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Export product range and economic performance – An emphasis on small advanced EU countries[1]

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Abstract: We analyse the number of different HS8 products in the EU countries' exports in 1995–2015. We review what share, or coverage, of the total possible number of these products the countries exported each year. We analyse whether the development in this coverage rate as opposed to concentration of exports as measured by the Herfindahl-Hirschman index is associated with GDP per capita growth. We find that changes in the coverage rate relate positively, but that the development of the HH index has no statistically significant relation to economic growth.

Key Words: Exports, export products, GDP growth, EU

JEL codes: F14, F43, O47

Tiivistelmä: Tässä tutkimuksessa analysoidaan EU-maiden vientiä HS8-numerotasolla vuosina 1995–2015. Tarkastelemme sitä, kuinka suurta osaa kaikista mahdollisista tuotteista maat veivät kunakin vuonna. Analysoimme sitä, liittyvätkö nämä muutokset tai Herfindahl-Hirschman-indeksillä lasketut viennin keskittymisen muutokset henkeä kohti lasketun bkt:n muutoksiin. Tulosten mukaan se, kuinka suurta osaa kaikista mahdollisista tuotteista maat vievät, on positiivisesti yhteydessä henkeä kohti lasketun bkt:n kasvuun. Sen sijaan HH-indeksin muutoksilla ei ole yhteyttä talouskasvuun.

Avainsanat: Vienti, vientituotteet, bkt:n kasvu, EU

JEL-koodit: F14, F43, O47

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A country's goods exports consist of a variety of products whose number depends largely on the country's economic size, production structure, trading relations and agreements, and geographical location. A more heterogeneous export product variety may be a good thing because it decreases the magnitude of adverse shocks in export markets. On the other hand, a more concentrated export structure may mean that the country is more specialised according to its comparative advantage. This should be tantamount to higher average productivity because there is strong empirical evidence that firms with the highest productivity are exporters, see e.g. Bernard and Jensen (2004) and Helpman, (2006).

Larger economies tend to export a larger variety of goods than small economies, because their production base is wider. Hummels and Klenow (2005) found that a wider set of goods explained 62 per cent of the greater value of exports of larger economies in 1995.

Countries' production structures also matter. The number of products listed in the Harmonised System (HS) 8-digit classification is around 10,000 depending on the year. However, different industries have different numbers of products in these classifications. It may be much easier to run a large variety of different export products in some manufacturing industries than in others. And especially if a country specialises in primary products it is likely to have a narrower export base than a country that exports manufactured goods.

While a larger economy, and possibly a more advanced economy, will export a wider variety of products, there is another factor at play that increases countries' extensive margins. Some countries have a lot of re-exports due to their geographical location. Large ports, for example in the Netherlands, serve as transport hubs for other countries too, and some of these transports are classified as Dutch re-exports.

We analyse the EU countries' exports at the disaggregated HS8 level to see how the development in the number of exported products (the extensive margin of trade) has changed in the member countries and what effect, if any, this has had on GDP per capita growth. We also use the Herfindahl-Hirschman index and other measures of concentration to review their development and importance for economic growth. Finally, we analyse the development by broad sectors of manufacturing industries.

The data are from 1995–2015 for the EU15 countries and from 1999–2015 for the new EU member countries (Poland and Slovakia in 2004–2015). These countries share a common trade regime and form a customs union. Even though the new member countries joined the EU only in 2004 and 2007, Europe Agreements had liberalised trade already in the 1990s. Croatia, Cyprus, Luxembourg and Malta are not included in the analysis. Otherwise we emphasise the small advanced economies in the EU15 area: Austria, Belgium, Denmark, Finland, Ireland and Sweden.

Looking at how large a share of all possible export products in the HS8 classification each country has been exporting in 1995–2015, we find that this share has tended to increase in the EU countries. Largest rises are in the new member countries as well as in Ireland, Greece and Portugal. A clear exception is Finland where the extensive margin has narrowed markedly. After controlling for the level of initial GDP per capita, a catching up term, an increase in the number of different exported products seems to contrib-

ute to growth in the EU countries. The relationship is positive and statistically very significant. On the other hand, the development of export concentration as measured by the Herfindahl-Hirschman (HH) index is not significant in explaining economic growth.

Literature

Our analysis covers the years 1995–2015 that witnessed the deepening of the internal market, the birth of the Economic and Monetary Union and the enlargement of the EU to Central and Eastern Europe. Economic integration has lowered trade costs and led to a restructuring of output through, among other things, foreign direct investment.

According to new trade theory, industries become concentrated in countries that have better access to large markets. This development should strengthen when economic integration deepens (e.g. Amiti, 1998). Also trade costs play a crucial role and may induce a U-shaped situation, where very high and very low costs create a different industrial structure than intermediate trade costs.

According to Rossi-Hansberg (2005) and Aiginger and Rossi-Hansberg (2006), a decrease in transportation costs will lead to a decrease in regional concentration of industries and an increase in the specialisation of industries or countries. Specialisation is supported by agglomeration while de-concentration is supported by lower transport costs.

Midelfart, Overman and Venables (2003) expected that there would be a modest increase in specialisation following the founding of the Economic and Monetary Union as firms relocate to benefit from comparative advantage and clustering. Other factors that affect the development are more fine-tuned global value chains, scale economies, monopolistic competition, and vertical linkages between up-stream and down-stream firms.

Re-exports notwithstanding, a country's export structure reflects its production structure. Using output data at the sectoral level, Imbs and Wacziarg (2003) found that countries' economic activity first becomes more diversified as they prosper but then, at a relatively late stage in their development process, they start to re-specialise. They find a statistically significant U-shaped relationship between sectoral concentration of employment and the level of per capita income. Aiginger and Davies (2004) found that the EU15 countries' industrial structures had become more specialised. On the other hand, the industries had become geographically more dispersed.

Cadot, Strauss-Khan and Carrère (2011) discuss extensively whether countries should or should not seek to diversify their exports. They find the same U-shaped relationship for export diversification as Imbs and Wacziarg (2003). According to their results, low and middle-income countries tend to diversify along the extensive margin whereas high-income countries tend to diversify in their intensive margin and finally re-specialise in their exports. They have 156 countries and 19 years of HS6-level data in their analysis. They also analyse new export products and draw conclusions from there, but do not take into account that some of the products are re-exports. Cadot, Carrère and Strauss-Khan (2013) review the literature on export diversification extensively.

Agosin, Alvarez and Bravo-Ortega (2011) use the GMM system estimator to explain export concentration in 79 countries over 1962–2000 at the 3-digit SITC classification.

They use a lagged dependent variable, trade openness, human capital, remoteness, terms of trade, domestic credit, exchange rate volatility and its overvaluation, and country fixed effects as independent variables. The results vary somewhat depending on which of the three concentration indices (Herfindahl, Gini or Theil) they analyse and which variables are taken into account. On average, they find that openness, remoteness and a rise in the terms of trade increase concentration, while an increase in human capital decreases it. A rise in the terms of trade increases concentration only in countries with low human capital.

Dennis and Shepherd (2011) analyse the extensive margin of EU countries' imports from developing countries at the HS8 level of disaggregation. Among other things they find that higher trade costs and barriers to domestic entry are associated with less diversified developing-country exports.

According to Funke and Ruhwedel (2001), the size of the export product variety (out of a total of about 6,400 products) in countries' exports to the US explains changes in relative GDP per capita levels in the OECD countries in 1989–1996. Funke and Ruhwedel (2005) analyse 14 European transition countries in 1993–2000 using export data for 1,473 products. In their semi-endogenous growth model the degree of product variety is found in the production function the same way labour-augmenting technology is present in the traditional Solow growth model. Increasing product variety raises per-capita income growth because of a better use of dynamic economies of scale. The growth rate of product variety has a positive impact on TFP growth.

Re-exports

The more the exported goods contain foreign value added as intermediate inputs the smaller is the share of local value added. However, this does not mean that countries should specialise in products that maximise the share of domestic value added. Global value chains have increasingly linked manufacturing output in different countries so that imported intermediate goods are widely used. For the most part, this has benefited the economies and consumers.

Aggregating across all sectors' value added we get gross domestic product and thereby local incomes. If we are interested in analysing the significance of the number of different export products on GDP per capita growth, re-exports may in principle disturb the analysis because of their little or negligible local value added content.

According to Mellens, Noordman and Verbruggen (2007), re-exports in the Netherlands have grown much faster than Dutch-made exports. Furthermore, re-exports and other exports are structurally different at the product level. They conclude that over a period of ten years, growth in re-exports contributed annually an average of almost 0.3 percentage points to GDP growth. Consequently, extensive re-exports can have a non-negligible positive impact on GDP over time.

