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SPECIALISATION PATTERNS IN EUROPE

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ABSTRACT

The purpose of this paper is to analyse whether specialisation has increased in European Union countries, and to determine whether specialisation patterns are consistent with trade theories. I present evidence of increasing specialisation in European Union countries between 1968 and 1990. I identify which industries have increased in geographical concentration and show that the characteristics of these industries are consistent with what is predicted by trade theories. The industries with increasing geographical concentration are characterised by high scale economies and high proportions of intermediate goods in production, providing support for the new trade theories and the economic geography theories.

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SPECIALISATION PATTERNS IN EUROPE

Mary Amiti

1. INTRODUCTION

Have specialisation patterns in the European Union (EU) changed? The process of dismantling trade barriers between member countries began in 1957 with the formation of the EU[1] and has continued to date. It has involved removing tariffs on goods traded between member countries and reducing non-tariff barriers by harmonizing product standards and simplifying government formalities. According to all strands of trade theory, reducing trade costs should lead to an increase in the degree of specialisation. However, there are three strands of literature which have distinct predictions about specialisation patterns. Firstly, the classical Heckscher-Ohlin theory determines that each country will specialise in industries which are intensive in the factors with which it is abundantly endowed. Secondly, the new trade theories show that each country will produce less product varieties within an industry to take advantage of increasing returns to scale, (Krugman (1979) and Ethier (1982)). And thirdly, the new economic geography theories show that vertical linkages between industries will result in the agglomeration of these industries in the one location (Krugman and Venables (1995) and Venables (1996)).

The purpose of this paper is to analyse whether specialisation has increased in EU countries, and to determine whether specialisation patterns are consistent with trade theories. Analysing whether specialisation has increased is one way to ascertain if expected gains from trade have been realised. These gains arise from allocating production according to comparative advantage and thereby achieving a more efficient allocation, by enabling firms to expand production to exploit economies of scale, and from the pecuniary externalities which arise from vertically linked industries locating close to each other. To see whether specialisation has increased in Europe, I construct country specialisation indices and geographical concentration indices. The

movements in the country specialisation indices indicate whether countries have become more different from each other in their industrial structures. The geographical concentration indices indicate which industries are the most concentrated. This enables us to study the characteristics of these industries and hence determine whether the specialisation patterns are consistent with the trade theories.

Empirical studies on specialisation patterns in Europe have produced conflicting results. For instance, Aquino (1978) suggests that specialisation in Europe fell or remained constant over the period 1951 to 1974, and Sapir (1996) finds that specialisation remained constant over the period 1977 to 1992 in Germany, Italy and the United Kingdom, and increased in France since 1986. In contrast, Hine (1990) and Greenaway and Hine (1991) show that specialisation increased in Europe, at least during the period 1980 to 1985. Each of these studies has adopted different approaches to measuring specialisation, raising a number of measurement issues. In particular, which data sources should we use: national or trade data? And how should we measure specialisation? In section 2 of this paper, I review the literature and discuss some of these measurement issues.

In section 3, I present evidence of increasing specialisation in EU countries. I construct country specialisation indices using production and employment data drawing from two data sets: one is from EUROSTAT which includes 65 manufacturing industries in Belgium, France, Germany, Italy and the United Kingdom for the period 1976 to 1989; the other is from UNIDO and is more aggregated with 27 manufacturing industries (but includes all of the EU countries except Ireland and Luxembourg) and it begins in 1968. An advantage of using the EUROSTAT data set is its high level of disaggregation for production data. Although the industries in the UNIDO data set are far more aggregated, there are more EU countries included, it is for a longer period and, furthermore, it also contains production data at constant prices.

In section 4, I identify which industries have increased in geographical concentratation over time and show that the

characteristics of these industries are consistent with what is predicted by trade theories. Using the EUROSTAT data set, I regress the geographical concentration indices on three variables, each 'representing' one of the three strands of trade theory: (i) a measure of the deviation of labour intensity from the average, to proxy the Heckscher-Ohlin theory; (ii) scale economies, to proxy the new trade theories; and (iii) the degree of intermediate goods in production, to proxy the economic geography theories. I find positive and significant coefficients on the scale economies and intermediate goods variables, which can be interpreted as providing some support for the new trade theories and the economic geography theories. The coefficient on the factor intensity variable is insignificant. This is not surprising given that the five countries in the sample are very similar in terms of relative factor endowments. The Heckcher-Ohlin theory relies on differences in relative factor endowments for trade and specialisation to take place. Section 5 concludes and the full results are contained in the Appendix.

2. THE LITERATURE

Various studies have investigated whether there is evidence of increasing specialisation in EU countries. The studies differ in terms of the measure of specialisation, the variables, and the level of aggregation of the data[2]. Aquino (1978) and Sapir (1996) found that specialisation did not increase in EU countries from 1951 to 1974 and 1977 to 1992, respectively, whereas Hine (1990) and Greenaway and Hine (1991) showed that specialisation increased in EU countries in the early 1980s.

Sapir (1996) uses the Herfindahl index with export data on 100 manufacturing industries to measure country specialisation and found that specialisation remained constant over the period 1977 to 1992 in Germany, Italy and the UK, and increased in France since 1986. The Hirfindahl index is defined as:

$$H_j = \sum_i (s_{ij})^2 \qquad \textbf{(1)}$$

where s_{ij} is industry i's share in total exports of country j. A value close to 1 implies almost complete specialisation in one industry and a value close to 0 implies a high degree of diversification. There are two main points to be made. Firstly, the H_j index is really a measure of 'absolute specialisation' since it indicates how different the distribution of production shares is from a uniform distribution. This index could change for reasons unrelated to changes in trade costs. For instance, consumer preferences may change or there may be a technological shock in a particular industry which affects all countries in the same way. But a skewed distribution towards one industry is also consistent with autarky and may have nothing to do with the level of trade costs. Trade theories predict that a fall in trade costs will lead to each country becoming more different from its trading partners. Therefore, to see whether the European experience is consistent with the trade hypothesis, it is preferable to construct indices of 'relative specialisation' which measure how different a country's distribution of production shares is from its trading partners' distribution of shares. Secondly, although in theory an increase in specialisation should be evident whether it is measured by export or production data, in practice exports may increase without any change in the volume of production due to a fall in domestic consumption. Consequently, exports may not be a good proxy for production.

Hine (1990) and Greenaway and Hine (1991) found evidence of increasing specialisation in the early 1980s using the mean of the Finger-Kreinin index (F-K), with production and export data on 28 manufacturing industries, defined as:

$$F\&K_{jk} = \sum_i \min(s_{ij}, s_{ik}) \qquad \textbf{(2)}$$

where the subscripts k and j refer to two different countries. The index ranges between 0 and 1: if the distribution of shares in both countries is identical then the index is equal to 1 and if the countries have completely disjoint production patterns then the index is equal to 0.[3]

The F-K index can be considered to be a measure of relative specialisation as it compares one country's distribution of shares in production to another. However, the mean of the F-K index may not be a satisfactory summary measure of specialisation if the bilateral comparisons (of country j with every other country in the sample) move in different directions, as large variations in the production shares of small countries could easily drive the value of the index. To illustrate this, suppose that there are three countries with two industries with the following production patterns:

t=1:	industry output			industry shares		mean F-K
	1	2	total	1	2	
country 1	5	5	10	.5	.5	.9
2	60	40	100	.6	.4	.85
3	80	120	200	.4	.6	.85
total	145	165	310	.47	.53	
t=2:	industry output			industry shares		mean F-K
	1	2	total	1	2	
country 1	0	10	10	0	1	.5
2	50	50	100	.5	.5	.75
3	100	100	200	.5	.5	.75
total	150	160	310	.48	.52	

It seems clear that in period 2 relative specialisation increased in country 1, and decreased in countries 2 and 3 as they are closer to the average distribution of shares. Yet according to the mean of the F-K index, specialisation increased in all countries. (The lower the index, the higher the degree of specialisation.)

