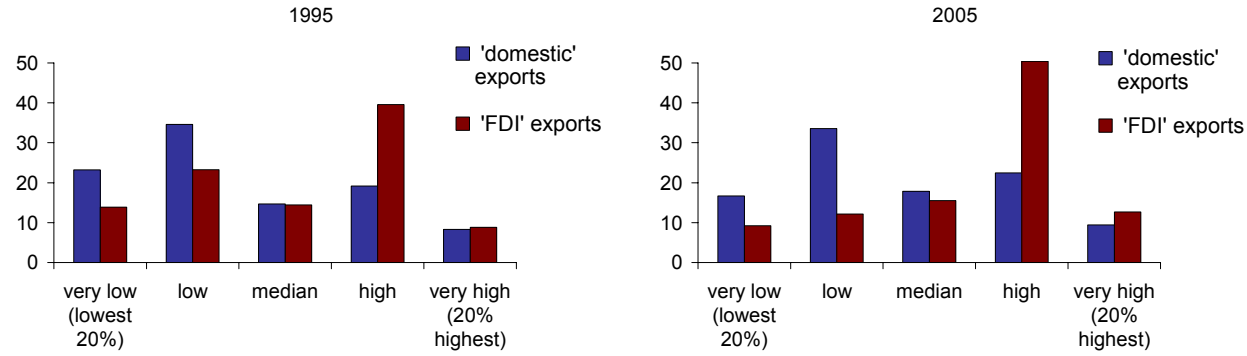
Prody Class in 2005	number of product classes	share of exports (%)		contribution to export growth (%)	share of FDI in total exports (%)		share of exports by foreign frims (%)	
		1995	2005		1995	2005	1995	2005
very high (20% highest)	217	8	10	13	34	43	9	13
high	235	25	31	40	50	56	40	50
median	216	14	16	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 and GEP/MTSS, Quadros de Pessoal

Notes: the table does not include data on 140 product classes, for which there is no data available on the presence of FDI; the share of FDI in each group is calculated as the weighted average of the FDI shares in the exports in each product, with the weights given by the share of each product in the exports of the group.

[18] In this and in the following tables, the share of FDI in each group is calculated as the weighted average of the FDI 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 3).

Figure 4: Share of exports of different PRODY classes



Source: own calculations based on INE 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 FDI-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 FDI exports 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 FDI in exports with high income content refers to traditional or to non-traditional sectors. In Table 7, we cross the information on exports by foreign affiliates per historical status (Table 5) with the information on exports by foreign affiliates per classes of PRODY (Table 6), for the year 2005. We observe that 31% of the FDI commanded exports correspond to "emerging" products with "High" income content and other 11% correspond to "rarities" with Very High income content".

Table 7: FDI 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 which there is no data available on the presence of FDI; the share of FDI in each group is calculated as the weighted average of the FDI shares in the exports in each product, with the weights given by the share of each product in the exports of the group.

Table 8 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 FDI 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 FDI in this FDI-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 8: Top 20 products in terms of contribution to export growth

Code	Commodity	share of exports in 2005 (%)	contribution to export growth (%)	share of FDI in exports in 1995 (%)	share of FDI 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	marginals
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	marginals
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	Moulding boxes for metal foundry; mould bases; moulding 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**	**-**	**-**

6. Conclusions

In this paper, we document that the average income content of the Portuguese exports has grown above the world average in recent years. This evolution is related to a "structural transformation effect" (that is, a shift in the specialization pattern towards products with higher income content), rather than to changes in the implied income of traditional exports. On the contrary, 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 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 1990 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 FDI is concerned, we draw three main conclusions. First, foreign affiliated 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 affiliated firms have contributed significantly to the change in the Portuguese specialization pattern. In particular, we find that the share of FDI commanded exports 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 FDI-led 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 FDI has played a relevant role in the Portuguese export performance, both in terms of growth, diversification and upscale movement.

The evidence found in this paper is consistent with Cabral (1996) and Magalhães and Africano (2007), in that FDI has contributed to the expansion of Portuguese exports, and with Gonçalves and Guimarães (1997) in that foreign affiliated firms tend to exhibit a production pattern that differs significantly from that of domestic firms. The evidence in this paper does not, support, however, the IMF (2008, pp 97-103) claim that FDI 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, broken down by income content, as we do in this paper.

It should be noted that a higher income content on exports does not necessarily correspond to a higher content of domestic value added on exports. As pointed out by Amaral (2006), some low tech traditional industries, like textiles and footwear, have a larger content of valued added generated domestically than high tech industries, like motor vehicles, which are more dependent on imports of intermediate inputs. Using the input-output methodology, Amaral (2006) estimates a decline in the domestic component of Portuguese exports, from 45% in 1995 to 44% in 2004, due to its changing structure. These estimates ignore, however, the indirect effects of innovation, including learning by doing, knowledge spillovers, information externalities and backward and forward linkages. As mentioned in Section 2, Hausmann et al. (2007) found that the sophistication of a country export basket is a leading indicator of economic growth, after controlling for the standard co-variates. That being so, the results we reach in this paper that (i) Portugal has moved its specialization pattern towards "rich country goods"; and (ii) FDI has

played a positive role in this process, seem to imply that FDI is indeed having a positive impact on the growth prospects of the Portuguese economy.

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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:

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

where Y_C is real GDP per capita in the c-th country, M is the number of countries and the the weights σ_{ci} 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.

EXPY: measures the "sophistication level" of a country export basket, as an weighted average of the PRODYs of the products exported by that country. The income content of a country export basket, EXPY, is computed, for each country, as:

$EXPY_c = \sum_i s_i PRODY_i$, where $s_i = \frac{X_{ic}}{X_c}$ 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:

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

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

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

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

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

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). The following table displays the results of this decomposition 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	46%	-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	48%	34	45%	-2%	5%
Madagascar	4.205	9.458	125%	1	50%	-5%	80%
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 – Export 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 Hong Kong 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
CostaRica							64	19	9	5	3	100	32	13	10	5	40	100	30,5	14,0	13,7	7,5	34,2	100
Cotedlvoire																			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	51,6	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
Kazakhstan							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
Kyrgyzstan							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
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
Norway							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	2,5	2,2	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 FDI 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 FDI 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.**	**%**
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 FDI in the exports of each CN category was computed as the weighted average of FDI shares each industry turnover, 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 FDI in the exports of product *i*; FT_j is the proportion of foreign-affiliated firms' turnover in the total turnover of industry *j;* and α_{ij} is the weight of industry *j* in the total turnover of industries associated with the product *i* (according the concordance tables), i.e.,

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

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