Re-exports accounted for 43 per cent of all goods exports from the Netherlands in the year 2000. The respective figure was 33 per cent in Belgium, 31 per cent in France, 20 per cent in Denmark, 16 per cent in Germany, 4 per cent in Finland and 2 per cent in Sweden. (Mellens *et al.*, 2007) The share of re-exports therefore varies considerably in the EU. According to Finnish Customs, re-exports peaked at 16 per cent of total Finnish

exports in 2008. The share then declined to 12–13 per cent in 2012–2015. Note that there may be differences in how re-exports are defined.

The Netherlands and Belgium, in particular, with their huge port facilities relative to the size of their economies are logistical gateways to EU markets. We can see from e.g. Ludwig and Brautzsch (2008) that the import content of exports and openness (average of exports and imports to GDP) is much higher in the Netherlands and Belgium than in the other EU15 countries.

The data

The overall number of HS8-products varies from year to year in the Eurostat database. Table 1 shows our calculations of the number of different HS8 product lines (codes) between 1995 and 2015. Between 1995 and 2011 the number of product lines declined by over one thousand and has since remained stable.

The nomenclature has a little over one thousand (500 in 1995–1996) codes that include letters. Among other things, these represent trade classified as corrections due to erroneous codes, trade broken down at chapter level only, and confidential trade. If they are included, there is an obvious case of double counting in terms of the number of product lines. On the other hand, if they are excluded there is a danger of omissions. We have chosen the latter path because we expect the error to be smaller this way and because the doubling of the number of the lettered products in 1997 causes a disruption in the time series that disturbs the analysis.

In the years we cover, the omitted letter codes include an average of 3.6 per cent of the total value of all goods exports across the EU countries varying from less than 0.3 per cent in Poland, Slovenia and Portugal to over 8 per cent in Hungary and over 12 per cent in the Netherlands. The average for the aggregate EU15 and EU27 is around 5 per cent.

Table 1 The number of product lines in the HS8 nomenclature (Chapters 1–97) 1995–2015

Year	Product lines with letter codes	Product lines without letter codes	Letter codes	Year	Product lines with letter codes	Product lines without letter codes	Letter codes
1995	10,949	10,449	500	**2006**	10,880	9,844	1,036
1996	10,996	10,496	500	**2007**	10,769	9,721	1,048
1997	11,631	10,607	1,024	**2008**	10,747	9,700	1,047
1998	11,642	10,587	1,055	**2009**	10,617	9,570	1,047
1999	11,484	10,429	1,055	**2010**	10,491	9,444	1,047
2000	11,378	10,315	1,063	**2011**	10,349	9,300	1,049
2001	11,382	10,275	1,107	**2012**	10,432	9,383	1,049
2002	11,582	10,401	1,181	**2013**	10,425	9,376	1,049
2003	11,593	10,405	1,188	**2014**	10,428	9,379	1,049
2004	11,364	10,176	1,188	**2015**	10,435	9,386	1,049
2005	11,289	10,098	1,191	**1995-2015**	–514	–1,063	549

Sources: Eurostat, own calculations.

We have also divided our data in seven broad manufacturing sectors. Some of our analysis will focus on how the number of export products has evolved in these subgroups. Table 2 shows the number of product lines per sector in 1995–2015. Metals and ma-

chinery constitute the largest group of product lines, but their numbers have declined by 639. Food and beverages are the second-largest group, and the number of product lines there has increased by 14, the only sector to have grown in this sense. The third-largest group is chemical products and the fourth is textiles and clothing.

We can see from the bottom two lines of the table that the shares of these sectors in the total manufacturing value added of the EU28 countries do not always correspond to their shares in the total numbers of possible export product lines. The correspondence is the highest in chemical industries and non-metallic mineral manufactures where the shares in total manufacturing value added and product lines are relatively similar. But the share of food and beverages in product lines, as well as that of textiles and clothing, far exceeds these sectors' share in total manufacturing value added while the opposite is true in metals and machinery.

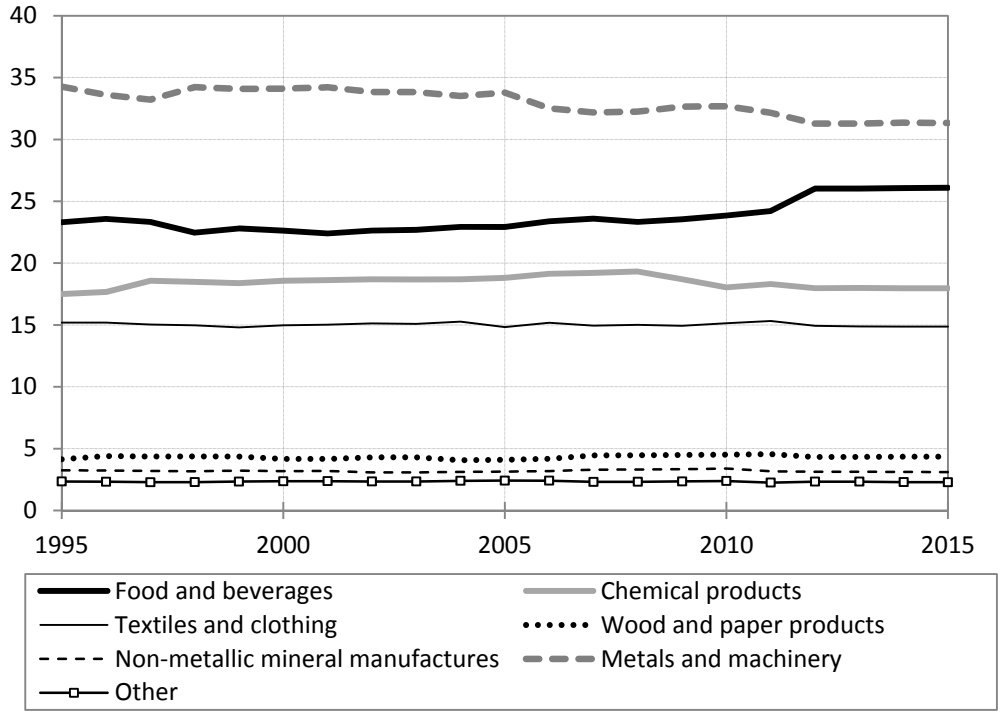
Figure 1 shows the per-cent distribution of the product lines in the seven sectors. We can see that the share of metals and machinery has declined considerably and that of food and beverages has risen markedly.

Table 2 Number of products lines by sectors and years

Year	Food and beverages (01–24)	Chemical products (25–40)	Textiles and clothing (41–43, 50–67)	Wood and paper products (40–49)	Non-metallic mineral manufactures (68–71)	Metals and machinery (72–93)	Other (94–97)
1995	2,435	1,828	1,588	433	340	3,580	245
1996	2,475	1,854	1,595	462	339	3,527	244
1997	2,475	1,969	1,595	462	339	3,524	243
1998	2,379	1,957	1,585	463	336	3,624	243
1999	2,378	1,917	1,544	455	336	3,555	244
2000	2,333	1,916	1,544	430	329	3,519	244
2001	2,302	1,913	1,544	428	329	3,515	244
2002	2,354	1,943	1,573	447	321	3,519	244
2003	2,360	1,943	1,570	447	321	3,520	244
2004	2,334	1,901	1,554	414	318	3,411	244
2005	2,314	1,899	1,497	414	318	3,412	244
2006	2,302	1,884	1,494	412	314	3,201	237
2007	2,293	1,867	1,453	433	321	3,129	225
2008	2,263	1,874	1,456	433	321	3,128	225
2009	2,253	1,789	1,429	430	320	3,124	225
2010	2,252	1,704	1,430	426	320	3,087	225
2011	2,252	1,703	1,425	424	295	2,991	210
2012	2,442	1,686	1,401	406	294	2,935	219
2013	2,440	1,687	1,395	407	294	2,934	219
2014	2,444	1,684	1,395	408	292	2,941	215
2015	2,449	1,686	1,395	408	292	2,941	215
1995-2015	14	-142	-193	-25	-48	-639	-30
% of product lines [1)]	26.1	18.0	14.9	4.3	3.1	31.3	2.3
% of value added [2)]	13.8	18.7	3.6	6.1	3.6	49.5	4.7

Note: HS2 Chapters shown in parentheses. [1)] Share in product lines in 2015, %. [2)] Share in manufacturing value added in current prices in the EU28 in 2014, %. Sources: Eurostat, own calculations.

