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Productive experience and specialization opportunities for Portugal: an empirical assessment

Miguel Lebre de Freitas

Susana Salvado

Luis Catela Nunes

Rui Costa Neves

Productive experience and specialization opportunities for Portugal: an empirical assessment [a]

Miguel Lebre de Freitas (UA, NIPE)[b], Susana Salvado (B. Portugal), Luis Catela Nunes (Nova SBE) and Rui Costa Neves (Nova SBE)

Abstract:

Following Hidalgo et. al. (2007), we use the structure of international trade in 2005 to estimate a measure of "revealed relatedness" for each pair of internationally traded products, which intends to capture similarities in terms of the capabilities they use in production. Our method departs from the original one, in that we run a probit model, instead of computing conditional probabilities. We then use the estimated matrix of "Revealed Relatedness
Indexes" to investigate which "upscale" products in which Portugal didn't develop comparative advantage are more related to products in which the country is currently specialized. The analysis suggests that more than 60% of Portugal's "upscale opportunities" lie in non-traditional sectors, such as "machinery" and "chemicals".

JEL: C14, F14.

Key-Words: International trade, Comparative advantage, PRODY, The Portuguese Economy.

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[b] Corresponding author. DEGEI, Universidade de Aveiro. Campus de Santiago 3810-193 Aveiro, Portugal. Tel: 351-234-370200. Fax: 351-234-370215. E-mail: afreitas@ua.pt.

1. Introduction

In the current debate on the Portuguese economy, there is a view that the country's specialization pattern – arguably 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 performance of the Portuguese economy will depend critically on its ability to shift its specialization pattern towards goods with higher "productivity content". In the case of Portugal, an extensive literature already exists focusing on the role of human capital and institutions - especially those in the labour market - as obstacles to industry reallocation (a seminal contribution is Blanchard and Portugal, 2001). Less attention has been given to the country *productive experience* as a barrier to structural transformation.

This paper investigates which products in which Portugal didn't achieve comparative advantage are more "related" to the Portuguese specialization pattern. The analysis draws on recent empirical work by Haussmann et al. (2007), who stressed the relationship between the type of goods that a country exports and its economic performance, and Hidalgo et al. (2008) (following Haussmann and Klinger, 2006, 2007), who tested the influence of a country specialization pattern on comparative advantages.

Hausmann et al. (2007) investigated whether a country's economic performance depends on the specific basket of products in which it specializes. The authors first built an index of "income content" for traded goods (PRODY), which is estimated as a weighted average of per capita income of the countries exporting these goods, with weights proportional to the Balassa (1965) index of Revealed Comparative Advantage (RCA). Products with high PRODY indexes are, by construction, those typically exported by rich countries. The underlying assumption is that the "income content" of goods is higher where comparative advantage is determined by factors other than unskilled labour, such as technology, specific knowledge, and public infrastructure. Using the estimated PRODY indexes, the authors then constructed a measure capturing the "average income content of a country export basket" (EXPY), which they found to be a good predictor of economic growth, after controlling for the standard covariates.

Haussmann and Klinger (2006, 2007) and Hidalgo et. al (2008) investigated whether the process of *structural transformation* (i.e., the process of shifting the specialization pattern towards products with higher "income content") is dependent on which industries the country is currently specialized. The underlying idea is that, by producing a particular basket of goods, a country develops specific "capabilities", such as technical knowledge, infrastructure, producer services, access to markets, and specific regulatory requirements. These capabilities, in turn, may be more favourable or more easily adapted to start producing some goods than others. To the extent that products differ in respect to the set of specific capabilities they need in production, the ability of a country to start producing "rich country goods" will depend on the usefulness of the capabilities inherited from the particular basket of goods in which the country is currently specialized.[1]

To assess how valuable the productive experience with one good is to develop comparative advantage in other goods, Hidalgo et al. (2007) and Hausmann and Klinger (2006, 2007) developed an outcome-based measure of "relatedness" between pairs of goods, which basically measures the likelihood of a country in the World having comparative advantages in both goods. Technically, such a measure is estimated as the *conditional probability* of a country having RCA in one product, given that it has RCA in another. The authors then relate the likelihood of a country developing comparative advantage in a new product with a measure called "density", that summarises the "relatedness" of that product with all the products in which the country already has RCA. Empirically, they found this "density" measure to be highly significant in predicting a country specialization pattern in the future. In other words, they found that, as countries change their export mix, there is a tendency to move towards "related" goods, rather than to goods that are "less related" to the current specialization pattern.

This paper follows the above referred literature, to focus on the Portuguese case. The estimation method departs, however, from the original one, in that, instead of computing non-parametric conditional probabilities, we run a probit model. In particular, we compute, for each pair of products, a Revealed Relatedness Index (RRI), which is defined as the *increment* in the probability of a country having RCA in one product due to the fact of having RCA in another product.

This method brings three novelties into the analysis. First, our method subjects the estimated measures of product relatedness to a statistical scrutiny. Since we find that a large proportion of the

[1] Theoretical models accounting for a circular causation between the specialization pattern and comparative advantages (arising from industry-specific learning or from the springing up of related non-tradable intermediate inputs) include Rodriguez-Clare (1996), Rodrik (1996), Matsuyama (1992), Young (1991), Lucas (1988), and Krugman (1987). Jovanovic and Nyarko (1996) build a microeconomic model whereby the individual decision to switch to a new technology depends on how transferable the knowledge accumulated in dealing with the old technology is.

estimated RRIs is not statistically significant, a question arises as to whether Haussmann and Klinger (2006, 2007), by considering all possible relationships between pairs of products, are overestimating the available options in the process of structural transformation.

Second, the approach allows the relatedness between each two products to be either positive or negative. The latter case captures the possibility of some capabilities used in the production of one product being unfavourable to the production of another. In the Hausmann-Klinger framework, pairs of products that are best produced in opposite economic environments are bounded to have strictly non-negative indexes of product relatedness.

A third novelty is that we do not impose symmetry in our matrix of product relatedness. Hausmann and Klinger imposed symmetry in their matrix, to overcome the limitation of computing conditional probabilities when only few countries have comparative advantage in one of the products. In our framework, cases where only few countries have RCA in both products result in non-significant estimates and the respective RRIs are set equal to zero. We believe that working with a non-symmetric matrix is more realistic and hence we expect our estimates to allow a more accurate analysis than if the Haussmann-Kingler method was used instead.

The remaining of the paper proceeds as follows. In Section 2, we present the data used, some definitions and the estimation method. In Section 3, we use the estimated RRIs to describe some products in which Portugal is currently specialized. In Section 4, we assess the extent to which the products in which Portugal exhibits revealed comparative advantage are related to the other products in which the country is currently specialized. In Section 5, we identify the "upscale products" in which Portugal didn't develop comparative advantage that are more "related" to the current specialization pattern. Section 6 concludes.

2. Data used, estimation method and definitions

2.1. The data

Our calculations use cross-country export data at the product level (HS-4), from the UN-COMTRADE database and per capita GDP levels (in PPP) by the International Monetary Fund, World Economic Outlook Database, April 2007. The data refers to the year of 2005 and covers 1245 products and 93 countries with population larger than 2 million.

2.2. The PRODY and EXPY indexes

To measure the "income content" of traded goods, Haussmann et al. (2007) proposed an index, which they labeled as PRODY. This index relates the "sophistication" level of each product with the level of development of countries having comparative advantage in that product. In particular, the PRODY 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 each country's revealed comparative advantage (RCA) in that product.

Formally, for each product *i*, the PRODY index is computed as:

$$PRODY_i = \sum_{c \in C} \sigma_{ic} Y_c \text{ , with } \sigma_{ic} = \frac{RCA_{ic}}{\sum_{d \in C} RCA_{id}} \text{ , } RCA_{ic} = \frac{X_{ic} / X_c}{X_i / \sum_{d \in C} X_d} \text{ , } \quad (1)$$

where Y_c denotes for real GDP per capita in country c, X_c denotes the total exports of country c, X_i denotes the world exports of product *i*, X_{ic} denotes the country c exports of product i, C refers to the set of countries in the sample, and the weights σ_{ic} normalize the Balassa index of Revealed Comparative Advantage of the c-country with respect to all the countries exporting the same product.

The average income content of a country export basket is measured by the EXPY index. This is computed as a weighted average of PRODYs, with the weights given by the share of each product in the country total exports:

$$EXPY_c = \sum_i \left(\frac{X_{ic}}{X_c} \right) PRODY_i \ . \qquad (2)$$

Our PRODY estimates accord to Hausmann et al. (2007) in that manufactured products and equipment tend to have higher PRODY indexes than raw materials and agriculture goods. Also in accordance to these authors, we find a positive and significant correlation between estimated EXPY indexes and per capita incomes. Estimated EXPY and PRODY indexes are available from the authors upon request.

2.3. Upscale products and value increments

When assessing the opportunities of a given country in the process of structural transformation, we focus on "up-scale products". These are defined as products with a higher PRODY index than the country average, EXPY.

Formally, the "value increment" associated to product *i* in country *c* is defined by the expression: ln (*PRODY* $_i$ / *EXPY* $_c$). Product *i* will be labelled as an "upscale product" for country *c* when the corresponding "value increment" is positive.

2.4. Revealed Relatedness Indexes (RRI)

To assess how valuable the productive experience with one product is to develop comparative advantage in other products, Hidalgo et al. (2007) and Hausmann and Klinger (2006, 2007) developed an outcome-based measure of *relatedness* between pairs of products, which basically measures the likelihood of a country in the world having RCA in both. For each pair of products, this was estimated as the minimum of the pairwise conditional probabilities of some country having revealed comparative advantage (RCA) in the one product, given that it has RCA in the other product. The authors dubbed this measure as "proximity".

