

# Economic Integration and Structural Change: The Case of Irish Regions<sup>1</sup>

by

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## 1. Introduction

Following a prolonged period of relative economic isolation Ireland opened up its trade to international competition during the 1960s and became a member of the European Economic Community (EEC) in 1973. This meant that the indigenous firms that grew up under the protection of tariff barriers were exposed to international competition. Subsequent initiatives by the European Union, such as the Single European Market (SEM) and European Monetary Union (EMU) have further contributed to the economic integration of Ireland into Europe. Ireland is now one of the most open economies in the world with the sum of imports and exports accounting for about 150% of GDP, although it should be noted that Ireland has particularly strong trading links with non-EU countries and especially the US. In addition to the opening of trade, from the 1960's Ireland pursued an industrial policy focused on attracting foreign direct investment (FDI).

While the change in economic policy during the 1960's initially brought only limited success in terms of convergence of living standards. However, starting in the early 1990's Ireland has experienced rapid economic growth, which has resulted in convergence to the average EU living standards. The reasons for this recent rapid convergence are multiple and complex., but the contributory factors include EU membership, a successful industrial policy a highly educated young workforce and a favourable tax regime (for more details see Barry, 1999). While many of these factors were in place during the 1980's a key factor that was absent during this period was the presence of stable government and credible policies that provided a favourable general economic environment<sup>2</sup>.

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<sup>2</sup> While Irish governments are elected for a 5 year term there were 5 elections during the period 1981 to 1989.

Apart from the national trends and their underlying causes it is also important to consider the degree to which the national turnaround in economic fortunes has been mirrored at the regional level. While the national trends are well known, the regional trends are often ignored for lack of data. However, as with the national case the regional development trends serve as an important case study of the trends that occur in periods of slow and fast growth.

It is particularly interesting to study the impact of the integration process on regional economic activity in Ireland, since the experience of the Irish regions may serve as a useful case study for the new EU member states which are all lagging in development, and have been subject to substantial trade opening and reorientation. In this respect we focus on the evolution of regional specialisation and how this relates to regional economic performance<sup>3</sup>. Our analysis shows that recent Irish growth experience seems to contradict the recent New Economic Geography literature, which predicts strong specialisation of core regions in the high returns to scale activities.

This paper is organized as follows. In section 2 we summarise the evolution of some key regional variables over time and we review the major regional policy initiative in section 3. Section 4 analyses the evolution of regional specialization and industrial concentration and section 5 outlines more robust econometric evidence. Finally, we summarize our findings and draw some conclusions in section 6.

## **2. The regional structure of the country and its change**

Before we deal with the degree of regional specialisation and industrial concentration, which is subject of the next section we concentrate on the key variables that describe the development of the NUTS 3 regions in Ireland. There are eight NUTS 3 region, and these make up two NUTS 2 regions, namely the Border, Midlands and West region and the Southern and Eastern region. While these regions do not constitute functional regions in the economic sense, they are the administrative regions for which data is available<sup>4</sup>. While it would be possible to further disaggregate to the county level but this would result in a serious reduction in the number of variables available for analysis.

Table 1 shows the key variables in each case for two years, one being the most recent year for which the data is available and one chosen close to the starting point of the analysis of specialization and concentration in 1972. Data availability means that particularly for the labour market variables the most recent year is 1983<sup>5</sup>. The first two rows show an index of per capita Gross Value Added (GVA), which is expressed as a percentage of the national average. Thus, in 1981 the Border region had a per capita GVA, which was 17% lower than the national average. This gap had grown to almost 30% by 2003. Overall, looking at these figures, it is clear that there has been a process of divergence among the Irish regions. What the table does not show is that there was very slight convergence over the period up to the late 1980's after which divergence became an increasing phenomenon (this is also supported by a number of studies such as Boyle,

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<sup>3</sup> A recent paper by Gleeson, Ruane and Sutherland (2006) considered the spatial and sectoral concentration of industry for a shorter period than is considered here. Furthermore, in contrast to that paper this article relates specialisation with economic performance.

<sup>4</sup> See Morgenroth, 1999 for an outline of the governance structures at the local and regional level in Ireland.

<sup>5</sup> It would be possible to use Census data for 1971 or 1981 but this is likely to suffer from consistency problems with the annual data that is collected specifically for labour market analysis. As the labour market indicators chosen here are those that are used by the statistics office for regional comparisons we utilise this data.

McCarthy and Walsh, 1999, O'Connor, 1999 and O'Leary, 1999, 2001). This trend occurred despite the fact that all regions have recorded very substantial annual average GVA growth rates of over 5% so that in EU terms all Irish regions have been converging to the EU average. Particularly pronounced are the growth rates for the Mid-East and the South West which both have a high proportion of multinational firms especially in manufacturing.

As output variables are susceptible to biases due to commuting patterns and transfer pricing by multinational firms, it is also useful to consider an indicator of personal income, which is shown in the table for 1973 and 2003. Immediately apparent is the smaller gap between the 'richest' and 'poorest' region, which was approximately 40% in 1973 and was 25.2% in 2003, which suggests that the regions have converged over that period. This is also confirmed by the growth rates, which for the 'poorer' regions exceed that of the richer regions. Notable too is the fact that the average annual growth rates are substantially lower for income than for output, which confirms the impact of foreign firms, which through transfer pricing artificially inflate the GVA figures. In summary we find that output, that is economic activity, appears to be diverging and thus concentrating while income is converging.

The extent to which the strong growth in both output and income is mirrored in the labour market statistics is also shown in the table. This shows that the unemployment rate, defined on the Principle Economic Status definition, has declined from 14% in 1983 to 6% in 2004 nationally and the highest rate of unemployment which is recorded for the Border regions standing at less than 8%. Overall the unemployment rate differentials have been declining. Apart from the drastic reduction in the unemployment rate the strong growth in the numbers employed is apparent. Nationally employment increased by about 650,000 over the period 1983 to 2004, which is an increase of over 60%. Indeed employment growth exceeded 60% in all regions except the Mid-East where employment more than doubled.

Finally, turning to the evolution of the population this has grown strongly over the period, although there was strong emigration and slight population decline during the 1980's. While all regions increased their population by about one quarter compared to 1971, one region namely the Mid-East stands out having doubled its population over the period. Of course, this region is the one that surrounds Dublin, the only city in Ireland with an international role, and this population growth reflects on the one hand rural-urban migration flows and development constraints in Dublin.