Figure 1 The share of all products lines by sectors and years, %



Sources: Eurostat, own calculations.

Export product coverage over time

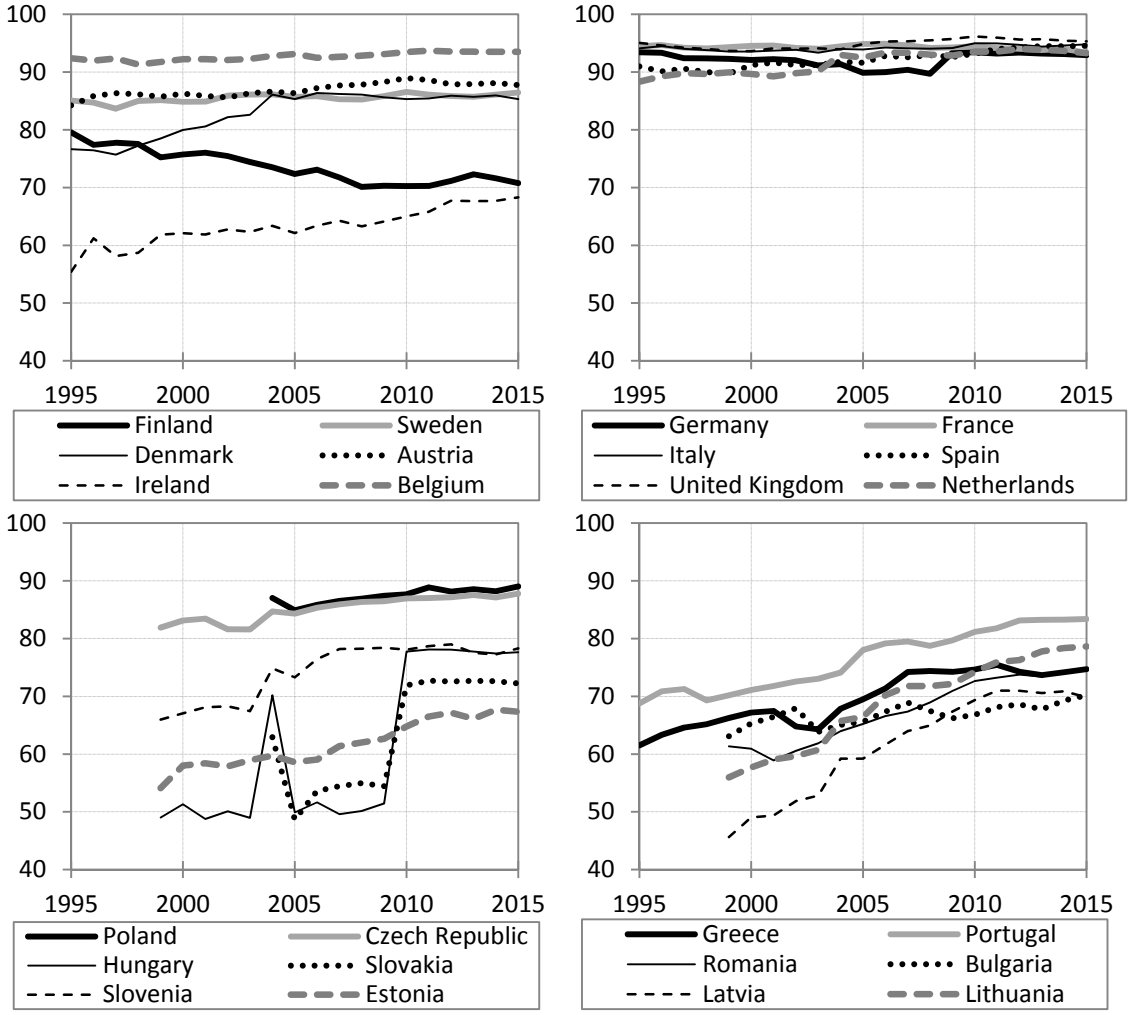
We have grouped the EU countries in the graphs in broad groups where the first group includes more advanced small countries, the second group includes more advanced large countries, and the third group includes more advanced new member countries from the 2004 enlargement. This leaves the fourth group somewhat mixed.

From Figure 2 we see that the number of exported products as a share of all possible products has in most countries increased across the analysed time frame. There has thus typically occurred diversification at the extensive margin. There is one notable exception, Finland, whose product coverage has declined by 8.8 percentage points. Small negative changes are also recorded for France and Germany over 1995–2015. By far the largest increases are recorded for the new member countries and Ireland.

In many cases the development has stalled, however. This is of course affected by the presence of the upper limit of 100% that cannot be surpassed. The decline in Finland stopped in 2008, as did the rise in product coverage in Denmark in 2004, the Netherlands in 2006, Austria in 2010, Greece in 2011 and Portugal in 2012, as well as in some new member countries (Poland, Slovenia, Hungary, Slovakia, Estonia and Latvia). The rise has continued for example in Ireland and Lithuania albeit there are some signs of levelling out there too.

The standard deviation across the number of exported products has declined. This is the case also for the EU15 countries' subgroup. In this respect, the EU countries have become more similar over time.

Figure 2 Number of HS8 export products, % of all possible export products



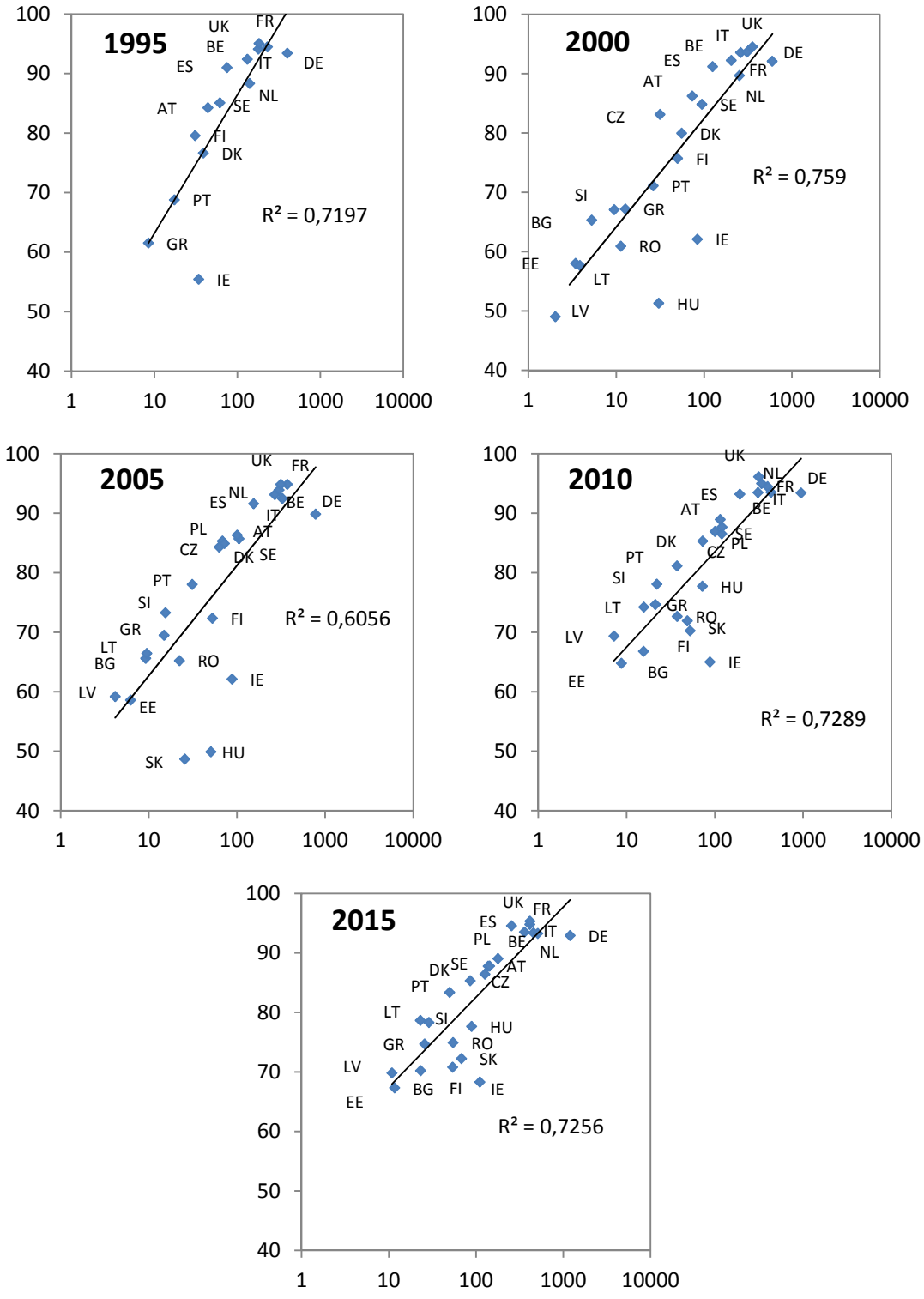
Note: The vertical scales are the same in all graphs to facilitate comparison. There are odd jumps in the data for Hungary and Slovakia that the author cannot explain. We control these in the econometric analysis.
Sources: Eurostat, own calculations.

