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## Revealed Comparative Advantages in Greece, Ireland, Portugal and Spain

Greece, Ireland, Portugal and Spain were all hit by the economic downturn in the course of the financial crisis and have been struggling with national debt crises and recession. A problem common to all of these countries is the collapse of national demand. Foreign trade might seem a logical way to restore economic strength, but little is known about the international competitiveness of these countries' industries. This paper sheds light on their export structures using the revealed comparative advantage indicator.

The economic turmoil in 2008, followed by the sovereign debt crisis, hit European countries to varying degrees. Among the countries struggling most were Greece, Ireland, Portugal and Spain. Each had diverse economic structures, and their initial economic situations were very different at the beginning of the crisis. A problem common to all of these countries at the time of writing is the collapse of national demand. Both private and public consumption have been weakened chronically due to high unemployment rates and mandatory spending gaps required for budgetary consolidation. This applies especially to Greece and Portugal, whose economies are dominated by the service and public sectors. Spain benefited until the onset of the crisis from the construction sector and from private consumption. The situation in Ireland is slightly different, as it had attracted substantial foreign direct investment (chemical, pharmaceutical and biotech industry) in recent years, but the bursting real estate bubble hit the Irish economy hard. Foreign trade might seem a logical way to restore economic strength, but little is known about the international competitiveness of these countries' industries. In this context, this paper provides some information on which of these four countries might benefit from exports in the short term.

It is evident that foreign trade is important to Greece, Portugal, Ireland and Spain, albeit it to varying degrees. The following analysis sheds some light on their export structures. To do so, the so-called revealed comparative

advantage (RCA) indicator is used. RCA analysis is widespread in the economic literature<sup>1</sup> and has at times been discussed critically.<sup>2</sup> Nonetheless, it offers helpful information on these countries' economic situations and addresses some problems which might constrain economic upswings. To begin, the degree of openness of the four countries, i.e. the trade volume (exports plus imports) as a share of total gross domestic product, is presented in Figure 1. As can be seen, the level of openness increased in all four countries beginning in 1995.<sup>3</sup> Greece, Portugal and Spain have rather similar values and faced similar developments, whereas Ireland is outstanding in this sample. The country's openness increased dramatically through 2001, with foreign trade becoming a significant part of the Irish economy.

The elements of trade openness are presented separately in Figure 2. With respect to the subsequent calculations, trade volumes are presented for commodities only. Ireland is the only country with an export surplus. The impact of the economic crisis is clearly evident from the drop in imports, indicating a breakdown of national consumption.

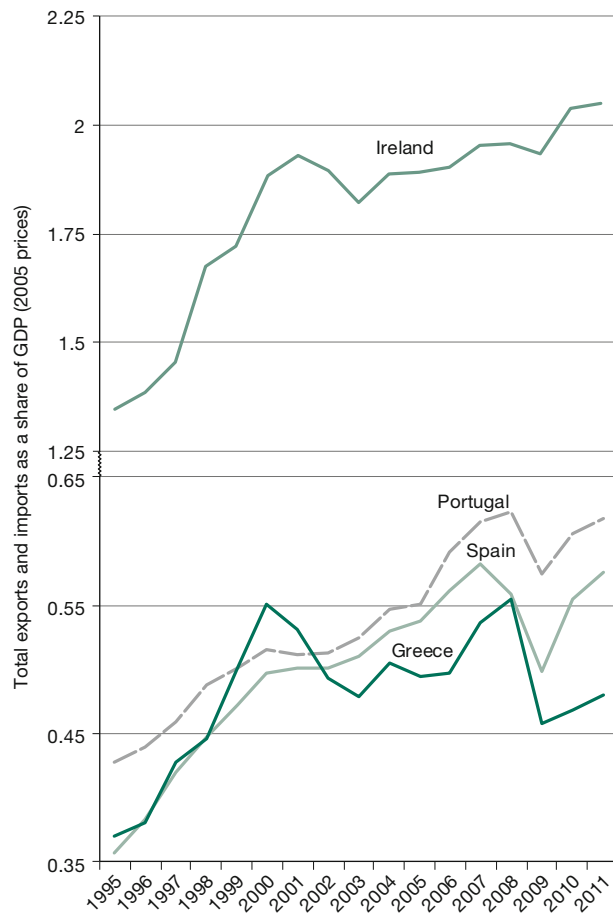
1 See, for example, J. Hinloopen, C. van Marrewijk: On the empirical distribution of the Balassa index, in: *Weltwirtschaftliches Archiv*, Vol. 137, No. 1, 2001, pp. 1-35 and the literature cited therein.

2 For a comparison of several indices, see especially T. Vollrath: A theoretical evaluation of alternative trade intensity measures of revealed comparative advantage, in: *Weltwirtschaftliches Archiv*, Vol. 127, No. 2, 1991, pp. 265-280; H. Bowen: On the theoretical interpretation of indices of trade intensity and revealed comparative advantage, in: *Weltwirtschaftliches Archiv*, Vol. 119, No. 3, 1993, pp. 464-72; and H. Bowen: On measuring comparative advantage: A reply and extensions, in: *Weltwirtschaftliches Archiv*, Vol. 121, No. 2, 1985, pp. 351-354.

3 The trade openness ratio of these countries from 1960 to 2005 is discussed in J. Amador, S. Cabral, J. Maria: International trade patterns over the last four decades: How does Portugal compare with other cohesion countries?, Banco de Portugal, Working Papers, No. 14/2007.

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**Figure 1**  
**Trade openness**  
in %



Sources: OECD: Economic Outlook No. 91, 2012; own calculations.

The introduction of the euro is also clearly reflected in the import figures. Other than Ireland, all countries show increasing imports. Exports, however, increased at a relatively slower rate, especially for Spain and Portugal. The negative trade balance in Greece rose dramatically after 2002.

