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IRELAND'S COMPETITIVE  
ADVANTAGE: A REVIEW OF  
SOME MEASURES

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## INTRODUCTION

### (i) **Surveying and Developing Indicators**

In developing the analysis of Ireland's competitive advantage it is necessary to begin by assembling those measures of competitiveness which are available in official or other sources. This will provide information on many aspects of Ireland's competitive advantages and disadvantages. It will also reveal what gaps exist in the available data and so assist the process of data collection which is likely to be necessary. This working paper reports the first stage of the assembly of measures of Ireland's competitiveness.

#### *Analytical Basis and Economic Relevance*

The value of comparative industrial data is dependent on the analytical basis and economic relevance of the measures chosen. It is these foundations which should guide selection of indicators and which can provide an approach to their interpretation. Although important gaps undoubtedly exist in comparative industrial data, the major constraint on analysis is frequently uncertainty concerning the meaning and relevance of the wide range of data which are available. As the data collection exercise proceeds attention will be given to these issues of meaning and relevance.

#### *Three Dimensions of Competitiveness*

In developing a set of indicators, use will be made of a distinction which has been found useful in the conceptual consideration of Ireland's competitive advantage. The complexity of the concept of competitiveness, and the widespread use of quite diverse measures, led Buckley, *et al.* (1988) to distinguish between:

COMPETITIVE PERFORMANCES  
COMPETITIVE POTENTIAL  
COMPETITIVE PROCESS

Each of these can be seen to describe different phases and dimensions of the competitive process. *Potential* measures the inputs into the operation, *performance* measures the outcome of the operation and *process* measures the management of the operation. The distinction is valuable for a number of reasons (see O'Donnell, 1992). It captures, to some degree, the dynamic character of competitiveness. It allows us to identify the limits of each category of measure on its own. Performance measures on their own ignore the sustainability of competitiveness and fail to capture the regeneration and maintenance of competitive potential. On the other hand, measures of competitive potential give no indication of whether this potential is turned into performance. Finally, qualitative measures of the management of competitive process would, on their own, tend to ignore much of the hard data through which the relative performance and potential of industry in different countries can be compared. When account is taken of the fact that potential, process and performance interact in various ways, this strongly suggests that the set of indicators developed for the analysis of Ireland's competitive advantage should, if possible, include some measures of each sort. However, it may not be possible to include many measures of competitive or management processes in the set of indicators, since measures of management process are a *firm* level.

Table 1 lists some of the widely used measures of competitiveness, as identified by Buckley, *et al.* (1988). It is clear that many of these measures can be used at national,

Table 1: *Measures of International Competitiveness*

|                          | <i>Performance</i>   | <i>Potential</i>   | <i>Management Process</i>  |
|--------------------------|--|--|--|
| <i>Level of Analysis</i> |  |  |  |
| <i>Country</i>           | Export market share<br>% manufacturing in total output<br>Balance of trade<br>Export growth<br>Profitability | Comparative advantage<br>Cost competitiveness<br>Productivity<br>Price competitiveness<br>Technology indicators<br>Access to resources | Commitment to international business<br>Government policies<br>Education/Training  |
| <i>Industry</i>          | Export market share<br>Balance of trade<br>Export growth<br>Profitability                                    | Cost competitiveness<br>productivity<br>Price competitiveness<br>Technology indicators   | Commitment to international business<br>(trade associations, etc.)   |
| <i>Firm</i>              | Export market share<br>Export dependency<br>Export growth<br>Profitability                                   | Cost competitiveness<br>Productivity<br>Price competition<br>Technology indicators   | Ownership Advantage<br>Commitment to international business<br>Marketing aptitude<br>Management relations<br>Closeness to customer<br>Economies of scale and scope |
| <i>Product</i>           | Export market share<br>Export growth<br>Profitability  | Cost competitiveness<br>Productivity<br>Price competitiveness<br>Quality competitiveness<br>Technology indicators                      | Product champion   |

*Source:* Buckley *et al.* (1988)

industry and firm level, while, appropriately, there is little overlap across the categories' performance, potential and process. The strengths and weaknesses of each of these types of measure have been identified by Buckley, *et al.* and were reported in O'Donnell (1992).

### (iii) Outline of the Paper

This working paper considers some measures of the competitive performance of Irish manufacturing industry. The first part of Section 2 reports recent developments in the output and employment of industry. A central feature of this analysis, and of the paper as a whole, is the attempt to review the industrial performance of individual sectors and subsectors, rather

than of manufacturing industry as a whole. This reflects the conviction that significant aspects of competitiveness are product and sector specific. In Section (ii) recent developments in productivity are reviewed. Productivity can be seen as both a measure of competitive performance and competitive potential. It is argued that Irish productivity trends require considerable further analysis, and combination with other data, if their significance for competitiveness is to be discovered.

Trade performance is a key element of competitive performance in an open economy. For the purpose of analysing competitive advantages it is disaggregated trade specialisation, rather than aggregate trade balance, which is relevant. Section (iii) examines Ireland's pattern of trade specialisation as reflected in its indices of revealed comparative advantages in 1990. The pattern of trade specialisation in 1990 is related to changes of revealed comparative advantages in other OECD countries.

Other dimensions of trade performance and competitiveness are revealed by the export orientation of Irish industry. Section (iv) considers export orientation and export dependence, drawing on data from the 1989 *Census of Industrial Production*. An initial attempt is made to relate export orientation to other variables such as size and import propensity. The geographical distribution of exports is examined. Section (v) gives an indication of the direction of further work by noting other variables currently being assembled and examined: export market share, import penetration, profits, costs and firm (or establishment) size.

The paper closes with a brief discussion of some alternative methods of classification which will be considered as the work proceeds. While one of the central arguments is the need to begin with detailed analysis of industries and industry segments, the challenge is to find ways of reaggregating this information using analytically meaningful systems of classification.

## 2. MEASURES OF PERFORMANCE

### (i) Output and Employment Trends

Trends in output and employment can provide a basic indicator of competitive performance. Consequently, the survey of measures of competitiveness begins with a review of output and employment trends in the years 1985 to 1991. These recent trends will be compared with longer run patterns documented in earlier studies, such as Blackwell and O'Malley (1984), NESO (1989) and the Department of Industry's periodic reviews of industrial performance.

The evolution of output and employment in Irish industry is summarised in Table 2, drawn from the Irish Statistical Bulletin. The Table shows an index of industrial production from 1986 to 1991 (with 1985=100). Employment in each sector is shown in parenthesis (in thousands). The output of manufacturing industry was more than 50% higher in 1991 than in 1985, but the employment increase was very slight. It is clear from Table 2 that most broad industrial sectors experienced both output and employment growth in the period 1985 to 1991. Output growth varied from 85% in metals and engineering to just 9% in non-metallic minerals and 17.6% in timber and wooden furniture. The one exception to this pattern of increasing output, was clothing, footwear and leather in which output fell by over 20% from 1985 to 1991. While the output trends of broad industrial sectors convey limited information concerning competitive advantage, they are notable in one respect. The upward path of output in most broad industrial sectors in the years since 1987 contrasts with the

Table 2 Annual Volume of Industrial Production Indices - Seasonally Adjusted, Year 1985=100

| Industrial Sector   | NACE Code                    | 1986                | 1987                | 1988                | 1989                 | 1990                 | 1991                 |
|---|------------------------------|---------------------|---------------------|---------------------|----------------------|----------------------|----------------------|
| <b>Non-Metallic Mineral Products</b>                              | <b>24</b>                    | <b>98.5 (12.2)</b>  | <b>92.9 (11.75)</b> | <b>93.9 (10.88)</b> | <b>110.9 (11.25)</b> | <b>116.6 (11.25)</b> | <b>109.5 (10.93)</b> |
| Chemicals (incl. man-made fibres)                                 | 25-26                        | 99.5 (12)           | 103.8 (12.2)        | 121.3(12.38)        | 145.3 (12.93)        | 150.1 (13.4)         | 182.5 (14.3)         |
| Basic industrial chemicals (incl. fertilizers)                    | 251                          | 96.2 (2.83)         | 102.1 (2.8)         | 102.0 (2.5)         | 107.9 (2.6)          | 110.8 (2.55)         | 113.9 (2.6)          |
| Pharmaceuticals   | 257                          | 90.0 (4.6)          | 103.8 (4.9)         | 126.1 (5.3)         | 159.0 (5.6)          | 163.1 (6.1)          | 206.7 (6.7)          |
| Other chemicals (incl. man-made fibres)                           | 255, 256, 258-260            | 103.5 (4.6)         | 104.9 (4.5)         | 116.1 (4.6)         | 120.9 (4.7)          | 128.8 (4.8)          | 140.4 (5.0)          |
| <b>Metals and engineering</b>                                     | <b>22, 31-37</b>             | <b>105.3 (58.1)</b> | <b>126.2 (58.1)</b> | <b>158.8 (60)</b>   | <b>178.3 (62.8)</b>  | <b>190.1 (66.5)</b>  | <b>185.4 (67.5)</b>  |
| Production and preliminary processing of metals                   | 22                           | 91.4 (1.8)          | 91.5 (1.7)          | 104.8 (1.7)         | 116.1 (1.8)          | 121.6 (1.7)          | 108.7 (1.7)          |
| Manufacture of metal articles                                     | 31                           | 91.7 (11.6)         | 91.9 (11.5)         | 95.1 (11.5)         | 100.3 (12.1)         | 107.3 (13)           | 101.8 (12.7)         |
| Metal engineering   | 32                           | 101.4 (7.7)         | 113.5 (7.4)         | 118.9 (7.6)         | 129.4 (8.2)          | 127.8 (8.4)          | 117.6 (8.2)          |
| Office and data processing machinery                              | 33                           | 117.2 (6.0)         | 159.2 (6.1)         | 210.6 (6.4)         | 234.9 (6.8)          | 248.2 (7.0)          | 224.6 (7.3)          |
| Electrical engineering  | 34                           | 104.6 (17.4)        | 127.1 (17.8)        | 165.8 (19.1)        | 213.8 (19.6)         | 234.0 (21.5)         | 252.6 (21.6)         |
| Manufacture and assembly of motor vehicles (incl. parts)          | 35                           | 85.6 (2.7)          | 85.9 (2.7)          | 108.6 (2.7)         | 136.1 (3.0)          | 123.9 (3.1)          | 103.1 (3.0)          |
| Manufacture of other means of transport                           | 36                           | 97.8 (4.1)          | 98.4 (4.2)          | 97.4 (4.1)          | 103.9 (4.1)          | 108.8 (4.3)          | 104.6 (4.9)          |
| Instrument engineering  | 37                           | 99.5 (6.8)          | 117.1 (6.9)         | 121.2 (6.9)         | 133.9 (7.3)          | 147.4 (7.6)          | 148.6 (8.3)          |
| <b>Food</b>   | <b>411-423</b>               | <b>103.7 (37.2)</b> | <b>117.2 (36.3)</b> | <b>123.6 (36.0)</b> | <b>126.1 (35.8)</b>  | <b>130.5 (36.7)</b>  | <b>136.6 (37.0)</b>  |
| Slaughtering and preserving of meat                               | 412                          | 104.7 (8.9)         | 111.2 (9.4)         | 105.8 (9.5)         | 106.2 (9.5)          | 132.5 (10.3)         | 152.4 (11.0)         |
| Manufacture of dairy products                                     | 413                          | 95.4 (7.6)          | 96.0 (7.2)          | 93.6 (7.0)          | 99.1 (7.7)           | 100.7 (7.6)          | 100.3 (7.3)          |
| Grain milling and manufacture of animal and poultry food          | 416, 422                     | 113.2 (3.2)         | 104.8 (3.0)         | 103.0 (2.9)         | 108.9 (2.7)          | 111.3 (2.8)          | 116.0 (2.6)          |
| Manufacture of sugar and cocoa, chocolate and sugar confectionery | 420-421                      | 95.2 (4.7)          | 95.5 (4.3)          | 127.7 (4.2)         | 112.8 (4.2)          | 127.1 (4.2)          | 129.7 (4.2)          |
| Other foods   | 411, 414, 415, 417, 418, 423 | 111.4 (5.5)         | 155.6 (5.6)         | 170.0 (6.0)         | 176.4 (6.0)          | 173.6 (6.3)          | 184.3 (6.6)          |