We will next analyse how the value of total exports and the number of exported products are related. These are shown at five-year intervals in Figure 3. We can see that there is a clear positive correlation between the two. This is not surprising because larger economies have a larger export base and a larger value of total exports.

Looking at the small advanced EU countries, we can see that Austria, Belgium, Denmark and Sweden have remained above the line every year, thus outperforming their size. Meanwhile, Finland started out above the line but has fallen clearly below it, and Ireland has remained below the line every year. Of the larger countries, Germany is found below the line.

Furthermore, graphs not shown here indicate that there is virtually no correlation between how open the economy is as measured with the exports-to-GDP ratio and the export product coverage. Countries that export a smaller-than-average variety of products given their openness to trade include most of the new member countries but also Finland, Greece and Ireland. Of the new member countries, the Czech Republic and Poland export a relatively large variety of products given their openness to trade.

Figure 3 **Number of exported products (% of total possible, vertical axis) and the natural logarithm of the value of total exports (horizontal axis)**



We also used OLS (results are not shown here) to explain export product coverage using the countries' GDP and their capital city's distance from the geographical midpoint of either the EU15 or the EU27 area. Distance is a measure of the degree of periphery for the countries and acts as a proxy for trade costs (logistics and distance from markets). GDP explains well the number of exported products. It is always positive and

statistically very significant. On the other hand, distance has always a negative coefficient meaning that location in periphery corresponds to a smaller export product base. In the EU15, distance is statistically slightly significant in 2000 and 2005, but not in 1995, 2010 or 2015. The importance of distance (trade costs) may therefore have been nonlinear in time. For the enlarged EU27 area we find that distance is always statistically very significant, albeit its statistical significance decreases in 2015. Furthermore, its coefficient has tended to decline which means that distance from the geographic midpoint seems to have become less important over time.

Specialisation over time

We saw above that in most cases the number of exported products as a percentage of the total possible number of products has increased over time. However, this is not necessarily the same thing as de-specialisation at the level of total exports because every product has the same weight. To check whether weighing matters or not, we will next first review the importance of the top-10 products in member countries' exports and then analyse Herfindahl-Hirschman indices. These two measures are highly correlated with a linear-trend R^2 of 0.90 across the member countries in 2015.

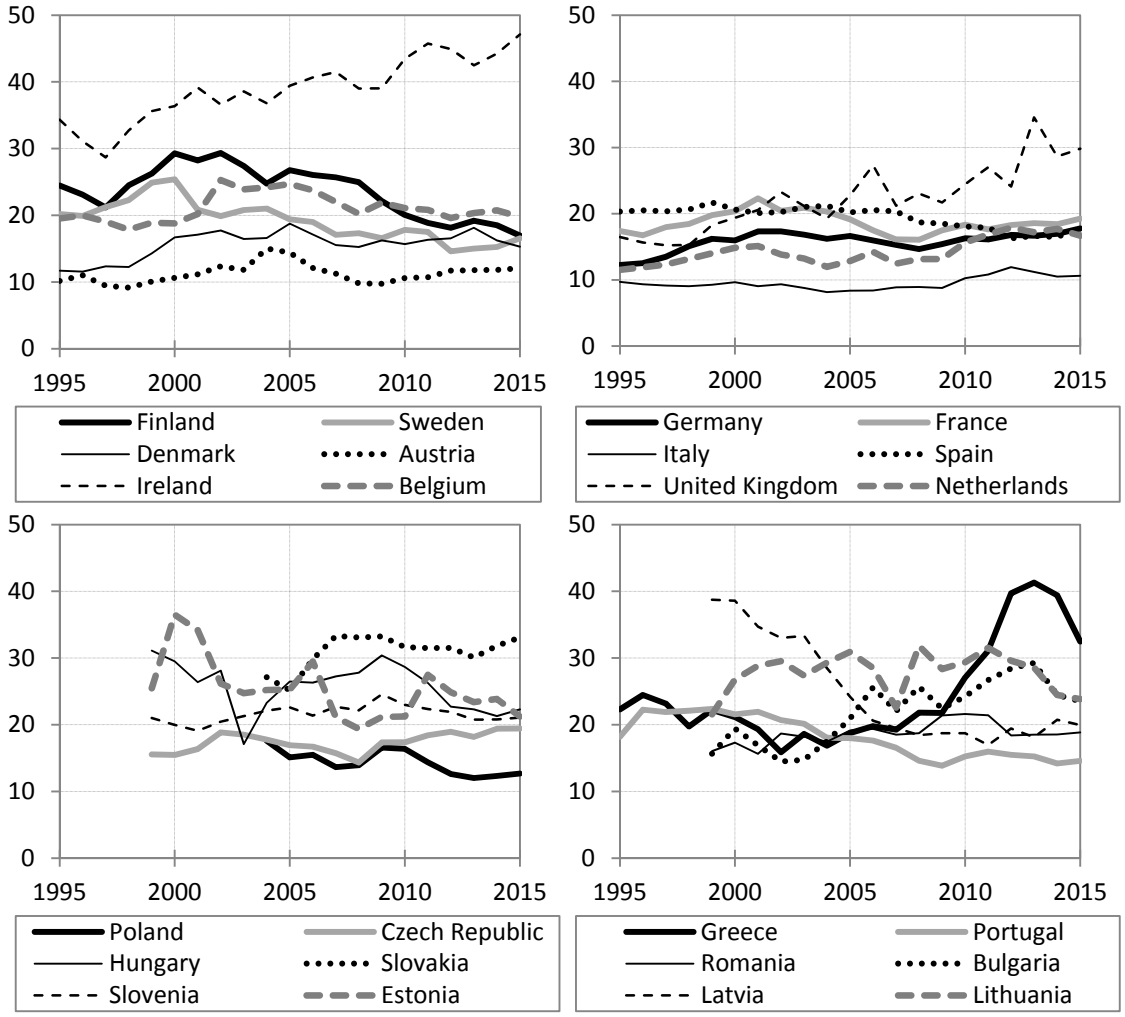
The share of the top-10 exported HS8-level products was by far the highest in Ireland in 2015, some 47 per cent of the total value of its goods exports. It was followed by Slovakia, Greece and the UK with 30–33 per cent shares. The lowest share was found in Italy and Austria at 11–12 per cent. The UK is an exception among the large countries with such a high share for the top-10 products. In the UK, the share peaked at 35 per cent in 2013 and then declined a little. Furthermore, development in the UK is very different from the other large EU countries as can be seen in Figure 4. All the other countries at the top of the list are small countries, either old cohesion countries (Ireland and Greece) or new member countries. Otherwise the small advanced EU countries can be found closer to the bottom of the list where the top-10 products' share is relatively small.

Table 3 The share of the top-10 export products in 2015, % of the total value of goods exports

Country	Share	Country	Share	Country	Share
Ireland	47.1	**Slovenia**	21.1	**Finland**	17.0
Slovakia	33.1	**Latvia**	20.0	**Netherlands**	16.7
Greece	32.5	**Belgium**	19.8	**Sweden**	16.6
UK	29.8	**Czech Republic**	19.4	**Denmark**	15.3
Lithuania	23.9	**France**	19.2	**Portugal**	14.6
Bulgaria	23.5	**Romania**	18.9	**Poland**	12.7
Hungary	22.3	**Spain**	17.9	**Austria**	12.1
Estonia	21.2	**Germany**	17.8	**Italy**	10.6

The development of the share of each year's top-10 exported products between 1999 and 2015 is very heterogeneous. The largest declines, and reflecting less specialisation over time, are recorded for Latvia (–19 percentage points), Finland and Hungary (–9), and Sweden and Portugal (–8). Meanwhile, the largest increases, thus showing higher concentration, are recorded in opposite corners of the EU in the UK (+12 percentage points) and Ireland (+11), and in Greece (+10) and Bulgaria (+8). The unweighted average of the changes across the EU countries is a little over +1.

