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The Effects of Globalization on Location of Industries in the OECD and European Union

By

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with Fernando De Paolis

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Abstract

Most international trade theory, whether classical or "new," predictst that increased globalization will be associated with increased locational concentration of particular economic activities, and hence increased specialization of national and regional economies, due to the greater freedom for industries to locate according to comparative advantage and economies of scale, and to integrate production systems based on an internationalization of intermediate goods sourcing. Relatively little empirical evidence exists on whether these predictions are correct.

This paper presents the results of a statistical investigation of the trade-location relationship, using the OECD-STAN database, from 1970 to 1995. This investigation shows that in spite of rapidly rising trade, only in a very few industries has the spatial distribution changed substantially over the period studied. While intra-industry trade has risen across-the-board, locational concentration and specialization have increased little, if at all, in the European Union countries, and European economies remain much less specialized than equivalent regions of the USA.

The paper then tries to speculate as to why this might be the case. Much of the intra-industry trade observed in Europe is probably not intermediate divisions of labor (production sharing), but head-to-head competition of largely national industries competing around similar products, through cross-market penetration. The question is how they manage to survive as such in an age of globalization. One hypothesis is that there are evolutionary dynamics involved: mature national firms and production clusters have capacities to adapt to changing circumstances which permit them to survive in more open markets. One major technique for adaptation is product differentiation, both horizontal (making the same products as competitors, through uptake of global state-of-the-art knowledge) and vertical (quality differentiation, based on superior local knowledge). In this sense, the response of the European economies to globalization may reflect fundamentally different evolutionary dynamics from their American counterpart, whose regions integrated early on before they had mature industrial complexes, and where new industries tend to assume highly localized patterns, that serve as locational cores for the entire national industry.

Most importantly, all of this implies that we need to develop non-deterministic

theories of the relationship between trade and location, which take into account much more than the standard factors of comparative advantage and scale and integrate a dynamic evolutionary perspective.

Keywords: Globalization, locational specialization, product differentiation

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I. THEORETICAL PERSPECTIVES ON GLOBALIZATION AND LOCATION

Globalization creates anxieties, largely because of what trade theory and international economics say about its likely impacts on the geographical distribution of economic activities. Classical Ricardian trade theory, if applied directly to a world of decreasing trade barriers and transportation/transactions costs, suggests that comparative advantage effects will be freed up to play themselves out on a wider spatial scale, leading to rearrangement of activities on the landscape. The economies of places will generally become more specialized, clearer expressions of their globally-redefined comparative advantages (Ricardo, 1963;Balassa, 1963). The trade theory of the New International Economics (NIE) leads to a similar overall prediction, but for different reasons. Scale economies which could not be fully realized with higher transactions/transportation costs or trade barriers will progressively now find fuller expression (Ethier, 1982). This leads to greater locational concentration of activities, specialization of regional and national economies, and inter-industry trade among them (Helpman and Krugman, 1985). The two dynamics can combine, moreover, to heighten each other's effects.

These theories do not only concern inter-industry patterns of specialization and trade. Given that complex intermediate input-output systems characterize most of modern productive activity, comparative advantage or scale effects should encourage the international reorganization of commodity chains (*filières*), resulting in growing intra-industry trade. Thus, much of contemporary trade theory and international economics predicts that globalization will lead to more intra-industry specialization due to locational concentration. The NIE actually makes two very different predictions about possible overall effects of trade opening on the degree of specialization of regional economies. When referring to scale and comparative advantage effects on inter-industry trade, authors such as Krugman (1991) predict that the member countries of the European Union (EU), as they pursue their project of integration, will become more similar to regions of the United States, which are much more sectorally-specialized than territories of similar extent in Europe. But when they refer to integration through heightened intra-industry trade, they envision a Europe with little change in the overall level of specialization (and neutral effects on inter-country relative incomes as well). Countries with similar development levels (i.e. Northern Europe) will become more specialized in particular intermediate outputs in the same branch of production (Krugman and Venables, 1996). This will have the overall effect of preserving a dispersed locational pattern and avoiding "Americanization" of Europe's industrial geography.

In addition to those considered by the NIE, however, there are very likely other forms of trade which have an important impact on contemporary economic geography. First, it is

conceivable that some agglomerations due to scale economies are also based on parts of industries whose factor contents differ substantially, in the sense that the average quality of the outputs is higher in one agglomeration (country) than another, so that the value of factor services differs between places. If countries specialize in products of different quality levels, then there are potentially as many different locations as there are quality differentials within an industry. Moreover, agglomerations could be involved in either final outputs or in intermediate goods.

Second, internal economies of scale might lead to a similar result. It is possible under such conditions for the firms of different countries to specialize in final outputs within a given industry, but differentiated by their level of quality and hence the price they fetch in the market. World market integration brings together functionally similar products from formerly divided markets, which correspond to different quality-based preference rankings and consumer budgeting; hence, when the German and French car industries come into open contact with each other, the Germans are more specialized in better quality and more expensive cars than the French, and market integration tends to expand the markets for their vertically-differentiated final outputs, maintaining their differences rather than effacing them. At the same time, it is possible that smaller and/or lower-income countries beginning to trade with Germany and France enter with still lower-quality products, but that they benefit from upgrading due to increased foreign direct investment in the wake of opening to the more developed countries' firms. These quality differentials do not find themselves into most work on intra-industry trade (cf. Bergstrand, 1990).

Thus, the term "intra-industry trade" can include four very different phenomena: cross-hauling of functionally-similar final outputs (vertical and horizontal), and trade between countries involving different intermediate stages of a single *filière* or commodity chain, also vertical and horizontal. In addition, certain types of inter-industry trade (based on agglomeration economies) might also be vertically differentiated. The way that most research on trade is carried out (using sectoral nomenclatures), these are difficult to disentangle. When a French car firm imports its motors from Germany, and assembles cars in France, while exporting transmissions to a German car firm, this is frequently measured as intra-industry trade.[5] Or, a French car firm might import motors for some of its models from Germany, while other German firms might import their motors from French car firms. Trade could be horizontally similar or vertically differentiated by quality, in both cases. Trade could also be one-way, as when important computer components made only in the United States are imported into other countries (whether through intra-firm or inter-firm trade), and assembled

[5] One could argue that this is merely a measurement problem having to do with insufficiently disaggregated categories and this is a limitation of most empirical research on the subject.

into electronic goods. In other cases, a country will export components or partially-finished goods to another country, and the final product will subsequently be sold in the original home country. These are all examples of geographical divisions of labor around intermediate steps in a commodity chain, or what has come to be known as international "production sharing." They should have important effects on the geography of production in a world of expanding trade.

These are phenomena with potentially major long-term consequences for nations and regions. In light of this, it is surprising that, though there is a huge theoretical literature, and there is considerable empirical literature on trade alone, there is very little empirical literature on the relationships between trade, location, and specialization patterns. Specialization concerns the economies of territories (e.g. nations and sub-national regions). Changes in the degree of specialization of territorially-bounded economies (regions or nations) are brought about by changes in the degree of locational concentration or dispersion of industrial sectors. However, it is very difficult, methodologically and empirically, to bring the sectoral and the territorial levels together in a single model and data set. In this paper, we devote most of our attention to sectoral patterns of locational concentration and dispersion. Even this sectoral analysis is not simple, however**.** Data sets, for a consistent set of industry codes over time and for a large set of countries, at the three-digit or more[6] level of resolution, generally contain either trade or output (the proxy for location) information, but not both. So, most empirical research contents itself to analyze either trade or output, but as a result it cannot simultaneously show the relationship between increasing trade and the overall locational trends of different industries, over time and over a wide set of major trading countries. In what follows, we present the results of our investigation of the trade-location relationship in the two main areas identified by theory: the degree of locational concentration and the level of intra-industry trade. We carry this out at the level of the OECD (*Organisation for Economic Cooperation and Development*, consisting of 24 countries in our data set) as a whole, and then for 13 of the 15 EU countries, which are tied together by even higher levels of trade than the OECD as a whole. The investigation confirms the across-the-board increase in intra-industry trade, but locational concentration is not uniformly in evidence.

This preliminary finding, that many sectors in the EU and the OECD are not becoming geographically concentrated in the presence of rapidly increasing trade, calls for possible alternative explanations of the geographical developmental patterns of industries under conditions of increasing market openness.[7] We will argue, in the conclusion, and in a

[6] Indeed, this sort of analysis ideally would require data at the four- or even five-digit levels, so that patterns of production could be compared at the level of narrowly-defined product groups.

[7] The dearth of empirical research on location and trade, however, also reflects a theoretical bias of the mainstream literature, which holds that by analyzing trade volumes and the composition of trade flows,

deliberately speculative manner, that locational processes cannot be accurately derived from analysis of trade nor attributed entirely to comparative advantage and scale effects. Instead, we will suggest that a satisfactory explanation of the relationship between trade, location and economic development in the advanced countries has to take into account the ways that firms and regional economies position themselves in the face of increasing trade, notably through variety- and quality-based competition, which can have big effects on locational patterns. This in turn raises the issue of the competencies of its firms, which stem in part from the regional or national system of innovation in which they are situated and its evolutionary dynamics(Dosi, Pavitt and Soete, 1990). But all is not regional or national in this scenario of adjustment to trade: location patterns of industries are strongly affected by international flows of knowledge and ideas and their local appropriation and transformation (Eaton and Kortum, 1999). Finally, all of this suggests that the trade-location/development nexus is much less determinate than is implied by the standard approaches and that we remain far from having a satisfactory method by which to study this extremely important topic.

II. DATA AND METHODS

The relationship between trade and location is poorly understood in part because most of the time series international data which are available by industry sector at a reasonable level of detail (e.g. 3-digit or more) report either on trade or on output (along with employment and establishments, a standard proxy for location). This makes it impossible to analyse their effects on each other, over time. One of the few such data bases is that of the OECD-STAN *(Structural analysis Database)*.[8] It contains data on both trade and output for a consistently-defined set of two-, three-, and four-digit ISIC manufacturing sectors, for the OECD countries, who account for most of the trade and output in the world economy. The data are also available over time, annually for the period 1970 to 1994, during which trade

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we can derive what we need to know about international location. The logic of location will be reflected in the factor content of trade (comparative advantage and scale-induced productivity effects) and the extent to which this trade is intra-industry in nature. These assumptions are made even by the New International Economics (see Fujita, Krugman and Venables, 1999).

[8] The STAN (structural analysis database) was created to fill the gap between the detailed data collected through industrial surveys (such as those found in the OECD's ISIS database) which have limited international comparability, and national accounts data which are more internationally comparable but only available at fairly aggregate levels. Through the use of established estimation techniques, the OECD Secretariat has created a database that is compatible with national accounts for 22 countries. It covers 49 ISIC-defined manufacturing industries for six variables with annual data from 1970'. Cited from http://www.oecd.org/dsti/sti/stat-ana/index.htm. In this paper, we only use two of the variables, i.e. Export and Import, and Production. The other varables are Value added, Gross fixed capital formation, Number engaged and Labour compensation.

TABLE 1: OECD Ratio of Trade to output 1971-1994

SECTORS	1970-74	1975-79	1980-84	1985-89	1990-94
3 Total manufacturing	**0.13**	0.16	0.18	0.19	***0.22***
313 Beverages	**0.07**	0.08	0.09	0.10	***0.12***
314 Tobacco	**0.03**	0.04	0.06	0.09	***0.12***
321 Textiles	**0.14**	0.16	0.20	0.21	***0.25***
322 Wearing apparel	0.10	0.12	0.12	0.15	***0.19***
323 Leather & products	**0.16**	0.20	0.25	0.28	***0.32***
324 Footwear	**0.16**	0.22	0.27	0.31	***0.35***
331 Wood products	**0.08**	0.09	0.11	0.11	***0.12***
332 Furniture & fixtures	**0.04**	0.07	0.09	0.10	***0.12***
341 Paper & products	**0.12**	0.13	0.15	0.17	***0.19***
342 Printing & publishing	**0.04**	0.04	0.04	0.04	***0.04***
351 Industrial chemicals	**0.22**	0.26	0.31	0.35	***0.39***
352 Other chemicals	**0.10**	0.13	0.19	0.19	***0.22***
353 Petroleum refineries	0.09	**0.08**	0.10	0.11	***0.11***
354 Petroleum & coal products	***0.14***	0.13	0.13	**0.13**	0.13
355 Rubber products	**0.12**	0.16	0.20	0.21	***0.25***
356 Plastic products, nec	**0.06**	0.07	0.08	0.08	***0.09***
361 Pottery, China etc	**0.14**	0.15	0.16	0.16	***0.17***
362 Glass & products	**0.12**	0.14	0.17	0.18	***0.21***
369 Non-metallic products, nec	**0.05**	0.07	0.08	0.08	***0.09***
371 Iron & Steel	**0.13**	0.14	0.17	0.17	0.17
372 Non-ferrous metal	**0.15**	**0.15**	0.20	0.21	***0.22***
381 Metal products	**0.08**	0.11	0.14	0.13	0.14
382 Non-electrical machinery	**0.24**	0.29	0.29	0.32	***0.34***
383 Electrical machinery	**0.15**	0.20	0.22	0.22	***0.27***
384 Transport equipment	**0.23**	0.27	0.31	0.31	***0.35***
385 Professional goods	**0.18**	0.23	0.25	0.29	***0.33***
Total of 26 (3 digits) sectors	**0.14**	0.17	0.19	0.21	***0.23***

NOTE: Export Shares are categorized into **HIGH** (bold italics)= mean + one standard deviation, **MEDIUM** (normal) = mean, and **LOW** (bold) = mean – one standard deviation, by each row.

levels and the share of trade in output of 25 out of our 26 industries increased, with a strong increase in 23 of them.