|  |                                |                     |                     |                     |                     |                      |                      |
|--|--------------------------------|---------------------|---------------------|---------------------|---------------------|----------------------|----------------------|
| <b>Drink and Tobacco</b>                       | <b>424-429</b>                 | <b>102.0 (7.4)</b>  | <b>99.8 (7.2)</b>   | <b>105.5 (6.8)</b>  | <b>116.6 (6.6)</b>  | <b>117.0 (6.3)</b>   | <b>122.8 (6.1)</b>   |
| Drink  | 424-428                        | 102.5 (5.5)         | 1101.2 (5.4)        | 109.1 (5.2)         | 122.9 (5.1)         | 124.5 (4.9)          | 130.0 (4.8)          |
| Tobacco  | 429                            | 100.0 (1.8)         | 93.5 (1.7)          | 90.5 (1.6)          | 90.7 (1.5)          | 86.8 (1.4)           | 94.2 (1.3)           |
| <b>Textile industry</b>                        | <b>43</b>                      | <b>99.0 (10.7)</b>  | <b>102.0 (10.4)</b> | <b>106.4 (10.4)</b> | <b>111.1 (10.7)</b> | <b>119.1 (10.6)</b>  | <b>118.8 (10.4)</b>  |
| Wool industry                                  | 431                            | 98.4 (2.0)          | 96.5 (1.8)          | 105.1 (1.7)         | 105.9 (1.7)         | 97.5 (1.7)           | 103.1 (1.5)          |
| Knitting industry                              | 436                            | 94.9 (3.9)          | 95.2 (3.9)          | 97.0 (3.9)          | 113.2 (4.3)         | 139.1 (4.5)          | 158.4 (4.5)          |
| Other textiles                                 | 432-434,<br>437-439            | 101.5 (4.8)         | 108.0 (4.7)         | 112.1 (4.9)         | 112.8 (4.7)         | 118.1 (4.5)          | 107.1 (4.4)          |
| <b>Clothing, footwear &amp; leather</b>        | <b>44-45</b>                   | <b>97.5 (15.4)</b>  | <b>98.1 (14.7)</b>  | <b>91.6 (13.9)</b>  | <b>87.1 (13.4)</b>  | <b>88.1 (13.5)</b>   | <b>77.7 (12.9)</b>   |
| Leather & footwear                             | 44, 451                        | 85.6 (1.9)          | 78.7 (1.7)          | 75.1 (1.6)          | 77.1 (1.5)          | 74.6 (1.4)           | 68.1 (1.3)           |
| Clothing                                       | 453-456                        | 100.1 (13.4)        | 102.4 (13.0)        | 95.3 (12.2)         | 89.4 (11.9)         | 91.3 (12.1)          | 80.0 (11.6)          |
| <b>Timber &amp; wooden furniture</b>           | <b>46</b>                      | <b>95.7 (7.5)</b>   | <b>96.3 (7.3)</b>   | <b>105.9 (7.4)</b>  | <b>111.1 (7.6)</b>  | <b>117.5 (7.8)</b>   | <b>117.6 (7.8)</b>   |
| <b>Paper &amp; printing</b>                    | <b>47</b>                      | <b>106.7 (13.3)</b> | <b>116.5 (13.4)</b> | <b>127.5 (13.7)</b> | <b>131.5 (14.2)</b> | <b>139.4 (14.6)</b>  | <b>152.1 (14.7)</b>  |
| Paper & paper products                         | 471-472                        | 104.1 (3.4)         | 103.1 (3.3)         | 100.6 (3.3)         | 108.2 (3.4)         | 107.4 (3.6)          | 109.6 (3.8)          |
| Printing and publishing                        | 473-474                        | 107.8 (10.0)        | 121.8 (10.1)        | 138.0 (10.5)        | 148.7 (10.9)        | 151.9 (11.0)         | 167.4 (11.0)         |
| <b>Misc. industries</b>                        | <b>14, 48-49</b>               | <b>106.1 (10.5)</b> | <b>110.2 (10.8)</b> | <b>113.4 (11.0)</b> | <b>120.7 (11.8)</b> | <b>129.3 (12.7)</b>  | <b>127.5 (13.1)</b>  |
| Mineral oil refining etc.                      | 14                             | 110.7               | 105.0               | 89.4                | 98.0                | 117.5                | 119.7                |
| Processing of rubber                           | 481-482                        | 99.1 (2.2)          | 101.3 (2.1)         | 104.7 (2.1)         | 103.6 (2.2)         | 117.9 (2.5)          | 123.7 (2.8)          |
| Processing of plastics                         | 483                            | 109.1 (5.6)         | 109.4 (5.9)         | 117.6 (6.1)         | 122.7 (6.6)         | 128.6 (7.0)          | 124.1 (7.1)          |
| Other manufacturing industries                 | 49                             | 104.3 (2.3)         | 126.3 (2.4)         | 126.4 (2.5)         | 149.1 (2.6)         | 153.3 (2.7)          | 147.6 (2.7)          |
| <b>Total Manufacturing Industries</b>          |                                | <b>102.9(184.2)</b> | <b>113.5(182.1)</b> | <b>127.7(182.4)</b> | <b>142.6(187.0)</b> | <b>149.4(193.0)</b>  | <b>154.3 (194.6)</b> |
| Mining, quarrying & turf                       | 111, 21,<br>23                 | 112.9 (8.0)         | 113.2 (7.5)         | 93.2 (6.5)          | 112.7 (5.9)         | 114.0 (5.2)          | 111.3 (5.0)          |
| <b>Total Transportable Industries of which</b> |                                | <b>103.1(192.2)</b> | <b>113.6(189.6)</b> | <b>126.5(189.0)</b> | <b>141.8(192.8)</b> | <b>148.3(198.2)</b>  | <b>152.8 (199.5)</b> |
| Capital goods                                  |                                | 108.0 (44.4)        | 133.1 (44.6)        | 165.2 (46.5)        | 193.6 (48.5)        | 205.8 (51.1)         | 201.6 (52.1)         |
| Intermediate goods                             |                                | 100.5 (59.8)        | 103.2 (58.6)        | 110.5 (57.8)        | 127.4 (59.1)        | 131.7 (60.5)         | 142.2 (60.7)         |
| Consumer goods                                 |                                | 101.9 (87.9)        | 109.9 (86.4)        | 115.5 (84.7)        | 121.3 (85.4)        | 125.8 (86.7)         | 130.9 (86.8)         |
| <b>Electricity, gas &amp; water</b>            | <b>13, 16-17</b>               | <b>95.1 (15.9)</b>  | <b>93.2 (15.2)</b>  | <b>96.3 (14.3)</b>  | <b>101.5 (13.9)</b> | <b>108.3 (13.7)</b>  | <b>116.1 (13.7)</b>  |
| <b>All Industries of which</b>                 | <b>1-4</b>                     | <b>102.1(208.1)</b> | <b>111.3(204.8)</b> | <b>123.2(203.2)</b> | <b>137.5(206.7)</b> | <b>143.9 (211.9)</b> | <b>148.8 (212.9)</b> |
| Energy producing industries                    | 11, 13,<br>14, 16,<br>239 part | 98.7 (19.1)         | 99.6 (18.3)         | 95.5 (16.8)         | 105.8 (15.8)        | 110.0 (15.0)         | 115.7 (14.5)         |

experience earlier in the 1980s and in some cases, the late 1970s. In several broad sectors - such as textiles, clothing and footwear, paper and printing, wood and furniture and others - output fell in the early 1980s, the late 1970s or both.

For the purpose of assembling a set of measures of Ireland's competitive advantage, the output and employment experience of broad industrial sectors is of limited use. Several reasons can be identified. First, given the growing importance of intra-industry specialisation and trade, competitive advantage or disadvantage can reside in particular segments or products rather than broad industrial sectors (NESC, 1989). Second, most broad sectors of industry contain sub-sectors which vary considerably in capital or labour intensity, level of technological sophistication, international or domestic orientation, size of firm etc. We can expect these characteristics to interact with competitive advantage. Consequently, in order to investigate the competitive advantage of Irish industry it is necessary to look at performance in considerable detail. A third limitation on the value of sectoral data arises because of the particular patterns of restructuring which have been observed in Irish manufacturing industry during the 1970s and 1980s. Despite major changes in trade regime and extreme volatility of economic activity, changes in the distribution of employment *between* broad industrial sectors were not very marked. But, using data drawn from IDA employment surveys, Ruane has shown that quite dramatic changes have occurred *within* sectors (Ruane, 1984). In particular, relatively small net changes in employment in many sectors were the result of very large job-losses and job-gains. Consequently, more detailed analysis is required to observe the changes in structure and competitive position of Irish manufacturing industry.

### *Non-Metallic Mineral Manufactures*

This is a sector which was classified by Blackwell and O'Malley (1984) and NESF (1989) as having a degree of natural protection and being fairly reliant on the home market. Although output grew in the 1960s, and from 1973 to 1980, it contracted during most of the 1980s. This is the background against which the modest growth in 1989 and 1990 should be viewed. Continuing slow growth of output and slow attrition of employment, when combined with a probable decrease in natural protection from import competition, do not suggest that this relatively large-firm, indigenous, sector is strengthening its competitive advantage. However, more detailed analysis and consideration of a range of performance, potential and process indicators may qualify this conclusion.

### *Chemicals*

Since at least the mid-1970s, the output and employment performance of sub-sectors within the chemical industry has differed sharply. The growth of output of fertilizers, soap, detergents and candles slowed dramatically after 1973, while the output of pharmaceuticals and man-made fibres increased steadily - reflecting very substantial grant-aided investment in these sub-sectors. By and large these trends have continued in the years from 1985 to 1991. This suggests the continued competitiveness of foreign-owned firms in this sector and continued weakness of firms in basic chemicals. However, once again it is likely that a more detailed study of the industry will reveal niches in which Irish firms are actually or potentially competitive.

### *Metals and Engineering*

It has long been recognised that the metals and engineering sector (NACE 22, 31-37) is made up of such different sub-sectors that its overall output and employment statistics tell us very little about competitive performance or competitive potential. In identifying the response of the various sub-sectors of engineering to free trade, the NESC drew attention to the important role of engineering sectors - such as metals, non-electrical machinery and electrical machinery - in the growth of Ireland's industrial economy from the 1950s to the 1970s (see also O'Malley, 1987). But NESC also noted "an ominous slowing of output growth after the mid-sixties, and the slow productivity growth of an engineering sector built behind protective tariffs" (NESC, 1989, p. 75). In contrast with these sub-sectors, those producing transport equipment - shipbuilding, motor assembly and railroad equipment - experienced considerable difficulties even before 1973. NESC interpreted the trends after accession to the EC as an exacerbation of problems already being felt in the engineering sector - though the path of output and employment appear different. The sub-sectors producing transport equipment turned from slowing growth to definite decline. The more robust sectors, electrical and non-electrical machinery, which had for a long period maintained output growth with slow productivity growth, experienced increased competitive pressure from imports. This heavy reliance on the domestic market was reflected in some growth whenever domestic demand was buoyant, but severe difficulties at other times. Over the twenty years since accession to the EC, this produced a striking fragmentation of much of the engineering industry, as the indigenous industry (with a few exceptions) retreated to segments, such as metal articles, which are largely immune from international competition by virtue of serving very local markets with custom made products. The other notable long term development was, of course, the rapid growth of a foreign owned engineering sector - in office and data processing

equipment, instrument engineering and parts of electrical engineering - as this sector received an increasing share of IDA grant aid after 1975.