In this paper, we adopt an alternative method to estimate product relatedness. In particular, our Revealed Relatedness Indexes (RRI) are estimated using a probit regression model, whereby the probability of a country having RCA in one product is conditional on having RCA in another product. For each pair of products, we then estimate the increment in probability - the marginal effect – of having RCA in one product due to the fact of having RCA in the other product. This is our RRI index.

Formally, let x_{kc} be a dummy variable equal to 1 if country *c* has RCA in product *k* and 0 otherwise, that is:

$$x_{kc} = \begin{cases} 1 & if \quad RCA_{kc} > 1 \\ 0 & if \quad otherwise \end{cases} \ . \qquad (3)$$

For each possible pair of products (*i,j*), the following model is estimated for the sample of 93 available observations (countries):

$$P\left(x_{jc} = 1 \middle| x_{ic}\right) = G\left(\alpha_0 + \alpha_1 x_{ic}\right), \qquad (4)$$

where *G*(.) is assumed to be the standard normal cumulative distribution function. The case with $\alpha_1 = 0$ means that the probability of having RCA in product *j* does not depend on having RCA in product *i* (actually, when $\alpha_1 = 0$, the estimate $P\left(x_{jc} = 1 \middle| x_{ic}\right) = G\left(\alpha_0\right)$ equals the percentage of countries having RCA in product *j*).

Significance is assessed using a standard z statistic with a significance level of 5%. Whenever the estimated relationship between two products *i* and *j* is significant (that is, when we reject the null hypothesis of α_1=0), we compute the *increment in probability* - the marginal effect – of having RCA in product *j* due to the fact of having RCA in product *i*. That is:

$$RRI_{ij} = G\left(\hat{\alpha}_0 + \hat{\alpha}_1\right) - G\left(\hat{\alpha}_0\right). \qquad (5)$$

Whenever we obtain a non-significant result, we set the corresponding RRI to zero.

Since we use HS-4 classification encompassing 1245 products, we have a total of 1245x1244=1,548,780 cells estimated in the (non-symmetric) matrix of all possible relations between pairs of products *(i,j)*.[2]

2.5.Discussion

Table 1 presents some summary statistics of our RRIs estimation. A novelty in our method is that it provides a significance test for the estimated RRIs. Hence, if only few countries have comparative advantage in one of the goods, our RRI measure will not be significant. As shown in Table 1, among the almost one and a half million RRIs estimated, only 16.11% were found to be significant. This evidence challenges Hausmann and Klinger (2006, 2007): because these authors considered all possible relations between pairs of products, they are likely to be overestimating the available options of countries in the process of structural transformation.[3]

A second novelty with our estimation is that it allows RRIs to be either positive or negative. This captures the possibility of some capabilities used in the production of one good being unfavourable to the production of another. An obvious example is climate: it may be that the climate necessary to produce bananas is detrimental to the production of olives. Also a country abundant in skilled labour and hence specialized in highly sophisticated goods may find it difficult to develop comparative advantage in products using unskilled labour intensively.

According to our estimations (Table 1), among the significant RRIs, 2.39% were found to be negative. Inspecting the estimated matrix, we observe that negative RRIs occur mostly with raw materials and other primary products, such as oil, gold and coffee. Specialization in these products depends on the availability of specific natural resources and tends to involve countries with very low export diversification, in some cases affected by the Dutch disease. In the Hausmann-Klinger framework, pairs of goods that are best produced in inconsistent economic frameworks are bounded to have strictly non-negative indexes of revealed relatedness.

Table 1: Summary results of the RRI estimation

	Number	% of Total	% Sig.
Non Significant	1,300,256	83.89	
Significant	249,769	16.11	
of Which:			
Positive	243,803	15.73	97.61
Negative	5,966	0.38	2.39
Total	1,550,025	100.00	100.00

Note: Significance is assessed by a *z-test* (using a normal distribution). The significance level chosen was 5%.

A third novelty in our method is that we do not need to impose symmetry in the matrix of product relatedness. Theoretically, the matrix of product relatedness should not be symmetric. As an example, consider automobiles and carpets: a country having RCA in automobiles may explore a synergy, developing the activity of producing carpets for automobiles. However, producing carpets for automobiles does not necessarily endow a country with the required capabilities to produce automobiles. We believe that working with a non-symmetric is more realistic and therefore we expect our estimates to allow for a more accurate analysis than if the Haussmann-Kingler method was used instead.

The disadvantage of not assuming a symmetric matrix is that we will not be able to map the product space in a two dimension plan, as nicely done by Hidalgo et al. (2007). For the purposes of this paper, however, working with a non-symmetric matrix will allow us to tackle more accurately the problem at hand. In particular, asymmetry allows us to distinguish two perspectives from each product "point of view":

[2] The estimated matrix is available from the authors upon request.

[3] This criticism does not apply to Hidalgo et al. (2007). These authors mapped the product space in a two dimension plan ignoring conditional probabilities lower than a given level. In particular, they considered only 1525 relationships, out of the 750x750 estimated relationships.

a row ("outward") perspective, whereby we assess the extent to which productive experience in one specific product is helpful to develop comparative advantage in other products; and a column ("inward") perspective, where we assess the extent to which the country overall specialization pattern is helpful to develop comparative advantage in a given new product.

2.6. Out-path indexes

As for the row ("outward") perspective, we are concerned with the extent to which the productive experience in a given product is helpful to develop comparative advantage in other products, in general.

Hausmann and Klinger (2006) assessed the overall relatedness of a product with other products proposing an index consisting in the sum of all conditional probabilities involving this product. Our corresponding measure is the row-total in the matrix of marginal effects and will be dubbed as "out-path":[4]

$$outpath_i = \sum_j RRI_{ij} \qquad (6)$$

This index reflects both the number of significant RRIs and their sizes. A high out-path index in respect to a particular product *i* shall be interpreted as indicating that productive experience with this product is very helpful to start producing other products, in general.

2.7. Pure Densities

As for the "inward" perspective, we are concerned with the extent to which a country overall productive experience is helpful to start producing a given new product. For each potential product *j* in country *c,* we compute the following measure, which we label as "pure-density":[5]

$$\omega_{j,c} = \sum_i RRI_{ij} x_{ic} \ , \qquad (7)$$

where x_{ic} is defined as in (3). We can interpret this measure as capturing the extent to which the products in which the country is currently specialized generate specific capabilities that are useful for the product under consideration, *j*. A high pure-density index in respect to a particular product *j* that the country is not producing suggests that the country accumulated experience that can easily be adapted for this product. Negative densities, or positive but very low densities, suggest that the product under consideration is "very unrelated" to the country core of capabilities.

3. Summary statistics for some products

To get a sense of what the estimates intend to capture, in this section we present some summary statistics for products in which Portugal is currently specialized.

Table 2 presents the RRI estimates for one specific row of our 1245x1245 matrix of product relatedness. The chosen row refers to "6302 – bed linen, table linen, toilet linen and kitchen linen", a product in which Portugal has considerable productive experience.

Column 1 displays the marginal effects of the probit model. These marginal effects measure the increment in the probability of having RCA in a given product *j,* given that a country has RCA in product 6302. For instance, productive experience in bed linen increases the probability of having comparative

[4] Note that, in our framework, row sums and columns sums are not, in general, equal.

[5] It should be noted that this measure differs slightly from the "density" measure proposed by Hausmann et al (2007), which is given by $\omega'_{j,c} = \sum_i RRI_{ij} x_{ic} \Big/ \sum_i RRI_{ij}$. Thus, while we are measuring the ***absolute*** relatedness of product *j* to the products in which the country is specialized, Hausmann et al (2007) measure the ***proportion*** of product j - overall relatedness to other products that is accounted by those in which the country is specialized. The reason to follow a different approach is twofold: on one hand, we believe that an absolute measure is more appropriate to capture the non-rivalrous nature of knowledge. On the other hand, a related investigation using panel data for the period 1962-2000 suggests that the "pure density" measure is a better predictor of future RCAs than the "density" measure (Nunes et al., 2013).

advantage in "6107 – Men's or boys' underpants, …" by 51 percentage points. In contrast, productive experience in bed linen is likely to decrease the likelihood of developing comparative advantage in "7108 – Gold …".[6]

Column 2 of Table 2 displays the *z-test*s corresponding to the estimated RRI (actually, in Table 2, the j-products are displayed by decreasing order of ***z***). Column 3 display the PRODY indexes of the j-products.

Table 2: Row RRIs for "6302 – "Bed Linen…. "

NC - 4	6302 - Bed linen, table linen, toilet linen and kitchen linen.	(1)	(2)	(3)
	PRODY = 6,82 (10^3)	RRI	Z	PRODY j (10^3)
6107	Men's or boys' underpants, briefs, nightshirts, pyjamas, bathrobes	0.51	5.11	9.18
6206	Women's or girls' blouses, shirts and shirt-blouses.	0.50	5.05	7.80
6108	Women's or girls' slips, petticoats, briefs, panties, nightdresses	0.50	5.05	8.95
6204	Women's or girls' suits, ensembles, jackets, blazers, dresses, skirts	0.50	5.00	7.98
6104	Women's or girls' suits, ensembles, jackets, blazers, dresses, skirts	0.49	4.91	7.54
6115	Panty hose, tights, stockings, socks and other hosiery	0.49	4.91	11.58
6106	Women's or girls' blouses, shirts and shirt-blouses, knitted or crocheted.	0.48	4.73	7.90
6103	Men's or boys' suits, ensembles, jackets, blazers, trousers, bib and brace ...	0.50	4.68	6.08
6109	T-shirts, singlets and other vests, knitted or crocheted.	0.43	4.59	8.85
6203	Men's or boys' suits, ensembles, jackets, blazers, trousers	0.41	4.40	7.72
(…)	(…)			
8306	Bells, gongs and the like, non-electric, of base metal; statuettes and othe ...	0.25	1.99	19.19
7323	Table, kitchen or other household articles and parts thereof, of iron or st ...	0.25	1.99	12.58
5106	Yarn of carded wool, not put up for retail sale.	0.25	1.99	21.54
3103	Mineral or chemical fertilisers, phosphatic.	0.25	1.99	9.22
0908	Nutmeg, mace and cardamoms	0.25	1.99	4.52
7108	Gold (including gold plated with platinum)	-0.19	-2.04	3.90

Note: RRI (revealed relatedness index) represents the increment in probability of having RCA in one product due to the fact of having RCA in "6302 – Bed Linen,...".