To sum up this brief description, the export orientations of Greece, Portugal and Spain are rather weak, and only Ireland is a net exporter. Thus, the number of sectors with comparative cost advantages should be fairly low, and with the exception of Ireland, these sectors should be of less importance to the total exports.

The analysis commences with two RCA measures (RCA 1 and RCA 2) and their results, using data from the United Nations Conference on Trade and Development (UNCTAD) for the years 1995-2011. This enables us to identify the effects of the euro introduction in 2002 and the impact

of the financial crisis in 2008/2009. The economies of the countries being analysed are divided into 255 products and goods which were traded in the years 1995-2011. The service sectors have not been taken into account due to a lack of data and to the fact that it is traditional in RCA analysis to concentrate on manufacturing sectors. Next, the Balassa index (RCA 1) is transformed into a standardised revealed symmetric comparative advantage (RSCA) index, which has values ranging from minus one to plus one. This indicator is plotted against the trade balance index (TBI) in order to determine whether the competitive sectors do indeed have an export surplus. This yields information on trade structure and specialisation. Finally, two types of specialisation are presented, and the level of specialisation ( $\beta$ -specialisation) and the specialisation process ( $\sigma$ -specialisation) are identified by an OLS estimation.

### RCA measurement

Many investigations aimed at identifying international competitiveness and trade performance can be found in the literature. A common issue is identifying the strengths and weaknesses of various national sectors and goods in international trade. This is done mainly with revealed comparative advantage measurements, using trade data and “post-trade equilibria”.<sup>4</sup> The specifications of these measurements are manifold. In this present study, two broadly used RCA indices were chosen. The first RCA indicator, RCA 1, was developed by Balassa.<sup>5</sup> It compares the relationship of national exports  $X_i$  of a single commodity  $i$  to total exports of all commodities, with the ratio of worldwide ( $w$ ) exports of that commodity  $X_i^w$  to total exports per annum:

$$RCA\ 1 = \frac{X_i / \sum_i X_i}{X_i^w / \sum_i X_i^w} \quad (1)$$

The critical value in this case is one. Values above one indicate comparative advantages, whereas values between zero and one indicate comparative disadvantages. This indicator is one of the most commonly used,<sup>6</sup> as its calculation is quite simple. The level of awareness helps in discussing the results and comparing them with previous studies. Nonetheless, there are several associated

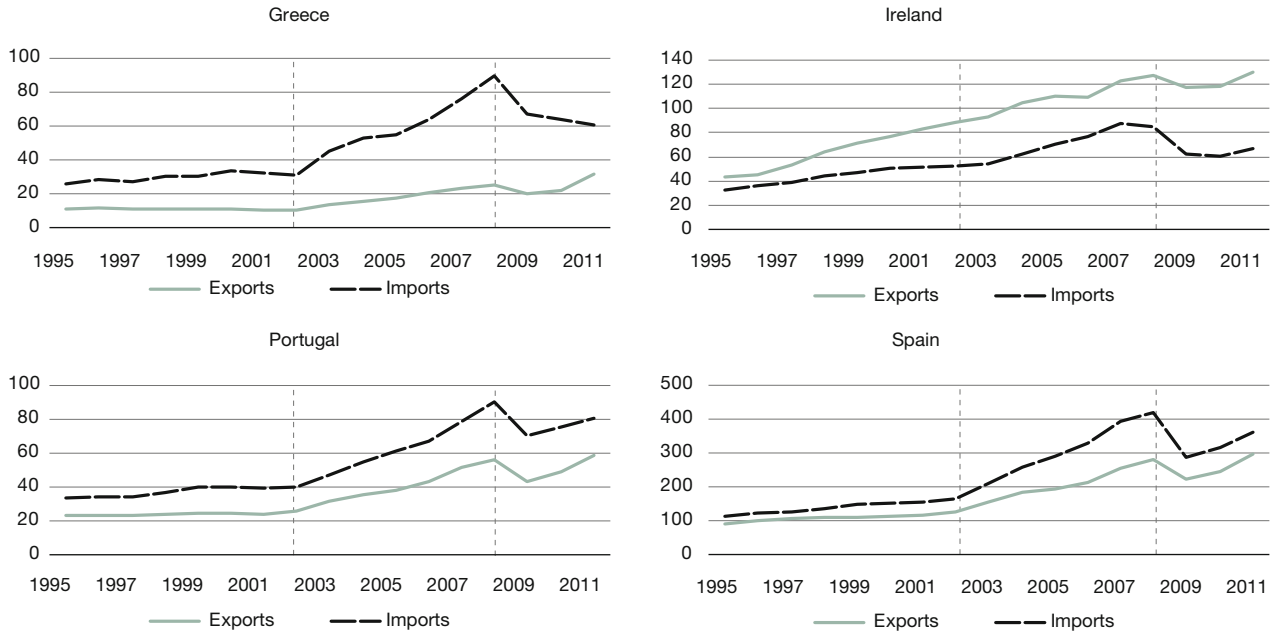
4 T. Vollrath, op. cit.

5 B. Balassa: Trade Liberalization and ‘Revealed’ Comparative Advantage, in: Manchester School of Economic and Social Studies, Vol. 23, No. 2, 1965, pp. 99-123.

6 See A. Yeats: On the appropriate interpretation of the revealed comparative advantage index: implications of a methodology based on industry sector analysis, in: Weltwirtschaftliches Archiv, Vol. 121, No. 1, 1985, pp. 61-73.