**Table 1 Summary Statistics on Key Variables on Regional Development**

	Border	Midlands	West	Dublin	Mid-East	Mid-West	South-East	South-West	State
Per Capita Gross Value Added (% of National 1981)	83.2%	84.4%	79.7%	129.7%*	61.8%*	95.3%	96.8%	101.1%	100.0%
Per Capita Gross Value Added (% of National, 2003)	73.4%	64.8%	69.5%	130.9%	74.1%	88.2%	84.7%	131.0%	100.0%
Avg. Annual Growth in Real Gross Value Added 1981-2003	7.3%	5.7%	7.2%	8.9%	11.5%	7.8%	7.1%	12.8%	10.2%
Per Capita Income (% of National, 1973)	84.4%	83.6%	82.6%	122.9%	94.8%	95.7%	91.2%	99.0%	100.0%
Per Capita Income (% of National, 2003)	89.9%	90.9%	92.3%	114.6%	99.8%	98.3%	89.4%	96.9%	100.0%
Avg. Annual Growth in Real Per Capita Income 1973-	5.9%	6.1%	6.4%	4.7%	5.8%	5.6%	5.2%	5.1%	5.3%
Unemployment Rate (1983 Q2) PES	16.9%	12.0%	10.3%	14.6%	13.6%	14.5%	14.8%	13.3%	14.0%
Unemployment Rate (2004Q2) PES	7.9%	6.0%	5.3%	6.1%	4.8%	6.6%	5.8%	5.4%	6.0%
Persons at Work (1983Q2)	121,600	63,200	114,800	351,100	90,300	95,600	117,700	170,900	1,125,200
Persons at Work (2004Q2)	183,200	101,000	169,400	526,900	198,000	151,200	186,900	253,600	1,770,200
Avg. Annual Employment Growth 1983-2004	1.6%	1.8%	1.5%	1.6%	2.6%	1.8%	1.8%	1.6%	1.7%
Population (1971)	360,790	178,908	312,267	852,219	210,001	269,804	328,604	465,655	2,978,200
Population (2006)	467,327	251,380	413,383	1,186,159	475,026	361,651	460,474	620,525	4,234,925
Avg. Annual Population Growth 1971-2006	0.8%	1.2%	0.9%	1.1%	3.6%	1.0%	1.2%	1.0%	1.2%

Source: CSO Census of Population, CSO Labour Force Survey, CSO Quarterly National Household Survey. \*these figures are own estimates.

An important aspect of the regional divergence among Irish regions is the contribution of the broad sectors to this. Data limitations mean that the regional gross value added can only be disaggregated into three broad sectors namely; (1) agriculture, forestry and fishing, (2) manufacturing, building and construction, and finally (3) market and non-market services, for a relatively short period of time. Table 2 shows the recent evolution of the sectoral shares. Most noticeable is the decline of the primary sector in all regions. Furthermore, the secondary and tertiary sectors have increased their share.

**Table 2 Sectoral Shares in Gross Value Added (GVA) by Region for 1991 and 2002**

	Agriculture, Forestry & Fishing	Manufacturing, Building and Construction	Market and Non-market Services	Total
1991				
Border	13.1%	42.4%	44.5%	100%
Midlands	15.5%	35.6%	48.9%	100%
West	13.4%	33.9%	52.6%	100%
Dublin	0.5%	28.8%	70.7%	100%
Mid-East	12.2%	36.9%	50.9%	100%
Mid West	11.3%	41.3%	47.4%	100%
South East	16.4%	39.1%	44.6%	100%
South West	12.7%	42.0%	45.3%	100%
State	8.2%	35.2%	56.6%	100%
2003				
Border	5.3%	35.4%	59.3%	100%
Midlands	5.0%	29.7%	65.3%	100%
West	4.6%	30.2%	65.2%	100%
Dublin	0.2%	27.0%	72.7%	100%
Mid-East	3.2%	47.5%	49.2%	100%
Mid West	3.4%	40.6%	55.9%	100%
South East	4.9%	44.0%	51.1%	100%
South West	2.8%	57.3%	39.9%	100%
State	2.5%	38.1%	59.4%	100%

Source: Own calculations using CSO Regional Accounts

Decomposing the sectoral contributions to overall growth in the regions yields some interesting results. Here we follow see Morgenroth and O'Malley (2003) by first showing the absolute growth rates of each sector in each region in Table 3, which also shows the relative contributions of the sectors to the overall growth performance. The latter is calculated by weighting the absolute growth rate by the sectoral share in GVA. Thus, while the overall performance of the primary sector is very poor, given the relatively small share of the primary sector this has a relatively small contribution to the overall growth rate. The tertiary sector has on average the largest contribution to overall growth, but in the case of two regions, namely the Mid-East and the South-West, the secondary sector has grown particularly strongly.

**Table 3 Average annual growth rates of Total Real Regional Gross Value Added (GVA) for the period 1991-2003 and sectoral decomposition, and weighted sectoral contributions to total growth**

	Agriculture, Forestry & Fishing	Manufacturing, Building and Construction	Market and Non-market Services	Total	Agriculture, Forestry & Fishing	Manufacturing, Building and Construction	Market and Non-market Services	Total
Border	-1.7	6.0	15.0	9.0	-0.2	2.5	6.7	9.0
Midlands	-3.1	6.3	15.6	9.4	-0.5	2.3	7.6	9.4
West	-2.5	8.1	14.8	10.2	-0.3	2.8	7.8	10.2
Dublin	-3.1	10.1	14.0	10.5	0.0	2.7	8.0	10.7
Mid-East	-2.8	15.0	15.4	12.3	-0.2	9.6	8.8	18.2
Mid West	-3.0	28.2	15.0	18.3	-0.4	4.2	6.6	10.5
South East	-2.5	13.9	13.2	12.2	-0.5	5.8	6.9	12.3
South West	-3.1	10.1	14.0	10.5	-0.4	11.8	6.8	18.3
State	-2.8	15.0	15.4	12.3	-0.2	4.9	7.5	12.2

Source: Own calculations using CSO Regional Accounts

Given the findings above it is also useful to consider how the sectoral performance has contributed to convergence or divergence, that is faster or slower growth relative to the national average. This is shown in Table 4 where the national average growth rate for each sector is subtracted from the regional sector growth rates. This shows that the deviations from the national growth rate of the primary sector are very small. However, these deviations are larger and very heterogeneous across regions for the secondary sector, and small but heterogeneous for the tertiary sector. Thus, one can conclude that the performance of the secondary sector has the largest bearing on the convergence/divergence performance of the regions, and it is therefore particularly relevant to further analyse the secondary sector.

**Table 4 Relative GVA growth rates and sectoral contributions to convergence/divergence**

	Agriculture, Forestry & Fishing	Manufacturing, Building and Construction	Market and Non-market Services	Total
Border	0.0	-2.4	-0.8	-3.2
Midlands	-0.3	-2.6	0.2	-2.8
West	-0.1	-2.1	0.3	-1.9
Dublin	0.2	-2.2	0.5	-1.5
Mid-East	0.0	4.7	1.3	6.0
Mid West	-0.1	-0.7	-0.9	-1.7
South East	-0.2	0.9	-0.6	0.1
South West	-0.2	7.0	-0.7	6.1

Source: Own calculations using CSO Regional Accounts.

### 3. Policy Background

As was shown above, as in all countries, Irish economic activity is not evenly spread throughout the country and indeed over the recent periods regional disparities have increased. As a consequence of the uneven spread of economic activity a range of policies has been pursued.