Figure 4 The share of the top-10 export products in 2015, % of total value of goods exports



The results are rather similar if we look at the top-30 products, or the top 3–10 products where the first and second-most-important products are omitted. Notable exceptions are Ireland and Latvia where the two most important products account for a very large share, 11 and 13 percentage points respectively, of the total absolute change in the share of the top-10 products. The two most important products have been significant drivers (5 to 7 percentage points) also in Hungary, the UK, Greece, Portugal, Lithuania and Finland.

If we draw graphs (not shown here) between the share of the top-10 products and the value of total exports we find a small negative correlation in 1995 and 2000, but by 2015 this correlation has declined to almost zero. Consequently, the share of the top-10 export products in total exports does not correlate with the total value of exports.

We will next use normalised Herfindahl-Hirschman indices to analyse specialisation:

$$HH_j = \frac{\sum_{i=1}^{n}\left(\frac{x_{ij}}{X_j}\right)^2 - 1/n}{1 - 1/n},$$

where x_{ij} is the value of exports of product i (1, …, n) from country j and X_j is the country's total exports. A higher index value indicates a more concentrated export structure.

As measured by the HH indices, the export structures of Ireland, the UK and Greece have become more specialised, i.e. more concentrated, over time as the top-10 data also indicated. Meanwhile the most notable declines in the index have occurred in Latvia, Portugal, Finland and Sweden.

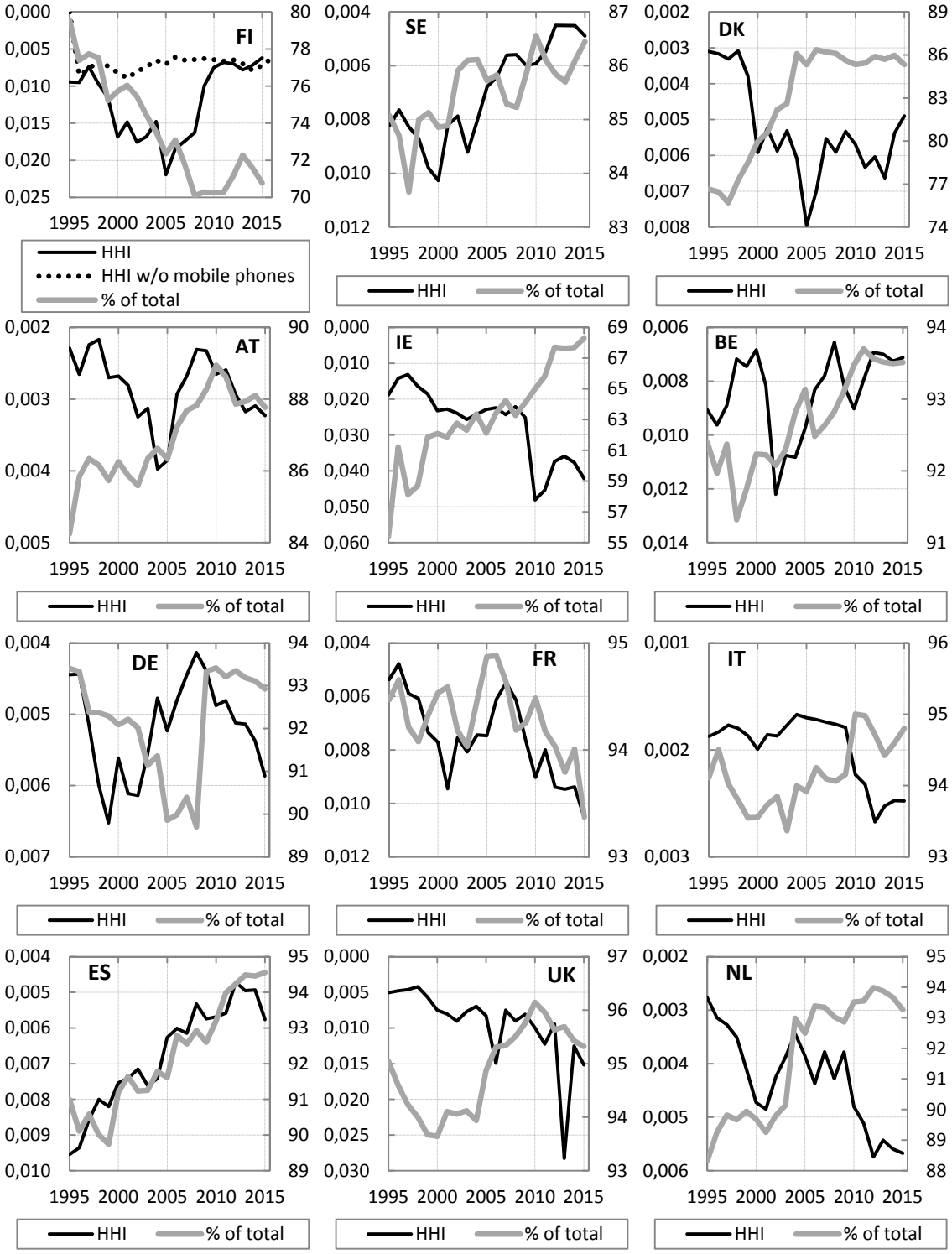
In 2015, the most diversified export product structures as measured by the HH index were in Italy, Poland, Austria and Portugal, while the most concentrated ones were in Ireland, Greece, Slovakia and the UK. The size of GDP does not correlate with the HH index value across the member countries. This is the case also for the EU15. We do find a negative correlation within the new-member-countries subgroup, but it is due Poland as an outlier. Consequently, smaller economies do not specialise more than large ones as measured by the HH index, or the share of the top-10 products as noted above.

The indices are presented in Figure 5 together with the product coverage in the six small advanced EU countries and the six largest EU countries. A rise in the HH index, i.e. a decline in the line as the scale has been inverted, indicates a more concentrated export structure. This may or may not be accompanied by a decline in the number of different exported products, also a more concentrated export structure. The lines may, however, move in different directions.

The development varies by countries and the period we examine. The developments are often non-monotonous. For example, Finland's export structure became more specialised in terms of both indicators up until 2005 but then the HH index reversed totally and started to rise while product coverage stagnated. If we remove the important (Nokia) mobile-phone related products (HS8 85171200, 85177090, 85252020, 85252080, 85252090, 85252091 and 85252099) the Finnish HH line is virtually horizontal as depicted in the graph. We saw above that for Finland the share of the top-10 products has continued to decline since 2002.

For Sweden, we find a clearer trend towards a less concentrated product structure in terms of both indices. This was also seen in the top-10-products analysis. In Denmark, the measures moved in opposite directions up until about 2004, but have since remained stable over time (as has the share of the top-10 products). In Ireland, the HH index and the share of the top-10 products shows a move towards a more concentrated export structure, but the coverage of possible export products rises constantly. The lines go nicely in the same direction in France and Spain with concentration in the former and diversification in the latter country. Otherwise there are different developments in the large economies. This shows that measuring the phenomenon is not fully unambiguous, and the numbers measure somewhat different things.

Figure 5 **HH index (left-hand scale, inverted) and export product coverage rates (right-hand scale) for a selection of countries. A decline in the lines reflects a more concentrated export structure.**



Specialisation and GDP Per Capita Growth

Exporting firms tend to have higher-than-average productivity as shown in numerous academic studies, see e.g. Bernard and Jensen (1995, 2004), Girma, Greenaway and Kneller (2004), and Wagner (2006, 2007) for empirical evidence, and Melitz (2003) and

Helpman (2006) for a theoretical approach. Consequently, an increase in exports should lead to an increase in average productivity and GDP growth. There is also evidence that growth in exports is typically due to both external and internal margins. We may thus expect an increase in export variety to correspond to an increase in total exports and average productivity.

Here we have analysed whether changes in the number of exported products as a share of all possible export products have affected GDP per capita growth over 1995–2015. This is basically the method used in Funke and Ruhwedel (2005), but with a larger set of countries, longer time span and more products. We also verify whether the development in the HH index has had any bearing on growth. In principle, specialisation based on comparative advantage could lead to faster growth. Notice that data for the new member countries starts in 1999. The analyses have been done with OLS.

Using lagged GDP per capita level, a catching-up term, as the only other independent variable we find a positive correlation between growth and an increase in product coverage when country fixed effects are not used. However, statistical significance vanishes when country fixed effects are used except when the change in the HH index is also included in specification 3 below in Table 4 (this is not shown in the table, however). Otherwise including both the change in export product coverage and the change in the HH index did not affect the results.