In Table 3, we display some of the indexes defined above, to characterize 8 products in which Portugal is currently specialized. As shown in Column 1 of Table 3, these 8 products accounted for roughly 27% of Portuguese exports in 2005. The corresponding Balassa (1965) RCA indexes (Column 2) are mostly well above unity, pointing to a quite strong specialization of Portugal in these products.

Columns 3 and 4 characterize the chosen products, in terms of PRODY and PRODY rank. For instance, the product "6109 T-Shirts" has an estimated PRODY index of 8.8 and this corresponds to the 83rd percentile in terms of PRODY rank. That is, only 16.8% of the 1245 products in the sample have lower income content than "6109 T-Shirts". Among the 8 products in the table, only "8473 Parts and accessories for use with machines of heading" ranks in the top 20% in terms of PRODY.

Column 5 of Table 3 displays the number of significant row ("outward") RRIs, for each product. These RRIs refer to the increment in the probability of having RCA in a product j, given that a country has RCA in one of these 8 products. For instance, specialization in "6302 - Bed linen" influences the probability of having RCA in 165 other products. In the case of "2204 - Wine", the corresponding figure is 128, only. Among the 8 products in the table, the one that influences the likelihood of a country having comparative advantage in more j-products is "8708 - Parts and accessories of the motor vehicles of headings", with 454 significant RRIs.

Columns 6 and 7 document the number of significant RRIs which are positive and negative, respectively. In the case of "6109 T-shirts", for instance, 29 RRIs are negative, meaning that having RCA in T-shirts decreases the probability of having RCA in 29 other products. This can be interpreted by the fact that t-shirts are normally produced in countries that are abundant in unskilled labor and hence, less endowed to produce highly sophisticated products. In contrast, "2204 - Wine" does not appear to be inconsistent with any other production.

[6] Of course, as any other estimation method, this approach is not free of spurious relationships. We believe, however, that the implied bias will be mitigated by the large number of products we are dealing with.

Table 3 – Summary statistics for some products

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
									Outpath by Prody Class				
Products	Share on PT exports (%)	RCA	PRODY (10^3)	PRODY Rank (%)	ni	ni>0	ni<0	Outpath	VL	L	A	H	VH
8703 Motor cars and other motor vehicles principally designed for the transport ...	7.7	1.4	23.0	20.5	442	435	7	158.1	2.8	16.4	33.7	53.3	51.9
8708 Parts and accessories of the motor vehicles of headings 87.01 to 87.05.	4.4	1.7	20.8	30.7	454	444	10	172.3	1.2	15.9	39.1	60.2	56.0
6403 Footwear with outer soles of rubber, plastics, leather or composition leath ...	3.7	9.0	12.4	70.2	263	259	4	94.3	18.3	27.7	20.6	21.5	6.3
8527 Reception apparatus for radio-telephony, radio-telegraphy or radio-broadcas ...	2.7	12.5	20.4	32.6	155	153	2	54.1	2.3	4.5	7.9	19.9	19.4
6109 T-shirts, singlets and other vests, knitted or crocheted.	2.2	8.3	8.8	83.2	171	142	29	51.0	25.4	20.0	7.1	1.7	-3.2
8473 Parts and accessories for use with machines of heading 84.69 to 84.72	2.2	1.1	23.2	19.3	229	226	3	86.0	3.5	8.9	11.8	25.1	36.7
2204 Wine of fresh grapes, including fortified wines	1.9	7.9	9.8	79.2	128	128	0	35.7	5.5	10.8	8.0	8.4	3.0
6302 Bed linen, table linen, toilet linen and kitchen linen.	1.9	13.0	6.8	89.1	165	164	1	54.4	21.2	19.8	10.3	2.8	0.4

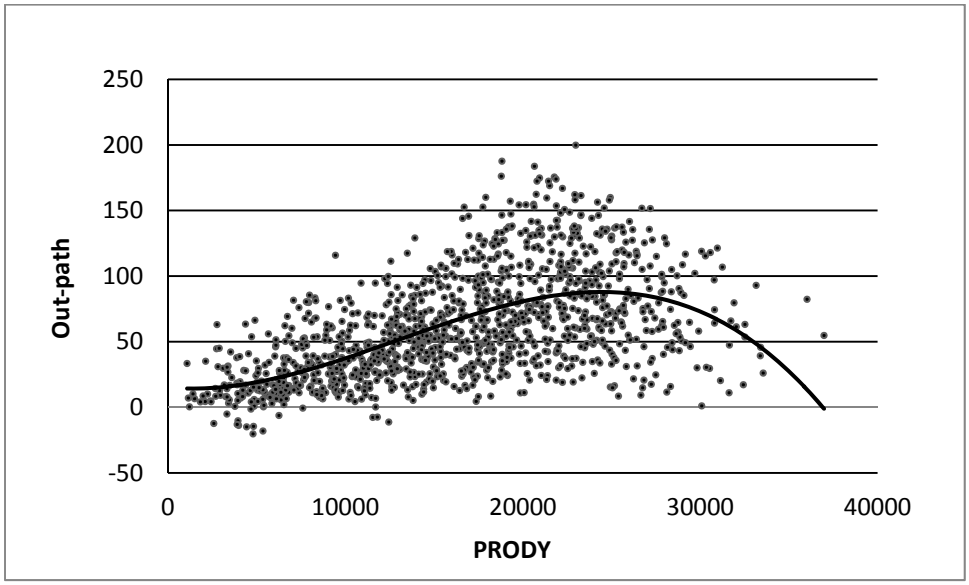
Notes: ni = number of significant RRI. The out-path index in column 8 is defined as in equation (6). The classes of PRODY in columns 9-13 correspond to the five quintiles in the PRODY series. These are "Very High" (VH, top 20%), "High" (H), "Average" (A), "Low" (L), "Very Low" (VL, lowest 20%). The out-path index of column 8 is decomposed in columns 9-13 according to, $outpath_i = \sum_{j \in VL} RRI_{ij} + \sum_{j \in L} RRI_{ij} + \sum_{j \in A} RRI_{ij} + \sum_{j \in H} RRI_{ij} + \sum_{j \in VH} RRI_{ij}$.

Colum 8 displays the out-path indexes for these 8 products (equation 6, above). This intends to capture the overall usefulness of the productive experience achieved in one good for a country to start producing other products, in general. In Table 3, we see that the products that appear to be more useful in terms of capabilities generated are "8703 - Motor cars " and "8708 - Parts and accessories…". In contrast, "6109 - T-shirts" and "2204 - Wine…" do not seem to be particularly interesting in terms of their learning potential.

A question that naturally arises is whether products typically produced in rich countries tend to have larger out-path indexes than products typically produced in poor countries. The relationship between out-path indexes and PRODY indexes for all products in the sample is displayed in Figure 1. A non-linear regression line is included, so as to capture the main pattern. The curve is initially positively sloped, suggesting that, in general, achieving specialization in "more sophisticated" products is helpful in terms of preparing a country to start producing other products.

However, the data also reveals an increasing dispersion of out-paths, as PRODY levels increase. Most interesting, at very high PRODY values, the average relationship between out-paths and PRODY values turns out to be negative. A natural interpretation is that some highly sophisticated products involve the use of very specialized skills that do not easily spill over to other productions. Products providing more useful productive experience are neither those of very high income content nor those of very low income content. This suggests that it does not help a poor country to devote efforts to install *any* industry of high income content.

Figure 1: Out-path and PRODY indexes



Note: PRODY defined in equation (1); Out-path defined in equation (6).

A limitation of the out-path index (6) is that it measures the relatedness of a product to all other products, irrespectively of the PRODY value of these products. To address this limitation, in columns 9-13 of Table 3 we split the out-path index for each "departing" product *i* into five sub-indexes, according to the PRODY class of the "arrival" products *j* (the classes of PRODY range from the 20% products with higher PRODY to the 20% products of lower PRODY).

For instance, most of the "6109: T-shirts" out-path is conducive to products with "Low" and "Very Low" PRODY value. In contrast, the out-path fraction that is conducive to products with "Very High" PRODY has a negative value, meaning that productive experience in "6109: T-shirts" reduces the probability of having comparative advantage in some high PRODY products. One interpretation is that the relative availability of unskilled labour that is required to develop comparative advantage in T-shirts is in general inconsistent with the relative availability of skilled labour that is required to develop comparative advantage in highly sophisticated products. In contrast, "9703 – Motor cars" and "8708 - Parts and accessories…" are mostly conducive to products with "High" and "Very High" PRODY indexes.