Unfortunately, our data set does not include service industries. However, since most of the conceptual apparatus of trade and location theory, especially with regard to economies of scale, was developed with manufacturing in mind, the limitation of the exercise to manufacturing helps us target explanations of location in light of increasing trade. Obviously, future work will have to extend to the quantitatively more important service industries.

Another problem with the data is that they concern only the OECD countries. Though this gives us the lion's share of world trade, it means that in those manufacturing sectors with high levels of import or export to non-OECD countries the imports and exports

will not be symmetrical in the data set, foreclosing certain kinds of detailed trade flow analysis. This would be the case, for example, for the clothing industry, where the OECD countries export significant quantities of semi-finished goods to developing countries and import high quantities of finished product.

Since the data are reported by the OECD in national currency units, they had to be converted into a common unit and indexed to constant value. In addition to converting them all to 1997 dollars, using the U.S. *GDP deflator Index*,[9] we first converted the national data into Purchasing Power Parity units, using the OECD's PPP index.[10] This is the appropriate strategy in using the data to analyze location. Production data reflect the market value of output, not physical quantities. Production data can be even more distorted by exchange rate fluctuations, and so it is desirable to make them reflect something like a real, comparable value of output, such that within a narrowly-defined sector, a given value would correspond roughly to a given level of real, physical output. Of course, some distortion remains, since there are productivity differences between countries. But because we are analysing a sample of highly developed countries with roughly similar total factor productivity levels and limited variations in sectoral productivity,[11] it is a good guess that the correction from converting to PPP is greater than these differences.

We then carried out two tests on the output data, for each sector over time. The first is a test of locational evenness or unevenness, the Herfindahl equivalent index (HE),

$$HE_{i,R} = 1 \Big/ \sum_{j} \left(\frac{Y_{ij}}{Y_{i,R}}\right)^2$$

where Y is the value of output, i stands for the sector, j for the country, and R for regions, where R-EU is 13 countries in the European Union and R-OECD is 24 OECD member countries. A higher value of N corresponds to a lower spatial concentration, and a lower value of HE to greater spatial concentration, because HE is the number of spatial areas (in this case countries of the OECD) with the same share of production that would be necessary to observe the corresponding Herfindahl index, many or few.

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[9] Data obtained from Department of Commerce - Bureau of Economic Analysis. 1999

[10] Data obtained form 1998 edition of National Accounts Volume 1: Main Aggregates 1960-1996, page 174-175

[11] If underlying productivity levels were greatly different, then PPPs would be distorting. However, in most industrial sectors, the OECD countries fluctuate within a band of 85-105% of US productivity.

We then measured the level of intra-industry trade (IIT) with the Grubel-Lloyd index

$$GL_i = 1 - \frac{|X_{ij} - M_{ij}|}{X_{ij} + M_{ij}}$$

(Grubel and Lloyd, 1975):[12]

where: 0<GL<1, i stands for sector, j for country, X for exports and M for imports. To account for change, year-to-year fluctuations had to be eliminated, so we defined t_1 as the 1970-74 average of yearly means for the two indices, and t_2 as the 1990-94 average of yearly means, for each country and sector studied (Table 2).[13] The GL index is generally calculated as a measured of bilateral intra-industry exchanges, between a given country to a given trading partner and within a given sector. We adopted a slightly different approach, in that we calculated average GL indices for a given sector with respect to a group of countries (R), either 13 EU member countries or 24 OECD member countries.[14]

Then, in order to plot two indices with different scales (HE and GL), and two time periods with different means, the data were converted into the value of standard deviations from the mean in each period, i.e. z-scores(Table 2A). Each sector's z-score was then plotted according to its positions in t_1 and t_2 , with HE on the vertical axis and GL on the horizontal, as shown in Figure 1 for the OECD and Figure 2 for the EU.

[12] We will return, in the final section of this paper, to various problems generated by the choice of HE and GL measures. The GL index, as is well known, cannot distinguish between vertical (quality differentiated) and horizontal (factor-neutral differentiated) trade in final outputs, nor between cross-hauling of final outputs and intra-industry trade due to international divisions of labor within an industry (production sharing). Our HE index cannot distinguish between concentration due to many units as opposed to a big unit, as is possible with the alternative Ellison-Glaeser index. Our data set does not permit these distinctions, but they will be taken into accoung in the discussion in the final section of the paper.

[13] We are primarily interested in change over the entire period examined here, where trade underwent a very considerable increase, and therefore we do not analyze year-to-year fluctuations within the period.

[14] $GL_{i,R,t} = \frac{1}{R}\sum_j GL_{ij}$

Thus, it should also be specified that the trade measured is each country's intra-sectoral trade with the world as a whole.

TABLE 2: HE/GL table for OECD and EU

	OECD				EU			
	GL		HE		GL		HE	
	1970-74	1990-94	1970-74	1990-94	1970-74	1990-94	1970-74	1990-94
SECTORS	First period t_1	Last period t_2	First period t_1	Last period t_2	First period t_1	Last period t_2	First period t_1	Last period t_2
3 Total manufacturing	***0.85***	***0.87***	5.62	5.41	***0.87***	***0.88***	6.37	6.19
313 Beverages	0.47	0.65	***6.78***	***6.73***	0.54	0.72	5.05	6.32
314 Tobacco	0.49	**0.43**	5.97	5.01	0.57	**0.55**	**4.15**	4.99
321 Textiles	***0.68***	***0.74***	6.47	5.64	***0.77***	0.80	6.29	5.55
322 Wearing apparel	0.53	**0.47**	5.04	5.81	0.58	**0.58**	6.10	5.54
323 Leather & products	***0.69***	0.64	***7.86***	6.05	***0.77***	0.75	6.09	**3.89**
324 Footwear	**0.36**	**0.35**	***6.80***	6.06	**0.44**	**0.45**	5.40	**3.88**
331 Wood products	**0.41**	**0.45**	5.24	4.27	**0.39**	**0.50**	***7.12***	***7.51***
332 Furniture & fixtures	0.56	0.61	6.49	6.16	0.60	0.68	6.50	5.68
341 Paper & products	**0.45**	0.57	5.24	4.57	**0.46**	**0.60**	***7.69***	***7.48***
342 Printing & publishing	0.59	0.63	**4.31**	**4.20**	0.71	0.75	***6.60***	***6.77***
351 Industrial chemicals	0.62	0.72	5.96	5.11	0.67	0.76	5.93	6.28
352 Other chemicals	0.58	0.62	5.20	4.97	0.63	0.69	5.59	5.78
353 Petroleum refineries	**0.44**	0.67	5.19	5.18	**0.48**	0.76	5.72	5.86
354 Petroleum & coal products	**0.43**	0.65	5.42	**4.21**	**0.45**	0.72	**4.93**	**4.38**
355 Rubber products	0.54	0.64	5.11	5.43	0.66	0.76	5.79	5.58
356 Plastic products, nec	0.63	0.68	5.85	5.18	***0.76***	0.79	5.91	5.78
361 Pottery, China etc	0.48	0.56	***6.77***	4.65	0.63	0.76	**4.63**	**2.98**
362 Glass & products	0.57	0.68	5.77	***6.44***	0.70	0.77	5.81	5.71
369 Non-metallic products, nec	***0.66***	0.70	***6.71***	***7.29***	0.72	0.74	6.18	6.48
371 Iron & Steel	0.59	***0.76***	5.44	4.86	0.65	0.75	5.75	5.42
372 Non-ferrous metal	0.56	0.70	5.48	5.68	0.64	0.77	6.11	5.22
381 Metal products	***0.66***	***0.74***	4.88	5.36	***0.76***	***0.83***	6.35	5.56
382 Non-electrical machinery	0.56	0.66	5.05	5.30	0.65	0.76	**4.90**	5.01
383 Electrical machinery	0.63	0.71	5.74	4.72	***0.77***	***0.86***	5.01	4.95
384 Transport equipment	0.57	0.66	4.62	4.92	0.61	0.75	5.50	4.88
385 Professional goods	0.50	0.63	**2.38**	**2.33**	0.59	0.72	**4.80**	4.99
3' Total of 26 sectors	***0.76***	***0.81***	5.57	5.32	***0.83***	***0.88***	6.16	5.92
CLASSIFICATION								
HIGH = Mean + one Standard Deviation	***0.64***	***0.73***	***6.66***	***6.21***	***0.73***	***0.81***	***6.55***	***6.51***
MEDIUM = Mean	0.55	0.63	5.61	5.24	0.62	0.72	5.76	5.48
LOW = Mean + one Standard Deviation	**0.46**	**0.53**	**4.56**	**4.26**	**0.51**	**0.62**	**4.97**	**4.45**
Standard Deviation	0.09	0.10	1.05	0.98	0.11	0.10	0.79	1.03
Mean	0.55	0.63	5.61	5.24	0.62	0.72	5.76	5.48
Median	0.56	0.65	5.46	5.18	0.64	0.75	5.80	5.56

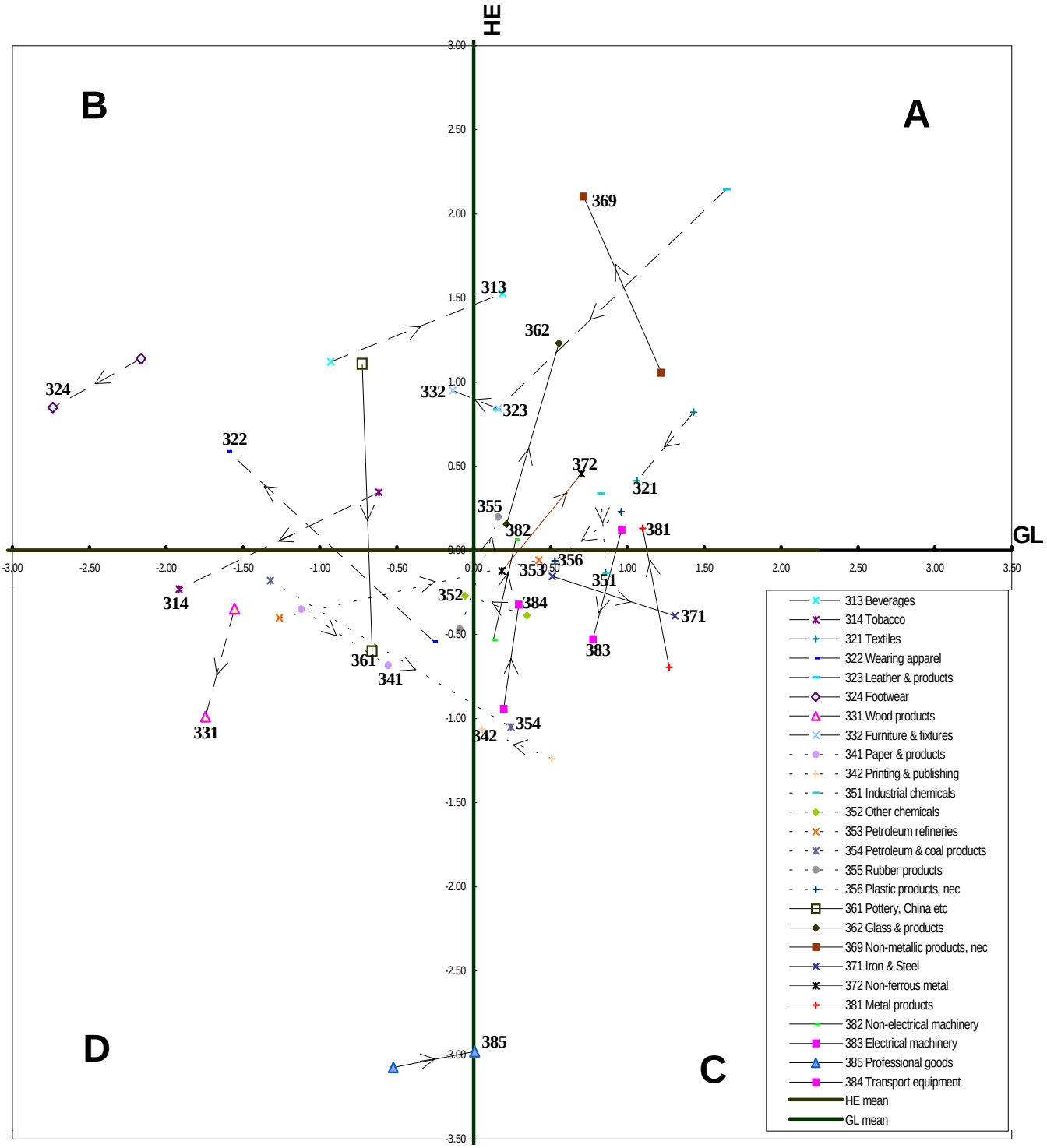
NOTE: HE and GL indices are categorized into **HIGH** (bold italics)= mean + one standard deviation, **MEDIUM** (normal) = mean, and **LOW** (bold) = mean – one standard deviation, by column.