Aquino (1978) found that inter-industry specialisation in 26 OECD countries has been limited over the period 1951 to 1974 with a tendency towards a further reduction in inter-industry specialisation. He used the standard deviation of the Balassa index weighted by industry shares to get a measure of country specialisation, s_j, and the standard deviation weighted by country shares to get a measure of industry specialisation, s_i with export data on 28 manufacturing industries. An increase in the standard deviation indicates an increase in specialisation. The Balassa (1965) index, originally designed to measure a country's 'revealed' comparative advantage using export data, is defined as:

$$B_{ij} = \frac{s_{ij}}{w_i} \qquad \textbf{(3)}$$

where s_{ij} is industry i's share in total production of country j, and w_i is the share of industry i in the world's total manufacturing production (or
in our study, in the EU). If a country's production structure matches that of the average of all other countries, then the index is equal to 1. An index greater than 1 reflects specialisation in that industry. It should be noted that the Balassa index has no upper bound and the lower limit is 0. Furthermore, a ratio of shares is likely to result in high values for industries which account for small shares of world production, small w_i's.[4] Hence, variations in small industries can unduly affect a summary measure using the Balassa index. The weighted standard deviation helps to reduce the small country and small industry influence inherent in the Balassa index.

Another approach to measuring specialisation, borrowed from the

inequality literature, is to calculate the Gini.[5] For the country specialisation Gini, first construct a Lorenz curve as follows: rank the Balassa index in descending order; plot the cumulative of the numerator on the vertical axis against the cumulative of the denominator on the horizontal axis. The Gini is equal to twice the area between a 45 degree line and the Lorenz curve. If the industrial structure of country j matches the industrial structure of the average of Europe, the Gini will equal zero. The higher the Gini, the more specialised is the country. (Analogously, we can construct a Gini for each industry to measure geographical concentration by rewriting the Balassa index as $B_{ij}=p_{ij}/w_j$ where p_{ij} is country j's production of industry i as a proportion of total European production of industry i, and w_j is country j's share of manufacturing in total European manufacturing.) The Gini places implicit relative value on changes in the middle parts of the distribution, so a transfer from a big industry to a small industry has a much greater effect on the country Gini if the two industries are near the middle rather than at either end of the distribution. (See Cowell (1995) for a discussion of problems related to the Gini.) This means that movements between industries which are the closest to the European average will get the most weight in the country Gini. As these industries may vary from year to year, the weighting of industries will also vary and we do not know whether these will be the big or small industries. Despite the potential problems with using the Gini as a measure of country specialisation and geographical concentration, it is an informative summary statistic and is the most commonly used measure.

3. SPECIALISATION IN THE EU COUNTRIES

I utilise two databases to investigate whether the degree of specialisation has increased in EU countries. I construct measures of specialisation for each country j using the Gini, G_j, and the weighted standard deviation of the Balassa index, s_j, with production and

employment data[6]. According to trade theories an increase in the degree of specialisation should be evident whether measured by production at current or constant prices, or employment.

Data

One data set is from EUROSTAT. It consists of 65 manufacturing industries classified according to NACE3, for Belgium, France, Germany, Italy and the UK. The other manufacturing industries and countries in the database were not included because of too many missing values. The data set represents approximately 65% of the total manufacturing output in these five countries. It presents annual data for production at current prices and employment covering the period 1976 to 1989. This was the most disaggregated national data available. In order to study specialisation patterns over a longer period and in more of the EU countries, we turn to the UNIDO data set. It includes all manufacturing industries, classified according to ISIC3 (27 industries), for 10 European Union countries: Belgium, Denmark, France, Germany, Greece, Italy, Netherlands, Portugal, Spain and the United Kingdom. It presents annual data covering the period 1968 to 1990. Data was available for production at constant 1980 prices as well as production at current prices and employment.

EUROSTAT

The specialisation indices[7] using the EUROSTAT data set with production and employment all indicate an increase in specialisation in all of the five countries over the period 1976 to 1989, except the increase in the G_j , with production and employment for Italy not significant at the 5% level[8]. I regressed the log of each index on a time trend to determine the growth rate of the indices[9]. The G_j index is given in Table 1 and the the s_j index in Table 2, with the growth rates

and the t statistic. The G_j index indicates that the degree of specialisation increased at an average annual rate of 2% in all countries except Italy which only increased by 0.5%. The s_j index indicates a similar pattern, with the correlation between the two measures at 99%.

TABLE 1
G_j index

	Production					Employment				
	Bel	Fra	Ger	Ita	UK	Bel	Fra	Ger	Ita	UK
1976	24.12	17.26	13.71	18.18	14.01	26.46	17.19	16.22	20.86	13.67
1977	24.48	16.80	12.65	18.61	13.89	26.53	17.88	15.33	20.65	13.77
1978	25.84	17.39	13.05	19.07	13.59	26.81	17.95	15.05	20.34	13.61
1979	26.13	17.26	13.18	20.62	14.76	26.97	17.86	14.97	21.71	15.06
1980	27.65	18.18	12.92	20.98	16.06	27.63	19.40	14.69	22.06	16.21
1981	27.45	18.19	13.89	21.17	16.25	27.84	19.42	15.22	22.36	17.52
1982	30.49	18.17	13.83	20.87	16.89	31.30	19.62	15.81	21.68	18.41
1983	29.99	17.90	13.99	20.45	17.47	28.95	19.11	16.22	21.26	19.40
1984	29.49	18.52	14.55	19.44	17.25	29.02	19.01	16.75	20.65	19.07
1985	29.36	19.13	15.52	20.38	17.24	29.51	19.72	17.23	20.94	18.93
1986	29.35	20.28	16.02	19.88	17.92	29.39	20.36	17.39	20.55	18.56
1987	30.25	20.40	16.02	20.19	17.47	29.39	20.59	17.85	21.48	18.61
1988	31.41	20.50	16.28	20.28	17.66	30.50	21.27	18.10	22.03	18.76
1989	31.32	21.01	16.56	20.71	18.08	30.55	21.69	17.89	23.01	18.64
ß	0.02*	0.02*	0.02*	0.005	0.02*	0.01*	0.01*	0.01*	0.003	0.03*
t	8.28	10.64	8.67	1.95	7.89	5.73	9.91	5.65	1.50	5.90