Figure 2  
Exports and imports, 1995-2011

in billion euros, 2005 prices



Source: UNCTAD.

problems, because, for example, the distribution of RCA values ranges from zero to infinity and is therefore asymmetric. Furthermore, the results apply only to the country in question: a comparison of the RCA value of Sector X in Country Y is not directly comparable to the parallel sector result in Country Z (apart from the question of whether it is greater or less than one).<sup>7</sup>

Note that imports are omitted, but this lack of information is dealt with by adding another RCA index from the German Council of Economic Experts.<sup>8</sup> Here, the exports of one commodity  $i$  in year  $t$  is related to the imports  $M$  of that commodity  $i$  in year  $t$ . This quotient is divided by the relationship of total exports to total imports in year  $t$ :

$$RCA 2 = 100 \cdot \ln \left( \frac{X_{it}/M_{it}}{\sum_i X_{it}/\sum_i M_{it}} \right) \quad (2)$$

The critical value is zero: positive (negative) values indicate comparative (dis-)advantages. Those goods and products with national relative cost advantages should be present in exports. National demand is an important factor here. Sectors are identified as internationally competitive if international competitors are less present in national markets than national producers are in foreign markets. This accepts trade protections as well as different cyclical trends in the sender and recipient countries, both of which might distort the results.

Perfectly free trade is the assumption underlying these results, i.e. that post-trade data indicate the cost structure and relationships. In reality, however, the results are distorted by several different aspects. In addition to trade policies, taxes, tariffs and subsidies, changes in consumer demand or exchange rates also impact the indices. Intra-industrial trade is a further point of criticism. In particular, tariffs and trade barriers affect imports more than exports, which is a disadvantage for RCA 2 compared to RCA 1. Excluding the imports, however, would not adequately reflect international trade. Thus, both indicators have their disadvantages but should nonetheless deliver interesting insights into the trade situations of the four countries examined here.

7 Further critical aspects are discussed in E. Sanidas, Y. Shin: Comparison of Revealed Comparative Advantage Indices with Application to Trade Tendencies of East Asian Countries, in: Department of Economics, Seoul National University, 2010, pp. 1-57.

8 This indicator is used broadly, e.g. J. Matthes: Deutschlands Handelspezialisierung auf forschungsintensive Güter, in: IW-Trend – Vierteljahresschrift zur empirischen Wirtschaftsforschung, Vol. 33, No. 3, 2006; or K. Aiginger: Specialization of European manufacturing, in: Austrian Economic Quarterly, 2000. V. Serin, A. Civan: Revealed Comparative Advantages and Competitiveness: A Case Study for Turkey towards the EU, in: Journal of Economic and Social Research, Vol. 10, No. 2, 2008, pp. 25-41, chose a slightly modified version of this indicator.

The results of the indicators RCA 1 and RCA 2 are presented in Table 1. For reasons of clarity, the top six sectors of each country are presented. The results are not given for each year but are averaged over four to seven years. The years from 1995 to 2011 are divided into three periods:

- a) 1995 to 2001, the years before the euro introduction;
- b) 2002 to 2007, the years after the euro introduction and before the financial crisis;
- c) 2008 to 2011, the period of the economic downturn and national debt crises.

The Portuguese sectors with the highest RCA values are beverages and tobacco [1xx],<sup>9</sup> crude materials [2xx], and non-mineral manufactures [66x]. Radio receivers are the only products of machinery [7xx] within the top ten of all four countries. As the world market leader in cork, the RCAs are unambiguously high, and these RCA 1 values are by far the highest of all the considered sectors in these countries.

Ireland's best performing sectors in the context of RCA values include products categorised as food and live animals [0xx], crude materials [2xx], chemicals and related products [5xx], and manufactured articles [8xx]. Note that the chemicals and related products are predominant in the RCA 1 ranking, whereas crude materials head the RCA 2 ranking where imports and national demand are taken into account.

The top Greek RCA sectors are quite diverse, including the foodstuff and tobacco [0xx and 1xx], crude materials [2xx], and manufactured goods [6xx] sectors. Products from natural resources lead the RCA rankings.

Spain's revealed comparative advantages are in producing foodstuff and animals [0xx and 4xx], crude materials [2xx], and manufacturing of natural resources [6xx]. Clay construction should be especially emphasised.

It is worth noting that the chemical [5xx] and machinery [7xx] sectors are underrepresented in the list (with the exception of the Irish chemical sector). The total number of sectors with comparative advantages increased in Portugal, Greece and Spain, while this number remains at a low level in Ireland. However, half of the sectors with RCA 1

values have values between one and two.<sup>10</sup> These sectors are regarded as having weak advantages.<sup>11</sup>

Furthermore, the RCA values for the ten most important export sectors (based on their share of a nation's total exports) of the last period are listed in Table 2, together with the values of the RCA 1 and RCA 2 estimations. Values indicating disadvantages are highlighted; those indicating weak advantages are underlined.<sup>12</sup> Most of the important export sectors do have comparative advantages. Portuguese exports are not clearly dominated by a single sector, and the weak RCA values of the two leading export sectors in Portugal represent this heterogeneous export structure. In Ireland, there are two main sectors which both have unambiguous comparative cost advantages [542, 515]. Over 50 per cent of exports are from the chemical industries, and all yield relatively high RCA values, indicating fairly sound export structures. Besides petroleum, the export shares of Greece are quite equal in several sectors. The RCA 2 value for medicaments [542] indicates disadvantages (with medium advantages in the context of the RCA 1 index), while all other sectors reveal cost advantages. As in Portugal (and Spain), a specialised export orientation is not visible. Spain's most important export sector is the automobile sector [78x]. Besides the aforementioned sectors, the structure of exports in these countries does not show any specialisation. Some of the sectors reveal comparative disadvantages or merely weak advantages.

To sum up, it is clear that the export structure of Ireland is different from those of the other three countries, as dominant trade sectors can be identified. The minor importance of foreign trade in Portugal, Greece and Spain is evident from the lack of sectors with a high share of exports. The automobile industry in Spain is an exception. Most sectors with a relatively high level of economic power do have cost advantages, although Spain shows some problems in that respect. Reviving their economies by improving exports will be difficult for these countries, as only a few powerful sectors with unique selling propositions can be identified. Besides Ireland, the sectors with revealed cost advantages are part of the low or medium-low technology industries, which is reflected in the export structure.<sup>13</sup> This will be investigated further in the product mapping that follows.