TABLE 2a: Standardized HE/GL table for OECD and EU

	OECD				EU			
	GL		HE		GL		HE	
	1970-74	1990-94	1970-74	1990-94	1970-74	1990-94	1970-74	1990-94
SECTORS	First period t_1	Last period t_2	First period t_1	Last period t_2	First period t_1	Last period t_2	First period t_1	Last period t_2
313 Beverages	-0.93	0.19	***1.12***	***1.53***	-0.76	0.00	-0.90	0.82
314 Tobacco	-0.62	**-1.92**	0.34	-0.23	-0.49	**-1.66**	**-2.05**	-0.47
321 Textiles	***1.43***	***1.06***	0.82	0.41	***1.33***	0.88	0.67	0.07
322 Wearing apparel	-0.26	**-1.60**	-0.54	0.59	-0.40	**-1.35**	0.43	0.05
323 Leather & products	***1.64***	0.15	***2.15***	0.84	***1.34***	0.32	0.42	**-1.55**
324 Footwear	**-2.16**	**-2.74**	***1.14***	0.85	**-1.67**	**-2.63**	-0.47	**-1.55**
331 Wood products	**-1.55**	**-1.74**	-0.35	-0.99	**-2.10**	**-2.16**	***1.71***	***1.97***
332 Furniture & fixtures	0.16	-0.14	0.84	0.95	-0.19	-0.40	0.93	0.20
341 Paper & products	**-1.12**	-0.56	-0.35	-0.68	**-1.49**	**-1.16**	***2.44***	***1.94***
342 Printing & publishing	0.51	0.05	**-1.24**	**-1.06**	0.78	0.35	***1.06***	***1.25***
351 Industrial chemicals	0.83	0.86	0.34	-0.13	0.42	0.50	0.21	0.77
352 Other chemicals	0.35	-0.06	-0.39	-0.27	0.08	-0.22	-0.22	0.29
353 Petroleum refineries	**-1.26**	0.42	-0.40	-0.06	**-1.27**	0.44	-0.06	0.37
354 Petroleum & coal products	**-1.32**	0.24	-0.18	**-1.05**	**-1.53**	0.03	**-1.05**	**-1.07**
355 Rubber products	-0.09	0.16	-0.47	0.20	0.31	0.49	0.03	0.10
356 Plastic products, nec	0.96	0.53	0.23	-0.06	***1.24***	0.78	0.19	0.29
361 Pottery, China etc	-0.72	-0.66	***1.11***	-0.60	0.05	0.47	**-1.44**	**-2.43**
362 Glass & products	0.21	0.55	0.16	***1.23***	0.71	0.60	0.05	0.23
369 Non-metallic products, nec	***1.22***	0.71	***1.06***	***2.11***	0.87	0.29	0.52	0.97
371 Iron & Steel	0.51	***1.31***	-0.15	-0.39	0.24	0.34	-0.02	-0.06
372 Non-ferrous metal	0.18	0.70	-0.12	0.46	0.16	0.59	0.44	-0.25
381 Metal products	***1.27***	***1.10***	-0.70	0.13	***1.22***	***1.16***	0.75	0.08
382 Non-electrical machinery	0.13	0.28	-0.53	0.06	0.22	0.50	**-1.10**	-0.46
383 Electrical machinery	0.96	0.78	0.12	-0.53	***1.28***	***1.46***	-0.96	-0.52
384 Transport equipment	0.19	0.29	-0.94	-0.32	-0.09	0.37	-0.33	-0.58
385 Professional goods	-0.52	0.01	**-3.07**	**-2.98**	-0.26	0.02	**-1.23**	-0.47
CLASSIFICATION								
HIGH = Mean + one Standard Deviation	***1.00***	***1.00***	***1.00***	***1.00***	***1.00***	***1.00***	***1.00***	***1.00***
MEDIUM = Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LOW = Mean + one Standard Deviation	**-1.00**	**-1.00**	**-1.00**	**-1.00**	**-1.00**	**-1.00**	**-1.00**	**-1.00**
Standard Deviation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Median	0.17	0.21	-0.14	-0.06	0.12	0.34	0.04	0.08

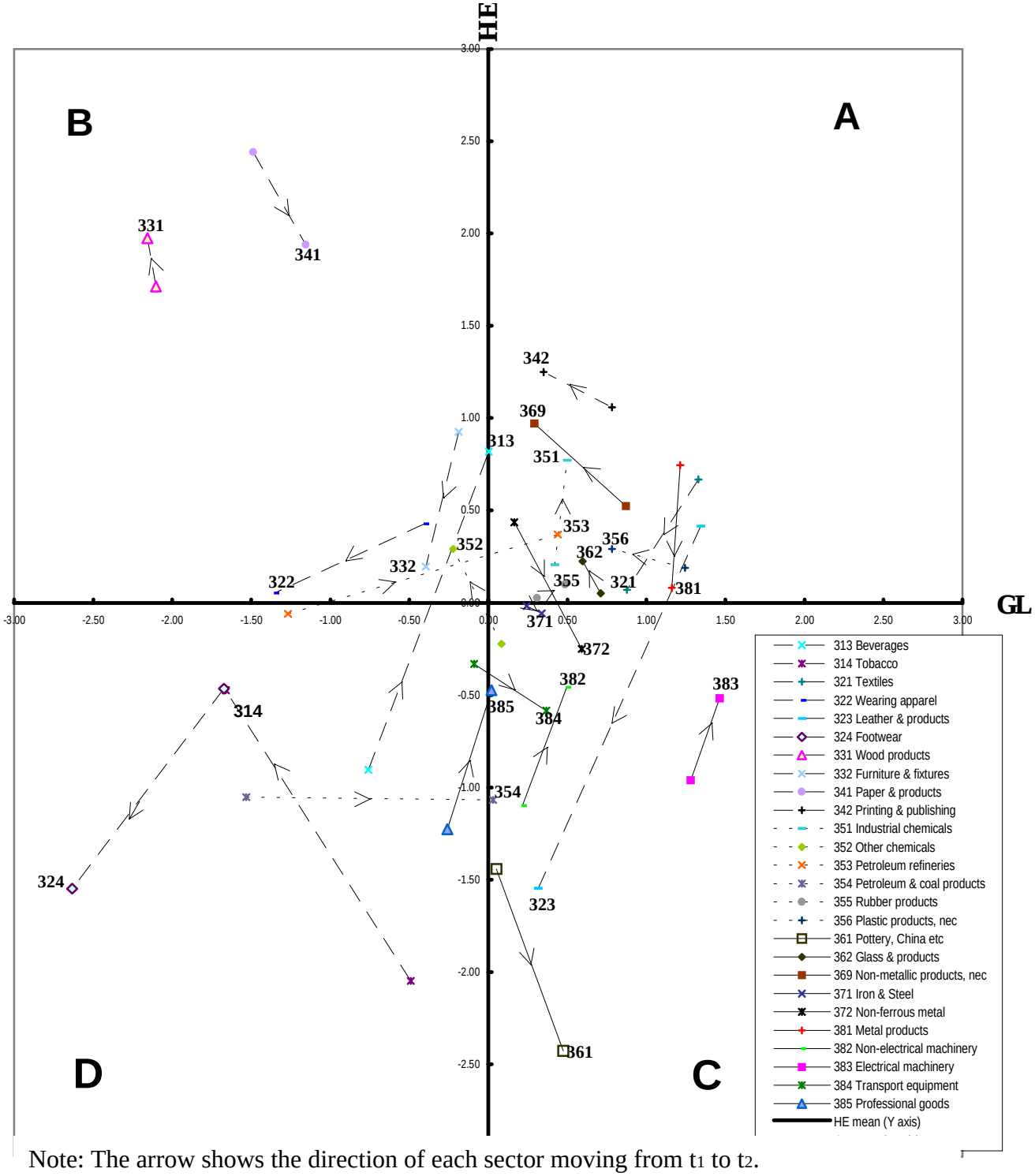
NOTE: HE and GL indices are categorized into **HIGH** (bold italics)= mean + one standard deviation, **MEDIUM** (normal) = mean, and **LOW** (bold) = mean – one standard deviation, by column.

Figure 1: OECD HE-GL Z- Score Plot



Note: The arrow shows the direction of each sector moving from t_1 to t_2.

Figure 2: EU HE-GL Z- Score Plot



Note: The arrow shows the direction of each sector moving from t_1 to t_2.

Using the means to define the x and y axes creates a worry, since means are statistical devices whose values do not necessarily correspond to any real threshholds of difference in the concrete reality of industrial sectors. This could pose problems when, as we shall see below, we attempt to analyze changes in positions between the four quadrants which are generated by using means. To provide a check on this possibility, we therefore carried out a second analysis of the t_1 and t_2 positions of the sectors, this time grouping them exclusively according to the direction of change in the two indices, and ignoring absolute position. To do this we simply analyzed the angle of the line joining the t_1 and t_2 positions for each sector. Tables 5 and 6 show the results of this analysis. The purpose of this directional analysis is to understand the tendency of HE and GL over time, regardless of their original positions (the quadrant in which they are situated at t_1 in the HE-GL graphs).

Table 3: OECD HE-GL Positional Data **(Value in 1997 billion US)**

DESTINATION (1990-1994)																										TOTAL					
Position		A						B							C							D									
Positi	SEC	Prod.		Export		Import		SEC	Prod.		Export		Import		SEC	Prod.		Export		Import		SEC	Prod.		Export		Import		Prod.		Export		Import	
		First t_1	Last t_2	First t_1	Last t_2	First t_1	Last t_2		First t_1	Last t_2	First t_1	Last t_2	First t_1	Last t_2		First t_1	Last t_2	First t_1	Last t_2	First t_1	Last t_2		First t_1	Last t_2	First t_1	Last t_2	First t_1	Last t_2	First t_1	Last t_2	First t_1	Last t_2	First t_1	Last t_2
A	321	398	297	55	75	48	90	332	116	159	5	19	5	22	351	353	461	80	177	65	159													
	323	34	31	5	10	6	15								356	117	280	7	24	7	35													
	369	183	213	9	18	7	15								383	503	916	76	243	62	247													
	362	54	68	7	14	6	13																				Total	1758	2427	246	581	207	597
																											Share	***27***	28	***27***	29	***27***	31
B	313	158	191	12	23	10	20	324	46	41	8	14	6	24								314	92	108	2	13	1	8						
																						361	23	30	3	5	3	6	319	370	25	54	20	58
																											Share	***5***	4	***3***	3	***3***	3
C	372	202	211	31	46	48	56								342	228	435	8	18	7	16	352	256	430	25	95	20	82						
	381	451	548	35	76	25	70								371	595	424	77	70	53	62													
	382	642	965	156	331	105	290								384	766	1230	177	425	121	367							Total	3138	4244	511	1062	380	944
																											Share	***49***	50	***56***	54	***50***	49
D	355	88	89	11	22	8	22	322	195	180	20	34	26	78	353	271	400	24	43	36	59	331	197	218	15	26	23	34						
															354	28	36	4	5	4	5	341	259	358	32	67	31	61						
															385	146	230	26	77	23	77							Total	1185	1511	133	273	151	335
																											Share	***19***	18	***15***	14	***20***	17
Total		2210	2614	322	615	264	593		357	380	33	67	37	124		3007	4413	481	1084	379	1027		827	1144	78	205	78	191	6400	8551	914	1971	758	1935
Share %		35	***31***	35	***31***	35	***31***		6	***4***	4	***3***	5	***6***		47	***52***	53	***55***	50	***53***		13	***13***	9	***10***	10	***10***	100	100	101	100	100	100