TABLE 2

s_j

	Production					Employment				
	Bel	Fra	Ger	Ita	UK	Bel	Fra	Ger	Ita	UK
1976	45.76	31.59	25.19	34.18	28.13	50.12	31.26	29.26	38.25	26.99
1977	48.06	30.42	23.10	35.37	27.55	50.48	32.41	27.57	37.47	26.74
1978	51.04	31.28	23.46	35.42	27.58	51.49	32.27	26.91	36.83	26.54
1979	49.37	31.38	23.94	38.34	29.60	51.63	33.05	26.79	38.91	27.96
1980	54.33	32.87	23.22	38.57	30.93	54.05	35.64	26.22	39.29	29.83
1981	55.09	32.98	24.86	39.37	32.63	55.12	35.70	27.22	39.91	32.85
1982	64.09	32.96	24.77	39.06	32.91	67.17	35.83	28.29	39.11	33.93
1983	59.28	32.46	25.13	39.09	34.62	57.74	34.90	28.87	38.44	35.99
1984	59.07	33.65	26.06	38.02	34.46	58.98	34.64	29.74	37.89	35.44
1985	57.90	34.99	27.83	40.24	34.64	60.09	35.96	30.57	38.41	35.02
1986	59.05	36.65	28.61	38.60	36.00	59.30	37.00	30.91	37.63	34.15
1987	64.97	37.11	28.61	39.20	34.97	60.00	37.40	31.67	38.96	34.15
1988	66.14	37.56	29.12	39.70	35.03	63.47	39.16	32.18	40.25	34.14
1989	66.94	38.62	29.70	40.90	36.11	65.73	39.73	32.02	42.37	34.20
ß	0.03*	0.02*	0.02*	0.01*	0.02*	0.02*	0.02*	0.01*	0.005*	0.02*
t	8.24	10.52	7.30	4.95	9.12	5.60	9.11	5.18	2.29	5.36

UNIDO

Table 3 presents the G_j index using production at constant prices and Table 4 presents the s_j index with production at constant prices. The indices with production at current prices and employment data are contained in the Tables 1a, 1b, 1c and 1d of the Appendix. The correlation between the two measures is

around 90%. Both measures, using all three variables, indicate a significant increase in specialisation between 1968 to 1990 for Denmark, Germany, Greece, Italy and Netherlands. For Belgium, France, Portugal and Spain all of the indices indicate a significant increase in specialisation from 1980 to 1990[10]. For the UK, the indices with production at constant prices indicate a significant increase since 1980, but the other indices indicate mixed results.

TABLE 3
G_j index with Production at 1980 prices

	Bel	Den	Fra	Ger	Gre	Ita	Net	Por	Spa	UK
1968	25.55	33.46	11.40	11.16	33.27	16.08	26.65	39.07	21.66	11.20
1970	23.55	34.12	10.67	11.15	32.68	13.95	27.09	36.07	19.46	9.35
1972	22.27	31.44	10.28	11.25	29.49	13.93	26.76	32.05	14.48	8.62
1974	22.06	33.07	10.14	11.80	32.59	13.66	26.43	34.21	14.87	8.31
1976	21.36	32.25	9.08	11.43	34.64	15.22	27.65	35.09	14.96	7.42
1978	21.24	33.02	8.38	11.07	36.30	14.18	28.03	31.99	15.38	6.78
1980	21.86	33.61	7.85	11.27	37.64	16.69	28.05	33.26	15.85	7.31
1982	23.01	34.24	7.55	12.42	38.40	17.09	27.19	31.73	17.04	5.66
1984	22.84	34.34	7.81	12.89	39.86	17.65	27.44	37.00	19.04	6.62
1986	23.86	35.69	8.58	13.99	43.27	17.76	29.25	41.56	19.35	6.40
1988	24.19	36.39	8.73	13.57	44.67	17.99	30.57	40.89	18.35	7.33
1990	25.94	35.96	8.67	13.44	45.66	18.68	29.63	42.51	19.25	7.99
ß	0.00	0.005*	-0.01*	0.01*	0.02*	0.01*	0.01*	0.01*	0.00	-0.02*
t	1.59	5.83	-4.89	8.22	14.41	7.69	7.33	2.88	1.14	-4.38

TABLE 4
s_j index with Production at 1980 prices

	Bel	Den	Fra	Ger	Gre	Ita	Net	Por	Spa	UK
1968	39.85	54.36	22.17	37.41	48.01	40.65	36.72	67.01	31.67	35.58
1970	34.64	55.88	21.03	37.70	46.39	36.25	40.20	59.38	29.90	31.90
1972	33.10	51.73	20.24	34.94	43.96	34.07	43.11	56.92	21.68	27.08
1974	33.07	56.15	20.41	36.05	49.74	34.89	41.82	63.15	24.69	27.50
1976	32.42	51.93	22.08	37.22	54.31	36.45	44.82	54.29	23.38	27.67
1978	32.29	52.88	21.56	36.50	55.99	36.30	43.99	48.62	23.32	26.77
1980	33.09	55.82	21.67	37.17	58.00	40.18	44.38	54.06	21.02	26.72
1982	34.81	56.73	22.03	39.03	62.14	40.33	43.95	52.45	23.87	23.78
1984	34.81	55.60	22.73	41.03	61.20	41.69	44.81	61.61	25.51	25.59
1986	37.06	58.94	23.93	44.56	67.87	42.91	46.58	68.43	24.33	26.34
1988	37.01	60.07	25.33	43.85	70.31	43.77	48.47	66.46	24.63	28.05
1990	40.96	59.91	26.67	44.43	73.74	44.82	46.53	67.88	24.49	30.51
ß	0.004*	0.005*	0.01*	0.01*	0.02*	0.01*	0.01*	0.004	-0.005	-0.01*
t	2.11	5.40	6.51	7.52	17.75	7.21	9.25	1.36	-1.84	-2.50

Spain and the UK are the only two countries to have both measures indicating a signifcant fall in specialisation since 1968, and Portugal with no significant change. Why might the degree of specialisation in a country fall? One possible explanation is that before joining the EU, the countries may have had high trade barriers protecting industries in which they did not have a comparative advantage. The elimination of trade barriers within the EU increased competitive pressures to increase production in the industries in which each country has a comparative advantage. All of these countries are late joiners to the EU and even though specialisation fell when comparing 1968 to 1990, there is an upward trend starting in the late 1970s and early 1980s in Portugal, Spain and the UK.

Even if the specialisation indices with the UNIDO data have not increased, we cannot rule out the possibility that specialisation has increased but is only obvious with more disaggregated data. This becomes clear in the case of France and the UK when we compare the results from EUROSTAT and UNIDO for the same period in Table 5 below, where K denotes production at constant prices, P denotes production at current prices, L denotes employment, (+) indicates a significant increase in the index (at the 5% level), a significant decrease, and (0) indicates no significant change. All the indices using the EUROSTAT data indicate an increase in specialisation for France and the UK, whereas some of the indices using the UNIDO data indicate that there has been no significant change in specialisation.

TABLE 5
1976 to 1989

	EUROSTAT		UNIDO	
	G_j	s_j	G_j	s_j
	P L	P L	K P L	K P L
Bel	+ +	+ +	+ + +	+ + +
Fra	+ +	+ +	0 0 +	0 0 +
Ger	+ +	+ +	+ + +	+ + +
Ita	0 0	+ +	+ + +	+ + +
UK	+ +	+ +	+ 0 +	+ + 0

4. GEOGRAPHICAL CONCENTRATION OF INDUSTRIES IN THE EU COUNTRIES

We saw that specialisation has increased in EU countries between 1968 and 1990. This means that some industries must have become more geographically concentrated in some countries. We can identify these industries by constructing geographical concentration indices in the same way as the country specialisation indices, but instead of aggregating across industries we aggregate across countries to obtain the Gini, G_i, and the weighted standard deviation of the Balassa index, s_i, for each industry i. An increase in G_i or s_i indicates that industry i has become more geographically concentrated which means that some countries have increased their production of industry i more than the increase in their total manufacturing, relative to the rest of Europe.