The catching-up term that implies an annual rate of convergence below 2 per cent is always statistically highly significant and negative, as expected, albeit the size of its coefficient varies a lot depending on whether country fixed effects are used or not. The negative sign implies that countries with lower GDP per capita have grown faster than wealthier countries.

Using a dummy for Finland and interaction terms between Finland and the independent variables in Table 5 shows that, regardless of the apparent differences between Finland and the other EU countries in the above graphs, there is no statistically significant difference between them.

We also carried out the same analysis using the HH index instead of the product coverage variable (Tables 6 and 7). We find that changes in the HH index are never statistically significant. Consequently, a rise in the product coverage is associated positively with economic growth, but changes in specialisation as measured by the HH index have had no bearing on GDP per capita growth in the EU countries in 1995–2015.

Table 4 Explaining GDP per capita growth with export product coverage

Variable	1	2	3	4	5	6	7
Constant	0.1866***	0.2115***	1.1802***	0.1928***	0.1151***	0.1946***	0.7691***
	(0.0229)	(0.0406)	(0.1076)	(0.0162)	(0.0290)	(0.0163)	(0.1214)
Lagged GDP per capita	-0.0167***	-0.0196***	-0.1165***	-0.0173***	-0.0084***	-0.0175***	-0.0752***
	(0.0023)	(0.0044)	(0.0108)	(0.0016)	(0.0032)	(0.0016)	(0.0122)
Change in product coverage, points	0.0037***	0.0037***	0.0022	0.0024**	0.0023**	0.0026**	0.0011
	(0.0014)	(0.0014)	(0.0013)	(0.0011)	(0.0011)	(0.0011)	(0.0010)
EU15 fixed effects	..	0.0051	..	..	-0.0162***		..
		(0.0068)			(0.0050)	..	
Finland fixed effects	..	..	..	..	..	0.0060	..
						(0.0054)	
Country fixed effects	no	no	yes	no	no	no	yes
Year fixed effects	no	no	no	yes	yes	yes	yes
R-squared	0.150	0.151	0.355	0.611	0.620	0.612	0.701
Adjusted R2	0.146	0.145	0.315	0.590	0.599	0.590	0.667
S.E. of regression	0.034	0.033	0.030	0.023	0.023	0.023	0.021
Sum squared resid.	0.473	0.472	0.359	0.217	0.211	0.216	0.166
Log likelihood	842.285	842.565	901.011	1008.055	1013.459	1008.692	1064.396
F-statistic	37.290	25.019	8.799	30.076	29.846	28.779	20.267
Prob(F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D-W stat	1.112	1.111	1.329	0.936	0.967	0.941	1.148
Periods	20	20	20	20	20	20	20
Cross-sections	24	24	24	24	24	24	24
Observations	425	425	425	425	425	425	425

Note: Change in product coverage is statistically significant at the 10 per cent level if the change in the HH index is included in the specification. Change in product coverage is measured as percentage point changes. The large swings in the coverage rate in the Hungarian and Slovakian data see in the above graph have been removed here. *** = significant at the 1 per cent level, ** = significant at the 5 per cent level, * = significant at the 10 per cent level.

Table 5 Explaining GDP per capita growth with export product coverage and interaction terms vis-à-vis Finland

Variable	1	2	3	4	5
Constant	0.1875***	1.1775***	0.1937***	0.1925***	0.7815***
	(0.0231)	(0.1081)	(0.0164)	(0.0164)	(0.1226)
Lagged GDP per capita	-0.0169***	-0.1141***	-0.0174***	-0.0173***	-0.0745***
	(0.0023)	(0.0110)	(0.0016)	(0.0016)	(0.0122)
Change in product coverage, points	0.0043***	0.0025*	0.0027**	0.0027**	0.0012
	(0.0014)	(0.0014)	(0.0011)	(0.0011)	(0.0011)
Interaction: Lagged GDP per capita x Finland	0.0003	-0.0432	0.0004	-0.0533	-0.0392
	(0.0008)	(0.0564)	(0.0006)	(0.0442)	(0.0399)
Interaction: Change in coverage x Finland	-0.0119	-0.0058	-0.0039	-0.0023	-0.0003
	(0.0079)	(0.0073)	(0.0057)	(0.0058)	(0.0053)
Finland fixed effects	..	..	..	0.5652	..
				(0.4642)	
Country fixed effects	no	yes	no	no	yes
Year fixed effects	no	no	yes	yes	yes
R-squared	0.157	0.358	0.612	0.614	0.702
Adjusted R2	0.149	0.314	0.590	0.590	0.666
S.E. of regression	0.033	0.030	0.023	0.023	0.021
Sum squared resid.	0.469	0.3571	0.216	0.215	0.166
Log likelihood	843.994	901.842	1008.925	1009.711	1064.981
F-statistic	19.555	8.196	27.508	26.456	19.360
Prob(F-statistic)	0.000	0.000	0.000	0.000	0.000
D-W stat	1.127	1.334	0.945	0.946	1.150
Periods	20	20	20	20	20
Cross-sections	24	24	24	24	24
Observations	425	425	425	425	425

Note: Change in product coverage is measured as percentage point changes. The large swings in the coverage rate in the Hungarian and Slovakian data see in the above graph have been removed here. *** = significant at the 1 per cent level, ** = significant at the 5 per cent level, * = significant at the 10 per cent level.

Table 6 Explaining GDP per capita growth with the HH index

Variable	1	2	3	4	5	6	7
Constant	0.2041***	0.1616***	1.2028***	0.2036***	0.0673**	0.2054***	0.7745***
	(0.0220)	(0.0363)	(0.1062)	(0.0155)	(0.0293)	(0.0157)	(0.1198)
Lagged GDP per capita	-0.0183***	-0.0140***	-0.1188***	-0.0183***	-0.0035	-0.0185***	-0.0757***
	(0.0022)	(0.0040)	(0.0107)	(0.0016)	(0.0033)	(0.0016)	(0.0121)
Change in HH index, points (reciprocal)	0.1133	0.3327	0.2876	-0.0367	0.2412	-0.0424	0.0334
	(0.4736)	(0.4231)	(0.4248)	(0.3367)	(0.3321)	(0.3369)	(0.3041)
EU15 dummy	..	-0.0024	..	..	-0.0174***		..
		(0.0066)			(0.0052)	..	
Finland fixed effects	..	..	..	..	..	0.0043	..
						(0.0054)	
Country fixed effects	no	no	yes	no	no	no	yes
Year fixed effects	no	no	no	yes	yes	yes	yes
R-squared	0.140	0.115	0.354	0.607	0.525	0.608	0.701
Adjusted R2	0.135	0.109	0.314	0.587	0.502	0.586	0.667
S.E. of regression	0.034	0.034	0.030	0.023	0.026	0.023	0.021
Sum squared resid.	0.482	0.559	0.362	0.220	0.300	0.220	0.167
Log likelihood	850.533	940.160	912.152	1018.977	1089.322	1019.311	1078.159
F-statistic	34.614	20.625	8.853	29.997	22.928	28.636	20.563
Prob(F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D-W stat	1.109	1.126	1.351	0.902	0.947	0.903	1.138
Periods	20	20	20	20	20	20	20
Cross-sections	24	24	24	24	24	24	24
Observations	430	480	430	430	480	430	430

Note: *** = significant at the 1 per cent level, ** = significant at the 5 per cent level, * = significant at the 10 per cent level.