TABLE 4: EU HE-GL Positional Data **(Value in 1997 billion US)**

ORIGIN (1970-1974) Position	SEC	DESTINATION (1990-1994) A Prod. First t_1	A Prod. Last t_2	A Export First t_1	A Export Last t_2	A Import First t_1	A Import Last t_2	SEC	B Prod. First t_1	B Prod. Last t_2	B Export First t_1	B Export Last t_2	B Import First t_1	B Import Last t_2	SEC	C Prod. First t_1	C Prod. Last t_2	C Export First t_1	C Export Last t_2	C Import First t_1	C Import Last t_2	SEC	D Prod. First t_1	D Prod. Last t_2	D Export First t_1	D Export Last t_2	D Import First t_1	D Import Last t_2	TOTAL Prod. First t_1	TOTAL Prod. Last t_2	TOTAL Export First t_1	TOTAL Export Last t_2	TOTAL Import First t_1	TOTAL Import Last t_2
A	321	199	146	41	58	35	60								323	21	18	4	8	4	9													
	342	85	148	6	13	4	10								372	79	77	19	25	33	33													
	351	177	207	54	117	49	114																										
	355	39	37	8	15	6	14																										
	356	51	114	6	19	5	19																										
	362	26	35	5	10	4	9																										
	369	89	109	8	15	6	11																										
	381	187	235	25	56	18	45																				Total			952	1127	176	335	162	323
																											Share			***34***	32	***29***	28	***33***	28
B								322	87	81	18	30	17	42																			
								331	72	71	9	12	14	18																			
								332	58	79	5	15	4	13																			
								341	98	124	18	39	21	41													Total			315	355	49	96	57	114
																											Share			***11***	10	***8***	8	***11***	10
C								352	117	183	19	68	15	57	371	257	160	50	52	37	42												
															382	272	405	105	190	74	168												
															383	228	342	45	122	41	130												
															361	16	22	2	4	2	3						Total			889	1112	220	435	168	400
																											Share			***32***	32	***37***	36	***34***	35
D	313	93	95	11	20	6	13								354	13	16	3	3	4	3	314	56	49	2	5	1	6						
	353	130	183	21	30	19	32								384	279	460	94	225	61	198	324	29	29	7	13	3	12						
															385	33	51	15	40	15	45						Total			633	884	153	337	110	309
																											Share			***23***	25	***26***	28	***22***	27
Total		1075	1309	185	352	150	326		432	538	68	164	71	171		1196	1552	336	669	271	631		85	78	9	19	5	18	2789	3478	598	1204	496	1146
Share %		39	***38***	31	***29***	30	***28***		15	***15***	11	***14***	14	***15***		43	***45***	56	***56***	55	***55***		3	2	1	2	1	***2***	100	99	100	100	100	100

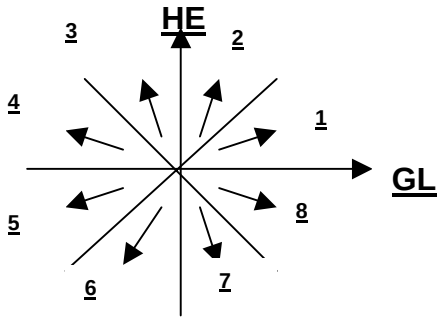
Table 5: OECD HE-GL Directional Analysis (Values in Billions of 1997 US)

Direction	Sector	Production		Exports		Imports	
		t_1	t_2	t_1	t_2	t_1	t_2
1	**313**	158	191	12	23	10	20
	353	271	400	24	43	36	59
	385	146	230	26	77	23	77
	Total	575	822	62	143	69	156
	Share	**9%**	**10%**	**7%**	**7%**	**9%**	**8%**
	Net Change		247		81		87
	Percent of Total Change		**11%**		**8%**		**7%**
2	**355**	88	89	11	22	8	22
	362	54	68	7	14	6	13
	372	202	211	31	46	48	56
	382	642	965	156	331	105	290
	384	766	1230	177	425	121	367
	Total	1,752	2,563	382	838	289	749
	Share	**27%**	**30%**	**42%**	**43%**	**38%**	**39%**
	Net Change		811		456		460
	Percent of Total Change		**38%**		**43%**		**39%**
3	**369**	183	213	9	18	7	15
	381	451	548	35	76	25	70
	Total	633	761	45	95	33	86
	Share	**10%**	**9%**	**5%**	**5%**	**4%**	**4%**
	Net Change		128		50		53
	Percent of Total Change		**6%**		**5%**		**4%**
4	**322**	195	180	20	34	26	78
	332	116	159	5	19	5	22
	342	228	435	8	18	7	16
	352	256	430	25	95	20	82
	Total	794	1,205	59	166	58	199
	Share	**12%**	**14%**	**6%**	**8%**	**8%**	**10%**
	Net Change		411		107		141
	Percent of Total Change		**19%**		**10%**		**12%**
5	**314**	92	108	2	13	1	8
	323	34	31	5	10	6	15
	324	46	41	8	14	6	24
	356	117	280	7	24	7	35
	Total	289	460	23	61	21	82
	Share	**5%**	**5%**	**2%**	**3%**	**3%**	**4%**
	Net Change		171		38		61
	Percent of Total Change		**8%**		**4%**		**5%**
6	**321**	398	297	55	75	48	90
	331	197	218	15	26	23	34
	383	503	916	76	243	62	247
	Total	1,098	1,431	147	344	134	372
	Share	**17%**	**17%**	**16%**	**17%**	**18%**	**19%**
	Net Change		333		198		238
	Percent of Total Change		**15%**		**19%**		**20%**
7	**351**	353	461	80	177	65	159
	361	23	30	3	5	3	6
	Total	376	491	83	182	68	165
	Share	**6%**	**6%**	**9%**	**9%**	**9%**	**9%**
	Net Change		115		99		97
	Percent of Total Change		**5%**		**9%**		**8%**
8	**341**	259	358	32	67	31	61
	354	28	36	4	5	4	5
	371	595	424	77	70	53	62
	Total	883	818	113	142	88	127
	Share	**14%**	**10%**	**12%**	**7%**	**12%**	**7%**
	Net Change		(65)		29		39
	Percent of Total Change		**-3%**		**3%**		**3%**
	Grand Total	6,400	8,551	914	1,971	758	1,935
	Share	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	Total Net Change		2,151		1,057		1,177
	Percent of Total Change		**100%**		**100%**		**100%**

Table 6: EU HE-GL Directional Analysis

Direction	Sector	Production		Exports		Imports	
		t_1	t_2	t_1	t_2	t_1	t_2
1	**353**	130	183	21	30	19	32
	355	39	37	8	15	6	14
	Total	169	220	29	45	24	46
	Share	**6%**	**6%**	**5%**	**4%**	**5%**	**4%**
	Net Change		51		15		21
	Percent of Total Change		**7%**		**3%**		**3%**
2	**313**	93	95	11	20	6	13
	351	177	207	54	117	49	114
	382	272	405	105	190	74	168
	383	228	342	45	122	41	130
	385	33	51	15	40	15	45
	Total	802	1,101	229	489	184	469
	Share	**29%**	**32%**	**38%**	**41%**	**37%**	**41%**
	Net Change		298		260		285
	Percent of Total Change		**43%**		**43%**		**44%**
3	**314**	56	49	2	5	1	6
	331	72	71	9	12	14	18
	352	117	183	19	68	15	57
	362	26	35	5	10	4	9
	Total	272	339	35	96	34	90
	Share	**10%**	**10%**	**6%**	**8%**	**7%**	**8%**
	Net Change		67		61		55
	Percent of Total Change		**10%**		**10%**		**9%**
4	**342**	85	148	6	13	4	10
	356	51	114	6	19	5	19
	369	89	109	8	15	6	11
	Total	224	371	19	47	15	40
	Share	**8%**	**11%**	**3%**	**4%**	**3%**	**3%**
	Net Change		146		27		25
	Percent of Total Change		**21%**		**5%**		**4%**
5	**322**	87	81	18	30	17	42
	Total	18	30	17	42	17	42
	Share	**3%**	**2%**	**3%**	**2%**	**3%**	**4%**
	Net Change		(6)		12		25
	Percent of Total Change		**-1%**		**2%**		**4%**
6	**321**	199	146	41	58	35	60
	323	21	18	4	8	4	9
	324	29	29	7	13	3	12
	332	58	79	5	15	4	13
	381	187	235	25	56	18	45
	Total	493	507	82	150	64	139
	Share	**18%**	**15%**	**14%**	**12%**	**13%**	**12%**
	Net Change		14		68		75
	Percent of Total Change		**2%**		**11%**		**12%**
7	**341**	98	124	18	39	21	41
	361	16	22	2	4	2	3
	372	79	77	19	25	33	33
	Total	193	223	39	68	56	77
	Share	**7%**	**6%**	**7%**	**6%**	**11%**	**7%**
	Net Change		30		29		22
	Percent of Total change		**4%**		**5%**		**3%**
8	**371**	257	160	50	52	37	42
	354	13	16	3	3	4	3
	384	279	460	94	225	61	198
	Total	549	636	147	280	102	244
	Share	**20%**	**18%**	**25%**	**23%**	**21%**	**21%**
	Net Change		87		133		141
	Percent of Total Change		**13%**		**22%**		**22%**
	Total	2,789	3,478	598	1,204	496	1,146
	Share	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	Total Net Change		688		606		650
	Percent of Total Change		**100%**		**100%**		**100%**

Note: The direction is constructed in the following way: Example: Direction 1 and 2 refer to a sector has increase in HE and GL from 70s to 90s, which means increase in location spread with increasing intra-industry trade. Direction 3 and 4 refer to increase in locational spread and decrease in intra-industies trade. Direction 5 and 6 show decrease in locational spread (or increase in concentration) with decrease in intra-industries trade. Direction 7 and 8 show decrease in locational spread with increase in intra-industries trade.



As we shall see, the two methods indicate very similar tendencies, albeit with somewhat different magnitudes. Thus, we can be confident that the overall story about change in location and its relationship to levels of intra-industry trade that we are about to tell is not merely an artifice of our cutoff points between categories.

III. THE MAIN TENDENCIES

Before examining the complex relationships between intra-industry trade and locational patterns, we first examined the tendencies in each of our main indices. Regressions across time – which measure the temporal strength and directional consistency of the evolution of the index -- were run, using as dependent variables the Grubel-Lloyd (GL) or Herfindahl equivalent coefficients(HE) across all years, on a year index and holding industry levels effects constant with dummy variables. The results for the GL and HE regressions are markedly different.

Table 7: Summary Results of OLS Regression Across Time, 1970-1994

I GRUBEL-LLOYD (GL)		**Parameter**	**T –stat**	**Adjusted R^2**
A. EU	Regression 1	0.004611	23.522	0.8942
B. OECD	Regression 1	0.003892	21.290	0.8815
II HERFINDAHL EQUIVALENT INDEX (HE)				
A. EU	Regression 1	0.013093	-6.698	0.8630
B. OECD	Regression 1	-0.017303	-8.644	0.8716

Intra-industry trade is increasing with remarkable constancy, across nearly all industries, and in both the EU and the OECD**.** For the OECD, the overall parameters on both regressions are positive and strongly significant for 22 out of 26 sectors (sectoral data are not reported in the table). For the EU, the parameters are greater. This is probably because the dismantling of trade barriers and progress of integration has been even faster within Europe than within the OECD overall in the period under examination. These regression results are supported by the box diagram for the GL coefficients in Figures 3 and 4. There is more dispersion of the GL ratios in the OECD than in the EU, but in both, there are significant differences between industries, possibly having to do with durable inter-industry differences, possibly to different phases of their development.