The G_i index with production data from EUROSTAT are listed in Table 2a of the Appendix, ranked in descending order based on the first years observations, and Table 2b groups the industries according to the following categories: positive significant growth; negative significant growth; and no significant change in the indices. (Since there is a high correlation of 93% between the G_i and the s_i indices, I only report the G_i indices.) The industries with the highest G_i index in the EUROSTAT set are: toys and sports, carpets, miscellaneous, bread and flour, and wool; and those with the lowest G_i index are processing of plastics, cocoa, chocolate and sugar, and iron and steel. According to the EUROSTAT data, 30 industries recorded an increase in geographical concentration between 1976 and 1989, ranging between 1% and 12% growth annually (cocoa, chocolate and sugar, textile finishing, working of stone and ready made clothing recorded the biggest increases); 12 industries recorded a fall in geographical concentration, ranging between 1% and 14% (manufacturing of concrete for construction recorded the biggest fall); and there was no significant change in geographical concentration in 23 industries[11].

Table 3a of the Appendix records the same information using the UNIDO data set. The industries with the highest G_i index with

production at current prices in the UNIDO set are: miscellaneous petroleum and coal products, pottery, china and earthenware, and professional and scientific equipment; and those with the lowest are fabricated metal products, and paper products. There were 11 industries which recorded a significant increase in geographical concentration between 1968 and 1990, ranging between 1% and 7% (wearing apparel recorded the biggest increase); 8 industries recorded a fall, ranging between 1% and 5% (plastic products recorded the biggest fall); and there was no significant change in 8 industries. In Table 3b of the Appendix we can see that the G_i index using production at **constant prices** gives a similar ranking of industries as the G_i index using production at **current prices S** there is a 94 % correlation between the two. The constant price G_i index indicates that 17 industries had positive significant growth. It includes all the ones in the G_j index with current prices, except fabricated metals; and additionally furniture, iron and steel, plastic, petroleum refineries, non-ferrous metals, food, and machinery. Although all trade theories predict that a reduction in trade barriers leads to an increase in specialisation, there are three strands of trade theories which have distinct predictions about the pattern of specialisation. I regress the geographical concentration indices on three variables which are meant to proxy the three strands of trade theories.

According to the new trade theories, reducing trade barriers leads to an increase in specialisation in industries which are subject to economies of scale. Krugman (1979) shows that when countries move from autarky to free trade the number of varieties of goods in each country falls, enabling firms to slide down their average cost curves. So there are gains from trade due to the lower unit cost of production and consumers have access to more varieties through trade. In order to try to capture this effect, I construct a variable, X_{1it}, to proxy scale economies. X_{1it} is defined as labour divided by the number of enterprises. So we would expect that industries which are subject to high scale economies to be more geographically concentrated.

The Heckscher-Ohlin theory predicts that countries will specialise

in industries which are intensive in the factors in which they are relatively abundant. Hence, labour-abundant countries will specialise in labour-intensive industries and capital-abundant countries will specialise in capital-intensive industries. Since the geographical concentration index is not specific to each country, I construct a variable which is the deviation of factor intensities from the mean. X_{2it} is defined as labour costs divided by value added, at factor cost, less the mean of total labour costs as a proportion of the mean of the value added at factor cost[12], all squared. According to the theory, those industries which have 'high' factor intensities should be the most geographically concentrated. Since the theory does not imply that capital-intensive industries will be more geographically concentrated than labour-intensive industries, or vice versa, the deviations of labour intensity from the mean is squared. So we would expect that those industries which differ a lot from the mean should be the most geographically concentrated.

According to the economic geography literature, as trade barriers are reduced vertically linked industries are likely to agglomerate in a limited number of locations. Krugman and Venables (1995) and Venables (1996) show that a large number of downstream firms attracts a large number of upstream firms due to 'demand linkages', and the more upstream firms are in the one location, the more intense is the competition, thereby reducing the price of upstream goods and providing a feedback effect which is referred to as a 'cost linkage'. This feedback effect may also come from downstream firms having access to a bigger variety of differentiated inputs. These demand and cost linkages are stronger the higher the proportion is of intermediate goods in production of final goods. X_{3it} is a proxy for intermediate good intensity, defined as production less value added, divided by production, at market prices. So we should expect that the higher the proportion of intermediate goods the higher the geographical concentration.

I estimate the following equation with the EUROSTAT data set[13] to see whether the pattern of specialisation in the EU is consistent with

any of the three strands of trade theory.

$$G_{it} = ß_0 + ß_1 X_{1it} + ß_2 X_{2it} + ß_3 X_{3it} + a_i + ?_t + e_{it} \quad \textbf{(4)}$$

Where subscript i denotes industry i and subscript t denotes time. a_i represents industry dummies and $?_t$ represents time dummies. The time dummies are relative to 1976 and the industry dummies are relative to iron and steel. The industry dummies represent fixed industry effects which are unobservable and the time dummies represent fixed time effects which are not explained by the model. The time dummies may capture reductions in trade barriers, such as the harmonisation of product standards and the reduction of government formalities in trade.

The mean and standard deviation of each variable are listed in Table 6a below, and the correlations between the explanatory variables in Table 6b. I estimate two versions of equation (4) using ordinary least squares. The G_{it} index is replaced by the s_{it} index as the explanatory variable to check that the results are not sensitive to the geographical concentration index. The variables are transformed into logs so that the $ß_i$'s can be interpreted as elasticities. The full results are provided in Tables 4a and 4b of the Appendix and are summarised in Table 7 below.

TABLE 6a

	mean	standard deviation
G_{it}	0.18	0.09
s_{it}	0.38	0.20
X_{1it}	178.5	166.69
X_{2it}	0.01	0.02

X_{3it}	0.62	0.09

TABLE 6b
Correlations

	X_2	X_3
X_1	0.18	0.11
X_2	0.13	

TABLE 7

	(i)	(ii)
dependent variable:	$\ln(G_i)$	$\ln(s_i)$
independent variables:		
X_1	0.38*	0.22*
	(3.69)	(2.20)
X_2	0.00	0.00
	(0.82)	(0.62)
X_3	0.90*	0.56*
	(3.37)	(2.10)
industry dummies	yes	yes
time dummies	yes	yes
adjusted R squared	0.83	0.83
number of observations	868	868

Both of the specifications indicate that changes in X_1, which is the proxy for scale economies, and X_3, which is a proxy for the economic geography theory, have a positive and significant effect on geographical

concentration. According to equation (i), with G_i as the dependent variable, a 1% increase in scale economies leads to nearly 0.5% increase in geographical concentration; and a 1% increase in the proportion of intermediate goods in production leads to approximately 1% increase in geographical concentration. The coefficients are smaller in equation (ii) with s_i as the explanatory variable.

Both equations indicate that the factor intensity variable has no effect on geographical concentration. This is not surprising since the five countries in the sample are very similar in terms of their relative factor endowments. The Heckscher-Ohlin theory relies on differences in relative factor endowments for trade and specialisation to take place. See Leamer and Levinsohn (1995) for a review of tests of the Heckscher-Ohlin theory.

Kim (1996) conducts a similar study of the determinants of geographical concentration in the United States using the Gini. He finds support for the Heckscher-Ohlin theory and the new trade theories but does not test for the new economic geography theories. The support the study claims for the Heckscher-Ohlin theory is questionable. The explanatory variable used in Kim (1996) to test for the Heckscher-Ohlin theory is a measure of raw material intensity and is defined as the cost of raw materials divided by value added. But the Heckscher-Ohlin theory does not claim that resource intensive industries will be more geographically concentrated than other factor intensive industries. Instead, it predicts that countries will specialise in industries which are intensive in the factors which they are relatively abundant. The explanatory variable used in Kim (1996) to test for the new trade theory is constructed in the same way as in this paper.