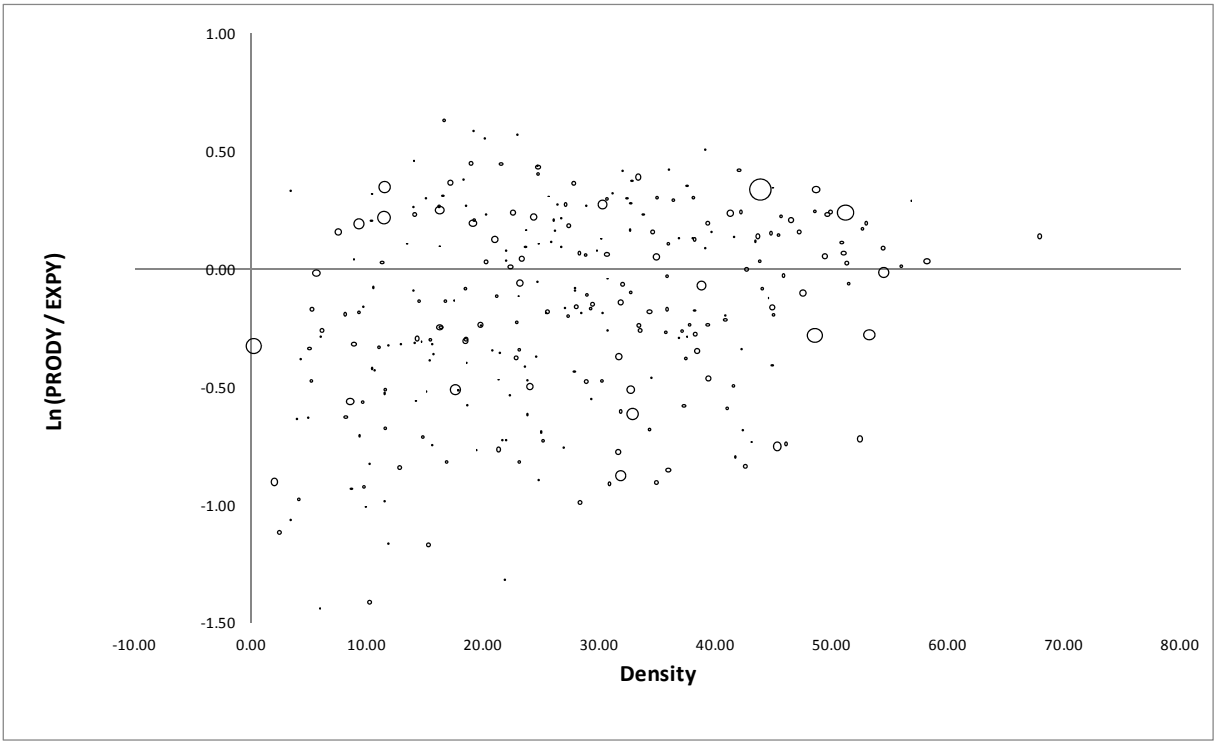
4. The Portuguese specialization pattern

4.1. Which products are more related to the country's specialization pattern?

We now assess, for each product, the extent to which it is related to the basket of products in which the country is currently specialized. We label this as an "inward" perspective, because we are focusing on the column ("arrival") condition of each product in the matrix of RRIs. The relatedness between a product and the country specialization pattern is assessed by the pure-density measure, (7).

As a first approximation to our problem, let's first look at the set of products in which Portugal is currently specialized (that is, those with RCA>1). These are 306 products, accounting for 82% of Portuguese exports. In Figure 2, we cross the "value increments" (as defined in Section 2.3) of these products with their corresponding pure-densities. In the figure, circle dimensions are proportional to export shares. Table 4 displays some summary statistics for the products displayed in Figure 2, grouped by classes of pure-density.

Figure 2 – Portugal: Value increments associated to the products with RCA>1, crossed with the corresponding pure-densities



Source: Own calculations. Circles are proportional to the share of each product in Portuguese exports. Summary statistics in Table 4. Data for some products are displayed in Appendix 1.

To help identify the more sizeable sectors depicted in Figure 2, in Appendix 1 we list the pure-densities and value increments associated to the 44 largest exporting products of Portugal, *irrespectively* of RCA, ranked by pure-densities. These products account to 60% of Portuguese exports. Notably, the top of the table (higher pure-densities) includes machinery, metals, textiles and footwear. It is also worth noting that the two largest exporting products in Portugal, "8703 - Motor cars" (7.7% of Portuguese exports), "8708 – Parts and accessories of the motor vehicles…" (4.4%) are upscale products (i.e., with PRODYs above the country's EXPY) and appear to fit quite well in the country specialization pattern, with pure-densities above 40.

Other products with pure-densities above 30 include "9401 – Seats" (1.7%), "8544 – Insulated wire, cable" (1.8%), "6403 – Footwear…" (3.7%), "6203 – Men's or boys' suits…" (1.2%), "4011 – New pneumatic tyres…" (1.4%), "6109 – T-shirts…" (2.2%), "6110 – Jerseys, pullovers…" (1.1%), "6302 – Bed linen…" (1.9%), "8480 – Moulding boxes for metal foundry…" (1.0%). Remarkably, among these products, only the last one is an upscale product.

In the other extreme, we identify two sizeable products lying at pure-densities lower than 5. These are "2710 – Petroleum oils" (3.7% of Portuguese exports, and downscale relative to the country EXPY), and "8542 - Electronic integrated circuits and micro-assemblies" (2.3% of exports, upscale, but with RCA<1).

Table 4 – Summary statistics for products in which Portugal has RCA>1

Densities	Number of products	% of Total	Share of Exports (%)	Value Increment (simple average)	Value Increment (weighted average)
[0,10[	33	10.78	10.84	-0.53	-0.30
[10,20[	73	23.86	15.14	-0.28	-0.07
[20,30[	78	25.49	9.17	-0.15	-0.10
[30,40[	67	21.90	16.85	-0.10	-0.30
[40,50[	39	12.75	19.57	-0.10	0.04
[50,60]	15	4.90	10.30	0.03	0.02
>60	1	0.33	0.30	0.14	0.14
Total	306	100.00	82.17	-	-

Notes: Own estimates. Values in the last column consist in a weighted average of value increments, with the weights equal to export shares.

4.2. How consistent is the Portuguese specialization pattern?

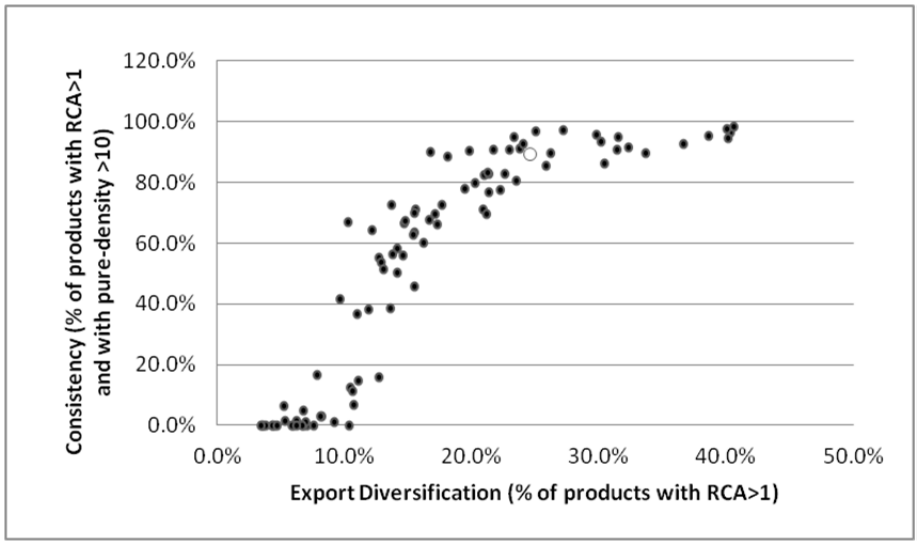
In Table 4, we see that most of the products in which Portugal is currently specialized - actually, 89% of the products, amounting to 89% of exports - fall in a range of pure-densities above 10. Whether this is suggestive of a "consistent" specialization pattern or not, we don't know, unless we compare with other countries.

Figure 3 provides a cross-country comparison to assess the "consistency" of specialization patterns (figures for individual countries in Appendix 2). We define a "consistency index" as the percentage of products with RCA>1 that lie at pure-densities higher than 10. In that figure, we assess for each country the consistency crossed with a measure of export diversification, defined as the share of products with RCA>1 in a country's total exports.

Figure 3 reveals that export diversification and consistency of the specialization pattern, in general, go along. This is an expected result, because as more products are exported, a higher productive experience will be acquired by a country and hence the higher the likelihood of any given product to be related to the country specialization pattern.

The case of Portugal is identified in Figure 3 by a large circle. Comparing to the world distribution, the evidence for Portugal is suggestive of a reasonably "consistent" specialization pattern. That is, most countries have more products with RCA>1 and densities lower than 10 than Portugal. Actually, Portugal ranks 23rd in this sample of 93 countries, in terms of the consistency index. Countries with patterns of specialization more consistent than Portugal include Germany, US, Spain, France, UK. Countries with less consistent specialization patterns include Greece, Ireland, Brazil, India and Canada.

Figure 3: Consistency of the specialization pattern and export diversification



Source: Appendix 2.