Figure 3: OECD GL Box Plot 1970-1994

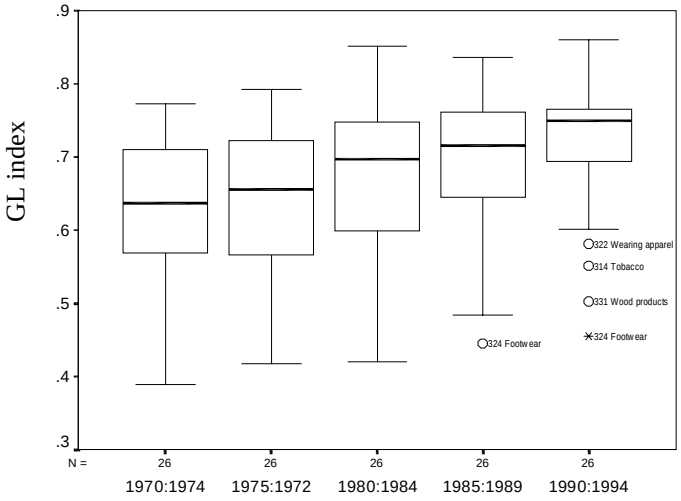


Figure 4: EU GL Box Plot 1970-1994

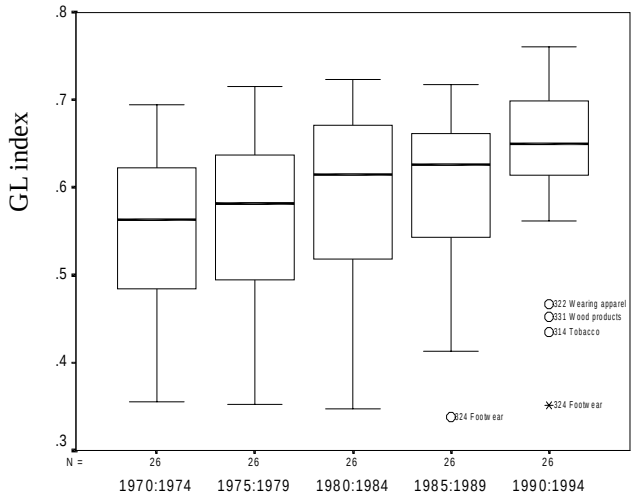


Figure 5: OECD HE Box Plot 1970-1994

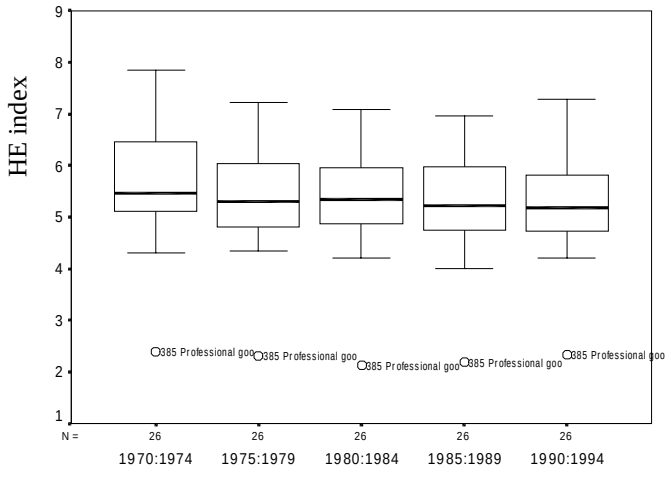
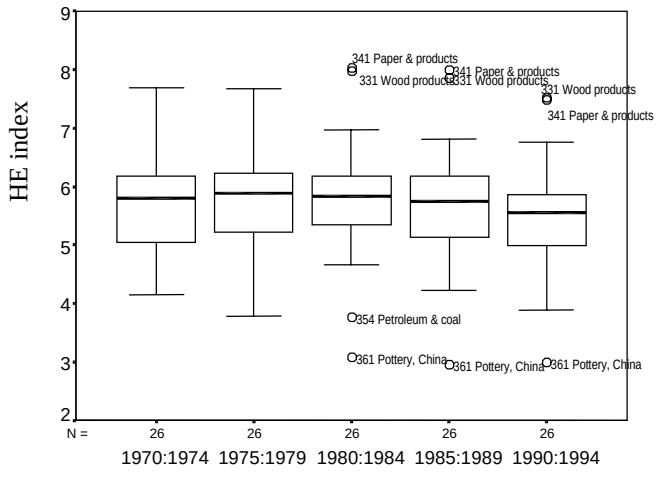


Figure 6: EU HE Box Plot 1970-1994



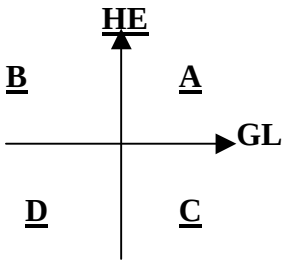
The story is quite different when it comes to the locational tendencies of industries. For the OECD, the time series regressions for the HE have parameters that are both weakly negative. In the second test, moreover, the t-statistic suggests a non-robust result, and the industry-by-industry results are extremely heterogeneous. For the European Union, the first parameter is weakly negative but robust, while the second is weakly positive and not robust, again with great variability from sector to sector. This lack of clear tendency can be seen in the box diagram. What this suggests – as we shall argue in more detail shortly -- is that in fact increasing trade is not leading all industries in the direction of greater locational concentration. It can safely be said that intra-industry trade is steadily and consistently increasing, whereas locational tendencies are much more varied.

The heart of our investigation consists in combining the two indices and then tracking the changes in position over time for each of the 26 three-digit sectors. As noted in the previous section, this was done in two ways, via analysis of position (Figures 1 and 2; Tables 3 and 4) and through an analysis of direction of change (Tables 5 and 6). In the northeast quadrant (A), we find high levels of IIT and low levels of locational concentration (high HE, high GL); in the southeast quadrant (C),high levels of IIT and high levels of locational concentration (low HE, high GL); in the northwest quadrant (B), there are low levels of IIT and low levels of geographical concentration (low GL and high HE); and finally in the southwest quadrant (D), there are low levels of IIT and high levels of geographical concentration (low GL and low HE). Of course, and as noted, these are stylized descriptions and industries which are close to the medians are more ambiguous cases in reality.

Table 8. Summary of HE-GL Positional Analysis (in percentage)

OECD	Production	Export	Import
HE-GL Position	$t_1 \rightarrow t_2$	$t_1 \rightarrow t_2$	$t_1 \rightarrow t_2$
A	27%(8) → 31%(9)	27%(8) → 31%(9)	27%(8) → 31%(9)
B	5%(4) → 4%(3)	3%(4) → 3%(3)	3%(4) → 6%(3)
C	49%(7) → 52%(9)	56%(7) → 55%(9)	50%(7) → 53%(9)
D	19%(7) → 13%(5)	15%(7) → 10%(5)	20%(7) → 10%(5)

EU	Production	Export	Import
HE-GL Position	$t_1 \rightarrow t_2$	$t_1 \rightarrow t_2$	$t_1 \rightarrow T_2$
A	34%(10) → 38%(10)	29%(10) → 29%(10)	33%(10) → 28%(10)
B	11%(4) → 15%(5)	8%(4) → 14%(5)	11%(4)) → 15%(5)
C	32%(5) → 45%(9)	37%(5) → 56%(9)	34%(5) → 55%(9)
D	23%(7) → 2%(2)	26%(7) → 2%(2))	22%(7) → 2%(2)



Note: The value in parentheses refers to number of sectors 3-digit sectors in each period. It shows the change in number of sectors from t_1 to t_2.

We may begin with Table 8 (OECD Origins t_1 + destinations t_2). The totals for the columns indicate the percentages of production, exports and imports for the industries which had a given quadrant as its destinations. Thus, for example, the sectors which ended up in quadrant A in t_2 accounted for 31% of the total production of the sectors in our sample. In t_1, these sectors accounted for 27% of total production, but they were not all in quadrant A at that time. To find out how much of total production was actually in quadrant A in t_1, one must look at the first figure in the quadrant A row in Tables 3 and 4, which is 27%**.**

By reading the column totals for each quadrant we can measure the relative growth or decline of the sectors that were going toward each group, and here things are quite clear for the OECD: the growing sectors are going predominantly toward destination C, with A suffering a slight decline in its share but remaining very important, while the B and D destinations are small and B is declining in importance. By reading the changes in row totals, we find out that origins were not so important as destinations: production shares did not undergo big changes by origins, presumably because industries underwent considerable restructuring during this period, causing them to move from one destination category to another.

The actual shifts in shares of production, exports and imports for the industries in each quadrant for t_1 and t_2, for the OECD, are rather modest. For output, 12 sectors which start out with low locational concentration (in A and B quadrants) show an increase in their share of production from 32% to 35%, while the 14 sectors initially with high locational concentration (in quadrants C and D), experience a slight decline in their share of production, from 68% to 65%. There is growth in the share of sectors with IIT above the GL mean, from 76% to 83% (production shares of A+C). In general, category C accounts for more than half of total production, exports, and imports. This first glance at the evidence thus suggests a picture which does not conform to the predictions of standard theory; in a period of strongly growing overall trade, sectoral locational concentration appears not to have increased across the board.

The EU countries are following a pathway which resembles that of the OECD in its broadest outlines, but there are several important differences as well. The shares of A and B actually increase from 45% to 53%, for 14 and 15 sectors, respectively. The sectors with above-mean IIT increase their share of production from 66**%** to 83% , almost exactly as in the OECD. This implies that the widely-held idea that the EU is simply less far down the pathway -- toward locational concentration and growing intermediate trade -- traced out by the OECD, is not correct, since in the EU there was an important increase in the share of industries with locational dispersion greater than the mean.

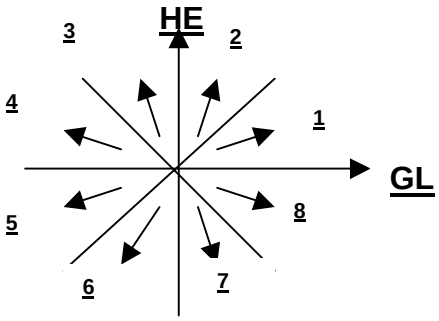
But things are more complex than this in the European case. Even though the overall directions of change are similar, the magnitudes remain very far apart. According to the production data in Table 8,

Table 9. Summary of HE-GL Directional Analysis (in percentage)

OECD	Production	Export	Import
HE-GL Direction	$t_1 \rightarrow t_2$	$t_1 \rightarrow t_2$	$t_1 \rightarrow t_2$
1(2) + 2(6)	36% → 40%	49% → 50%	47% → 47%
3(2) + 4(4)	22% → 23%	11% → 13%	12% → 14%
5(4) + 6(3)	23% → 23%	18% → 20%	21% → 23%
7(3) + 8(2)	20% → 16%	21% → 16%	21% → 16%

EU	Production	Export	Import
HE-GL Direction	$t_1 \rightarrow t_2$	$t_1 \rightarrow t_2$	$t_1 \rightarrow t_2$
1(3) + 2(5)	35% → 38%	43% → 45%	43% → 45%
3(4) + 4(3)	18% → 21%	9% → 12%	10% → 12%
5(1) + 6(5)	21% → 17%	17% → 14%	16% → 16%
7(3) + 8(2)	27% → 24%	32% → 29%	32% → 29%

NOTE: The number in parentheses refers to number of 3-digit sectors in each direction.
Directions 1 + 2 refer to increase in production spread (HE) and increase in intra-industry trade (GL).
Directions 3 + 4 refer to increase in production spread (HE) and decrease in intra-industry trade (GL).
Directions 5 + 6 refer to decrease in production spread (HE) and decrease in intra-industry trade (GL).
Directions 7 + 8 refer to decrease in production spread (HE) and increase in intra-industry trade (GL).



the shares of locationally deconcentrated sectors in the EU are much larger than in OECD in the second period (53% versus 35%). More importantly, as indicated in Tables 3 and 4, inter-quadrant mobility is higher for the OECD than the EU, although both show increases in quadrants A and C. Thus, sectoral locational patterns in the EU are more stable than in the OECD, with less inter-quadrant movement of sectors. Most of the EU sectors end up in the same quadrant from which they originated, and this is especially pronounced for quadrant A of the EU. For the OECD, the origins are quite diverse, and the destinations more concentrated. Put another way, the distribution of sectors is more concentrated on the diagonals for Table 4 (EU) than Table 3(OECD).