Brulhart and Torstensson (1996) also find support for the new trade theories based on scale economies, using the Spearman rank correlation test. They use the Gini to rank the 18 industries in their sample of EU countries and find a high correlation with the ranking of industries according to scale economies based on 'products and production runs' and 'size of establishments'. Scherer (1980) distinguishes between three different types of economies of scale in

production: product specific, plant specific and multi-plant economies. Plant size will only capture certain aspects of scale economies.

Nearly all of the industry dummies are positive and significant indicating that there are unobserved fixed industry effects. Therefore all of the industries are more geographically concentrated than iron and steel, holding everything else constant. The time dummies show an increasing trend beginning in the early 1980s.

5. CONCLUSIONS

This paper has shown that there is evidence of increasing specialisation in EU countries between 1968 and 1990. International trade theories predict that the industrial structure of each country should become more different from its trading partners as trade costs fall. To determine whether the European experience is consistent with this trade theory hypothesis, I constructed country specialisation indices and geographical concentration indices and presented evidence of increasing specialisation in EU countries.

The disaggregated EUROSTAT data set shows that specialisation increased in all five countries (Belgium, France, Germany, Italy and UK) between 1976 and 1989. With the UNIDO data set, which includes 10 EU countries, both the Gini and the weighted standard deviation of the Balassa index using production at current and constant prices, and employment indicated that between 1968 and 1990 there was significant growth in specialisation in Denmark, Germany, Greece, Italy and Netherlands. For Belgium, France, Portugal and Spain all of the indices indicated a significant increase in specialisation between 1980 to 1990. Both measures indicated a significant fall in specialisation between 1968 and 1990 in Spain and the UK, and no significant change in Portugal. Specialisation may fall in countries which had high trade barriers to protect industries in which they did not have a comparative advantage. This may explain why late joiners to the EU such as Portugal, Spain and the UK, although they

experienced a fall or no significant change in specialisation when comparing 1968 to 1990, do have an upward trend in specialisation starting in the late 1970s and early 1980s.

The geographical concentration indices with production at current prices and employment show an increase in concentration in nearly half of the industries, whereas the indices with production at constant prices indicate that nearly two thirds of the industries experienced an increase in concentration between 1968 and 1990. The econometric analysis provides some support for the economic geography theories based on vertical linkages and the new trade theories based on scale economies. The coefficient on the proxy for the Heckscher-Ohlin theory was insignificant. This is not surprising since the five countries in the sample are very similar in terms of their relative factor endowments. The Heckscher-Ohlin theory relies on differences in factor endowments for trade and specialisation to take place.

This paper has only shown that the EU experience is consistent with trade theories. In order to test the theories we need a measure of the level of trade costs, preferably for each country and for each industry.

ENDNOTES

1. The European Community, which is now called the European Union, was formed in 1957. The first countries to form the EU were Belgium, Germany, France, Italy, Luxembourg and Netherlands. The EU was expanded to include Denmark, Ireland and the United Kingdom in 1973; Greece in 1981; and Spain and Portugal in 1986. Austria, Finland and Sweden joined in 1994 **S** these countries are not included in this study since the data ends in 1990.

2. The level of aggregation and the way industries are classified is usually dictated by the availability of data, and the problems this raises are well known. (See for example Aquino (1978)). The more aggregated the data, the less information we are likely to obtain. Also note that the main focus of many of the empirical papers is to distinguish between the extent of inter- and intra-industry trade specialisation. I will not categorise specialisation in this way. To do so would require a higher level of disaggregation of the data (which is not available for production) and then a re-categorisation according to an economic definition of an industry.

3. The F-K index is also known as the Michaely index. The F-K index is a transformation of the Krugman (1991b) index, where the Krugman index is equal to $\sum_i \# s_{ij} - s_{ik} \#$ and the F-K index is equal to $1 - \frac{1}{2} \sum_i \# s_{ij} - s_{ik} \#$. The Krugman index lies between 0 and 2. Krugman (1991b) compares the degree of specialisation in four EU countries with similarly sized American regions using employment data and found that the EU countries were less specialised than American regions.

4. Kol and Mennes (1986) discuss some problems with the Balassa index as a measure of similarity of trade patterns.

5. Krugman (1991b) uses the Gini to determine the degree of

geographical concentration of industries in the United States. Brulhart and Torstensson (1996) use the Gini in a study of 18 industries in 11 EU countries and found that geographical concentration has increased between 1980 and 1990. Helg *et al* (1995) use the Gini to measure geographical concentration of industries and country specialisation in the EU. In their country specialisation measure they only use shares (the numerator of the Balassa index) which means they are comparing the distribution of shares to a uniform distribution and not to the distribution of the average of the countries, which is a measure of absolute specialisation.

6. See Amiti (1996) for a full discussion and presentation of all the different measures of specialisation discussed in the previous section. Since bilateral comparisons of the F-K index for country j with all the other countries in the sample do not move in the same direction, the mean of the F-K may not be a reliable measure and therefore is not presented here.

7. All the indices are multiplied by 100.

8. Even though the G_j index does not give a significant increase in specialisation for Italy it is clear from Table 1 that specialisation did actually increase between 1976 and 1989 but not with a smooth trend **S** the R bar squared was only 17% for Italy whereas it was over 80% for the other countries.

9. The UK reclassified its manufacturing industries in 1979. To check that the reclassification is not driving the results, I re-calculated all the indices excluding the UK and found that specialisation increased in the remaining four countries.

10. There were two exceptions: for France the G_j index with production at current prices indicates no significant change and for Spain the s_j index with production at constant prices indicates no signficant change since 1980.

11. This may just indicate that a linear time trend does not fit the data.

12. I dropped the following three industries as they had negative value added: 4110 manufacture of vegetable and animal oils and fats; 4130 manufacture of dairy products; and 4240 spirit distilling.

13. It was not possible to estimate this equation with the UNIDO data set since value added is measured in factor prices for some countries and market prices for others.

APPENDIX: TABLE 1a
G_j index with Production at current prices

	Bel	Den	Fra	Ger	Gre	Ita	Net	Por	Spa	UK
1968	20.97	27.48	11.22	11.59	35.24	13.84	23.12	38.74	20.90	10.94
1970	21.69	29.50	10.86	12.19	34.30	13.42	25.18	39.04	22.75	9.56
1972	21.66	28.65	11.17	12.52	33.29	13.28	24.69	35.86	24.10	9.40
1974	21.24	31.29	9.60	12.95	33.10	12.19	24.96	36.51	21.64	9.18
1976	21.30	30.62	9.69	13.14	35.42	13.09	26.12	36.11	22.94	8.25
1978	21.82	33.67	9.54	12.10	37.49	13.66	27.93	32.68	16.60	8.24
1980	21.86	33.61	7.85	11.27	37.64	16.69	28.05	33.26	15.85	7.31
1982	21.93	33.30	7.66	11.91	38.93	15.59	28.07	32.65	15.93	7.21
1984	22.41	33.95	8.69	12.99	40.95	15.53	28.31	35.56	17.99	6.13
1986	23.01	34.10	9.04	14.06	42.18	16.38	26.94	38.90	18.00	7.68
1988	23.34	34.26	8.83	13.54	43.33	16.77	29.29	38.45	18.98	7.87
1990	23.64	33.25	8.14	13.26	43.60	16.89	27.01	38.68	18.39	7.60
ß	0.05*	0.01*	-0.01*	0.01*	0.01*	0.02*	0.01*	0.00	-0.01*	-0.02*
t	8.04	8.47	-6.80	3.28	13.25	8.10	7.07	-0.07	-4.13	-5.93