Post war Irish regional policy started with the Underdeveloped Areas Act in 1952, which remained in place until 1969. The key feature of this legislation was to allow a

differential in industrial development grants across regions, favouring the less developed regions. Towards the end of the 1950's the regional dimension of the act was increasingly neglected in favour of national growth, a trend, which was reinforced by subsequent acts such as the Industrial Grants Acts of 1956 and 1959. These acts reduced the grant differential between the designated regions and the rest of the country.

During the 1960's the idea of growth centres was promoted although no specific policies to promote growth centres were enacted. The concept of developing growth centres derived from the assumption that growth will only be self-sustaining in centres above a critical size. The debate about this policy was extensive and the Government finally decided upon a policy of more dispersed development through the Regional Industrial Plans, which were published by the Industrial Development Agency (IDA) in 1972. These were aimed at dispersing industrial development rather than concentrating it in a few growth centres. In general the IDA managed to generate substantial numbers of manufacturing jobs. During the 1980's regional issues lost in importance as unemployment soared, and job creation at any location became the national priority.

The EU Structural Funds are also an important regional development policy for Ireland. However, since Ireland as a whole constituted on Objective 1 region and Ireland had not been split up into distinct regions for Structural Funds purposes, no serious economic evaluation of the regional impact of the Structural Funds has been carried out (see Fitz Gerald et.al., 2003). While the economic impact of the Structural Funds was not assessed at the regional level, various evaluations have shown a strong economic return (e.g. Honohan, 1997, Bradley, Morgenroth and Untiedt, 2003).

Following on from the first two Structural Funds programmes, 1989-1994 and 1995-1999, the Irish Government published the National Development Plan (NDP) for the period 2000-2006, in 1999, which included the objective to achieve a more balanced regional development, reducing the disparities between and within the two NUTS 2 regions which were established in 2000. The recent mid-term evaluation of the NDP showed that on the one hand there appeared to be some evidence that the NDP is reducing disparities, but on the other hand it highlighted that much of the investment under the NDP is not allocated with regional development in mind.

In 2001 the government published the National Spatial Strategy (NSS), which is a wide ranging document in that it does not concentrate merely on enterprise development, but deals with all aspects of regional development and most importantly land use. Interestingly it returned to the centre based approach that was put forward during the 1960's and which was dismissed then in favour of a dispersal policy. Another development that started in 1989 was the programme to 'decentralise' civil servants away from Dublin. In addition to the decentralisation that took place during the 1990's a new programme of 'decentralisation' has been announced in the budget (2004)<sup>6</sup>.

#### **4. A Descriptive Analysis of Regional Specialisation and Concentration**

Differences regarding the manufacturing sector at the regional and county level were explored in Bradley and Morgenroth (2000). Their paper showed that with regard to a number of performance indicators the differences within the regions (at county level) are greater than those between the regions. More recently, Morgenroth (2001) carried out an analysis of the Dublin and Mid-East regions which included a detailed analysis of the manufacturing sector in these regions that focused on sectoral specialisation and clustering. This research found large differences between counties regarding their

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<sup>6</sup> No evaluation of the decentralisation programmes has been published.

concentration of employment in fast growing sectors that explain much of the differences in performance.

At the national level, the Food and Beverage sector constitutes the largest sector in terms of employment. Noticeable is also that the Chemicals and Pharmaceuticals sector is now the second largest sector and the Medical, Precision and Optical Instruments sector is the third largest sector, while Office Machinery has also grown significantly. Sectors that have declined in importance include Textiles, Wearing Apparel, and Fabricated Metal products. Thus, there is a gradual shift from the traditional sectors towards more high-tech sectors.

Turning to the regional employment shares these are shown for 2003 in Table 5. In that table notable deviations are marked with darker shading. Thus for example the West and Mid-West regions have relatively low employment shares in the Food and Beverages sector, while the West region has a high employment share in Textiles. For both the Border and Dublin regions Wearing Apparel is more important than in the other regions. For the Midlands region Wood and Wood products and rubber and Plastics are relatively more important while Chemicals and Pharmaceuticals play a relatively small role. Chemicals and Pharmaceuticals are more important in the South-West region and Publishing is significantly more important in the Dublin region, which is of course related to its capital city status. Finally for the West region Medical, Precision and Optical instruments is a very important sector. From this table it is immediately apparent that there are significant differences regarding the sectoral specialisation at the regional level but this simple analysis is not sufficient to fully capture the specialisation and concentration of sectors and regions. Thus, a more thorough analysis using a number of indices will be carried out below.



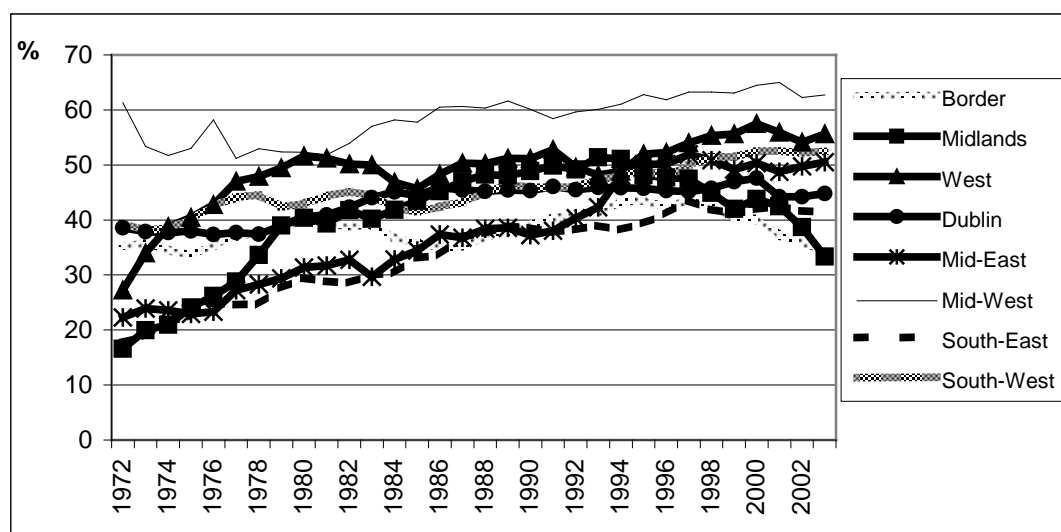
**Table 5 Regional Employment Shares, 2003**