The output and employment trends from 1985 to 1991 (reported in Table 2) conform to the long run pattern summarised above. Preliminary processing of metals (NACE 22) and manufacture of metal articles (NACE 31) contracted in the first years of this period and grew slowly in the latter years - a pattern which closely reflects the movement of domestic demand. The output of office and data processing machinery (NACE 33), electrical engineering (NACE 34) and instrument engineering (NACE 37) all grew strongly - though an explanation needs to be found, for the fact that the former two grew almost three times as fast as instrument engineering. The factors noted above - reliance on the domestic market and vulnerability to international competition - do not seem to offer a ready explanation for the recent output and employment performance of the motor vehicles and parts (NACE 35) and other means of transport (NACE 36). This may be a specific instance of a general problem which now arises in using output and employment data to assess the competitive performance and competitive potential of the engineering industry. The restructuring of this sector in the 1970s and 1980s has been so profound that the population of firms in several subsectors may be quite different from that which existed earlier. Consequently, the structural or behavioral characteristics which explain past competitive strengths and weaknesses may not necessarily explain current or future competitiveness. Only detailed analysis of the sector, as it exists at present, can establish whether this is so.

## *Food*

Some parts of the Irish food industry - such as bread, biscuit and flour confectionery, cocoa, chocolate, sugar confectionery, fruit and vegetable processing and margarines - have had a poor output and employment performance since the early 1970s. Indeed, in a few of these sub-sectors, stagnation started earlier. While more detailed analysis will be required, the output and employment trends reported in Table 2 suggest some improvement, at least where output is concerned, in the late 1980s. For example, the output of grain milling etc (NACE 416 and 422) and sugar etc (NACE 420-421) in 1991 were 16% and 29% higher than in 1985 respectively. However, in both subsectors employment fell slightly - a continuation of a long run trend in these segments of the Irish food industry. An assessment of competitive performance and potential will require that output and employment data be combined with data on exports and imports, job gains and losses, new establishment and closure and firm size and age.

The CIP category "other foods" is one that requires careful interpretation since it includes quite diverse sub-sectors, such as fish products (NACE 415), food pastes (NACE 417) and cola concentrate. Further analysis is required to trace the source and meaning of the strong growth of output, and steady growth in employment, in the years between 1985 and 1991 (see Table 2).

The largest sub-sectors in the Irish food industry are those which process the main outputs of Irish agriculture - meat and milk. Output of dairy products was no higher in 1991 than in 1985 and employment was also virtually constant over this period. This output trend, probably determined by the EC milk quota, represents a contrast with earlier years when

output grew. However, the maintenance of employment levels marks a distinct improvement; employment in the manufacture of dairy products fell by over 24% between 1980 and 1987 (NESC, 1989). The aggregate output and employment trends of a sub-sector such as dairy products conveys limited information concerning competitive performance, potential or process. More detailed study of product categories and of market structures is necessary to assess the relative competitiveness of firms or countries in the highly oligopolistic international food industry. Further work on this will proceed in close collaboration with researchers at the National Food Centre.

The aggregate output of the meat processing industry was 50% higher in 1991 than in 1985. Employment also increased over the period - again, in contrast with the period from 1980 to 1985, when employment fell (but not so sharply as in the dairy industry). Assessment of competitiveness requires considerable further analysis.

#### *Drink and Tobacco*

These are the classical example of industries identified by Blackwell and O'Malley (1984), O'Malley (1987) and NESC (1989) as both benefitting from a degree of natural protection and being reliant on the home market. Over the past twenty years, these characteristics are reflected in the maintenance of a relatively concentrated industrial structure and an output and employment performance which strongly reflects the buoyancy of the domestic market. However, within that pattern, two secular trends would appear to have existed. First, the output of tobacco has been stagnant or falling since the mid-1950s - presumably reflecting a long run decline in demand. Second, although the Irish drinks industry has an element of natural protection (deriving, O'Malley has argued, from the early dominance of a few local

producers) this has not been sufficient to prevent creeping import penetration. NESC argued that, in the absence of exportable products and brands, this posed a long run threat to the industry in Ireland (NESC, 1989).

The data in Table 2 strongly suggest that the secular trend in the tobacco industry continued in the years from 1985 to 1991. Both output and employment fell slowly over the period. It is less easy to interpret the output and employment data on the drinks industry. Three fairly distinct product categories now exist: brewing, distilling and mineral waters. The output, employment and trade performance of these product categories must be considered separately. There have been significant changes in the international beer industry in recent years and these mean that, in contrast to earlier times, the *output* and *employment* trend of Irish producers give a limited indication of competitive advantage. Separate consideration of the brewing, distilling and water industries does not imply that they are totally unrelated; the oligopolistic nature of the international drinks industry means that, whatever about production, competitive strength in distribution and marketing may link these product markets.

### *Textiles*

Textiles have long been a sector in which international competition is fierce. In addition, in recent times technological change has emerged as an important force in the evolution of the industry. These two industry characteristics were clearly reflected in the performance of the Irish textile industry since accession to the EC in 1973 - or even before - (NESC, 1989). Research by Blackwell, Danaher and O'Malley (1983) showed rapid import penetration from 1965 to 1973. Productivity growth, when combined with slow growth of



output, implied falling employment in the industry - especially in woollens and knitting. These trends were reinforced in the prolonged recession of the 1980s when employment fell between 1980 and 1987 - by 43.8% in the woollen industry, 21.6% in the knitting industry and over 40% in other textiles. The recent output and employment performance seems somewhat better. While output of the woollen industry recovered slightly, employment has continued to fall. It is in the knitting industry that there are signs of a more significant gain in competitiveness (see Table 2). To understand this, it will be necessary to consider other data, including, trade, firm size and new firm formation. The performance of other textiles sub-sectors (NACE 432-434, 437-439) has also improved in recent years, but more detailed study is required to interpret what this means for competitive performance or competitive potential.

#### *Clothing, Footwear and Leather*

In several sectors of indigenous industry, there has been evidence of improved competitive performance in recent years. This suggests that some of the output and employment loss of the 1970s and 1980s may have represented a once-off adjustment to international competition and a shake-out of firms which were unlikely to be competitive in the international market. The aggregate output and employment trends in clothing, footwear and leather in recent years, reported in Table 2, do not indicate that this interpretation applies in these sectors. Output in clothing was 20% lower in 1991 than in 1985 - continuation of a downward trend which had existed since 1973. The problem in the footwear and leather industries date back even further, but amounted to virtual collapse in the 1980s - when output fell by almost 54% and employment fell by over 70 per cent. These disappointing output and employment trends need to be combined with more detailed information on trade (including its geographical

distribution), firm size, start-ups and closures. Nevertheless, the overall output and employment trends do suggest that isolated success stories in the clothing industry reflect firm-specific competitive advantages rather than the potential for a competitive industry or cluster.

#### *Timber and Wooden Furniture*

The recent output and employment performance of these sub-sectors is fairly typical of an industry reliant on the home market. After a fall in output in the early and mid-1980s, production grew when domestic demand revived. After a fall in employment in the first half of the 1980s, numbers have stabilised since then. However, the picture of crisis and recovery which this account conveys does not adequately capture the dynamics of the industry. IDA Employment Surveys revealed considerable job losses and job gains in the 1970s and the NESCC's 1989 analysis showed some fragmentation (of firm size) in the indigenous segment of the industry. The implication of these changes in structure for competitive potential can only be ascertained when output and employment data are combined with recent information on trade, location and firm size.

#### *Paper and Printing*

While the output of the Irish paper and printing industries grew strongly in the twenty years before 1973, since then output has been volatile. In general, paper and products experienced more marked contractions of both output and employment than printing, but these were much less severe than in many other sectors of Irish manufacturing industry. The limited overall degree of international trade in paper has not prevented creeping import penetration in those segments where international competition is active. Both output and employment of the Irish

paper and paper products industries have been fairly stable since 1985. Further investigation will be necessary to establish whether this reflects offsetting trends in different segments and to assess its implications for competitive performance and potential. There have been dramatic changes in the printing and publishing industries, in most countries, in recent years. A remarkable feature of the print era was the use of one basic technology for over 500 years. However, in the past 25 years computerisation has induced rapid technological and organisational change. These changes have lowered costs and greatly reduced barriers to entry - particularly in printing. As a result, that industry is less concentrated and comprised of smaller firms than most other OECD manufacturing sectors. However, the publishing industry in many countries has recently seen a wave of foreign investment and transnational mergers and acquisitions.

In 1989, the NESC suggested that the introduction of new printing technology had been relatively slow in both the UK and Ireland and this was reflected in relatively slow output and productivity growth (when compared with other OECD countries). It can be seen from Table 2 that output of printing and publishing was 67% higher in 1991 than in 1985. This is only slightly more than the growth of total manufactured output, 54%. The small increase in employment in printing and publishing in this period suggests that the Irish industry is beginning to achieve the productivity growth which is feasible in this sub-sector (see Section ii below). There is no doubt that further interpretation of the competitive performance and potential of printing and publishing requires that the output and employment data be combined with a range of other indicators. One of the questions which needs to be considered is the nature of the reliance of the Irish printing industry on the foreign-owned firms in engineering.

The output of paper and paper products increased very little in recent years (see Table 2). Assessment of the significance of this for competitiveness will depend on consideration of market growth, export market share and import penetration.

## (ii) Productivity

Productivity is widely used as both a measure of competitive performance and a measure of competitive potential. It has clear meaning as a measure of performance since, in most cases, it is a ratio of output levels (or growth) to employment levels (or growth) and these are obviously indicators of performance. But in the view of many, productivity is an important determinant of international competitive advantage. Porter argues that "the only meaningful concept of competitiveness at the national level is national productivity" (Porter, 1990, p. 6). In a British study of relative productivity in the UK, the US and Germany, it was likewise argued that productivity is the key measure of national competitiveness since "at the national level, output per man, and by extension, output per head of the population, is the basic determinant of living standards" (Smith *et al*, 1982). Relative productivity has been the subject of a major research programme at the National Institute of Economic and Social Research in London (see Prais, 1988; Steedman and Wagner, 1987 1989; Van Ark, 1990; Oulton, 1990; O'Mahony, 1992). Likewise, productivity has been the focus of the work of Hitchens and others on the competitiveness of Northern Ireland and the Republic (Hitchens and Birnie, 1991, 1992; Hitchens, Wagner and Birnie, 1990). In its recent report, *The Association Between Economic Growth and Employment Growth in Ireland* (1992), NESC provide a valuable overview of productivity trends in Irish manufacturing industry in the period 1973 to 1990. While more detailed analysis, focusing on competitive advantage, may

eventually add further information, an initial consideration of measures - such as is provided in this working paper - must begin with the NESC account.

For the purpose of assessing competitive advantage, an important point to emerge from the NESC study is that much of the recorded increase in Irish manufacturing productivity can be attributed to the extent and impact of structural change (NESC, 1992, pp. 35-46). This reinforces one of the main arguments of this paper, that assessment of Ireland's competitive advantage requires fairly disaggregated and detailed analysis of industries and firms. Only such analysis will penetrate the distorting images created by averaging across industrial sectors and activities which have very different economic characteristics.

A second feature of Irish manufacturing productivity highlighted by NESC is the wide spread of productivity levels across industrial sectors. Data drawn from the *Census of Industrial Production*, show that recorded gross value added per person in 1989 ranges from £154,500 per person in pharmaceuticals to just £9,900 per person in clothing, footwear and leather. Although pharmaceuticals and ODP have productivity levels which are twice or three times as high as all other sub-sectors, and this accounts for the very large absolute spread noted above, there remains considerable variations among the remaining sectors. NESC show that the gap between the productivity levels of different industries is greater in Ireland than in any other EC country.