9 The numbers and product labels are from UNCTAD's Standard International Trade Classification Revision 3, which is available at [http://unctadstat.unctad.org/UnctadStatMetadata/Classifications/Unctad-Stat.SitcRev3Products.Official.Classification\\_En.pdf](http://unctadstat.unctad.org/UnctadStatMetadata/Classifications/Unctad-Stat.SitcRev3Products.Official.Classification_En.pdf).

10 For 2008-2011 the number of sectors with RCA 1 > 2 are 57 (Portugal), 27 (Ireland), 43 (Greece) and 37 (Spain).

11 See J. Hinlopen, C. van Marrewijk, op. cit.

12 As this classification for the RCA 2 indicator is not realisable without further efforts, values lower than ten are underlined as a suggestion.

13 These results are in line with J. Amador, et al., op. cit.

Table 1  
RCA 1 and RCA 2 values for the top six sectors in Greece, Ireland, Portugal and Spain

	RCA 1	2008 - 2011	2002 - 2007	1995 - 2001	RCA 2	2008 - 2011	2002 - 2007	1995 - 2001
Greece	[121] Tobacco, unmanufactured; tobacco refuse	18.24	25.08	25.64	[263] Cotton	451.31	481.75	420.78
	[058] Fruit, preserved, and fruit preparations (no juice)	18.21	20.38	24.88	[211] Hides and skins (except furskins), raw	352.74	294.02	193.28
	[263] Cotton	17.33	17.92	18.34	[284] Nickel ores & concentrates; nickel mattes, etc.	337.88	73.68	0.00
	[613] Furskins, tanned or dressed, excluding those of 8483	15.74	15.14	12.84	[058] Fruit, preserved, and fruit preparations (no juice)	283.09	289.16	342.34
	[056] Vegetables, roots, tubers, prepared, preserved, n.e.s.	12.72	12.31	13.04	[285] Aluminium ores and concentrates (incl. alumina)	252.35	303.57	492.93
	[661] Lime, cement, fabrica. constr. mat. (excluding glass, clay)	8.35	8.56	13.63	[661] Lime, cement, fabrica. constr. mat. (excluding glass, clay)	250.88	287.61	396.00
	<i>Sectors with RCA 1 &gt; 1</i>	91	87	73	<i>Sectors with RCA 2 &gt; 0</i>	94	81	69
Ireland	[551] Essential oils, perfume & flavour materials	39.81	31.42	16.55	[212] Furskins, raw, other than hides & skins of group 211	628.73	401.77	516.70
	[515] Organo-inorganic, heterocycl. compounds, nucl. acids	28.52	22.01	19.20	[211] Hides and skins (except furskins), raw	512.29	295.95	237.38
	[023] Butter and other fats and oils derived from milk	10.55	9.85	11.75	[287] Ores and concentrates of base metals, n.e.s.	403.96	378.50	284.88
	[542] Medicaments (incl. veterinary medicaments)	8.89	7.08	4.58	[282] Ferrous waste, scrape; remelting ingots, iron, steel	328.38	371.08	-120.47
	[899] Miscellaneous manufactured articles, n.e.s.	7.70	5.79	5.79	[289] Ores & concentrates of precious metals; waste, scrap	284.92	163.29	1.19
	[541] Medicinal and pharmaceutical products, excluding 542	7.54	3.97	3.97	[269] Worn clothing and other worn textile articles	271.06	232.35	54.84
	<i>Sectors with RCA 1 &gt; 1</i>	40	36	41	<i>Sectors with RCA 2 &gt; 0</i>	41	47	54
Portugal	[633] Cork manufactures	186.05	162.35	150.06	[283] Copper ores and concentrates; copper mattes, cemen	900.36	888.00	768.67
	[762] Radio-broadcast receivers, whether or not combined	18.13	13.47	7.85	[289] Ores & concentrates of precious metals; waste, scrap	451.23	636.18	432.12
	[666] Pottery	8.91	11.00	12.00	[633] Cork manufactures	367.53	356.37	395.95
	[851] Footwear	6.00	6.73	8.45	[762] Radio-broadcast receivers, whether or not combined	344.81	307.98	253.37
	[665] Glassware	5.98	4.67	4.08	[251] Pulp and waste paper	297.45	280.01	265.60
	[266] Synthetic fibres suitable for spinning	5.92	3.66	2.26	[344] Petroleum gases, other gaseous hydrocarbons, n.e.s.	251.74	146.55	175.65
	<i>Sectors with RCA 1 &gt; 1</i>	107	86	64	<i>Sectors with RCA 2 &gt; 0</i>	97	84	71
Spain	[662] Clay construction, refracto. construction materials	7.63	8.54	8.47	[284] Nickel ores & concentrates; nickel mattes, etc.	617.08	162.99	-152.71
	[633] Cork manufactures	7.43	6.65	6.29	[662] Clay construction, refracto. construction materials	273.33	282.67	293.89
	[054] Vegetables	6.33	6.63	6.37	[212] Furskins, raw, other than hides & skins of group 211	248.81	4.60	-160.20
	[421] Fixed vegetable fats & oils, crude, refined, fractio.	6.02	6.70	5.38	[686] Zinc	222.68	229.73	209.61
	[057] Fruits and nuts (excluding oil nuts), fresh or dried	6.02	6.25	6.59	[613] Furskins, tanned or dressed, excluding those of 8483	220.64	237.69	282.81
	[016] Meat, edible meat offal, salted, dried; flours, meals	4.46	2.41	3.92	[016] Meat, edible meat offal, salted, dried; flours, meals	209.28	226.42	235.56
	<i>Sectors with RCA 1 &gt; 1</i>	115	111	97	<i>Sectors with RCA 2 &gt; 0</i>	126	116	93

Source: Own calculations based on UNCTAD data.