TABLE 1b
G_j index with Employment

	Bel	Den	Fra	Ger	Gre	Ita	Net	Por	Spa	UK
1968	19.80	24.31	7.30	13.85	38.24	15.56	19.67	47.64	25.24	8.80
1970	19.59	25.53	7.47	13.99	37.27	16.05	22.04	48.30	25.71	8.26
1972	19.92	25.59	7.08	13.84	35.60	13.06	21.96	43.32	24.76	8.29
1974	21.39	25.52	7.01	14.83	36.26	12.81	21.50	42.32	24.74	8.27
1976	20.17	25.46	6.98	15.16	37.73	12.61	22.81	39.95	24.31	8.32
1978	19.71	27.52	6.70	14.14	38.54	13.04	24.72	39.39	20.43	7.90
1980	18.82	28.01	6.75	13.79	39.93	13.46	25.69	38.91	19.74	7.73
1982	19.79	27.12	6.64	14.46	41.08	13.94	24.43	38.78	18.23	7.91
1984	20.55	27.74	7.69	15.03	41.24	15.12	24.90	40.14	18.70	8.34
1986	20.75	28.11	8.33	15.86	42.75	15.87	24.20	42.91	20.49	7.82
1988	20.44	28.62	8.58	16.52	42.62	16.58	24.47	42.86	20.95	7.70
1990	20.89	32.56	8.57	16.46	43.53	17.22	23.27	43.81	21.22	7.50
ß	0.00	0.01*	0.01*	0.01*	0.01*	0.01*	0.01*	0.00	-0.01*	-0.005*
t	0.91	8.64	3.41	6.36	10.79	2.74	5.13	-1.99	-5.72	-5.96

TABLE 1c
s_j index with Production at current prices

	Bel	Den	Fra	Ger	Gre	Ita	Net	Por	Spa	UK
1968	36.19	42.52	24.48	35.29	55.79	33.56	35.57	60.50	35.11	32.47
1970	34.75	45.91	24.78	38.36	49.79	32.69	38.52	60.50	38.08	30.24
1972	33.92	45.55	24.70	37.49	50.93	32.36	39.20	53.56	43.99	26.84
1974	34.23	51.26	20.14	37.84	50.82	31.56	40.39	60.61	40.65	25.35
1976	33.28	49.11	23.10	38.99	56.51	32.28	42.49	54.50	41.71	25.13
1978	34.00	55.30	23.27	39.15	59.04	36.15	42.86	48.81	23.78	27.43
1980	33.09	55.82	21.67	37.17	58.00	40.18	44.38	54.06	21.02	26.72
1982	32.03	57.56	22.23	38.52	59.63	40.19	42.94	48.09	22.38	26.60
1984	32.67	57.46	23.88	40.86	63.85	39.05	43.12	50.23	24.93	25.11
1986	34.13	54.43	25.19	43.98	64.78	37.62	42.21	59.27	25.27	28.49
1988	34.43	53.63	25.13	43.65	66.33	38.93	45.08	57.12	29.21	28.56
1990	34.62	52.70	25.28	43.01	65.58	40.96	40.97	56.32	28.22	28.27
ß	0.00	0.01*	0.00	0.01*	0.01*	0.01*	0.01*	0.00	-0.02*	0.00
t	-1.69	5.75	1.28	7.55	9.59	8.28	5.46	-1.14	-4.04	-1.06

TABLE 1d
s_j index with employment

	Bel	Den	Fra	Ger	Gre	Ita	Net	Por	Spa	UK
1968	33.24	38.80	25.08	44.14	63.97	28.25	33.09	76.86	35.34	32.10
1970	34.27	40.46	25.73	45.10	60.18	29.40	33.98	78.15	35.43	31.10
1972	34.83	40.10	24.90	42.66	53.51	28.47	33.90	69.66	36.62	27.82
1974	34.06	41.79	24.67	43.95	54.03	28.16	34.80	69.99	37.31	26.70
1976	31.80	40.94	24.72	43.86	56.67	28.30	38.04	64.14	37.21	25.96
1978	31.63	44.19	23.93	41.72	59.14	30.08	42.31	63.78	26.72	25.68
1980	30.07	45.95	22.64	41.32	61.03	30.42	44.49	65.34	26.30	25.32
1982	30.84	45.06	22.46	42.58	63.43	30.93	43.48	66.42	24.00	23.84
1984	31.89	46.75	24.81	43.46	64.62	32.02	45.08	70.85	25.43	23.48
1986	32.30	47.65	24.91	46.52	67.40	33.50	44.95	75.74	27.26	22.47
1988	31.93	48.68	25.29	48.04	68.27	35.01	44.76	77.69	27.68	21.94
1990	33.54	57.11	26.08	49.07	72.30	36.05	43.06	81.78	28.65	22.26
ß	-0.004*	0.01*	0.00	0.004*	0.01*	0.01*	0.02*	0.00	-0.02*	-0.02*
t	-2.99	12.67	-0.18	2.68	5.73	11.05	10.07	1.09	-5.23	-17.89

TABLE 2a
Gjt index with production (EUROSTAT)

industry		1976	1989
4940	toys & sports goods	38.13	21.41
4380	carpets & other floor coverings	30.89	38.16
4950	miscellaneous industries	30.14	32.80
4190	bread & flour confectionary	29.18	18.06
4310	wool industry	29.03	33.76
4270	brewing & malting	28.93	33.12
2550	manuf of paint	26.84	25.37
4510	mass-produced footwear	26.47	38.54
4650	other wood manufactures	26.42	30.54
4910	jewellery	25.85	40.98
3270	other machinery: specific industry	25.82	33.38
3710	measuring instruments	25.16	29.65
3620	railway & tramway rolling stock	24.52	35.66
4140	processing of fruit & vegetables	23.58	16.46
4220	animal & poultry foods	22.80	19.25
4240	spirit distilling & compounding	21.64	22.45
4610	sawing & processing of wood	21.11	18.11
3150	boilermaking	20.86	26.66
4120	slaughtering & preparing meat	20.83	25.09
3230	manuf of textile machinery	20.03	30.58
4620	semi-finished wood products	19.86	15.50
4230	other food products	19.78	17.12
3130	secondary transform of metals	19.47	23.73
4660	plaiting materials	19.14	12.12
2410	manuf of clay products	18.95	20.85
4130	manuf of dairy products	18.13	18.74
2480	manuf of ceramic goods	17.97	23.49
3260	manuf of transmission equipment	17.91	18.25
4630	carpentry & joinery components	17.43	7.98
4150	processing of fish & seafoods	17.09	29.49
3220	manuf of tools	17.08	26.75
2450	working of stone	16.57	40.50
3280	manuf of other machinery	16.48	14.09

TABLE 2a cont/...