To a considerable extent, these sectoral differences in productivity coincide with differences in firm nationality. The evidence suggests that productivity levels in foreign companies located in Ireland are *high* by international standards and that productivity among

Irish-owned firms are *low* by international standards (NESC, 1992, p. 44). In recent years, *the Census of Industrial Production* makes some distinction between Irish and foreign-owned firms. Data from the 1989 census, cited in NESC (1992), show that the net output per person is consistently higher in foreign-owned firms. Furthermore, this difference cannot be entirely attributed to inter-sectoral differences in productivity. Striking differences in net productivity are found between foreign and Irish-owned firms *within* sectors such as motor vehicles, timber and wooden furniture, non-metallic minerals and mechanical engineering, and significant differences are evident in preliminary processing of metals, metal articles, food, drink and tobacco, and textiles (see NESC, 1992, Table 2).

In our survey of recent output and employment trends it was noted that the years since 1987 may have constituted a significant long run improvement in Irish manufacturing performance - reflecting the end of a period increased international competition, rapid structural change and shake-out of an older cohort of firms. This hypothesis remains to be verified. Recent developments in productivity provide some evidence in favour of it. In a number of sectors, productivity growth was significantly faster, between 1986 and 1990, than over the longer period 1973-1990. This is particularly so in sectors which have traditionally displayed low productivity growth. The long run productivity growth in paper and printing was 0.9% per annum (1973-1990); but output per head rose by 5.4% per year between 1986 and 1990. In motor vehicles, the recent growth of 7.9% per year greatly exceeds the long run growth of 0.4% (1973-1990). In timber and wooden furniture, the long run productivity growth of 2.3 per cent per year was almost doubled in the period 1986-1990. A similar pattern can be found in mechanical engineering, other transport equipment, non-metallic minerals, drink and tobacco and instrument engineering (see NESC, 1992, Appendix 2). While

these rapid recent productivity growth rates clearly have a cyclical component, they also exceed the rates achieved in the previous boom period, 1973 to 1979 (*ibid*). Considerable further analysis will be necessary to adequately interpret the significance of these recent developments for Ireland's competitive advantage. Data on productivity must be combined with a range of other variables - on the output, trade, profits, size, cost and technology indicators - and analyses using some system of classification of international industries and markets.

International comparisons of productivity are an important element in evaluation of national competitive performance, potential and process. In recent years there has been renewed interest in this subject. However, international productivity comparisons present a number of complex measurement problems (Broadberry and Crafts, 1990; Van Ark, 1990; Crafts, 1992). NESC provide some initial comparisons of Irish productivity with those in other EC and OECD countries. A rough comparison of productivity rates in seven major OECD countries with those in Ireland suggests that "Ireland long-run rate of productivity growth in medium and low-tech industry would appear to place it at the upper-end of the [dominant 2-4 per cent] range, but do *not* justify a view of Ireland as a particularly noticeable deviant from international norms" (NESC, 1992, p.58). A more detailed sectoral comparison of productivity *levels* in Ireland and the EC-9 seems to suggest a somewhat different conclusion. In 1980 the level of productivity in manufacturing (as measured by gross value added per employee) was 71 per cent of the EC average; by 1988 this had risen to 123 per cent. As NESC note, sectoral comparisons are of more interest. These "do not support the view that labour productivity growth in Irish medium and low-tech industries has been uniformly higher than in other developed EC economies" (NESC, 1992, p.60). In seven sectors the productivity gap narrowed (or disappeared) between 1980 and 1988: mechanical

engineering, motor vehicles, non-metallic minerals, metal articles, "other foods" and timber and wooden furniture. However, in six sectors the productivity gap widened: preliminary processing of metals, chemicals (excluding pharmaceuticals), transport equipment other than motor vehicles, food, drink and tobacco, clothing, footwear and leather, and paper and printing (NESC, 1990, Table 26). It should be noted, however, that the period covered in this comparison does not really include the resumption of economic in Ireland in the late 1980s and early 1990s. Further reference to comparative data in later editions of Eurostat's *Structure and Activity of Industry* will assist interpretation of more recent developments in Irish industry.

### **(iii) Revealed Comparative Advantage.**

#### *The Concept*

The theory of comparative advantage relates a country's trade specialisation to the relative scarcity of its endowments of factors of production. Any attempt to test or even demonstrate the validity of this doctrine faces severe conceptual and methodological difficulties (Chipman, 1987). Among these is the fact that several of the key variables in the theory - such as pre-trade relative prices or factor scarcities - are unobservable. Balassa has proposed a measure of export performance known as 'revealed comparative advantage' (1966, 1977). An index of revealed comparative advantage (RCA) in a particular industry is calculated by dividing a country's share in world exports of a given commodity category by its share in total world exports.



$$RCA_{ij} = \frac{\frac{X_{ij}}{\sum_i X_{ij}}}{\frac{\sum_i X_{ij}}{\sum_i \sum_j X_{ij}}} \times 100$$

$i = 1 \dots n$  (countries)

$j = 1 \dots m$  (commodities)

$X_{ij}$  = exports of commodity  $j$  from country  $i$

Index values greater than 100 indicate a revealed comparative advantage, while values less than 100 suggest a revealed comparative disadvantage.

#### *Ireland's Revealed Comparative Advantage 1990*

Revealed comparative advantage indices can be calculated for any subset of export sectors and countries. While it is common to study a country's RCA in manufactured goods, there may be some value in beginning with an overview of Ireland's overall RCA in all traded goods with all countries. The latest available world trade data appear in the 1990 *United Nations International Trade Statistics Yearbook*. Appendix Table 1 presents the calculations of Ireland's RCA at the SITC 3-digit level. Product categories showing a revealed comparative advantage index greater than 100 are listed in Table 3.

Table 3: *Sectors Showing a Revealed Comparative Advantage, 1990*

| SITC<br>0           | FOOD AND LIVE ANIMALS        | RCA<br>Index |
|---------------------|------------------------------|--------------|
| 001                 | Live Animals for Food        | 608.8        |
| 011                 | Meat, Fresh, Chilled, Frozen | 604.0        |
| 012                 | Meat, Dried, Salted, Smoked  | 305.5        |
| 014                 | Meat, Prepared, Preserved    | 387.5        |
| 022                 | Milk and Cream               | 467.4        |
| 023                 | Butter                       | 1,141.7      |
| 024                 | Cheese and Curd              | 475.6        |
| 034                 | Fish, Fresh, Chilled, Frozen | 151.9        |
| 035                 | Fish, Salted, Dried, Smoked  | 120.6        |
| 043                 | Barley Unmilled              | 300.0        |
| 048                 | Cereal ETC Preparations      | 473.0        |
| 062                 | Sugar Candy, Non-Chocolate   | 386.3        |
| 073                 | Chocolate and Products       | 748.6        |
| 091                 | Margarine and Shortening     | 328.7        |
| 098                 | Edible Products, Preps NES   | 1,685.4      |
| 1.                  | DRINK AND TOBACCO            |              |
| 111                 | Non-Alcoholic Beverages      | 178.0        |
| 112                 | Alcoholic Beverages          | 322.1        |
| Table 1 (continued) |                              |              |
| 2.                  | CRUDE MATERIALS              |              |
| 211                 | Hides, Shins, Furs           | 294.9        |
| 266                 | Synthetic Fibres to Spin     | 398.4        |
| 287                 | Base Metal Ores              | 310.7        |
| 291                 | Crude Animal Materials       | 129.4        |
| 4.                  | ANIMAL OILS AND FATS         |              |
| 411                 | Animal Oils and Fats         | 189.4        |
| 5.                  | CHEMICALS                    |              |
| 513                 | Carboxylic Acids, etc.       | 181.6        |
| 514                 | Nitrogen Compounds           | 380.9        |

|                     |  |         |
|---------------------|--|---------|
| 515                 | Org-inorg Compounds                        | 1,052.1 |
| 541                 | Medicine/Pharm. Products                   | 352.9   |
| 551                 | Essential Oils, Perfumes                   | 1,067.2 |
| 553                 | Perfumery/Cosmetics                        | 268.0   |
| 584                 | Cellulose Derivatives                      | 343.1   |
| 6                   | <b>MANUFACTURES CLASSIFIED BY MATERIAL</b> |         |
| 621                 | Materials of Rubber                        | 248.7   |
| 651                 | Textile Yarn                               | 106.9   |
| 665                 | Glassware                                  | 184.6   |
| 673                 | Iron, Steel Shapes, etc.                   | 99.8    |
| 685                 | Lead                                       | 183.3   |
| 693                 | Wire Products, non-elec.                   | 108.6   |
| 699                 | Base Metal Manufactures                    | 109.1   |
| 7                   | <b>MACHINERY AND TRANSPORT EQUIPMENT</b>   |         |
| 714                 | Engines + Motors NES                       | 158.4   |
| 741                 | Heating, Cooling Equipment                 | 131.6   |
| 752                 | ADP Equipment                              | 497.7   |
| 759                 | Office, ADP, Parts, Accessories            | 565.0   |
| 772                 | Switchgear, etc., Parts NES                | 101.5   |
| 773                 | Electrical Distribution Equipment          | 286.3   |
| 775                 | Household Type Equipment                   | 155.9   |
| Table 1 (continued) |  |         |
| 8                   | <b>MISCELLANEOUS MANUFACTURES</b>          |         |
| 846                 | Under Garments, Knitted                    | 168.5   |
| 872                 | Musical Instruments NES                    | 530.7   |
| 883                 | Developed Cinema Film                      | 365.2   |
| 884                 | Optical Goods NES                          | 424.8   |
| 893                 | Articles of Plastic NES                    | 151.3   |
| 895                 | Office Supplies NES                        | 158.0   |
| 898                 | Musical Instruments                        | 784.4   |
| 899                 | Other Manufactured Goods                   | 101.4   |

Study of these tables gives an initial outline of Ireland's strength in export markets. Some of the notable features would seem to be the following. First, Ireland's revealed comparative advantage is most consistent in SITC Section 0, Food and Live Animals. From Appendix Table 1 it can be seen that Ireland has a revealed comparative advantage in a high proportion of the food categories to which its climate is suited. Second, alcoholic and non-alcoholic drinks remain relatively strong in export markets, though Ireland had a trade deficit in non-alcoholic drinks in 1990 (note the Export/Import index of less than 100 in Appendix Table 1). Third, Ireland displays a revealed comparative advantage in two broad high technology sectors, chemicals (SITC 5) and electronic equipment (SITC 752, 759, 722, 773). The remaining 3-digit sectors with a revealed comparative advantage would seem to fall into two categories. The first is a miscellaneous set of manufacturing sectors such as medical instruments (SITC 872), optical goods (SITC 884), "musical instruments" SITC (Section 898) - which in Ireland's case is dominated by export of magnetic tapes and discs), household electrical equipment (SITC 775) and heating and cooling equipment (SITC 741). The second group of sectors with a revealed comparative advantage are those which seem somewhat more traditional, such as glassware (SITC 665), textile yarn (SITC 651), under garments (SITC 846), wire products (SITC 693), base metal manufactures (SITC 699), articles of plastic (SITC 893) and office supplies (SITC 895). Other features of Ireland's export pattern emerge when note is taken of areas in which Ireland does *not* have a revealed comparative advantage. Ireland has a revealed comparative advantage in very few of the product categories in SITC Section 6, 'Manufactures Classified by Material'. The RCA index and the X/M index for 1990 are greater than 100 in few industries making manufactured products of leather, wood, textiles, paper, iron or steel. Likewise, Ireland's revealed comparative advantage in machinery (SITC Section 7) is confined to 7 of the 35 3-digit product categories.

This account of Table 3 involves an implicit categorisation of those sectors with a revealed comparative advantage in 1990. This categorisation is very preliminary and has a very limited analytical content. It required to be reviewed and revised as the analysis of measures of performance, potential and process proceeds.

#### *Changes in Revealed Comparative Advantage*

The Balassa index of RCA is used by a number of authors in their study of export specialisation, structural competitiveness and national systems of innovation (NSI). Putting aside any qualifications or reservations about the relation of revealed comparative advantage to structural competitiveness and the NSI, we can use some of this work to complement our calculations for 1990. Dalum (1992) reports results derived from analysis of OECD trade statistics at the 4-digit SITC level for the period 1961 to 1987. In order to explore broad long-run changes in international specialisation, he aggregated the detailed trade data to five sectors:

- (1) products based on natural resources
- (2) oil and gas
- (3) chemicals
- (4) engineering products
- (5) traditional manufacturing industries.