Table 2  
RCA values of the most important export sectors in Greece, Ireland, Portugal and Spain

	% exports	RCA 1	RCA 2		% exports	RCA 1	RCA 2
Greece				Ireland			
[334] Petroleum oils or bituminous minerals > 70% oil	15.66	3.00	99.92	[542] Medicaments (incl. veterinary medicaments)	19.80	8.89	134.69
[542] Medicaments (incl. veterinary medicaments)	5.35	2.47	-15.17	[515] Organo-inorganic, heterocycl. compounds, nucl. acids	18.95	28.52	202.74
[684] Aluminium	4.38	6.20	149.90	[541] Medicinal and pharmaceutical products, excluding 542	7.18	7.54	115.44
[057] Fruits and nuts (excluding oil nuts), fresh or dried	3.42	6.87	173.69	[551] Essential oils, perfume & flavour materials	5.50	39.81	249.75
[034] Fish, fresh (live or dead), chilled or frozen	2.65	7.71	194.89	[899] Miscellaneous manufactured articles, n.e.s.	3.77	7.70	111.14
[056] Vegetables, roots, tubers, prepared, preserved, n.e.s.	2.18	12.72	217.24	[752] Automatic data processing machines, n.e.s.	3.47	2.20	11.34
[682] Copper	1.94	2.76	103.04	[598] Miscellaneous chemical products, n.e.s.	2.91	4.39	143.98
[263] Cotton	1.87	17.33	451.31	[72] Instruments & appliances, n.e.s., for medical, etc.	2.90	5.63	93.83
[058] Fruit, preserved, and fruit preparations (no juice)	1.87	18.21	283.09	[776] Cathode valves & tubes	2.26	0.87	44.98
[676] Iron & steel bars, rods, angles, shapes & sections	1.85	3.52	166.83	[759] Parts, accessories for machines of groups 751, 752	2.21	<u>1.98</u>	-38.16
Portugal				Spain			
[334] Petroleum oils or bituminous minerals > 70% oil	5.16	<u>1.07</u>	80.04	[781] Motor vehicles for the transport of persons	10.94	2.99	91.10
[781] Motor vehicles for the transport of persons	4.62	<u>1.25</u>	-9.23	[784] Parts & accessories of vehicles of 722, 781, 782, 783	4.22	2.25	-4.24
[784] Parts & accessories of vehicles of 722, 781, 782, 783	4.40	2.24	36.46	[542] Medicaments (incl. veterinary medicaments)	3.93	<u>1.81</u>	<u>9.11</u>
[851] Footwear	3.74	6.00	140.62	[334] Petroleum oils or bituminous minerals > 70% oil	3.64	0.89	-10.43
[641] Paper and paperboard	2.86	3.52	76.62	[057] Fruits and nuts (excluding oil nuts), fresh or dried	2.99	6.02	158.56
[845] Articles of apparel, of textile fabrics, n.e.s.	2.82	3.46	92.94	[054] Vegetables	2.35	6.33	178.08
[821] Furniture & parts	2.53	2.91	85.10	[782] Motor vehic. for transport of goods, special purpo.	2.01	3.05	152.96
[112] Alcoholic beverages	2.23	5.10	163.57	[676] Iron & steel bars, rods, angles, shapes & sections	1.94	3.83	168.98
[762] Radio-broadcast receivers, whether or not combined	1.82	18.13	344.81	[792] Aircraft & associated equipment; spacecraft, etc.	1.44	<u>1.45</u>	50.58
[633] Cork manufactures	1.82	186.05	367.53	[112] Alcoholic beverages	1.34	3.08	89.06

Source: Own calculations based on UNCTAD data.

Note: Values indicating disadvantages are highlighted, and those indicating weak advantages are underlined.

### Product mapping

In a next step, the comparative advantages, i.e. competitiveness on international markets, are directly compared

with the degree of export specialisation for these products. A few changes are made to RCA 1, and TBI is introduced to develop a product map. First of all, RCA 1 is modified so as to obtain a symmetric index with val-

ues from -1 to +1. This RSCA index<sup>14</sup> is neutral at zero and takes the form

$$RSCA_i = (RCA_i - 1) / (RCA_i + 1) \quad (3)$$

The trade balance reveals whether the country is a net exporter or importer for each commodity  $i$  by comparing the net exports with the total trade volume:

$$TBI_i = (X_i - M_i) / (X_i + M_i) \quad (4)$$

Both indicators yield symmetric values, where the critical value for each is zero. By plotting these indicators into a matrix,<sup>15</sup> the commodities can be divided into four main groups, as presented in Table 3.

14 This index is provided by B. Dalum, K. Larsen, G. Villumsen: Structural Change in OECD Export Specialisation Patterns: de-specialization and 'stickiness', in: International Review of Applied Economics, Vol. 12, No. 3, 1998, pp. 423-443.

15 The matrix follows T. Widodo: Dynamic changes in comparative advantage: Japan's "flying geese" model and its implications for China, in: Journal of Chinese Economic and Foreign Trade Studies, Vol. 1, No. 3, 2008, pp. 200-213; and T. Widodo: Comparative advantage: Theory, empirical measures and case studies, in: Review of Economic and Business Studies, Vol. 2, No. 2, 2009, pp. 57-82. This mapping, the so-called flying geese concept, is used, for instance, in E. Sanidas: Patterns and distances of catch-up in trade: China and East Asia, in: China Economic Journal, Vol. 2, No. 1, 2009, pp. 105-118, to identify the catch-up process of China and East Asian countries.

**Table 3**  
**Product mapping**

Revealed Symmetric Comparative Advantage	RSCA > 0	Group 1: Comparative advantage and net importer	Group 2: Comparative advantage and net exporter
	RSCA < 0	Group 3: Comparative disadvantage and net importer	Group 4: Comparative disadvantage and net exporter
Trade Balance Index		TBI < 0	TBI > 0

Source: Own calculations.