As was noted, we wanted to be sure that the four categories employed above are not mere statistical artifacts, since the means used to establish their borders are mere statistical artifacts. Thus, we undertook a second analysis, where we analyzed the direction of change of each industry, irrespective of its position. The pie chart next to Table 9 shows graphically the directions of change whose realization would correspond to the four destination categories used in Figures 1 and 2. Thus, directions of change 1+2 ultimately would place industries in destination A, 3+4 in B, 5+6 in D, and 7 +8 in C. But since these are tendencies rather than destinations, the sectors in each category do not necessarily correspond to those in the destination categories analyzed above. Tables 5 and 6 show the directional numbers, Table 9

summarizes the production, import and export data and compares it in a simplified way to the destination analysis. Table 10 then summarizes the shares of change accounted for by industries going in

Table 10: Share of Total Change in HE-GL directional analysis (in percentage)

OUTPUT		**GL** (Intra-Industrial Trade)	
		High	Low
HE (Production Spread)	High	(direction 1 + 2) OECD: 49% EU: 50%	(direction 3 + 4) OECD: 25% EU: 31%
	Low	(direction 7 + 8) OECD: 2% EU: 17%	(direction 5 + 6) OECD: 23% EU: 1%

each of the measured directions.[15]

This analysis supports the general story we told above. Both the OECD and EU show very similar tendencies toward more spread in the share of production, and both manifest strong increases in IIT. The share of deconcentrated sectors (sum of directional categories #5-8) has increased for both the EU and the OECD, accounting for approximately 60% of share of production at the end of the period. The shares of locationally concentrated sectors (sum of directional categories #1-4) actually decreased for both the OECD (43% to 38%) and the EU (48% to 41%). However, there are important differences between the EU and the OECD as a whole. Table 10 shows that the share of total change accounted for by sectors moving in the direction of greater production spread is slightly higher for Europe (81%) than the OECD (74%). Moreover, the EU share of total change in IIT grows faster than OECD, 67% versus 53%. This shows that despite more rapid growth in IIT, the EU does not show a higher degree of locational concentration. This finding further illustrates the tendency of the EU to have a more spread out location pattern than the OECD, at the same level of IIT development.

In summary, three preliminary conclusions can be drawn about current trends in spatial development in the face of rapidly increasing trade. Across the board, intra-industry trade is rising as a proportion of total trade. In the OECD, there is a rather strong general tendency toward locational concentration, but a certain number of sectors are resisting this trend or, in a small number of cases, actually tending to spread out. By contrast, the European Union seems to be tracing out a different pathway of development. Locational concentration tendencies are weaker on the whole, and the intersectoral variation in such tendencies is greater than in the OECD (Table 7, Figures 3-6). Notably, it

[15] Our discussion will concentrate on aggregated categories (1+2, 3+4, etc), because these correspond to the quadrants generated by the positional data. We decided, however, to retain the basic data in their most detailed form for greater transparency.

appears that a number of sectors are either not concentrating or are spreading out. This possibility of a "European route to globalization,"[16] as well as the rather surprising finding that locational concentration is not universal even at the level of the OECD as a whole, opens up many interesting questions, to which we turn below.

IV. THE LEVEL OF NATIONAL SPECIALIZATION

As noted, changes in degree of dispersion or concentration of sectors should be systematically connected to changes in the overall level of specialization of national economies, in an integrated and open world production and trade system. Bringing them together in a single model is quite difficult and cannot be done with the data used here, but we can trace changes in overall output specialization of each national economy. To do so, we use the Revealed Comparative Advantage index (Balassa, 1965), which is expressed as follows:

$$RCA_{ij} = \frac{X_{ij} / \sum_{i} X_{ij}}{\sum_{j} X_{ij} / \sum_{i} \sum_{j} X_{ij}}$$

where i represents sector, and j stands for country. The RCA index contains a comparison of national export structure(the numerator) with the OECD export structure (the denominator). When the RCA equals 1 for a given sector in a given country, the percentage share of that sector is identical with the OECD average. Where RCA is above 1 the country is said to be specialised in that sector and where RCA is less than unity, the country is not specialized in it. Since the RCA is bounded by zero and infinity, it is unwieldy. Therefore, we converted it to a symmetrical index (centered on zero), i.e. (RCA-1)/(RCA+1). The resulting measure ranges from –1 to +1 and resembles a location quotient. The measure is labelled "Revealed Symmetric Comparative Advantage" (RSCA).

In order to test whether overall country specializations are composed of the same sectors or not, and whether overall increases in specialization are due to reinforced specialization in the same sectors or in different sectors, we employed a method used by Cantwell (1989) and Laursen (1998). Stability (and specialisation trends) is tested by means of the following OLS regression equation (country by country):

$$RSCA_{ij}^{t_2} = \alpha_i + \beta_i RSCA_{ij}^{t_1} + \varepsilon_{ij}$$

[16] Suggested by Fontagné, L, Freudenberg, M, and Péridy, N, 1997.

Figures 7: OECD RSCA Specialization Graph

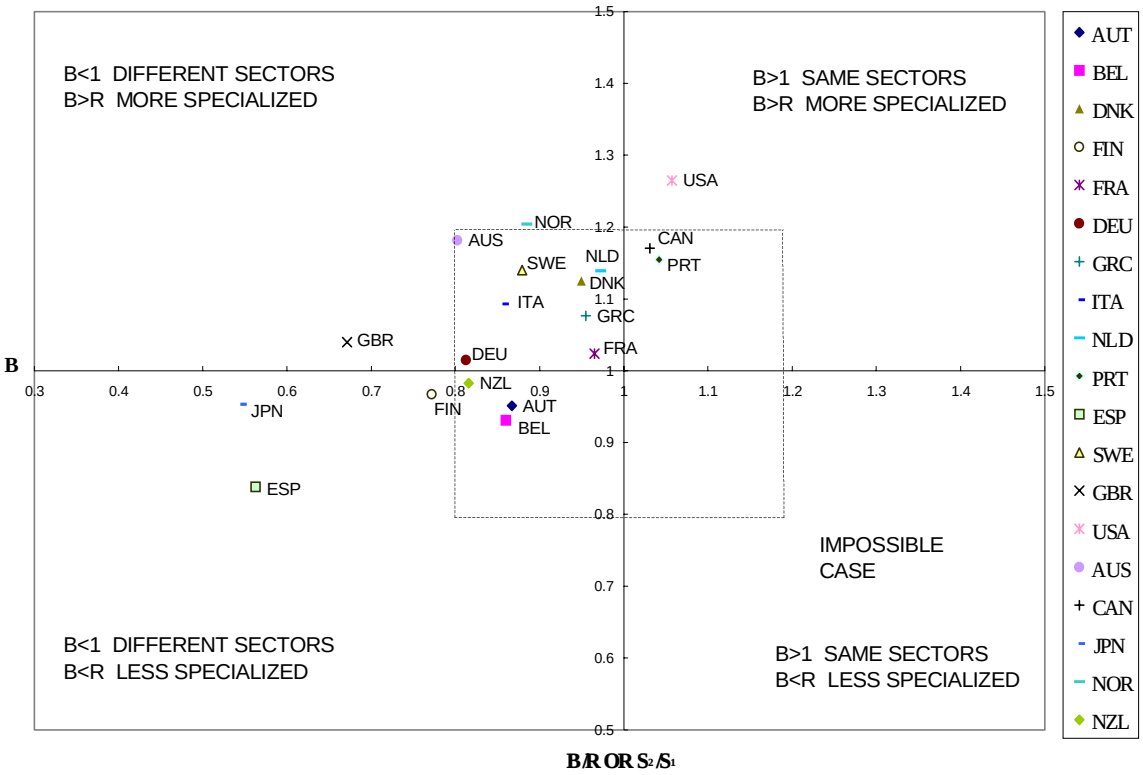
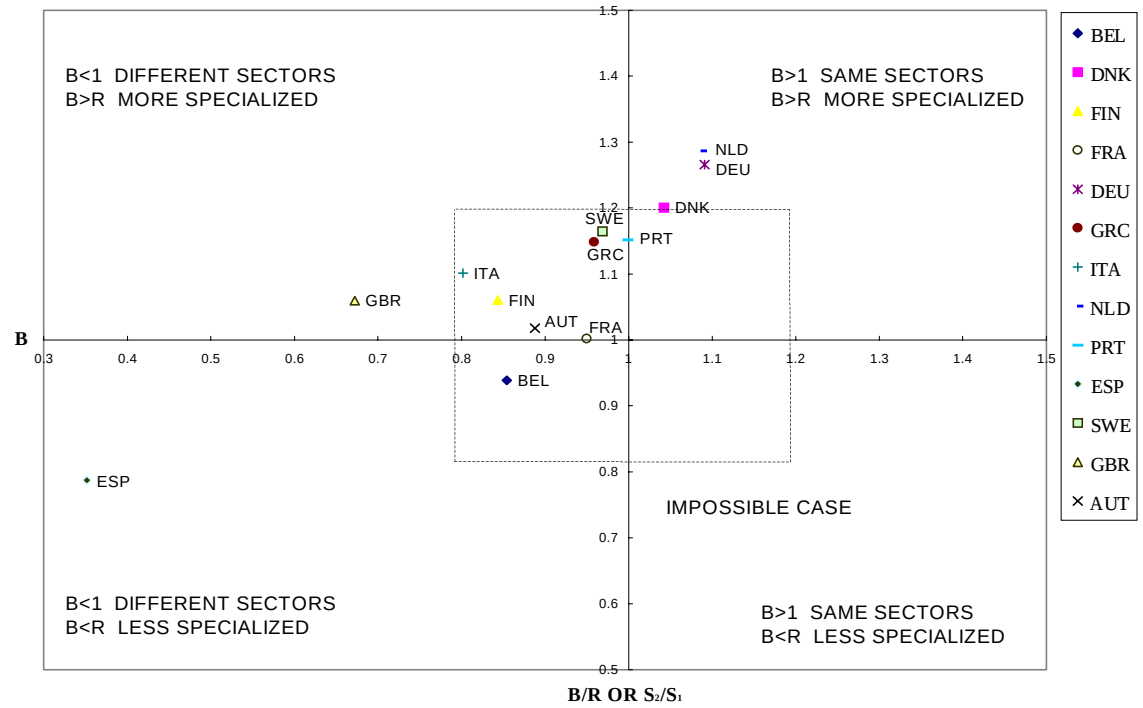


Figure 8: EU RSCA Specialization Graph



The idea behind the regression is that if β=1 and ε is statistically indistinguishable from zero, this corresponds to an unchanged pattern from t1 to t2. By contrast, if β >1 the country tends to become more specialised in sectors where it is already specialised, and less specialised where its initial sectoral specialization is low; i.e. the existing sectoral pattern of specialization is strengthened. β >1 is termed β -specialisation. Similarly, 0< β <1 can be termed β-de-specialisation, i.e., on average sectors with initial low RSCAs increase over time while sectors with initial high RSCAs decrease their values. In Figures 7 and 8, this specialization is shown in the northeast quadrant and labelled "same sectors," whereas de-specialization is found in the southwest and northwest quadrants and labelled "different sectors."

However β >1 is not only way an increase in overall national specialisation can be captured (Cantwell, 1989; Laursen 1998). With reference to Hart(1976), cited by Laursen(1998), it can be shown via the following f-test of homogeneity at t_1 and t_2 that

$$\sigma_i^{2t_2} / \sigma_i^{2t_1} = \beta_i^2 / R_i^2$$

Thus,

$$\sigma_i^{t_2} / \sigma_i^{t_1} = |\beta_i| / |R_i|$$

If β >R (equivalent to an increase in dispersion), the degree of specialization has increased, whereas if β <R (equivalent to a decrease in dispersion), the degree of specialization can be said to have decreased.
There is one impossible case in Figures 7 and 8, where β >1<R; an economy cannot become more specialized in the same sectors but less specialized in general. So, there are three possible combinations of the two types of specialization.

For the OECD, two results stand out. First, most countries are in the northwest quadrant, but not very far within it. They are shedding certain sectors in the context of globalization, as predicted by standard theory. The overall increase in specialization in the USA is probably due to the greater and faster shedding of sectors in the USA in the face of globalization than in Europe. In a few countries, the sectors have changed to a significant degree (UK, Spain, Japan). We can speculate that this is an effect of Japanese offshoring to Asia due to its rapidly rising labor costs, and of Spain's integration into the EU, with important effects of inward FDI. In the EU case, the UK and Spain seem, again, to be experiencing changes in the sectors in which they specialize, while the Netherlands and Germany are becoming somewhat more specialized in their pre-existing areas of strength. There are very few countries which are well away from the two medians in the graph; most countries' changes in position are minor, as shown by

their presence within the central zone of the Figures 7 and 8. In order to check this analysis, we performed another test of similarity of output export structures to the EU and OECD, and the results, which are similar are reported in the Appendix.