The fourth category, engineering products, includes electrical and non-electrical machinery, electronics and transport equipment. The term 'traditional' is used to describe manufactures of metal, furniture, clothing, etc. Taking the OECD as a whole, the most salient feature of structural change of exports is the long-term decrease in the share of natural resource-based products versus the increase of engineering products. But chemicals and traditional industries

also increased their share of total exports over the period 1961 to 1987; Dalum considers that the data indicate the presence of three high-growth sectors - engineering, chemicals and products from traditional industries - and one 'laggard', natural resource-based products. Since the growth rates of the three dynamic sectors were very similar - with engineering growing slightly faster than the other two - Dalum judges that there is little *empirical* reason for distinguishing the three sectors when assessing the significance of structural change for national competitiveness.

Tracking the evolution of each OECD country's RCA in the five sectors listed above from 1961 to 1987, Dalum identified which countries had radical change, no change or some change. His findings are summarised in Table 4, which shows that Ireland is one of only four countries which experienced radical change. The increase of oil exports is the explanation of the presence of the UK and Norway in this group. The radical change in Japan and Ireland bear certain similarities, but differ in important respects also. Both experienced a strong increase in engineering exports and strong decline in specialisation in traditional sectors. While Ireland's increased relative specialisation in chemicals was a major part of its radical change, Japan's specialisation in this sector declined somewhat. Dalum notes, of course, that the more significant contrast is in the economic structures which underlie export

Table 4: *Change of Specialisation Patterns 1961-87*

| <i>Radical change</i> | <i>No change</i> | <i>Some change</i> |
|-----------------------|------------------|--------------------|
| Japan                 | West Germany     | USA                |
| Ireland               | Sweden           | Belgium-Luxembourg |
|                       | Switzerland      | Denmark            |
| United Kingdom        | Netherlands      | Finland            |
| Norway                | France           | Spain              |
|                       | Italy            | Portugal           |
|                       | Canada           | Turkey             |
|                       | Austria          | Greece             |
|                       | Iceland          |                    |

Dalum, 1992

specialisation. While Japan has been the home nation for the emergence of a large number of MNEs, "Ireland has, on the other hand, mainly been characterised as a host country for foreign MNE assembly and chemical plants; and no significant technological innovation capability appears to have emerged in Irish manufacturing". Indeed, Dalum adds that "lack of 'indigenous' innovative development forces appears to be a major problem" (Dalum, 1992, p. 204).

A diverse group of countries has experienced 'some change' in specialisation in the period 1961 to 1987. These include mature industrial economies (such as the US), small developed European economies (such as Denmark, Finland, and Belgium-Luxembourg) and developing, peripheral countries (such as Spain, Greece, Turkey and Portugal).

Four other features which emerge from Dalum's analysis should be noted. A high, and frequently rising, specialisation in natural resource-based products is a feature, not only of a developing economy, such as Spain, but also of relatively small developed economies such

as Denmark, Sweden, Austria, Belgium-Luxembourg, the Netherlands and Finland, and even of France. Dalum concludes that such specialisation "is not necessarily an indication of a low level of development" (Dalum, 1992, p. 205). In all three groups - radical change, no change and some change - almost all countries exhibit distinctly different development patterns, even at the highly aggregated five-sector analysis conducted by Dalum. There is little evidence of convergence in export specialisation patterns.

Dalum argues that export specialisation in engineering is a proxy for an internationally competitive capital goods sector, which is, in turn, an indicator of a strong national system of innovation. He finds that the five high innovation performers - US, Japan, Germany, Switzerland and Sweden - all display specialisation (revealed comparative advantage) in engineering. In addition, countries achieving development in the period 1961 to 1987, such as Finland and Spain, showed a significant increase in specialisation on engineering. Finally, despite these observations, the cases of Ireland and Canada suggest that use of revealed comparative advantage in engineering as a proxy for innovative strength should not be pushed too far. "Both economies are characterised as typical hosts for foreign direct investment, with a fairly low degree of technological spillover to their respective NSIs, especially in the Irish". Dalum infers from this that "our proxy for strength may be too broad" (Dalum, 1992, p. 207). This is not only true of Dalum's highly aggregate five sectors, but even of our calculations of RCA derived from the SITC 3-digit data. It is noted below that an important next step in analysis of Ireland's competitive advantage is an even more disaggregated examination of various measures of performance, potential and process.

#### *The Evolution of Ireland's RCA*

Ireland's revealed comparative advantage in the export of manufactures from 1969 to 1982 was examined by Thornhill (1986). His interest lay in the relative merits of the



Ricardian, Heckscher-Ohlin and product-life-cycle theories of comparative advantage. Consequently, he classified each SITC 3-digit sector according to their capital or labour intensity, their high- or low-skill intensity and their natural resource intensity. Comparing RCA indices for the periods 1969-71, 1976-78 and 1980-82 Thornhill identified three main trends:

- a decreasing specialisation in resource-intensive industries
- an increasing specialisation in capital-intensive industries
- a shift from low-skill to high-skill industries

In interpreting these trends, it is important to appreciate that declining revealed comparative advantage of a particular sector does not necessarily imply absolute decline in the employment, output or exports of the sector. Thus the decline in Ireland's specialisation in the export of resource-based products is not inconsistent with growing exports of some food products. Indeed, Thornhill noted that within the resource-intensive category the decline in the share of export industries with a revealed comparative advantage was least pronounced for the relatively high-skill and capital-intensive segments such as dairy products, alcoholic beverages, animal feeding stuffs and sugar preparations.

Ireland's increased specialisation in capital-intensive goods in the period 1969 to 1982 was largely due to the growth of exports of three sectors:

|     |                           |
|-----|---------------------------|
| 099 | Food preparations, n.e.s. |
| 512 | Organic chemicals         |
| 714 | Office machines.          |

These are relatively high-skill industries and so the shift to capital intensity reinforced, or coincided with, the increasing specialisation in high-skill sectors.

The other cause of the shift from low skill and labour intensive sectors was the declining export share of industries such as textiles, clothing, floor coverings, clay products, and domestic electrical equipment.

Our calculations of RCA indices for 1990 suggest that, by and large, these trends in Ireland's export specialisation have continued through the 1980s. However, further more detailed study of Ireland's trade performance will be necessary to ascertain whether the rate of structural change continues to be as rapid as it was in the period from EC accession in 1973 to the mid-1980s.

#### **(iv) Export Orientation and Export Dependence**

In assessing competitive advantage, exports can be viewed as both a measure of competitive performance and, to some degree, as a measure of competitive potential. Likewise, while export achievement is undoubtedly an indicator of competitive performance, and therefore of competitive strength, *dependence* on export markets might be viewed as a sign of a possible weakness. The *Census of Industrial Production* reports data on the export orientation of manufacturing establishments and these can be used to make some assessment of these dimensions of the Irish manufacturing sector.

Table 5 presents a range of calculations derived from the Census of Industrial Establishments. Column 1 shows the number of establishments in a series of manufacturing sectors and subsectors. Column 2 shows the percentage of these which export. This ranges from just over 5 per cent in bread, biscuits and flour confectionery (NACE 419) to 94 per cent in ODP (NACE 33). Column 3 shows total employment in the various sectors, while column 4 reports the percentage of this employment which is in exporting establishments. Column 5 shows the percentage of Gross Output of each sector which is exported. This ranges from 5.4 per cent in bread, etc., to 98.1 per cent in instrument engineering (NACE 37).

Column 6 shows the percentage of the gross output of exporting establishments which is exported - ranging from low percentages such as 21.5 per cent in bread and 22.2 per cent in printing - to virtually 100 per cent in instrument engineering, ODP and pharmaceuticals. The percentage of material inputs of each sector (exporting and non-exporting establishments) purchased in Ireland is shown in column 7. This ranges from over 97 per cent in meat (NACE 412) to lows of 8 per cent in 'other manufactures' (NACE 14, 49) and 13.2 per cent in knitting (NACE 436). The final two columns show the average size of exporting and non-exporting firms.

Overall, these data show a remarkable export orientation in Irish manufacturing industry. Almost 60 per cent of all establishments are involved in export business. Indeed, in many broad (NACE 2-digit) industrial sectors - such as chemicals, metals and engineering, and textiles - this export orientation is very much higher. In three broad sectors - non-metallic minerals, food and paper and printing - about 40 per cent of establishments are involved in production for export. It can be seen from column 4 that an even higher proportion of total employment (76.2 per cent) is in exporting establishments. Even in sectors such as non-metallic minerals and food, where around 40 per cent of establishments export, employment in such establishments accounts for almost 70 per cent of total employment. The remarkable export orientation is underlined when gross output is considered. Over 60 per cent of manufacturing gross output was exported in 1989 (see column 6). Among establishments which export, over 75 per cent of gross output was exported (see column 7).





Once the striking overall export orientation of Irish manufacturing industry has been noted, it is important to take account of inter-sectoral variations and to trace these to various structural and behavioral characteristics. In many, highly export-oriented, sectors the proportion of gross output exported exceeds the proportion of all establishments which export and the proportion of total employment in these establishments. The aggregate metals and engineering sector (NACE 22, 31-37) conforms to this pattern. However, there is a range of sectors in which a different pattern exists. In timber and furniture (NACE 46), metal articles (NACE 31), motor vehicles (NACE 35), drink and tobacco (NACE 424-429), clothing and footwear (453-456 and 451) and paper and printing (NACE 47) a relatively small proportion of gross output is exported - regardless of the fact that, in general, a significant proportion of establishments are involved in exporting. Some of these are sectors identified by Blackwell and O'Malley (1984) as "reliant on the domestic market". Their pattern of adjustment to free trade, and their place in the Irish economy, was further analysed in NESG (1989). Their heavy reliance on the domestic market can arise for one of two broad sets of reasons. Some - such as drink and tobacco, paper and printing, metal articles and wooden products - have a degree of natural protection arising from large size, access to materials or domination of highly local markets. In other cases, such as clothing and footwear, heavy reliance on the domestic market tends to reflect a weak position in a highly competitive international industry. In proceeding to more detailed empirical analysis of Ireland's competitive advantage, account will be taken of the different market structures and environments in which different segments of Irish industry exist.