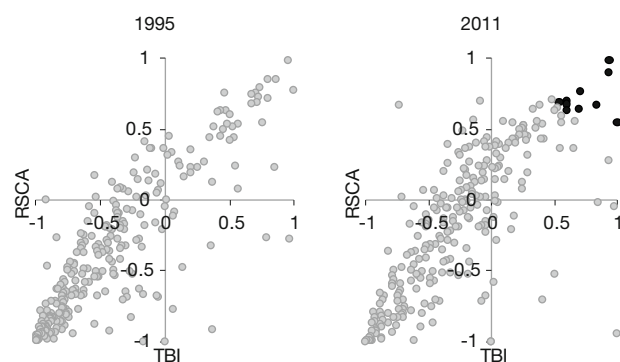
Groups 2 and 3 are the most intuitive constellations. In sectors with comparative advantages, there should be an export surplus, whereas in sectors with comparative disadvantages, exports should play a minor role. Group 4 is especially counterintuitive. Here, only a few sectors should be identified, and the same applies to Group 1. When allocating the sectors to this map, information on country trade structure can be depicted. If most sectors are indeed placed in Groups 2 and 3, export specialisation by those sectors with international competitiveness can be assumed, as can the importation of those goods with low levels of competitiveness. Especially sectors in Group 1, with relatively high competitiveness levels but poorer export performance, offer potential for the further development of economic strength. The number of sectors in each group for the four countries is presented in Table 4. The share of this number as a proportion of all

**Table 4**  
**Average number of sectors in each group and share of total sectors**

Greece						Ireland					
Group 1			Group 2			Group 1			Group 2		
1995-2001	41	0.163	1995-2001	29	0.115	1995-2001	4	0.016	1995-2001	35	0.138
2002-2007	55	0.217	2002-2007	29	0.114	2002-2007	6	0.024	2002-2007	30	0.118
2008-2011	56	0.221	2008-2011	33	0.130	2008-2011	3	0.012	2008-2011	36	0.143
Group 3			Group 4			Group 3			Group 4		
1995-2001	181	0.718	1995-2001	1	0.004	1995-2001	187	0.736	1995-2001	28	0.110
2002-2007	169	0.665	2002-2007	1	0.004	2002-2007	189	0.741	2002-2007	30	0.118
2008-2011	159	0.628	2008-2011	5	0.020	2008-2011	183	0.726	2008-2011	30	0.119
Portugal						Spain					
Group 1			Group 2			Group 1			Group 2		
1995-2001	25	0.098	1995-2001	37	0.146	1995-2001	35	0.137	1995-2001	60	0.235
2002-2007	42	0.165	2002-2007	41	0.161	2002-2007	54	0.212	2002-2007	57	0.224
2008-2011	50	0.197	2008-2011	56	0.220	2008-2011	43	0.169	2008-2011	71	0.278
Group 3			Group 4			Group 3			Group 4		
1995-2001	184	0.724	1995-2001	8	0.031	1995-2001	150	0.588	1995-2001	10	0.039
2002-2007	164	0.646	2002-2007	7	0.028	2002-2007	135	0.529	2002-2007	9	0.035
2008-2011	142	0.559	2008-2011	6	0.024	2008-2011	127	0.498	2008-2011	14	0.055

Source: Own calculation based on UNCTAD data.

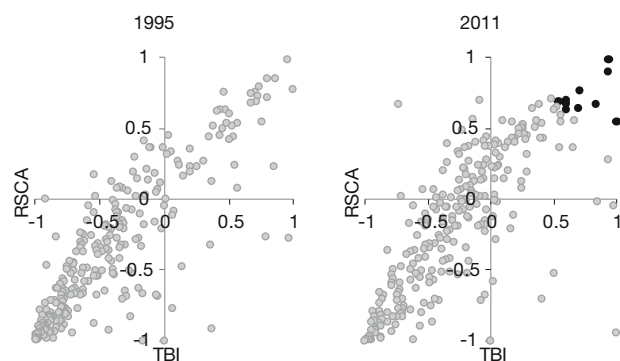
**Table 5**  
**Product mapping of Portugal with top ten sectors, 2011**



Sector	Rank 1995	% of exports <sup>1</sup>
[551] Essential oils, perfume & flavour materials	7	5.6
[023] Butter and other fats and oils derived from milk	1	0.5
[515] Organo-inorganic, heterocycl. compounds, nucl. acids	4	18.8
[011] Meat of bovine animals, fresh, chilled or frozen	3	1.5
[899] Miscellaneous manufactured articles, n.e.s.	38	3.5
[542] Medicaments (incl. veterinary medicaments)	14	18.5
[541] Medicinal and pharmaceutical products, excluding 542	31	6.5
[211] Hides and skins (except furskins), raw	10	0.1
[898] Musical instruments, parts; records, tapes & similar	6	1.5
[872] Instruments & appliances, n.e.s., for medical, etc.	19	2.9

<sup>1</sup> 2009-2011 average.  
Source: Own calculations based on UNCTAD data.

**Table 6**  
**Product mapping of Ireland with top ten sectors, 2011**



Sector	Rank 1995	% of exports <sup>1</sup>
[551] Essential oils, perfume & flavour materials	7	5.6
[023] Butter and other fats and oils derived from milk	1	0.5
[515] Organo-inorganic, heterocycl. compounds, nucl. acids	4	18.8
[011] Meat of bovine animals, fresh, chilled or frozen	3	1.5
[899] Miscellaneous manufactured articles, n.e.s.	38	3.5
[542] Medicaments (incl. veterinary medicaments)	14	18.5
[541] Medicinal and pharmaceutical products, excluding 542	31	6.5
[211] Hides and skins (except furskins), raw	10	0.1
[898] Musical instruments, parts; records, tapes & similar	6	1.5
[872] Instruments & appliances, n.e.s., for medical, etc.	19	2.9

<sup>1</sup> 2009-2011 average.  
Source: Own calculations based on UNCTAD data.

sectors is also given. Indeed, the majority of sectors are located within Groups 2 and 3 (75-88 per cent). Besides Ireland, Group 4 is only of minor interest. Group 1 includes a remarkable number of sectors in Spain and even more so in Greece. Here, some sectors could obviously expand their export performance, due to comparative advantages.