	B	M	W	D	ME	MW	SE	SW
<b>15Food &amp; Beverages</b>	28.9%	25.8%	14.1%	25.2%	21.0%	14.7%	24.5%	24.6%
<b>16Tobacco</b>	0.2%	1.2%	0.2%	0.8%	0.0%	0.0%	0.0%	0.0%
<b>17Textiles</b>	4.4%	1.1%	1.3%	1.0%	1.8%	0.5%	0.4%	2.8%
<b>18Wearing Apparel</b>	2.3%	0.7%	0.5%	2.6%	0.5%	0.5%	0.6%	1.1%
<b>19Leather &amp; leather products</b>	0.2%	0.1%	0.4%	0.0%	0.1%	0.1%	0.4%	0.0%
<b>20Wood &amp; wood products</b>	4.2%	6.4%	3.7%	1.1%	2.2%	1.9%	3.2%	4.4%
<b>21Paper &amp; Pulp</b>	0.4%	0.4%	1.3%	5.1%	2.6%	1.6%	0.4%	1.1%
<b>22Publishing</b>	2.2%	2.6%	2.2%	10.9%	2.2%	1.5%	2.0%	2.2%
<b>23Fuel</b>	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.6%
<b>Chemicals, pharmaceuticals and</b>								
<b>24man-made fibres</b>	10.4%	1.8%	9.7%	11.8%	13.6%	8.5%	12.2%	16.0%
<b>25Rubber &amp; plastics</b>	6.5%	7.0%	2.3%	2.8%	3.0%	2.5%	3.0%	2.9%
<b>26Non-metallic minerals</b>	7.3%	7.7%	3.4%	2.3%	7.9%	5.8%	10.6%	3.6%
<b>27Basic metals</b>	0.5%	1.5%	0.1%	0.3%	0.2%	2.3%	0.7%	0.1%
<b>28Fabricated metal products</b>	6.4%	6.9%	6.4%	5.8%	4.5%	10.5%	7.3%	6.2%
<b>29Machinery nec.</b>	6.0%	4.5%	6.9%	2.6%	4.0%	4.7%	10.4%	3.4%
<b>30Office machinery</b>	1.9%	1.6%	2.5%	4.7%	23.1%	14.8%	0.1%	3.8%
<b>31Electrical machinery nec.</b>	3.3%	2.0%	7.3%	3.5%	3.0%	14.9%	1.7%	5.6%
<b>Radio, television and</b>								
<b>32communications</b>	3.0%	2.1%	2.9%	5.1%	1.6%	3.2%	0.9%	9.3%
<b>Medical, precision and optical</b>								
<b>33instruments</b>	4.4%	12.5%	30.0%	3.7%	3.0%	9.1%	12.8%	7.8%
<b>34Motor vehicles and trailers</b>	2.0%	6.5%	0.5%	0.9%	1.3%	0.2%	2.0%	1.5%
<b>35Other transport equipment</b>	0.2%	1.5%	0.1%	4.0%	0.1%	0.8%	3.3%	1.3%
<b>36Manufacturing nec. Incl. Furniture</b>	5.5%	6.1%	3.8%	5.6%	4.4%	2.0%	3.4%	1.8%

Source: Own calculations using Forfas Employment Survey data. The top row refers to the regions: B (Border), M (Midlands), W (West), D (Dublin), ME (Mid-East), MW (Mid-West), SE (South-East), and SW (South West).

An important feature of Irish industrial development is the role of foreign multinational firms, which have invested heavily over a longer time span. In order to identify the regional importance of foreign direct investment (FDI) we plot the share of manufacturing employment in foreign owned firms in Figure 1. Overall the importance of FDI has increased over time. Indeed in the Mid-West the share of manufacturing employment in foreign firms is over 60%. However in a number of regions such as the Border and Midlands that importance has been declining recently.

**Figure 1 Foreign Share in Manufacturing Employment**



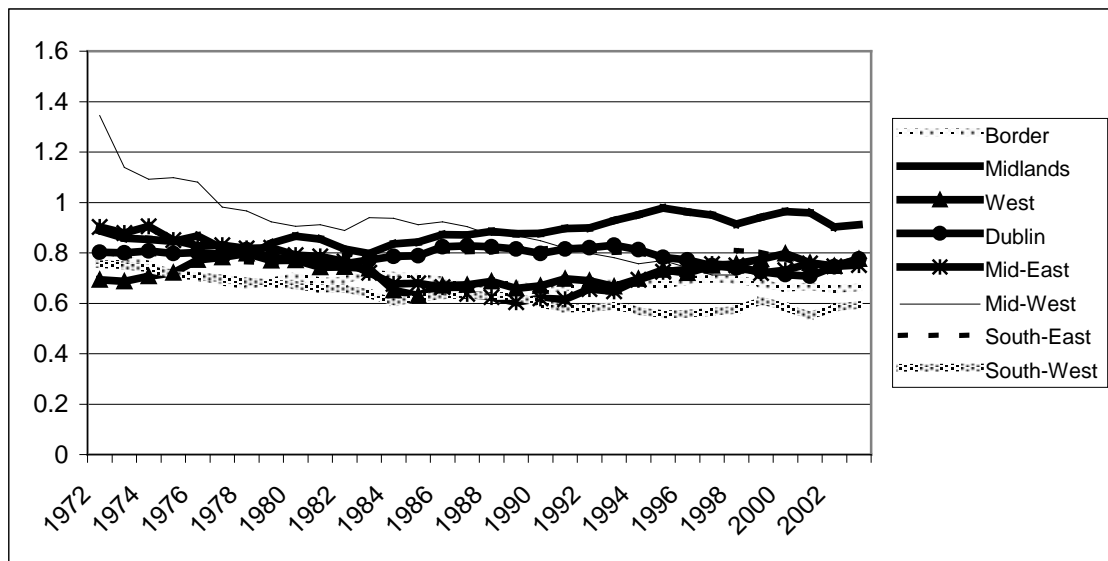
Source: Own calculations using plant level data from the Fofas Employment Survey. Note that foreign firms are those that have at least 50% foreign ownership.

Given the level of detail available it is possible to calculate the specialisation and concentration indices at different levels of sectoral disaggregation. Since the two-digit level is too aggregate and the four-digit level might introduce some errors due to difficulties in coding firms into the right sector at that level, the most useful level is the three digit NACE level. Here we concentrate on the Krugman index, which is defined relative to the national average sectoral distribution<sup>7</sup>. In general, the Krugman index is perhaps the more useful measure since this is less influenced by a few large observations than the Herfindahl index, which is more of a problem with three digit data as the shares are typically small except for a few large shares.

Krugman index of relative specialisation is shown in Figure 2. Overall, the level of specialisation appears to have declined slightly for most regions but particularly for the Mid-West there has been a decline in specialisation in the 1970's. Indeed only the Midlands region has a higher level of specialisation in 2003 than in 1972. If one disregards the Midlands region then there appears to be some convergence between the regions in terms of their specialisation. However, if one disregards the Mid-West then the degree of specialisation is diverging even though in general specialisation is declining. In other words the rate of change may differ significantly between the regions.

<sup>7</sup> Additional detail using the two digit level and the Herfindahl and Theil index is available in Morgenroth (2004).