5. Upscale opportunities

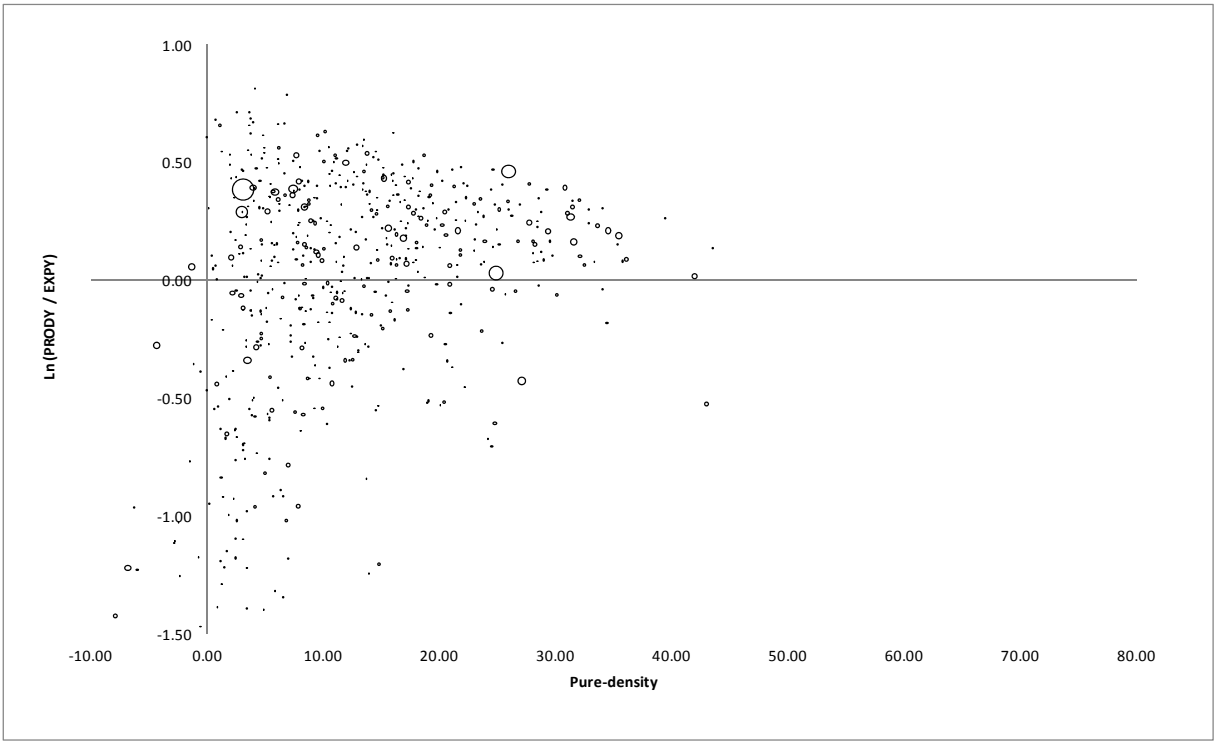
5.1. How many products?

We now assess the opportunities of Portugal in the process of structural transformation. This is investigated looking at the "upscale products" in which Portugal didn't develop comparative advantage that are more related to products in which the country is currently specialized. We restrict the analysis to products that Portugal is already exporting.

Figure 4 provides a visual inspection. As before, we cross pure-densities and value increments, but in this case for products with RCA<1. The figure includes both upscale and downscale products. In the following, we focus on upscale products with pure-densities larger than 10, as that is the range where 89% of the products with RCA>1 are (Table 4).

As shown in Figure 4, Portugal has a considerable number of "upscale" opportunities at pure-densities larger than 30. At pure densities larger than 10, there are 275 upscale products. Interesting enough, the products with higher value increments, and hence higher PRODY, tend to be located close to the origin, that is, farther in respect to the country core of capabilities.

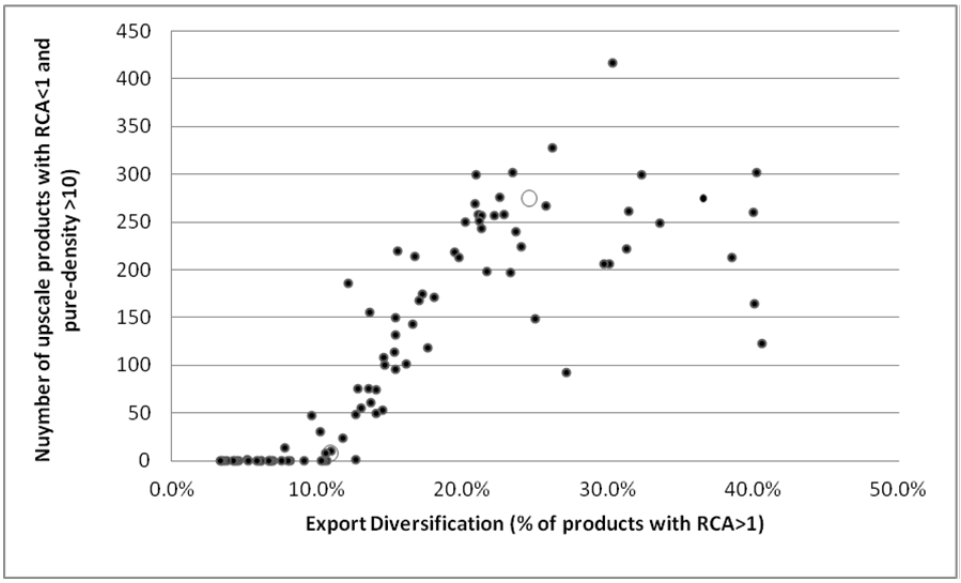
Figure 4 – Portugal: Value increments associated to products with RCA<1, crossed with pure-densities



Source: Own calculations. Circles are proportional to the share of each product in Portuguese exports. Summary statistics for some upscale products that have pure-densities higher than 10 are displayed in Appendix 4 (top 50 products ordered by density level).

In order to qualify the Portuguese case, we turn again to international comparisons. In Appendix 3, we repeat the exercise in Figure 4 for 9 countries. The analysis is however restricted to "upscale products" and positive densities. The countries considered are Argentina, Finland, France, Hungary, Morocco, Rep. of Korea, Senegal, Spain and Turkey. Visual inspection of these scatter-plots suggests that specialization patterns are not all alike in terms of preparing a country to develop comparative advantage in new products. While countries like France and Spain appear to be well prepared to start producing new and high valuable products, countries like, Senegal, Argentina and Morocco can hardly be considered has having developed capabilities that are favorable to diversification moves. Senegal, in particular, does not have any upscale opportunity at pure-densities above 13.3.

Figure 5 – Upscale opportunities at pure-densities larger than 10 and export diversification



Source: Appendix 2.

Sticking with 10 as the benchmark lower limit for pure-densities characterizing specialization opportunities, we compute, in the last column of the table in Appendix 2, the number of upscale opportunities available for each country. That is, we compute, for each country, the number of products with positive value increments and RCA<1 lying at pure-densities larger than 10.

In Figure 5, we cross this information with our measure of export diversification. As expected, in Figure 5, a positive relationship between export diversification and upscale opportunities is observed: as a country becomes more diversified in terms of exports, the likelihood of having developed capabilities that are helpful to start producing other products increases. The relationship is however non-linear, with a more regular behavior when export diversification is in the range from 10% until 25%.

The case of Portugal (with diversification equal to 25% and 275 upscale opportunities) is identified in Figure 5 with a large circle. Clearly, this country has more upscale opportunities than most other countries with similar levels of export diversification. For instance, Japan and Slovenia, have 148 and 224 upscale products at pure-densities higher than 10 (Appendix 2). On the other hand, Thailand with a similar level of export diversification has far more upscale opportunities (327) than Portugal. In this sample of 93 countries, Portugal ranks 8th in terms of the number of upscale opportunities available at a density range above 10.

5.2. How valuable?

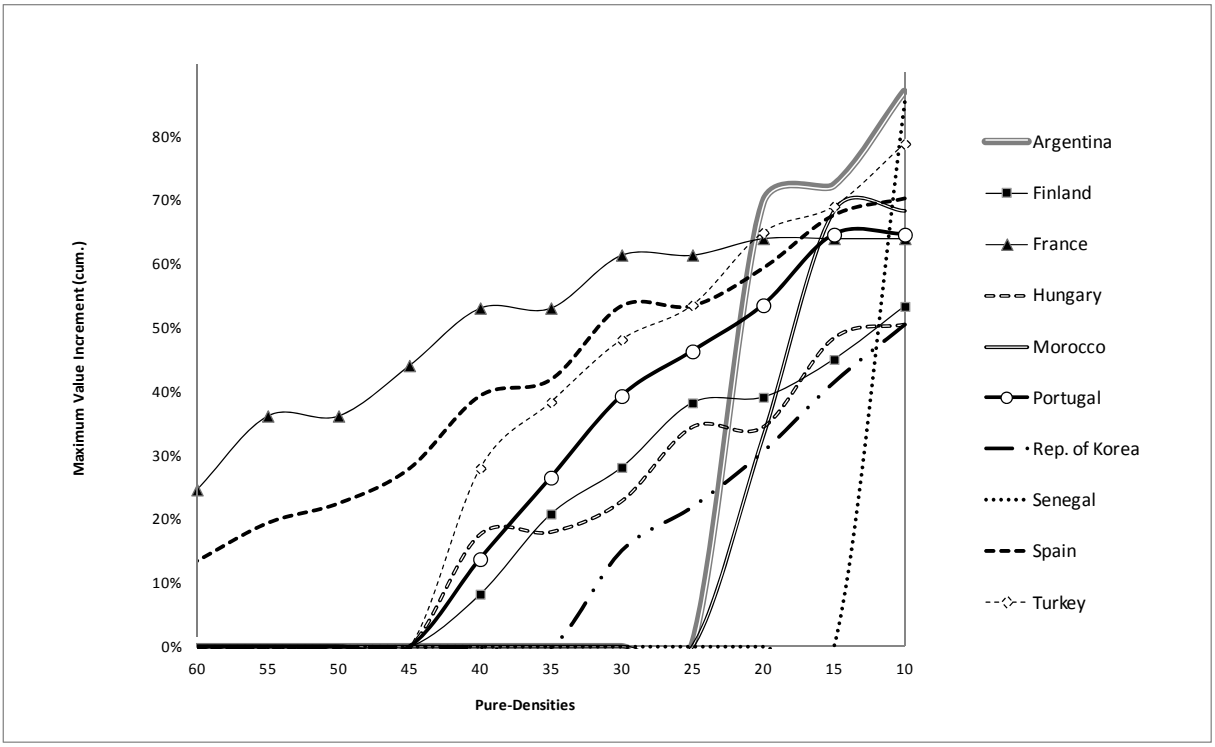
Another question that arises is whether upscale opportunities for each country imply large value increments or small value increments. A visual inspection of Appendix 3 suggests, for instance, that all upscale opportunities in the cases of Finland and France have value increments lower than 70%. This is an obvious consequence of the fact that these two countries already have very high EXPY levels. In contrast, Morocco and Senegal have upscale opportunities implying value increments higher than 100%.

