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**Irish Industry, International Trade and
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IRISH INDUSTRY, INTERNATIONAL TRADE AND EUROPEAN INTEGRATION¹

I. INTRODUCTION

The Irish economy is one in which, as in Europe in general, industrial activity is unevenly distributed. Some sectors perform - and have developed - better than others. Some have concentrated spatially to a greater extent than others. Yet this uneven development has been the basis for Ireland's recent economic growth. The causes of this unbalanced industrial development include a complex interplay of historical, cultural and institutional factors in addition to traditional comparative advantage. All of these forces operate in the context of an increasingly integrated Europe.

Ireland's economy can be characterised as one which is small and open. A large percentage of Ireland's economic activity takes place in the international sector, through exports and imports. In this paper we will examine different schools of trade theory and their respective explanations of differential industrial development between countries and regions. We will examine to what extent these theories can describe Irish experience to date. We will conclude by drawing out the implications for Irish trade and industrial policy in the future. In general what we show is that 'lumpiness' in the spatial concentration of industry is consistent both with the theories of international trade and the theories of industrial development.

II. COMPARATIVE ADVANTAGE

According to the traditional Ricardian comparative advantage theory of international trade, countries will specialise in the production and export of those goods in which they have a comparative advantage. Even if Country A can produce, say, both cars and refrigerators better than Country B, as long as A is **relatively** better (cheaper, more efficient) at producing cars, then A will produce cars and export them to B, and B will produce refrigerators and export them to A. What follows from this is an expectation that when barriers to trade are removed, there will be inter-industry specialisation; the countries involved will begin to specialise in different industries, some countries producing and exporting more cars, and others producing and exporting more refrigerators. Moreover, those that increase their production of cars will, it would be expected, transfer resources out of the refrigerator industry and

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therefor produce fewer refrigerators. All countries theoretically benefit from the increased productivity brought about this process of specialisation.

Comparative advantage has been at the base of all neoclassical international trade theory (i.e. since the late 19th century). The major innovation in neoclassical theory this century came with the development of the Heckscher-Ohlin-Samuelson (HOS) model. This model has been at the core of neoclassical international trade theory at least up to the end of the 1980s, and it still is the central model in many text books. The HOS model rests heavily on comparative advantage. It states that, with free trade, a country will export the good that uses most intensively the factor of production with which that country is most richly endowed. The rich endowment of the factor makes that factor relatively cheaper, and therefore the production of that good relatively less expensive. With lower relative production costs, this good will be the one that is exported. It is in this latter sense that HOS is based on comparative advantage.² The conclusion from HOS is little different from that of simple comparative advantage, namely that, in a free trade context, there will be inter-industry specialisation among countries. What HOS adds is that the reason for this inter-industry specialisation is the difference between countries in endowments of the different factors of production.

The policy implication of these theories is that all countries would be better off if there were no intervention by states in international trade, allowing each country to specialise in its most efficient, least cost industry. However, both the comparative advantage theory and this policy conclusion have come under critical scrutiny. Development economists³, for example, have for long held that:

- (1) the assumptions upon which comparative advantage theory is based, such as perfect competition and perfect mobility of resources, do not hold, and therefore the theory itself does not hold;

² For an excellent treatment of international trade theory that includes both the standard neoclassical approaches and some of the oligopoly-based models of international trade, see Södersten and Reed, 1994.

³ See Donaldson, 1984, pp. 260-281.

- (2) comparative advantage theory is static, and does not allow for dynamic effects, as in the case of planned, created comparative advantage and the important role of leading industries;⁴
- (3) the theory does not take into consideration distribution effects, such as the extent to which inter-industry specialisation within an economy may reduce the welfare of those whose livelihood depended on the good whose production is cut back; and,
- (4) among relatively less developed countries (LDCs), a dualism can emerge as a result of trade with more developed countries (MDCs), in which there is an advanced, wealthy, high employment sector and a technologically backward, poor, high unemployment sector, with little relationship between them.⁵

Donaldson (1984, p.267), having considered such issues, concludes that "free trade (that is, trade that is carried on without LDC government intervention of any kind) for a developing LDC in the real world situation is only rarely the optimal policy."