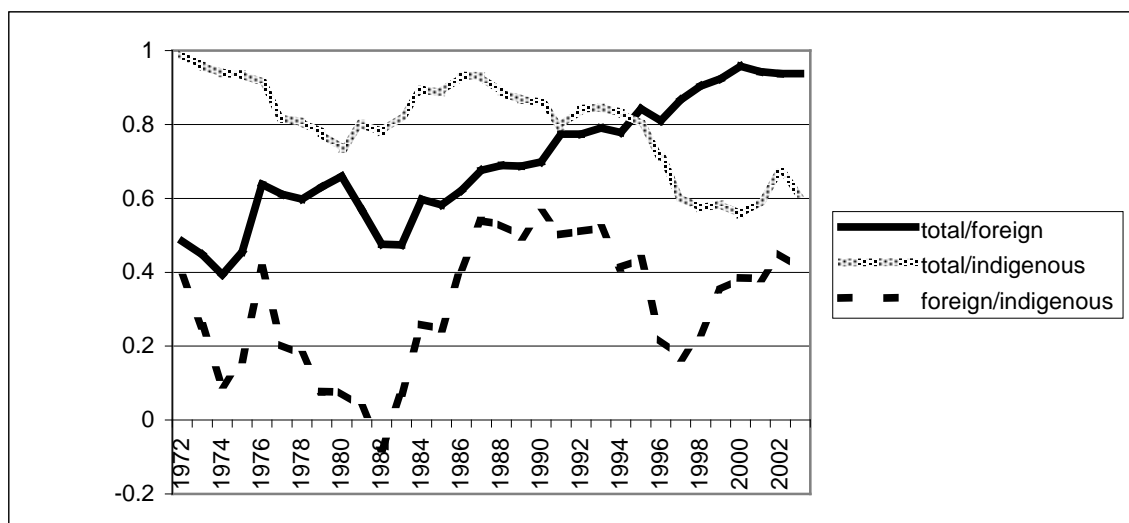
**Figure 2 Krugman Index of Relative Specialisation (3Digit)**



Source: Own calculations using Forfas Employment Survey data.

As was noted above, foreign direct investment is particularly important in Ireland, and this importance has increased over time as shown in Figure 1. It is therefore likely that foreign firms have influenced the degree of regional specialisation. In order to test this we disaggregate the data into foreign and indigenous and construct the specialisation indices for both and compare them with each other and the total ones outlined above. As Figure 3 shows, initially the index defined for the indigenous employment is most highly correlated with the one defined for all employment while that defined over foreign employment has a lower correlation coefficient. However, from the mid-1990's onwards the reverse is the case. The correlation between the foreign and indigenous index is lower but still positive. This suggests firstly, that FDI plays a strong and increasing role in determining the degree of regional specialisation. Secondly, as there is a positive correlation between the indigenous and foreign indices, FDI and indigenous employment are not counterbalancing each other in determining the overall index. As there is a general trend towards less specialisation this implies that both indigenous and foreign employment are both contributing to this trend, with FDI having a stronger influence over more recent years.

**Figure 3 Correlation Between the Krugman specialisation index defined for total, indigenous and foreign employment over time**



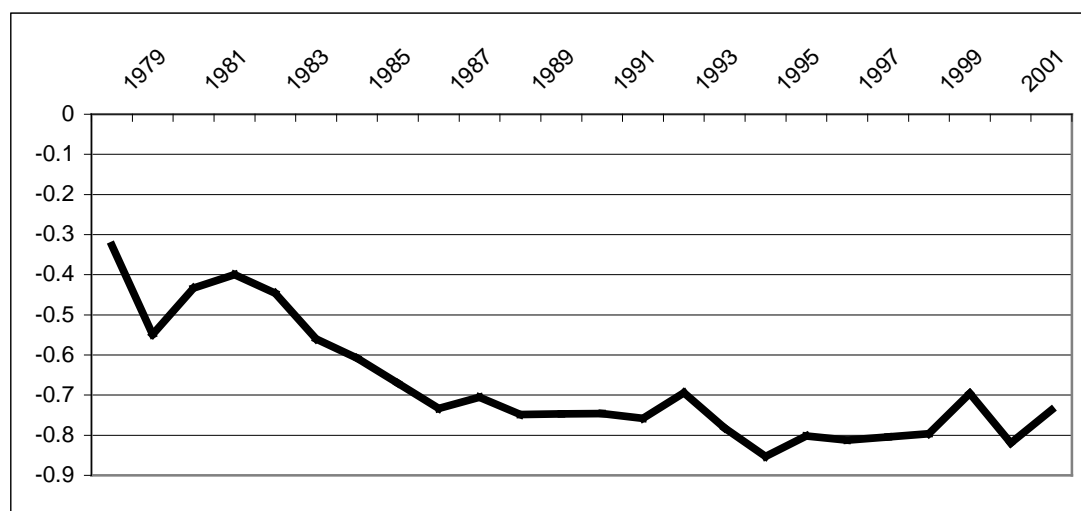
Source: Own calculations using Forfas Employment Survey data.

Clearly not all regions are the same and it is possible to group regions into some broad categories according to their industrial structure which allows for a comparison across these categories. Firstly, given the importance of a core-periphery pattern in the New Economic Geography literature, it is useful to consider central regions. These are particularly important in monocentric countries such as Ireland and these central regions tend to be more specialised in knowledge intensive industries. Secondly, regions proximate to these central regions may benefit from spillovers from the central regions so these are also identified. Apart from the central regions, which tend to contain accumulations of knowledge intensive industries, highly industrialised regions can often also be identified, but in the Irish case due to the late industrialisation such a region does not exist. On the other hand peripheral regions tend to have more basic industry mix, focusing more on resource intensive industries, agriculture and footloose industries can also be identified. These are usually situated at the external EU borders. Of course some regions have an industry mix characteristic of both peripheral and highly industrial regions, and they may be referred to as semi-peripheral. Thus we define five types of regions: central; semi-central; highly industrialised; peripheral and semi-peripheral, but in Ireland we identify just four types. Once on groups the regions into these categories, the extreme observations are averaged out and we find that with the exception of peripheral regions, specialisation declines over time. Even for peripheral regions specialisation does not increase.

An important question is the degree to which regional performance is related to specialisation. Because, the specialisation indices are defined for manufacturing sectors only it is only valid to consider the relationship of specialisation with measures of manufacturing performance. Firstly, we calculate the correlation of output per worker with the relative measure of specialisation, which is shown for the period 1979 to 2002 in Figure 4. This shows clearly that there is a strong negative correlation between these two variables, which is becoming stronger over time. In other words, more highly specialised regions have a lower productivity. It is also useful to calculate correlation coefficients between specialisation and growth rates in both output and employment. As these correlations may not be constant over time we calculate them for different periods. Furthermore, since we are also interested in the effect of changes in specialisation on

growth we calculate the correlations between the economic performance measures and the initial specialisation and the change in specialisation over the period. The results in Table 6 show that a higher level of initial specialisation was associated with higher employment growth in all periods except the high growth 1990's. The opposite was found for the correlation between the change in specialisation and employment growth, which was negatively correlated in all periods except the 1990's. On the other hand the correlations between specialisation and output growth were negative in all cases, indicating that more diverse regions grow faster and indeed that an increase in specialisation reduces growth.