TABLE 2a continued
Gjt index with production (EUROSTAT)

industry		**1976**	**1989**
4670	wooden furniture	16.45	9.20
2420	cement, lime & plaster	16.23	13.08
3140	manuf of structural metals	15.44	11.32
4160	grain milling	14.31	25.11
4730	printing & allied industries	13.93	28.28
2230	drawing & cold rolling	12.97	9.28
2430	manuf of concrete for construction	12.61	3.56
2570	manuf of pharmaceutical products	12.53	14.34
3240	manuf food & chemical machinery	12.33	18.98
4720	processing of paper & board	11.87	11.41
4360	knitting industry	11.41	26.24
4810	rubber products	11.06	9.11
4320	cotton industry	10.51	17.61
2470	manuf of glass & glassware	10.09	9.64
3250	manuf of plant for mines	9.34	9.15
3110	foundaries	8.94	8.44
4390	miscellaneous textile industries	8.82	10.50
3160	manuf of tools	8.41	17.66
2240	processing of non-ferrous metals	8.23	7.34
2510	manuf of basic industrial chemicals	8.11	11.59
4280	manuf of soft drinks	7.82	13.30
4370	textile finishing	7.64	25.31
2580	manuf of soap & toilet preparations	7.40	11.80
4710	pulp, paper & board	6.99	5.39
3610	shipbuilding	6.82	15.79
4110	vegetable & animal oils	6.63	14.58
3210	manuf of agricultural machinery	6.56	16.05
4530	ready made clothing	6.36	17.09
4560	furs & fur goods	5.28	34.38
2210	iron & steel	5.15	10.32
4210	cocoa, chocolate & sugar confection	4.95	16.52
4830	processing of plastics	4.79	4.50

TABLE 2b
Changes in Gi index with NACE production

industries with positive & significant growth		ß	t value
4210	cocoa, chocolate & sugar	0.12	6.02
4370	textile finishing	0.10	7.26
2450	working of stone	0.08	6.76
4530	ready made clothing	0.08	9.90
4360	knitting industry	0.07	14.18
4560	furs & fur goods	0.07	3.14
4110	vegetable & animal oils	0.07	5.31
3160	manuf of tools	0.05	11.27
4150	processing of fish & sea foods	0.05	2.71
2580	manuf soap & toilet preparations	0.05	6.55
4730	printing & allied industries	0.05	7.48
3610	shipbuilding	0.04	3.25
3210	manuf of agricultural machinery	0.04	3.30
3220	manuf of machine tools	0.04	10.40
4120	slaughtering & preparing meats	0.04	5.65
4910	jewellery	0.03	6.75
4160	grain milling	0.03	6.90
3230	manuf of textile machinery	0.03	4.01
3240	manuf food & chemical machinery	0.03	3.34
4320	cotton industry	0.03	4.12
3270	other machinery:specific industry	0.03	8.91
4510	mass-produced footwear	0.03	8.10
4380	carpets & other floor coverings	0.02	6.77
2510	manuf basic industrial chemicals	0.02	3.75
2570	manuf of pharmaceutical products	0.02	3.50
4130	manuf of dairy products	0.01	2.38
4310	wool industry	0.01	4.75
4650	other wood manufactures	0.01	2.96
3150	boilermaking	0.01	2.41
4270	brewing & malting	0.01	5.34

TABLE 2b cont/...

TABLE 2b continued
Changes in Gi index with NACE production

industries with negative significant growth			
2430	manuf concrete for construction	-0.14	-5.22
4630	carpentry & joinery components	-0.08	-4.30
4670	wooden furniture	-0.03	-3.36
4140	processing of fruit & vegetables	-0.03	-2.33
4710	pulp, paper & board	-0.03	-3.53
4190	bread & flour confectionary	-0.03	-6.42
4810	rubber products	-0.02	-2.68
4620	semi-finished wood products	-0.02	-5.54
3280	manuf of other machinery	-0.02	-2.81
2420	manuf of cement, lime & plaster	-0.01	-2.39
4720	processing of paper & board	-0.01	-2.21
4220	animal & poultry foods	-0.01	-2.65
industries with no significant change		**ß**	**t value**
2210	iron & steel	0.02	0.88
2230	Drawing & cold rolling	-0.01	-0.66
2240	processing of non ferrous metal	-0.01	-0.99
2410	manuf of clay products	0.00	0.37
2470	manuf of glass & glassware	0.00	0.07
2480	manuf of ceramic goods	0.01	1.89
2550	manuf of paint	0.01	1.49
3110	foundaries	0.01	1.17
3130	secondary transform of metals	0.01	1.49
3140	manuf of structural metals	-0.02	-1.10
3250	manuf plant for mines	0.02	1.40
3260	manuf of transmission equipment	0.01	1.46
3620	railway & tramway rolling stock	0.01	1.17
3710	meausuring instruments	0.00	0.27
4230	other food products	0.00	0.40
4240	spirit distilling & compounding	0.00	0.39
4280	manuf of soft drinks	0.02	1.43
4390	miscellaneous textile industries	0.01	1.43
4610	sawing & processing of wood	0.01	0.73
4660	plaiting materials	-0.02	-1.82
4830	processing of plastics	0.02	1.43
4940	toys & sports	-0.03	-1.68
4950	miscellaneous	0.01	1.69

TABLE 3a
Gjt index with production at current prices (UNIDO)

industry		1968	1990
354	misc. petroleum & coal products	43.74	28.52
361	poettery, china, earthenware	27.38	38.49
385	professional & scientific equipment	22.68	17.97
314	tobacco	22.00	26.21
353	petroleum refineries	19.24	11.70
311	food products	17.52	18.39
372	non-ferrous metals	17.40	9.73
332	furniture	16.48	13.73
342	printing & publishing	16.15	22.66
352	other chemicals	14.63	10.58
331	wood products	13.72	12.70
355	rubber products	13.69	8.92
313	beverages	13.18	12.35
356	plastic products	12.88	5.01
362	glass & products	12.23	10.22
382	machinery, except electrical	12.07	13.40
371	iron & steel	11.84	12.47
323	leather products	11.60	36.73
383	machinery electric	11.54	11.42
384	transport equipment	11.31	12.17
324	footwear	11.12	38.73
351	industrial chemicals	9.92	13.80
321	textiles	9.68	22.39
369	other non-metallic mineral products	9.28	14.85
322	wearing apparel	6.78	21.64
341	paper & products	4.80	6.32
381	fabricated metal products	4.66	7.56

TABLE 3a cont/...

TABLE 3a continued
Gjt index with production at current prices (UNIDO)

industries with positive & significant growth		**ß**	**t value**
322	wearing apparel	0.07	17.29
321	textiles	0.04	19.01
323	leather products	0.04	11.74
324	footwear	0.04	7.58
369	other non-metalic mineral products	0.03	8.99
381	fabricated metal products	0.03	2.41
361	pottery, china, earthenware	0.02	8.93
342	printing & publishing	0.02	14.91
351	industrial chemicals	0.02	6.79
384	transport equipment	0.02	4.18
314	tobacco	0.01	4.31
industries with negative significant growth			
356	plastic products	-0.05	-15.72
352	other chemicals	-0.03	-4.36
372	non-ferrous metals	-0.02	-6.54
353	petroleum refineries	-0.02	-4.81
354	misc. petroleum & coal products	-0.02	-7.21
332	furniture	-0.01	-3.66
355	rubber products	-0.01	-3.22
385	professional & scientific equipment	-0.01	-2.79
industries with no significant change			
311	food products	0.00	-0.30
313	beverages	0.00	0.48
331	wood products	0.00	-0.75
341	paper & products	0.00	0.43
362	glass & products	0.00	-0.57
371	iron & steel	0.00	0.12
382	machinery	0.00	0.91
383	electrical machinery	0.00	-1.29