Table 7 Explaining GDP per capita growth with the HH index and interaction terms vis-à-vis Finland

Variable	1	2	3	4	5
Constant	0.2060***	1.1975***	0.2053***	0.2042***	0.7870***
	(0.0222)	(0.1065)	(0.0157)	(0.0157)	(0.1207)
Lagged GDP per capita	-0.0186***	-0.1169***	-0.0185***	-0.0184***	-0.0753***
	(0.0022)	(0.0109)	(0.0016)	(0.0016)	(0.0121)
Change in HH index, points (reciprocal)	0.2661	0.4111	-0.0199	-0.0191	0.0623
	(0.4809)	(0.4319)	(0.3426)	(0.3425)	(0.3094)
Interaction: Lagged GDP per capita x Finland	0.0006	-0.0268	0.0004	-0.0507	-0.0343
	(0.0007)	(0.0570)	(0.0005)	(0.0450)	(0.0405)
Interaction: Change in HH (reciprocal) x Finland	-4.7098*	-3.3208	-0.6958	-0.0752	-0.4456
	(2.6118)	(2.4280)	(1.8517)	(1.9301)	(1.7331)
Finland fixed effects	..	..	..	0.5370	..
				(0.4730)	
Country fixed effects	no	yes	no	no	yes
Year fixed effects	no	no	yes	yes	yes
R-squared	0.147	0.358	0.608	0.609	0.702
Adjusted R2	0.139	0.315	0.585	0.586	0.667
S.E. of regression	0.034	0.030	0.023	0.023	0.021
Sum squared resid.	0.478	0.359	0.220	0.219	0.167
Log likelihood	852.446	913.565	1019.374	1020.057	1078.713
F-statistic	18.330	8.309	27.337	26.270	19.639
Prob(F-statistic)	0.000	0.000	0.000	0.000	0.000
D-W stat	1.121	1.358	0.903	0.904	1.138
Periods	20	20	20	20	20
Cross-sections	24	24	24	24	24
Observations	430	430	430	430	430

Note: *** = significant at the 1 per cent level, ** = significant at the 5 per cent level, * = significant at the 10 per cent level.

Our results are in line with Feenstra and Kee (2008) who found that an increase in export variety to the United States is associated with an increase in productivity for the exporters. Their results also conclude that export variety manages to explain within-

county variations in productivity but not the absolute productivity differences between countries. Our results are also in line with Funke and Ruhwedel (2005).

Export structure

A country's export structure can bias our results. There are very different numbers of products in our database depending on the HS2 level Chapter, varying from 5 to 874 product lines in 2015. This means that a country may be specialised in industries whose export products are classified under a relatively small number of codes. This will also affect our results so that some countries export a smaller or larger number of products than they in principle "should" given the size of their economies.

Furthermore, the level of technological substitutability between products varies in the sense that depending on the sector it may be easier or more difficult for a producer to switch from one product to another or to expand output to a new product line in response to changes in market conditions. There are also some food and beverage products that cannot be produced outside a given geographical region in the EU, but they can nevertheless be exported by all EU countries as re-exports.[2]

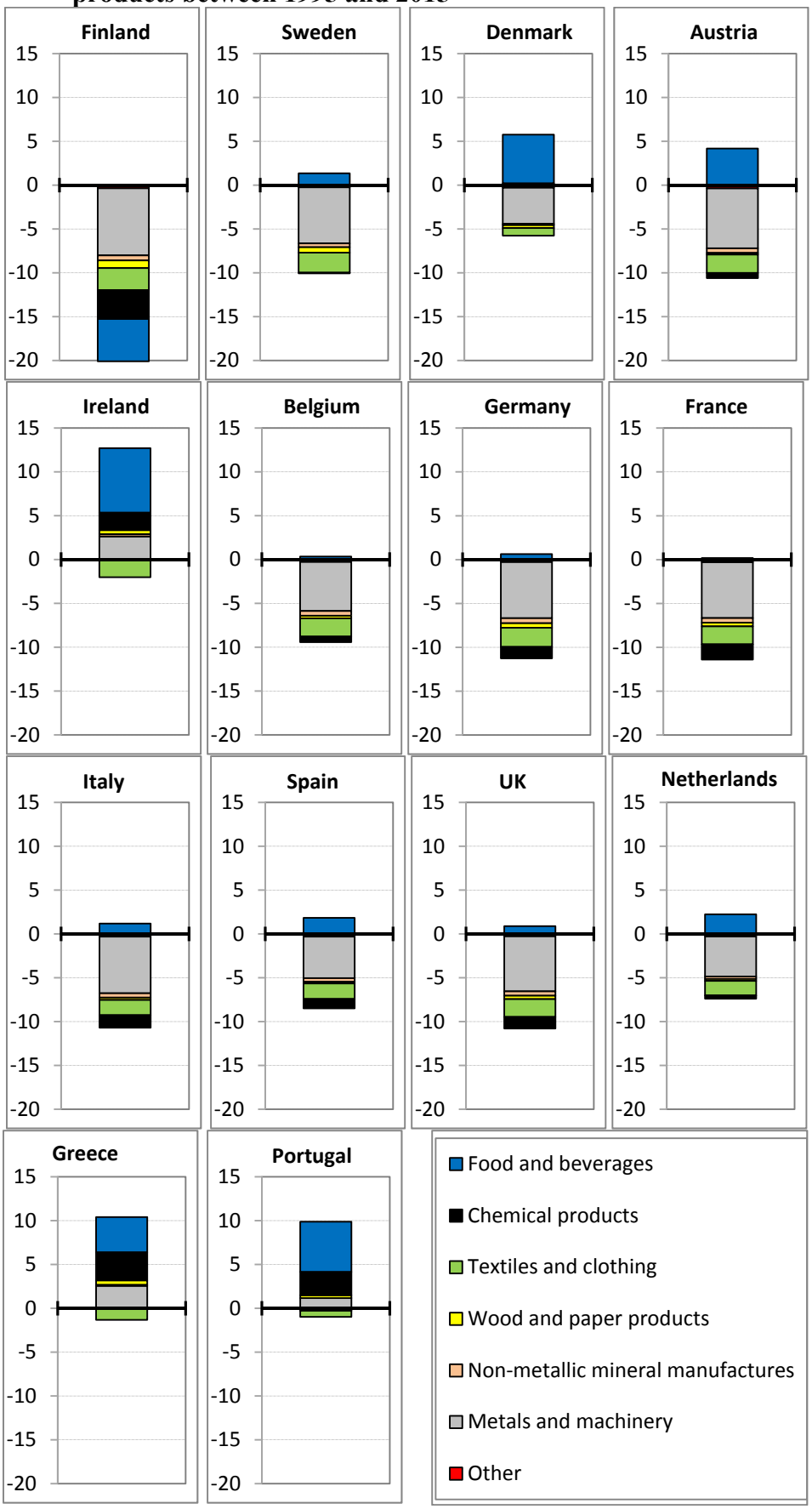
We have seen that Finland has been an exception among the EU15 countries in that its export product coverage has declined considerably while other countries' coverage rates have either risen or remained relatively stable. One thing that sets Finland clearly apart from the other countries is the decline in food-and-beverages-related products. Their absolute numbers have increased in all other countries, especially in Latvia, Lithuania and Hungary (see Figure 6 for the EU15 countries in 1995–2015 and Table 8 for all countries in 1999–2015). The number of different chemical products also shows a much larger decline in Finland than in the other countries. Between 1995 and 2015 Finland leads in the decline in all other product groups as well, but there the differences are smaller.

If we disregard food and beverages, the number of different export products still declines the most in Finland, but now Sweden, Austria, Germany, Italy and the UK come relatively close. This contrasts with the other small advanced countries where food and beverages have been among the largest positive contributors to the number of export products. The other small countries have performed well in almost all broad product groups.

Food and beverages notwithstanding, the number of Finland's export products declined up until 2008 (see Figure 7). Then it revived to its 2004–2006 level a few years later. There is a rise in the other small advanced economies that fades away in all countries. The increase stabilises around 2002 in Sweden, 2004 in Denmark, 2010 in Belgium and 2012 in Ireland. The line first declines slightly in Austria but rises back by 2007 and then stabilises there.

[2] For example in 2015, all but five of the EU28 countries exported Bordeaux white wines (HS 22042112), which are only produced in France. France accounted for 84 per cent of the value of the EU28 countries' total exports of these products. France also imported these wines, both from inside and outside the EU.

Figure 6 Percentage point contributions to the changes in the number of export products between 1995 and 2015



Note: These are the absolute changes in the number of product lines.