**Figure 4 Correlations between Net Output per Worker in Manufacturing and Specialisation**



Source: Own calculations using CSO Census of Industrial Production and Forfas Employment Survey data.

**Table 6 Correlation Coefficients Between Specialisation and Growth in Manufacturing Employment and Productivity**

	Initial specialisation and annual average employment growth	Change in specialisation and employment growth	Initial specialisation and output growth	Change in specialisation and output growth
1972-1980	0.58	-0.21		
1980-1990	0.13	-0.23	-0.45	-0.39
1990-2000	-0.49	0.59	-0.31	-0.44
2000-2003	0.19	-0.52	-0.09*	-0.04*

Source: Own calculations using CSO Census of Industrial Production and Forfas Employment Survey data. \*For the last period the correlations with respect to net output growth are calculated only for the period 2000-2002

Of course it is also interesting to consider what happened to individual sectors in terms of their concentration, that is the degree to which they are concentrated in a few regions. Again we calculate relative Krugman indices that we used above. Individual sectors have quite different levels of concentration as is shown in Table 7. For example the Fuel sector is extremely highly concentrated, while other sectors like Wood and Wood products is quite dispersed. As can be seen in the last two rows of the table, on average the level of concentration is declining as is the dispersion between the sectors. However, as is evident in the indices many sectors are perfectly concentrated initially, but

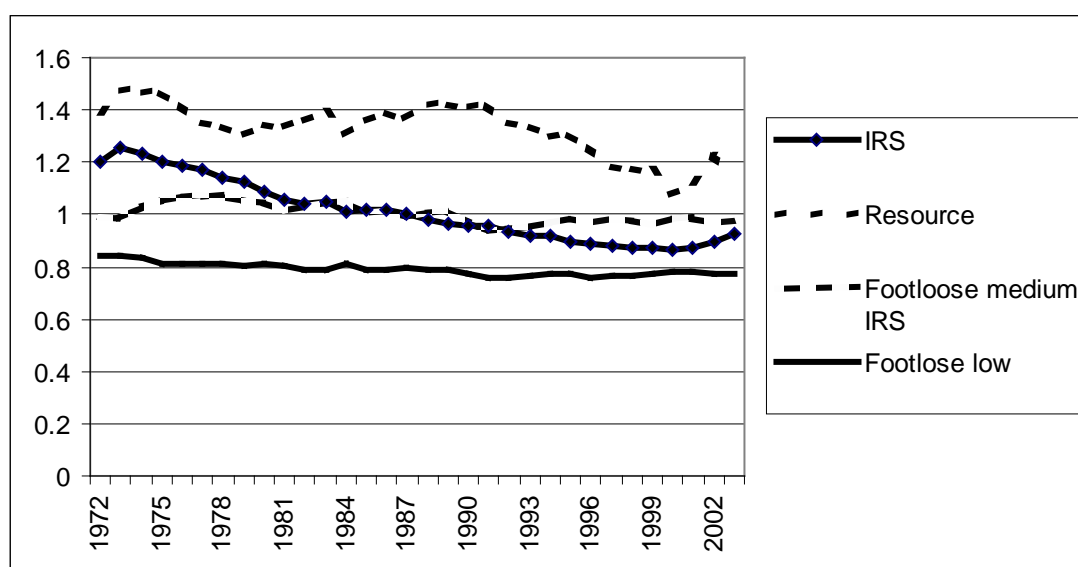
as Ireland developed this level of concentration has declined very quickly. Importantly, the more high tech industries appear to have become less concentrated.

The table shows that the average level of concentration has declined. In particular there was rapid decline of concentration from 1973 to 1994, but there a slight increase over the more recent period. Furthermore, there is little evidence that the dispersion of the concentration has declined. Interestingly, there are sectors, which are becoming more concentrated, such as some of the food subsectors, while others such as pharmaceuticals continually disperse and other sectors concentrate after a period of dispersal (e.g. Basic Metals).

Given the large number of sectors it is useful to categorise them into different groups, identifying especially those that are subject to increasing returns to scale (IRS). This is particularly interesting since NEG models predict that those sectors that are subject to increasing returns to scale concentrate in the central regions, so that these ought to be more concentrated. By classifying industries into different types and considering the pattern of specialisation. Specifically, it is usual to classify industries into high increasing returns to scale industries according to the classification produced by Pratten (1988) and resource intensive industries according to the classification of the OECD. Furthermore, we classify the remaining sectors into footloose sectors that have either medium or low returns to scale. Thus, all industries were categorised into four groups: increasing returns; resource intensive; footloose medium and footloose low.

The average concentration for these groups is shown in Figure 5. The most notable result is that the concentration of the high returns to scale sectors, which was relatively high at the in 1973 has decreased continually so that it now is relatively low. Thus there is no evidence in favour of the catastrophic relocation of high returns to scale sectors as is predicted by the NEG literature. In general there is decreasing concentration, but resource intensive industries have concentrated sharply over recent year. However, it should be noted that resource intensive industries have only a small share in total employment and the closure of one plant can have a significant impact.

**Figure 5 Average Concentration Indices for Manufacturing Industry Groups**



Source: Own calculations using CSO Census of Industrial Production and Forfas Employment Survey data.

Finally, since foreign multinationals are more prominent in some sectors than other it is also important to check the degree to which they determine the overall concentration

levels. Again, this can be done through the calculation of correlation coefficients, which show firstly a strong positive correlation across the sectors between the concentration indices defined over total employment and those defined for foreign employment only. Furthermore, if one calculates these correlations for each sector across time then the majority, 52 out of 64 sectors, show a positive correlation, so that on average the degree of sectoral concentration of foreign owned plants corresponds to that of indigenous plants.

## **5. Specialization, structural change, and regional growth**

The above analysis is largely descriptive, in that it focuses on the indices and simple correlations. However, the significance of the relationships can only be established once one conditions on other variables since these may dominate. It is thus necessary to conduct econometric analysis.

Some related econometric analysis has already been carried out by other authors. For example Barrios, Bertinelli, Strobl and Teixeira (2003) compare the spatial distribution of manufacturing activity for Belgium, Ireland and Portugal for one year, 1998 using the Ellison Glaezer (1997) index. Thus, in contrast to our study they are not analysing the change in industrial concentration over time. Overall they find that the EG index is significantly different from zero in about 25% of the sectors. In general it appears that the degree and pattern of concentration in Ireland differs from that in Belgium and Portugal.

Their paper also aims to explain the determinants of agglomeration using regression analysis, where the EG index is the dependent variable and the data is pooled across the three countries. The degree of economic integration of the country or region is not taken into account in this analysis. Of the explanatory variables, input purchases, wages and salaries, purchase of energy inputs, average plant size, are the only statistically significant explanatory variables. Overall the authors conclude that agglomeration forces are stronger at a more disaggregated spatial level which of course, supports the focus on NUTS 3 regions in this paper as compared to the common use of NUTS 2 level or even country level data. Furthermore, they conclude that forward and backward linkages increase agglomeration while wages decrease agglomeration. However, given that the variables used in the analysis do not identify where purchases take place this conclusion should be interpreted cautiously.