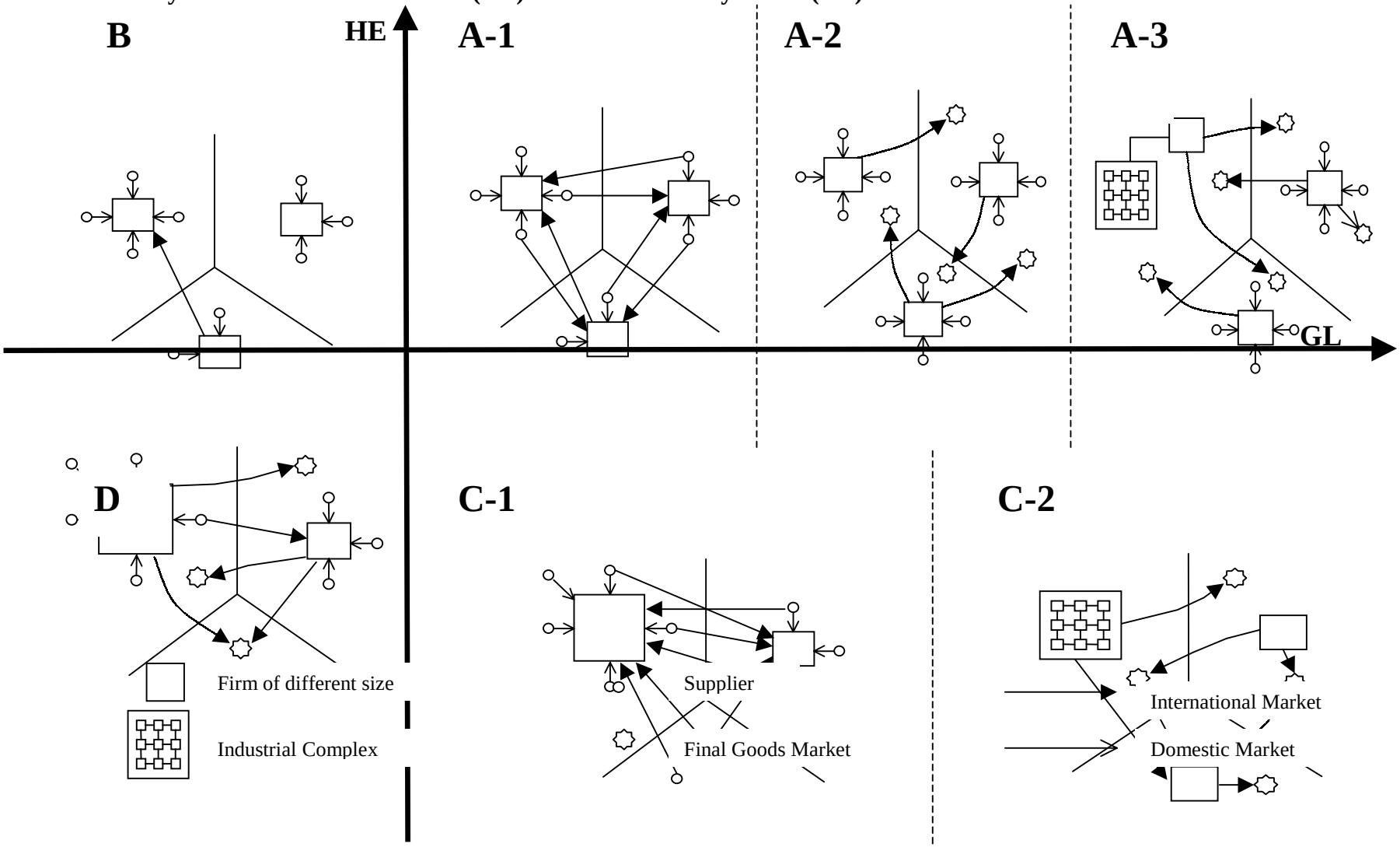
V. SOME POSSIBLE EXPLANATIONS

Location Structures and Trade Patterns

Imagine the four locational cases we have defined in statistical terms above, but this time as concrete locational patterns of the production systems which could give rise to a given degree of locational concentration and a given level of intra-industry trade. Some such possibilities can be found in Figure 7, where we stylize the inter-firm relationships and other input-output relationships in space for each of the combinations of indicators. Cases B and D are relatively straightforward. In B, the combination of low locational concentration and low intra-industry trade implies that most trade will be in final outputs and that it will be highly asymmetrical (with exporters and importers not overlapping much), and that there will be a high level of self-supply without international trade. In D, a high degree of locational concentration, whether due to big plants or a high level of agglomeration of the input-output chain (proximity relations between firms in a more fragmented division of labor), leads to final output trade and to major asymmetries between exports and imports, and hence to the statistic of low intra-industry trade.

Our major destination cases are much more indeterminate, however. In case A, for example, version A-1 shows how low locational concentration and high intra-industry trade could be the result of international cross-shipment between the intermediate goods complexes of different countries. Each country, in other words, could specialize in some kind of intermediate output, and could also have local sourcing relationships (thus, local proximity relations as well). This specialization could be due to scale effects in intermediates which are freed up by market integration, or they could be due to comparative advantages or geographically-differentiated technological-knowledge advantages. A second version (A-2) tells a rather different story which could lie behind the same statistics. It pictures an industry where

FIGURE 9: Stylized Scenarios of Location (HE) and Intra-Industry Trade (GL)



essentially separate national industrial complexes are competing through international cross-market penetration.[17] Another version of this pattern is market-oriented foreign direct investment, where a large foreign firm invests in another OECD country, while continuing its backward sourcing of intermediate inputs from the country of origin. This could correspond to two rather different on-the-ground situations. One is the now-common situation where globalization brings into a given market many more versions of very similar products, i.e. greater horizontal product differentiation. Another is the greater quality-based differentiation of products in a narrowly-defined final use category which comes about as more foreign firms enter a given consumer market through exporting. In the case of A-3 production systems, smaller, competing firms or complexes engage in the variety- or quality-based competition strategies alluded to above and generate cross-market invasion within the industry, pushing up the intra-industry trade ratio (so it is a disguised form of final output competition). In all three types of production system organization and geography, complex competitive strategies on the part of pre-existing national complexes may prolong locational spread or even increase it in the face of globalization. As we shall see shortly, this is precisely the current thinking about the evolution of the EU compared to the OECD as a whole.

Much the same ambiguity can be found in interpreting the realities behind category C. The ambiguity with respect to concentration has to do with our inability to know whether it is because of standard scale considerations (a big firm or some big production units) or because of spatial proximity relations between many modestly-sized firms and production units, or even a combination of both – a big firms with many small and medium-sized suppliers clustered around it. These differences can be detected using the Ellison-Glaeser index, but it requires detailed plant-level data which are not available here (Ellison and Glaeser, 1997). Moreover, in the case of significant agglomerations of small-and medium-sized firms, a wide variety of potential causes could be at stake, ranging from standard input-output linkage costs to soft factors such as technological spillovers or complex relational content to inter-firm linkages; all are now subjects of major theoretical and empirical literatures.

To this multiplicity of locational patterns, we add a variety of possible sources of intra-industry trade. In version C-1, we depict the case which might be imagined by standard theory, where a big firm or a big production complex in one country is sourced internationally, and in turn where its outputs, whether intermediate or final, are cross-shipped to these sourcing countries, possibly to its own branches or to competitor or upstream or downstream firms. In version C-2, the central firm or cluster is itself geared to the production of quality and variety-differentiated outputs, but to do this, it needs variegated international sourcing. The intra-industry trade is asymmetrical in the sense that it involves the locational

[17] In part, this ambiguity is because the G-L index as we have calculated it cannot distinguish between intra-industry trade in the sense of trade between places in products within the same SIC category, and true intermediate (non-final) outputs.

centers receiving varied inputs, and then shipping outward a range of quality- and variety- differentiated final products. Thus, different locations correspond to different phases of the commodity chain, for a wide variety of possible reasons, leading to aggregate locational concentration.

Only by examining in greater detail the nature and levels of the trade flows, in relationship to a more detailed knowledge of the locational structure would we be able to distinguish these three possibilities in a reliable way. Each of them involves rather different developmental forces and implications for the countries involved.

Europe versus the OECD

We have just suggested, by way of examples, that there may be strategic and competitive processes which drive the nature and degree of locational concentration and intra-industry trade. Among these are variety-based competition (competition among similar versions of the same product), in industries with certain kinds of market and scale characteristics, supporting numerous poles of production in very similar industry segments. Another force making for indeterminacy is the possibility of quality-based competition (higher and lower quality versions of the same product), leading to multiple poles of somewhat differentiated production within the same industry. And in all industries, the locational dynamics of the input-output chain can lead to many different locational pushes and pulls, both intra- and inter-industry in nature. Crucially, it is highly probable that increased intra-industry trade in many industries is based not simply on locational restructuring around scale-intensive intermediate goods, but on quality or variety-based competition in these intermediate goods markets as well as in final outputs. This is the distinction between "horizontal" and "vertical" intra-industry trade referred to earlier (Greenaway and Milner, 1984; see also Eaton and Kierzkowski, 1984); Jaskold-Gabszewicz et.al., 1981). In addition to this distinction, it should be remembered that intra-industry trade refers both to international cross-hauling of final outputs in contestable markets and to international production sharing via a division of labor in a filière (and both can be divided into horizontal and vertical forms). In other words, there exists in many sectors a complex set of possibilities for locational and trade patterns.

If this is true, then it may help explain why Europe seems to be developing rather differently from the OECD. Detailed research on intra-industry trade in Europe, which analyses products according to their quality levels, has shown that European firms are developing quality- and variety-based competition to a greater extent than in the OECD as a whole (Fontagné et al, 1997*; Commissariat Général du Plan,* 1999). These strategies may permit firms and agglomerations to follow location pattern A-2 (Figure 9), maintaining a high degree of international dispersion, as reflected in the HE index.

The European economies have different industrial histories from American regions: highly developed and widely geographically dispersed production complexes, consisting of firms with strong technological and organizational competencies and a high level of institutional coordination. Their capacities to adjust to globalization appear to permit the A-2 and A-3 locational patterns to persist, so that European regions are not following the American pattern of more specialized regional economies and more locationally concentrated industrial sectors. Of course, in sectors not amenable to quality differentiation of outputs, different locational outcomes are expected. International and even sub-national concentration are more likely, as national firms attempt to compete in the international environment by maximizing economies of scale, while foreign direct (inward) investors concentrate at a small number of locations to serve their new markets, also by maximizing scale economies. Though we cannot measure sub-national locational concentration with this data set, other recent research in the EU confirms that many sectors are becoming more locationally concentrated at the sub-national level, probably by adopting the C-1 location pattern at the national level (Thisse, 1998; Veltz, 1996; *Commissariat Général du Plan*, 1999).

VI. KNOWLEDGE, EVOLUTION, LOCALIZATION AND TRADE

The interpretation advanced here can can be "stretched" theoretically, albeit in a somewhat speculative manner. It implies that the evolutionary dynamics of existing production complexes may strongly influence what happens after market opening, and not simply convergence toward a universal global optimum. Such evolutionary dynamics could include the effects of strategic choices on pathways of development.

To take these forces into account and construct a more satisfactory explanation of international patterns of location and trade would require a much richer conception of how advantages are constructed in different places in the face of declining trade and transactions barriers, and thereby affecting the resulting locational patterns. To put this another way, if such processes as we have suggested above are important, then the question is what enables them to take place, i.e. what lies "upstream" (causally speaking) of abilities to create quality and variety. The geography of quality and variety would then intersect with the opening of markets and affect the resulting pattern of location in the face of globalization, and hence the pattern of trade.

These evolutionary processes in sectors and local economies, which depend on the evolution of the capabilities of firms in different places, depend in turn on the interaction of locally-created knowledge and international knowledge flows. In recent years, much has been said about two apparently

very different processes of knowledge creation. On the one hand, the literatures on the capability-based firm (Langlois and Foss, 1997) and on national and regional innovation systems (Nelson, 1992; Edquist and McKelvey, 1999**)** call our attention to the ways that firms and networks of firms, highly embedded in geographical and historical contexts, develop their particular innovation and adjustment capacities. International quality-differentiated competition – whether carried out by large firms or by smaller firms – is widely-held to reflect strongly certain kinds of specific capabilities of firms and their local environments, built up over time and not entirely codifiable or imitable at the international level, or at least not rapidly and at economically-feasible cost of imitation (Dunning, 2000).