To compare the different patterns, we plot “efficiency frontiers” for the countries listed in Appendix 3. These “efficiency frontiers” (Figure 6) are defined as the maximum value increment achievable at pure-densities higher than a given level, with this level decreasing from 60 to 10. To some extent, these efficiency frontiers draw an “ideal path” for each country in the process of structural transformation, as they correspond to picking up the more valuable product available, as the country departs from its core of capabilities.

Figure 6 reveals France as the country with more valuable upscale opportunities nearby. Spain also has sizeable upscale opportunities very close to the country core of capabilities. Interesting enough, Turkey has less upscale products than Portugal at pure-densities exceeding 10, but the value increments associated to the products that are closer to the country core of capabilities are higher than in the

Portuguese case. In turn, Hungary, Finland and Rep. of Korea appear to have less favorable upscale opportunities than Portugal. Argentina, Morocco and Senegal lack any upscale opportunities at a range of pure densities exceeding 25.

Figure 6 - Maximum Value Increment, at pure-densities above x, where x varies from 60 to 10.



Notes: (a) The efficiency frontier for each country assesses the maximum value increment achievable by that country at an pure-density above x, where x varies from 60 to 10. (b) Plots with product-level observations are displayed in Appendix 3.

5.3 Which sectors?

In this section, we inspect the database, to identify the sectors where the upscale opportunities for each country belong.

In the case of Portugal, upscale opportunities at pure densities higher than 10 and in which the country already accumulated sizeable productive experience include:[7] "8704 - Motor vehicles for the transport of goods (density 24.9; 0.91% of total exports), "3004 – medicaments" (25.9; 0.9%), "8414 - Air or vacuum pumps" (31.3; 0.25%), "8504 – electric transformers (15.6; 0.22%), "8501 – electric motors and generators" (31.5; 0.19%).

In Table 5, we display the number of upscale products available to each country considered in Appendix 3, at pure-densities larger than 10, broken down by product category. As shown in the table, in the case of Portugal most upscale opportunities lie in Machinery (72), Chemicals (55), Metals (46), and Miscellaneous (23). Other countries in this sample with high proportions of upscale opportunities in Machinery, miscellaneous and chemicals include France, Spain, Rep. Korea, Hungary, and Finland. In contrast, Morocco has most upscale product opportunities in textiles, footwear and clothing (39%), while Senegal has 50% of upscale opportunities in primary sectors.

[7] Product level information for the 50 upscale products with higher densities in the case of Portugal is available in Appendix 4.

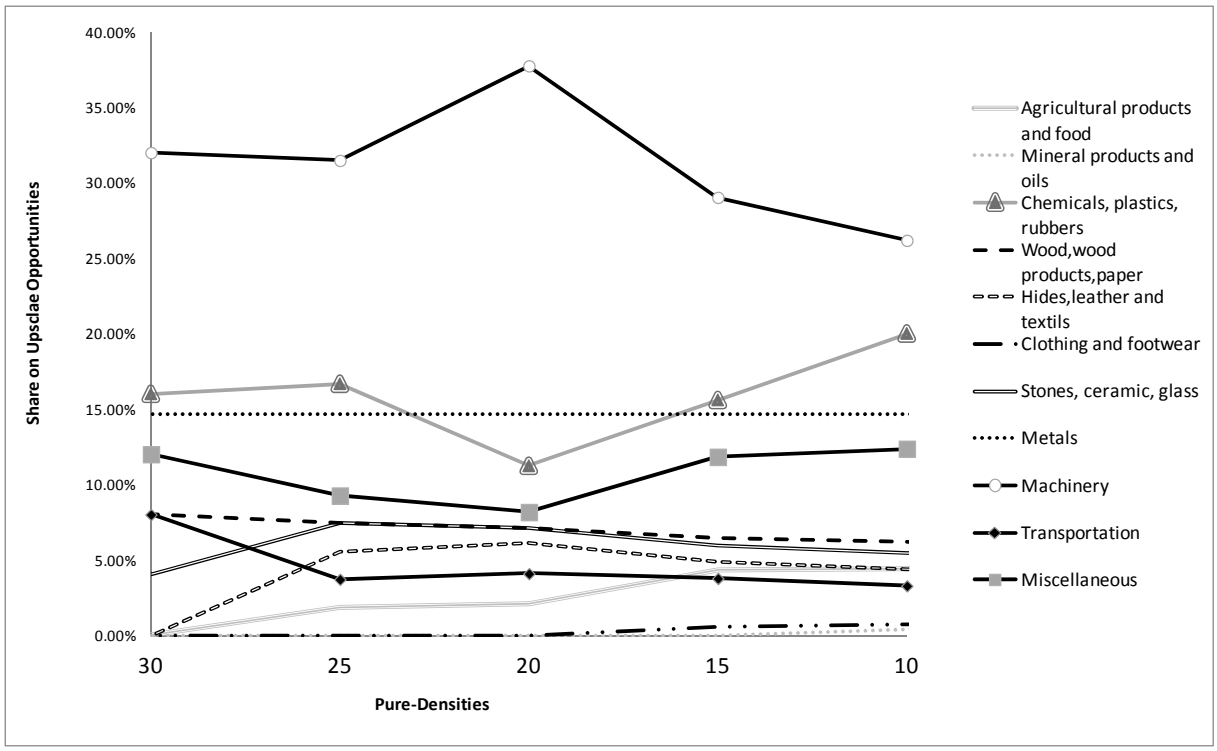
Table 5 – Upscale products at pure-densities higher than 10, broken down by product category

Category	Chapter of HS	Argentina	Finland	France	Hungary	Morocco	Portugal	Rep. of Korea	Senegal	Spain	Turkey
Agricultural products and food	01-24	14	7	2	6	3	12	2	1	7	18
Mineral products and oils	25-27	1	1	2	0	0	1	0	0	0	2
Chemicals, plastics, rubbers	28-40	47	51	48	52	3	55	54	2	68	46
Wood,wood products,paper	44-49	8	7	10	14	1	17	12	4	13	23
Hides,leather and textils	41-43, 50-60, 63	5	8	9	10	16	12	7	1	11	14
Clothing and footwear	61-62,64-67	0	0	1	0	3	2	1	0	1	4
Stones, ceramic, glass	68-71	8	9	16	10	6	15	14	0	18	12
Metals	72-83	23	21	27	35	11	46	27	0	42	48
Machinery	84-85	23	42	61	56	2	72	57	1	70	62
Transportation	86-89	6	5	5	6	1	9	5	0	5	7
Miscellaneous	90-97	8	20	32	24	3	34	35	1	40	31
Total		143	171	213	213	49	275	214	10	275	267
Memo (percentage of total):											
Agricultural, mineral, wood		16.1%	8.8%	6.6%	9.4%	8.2%	10.9%	6.5%	50.0%	7.3%	16.1%
Textiles, clothing, footwear		3.5%	4.7%	4.7%	4.7%	38.8%	5.1%	3.7%	10.0%	4.4%	6.7%
Machinery, transportation, misc.		25.9%	39.2%	46.0%	40.4%	12.2%	41.8%	45.3%	20.0%	41.8%	37.5%
Chemicals		32.9%	29.8%	22.5%	24.4%	6.1%	20.0%	25.2%	20.0%	24.7%	17.2%

Source: own calculations, inspecting the database for the observations depicted in Appendix 3.

One may rightly argue that setting a lower limit of 10 on pure-densities does not allow to distinguish the products that are very close to the country core of capabilities. To address this limitation, we investigate how the sectorial composition of upscale opportunities in Portugal change as the threshold declines from 30 to 10. As shown in Figure 7, the group of products that is closer to the country core of capabilities is definitely Machinery. At pure densities higher than 20, more than 30% of upscale opportunities belong to this group. As we move away from the country core of capabilities (declining values of pure-density), the share of Machinery declines slightly, reflecting an increasing role of products belonging to the categories of "chemicals" and "miscellaneous products".

Figure 7 – Shares of the different product categories on upscale opportunities of Portugal, as the minimum threshold decreases from 30 to 10.



6. Conclusions

In this paper, we use the structure of international trade in 2005 to estimate "revealed relatedness indexes" between pairs of products. Our approach differs for that of Hidalgo et. al. (2007), in that our measure of product relatedness is subject to a statistical scrutiny and can be either positive or negative. We find that a large number of pairs of products are not statistically significant and that most significant relationships have a positive sign. Our approach is also distinctive in that we do not impose symmetry in the matrix of product relatedness.

Our results suggest that, in the case of Portugal, most comparative advantages have been developed inside the country core of capabilities. This includes the three largest exporting sectors in Portugal: "motor cars", "Accessories of the motor vehicles", and "Footwear". However, the latter, as well as most export products on textiles, are downscale products (i.e., have PRODYs below the country's EXPY).

Comparing to other countries, we found that Portugal ranks 23rd (out of 93) in terms of "consistency of the export basket". There are, however, some sizeable export sectors not much related to the country core of capabilities. This includes Petroleum oils and Electronic integrated circuits.