The sectoral trade performance in Ireland has not changed notably during the last 16 years, at least in terms of the indicators used here. Portugal and Greece, how-

ever, have managed to place some sectors in Group 1 after the euro was introduced. The international competitiveness of Spain's sectors increased since the euro introduction, but the import/export situation changed in several sectors. The 19 additional sectors that became net exporters on average between the periods 2002-2007 (57+9) and 2008-2011 (71+14) could be interpreted as evidence of export specialisation. A more likely cause, however, is the decreasing national income, due to the enormous economic downturn and rising unemployment rate. Since imports are dependent on national consumption



Table 7  
Product mapping of Greece with top ten sectors, 2011

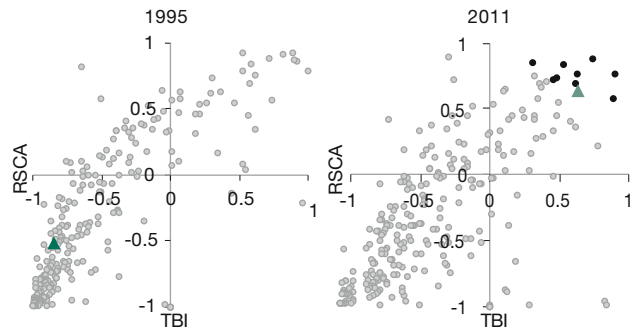
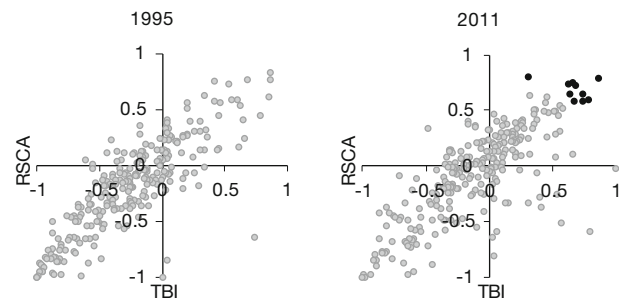


Table 8  
Product mapping of Spain with top ten sectors, 2011



and hence on national income, the changes in the trade balances more or less signal national economic turmoil.

The product mapping for 1995 and 2011 is presented in Tables 5-8, where the ten top sectors (i.e. the sum of RSCA and TBI) of 2011 are listed. Furthermore, their ranking in 1995 and their average share of exports (2009-2011) are also presented.

The sectoral position in this ranking does not change significantly for the top sectors. The only sector to experi-

Sector	Rank 1995	% of exports <sup>1</sup>
[263] Cotton	4	1.7
[058] Fruit, preserved, and fruit preparations (no juice)	1	1.9
[211] Hides and skins (except furskins), raw	24	0.1
[273] Stone, sand and gravel	15	0.4
[056] Vegetables, roots, tubers, prepared, preserved, n.e.s.	8	2.1
[661] Lime, cement, fabrica. constr. mat. (excluding glass, clay)	2	1.5
[676] Iron & steel bars, rods, angles, shapes & sections	146	
[034] Fish, fresh (live or dead), chilled or frozen	23	2.5
[848] Articles of apparel, clothing access., excluding textile	9	1.2
[121] Tobacco, unmanufactured; tobacco refuse	7	1.4

<sup>1</sup> 2009-2011 average.

Source: Own calculations based on UNCTAD data.

Sector	Rank 1995	% of exports <sup>1</sup>
[662] Clay construction, refracto. construction materials	2	1.2
[421] Fixed vegetable fats & oils, crude, refined, fraction	14	1.3
[054] Vegetables	5	2.3
[016] Meat, edible meat offal, salted, dried; flours, meals	16	0.1
[613] Fur skins, tanned or dressed, excluding those of 8483	1	0.0
[057] Fruits and nuts (excluding oil nuts), fresh or dried	9	2.9
[686] Zinc	6	0.3
[676] Iron & steel bars, rods, angles, shapes & sections	15	2.0
[012] Other meat and edible meat offal	78	1.3
[633] Cork manufactures	8	0.1

<sup>1</sup> 2009-2011 average.

Source: Own calculations based on UNCTAD data.

ence a major change in position was iron and steel bars (▲) in Greece, which rose from 146th in 1995 to seventh in 2011. In addition to its change in rank, it is notable that in 1995 this sector had unambiguously negative values for both the RSCA and TBI indicators. Note that most of the sectors in this study with high RSCA and TBI values are in the agricultural (fruits, meat, vegetables) and natural resources (cork, skins zinc, copper, clay) sectors. The machinery sector [7xx] is underrepresented, and chemical products [5xx] and high-tech instruments [87x] can only be found in Ireland. As mentioned above, the dominant

sectors in Greece and Portugal (and to a certain degree in Spain) are primarily the low and medium-low technology sectors. The small number of sectors with comparative advantages in all four of these countries is also evident in Tables 5-8, as most dots are below the abscissa.

### Trends of specialisation

Finally, the indication for revealed (symmetric) comparative advantages will be used to show whether an export specialisation in these countries had in fact taken place. To obtain information on this issue, we follow the methodology of Dalum et al.,<sup>16</sup> as they regress the RSCA values of country  $j$  and commodity  $i$  at time  $t2$  against the RSCA value of a previous year  $t1$ :<sup>17</sup>

$$RSCA_{ij}^{t2} = \alpha_i + \beta_i RSCA_{ij}^{t1} + \varepsilon_{ij} \quad (5)$$

Here, 2011 ( $t2$ ) and 1995 ( $t1$ ) are chosen. There are two main interpretations of the regressions results, referred to as  $\beta$ -specialisation (regression effect) and  $\sigma$ -specialisation (mobility effect).