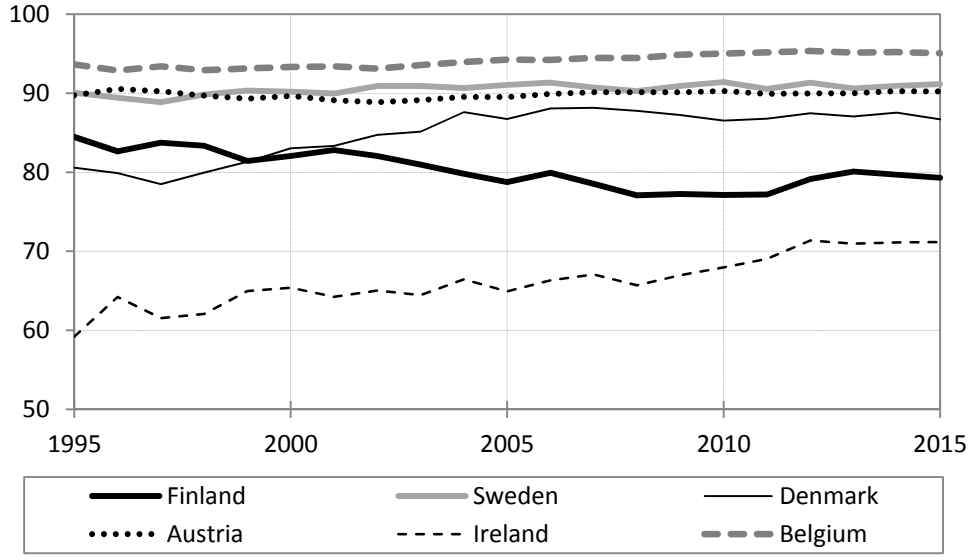
Table 8 Percentage point contributions to the changes in the number of export products between 1999 and 2015

	Food and beverages	Chemical products	Textiles and clothing	Wood and paper products	Non-metallic mineral manufactures	Metals and machinery	Other	Total	Total without food and beverages
Finland	–1.9	–4.1	–2.3	–0.9	–0.3	–5.5	–0.3	–15.3	–13.4
Sweden	2.1	–1.5	–1.5	–0.7	–0.5	–6.2	–0.3	–8.6	–10.7
Denmark	4.3	–0.4	–0.9	–0.4	–0.2	–4.4	–0.3	–2.2	–6.5
Austria	2.6	–1.2	–1.7	–0.4	–0.5	–6.3	–0.4	–7.9	–10.4
Ireland	4.0	–0.6	–2.0	–0.2	–0.1	–1.4	–0.3	–0.6	–4.6
Belgium	1.2	–1.7	–1.5	–0.6	–0.4	–5.0	–0.3	–8.3	–9.5
Germany	0.9	–1.5	–1.5	–0.6	–0.5	–5.8	–0.3	–9.4	–10.2
France	0.6	–2.4	–1.6	–0.6	–0.5	–6.2	–0.3	–10.9	–11.5
Italy	1.6	–1.9	–1.4	–0.4	–0.4	–6.0	–0.3	–8.8	–10.4
Spain	2.8	–1.5	–1.1	–0.3	–0.4	–4.3	–0.3	–5.2	–7.9
UK	1.1	–1.6	–1.4	–0.4	–0.4	–5.5	–0.3	–8.4	–9.6
Netherlands	1.3	–1.2	–1.2	–0.5	–0.1	–4.7	–0.3	–6.7	–8.0
Czech Republic	6.4	–1.1	–1.7	–0.5	–0.5	–5.9	–0.3	–3.5	–10.0
Hungary	17.2	10.0	3.5	1.6	0.9	9.2	0.2	42.6	25.4
Slovenia	7.8	2.5	–0.5	–0.1	–0.3	–2.4	–0.3	6.8	–1.0
Estonia	9.2	2.9	–1.2	0.4	0.1	0.5	–0.1	12.0	2.7
Greece	3.5	0.9	–1.7	0.1	–0.3	–0.9	–0.1	1.5	–2.0
Portugal	6.0	1.8	–0.4	0.3	0.0	–0.5	–0.2	6.9	0.9
Romania	6.3	2.5	–0.1	0.1	0.1	1.1	–0.1	9.9	3.6
Bulgaria	1.5	–0.3	–0.1	–0.2	0.0	–0.4	–0.2	0.1	–1.3
Latvia	18.3	3.5	3.9	0.8	1.9	9.1	0.3	37.7	19.5
Lithuania	14.3	4.6	1.8	0.7	0.6	4.5	0.1	26.5	12.2
EU15	0.7	–2.2	–1.4	–0.5	–0.4	–6.0	–0.3	–10.0	–10.7
EU27	0.7	–2.2	–1.4	–0.5	–0.4	–5.9	–0.3	–10.0	–10.7

Table 9 Contribution to the number of export products relative to the EU15 countries between 1995 and 2015, percentage points

	Food and beverages	Chemical products	Textiles and clothing	Wood and paper products	Non-metallic mineral manufactures	Metals and machinery	Other	Total	Total without food and beverages
Finland	-5.0	-2.0	-0.7	-0.6	-0.1	-1.5	-0.1	-9.9	-4.9
Sweden	1.2	1.2	-0.4	-0.4	0.0	-0.2	0.0	1.5	0.3
Denmark	5.4	1.5	1.0	-0.1	0.3	2.1	0.0	10.2	4.8
Austria	4.0	0.7	-0.3	0.1	-0.1	-0.6	-0.1	3.8	-0.3
Ireland	7.2	3.3	-0.1	0.7	0.7	8.8	0.2	20.9	13.7
Belgium	0.2	0.7	-0.2	-0.1	-0.1	0.6	0.0	1.1	0.9
Germany	0.5	0.0	-0.3	-0.3	-0.1	-0.2	0.0	-0.5	-0.9
France	0.0	-0.4	-0.2	-0.2	-0.1	-0.2	0.0	-1.0	-1.1
Italy	1.0	-0.1	0.1	0.0	0.0	-0.3	0.0	0.7	-0.4
Spain	1.7	0.2	0.1	0.1	0.0	1.5	0.0	3.5	1.9
UK	0.7	0.0	-0.2	-0.1	0.0	-0.1	0.0	0.3	-0.5
Netherlands	2.1	0.9	0.2	0.0	0.2	1.6	0.0	5.0	3.0
Greece	3.9	4.5	0.6	0.7	0.6	8.8	0.2	19.3	15.4
Portugal	5.6	4.0	1.1	0.6	0.4	7.4	0.0	19.1	13.5

Figure 7 Export product coverage without food and beverages, %



Conclusions

We do not find a U-shaped curve in the EU countries' extensive margin at the HS8 level as reported in Imbs and Wacziarg (2003), and Cadot, Strauss-Khan and Carrère (2011).[3] Instead, the EU15 countries have typically witnessed a slow rise in their coverage of the total possible number of export products, i.e. diversification at the extensive margin. The exceptions are Ireland where the rise has been quite fast and Finland where the coverage has declined considerably after 1995. In the case of Finland, the decline levelled out in 2008. Ireland, Greece, Portugal and the new member countries have seen a dramatic increase in their export product coverage after 1995/1999 that has mostly tended to level out during the past few years. In some countries, the number of different exported products has continued to increase. Overall, the EU countries have become more similar over time in terms of their export product coverage. The value of total exports and the number of exported products are positively related.

Relative to the other EU countries, the number of Finland's export products has declined considerably after 1995. The largest reason for this is the decline in the number of export product lines related to food and beverages. These numbers have increased in all other EU countries.

There is virtually no correlation between how open the economy is as measured with the exports-to-GDP ratio and the export product coverage rate. Countries that export a smaller-than-average variety of products given their openness to trade include most of the new member countries but also Finland, Greece and Ireland. Of the new member countries, the Czech Republic and Poland export a relatively large variety of products given their openness to trade.

The share of the top-10 export products is a crude measure of concentration. At the top of this concentration list we find small countries, either old cohesion countries (Ireland and Greece) or new member countries, but also the UK. On the other hand, out of the

[3] We do find a U-curve between HH and incomes, but it is due to just Ireland as an outlier. Consequently, we dismiss it as evidence.

six most advanced small EU countries, Austria, Denmark, Finland and Sweden are among the least concentrated countries using this measure. In 1999–2015 we find that the share of the top-10 products has declined the most in Latvia, Finland, Hungary, Sweden and Portugal, and risen the most in the UK, Ireland, Greece and Bulgaria. The share of the top-10 export products in total exports does not correlate with the total value of exports.

Despite its simplicity, the share of the top-10 export products correlates very highly with the Herfindahl-Hirschman (HH) index. Unsurprisingly, also the HH indices indicate that the export structures of Ireland, the UK and Greece have become more specialised over time. The largest declines in the index have occurred in Latvia, Portugal, Finland and Sweden. The changes in the HH index do not correlate with productivity growth in the EU countries. Furthermore, aggregate GDP does not correlate with the HH index value. Consequently, smaller economies do not specialise more than large ones.

Using lagged GDP per capita level–a catching-up term–as the only other independent variable we find a positive correlation between growth and an increase in product coverage. Our results are in line with Funke and Ruhwedel (2005). The catching-up term is always statistically highly significant and negative, as expected. Despite clear differences in the graphs, Finland does not differ from the other member countries on the basis of our econometric analysis. Meanwhile, changes in the HH index have had no bearing on GDP per capita growth in the EU countries.

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