We then identify the upscale products in which the country didn't develop comparative advantage that are more related to the current specialization pattern. We find 275 products satisfying these requirements, including some in which Portugal already accumulated significant productive experience, namely "Motor vehicles for the transport of goods" and "Medicaments". We observe that most upscale opportunities in the case of Portugal belong to the group of "machinery", followed by "chemicals", and "miscellaneous".

In this sample of 93 countries, Portugal ranks 8th, in terms of the number of upscale opportunities that are very related to the country core of capabilities. Despite having a large number of upscale products nearby, the corresponding PRODYs are not impressive compared with the country average. Spain, France, and Turkey have equal or less upscale opportunities, but those closer to the respective core of capabilities imply higher value increments than in the case of Portugal. In this respect, Portugal compares positively with countries such as Finland, Rep. Korea and Hungary.

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Appendix 1 – Pure-densities and value increments of the largest 44 exporting products, accounting for 60% of the Portuguese export basket

Code	Products	Pure-Densities	Value Increments	Share of Exports	RCA
7308	Structures (excluding prefabricated buildings of heading 94.06)	58.21	0.03	0.50	2.03
9401	Seats (other than those of heading 94.02), whether or not convertible into ...	54.46	-0.01	1.70	3.82
8544	Insulated (including enamelled or anodised) wire, cable	53.23	-0.28	1.83	2.91
6204	Women's or girls' suits, ensembles, jackets, blazers, dresses, skirts	52.42	-0.72	0.59	1.19
8708	Parts and accessories of the motor vehicles of headings 87.01 to 87.05.	51.15	0.24	4.40	1.72
8481	Taps, cocks, valves and similar appliances for pipes, boiler shells	48.66	0.34	0.72	1.55
6403	Footwear with outer soles of rubber, plastics, leather or composition leath ...	48.58	-0.28	3.65	9.00
9403	Other furniture and parts thereof.	47.49	-0.10	0.75	1.35
3926	Other articles of plastics and articles of other materials of headings 39.0 ...	46.49	0.21	0.55	1.34
6203	Men's or boys' suits, ensembles, jackets, blazers, trousers	45.31	-0.75	1.21	3.50
8703	Motor cars and other motor vehicles principally designed for the transport ...	43.88	0.34	7.70	1.37
3920	Other plates, sheets, film, foil and strip, of plastics	41.26	0.24	0.54	1.46
6910	Ceramic sinks, wash basins, wash basin pedestals, baths, bidets, water clos ...	39.35	-0.46	0.41	10.62
4011	New pneumatic tyres, of rubber.	38.79	-0.07	1.42	3.13
6115	Panty hose, tights, stockings, socks and other hosiery	38.39	-0.35	0.52	6.37
8409	Parts suitable for use solely or principally with the engines of heading 84 ...	34.93	0.05	0.62	1.20
8419	Machinery, plant or laboratory equipment	33.34	0.39	0.51	2.02
6109	T-shirts, singlets and other vests, knitted or crocheted.	32.85	-0.62	2.21	8.28
6110	Jerseys, pullovers, cardigans, waist-coats and similar articles, knitted or ...	32.68	-0.51	1.06	3.06
6302	Bed linen, table linen, toilet linen and kitchen linen.	31.85	-0.88	1.85	12.99
7010	Carboys, bottles, flasks, jars, pots, phials, ampoules and other containers ...	31.69	-0.37	0.66	11.40
6104	Women's or girls' suits, ensembles, jackets, blazers, dresses, skirts	31.66	-0.78	0.41	3.95
8480	Moulding boxes for metal foundry; mould bases; moulding patterns	30.27	0.27	1.05	7.75
3004	Medicaments (excluding goods of heading 30.02, 30.05 or 30.06)	25.93	0.46	0.86	0.37
8704	Motor vehicles for the transport of goods.	24.90	0.03	0.91	0.95
8536	Electrical apparatus for switching or protecting electrical circuits, or fo ...	24.38	0.22	0.69	1.07
7214	Other bars and rods of iron or non-alloy steel, not further worked than for ...	24.06	-0.50	0.64	5.21
6908	Glazed ceramic flags and paving, hearth or wall tiles	23.17	-0.06	0.56	5.67
3901	Polymers of ethylene, in primary forms.	20.96	0.13	0.65	1.55
6802	Worked monumental or building stone (except slate) and articles thereof	19.76	-0.23	0.42	4.83
2901	Acyclic hydrocarbons.	19.14	0.20	0.79	5.61
2204	Wine of fresh grapes, including fortified wines	17.63	-0.51	1.88	7.88
4504	Agglomerated cork (with or without a binding substance)	16.29	0.25	1.15	134.06
7210	Flat-rolled products of iron or non-alloy steel	16.28	-0.25	0.56	1.72
8473	Parts and accessories for use with machines of heading 84.69 to 84.72	11.50	0.35	2.21	1.07
8527	Reception apparatus for radio-telephony, radio-telegraphy or radio-broadcas ...	11.49	0.22	2.74	12.48
4503	Articles of natural cork.	9.31	0.19	1.49	174.75
2402	Cigars, cheroots, cigarillos and cigarettes	8.54	-0.56	0.79	4.75
2902	Cyclic hydrocarbons.	7.54	0.16	0.69	2.10
7601	Unwrought aluminium.	5.66	-0.02	0.82	2.31
8542	Electronic integrated circuits and microassemblies.	3.13	0.38	2.30	0.75
8802	Other aircraft (for example, helicopters, aeroplanes); spacecraft	2.96	0.29	0.62	0.64
2603	Copper ores and concentrates.	2.00	-0.90	0.75	5.00
2710	Petroleum oils, other than crude	0.29	-0.33	3.71	1.06

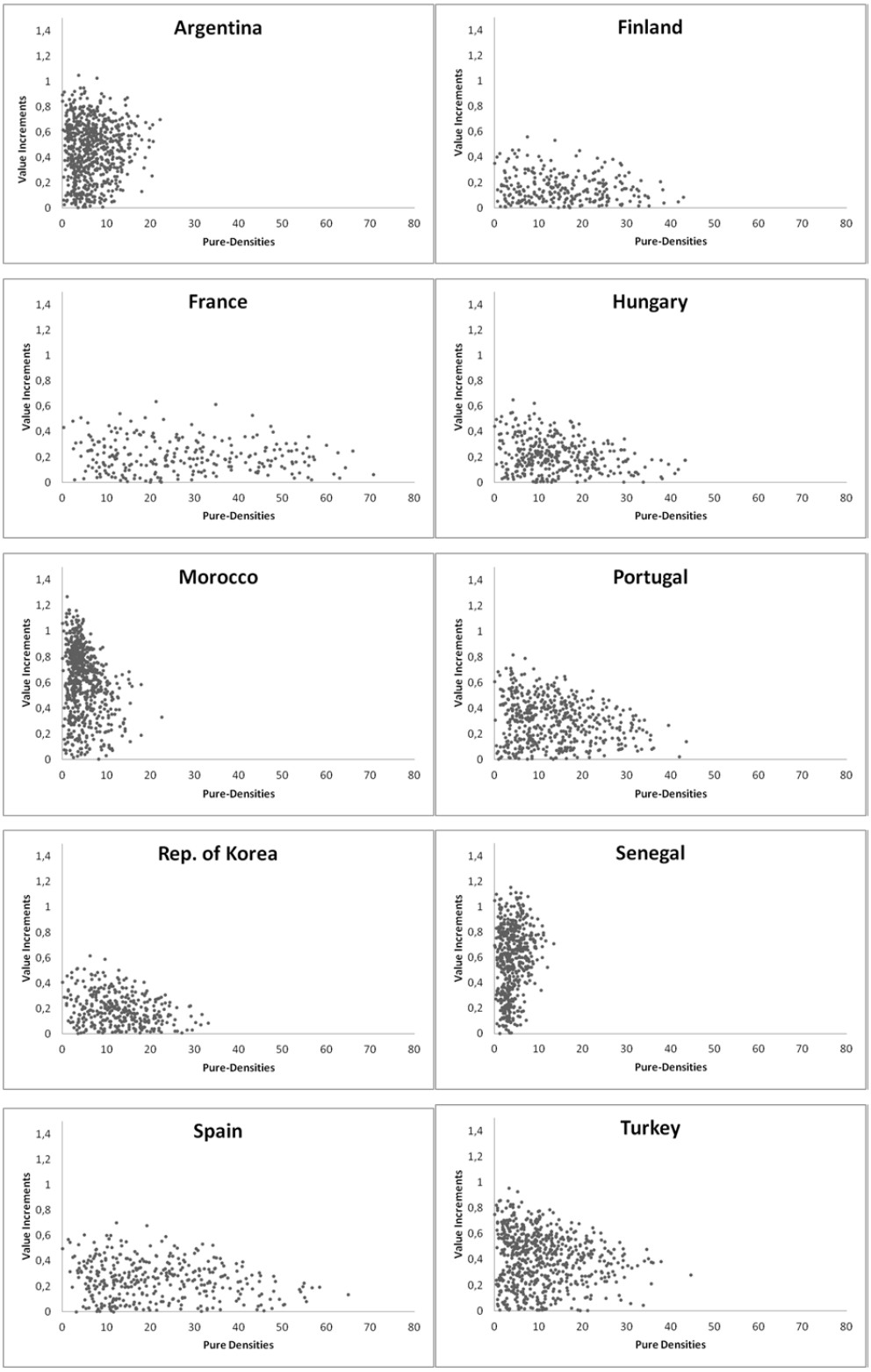
Note: Exports shares are computed using National Institute of Statistics data.