Another paper which utilises the Ellison and Glaezer index in the Irish context is that by Barrios, Bertinelli and Strobl (2003), which aims at analysing the impact of the agglomeration of foreign firms on local firms. Their analysis covers the period 1972 to 1999 and they find that there is significant co-agglomeration of foreign and local firms in a many of sectors, which supports the findings above. They further investigate how the extent of co-agglomeration impacts on employment growth in indigenous firms they estimate plant level employment growth equations where the regressors include, lagged employment growth, output, wage growth, growth in the sector, lagged foreign share in the sector, lagged foreign density in the sector. They find that output, wage growth, sectoral growth and lagged foreign share are significant determinants of firm level employment growth. The latter indeed suggests the positive spillover of foreign firms on the indigenous firms. However, with regard to the other coefficients, endogeneity issues are not taken into account, which may bias the results.

A different approach is taken in Morgenroth (2005). He firstly attempts to explain the impact of integration on specialization, by regressing the specialization index on a measure of foreign direct investment, the degree of trade openness and the degree of urbanisation. This relationship is estimated for the regions using seemingly unrelated

regression (SUR). All three variables have significant impact on specialization. While, urbanization reduces specialization, presumably because it allows for more diversification through scale, trade openness seems to increase specialisation. On the other hand a higher foreign employment share reduces specialisation, which supports the findings of the descriptive analysis above.

This paper also seeks to explain the impact of specialisation on productivity. A production functions for the manufacturing sector are estimated at the county level, for the period 1979 to 2002. The data used is from the annual Census of Industrial Production (CIP) with the specialisation indices, namely the Herfindahl and the Krugman index, are added to the standard log-linearised Cobb-Douglas function as additional variables. The results yield a negative coefficient for the specialization indices, which in the case of the Krugman and a lagged Krugman index are statistically significant at the 99% level. These results are robust to the inclusion of further explanatory variables to capture agglomeration, high-tech and FDI effects. However, the results throw up a peculiar finding that once fixed effects are taken account of, and all variables are included then the coefficients for population density and the percentage of employment in high tech firms is negative and significant while that for the percentage of employment for foreign firms is positive and significant. In other words indigenous high tech firms have not performed as well and firms in the more urbanized counties have also been performing less well.

## 6. Conclusions

Ireland has been one of the fastest growing economies in the western world over the last decade and a half. While this national performance is impressive, less is known about the regional distribution of this growth. In terms of per capita Gross Value there has been divergence during the so-called Celtic Tiger era, despite (or perhaps in spite) of the fact that Irish regions have all grown faster than the EU average so that they have been converging (and in some cases surpassing) the EU average. A decomposition of regional growth suggests that the differences in the manufacturing growth rates between regions are primarily responsible for the divergence. Thus, the focus on manufacturing in this paper is warranted.

A prominent feature of Irish economic development has been the dramatic increase in economic openness as measured by trade volumes relative to output and in terms of FDI. While it is difficult to identify precisely what role integration has played in the change of specialisation and concentration, the analysis presented here shows that FDI and indigenous development have worked in the same direction, namely to reduce specialisation and to reduce by in large average concentration of industries. However, the evidence provided by Morgenroth (2005), suggests that trade openness works to increase specialisation while FDI reduces specialisation.

The results of our analysis suggests that a high level of specialisation is not conducive to growth, so that specialisation inhibits convergence. While the degree of specialisation is declining in most regions this is not the case in the peripheral regions. Given the negative relationship between specialisation and growth this divergence of the degree of specialisation appears to be a factor that can explain the divergence in terms of GVA that was outlined above.

To the extent that there was convergence during the 1980's one might be given to think that Irish regional policy was successful, but while regional policy was of high importance during the 1950's 60' and 70's less importance was attached to regional issues as there were important national issues to be dealt with first. Similarly, the fact that there was divergence over the 1990's is in itself not enough to conclude that the regional policy



initiatives including the Structural Funds were a failure, since it is not clear what the counterfactual development would have been without these. Clearly, this is an area that requires further work, including research on the more recent policy initiatives, such as the National Spatial Strategy and the Decentralisation Plan.

Finally, the New Economic Geography literature has received much attention. Initially, this was largely a theoretical literature, the results of which were largely untested. Here we were able to analyse on prediction from this literature, namely, that increasing returns to scale industries agglomerate in the economic centre once transport costs are positive but not prohibitive. For Ireland we found these increasing returns to scale sectors to be declining in concentration rather than increasing in concentration. Indeed these sectors have increased their overall share in manufacturing employment from 13% in 1972 to 30% in 2003.

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**Table 7 Krugman Index of Relative Concentration for 3 Digit sectors, for selected years**