On the other hand, we know that certain kinds of economically-useful knowledge can flow across long distances (Eaton and Kortum, 1997, 1999). Many kinds of knowledge can be widely imitated or communicated at economically-feasible costs. In general, this kind of knowledge is thought to be more cognitively simple and stable than the other kind, enabling organizations and individuals to break it down into manageable pieces. But in many cases, it is can only be partially simplified, and in order to stretch it out over long distances, firms must make big investments in the human relations necessary to make it flow far and wide, or draw on institutional third parties to gain access to it. An example of the latter is international trade associations and professional associations, or consulting firms, who act as the transmission belts for "moderately complex" forms of knowledge. An example of the former is the ways that large firms must regularly bring key personnel together across international lines in order to facilitate the understandings and relationships that then permit knowledge to flow in a more routine way; but these contacts must be periodically renewed face-to-face.

These two processes probably combine in the European trajectory which is provisionally identified above. The possibility that increased trade and elimination of market barriers has not led to locational concentration in certain routine production sectors might be explained as follows: if knowledge about how to meet international price, quality, and productivity standards in these industries can now be appropriated internationally, then it is possible for existing firms, with their historically built-up capabilities and their strong institutional support at regional and national levels, to respond to the challenge of globalization by generating what we described as greater horizontally-based competition (similar products invading each other's markets). This would be consistent with the well-documented tendencies toward convergence of productivity levels within industries among the advanced industrial economies.

The EU's lower rate of locational concentration, however, is probably also based on the well-known flourishing of quality-based production in many industries in Europe (Fontagné et al, 1997). Existing firms, and regionally-based groups of firms in many industries are mobilizing themselves to

generate a greater variety of quality-differentiated products. Translated into an hypothesis about globalization, we might say that the creation of "local" knowledge (through the regional and national systems of innovation), is remaking "global" knowledge by having important market-defining effects at a global level through quality differentiation. So the "global" evolution of the industry, and its location and trade patterns, is the result of many, at least partially-, local or "endogenous" knowledge- and technology-creation processes (Dosi, Pavitt and Soete, 1990).

But Many Questions Remain Unanswered…

There are many empirical issues left open by a statistical exercise at this geographical scale. Our data do not permit an examination of plant-level versus place-level concentration of industry. It would be essential, in examining further the emerging patterns of geographical concentration, to know the extent to which they are generated by bigger and fewer plants as opposed to clustering of firms. This would require construction of international data similar to those used by Ellison and Glaeser (1997) to construct their, more sophisticated, locational measures. Moreover, because our data use national territories as their geographical units, we cannot know to what extent the national patterns – which indicate moderate concentration at the OECD level and a mixed story at the European level – mask regional (subnational) spread or concentration within countries. A good deal of literature has suggested that European economies are going through a wave of metropolitan concentration of industry, to the detriment of a more even intra-national spread of production (Veltz, 1996; Thisse, 1998). If this is the case, there would be less support for the preliminary finding here, that Europe is not going through a major wave of territorial consolidation of manufacturing (at least in the limited 26-industry sample examined in this paper). So, much more detailed data are needed in order to revisit some of these issues.

Since the data used here concern only the OECD countries, i.e. advanced economies, it is also possible that they mask wider patterns of spread or concentration and intra- versus inter-industry trade. For example, if routine production is being located outside the OECD in ever-increasing proportions, then it might be generating spread tendencies on a world scale; but then again, as many articles have claimed, globalization might also be leading a global consolidation of production, as old national development policies are dismantled and production systems in different countries are integrated into world wide commodity chains.

Furthermore, this analysis concerns only manufacturing (and a subset of it, at that) and not the major locus of employment and output in advanced economies, which is services. Though many services

are untradeable or less tradeable than goods production, they are undergoing major changes as a consequence of market integration, and future work should certainly be extended to them.

Finally, even though these data represent a relatively long time period, it is anyone's guess as to where they stand relative to the current process of trade growth and global locational change. Do the OECD data, for example, suggest that the national economies are going to lose little of their diversity in the end, or that this is just the tip of the iceberg, the beginning of a long, secular trend which will see plunging Herfindahl indices? More sophisticated work, which can link the observed national and sectoral trends to causal models of location, is needed to make sense of these descriptions.

APPENDIX

We constructed another index to show the similarity of export structure of individual countries to the OECD and EU. $\chi 2$ measures the sum of the squared difference between the export distribution of a given country and the total OECD divided by the OECD export distribution, derived from the following:

$$\chi^2 = \sum_i [[(X_{ij} / \sum_i X_{ij}) - (\sum_j X_{ij} / \sum_i \sum_j X_{ij})]^2 / (\sum_j X_{ij} / \sum_i \sum_j X_{ij})]$$

If a country has an export structure exactly similar to the OECD or the EU, the value of the index will be zero. The more a country differs from OECD, the greater the value of $\chi 2$. Over time its evolution tracks changes in the degree of specialisation for each country.

The results of our revealed comparative advantage analysis are reported in Tables 11 and 12. The results confirm the impressions gained from examining Figures 7 and 8. In the analysis of output patterns in Table 11, it can be seen that most countries do not tend to become more specialized in sectors in which they already specialize at the beginning of the period. But this can mean many different things, especially if they were relatively un-specialized at the beginning. In the second column of the output analysis, there seem to be slight increases in specialization for a number of countries, measured by the correlation coefficient of the standard deviation of t_2 to t_1. There are many different national patterns as well. In Table 12, the specialization of each country is measured with respect to the EU or OECD averages, respectively. The first thing to note is that most of the changes are rather small. For the EU,

TABLE 12: Chi-Square Analysis for RSCA

EU														
EXPORTS					IMPORTS					OUTPUT				
Coun-tries	70-74 χ_{t1}	90-94 χ_{t2}	Similar to EU	$\chi_{t2}-\chi_{t1}$	Coun-tries	70-74 χ_{t1}	90-94 χ_{t2}	Similar to EU	$\chi_{t2}-\chi_{t1}$	Coun-tries	70-74 χ_{t1}	90-94 χ_{t2}	Similar to EU	$\chi_{t2}-\chi_{t1}$
AUT	0.52	0.23	MORE	-0.29	**AUT**	0.10	0.06	MORE	0.64	**AUT**	0.11	0.12	LESS	***1.09***
BEL	0.35	0.15	MORE	-0.20	**BEL**	0.07	0.04	MORE	0.62	**BEL**	0.14	0.13	MORE	0.89
DNK	0.20	0.26	LESS	0.05	**DNK**	0.11	0.05	MORE	0.45	**DNK**	0.19	0.19	LESS	***1.02***
FIN	6.21	2.92	MORE	-3.29	**FIN**	0.14	0.06	MORE	0.43	**FIN**	0.93	0.80	MORE	0.86
FRA	0.07	0.08	LESS	0.01	**FRA**	0.04	0.01	MORE	0.16	**FRA**	0.05	0.03	MORE	0.71
DEU	0.12	0.06	MORE	-0.05	**DEU**	0.07	0.02	MORE	0.32	**DEU**	0.05	0.05	LESS	***1.10***
GRC	1.09	2.02	LESS	0.93	**GRC**	0.23	0.06	MORE	0.27	**GRC**	0.38	0.53	LESS	***1.41***
ITA	0.25	0.30	LESS	0.05	**ITA**	0.05	0.04	MORE	0.80	**ITA**	0.13	0.18	LESS	***1.45***
NLD	0.35	0.25	MORE	-0.10	**NLD**	0.06	0.02	MORE	0.42	**NLD**	0.15	0.18	LESS	***1.24***
PRT	1.60	2.12	LESS	0.52	**PRT**	0.13	0.09	MORE	0.66	**PRT**	0.39	0.62	LESS	***1.58***
ESP	0.50	0.23	MORE	-0.27	**ESP**	0.20	0.03	MORE	0.15	**ESP**	0.30	0.10	MORE	0.35
SWE	1.15	0.63	MORE	-0.52	**SWE**	0.16	0.04	MORE	0.28	**SWE**	0.35	0.33	MORE	0.94
GBR	0.09	0.08	MORE	-0.02	**GBR**	0.09	0.03	MORE	0.28	**GBR**	0.04	0.04	MORE	0.94
Average				-0.24	Average				0.42	Average				***1.04***

OECD														
EXPORTS					IMPORTS					OUTPUT				
Coun-tries	70-74 χ_{t1}	90-94 χ_{t2}	Similar to OECD	$\chi_{t2}-\chi_{t1}$	Coun-tries	70-74 χ_{t1}	90-94 χ_{t2}	Similar to OECD	$\chi_{t2}-\chi_{t1}$	Coun-tries	70-74 χ_{t1}	90-94 χ_{t2}	Similar to OECD	$\chi_{t2}-\chi_{t1}$
AUT	0.53	0.22	MORE	-0.31	**AUT**	0.11	0.07	MORE	-0.05	**AUT**	0.15	0.14	MORE	-0.02
BEL	0.37	0.22	MORE	-0.15	**BEL**	0.06	0.08	LESS	0.02	**BEL**	0.19	0.17	MORE	-0.02
DNK	0.26	0.34	LESS	0.08	**DNK**	0.07	0.07	MORE	0.00	**DNK**	0.19	0.19	LESS	0.01
FIN	5.40	2.65	MORE	-2.74	**FIN**	0.14	0.08	MORE	-0.06	**FIN**	0.76	0.62	MORE	-0.14
FRA	0.10	0.13	LESS	0.02	**FRA**	0.07	0.02	MORE	-0.05	**FRA**	0.04	0.03	MORE	-0.01
DEU	0.10	0.04	MORE	-0.06	**DEU**	0.08	0.02	MORE	-0.06	**DEU**	0.07	0.05	MORE	-0.02
GRC	1.37	2.76	LESS	***1.39***	**GRC**	0.17	0.08	MORE	-0.08	**GRC**	0.54	0.69	LESS	0.16
ITA	0.44	0.52	LESS	0.07	**ITA**	0.09	0.07	MORE	-0.02	**ITA**	0.21	0.32	LESS	0.12
NLD	0.48	0.28	MORE	-0.19	**NLD**	0.07	0.05	MORE	-0.02	**NLD**	0.17	0.21	LESS	0.03
PRT	1.88	3.04	LESS	***1.16***	**PRT**	0.15	0.10	MORE	-0.05	**PRT**	0.50	0.94	LESS	0.43
ESP	0.80	0.26	MORE	-0.53	**ESP**	0.27	0.03	MORE	-0.23	**ESP**	0.33	0.15	MORE	-0.18
SWE	0.94	0.54	MORE	-0.40	**SWE**	0.11	0.04	MORE	-0.07	**SWE**	0.25	0.22	MORE	-0.02
GBR	0.10	0.08	MORE	-0.03	**GBR**	0.09	0.02	MORE	-0.07	**GBR**	0.07	0.05	MORE	-0.01
USA	0.16	0.09	MORE	-0.07	**USA**	0.13	0.06	MORE	-0.08	**USA**	0.04	0.05	LESS	0.00
AUS	0.54	1.14	LESS	0.60	**AUS**	0.17	0.08	MORE	-0.08	**AUS**	0.09	0.22	LESS	0.14
CAN	1.33	0.84	MORE	-0.49	**CAN**	0.40	0.14	MORE	-0.26	**CAN**	0.18	0.20	LESS	0.02
JPN	0.31	0.32	LESS	0.01	**JPN**	0.26	0.26	LESS	0.00	**JPN**	0.09	0.11	LESS	0.02
ISL	2.65	1.14	MORE	-1.52	**ISL**	0.22	0.22	MORE	-0.01	**ISL**				0.00
NOR	1.04	1.26	LESS	0.22	**NOR**	0.10	0.08	MORE	-0.02	**NOR**	0.26	0.27	LESS	0.01
NZL	0.67	0.67	MORE	0.00	**NZL**	0.20	0.08	MORE	-0.12	**NZL**	0.21	0.24	LESS	0.03
Average (excluding ISL)				-0.08	Average (excluding ISL)				-0.07	Average (excluding ISL)				0.00

Note: Chi-square indicates how strongly each country is specialized with respect to OECD or EU at $\mathbf{t_1}$, $\mathbf{t_2}$. The more a country differs from OECD or EU, the greater the difference from 1. $\chi_{t2}-\chi_{t1}$ indicate the absolute change of χvalues.

only Italy, Greece, Portugal, and Spain had anything other than very minor changes. Each of them was involved in major adjustments during this period. Most of the coefficients for other EU countries are not far off the EU average and they did not move very much. In the OECD, strong changes are in evidence in Greece, Italy, Portugal, Spain, and Australia, with only small changes in the remaining countries. There seems to be somewhat more increase in overall specialization of the OECD than in the EU, consistent with our earlier evidence on sectors, where EU "spread" patterns are much stronger than in the OECD. Much more detailed work will have to be done in order to analyze the relationships between sectoral and national changes, but from this first approach to the data, the results of the two seem not to be inconsistent.

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