TABLE 3b
Gjt index with production at constant prices (UNIDO)

industry		1968	1990
354	misc. petroleum & coal products	33.99	31.19
361	pottery, china, earthenware	32.43	41.28
385	professional & scientific equipment	24.93	18.91
314	tobacco	22.60	28.87
352	other chemicals	19.50	7.97
342	printing & publishing	19.41	22.99
323	leather products	18.65	33.53
324	footwear	17.60	33.21
311	food products	16.51	17.30
355	rubber products	15.89	12.09
322	wearing apparel	15.78	18.06
313	beverages	15.28	12.33
382	machinery, except electrical	14.24	15.17
353	petroleum refineries	13.95	16.93
321	textiles	13.10	21.99
362	glass & products	12.42	8.85
331	wood products	12.29	11.01
369	other non-metallic mineral products	11.91	16.68
372	non-ferrous metals	11.45	13.49
383	machinery electric	11.14	13.22
384	transport equipment	10.65	12.88
371	iron & steel	10.34	12.84
341	paper & products	10.15	3.15
332	furniture	9.57	15.65
351	industrial chemicals	9.09	13.27
356	plastic products	9.03	11.13
381	fabricated metal products	6.78	4.44

TABLE 3b cont/...

TABLE 3b continued
Gjt index with production at constant prices (UNIDO)

industries with positive & significant growth		**ß**	**t value**
323	leather products	0.03	13.28
384	transport equipment	0.03	5.86
321	textiles	0.03	17.46
324	footwear	0.03	11.63
332	furniture	0.02	7.19
369	other non-metallic mineral products	0.02	7.99
371	iron & steel	0.02	6.90
356	plastic products	0.02	2.97
322	wearing apparel	0.02	4.50
351	industrial chemicals	0.01	4.88
353	petroleum refineries	0.01	3.17
361	pottery, china, earthenware	0.01	22.10
372	non-ferrous metals	0.01	7.67
314	tobacco	0.01	11.88
311	food products	0.01	6.18
342	printing & publishing	0.01	5.88
382	machinery	0.01	2.65
industries with negative significant growth			
341	paper & products	-0.06	-12.35
352	other chemicals	-0.05	-8.55
385	professional & scientific equipment	-0.01	-4.87
362	glass & products	-0.01	-6.32
355	rubber products	-0.01	-2.82
313	beverages	-0.01	-2.76
industries with no significant change			
383	electrical machinery	0.00	1.24
381	fabricated metal products	0.01	0.60
331	wood products	-0.01	-1.01
354	misc. petroleum & coal products	0.00	-1.24

TABLE 4a

Dependent variable	ln Gi		ln si	
	ß	t value	ß	t value
constant	-4.86	-6.71	-2.86	-3.97
X1	0.38	3.69	0.22	2.20
X2	0.00	0.82	0.00	0.62
X3	0.90	3.37	0.56	2.10
industry dummies:				
Drawing & cold rolling	0.88	4.00	0.68	3.10
processing of non ferrous metal	0.39	2.61	0.18	1.20
manuf of clay products	2.11	6.85	1.25	4.09
manuf of cement, lime & plaster	1.40	7.24	0.74	3.84
manuf concrete for construction	0.58	2.04	-0.24	-0.84
working of stone	2.49	7.81	1.62	5.12
manuf of glass & glassware	1.11	5.40	0.46	2.25
manuf of ceramic goods	1.87	7.90	1.22	5.20
manuf basic industrial chemicals	0.34	3.28	-0.18	-1.78
manuf of paint	1.85	8.34	1.13	5.11
manuf of pharmaceutical products	1.02	5.90	0.32	1.87
manuf soap & toilet preparations	0.56	3.32	-0.03	-0.18
foundries	1.05	4.40	0.44	1.84
secondary transform of metals	2.35	7.23	1.42	4.38
manuf of structural metals	1.31	4.60	0.49	1.73
boilermaking	2.08	8.10	1.27	4.99
manuf of tools	1.35	5.18	0.62	2.39
manuf of agricultural machinery	1.16	5.49	0.51	2.45
manuf of machine tools	2.10	7.61	1.24	4.53
manuf of textile machinery	2.01	9.13	1.21	5.54
manuf food & chemical machinery	1.53	6.10	0.84	3.36
manuf plant for mines	0.86	3.94	0.17	0.78
manuf of transmission equipment	1.62	7.33	0.92	4.17
other machinery: specific industry	2.21	8.96	1.42	5.79
manuf of other machinery	1.38	6.25	0.67	3.04
shipbuilding	1.05	6.49	0.45	2.81
railway & tramway rolling stock	1.69	12.40	1.26	9.25
meausuring instruments	2.28	8.77	1.43	5.52
slaughtering & preparing meats	1.60	6.57	0.95	3.94
processing of fruit & vegetables	1.35	5.99	0.67	2.98
processing of fish & sea foods	1.67	7.66	1.07	4.96
grain milling	1.70	5.93	1.04	3.65
bread & flour confectionary	1.86	7.73	1.23	5.12

TABLE 4a cont/...

TABLE 4a continued

cocoa, chocolate & sugar		0.75	4.65	0.17	1.07
animal & poultry foods		1.62	5.93	0.93	3.42
other food products		1.29	6.84	0.64	3.43
brewing & malting		2.35	9.40	1.46	5.88
manuf of soft drinks		0.91	3.76	0.15	0.60
wool industry		2.15	8.99	1.43	6.02
cotton industry		1.19	5.95	0.48	2.38
knitting industry		1.79	6.89	1.00	3.88
textile finishing		1.77	6.32	1.11	3.97
carpets & other floor coverings		2.06	10.37	1.80	9.13
miscellaneous textile industries		1.36	4.74	0.50	1.75
mass-produced footwear		2.37	8.91	1.56	5.91
ready made clothing		1.27	4.62	0.51	1.85
furs & fur goods		2.08	6.15	1.15	3.43
sawing & processing of wood		1.95	5.88	1.09	3.29
semi-finished wood products		1.62	6.46	0.98	3.94
carpentry & joinery components		1.42	4.74	0.63	2.12
other wood manufactures		2.51	7.95	1.63	5.20
plaiting materials		1.84	5.97	1.03	3.37
wooden furniture		1.22	4.21	0.34	1.16
pulp, paper & board		0.10	0.64	-0.43	-2.65
processing of paper & board		1.29	5.23	0.50	2.03
printing & allied industries		2.18	7.45	1.25	4.30
rubber products		0.82	4.88	0.21	1.28
processing of plastics		0.36	1.34	-0.30	-1.12
jewellery		2.53	7.87	2.10	6.57
toys & sports		1.97	7.34	1.17	4.38
miscellaneous		2.52	8.52	1.65	5.63
time	1977	0.01	0.24	0.02	0.43
dummies	1978	0.00	0.13	0.01	0.35
	1979	0.05	1.40	0.07	1.83
	1980	0.08	1.93	0.09	2.22
	1981	0.12	3.06	0.13	3.18
	1982	0.11	2.66	0.12	2.98
	1983	0.16	3.85	0.17	3.97
	1984	0.14	3.23	0.14	3.24
	1985	0.13	2.85	0.14	3.08
	1986	0.14	3.31	0.15	3.42
	1987	0.17	3.93	0.18	4.12
	1988	0.20	4.54	0.21	4.90
	1989	0.20	4.28	0.22	4.73
Adjusted R squared		0.83		0.83	

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