It is clear that export orientation requires careful interpretation in any assessment of competitive advantage. Likewise, export activity itself needs to be examined in some detail. Table 6 shows the broad geographical destination of the exported gross output reported in

Table 5. This shows that 27.4 per cent of exported gross output was exported to the UK, while the rest of the EC, the US and other countries took 42.7, 9.7 and 20.2 per cent respectively. Although these overall shares are of considerable importance in assessing the significance of exchange rate movements for the Irish economy as a whole, they are of limited relevance to the analysis of Ireland's competitive advantage. This is so because of the sectoral variation in destination of Irish manufactured exports. Three broad groups can be

Table 6: Geographical Distribution of Exports

| NACE<br>CODE               | INDUSTRIAL SECTOR  | % of Gross Output Exported |              |      |           |
|----------------------------|--|----------------------------|--------------|------|-----------|
|                            |  | UK                         | Other<br>EEC | USA  | Elsewhere |
|                            |  | T                          | K            | L    | M         |
| 24                         | Manufacture of non-metallic mineral products                             | 14.4                       | 31.8         | 23.4 | 30.3      |
| 25-26                      | CHEMICALS (INCL. MAN-MADE FIBRES)  | 17.3                       | 47.2         | 16.1 | 19.5      |
| 251                        | Basic industrial chemicals (incl. fertilisers)                           | 30.4                       | 32.8         | 7.0  | 29.8      |
| 257                        | Pharmaceuticals  | 11.2                       | 46.3         | 21.9 | 20.7      |
| 255-256)<br>258-260)       | Chemicals, remainder (incl. man-made fibres)                             | 30.3                       | 57.6         | 1.9  | 10.1      |
| 22,31-37                   | METALS AND ENGINEERING   | 23.6                       | 53.4         | 9.3  | 13.7      |
| 22                         | Production and preliminary processing of metals                          | 56.2                       | 37.0         | 1.2  | 5.6       |
| 31                         | Manufacture of metal articles  | 47.3                       | 32.0         | 12.3 | 8.4       |
| 32                         | Mechanical engineering   | 24.2                       | 46.1         | 11.6 | 18.2      |
| 33                         | Office and data processing machinery                                     | 22.4                       | 54.3         | 6.2  | 17.1      |
| 34                         | Electrical engineering   | 22.9                       | 61.1         | 8.1  | 7.9       |
| 35                         | Manufacture and assembly of motor vehicles (incl. parts and accessories) | 31.1                       | 44.4         | 11.9 | 12.6      |
| 36                         | Manufacture of other means of transport                                  | 17.6                       | 14.2         | 43.2 | 25.0      |
| 37                         | Instrument engineering   | 12.9                       | 27.5         | 5.0  | 35.1      |
| 411-423                    | FOOD (+)   | 32.4                       | 27.5         | 5.0  | 35.1      |
| 412                        | Slaughtering, preparing and preserving of meat (+)                       | 43.0                       | 33.2         | 1.5  | 22.3      |
| 413                        | Manufacture of dairy products (+)  | 23.6                       | 15.6         | 11.6 | 49.2      |
| 416,422                    | Grain milling and animal feeding stuffs                                  | 89.4                       | 10.1         | .2   | .3        |
| 419                        | Bread, biscuits and flour confectionery                                  | 86.0                       | 8.6          | 2.6  | 2.8       |
| 420-421                    | Sugar, cocoa, chocolate and sugar confectionery                          | 77.7                       | 7.9          | 7.5  | 6.9       |
| 411,414-5,)<br>417-8,423 ) | Other food   | 20.1                       | 41.2         | .3   | 38.4      |
| 424-429                    | Drink and tobacco  | 33.2                       | 28.5         | 24.6 | 13.7      |
| 43                         | TEXTILE INDUSTRY   | 43.6                       | 44.8         | 8.0  | 3.6       |
| 431                        | Wool industry  | 43.6                       | 44.8         | 8.0  | 3.6       |
| 436                        | Knitting industry  | 62.7                       | 22.3         | 9.9  | 5.1       |



Table 4 (continued)

|           |   |      |      |      |      |
|-----------|---|------|------|------|------|
| 432-434,) |   |      |      |      |      |
| 437-439 ) | Other textiles  | 43.8 | 43.9 | 7.6  | 4.8  |
| 44-45     | CLOTHING, FOOTWEAR AND LEATHER  | 55.7 | 25.3 | 7.6  | 11.4 |
| 44        | Leather and leather goods   | 33.0 | 57.8 | .4   | 8.8  |
| 451       | Footwear  | 68.1 | 15.4 | 10.4 | 6.0  |
| 453-456   | Clothing (incl. furs and household textiles)  | 73.3 | 13.8 | 10.1 | 12.8 |
| 46        | TIMBER AND WOODEN FURNITURE INDUSTRIES  | 74.3 | 20.5 | 2.2  | 3.0  |
| 47        | PAPER AND PAPER PRODUCTS, PRINTING AND PUBLISHING                                   | 85.8 | 9.5  | 2.6  | 2.1  |
| 471-472   | Paper and paper products  | 96.1 | 3.1  | .0   | .7   |
| 473-474   | Printing and publishing   | 76.9 | 15.0 | 4.9  | 3.2  |
| 14, 48-49 | MISCELLANEOUS INDUSTRIES  | 37.8 | 45.8 | 3.1  | 13.3 |
| 481-482   | Manufacture of rubber products (incl. retreading of tyres)                          | 11.0 | 72.2 | 2.7  | 14.2 |
| 483       | Processing of plastics  | 53.7 | 32.7 | 2.6  | 11.0 |
| 14, 49    | Other manufacturing industries  | 30.8 | 46.3 | 4.9  | 18.0 |
|           | Total all manufacturing industries (+)<br>(NACE 1 to 4 less 11, 13, 16, 17, 21, 23) | 27.4 | 42.7 | 9.7  | 20.2 |

Source: *Census of Industrial Production*, 1989.

discerned in Table 6. Sectors dominated by foreign-owned firms - such as chemicals, pharmaceutical, ODP, electrical engineering and instrument engineering - export a relatively large proportion to the 'other EC' category. However, it should be noted that these sectors generally have substantial exports to the UK also. The second broad group consists of those sectors and subsectors whose exports are heavily to the UK. In this general category we find extreme concentration on the UK in bread, biscuits, flour confectionery, grain milling, animal feeding stuffs, paper and paper products (over 85 per cent) and very high reliance in textiles, clothing, footwear, timber and furniture, plastics, metal articles, preliminary processing of metals and sugar, cocoa, etc. A third pattern is found where exports outside of the European Community and the US are significant. This is so primarily in natural resource-based industries such as dairy produce, some other foods, basic industrial chemicals and non-

metallic mineral products. Although these broad patterns reflect underlying economic and industrial forces, later work on Ireland's competitive performance, potential and process will undoubtedly entail detailed consideration of individual sectors.

The Census of Industrial Establishments reports some data on the purchase of Irish materials. Although this is less detailed than that in the IDA Irish Economy Expenditure Survey, it is a useful complement to the CIP data on export orientation. Column 7 of Table 5 shows the percentage of all materials used were Irish-produced. The average for all manufacturing industry is just over 50 per cent, ranging from a high of 97 per cent in manufacture of dairy products to only 9 per cent in the manufacture of some transport equipment (NACE 36). While a high proportion of materials used in most food sectors are Irish-produced, outside of this industry there is relatively little variance. This reflects the fact that many manufacturing sectors in Ireland have relatively high import content. Examples evident in Table 5 are textiles, clothing, paper, and various engineering sectors, in which only about 20 per cent of materials used are of Irish origin.

The data in Tables 5 and 6 require further, more statistical, analysis in order to uncover the relationships that exist between key variables such as export orientation, size, the purchase of Irish materials and export market destination. Initial observation suggests that there is little relationship between the export orientation of a subsector and the purchase of Irish inputs - reflecting the high general import propensity of Irish manufacturing. There would seem to be a positive relationship between establishment size and export orientation. The final two columns of Table 5 demonstrate a consistent and very significant difference between the average size of exporting and non-exporting establishments within every sector and subsector. There may also be a relationship between average establishment size and the proportion of gross output exported across sectors. However, if such a relationship exists it

is not unambiguous. The single largest average size of exporting establishments is in bread, etc., and other relatively large average establishment sizes are found in drink and tobacco, sugar and dairy products; but all of these sectors export a comparatively low proportion of gross output. More thorough statistical analysis will be necessary to disentangle the complex relationships that exist within and between sectors.

Other relationships which might be explored include that between the number of establishments (or firms) in a sector and export propensity and the relationship between establishment size and the share of exports to the UK. In their research on the effects of EC accession on Irish manufacturing, NESC drew attention to the phenomenon, identified originally in Belgian research, that although large firms generally tend to export more, firms which dominate their local market tend not to export so much (NESC, 1989). NESC suggested that some Irish drink and tobacco manufacturers conformed to this hypothesis. It will be of interest to re-examine this relationship using later data.

Initial observation suggests a negative relationship between average establishment size and the share of exports to the UK. Once again, however, such a relationship, if it exists, will not be unambiguous. Some sectors with large average size, such as bread, biscuits and confectionery, display a heavy reliance on exports to the UK market. In investigating these relationships, and their links to competitive advantage, it is important to distinguish between inter-sectoral differences in size, export orientation, etc., and intra-sectoral effects.

#### **(v) Other Measures Under Consideration**

A range of other measures of competitive performance are under consideration, and attention will be turned to measures of competitive potential.

### *Market Share and Import Penetration*

The most common and easily accessible measures of market share are those of export and import market. The former can be derived from international data on exports, the latter from study of the imports of relevant countries. Such shares can be studied both over time and across sectors. Actual shares of foreign market demand, and import penetration of domestic markets, is somewhat more difficult to ascertain. Measures of trade market share and import penetration are under active consideration and will be reported in subsequent working papers.

### *Profits*

Profits are a fundamental measure of competitive performance and can be a direct indicator of competitive potential. The *Census of Industrial Production* provides only a rough indication of profitability. Survey-based estimates of profits can be derived from the IDA Irish Expenditure Survey. Data from this source will be analysed and related to competitive advantage. Haskel and Kay (1990) suggest a method for analysing structural change, relating changes in competitive advantage (which they equate with profitability) to a range of other structural and behaviour variables such as employment, price-cost margins, trade, industrial concentration, wages and skill levels. In so far as data permit, a similar analysis will be conducted for Ireland.

### *Costs*

While aggregate national relative unit labour costs are monitored for the purposes of macro economic analysis, sectoral costs are more significant in an investigation of Ireland's competitive advantage. Analysis will be undertaken of relative sectoral labour cost as published periodically by Eurostat in *Labour Costs*. Initial observation suggests that relative

labour costs vary significantly across industrial sectors in ways which reflect market structures and the degree of international competition.

### *Size Structure*

Size structure and scale have increasingly figured in analyses of Irish industry. A brief survey of this question was undertaken by O'Malley, Kennedy and O'Donnell (1992). This emphasised the importance of detailed industry-specific analysis, since the significance of industrial structure and size differs across sectors and products. The ongoing study of competitive advantage with review and update this work and attempt to identify the relevance of size to competitive advantage in different market segments. As noted in the discussion of export orientation (Section iv), statistical analysis of the relationship of size to other variables is necessary to disentangle inter and *intra*-industry relationships.

### 3. FURTHER ANALYSIS OF MEASURES OF COMPETITIVENESS: CLASSIFICATION OF INDUSTRIES AND ENVIRONMENTS

An analysis of several measures of competitive performance has been reported in Section 2 and other measures of performance and potential are currently under consideration. Documentation and discussion of these will be included in further working papers. Perhaps the most important point about all these measures of competitiveness is the need for even more disaggregation than has been presented in this paper. In using output and employment trends to interpret competitive performance or potential, it is desirable to consider industry or product categories which are really economic industries and strategic markets, in the sense defined by Kay (Kay, 1990). The product range which defines an industry or a market may be quite narrow and this calls for disaggregated study. Likewise, when using trade data to indicate competitive performance considerable detail is desirable. Our calculations of revealed comparative advantage are based SITC 3-digit data. Although this is more detailed than many discussions of trade specialisation - for example, in work on competitive advantage in the European internal market - it is less detailed than it needs to be. It is noticeable that Porter's procedure for identifying clusters of competitive advantage begins with study of trade performance at the most detailed level available - SITC 5-digit level. Similar comments apply to consideration of export orientation - though it is not clear whether more disaggregated data are easily available.

If disaggregation is pushed to the limit we would end up at firm level and with a largely descriptive account of what exists. While detailed analysis is necessary, it seems not to sufficient. Recall Porter's observation that "nations succeed not in isolated industries but in *clusters* of industries connected through vertical and horizontal relationships" (Porter, 1991). We cite this statement here not to introduce Porter's particular idea of clusters, nor to

suggest use of his particular formula to identifying national competitive advantage, but as an example of a general trend in analysis of international competition. Recent developments in study of industry and trade have given rise to two general propositions.

- (i) All firms and industries are not of equal significance to a country's long-term competitiveness.
- (ii) The economy should not be seen as just a random collection of firms and industries. Certain *aggregations* of firms and industries are significant in creating competitiveness.

These propositions suggest the following questions:

- (i) On what basis do we judge some industries more significant than others, and what industries emerge as *key sectors* for Ireland?
- (ii) What existing, to potential aggregates of firms and industries are relevant to Ireland's competitiveness.

This suggests that the challenge is to combine disaggregated analysis of output, employment, trade etc. with some reaggregation using some appropriate system of classification.