	1973	1979	1987	1994	2000	2003
Food and Beverages	1.73	1.69	1.67	1.30	0.91	0.79
Processing and Preserving of Meat	0.44	0.39	0.48	0.40	0.37	0.36
Processing and Preserving of Fish	0.35	0.52	0.62	0.70	0.73	0.73
Processing and Preserving of Fruit and Vegetables	0.47	0.67	0.79	0.66	0.66	0.76
Vegetable and Animal Oils	1.28	1.24	1.00	0.86	1.24	1.18
Dairy Products	0.43	0.46	0.52	0.57	0.66	0.64
Grain Mill Products	0.31	0.23	0.51	0.41	0.56	0.59
Prepared Animal Feeds	0.62	0.62	0.70	0.60	0.63	0.65
Other Food Products	0.43	0.37	0.35	0.35	0.41	0.49
Beverages	0.41	0.47	0.56	0.43	0.45	0.49
Tobacco	0.87	0.91	0.88	0.83	0.87	1.11
Spinning of Textile Fibres	0.96	1.07	0.98	0.91	0.98	0.94
Textile Weaving	0.59	0.80	0.53	0.79	1.24	1.06
Finishing of Textiles	1.24	1.20	1.10	0.88	1.31	1.35
Man-made textile Articles except Apparel	0.76	0.57	0.58	0.50	0.43	0.34
Other Textiles	1.16	1.05	1.03	0.97	0.88	0.74
Textiles n.e.c.				1.69	1.74	1.76
Knitted and Crocheted Articles	0.88	0.93	0.97	0.97	0.88	0.82
Leather Clothes	1.24	1.36	1.37	0.88	1.21	1.44
Other Leather Wearing Apparel	0.53	0.59	0.64	0.58	0.58	0.64
Dying of Fur, Leather n.e.c.	0.82	0.89	1.09	1.65		
Tanning and Dressing of Leather	1.18	1.31	0.74	1.07	1.20	1.15
Luggage, Handbags and Saddlery	0.96	0.73	0.76	0.82	0.54	0.80
Footwear	0.94	0.86	1.12	1.36	1.24	1.19
Sawmilling and Planing of Wood	0.73	0.63	0.47	0.47	0.51	0.54
Veneer, Plywood and Laminboard	1.57	1.44	1.37	0.91	0.87	0.83
Builders' Carpentry	0.88	0.63	0.47	0.60	0.74	0.68
Wooden Containers	0.89	0.65	0.68	0.68	0.74	0.82
Other Woods Products	0.62	0.89	0.45	0.44	0.47	0.47
Pulp, Paper, Paperboard	0.69	0.66	0.73	0.71	0.92	0.94
Articles of Paper and Paperboard	1.04	1.01	0.92	0.91	0.76	0.76
Publishing	0.56	0.61	0.73	0.71	0.60	0.52
Printing and service activities related to Printing	0.62	0.73	0.76	0.95	0.88	0.86
Refined Petroleum Products			1.86	1.46	1.35	1.40
Basic Chemicals	1.59	1.56	1.42	1.41	1.38	1.45
Pesticides and Agrochemicals	0.79	0.98	0.86	0.83	0.72	0.69
Paints, Varnishes and Coatings	1.59	1.52	1.32	0.71	0.68	0.81
Pharmaceuticals, Medical Chemicals and Botanical Products	0.86	0.80	0.73	0.55	0.51	0.43
Soap and Detergents	0.57	0.38	0.33	0.21	0.24	0.31
Other Chemical Products	0.98	0.62	0.65	0.56	0.75	0.74
Man-made Fibres	0.62	0.61	0.78	0.75	0.55	0.59
Rubber and Plastics	1.43	1.54	1.56	1.53	1.75	1.76
Rubber Products	1.24	1.20	1.26	1.02	1.03	1.06
Plastic Products	0.52	0.38	0.42	0.66	0.60	0.62
Non-metlic Mineral Products	0.54	0.26	0.28	0.18	0.24	0.28
Glass and Glass Products		1.85	1.81	1.75	1.56	1.52
Non-refractory Ceramics	0.91	0.89	0.98	0.87	0.82	1.01
Ceramic Tiles	1.24	1.15	0.85	0.66	0.55	0.62
Bricks and Tiles made from Clay			1.53	1.69	1.30	1.27
Cement, Lime and Plaster	0.78	0.93	0.80	1.09	1.04	1.04
Concrete Articles	1.20	1.21	1.22	1.14	1.18	1.26
Cutting, Shaping and Finishing of Stone	0.24	0.25	0.43	0.37	0.32	0.34
Other Non-metallic Minerals	0.86	0.72	0.71	0.75	0.72	0.70

Table 7 continued

	1973	1979	1987	1994	2000	2003
Basic Iron and Steel	1.54	1.31	0.92	0.85	0.79	0.83
Cast Iron Tubes	1.32	1.13	1.59	1.57	0.70	1.04
Basic Precious and Non-ferrous metals	1.24	1.52	1.44	1.24	1.24	1.22
Casting of Metals				1.90	1.41	
Fabricated Metal Products	1.29	0.87	1.16	1.06	1.03	1.06
Structural Metal Products	1.54	1.08	0.93	0.87	0.83	1.20
Tanks, Reservoirs and other metal containers	1.53	1.28	0.68	0.61	0.83	0.33
Steam Generators	0.62	0.43	0.22	0.19	0.28	0.31
Forging, Processing and Stamping of Metal	0.76	0.79	0.66	0.49	0.48	0.41
Metal Coating	1.69	1.69	1.55	1.50	1.46	1.76
Cutlery, Tools and General Hardware	1.90	1.71	1.68	1.05	0.99	0.99
other Fabricated Metal Products	0.52	0.52	0.51	0.57	0.40	0.48
Machinery and Equipment n.e.c.	0.93	0.94	0.85	0.76	0.62	0.64
Machinery for mechanical power	0.31	0.15	0.24	0.36	0.38	0.43
other General Purpose Machinery		1.69	1.31	1.27	0.99	0.96
Agricultural and Forestry Machinery	0.91	0.94	0.73	0.85	0.89	0.71
Machine Tools	0.70	0.61	0.49	0.41	0.41	0.45
Other Special Purpose Machinery	0.90	0.82	0.44	0.76	0.68	0.65
Domestic Appliance n.e.c.	1.69	1.08	0.99	0.78	0.81	0.99
Office Machinery and Computers	0.61	0.48	0.46	0.56	0.52	0.52
Electric Motors, Generators and Transformers	1.61	1.34	1.19	1.12	1.18	1.32
Electricity Distribution and Control Equipment	1.40	0.59	0.44	0.62	0.80	0.93
Insulated Wire and Cable			1.83	1.37	1.17	1.25
Accumulators, Primary Cells and Primary batteries	1.08	0.85	0.50	0.72	0.67	0.54
Lighting Equipment and Electric Lamps	1.71	1.60	1.15	1.04	0.81	0.79
Electrical Equipment n.e.c.	0.84	0.95	0.71	0.69	0.69	0.67
Electronic Valves, Tubes and Other Components	1.24	1.36	1.45	1.33	1.54	1.57
Televisions and Radio Transmitters and Telephone Equipment	1.07	0.99	0.76	0.71	0.62	0.58
Televisions and Radio Receivers, Sound and Video Recording Equipment	1.23	1.00	0.82	0.60	0.38	0.70
Medical and Surgical Equipment	1.90	1.30	1.05	0.95	0.80	0.75
Instruments and Appliances for measuring, Checking and Navigation	1.10	0.63	0.89	0.62	0.58	0.85
Industrial Process Equipment	1.20	1.01	0.61	1.06	1.00	1.33
Optical Instruments and Photographic Equipment	0.73	1.00	0.74	0.83	0.84	0.77
Motor Vehicles, Trailers and Semi-trailers	1.16	0.71	0.66	0.48	0.40	0.44
Coachwork for Motor Vehicles, Trailers and Semi-trailers	1.90	1.86	1.27	0.84	0.70	0.83
Parts and Accessories for Motor Vehicles	0.93	0.92	1.23	1.41	1.29	1.31
Building and Repairing of Ships			1.90	1.43	1.54	0.00
Railway and tramway Rolling Stock	0.83	0.88	1.07	0.85	0.84	1.02
Aircraft and Spacecraft	0.40	0.82	0.43	0.68	0.91	0.93
Motorcycles and Bicycles	1.01	0.64	0.60	0.76	0.80	0.71
Other Transport Equipment n.e.c.	0.91	1.05	0.73	1.01	0.83	0.70
Furniture	1.93	1.90	1.90	1.81	1.89	1.88
Jewellery	1.25	1.31	1.26	1.13	0.96	0.99
Musical Instruments	1.24	1.36			1.77	1.76
Sports Goods		1.90	1.90	1.33	1.43	1.48
Games and Toys	0.52	0.47	0.47	0.51	0.48	0.44
Miscellaneous Manufacturing n.e.c.	0.57	0.68	0.58	0.83	0.89	0.96
Average	1.55	1.19	0.84	0.69	0.77	0.75
Standard Deviation	1.31	1.58	1.37	1.35	1.34	1.35

Source: Own calculations using Forfas Employment Survey data.