**$\beta$ -specialisation:** The country became more (less) specialised in 2011 in sectors with relatively high (low) specialisation in 1995 if  $\beta_i > 1$ . Otherwise, if sectors with high (low) RSCA values in 1995 present relatively low (high) RSCA values in 2011,  $\beta_i$  will be between zero and one. This can be interpreted as de-specialisation on average.

**$\sigma$ -specialisation:** Here, the process of specialisation is shown by comparing the estimator  $\beta$  and the  $R^2$ , i.e.  $m = \beta/|R|$ . Thus, if  $m > 1$  the dispersion and the degree of specialisation increased, whereas if  $m < 1$ , the opposite is true.<sup>18</sup>

The results are presented in Table 6. The  $\beta$ -specialisation does not indicate high degrees of specialisation in those countries. According to the  $\sigma$ -specialisation, there do not appear to be any significant specialisation or de-special-

16 B. Dalum et al., op. cit.

17 Lee chose this methodology to identify specialisation trends with regard to technology intensity. He investigates the effect of export specialisation on economic performance using the Balassa index. See J. Lee: Export specialization and economic growth around the world, in: Economic Systems, Vol. 35, No. 1, 2011, pp. 45-63.

18 See B. Dalum et al., op. cit.; and K. Laursen: Revealed Comparative Advantage and the Alternatives as Measures of International Specialization, Danish Research Unit for Industrial Dynamics, DRUID Working Paper, No. 98-30, 1998.

Table 9  
Stability and development of export specialisation, 1995-2011

	$\alpha$	$\beta$	$R^2$	$m = \beta/ R $
Portugal	-0.226	0.766	0.608	0.982
Ireland	-0.05	0.817	0.678	0.992
Greece	-0.108	0.837	0.613	1.069
Spain	-0.137	0.798	0.623	1.01

Source: Own calculations.

isation trends since 1995,<sup>19</sup> as  $m$  is neither notably below nor above one.<sup>20</sup>

Note that specialisation and structural reforms take time. A longer estimation period would therefore be of interest in further research. However, this short-term regression confirms the assumptions made above, as all four countries obviously have minimal export orientations. Furthermore, the main export sectors are dominated by foreign investment, especially in Spain and Ireland. The traditional sectors that remain internationally competitive, predominantly located in the agricultural, beverages and foodstuff industries, have only a minor impact. The national economies of Greece and Portugal focus on the service sector, while Spain's industry has been dominated by construction and the automobile sector in recent years. Thus, a concentration of production capacities and an orientation towards exports did not take place to any significant extent. The core competences of these countries can therefore barely be detected by investigating their foreign trade situations.

### Conclusion

This paper sheds light on the export structures of Greece, Ireland, Portugal and Spain. These countries were all hit by the economic downturn in the course of the financial crisis and have been struggling with national debt crises and recession. The economic situation, however, is different for each country. In particular Greece must consider the possibility of a departure from the eurozone, which would require the country to establish an internationally competitive economy with its own currency. Thus, for Greece as well as for the other three countries, the question arises as to where their advantages and strengths

19 Specialisation and competitiveness in manufacturing sectors before 1995 for European countries are discussed in K. Aiginger, op. cit.

20 The data for the years 1995-2007 yield similar results. As the European Union is the most important market for all of these countries, the estimation was also conducted with a focus on exports to the EU. Again, the estimation results show  $\beta$ -specialisation degrees below one and no specialisation trend, as  $\sigma$ -specialisation also does not exceed one (values range from 0.950 to 1.000) for the period 1995-2011 as well as for 1995-2007.

are located. One way to identify sectoral international competitiveness is provided by the revealed comparative advantage index developed by Balassa (RCA 1). This indicator was further developed through several studies, for example by the German Council of Economic Experts (RCA 2). Both indicators suggest that the dominant sectoral advantages in Portugal and Greece can be found within agriculture and natural resources. The dominant export sectors are also located there. Ireland stands out from the other three countries, as high-tech and medical/chemical products can be found among the country's top sectors. Meanwhile, Spain's top export sectors do not have the competitiveness that one might expect.

To sum up, the economic structure of Greece is the most problematic. Regarding the structure of exports and the competitiveness of most sectors, the country's international standing is far from solid. With Greek national demand weak and unlikely to recover in the next few years, the export sectors do not seem to have enough power to help the Greek economy in the short term. Clearly, enormous efforts have to be undertaken to restructure the factor allocation and strengthen the nation's economy. This problematic structure existed before the introduction of the euro and has not changed significantly. The recovery of the Greek economy will be a truly long-term process. Gaining from the global economy through export growth will not have a major impact, given the prevailing economic structure. The same holds true for Portugal with its dominant service sector. Ireland seems to have a more balanced and specialised export structure, but the dominant industries are part of international companies and foreign direct investments. Native industries with export orientations are of secondary importance. Thus, Ireland is to a certain extent dependent on the world market and lacking the foundation of a sound national industry. Spain does have competitive sectors and a degree of specialisation, but the most important sectors are less competitive. Improvements in factor allocation and structural reforms should be implemented to exploit the potential of the economy.

Internationally competitive sectors with a high level of importance for the domestic economy are barely evident in Greece. It is necessary to ascertain potential fields of this nature and pool all available forces to expand them. National production factors have to be allocated efficiently, and foreign investment must be attracted and integrated. For this, stable institutional conditions and lean structures with low bureaucratic hurdles are necessary. Building up powerful industries with a dynamic and adequately educated labour force and creating more flexible economies will require a major and long-lasting reform process which may take decades.