Some reaggregation of classification is necessary not only because certain aggregates are relevant to competitive advantage but also because the significance of various indicators of performance and potential (such as market share, balance of trade, costs, R+D expenditure) varies from one industry or segment to another. While it is advisable to assemble the same range of qualitative indicators for each industry, the data set should also include some variables which classify each industry and thereby provide a guide to the relative significance of the various quantitative variables. Various approaches to classification and aggregation are available. In analysis of Irish industry it is common to distinguish between the 'modern' and

'traditional' sectors (Baker). When account is taken of the particular characteristics of the food industry, this yields a three-way classification/aggregation.

1. Modern
2. Traditional
3. Food

A different three-way classification has emerged in study of the responses of Irish industry to free trade. Blackwell and O'Malley (1984) proposed the following categorisation.

1. Grant aided, foreign-owned, export oriented.
2. Reliant in the domestic market.
3. Internationally traded, competitive industries.

NESC made use of this system of classification in its detailed analysis to EC membership (NESC, 1989)

A third system of classification which is commonly used focused on the production side:

1. High-tech
2. Medium-tech
3. Low-tech

A classification of various sectors and sub-sectors into these groups was used by OECD (1992) and adopted by NESC in its recent study of the relationship between output growth and employment growth in Ireland (NESC, 1992).

In their analysis of the European internal market Buigues and Jacquemin (1989) identify four principal competitive environments in which strategic behaviour will vary. They do this by applying two criteria derived from Porter's work: the advantages of being a leading



firm and the opportunities for product differentiation. This yields the fourfold classification shown in Figure 1.

Figure 1: *Competitive Environment Matrix*

|                                     |      |            |             |
|-------------------------------------|------|------------|-------------|
| Number of possible differentiations | High | Fragmented | Specialized |
|                                     | Low  | Impasse    | Volume      |
|                                     |      | Weak       | Strong      |

Advantages of being a leading firm

They assign each sector to one of these environments and use this to predict the pattern of strategic responses to the removal of non-tariff barriers.

An alternative is the fivefold classification proposed by the OECD in *Structural Adjustment and Economic Performance* (1987). This is derived by asking what is the key source of competitive advantage in each industry:

1. Resource-intensive
2. Labour-intensive
3. Scale-intensive
4. Differentiated
5. Science-based.

This system identifies the relative significance of different variables as indicators of competitive advantage. Yet another possible classification emerges from Kogut's analysis of comparative and competitive value-added chains (1985). Comparative advantage refers to advantages between countries and the chain of comparative advantage is the distribution of

economic activities across countries. Competitive advantage refers to advantages between firms and the chain of value added refers to the way in which value is created at different stages of production and distribution. In some industries *countries* have strong (traditional) comparative advantage while in others such resource differences are negligible. In some industries it is possible for *firms* to have strong competitive advantages, while in others this is unlikely. Combining these possibilities Kogut identifies three modes or models of international competition as identified in Figure 2. Sectors and sub-sectors can be allocated to the three models of international competition and this suggests the industrial and market structure which is to be expected in each case.

These systems of classification and aggregation are an important guide to the economic relevance of measures of competitive performance, competitive potential and competitive process. While all of them have considerable descriptive value, some of them have analytical content also. Further work will attempt to combine more detailed empirical examination with reaggregation and classification.

Figure 2: *Modes of International Competition*

|                                 |              | Comparative Advantages of Countries   |   |
|---------------------------------|--------------|---|---|
|                                 |              | No Advantage  | Advantaged  |
| Competitive Advantages of Firms | No Advantage | * Nationally Segmented  | * <u>Inter</u> industry Trade<br>* International Vertical Integration of Firms<br>I   |
|                                 | Advantaged   | * <u>Intra</u> -industry Trade<br>* International Horizontal Integration of Firms<br>II | * Internationally Vertically and Horizontally Integrated Firms with Different Configurations of Market Penetrations and Sourcing Sites<br>III |

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## Appendix 1

### Revealed Comparative Advantage and Export/Import Index, 1990

| SITC<br>Code | Industrial Sector            | RCA<br>Index | X/M<br>Index |
|--------------|------------------------------|--------------|--------------|
| 001          | Live Animals for Food        | 608.8        | 362.8        |
| 011          | Meat, Fresh, Chilled, Frozen | 604.0        | 1711.0       |
| 012          | Meat, Dried, Salted, Smoked  | 305.5        | 108.9        |
| 014          | Meat, Prepared, Preserved    | 387.5        | 263.9        |
| 022          | Milk and Cream               | 467.4        | ERR          |
| 023          | Butter                       | 1141.7       | 3556.3       |
| 024          | Cheese and Curd              | 475.6        | 910.8        |
| 025          | Eggs, Birds, Fish, PRSRVD    | 24.1         | 32.8         |
| 034          | Fish, Fresh, chilled, Frozen | 151.9        | 497.7        |
| 035          | Fish, Salted, Dried, Smoked  | 120.6        | 356.4        |
| 036          | Shell Fish, Fresh, Frozen    | 96.8         | 555.8        |
| 037          | Fish ETC, PREPD, PRSVD NES   | 12.8         | 13.9         |
| 041          | Wheat ETC, Unmilled          | 18.6         | 37.4         |
| 042          | Rice                         | 0.0          | ERR          |
| 043          | Barley Unmilled              | 300.0        | 5064.3       |
| 044          | Maize Unmilled               | 0.0          | 0.0          |
| 045          | Cereals NES Unmilled         | 28.9         | ERR          |
| 046          | Wheat ETC Meal or Flour      | 11.4         | 5.4          |
| 047          | Other Cereal, Meals, Flour   | 31.8         | 22.2         |
| 048          | Cereal ETC Preparations      | 473.0        | 153.1        |
| 054          | VEG ETC FRSH, Simply PRSVD   | 60.8         | 49.8         |
| 056          | VEGTBLES ETC PRSVD, PREPD    | 33.7         | 40.1         |
| 057          | Fruit, Nuts, Fresh, Dried    | 0.0          | 0.0          |
| 058          | Fruit Preserved, Prepared    | 25.0         | 26.6         |
| 061          | Sugar and Honey              | 52.0         | 86.6         |
| 062          | Sugar Candy, Non-Chocolate   | 386.3        | 109.7        |
| 071          | Coffee and substitutes       | 0.0          | 0.0          |
| 072          | Cocoa                        | 0.0          | 0.0          |
| 073          | Chocolate and Products       | 748.6        | 271.4        |
| 074          | Tea and Mate                 | 35.1         | 14.3         |
| 075          | Spices                       | 0.0          | 0.0          |
| 081          | Feeding Stuff for Animal     | 71.7         | 22.3         |
| 091          | Margarine and shortening     | 328.7        | 81.4         |
| 098          | Edible products, Preps NES   | 1685.4       | 1009.8       |
| 111          | Non-Alcohol Beverages NES    | 178.0        | 69.6         |
| 112          | Alcoholic Beverages          | 322.1        | 288.9        |
| 121          | Tobacco Unmfrctrd, Refuse    | 0.0          | 0.0          |
| 122          | Tobacco, Manufactured        | 49.2         | 134.4        |
| 211          | Hides, Skins, EXC Furs, Raw  | 284.8        | 2654.5       |
| 212          | Furskins, Raw                | 26.9         | 52500.0      |
| 222          | Seeds for "Soft" Fixed Oil   | 15.3         | 182.5        |
| 223          | Seeds for Other Fixed Oils   | 0.0          | 0.0          |
| 232          | Natural Rubber, Gums         | 0.3          | 1.0          |
| 233          | Rubber, synthetic, reclaimed | 4.9          | 11.9         |
| 244          | Cork, Natural, Raw, Waste    | 0.0          | 0.0          |

Revealed Comparative Advantage and Export/Import Index, 1990

| SITC Code | Industrial Sector                   | RCA Index | X/M Index |
|-----------|-------------------------------------|-----------|-----------|
| 245       | Fuel, Wood NES, Charcoal            | 17.0      | 40.0      |
| 246       | Pulpwood, Chips, Woodwaste          | 72.1      | 950.0     |
| 247       | Other Wood, Rough, Squared          | 22.5      | 254.2     |
| 248       | Wood Shař                           | 23.4      | 21.9      |
| 251       | Pulp and W                          | 6.3       | 50.3      |
| 261       | Silk                                | 0.4       | 0.7       |
| 263       | Cotton                              | 0.0       | 0.0       |
| 264       | Jute, Other Tex Based Fibres        | 3.8       | 6.0       |
| 265       | VEG Fibre, Excl Cotton, Jute        | 6.8       | 20.0      |
| 266       | Synthetic fibres to spin            | 398.4     | 586.4     |
| 267       | Other Man-made fibres               | 13.5      | 12.3      |
| 268       | Wool (EXC Tops) Animal Hair         | 52.1      | 109.4     |
| 269       | Waste of Textile Fabrics            | 6.9       | ERR       |
| 271       | Fertilizers, Crude                  | 0.7       | 9.1       |
| 273       | Stone, Sand and Gravel              | 91.0      | 110.6     |
| 274       | Sulpher, UNRSTD IRN PYRTE           | 0.0       | ERR       |
| 277       | Natural Abrasives NES               | 19.2      | 10.1      |
| 278       | Other Crude Minerals                | 18.8      | 23.9      |
| 281       | Iron Ore, Concentrates              | 0.0       | ERR       |
| 282       | Iron and Steel, Scrap               | 9.1       | 11.8      |
| 286       | Uranium, Thorium Ore, Conc          | 0.0       | ERR       |
| 287       | Base Metal Ores, Conc NES           | 310.7     | 436.7     |
| 288       | Non-Ferrous Metal Scrap NES         | 74.0      | 300.9     |
| 289       | PREC Metal Ores, Waste NES          | 12.2      | 1200.0    |
| 291       | Crude Animal Materials NES          | 129.4     | 447.8     |
| 292       | Crude VEG Materials NES             | 80.4      | 108.5     |
| 322       | Coal Lignite and Peat               | 36.2      | 16.9      |
| 323       | Briquettes, Coke, Semi-Coke         | 1.0       | 1.3       |
| 333       | Crude Petroleum                     | 0.0       | 0.0       |
| 334       | Petroleum Products, Refined         | 0.0       | 0.0       |
| 335       | Residual Petroleum Products NES     | 5.2       | 6.3       |
| 341       | Gas, Natural and Manufactured       | 3.0       | 21.5      |
| 411       | Animal Oils and Fats                | 189.4     | 352.2     |
| 423       | Fixed VEG Oils, Soft                | 1.1       | 1.7       |
| 424       | Fixed VEG Oil, Non-Soft             | 0.0       | 0.0       |
| 431       | Processed Animal, Vegetable Oil, ET | 7.8       | 6.7       |
| 511       | Hydrocarbons NES, Derivs            | 0.8       | 5.7       |
| 512       | Alcohols, Phenols, ETC              | 0.0       | 0.0       |
| 513       | Carboxylic Acids ETC                | 181.6     | 144.3     |
| 514       | Nitrogen-Fnctn Compounds            | 380.9     | 352.6     |
| 515       | ORG-INORG Compounds ETC             | 1052.1    | 632.0     |
| 516       | Other Organic Chemicals             | 81.7      | 76.8      |
| 522       | Inorg Elements, Oxides, ETC         | 33.2      | 33.8      |
| 523       | Other Inorg chemicals ETC           | 40.9      | 44.8      |
| 524       | Radioactive ETC Material            | 2.3       | 47.4      |