Other criticisms of comparative advantage and/or HOS have followed from the Leontief Paradox. In the 1950s and 1960s, Leontief undertook research on US trade patterns. His results unexpectedly showed that the US seemed to export labour intensive products. HOS would have predicted that as the US is a capital rich country, it should export capital rather than labour intensive goods. Alternative theories were therefor required.

To account for Leontief's Paradox a number of theories provided alternative explanations for the flows of goods and services between countries. Of the economists whose work has influenced post-Leontief international trade theory, the most important is probably Paul Krugman.

⁴ From a dynamic perspective it is possible to plan comparative advantage. Thus a state institutions can intervene to create an industry in which that country at first does not have, but then develops, a comparative advantage. Specialization in a leading industry, through its associated infrastructure and expertise, has implications for future innovations in other industries. It does matter whether a country specializes in potato chips or computer chips.

⁵ This argument, though not exclusive to, is most developed by various schools of dependency theory.

III. ECONOMIES OF SCALE AND TRANSPORTATION

Krugman (1987a, 1987b, 1993) has been prominent in international trade theory, strategic trade policy and the geography of trade, though the originality of his contributions has sometimes been questioned.⁶ He has argued that, in addition to comparative advantage as a determinant of the nature and direction of flows of goods and services between countries, product differentiation, economies of scale and imperfect competition must be added.⁷

The need for alternative explanations for the nature and direction of trade flows followed not just from Leontief, but also from other empirical work. At its simplest, what this work showed was that when barriers to trade were removed in Europe, the expected inter-industry specialisation did not emerge. When the Common Market was formed, the economies that had been involved in car production, for example, continued to manufacture cars. Those that were involved in the production of other consumer durables, like refrigerators and washing machines, continued to manufacture these also. It was expected that some would specialise out of cars and into other products. What did change was that a greater proportion of output was exported, and a greater proportion of local purchases was imported. The choice facing consumers broadened.

There was more product differentiation, expressing itself as *intra*-industry trade. Intra-industry specialisation took place, in which firms in one country produced certain types or makes of cars, and those in other countries produced other types or makes of cars. There was specialisation *within* industries and not, as was expected, across industries.

A related factor is one of economies of scale. Once it is shown that the market structure is not perfectly competitive - which necessarily follows from the fact that the product is differentiated - then the neoclassical, perfectly competitive, long run equilibrium in which firms are producing at the bottom of their long run average cost curves no longer holds. It becomes reasonable to assume that expanding firms could benefit from increasing returns to scale. A firm (let us call it Firm A, in the

⁶ e.g. McGovern, 1994.

⁷ This awareness of the role of factors such as product differentiation and increasing returns to scale was not incorporated into international trade theory until the 1980s. For discussions on product differentiation and international trade, see Krugman (1983), and McGovern (1994). McGovern points out that Lovasy (1941) had already, decades before the "new international trade theorists", used product differentiation to explain aspects of international trade.

market for a good X) may now have an advantage in competition with other firms, domestic and foreign, simply because Firm A is producing on a larger scale and is therefore further down its average cost curve. Because it has higher volumes, it has lower unit costs. There are a number of possible reasons that Firm A may have higher volumes than its competitors, even assuming that the two firms have identical production functions. These include that Firm A began producing earlier (first mover advantage), that Firm A's local market is bigger, or that Firm A began exporting earlier.

Imperfect competition and economies of scale contribute to an understanding of uneven development. They are elements of a process whereby, even in the absence of state intervention of any kind, production of a good can become concentrated in a particular place. Firm A defeats all other firms in the market for X because it has lower costs. Due to the existence of transportation costs all upstream and downstream production, distribution and other services associated with the production of X are now more likely to be located near to Firm A. Other products using similar inputs - or downstream services - to those of X may now also have an incentive to locate near to Firm A. The result is a concentration of economic activity in that place.