Appendix 2 – Export diversification, consistency of the specialization pattern and number of upscale opportunities at pure-densities larger than 10

Country	Export Diversification	Consistency	Number of Upscale	Country	Export Diversification	Consistency	Number of Upscale
India	30.4%	86.2%	416	Guatemala	16.2%	60.2%	101
Thailand	26.2%	89.6%	327	TFYR of Macedonia	14.7%	67.2%	100
Serbia	23.5%	80.5%	302	Australia	15.4%	45.8%	95
China	40.3%	96.2%	301	Switzerland	27.2%	97.0%	92
Mexico	21.0%	82.4%	299	Honduras	13.6%	38.5%	75
Poland	32.3%	91.3%	299	Rep. of Moldova	12.9%	53.8%	75
Bulgaria	22.6%	82.9%	276	Costa Rica	14.1%	50.3%	74
Portugal	24.6%	89.2%	275	Sri Lanka	13.7%	56.1%	60
Spain	36.6%	92.5%	275	Uruguay	13.0%	51.2%	55
Brazil	20.9%	71.2%	269	Pakistan	14.5%	55.8%	52
Turkey	25.8%	85.4%	267	Morocco	14.1%	58.3%	49
Czech Rep.	31.4%	94.9%	261	Albania	12.7%	55.1%	48
Italy	40.0%	97.4%	260	Russian Federation	9.6%	41.7%	47
Slovakia	22.9%	90.5%	258	Ireland	10.2%	66.9%	30
South Africa	21.1%	69.6%	257	Madagascar	11.8%	38.1%	23
Croatia	21.3%	82.6%	256	Norway	7.8%	16.5%	13
Greece	22.2%	77.5%	256	Senegal	11.0%	14.6%	10
Romania	21.2%	83.0%	251	Syria	10.9%	36.8%	8
Latvia	20.3%	79.8%	250	Kyrgyzstan	10.6%	11.4%	7
Netherlands	33.6%	89.5%	249	Mongolia	5.2%	6.2%	1
Canada	21.3%	76.6%	243	Peru	12.7%	15.8%	1
Denmark	23.7%	91.2%	240	Armenia	6.2%	1.3%	0
Slovenia	24.0%	92.6%	224	Azerbaijan	4.5%	0.0%	0
Belgium	31.4%	90.5%	222	Benin	4.3%	0.0%	0
Belarus	15.6%	71.1%	219	Bolivia	7.0%	0.0%	0
Lithuania	19.5%	77.7%	218	Cameroon	3.6%	0.0%	0
Rep. of Korea	16.7%	89.9%	214	Chile	10.5%	12.3%	0
France	38.6%	95.2%	213	Cote d'Ivoire	7.6%	0.0%	0
Hungary	19.8%	90.2%	213	Ecuador	6.8%	0.0%	0
Austria	29.7%	95.7%	206	Ghana	5.9%	0.0%	0
United Kingdom	30.1%	93.3%	206	Iran	6.9%	1.2%	0
Sweden	21.7%	90.7%	198	Jamaica	4.3%	0.0%	0
China, Hong Kong SAR	23.3%	94.8%	197	Kazakhstan	6.8%	4.8%	0
Israel	12.1%	64.2%	186	Malawi	5.3%	1.5%	0
New Zealand	17.3%	66.0%	174	Mozambique	4.7%	0.0%	0
Finland	18.1%	88.4%	171	Namibia	10.7%	6.8%	0
Tunisia	17.0%	69.3%	167	Nicaragua	8.2%	2.9%	0
USA	40.1%	94.6%	164	Niger	3.5%	0.0%	0
Singapore	13.7%	72.4%	155	Oman	3.8%	0.0%	0
Bosnia Herzegovina	15.4%	69.8%	149	Panama	5.9%	0.0%	0
Japan	25.0%	96.8%	148	Paraguay	8.0%	3.0%	0
Argentina	16.6%	67.6%	143	Saudi Arabia	3.4%	0.0%	0
Colombia	15.4%	63.5%	131	Togo	6.7%	0.0%	0
Germany	40.6%	98.2%	122	Uganda	9.2%	0.9%	0
Viet Nam	17.6%	72.6%	118	United Rep. of Tanzania	10.3%	0.0%	0
Jordan	15.4%	62.8%	113	Zambia	6.2%	0.0%	0
Malaysia	14.6%	66.5%	108				

Note: Export diversification is measured by the percentage of products with RCA>1 in the total number of products. The consistency of the specialization pattern is measured by the percentage of products with pure-densities larger than 10 in the total number of products in which the country exhibits revealed comparative advantage. Upscale opportunities refer to the number of products with RCA<1 that are upscale and lie in a range of pure-densities larger than 10.

Appendix 3– Visual representation of upscale opportunities for a sample of countries



Notes: These figures account for all products with RCA<1 that countries already export.

Appendix 4 – Top 50 products with 0<RCA<1, in terms of pure-densities (Portugal)

Code	Products	Pure Density	Value Increments	Export Shares
7307	Tube or pipe fittings (for example, couplings, elbows, sleeves), of iron or ...	43.50	0.14	0.01975%
3402	Organic surface-active agents (other than soap)	41.94	0.02	0.15915%
4902	Newspapers, journals and periodicals	39.44	0.27	0.00919%
9406	Prefabricated buildings.	36.08	0.09	0.05568%
6902	Refractory bricks, blocks, tiles and similar refractory ceramic constructio ...	35.75	0.08	0.00941%
8716	Trailers and semi-trailers	35.42	0.19	0.15482%
7322	Radiators for central heating, not electrically heated, and parts thereof	35.32	0.15	0.00118%
9405	Lamps and lighting fittings including searchlights and spotlights and parts ...	34.51	0.21	0.14914%
4911	Other printed matter, including printed pictures and photographs.	34.05	0.31	0.00823%
8512	Electrical lighting or signalling equipment	33.62	0.23	0.04971%
4005	Compounded rubber, unvulcanised, in primary forms or in plates, sheets or s ...	33.34	0.08	0.00522%
7607	Aluminium foil (whether or not printed or backed with paper, paperboard or ...	32.85	0.24	0.00469%
8433	Harvesting or threshing machinery, including straw or fodder balers	32.85	0.30	0.00447%
3925	Builders' ware of plastics, not elsewhere specified or included.	32.49	0.07	0.03125%
8455	Metal-rolling mills and rolls therefor.	32.14	0.22	0.00002%
7610	Aluminium structures (excluding prefabricated buildings of heading 94.06)	32.08	0.10	0.04945%
8417	Industrial or laboratory furnaces and ovens, including incinerators, non-el ...	32.03	0.34	0.03080%
8501	Electric motors and generators (excluding generating sets).	31.52	0.16	0.18885%
8483	Transmission shafts (including cam shafts and crank shafts) and cranks	31.48	0.31	0.09083%
9402	Medical, surgical, dental or veterinary furniture	31.44	0.34	0.00778%
8414	Air or vacuum pumps, air or other gas compressors and fans	31.31	0.27	0.24991%
8607	Parts of railway or tramway locomotives or rolling-stock.	31.20	0.25	0.00018%
7318	Screws, bolts, nuts, coach screws, screw hooks, rivets, cotters, cotter-pin ...	31.01	0.28	0.05131%
4010	Conveyor or transmission belts or belting, of vulcanised rubber.	30.94	0.22	0.00208%
8428	Other lifting, handling, loading or unloading machinery	30.79	0.39	0.09603%
5309	Woven fabrics of flax.	29.69	0.11	0.00888%
3214	Glaziers' putty, grafting putty, resin cements	29.52	0.17	0.01432%
8431	Parts suitable for use principally with the machinery of headings 84.25 to ...	29.37	0.21	0.14232%
7412	Copper tube or pipe fittings (for example, couplings, elbows, sleeves).	29.24	0.38	0.01328%
4008	Plates, sheets, strip, rods and profile shapes, of vulcanised rubber	28.96	0.09	0.01753%
9028	Gas, liquid or electricity supply or production meters	28.73	0.12	0.01532%
8484	Gaskets and similar joints of metal sheeting combined with other material	28.72	0.29	0.00318%
9604	Hand sieves and hand riddles.	28.62	0.08	0.00003%
8454	Converters, ladles, ingot moulds and casting machines	28.52	0.35	0.00062%
6807	Articles of asphalt or of similar material	28.45	0.08	0.00464%
7228	Other bars and rods of other alloy steel;	28.44	0.23	0.00473%
7211	Flat-rolled products of iron or non-alloy steel, of a width of less than 60 ...	28.42	0.25	0.00419%
8511	Electrical ignition or starting equipment	28.22	0.15	0.08244%
8450	Household or laundry-type washing machines, including machines which both w ...	28.12	0.08	0.00619%
3816	Refractory cements, mortars, concretes and similar compositions	28.07	0.11	0.00248%
8432	Agricultural, horticultural or forestry machinery for soil preparation or c ...	28.01	0.17	0.03664%
8438	Machinery, not specified or included elsewhere in this Chapter	27.77	0.41	0.03204%
4901	Printed books, brochures, leaflets and similar printed matter	27.74	0.24	0.11983%
1501	Pig fat (including lard) and poultry fat	27.42	0.40	0.00069%
5603	Nonwovens, whether or not impregnated, coated, covered or laminated.	26.89	0.32	0.01335%
6005	Warp knit fabrics (including those made on galloon knitting machines)	26.75	0.17	0.02463%
7008	Multiple-walled insulating units of glass.	26.64	0.25	0.00065%
7009	Glass mirrors, whether or not framed, including rear-view mirrors.	26.21	0.28	0.01861%
8503	Parts suitable for use principally with the machines of heading 85.01 or 85 ...	25.97	0.30	0.01276%
3004	Medicaments (excluding goods of heading 30.02, 30.05 or 30.06)	25.93	0.46	0.86146%

Note: Exports shares are computed using National Institute of Statistics data.