Revealed Comparative Advantage and Export/Import Index, 1990

| SITC Code | Industrial Sector                  | RCA Index | X/M Index |
|-----------|------------------------------------|-----------|-----------|
| 531       | SYNT Dye, NAT INDGO, Lakes         | 2.1       | 6.5       |
| 532       | Dyes NES, Tanning PROD             | 60.9      | 41.5      |
| 533       | Pigments, Paints ETC               | 27.4      | 30.1      |
| 541       | Medicinal/Pharm Products           | 352.9     | 225.8     |
| 551       | Essential Oils, Perfumes ETC       | 1067.2    | 310.4     |
| 553       | Perfumery/Cosmetics ETC            | 268.0     | 174.0     |
| 554       | Soap, Cleansing ETC Preparations   | 70.0      | 32.3      |
| 562       | Fertilizers, Manufacture           | 65.6      | 20.8      |
| 572       | Explosive, Pyrotech Products       | 1.1       | 1.8       |
| 582       | Prod of condensation ETC           | 22.3      | 26.1      |
| 583       | Polymerisation ETC Products        | 17.6      | 16.6      |
| 584       | Cellulose derivatives ETC          | 343.1     | 352.7     |
| 585       | Plastic Material NES               | 2.9       | 2.8       |
| 591       | Pesticides, Disinfectants          | 12.4      | 12.9      |
| 592       | Starch, Inulin, Glutin, ETC        | 657.3     | 267.6     |
| 598       | Miscel Chemical Products NES       | 54.5      | 65.5      |
| 611       | Leather                            | 26.3      | 169.4     |
| 612       | Leather ETC Manufactures           | 21.6      | 52.6      |
| 613       | Fur Skins, Tanned, Dressed         | 64.7      | 1020.0    |
| 621       | Materials of Rubber                | 248.7     | 229.1     |
| 625       | Rubber Tyres, Tubes ETC            | 63.4      | 99.6      |
| 628       | Rubber Articles NES                | 77.9      | 89.5      |
| 633       | Cork Manufactures                  | 5.1       | 30.0      |
| 634       | Veneers, Plywood ETC               | 16.1      | 19.2      |
| 635       | Wood Manufactures NES              | 53.4      | 46.9      |
| 641       | Paper and Paperboard               | 26.0      | 23.3      |
| 642       | Paper ETC, Precut, ARTS of         | 82.8      | 32.8      |
| 651       | Textile Yarn                       | 106.9     | 96.8      |
| 652       | Cotton Fabrics, Woven              | 93.2      | 126.3     |
| 653       | Woven Man-Made Fibre Fabric        | 52.3      | 83.0      |
| 654       | Other Woven Textile Fabric         | 64.6      | 122.0     |
| 655       | Knitted ETC, Fabrics               | 7.1       | 7.4       |
| 656       | Lace, Ribbons, Tulle ETC           | 85.6      | 76.7      |
| 657       | Special TXTL Fabric Products       | 73.9      | 97.4      |
| 658       | Textile Articles NES               | 95.5      | 67.9      |
| 659       | Floor Coverings ETC                | 91.8      | 62.7      |
| 661       | Lime, Cement, Building Products    | 91.6      | 83.1      |
| 662       | Clay, Refractory Building Products | 49.5      | 66.5      |
| 663       | Mineral Manufactures NES           | 57.0      | 54.5      |
| 664       | Glass                              | 94.5      | 88.6      |
| 665       | Glassware                          | 184.6     | 175.0     |
| 666       | Pottery                            | 54.8      | 45.3      |
| 667       | Pearl, PREC-, Semi-P Stone         | 0.0       | 0.0       |
| 671       | Pig Iron ETC                       | 0.0       | 0.0       |
| 672       | Iron, Steel, Primary Forms         | 1.6       | ERR       |

Revealed Comparative Advantage and Export/Import Index, 1990

| SITC Code | Industrial Sector                    | RCA Index | X/M Index |
|-----------|--------------------------------------|-----------|-----------|
| 673       | Iron, Steel Shapes ETC               | 99.8      | 124.8     |
| 674       | Iron, Steel, Univ, Plate Sheet       | 3.0       | 5.0       |
| 675       | Iron, Steel, Hoop, strip             | 2.2       | 3.5       |
| 676       | Railway Rails ETC, Iron, Steel       | 3.0       | 3.9       |
| 677       | Iron, Steel, Wire (excl W Rod)       | 31.3      | 24.8      |
| 678       | Iron, Steel, Tubes, Pipes ETC        | 6.4       | 11.4      |
| 679       | Iron, Steel, Castings Unworked       | 18.1      | 18.8      |
| 681       | Silver, Platinum ETC                 | 3.5       | 24.3      |
| 682       | Copper EXC Cement Copper             | 3.9       | 5.8       |
| 683       | Nickel                               | 46.7      | 59.6      |
| 684       | Aluminium                            | 12.4      | 15.3      |
| 685       | Lead                                 | 183.3     | 200.0     |
| 686       | Zinc                                 | 0.7       | 4.9       |
| 687       | Tin                                  | 1.0       | 6.3       |
| 689       | Non-FER Base Metals NES              | 3.9       | 21.7      |
| 691       | Structures and Parts NES             | 82.1      | 75.9      |
| 692       | Metal Tanks, Boxes ETC               | 79.7      | 36.8      |
| 693       | Wire Products, Non-Electric          | 108.6     | 87.8      |
| 694       | Steel, Copper, Nails, Nuts ETC       | 42.5      | 47.4      |
| 695       | Tools                                | 88.0      | 99.6      |
| 696       | Cutlery                              | 29.5      | 29.3      |
| 697       | Base Metal Household Equipment       | 67.3      | 45.0      |
| 699       | Base Metal Manufactures NES          | 109.1     | 91.7      |
| 711       | Steam Boilers and AUX PLNT           | 4.7       | 10.4      |
| 712       | Steam Engines, Turbines              | 37.1      | 132.4     |
| 713       | INTRNL COMBUS PSTN ENGIN             | 7.0       | 24.8      |
| 714       | Engines and Motors NES               | 158.4     | 80.9      |
| 716       | Rotating Electric Plant              | 20.2      | 34.1      |
| 718       | Other Power Generating Machinery     | 11.7      | ERR       |
| 721       | AGRIC Machinery EXC Tractors         | 56.8      | 29.3      |
| 722       | Tractors, Non-Road                   | 13.9      | 9.2       |
| 723       | Civil engineering equipment ETC      | 11.3      | 16.5      |
| 724       | Textile, Leather Machinery           | 10.7      | 21.8      |
| 725       | Paper ETC Mill Machinery             | 29.7      | 60.8      |
| 726       | Printing, BKBLNDG Machinery, PTS     | 38.2      | 43.7      |
| 727       | Food Machinery, Non-Domestic         | 30.5      | 23.2      |
| 728       | Other Machinery for Special Industry | 20.5      | 27.5      |
| 736       | Metal Working Machine Tools          | 18.0      | 42.6      |
| 737       | Metal working Machinery NES          | 21.3      | 57.6      |
| 741       | Heating, Cooling Equipment           | 131.6     | 156.5     |
| 742       | Pumps for Liquids ETC                | 83.6      | 124.8     |
| 743       | Pumps NES, Centrefuges ETC           | 40.9      | 68.8      |
| 744       | Mechanical Handling Equipment        | 50.2      | 66.5      |
| 745       | Non-Electrical Machinery, Tools NES  | 37.6      | 45.9      |
| 749       | Non-Electric Machinery PTS, ACC NES  | 26.8      | 55.9      |

Revealed Comparative Advantage and Export/Import Index, 1990

| SITC Code | Industrial Sector                     | RCA Index | X/M Index |
|-----------|---------------------------------------|-----------|-----------|
| 751       | Office Machines                       | 9.9       | 19.6      |
| 752       | Automatic Data Processing Equipment   | 497.7     | 438.0     |
| 759       | Office, ADP, MCH PTS, ACCES           | 565.0     | 154.7     |
| 761       | Television Receivers                  | 6.2       | 11.8      |
| 762       | Radio Broadcast Receivers             | 2.2       | 6.6       |
| 763       | Sound Recorders, Phonograph           | 3.8       | 11.0      |
| 764       | Telecom Equipment, PTS, ACC NES       | 67.6      | 102.6     |
| 771       | Electric Power Machinery NES          | 77.2      | 124.2     |
| 772       | Switchgear ETC, Parts NES             | 101.5     | 59.0      |
| 773       | Electr Distributing Equip             | 286.3     | 224.1     |
| 774       | Electro-MEDCL, XRAY Equip             | 18.5      | 88.8      |
| 775       | Household Type Equipment NES          | 155.9     | 107.5     |
| 776       | Transistors, Valves ETC               | 55.7      | 54.7      |
| 778       | Electrical Machinery NES              | 32.4      | 59.7      |
| 781       | PASS Motor Vehicles EXC Buses         | 2.4       | 4.4       |
| 782       | Lorries SPCL MTR Vehicles NES         | 10.7      | 10.7      |
| 783       | Road Motor Vehicles NES               | 6.2       | 5.1       |
| 784       | Motor Vehicle Parts, ACCES NES        | 9.1       | 31.0      |
| 785       | Cycles ETC, Motorised or not          | 11.7      | 20.6      |
| 786       | Trailers, Non-Motor Vehicles NES      | 46.9      | 45.2      |
| 791       | Railway Vehicles                      | 7.7       | ERR       |
| 792       | Aircraft ETC                          | 11.5      | 18.7      |
| 793       | Ships and Boats ETC                   | 13.9      | 121.4     |
| 812       | Plumbing, Heating, Lighting Equipment | 68.6      | 48.0      |
| 821       | Furniture, Parts Thereof              | 53.0      | 68.5      |
| 831       | Travel Goods, Handbags                | 22.6      | 43.6      |
| 842       | Mens Outerwear Not Knit               | 61.6      | 59.6      |
| 843       | Womens Outerwear Non Knit             | 59.6      | 43.9      |
| 844       | Under Garments Not Knit               | 31.5      | 28.0      |
| 845       | Outerwear Knit, Non-Elastic           | 47.6      | 36.5      |
| 846       | Under Garments, Knitted               | 168.5     | 140.6     |
| 847       | Textile Clothing ACCES NES            | 47.1      | 39.6      |
| 848       | Headgear, Non-Textile Clothing        | 17.6      | 29.4      |
| 851       | Footwear                              | 17.3      | 15.0      |
| 871       | Optical Instruments                   | 69.6      | 243.4     |
| 872       | Medical Instruments NES               | 530.7     | 296.3     |
| 873       | Meters and Counters NES               | 4.9       | 10.9      |
| 874       | Measuring, Controlling Instruments    | 94.2      | 131.2     |
| 881       | Photo apparatus, Equipment NES        | 25.7      | 55.8      |
| 882       | Photo, Cinema Supplies                | 27.4      | 51.2      |
| 883       | Developing Cinema Film                | 365.2     | 430.0     |
| 884       | Optical Goods NES                     | 424.8     | 276.5     |
| 885       | Watches and Clocks                    | 5.8       | 27.2      |
| 892       | Printed Matter                        | 96.6      | 59.3      |
| 893       | Articles of Plastic NES               | 151.3     | 75.0      |

## Revealed Comparative Advantage and Export/Import Index, 1990

| SITC Code | Industrial Sector           | RCA Index | X/M Index |
|-----------|-----------------------------|-----------|-----------|
| 894       | Toys, Sporting Goods ETC    | 94.9      | 99.2      |
| 895       | Office Supplies NES         | 158.0     | 176.9     |
| 896       | Works of ART ETC            | 22.5      | 200.8     |
| 897       | Gold, Silverware, Jewellery | 41.3      | 112.5     |
| 898       | Musical Instruments, PTS    | 784.4     | 710.3     |
| 899       | Other Manufactured Goods    | 101.4     | 130.3     |
| 911       | Mail Not Classed By Kin     | 253.7     | 13.3      |
| 931       | Special Transactions        | 223.1     | 316.4     |
| 941       | Zoo Animals, Pets ETC       | 268.3     | 900.0     |
| 951       | War Firearms, Amunition     | 0.0       | 0.0       |
| 961       | Coin, Non-Gold, Non-Current | 0.0       | 0.0       |
| 971       | Gold, Non-Monetary NES      | 0.0       | 0.0       |

Source: UN Trade Statistics Yearbook, 1990