It is important to emphasise that this result could be a consequence of factors other than comparative advantage. Firm A may experience lower costs arising from economies of scale, for example, which more than offset relatively higher costs of factors of production in that place.

Krugman (1993, p.98) sums up the impact of economies of scale by concluding that "producers have an incentive to concentrate production of each good or service in a limited number of locations". He factors in "the costs of transactions across distance:"

the preferred locations for each individual producer are those where demand is large or supply of inputs is particularly convenient - which in general are the locations chosen by other producers. Thus concentrations of industry, once established, tend to be self-sustaining; this applies both to the localisation of individual industries and to such grand agglomerations as the Boston-Washington corridor.

The somewhat contradictory result of this kind of analysis, is an explanation for why, in the period following the removal of barriers to trade, various goods continued to be produced in more than one of the member countries of the European Economic Community, on the one hand, and why industry and multi-industry agglomerations developed in specific locations, on the other. The result depended on the relative weights of the different factors: the more important was product differentiation - or intra-industry specialisation - the more likely it was that production in this industry continued to take place in a number of locations. The more important were the economies of scale, and the more advantageous the local conditions in one particular place, the more likely it was that production would become concentrated in that place. Local conditions, high transaction costs across distance and economies of scale in a number of industries together explain "grand agglomerations" emerging at different levels of industrial disaggregation.⁸

It might appear from these conclusions that there is a justification in Krugman's work for strategic trade policy. This is policy that is aimed for example at developing a comparative advantage in a particular industry. Strategic trade policy is often applied as industrial policy, focusing on positive encouragement of development, for example through subsidies, rather than through negative prevention of competition through tariffs. However, Krugman has consistently argued that free trade (and the absence of strategic trade policy) continues to be best from an international welfare perspective. "The problem is", he writes, "that while strategic trade policies may be in any one country's interest, if all countries pursue them the result may be to block mutually beneficial integration" (1987b, p.121). While perhaps theoretically defensible, this vision of universal international forbearance appears utopian.

Analogously, it could be argued that a particular state's industrial policy encouraging inward foreign direct investment (FDI) could be beneficial to that economy, but if other states introduced similar policies this could cease to be the case. The "price" to be paid for the FDI would be bid up. The end result would be a redistribution of wealth from the relatively poorer taxpayers in each state to the relatively wealthy owners of the multinational corporations (MNCs). It follows though that a country's strategic trade policies can succeed if other countries either are not aware of them or are tardy in implementing their own policies. A second possibility is that richer states

are willing to tolerate these policies in the poorer state for developmental or other political reasons.

In the case of Ireland's encouragement of FDI, it has been relatively successful because Ireland was among the first European locations to have a well-organised strategy of this kind, and because, although the policy contravenes the spirit of the Treaty of Rome, it has been allowed by the EU as a means to bring Ireland's level of economic development up to the European average. The gap between levels of economic activity in Ireland and the European core was in fact reduced by the industrial strategy of encouraging FDI. In the future, however, Ireland must beware of bidding away any potential benefits in competition with other states.

IV. AGGLOMERATION AND CLUSTERS⁹

What follows from the work of Marshall as updated by Krugman (1993), is that, under certain circumstances, firms within an industry or in related industries will agglomerate, that is they will locate in the same place, close to one another. The agglomeration economies will be greater than the benefits that firms could derive from a more diffuse locational distribution.

A locality or region may become the site for an expansion of common pools of labour, capital and infrastructure. Pecuniary externalities may arise when new investments are made by firms in some particular place. In such a case the reduction in unit costs arising from the externalities are called agglomeration economies (Harrison, 1992).

Agglomerations of various kinds are probably the norm. It is likely that a higher proportion of the industrial output of the economies of the world is accounted for by production in agglomerations than by production in stand-alone firms, evenly distributed around geographic space. This is consistent with Porter's (1990, p.18) argument that "firms based in particular nations achieve international success in distinct segments and industries". He rejects the traditional comparative advantage model mainly because its assumptions are unrealistic. The recent revisions in international trade theory around economies of scale and the consequences of other

⁸ The fact that firms and industries will tend to agglomerate was well documented by early economists, and in particular Marshall. Krugman's work in this area explicitly builds on that of Marshall.

⁹ Some of the discussion on Porter in this section draws on Jacobson and Andréosso-O'Callaghan, 1996, pp.119-121.

market imperfections, he writes (1990, p.16), leave unanswered the question that is for him the most important: "Which nation's firms will reap them [these economies] and in what industries?" Porter's theoretical and empirical contributions have been in attempting to answer this question.

Porter's primary tool for illustrating "patterns of national advantage" is the cluster chart. This chart includes the successful (competitive) industries of a country, identified as such either by having "a world export share greater than the nation's average share of world exports or an international position based on foreign investment that was estimated to be as significant" (1990, pp.287-288). Having identified the patterns of national advantage with the cluster chart, he explains them with four factors he calls the "diamond". These factors are: (1) factor conditions (including all factors of production, as well as means such as training and education for improving those factors of production); (2) demand conditions (for example, the bigger the home demand for an industry's product, the better); (3) related and supporting industries (the presence in a country of internationally competitive supplier industries, for example, will enhance the competitiveness of the buyer industries); and (4) firm strategy, structure and rivalry (including domestic rivalry, and rules and institutions governing that rivalry - the more intense the domestic rivalry, the greater the potential for the firms to be internationally competitive) (1990, p.71).

Porter's clusters are firms and industries connected through horizontal and vertical relationships. Vertical links are those, such as buyer/supplier, involving firms up or downstream from one another in the process of converting raw materials into consumer goods. Horizontal links are those between industries, for example, firms in two industries may have common customers, technologies or distribution channels. Because of agglomeration economies, clustering "works best when the industries involved are geographically concentrated" (Porter, 1990, p. 157).

The work of Porter and Krugman on industrial agglomeration reinforce one another. Krugman shows how, from the perspective of international trade, industries can become concentrated in particular places, and Porter shows how, from the perspective of links between firms and industries within a country, agglomeration contributes to international competitiveness.

The work on the potential for industrial agglomerations and their contribution to a country's international trade has not been without critics. Dunning (1992), for

example, argues that Porter's focus does not adequately incorporate MNCs. He points out that Nestlè, though a Swiss company, has 95 per cent of sales accounted for by its foreign subsidiaries. The diamonds of competitive advantage of the host countries in which those subsidiaries operate may therefore have more to do with Nestlè's contribution to Switzerland's GNP than Switzerland's own diamond of competitive advantage. Dunning suggests the addition of a transnational business variable as a separate factor in the diamond of competitive advantages.

Scasselati (1991) would agree with this,¹⁰ though he goes even further (perhaps too far), in criticising Porter's focus on national entities. He emphasises corporations that in "their inherent drive toward ever expanding accumulation,... simply cannot afford to tie themselves to any territory". It can be observed, however, that MNCs, though not committed to any one location, are developing long term relationships in various locations with such collaborative partners as suppliers providing components and services (Sabel, 1996).

Jacobs and de Jong (1991) have two fundamental criticisms of Porter's approach. They argue, firstly, that there is an over-emphasis on end product. In their application of the model to the Netherlands, for example, they find that a cluster may be in an intermediate stage and not at the end-use stage. This makes it difficult to accurately identify the cluster in Porter's chart. Second, the approach is one-sided in that international diversity is stressed. While Jacobs and de Jong accept that both international divergence and convergence are evident, Porter's approach, in their view, does not capture the dynamic relationship between the two tendencies.

The first of these observations is most applicable to the Irish case. A full Porterian cluster may be too extensive, spreading beyond the scale and capacity of a small, open economy like Ireland's (O'Donnellan, 1994). In such economies, the domestic market may be too small to generate national clusters. Larger economic spaces may have to be analysed in order to identify the extent to which industries in Ireland may be elements in, for example, a European cluster.

Despite these criticisms, Porter is praised for introducing "the idea to an audience of economists that globalization somewhat paradoxically leads to more emphasis on

¹⁰ Scasselatti also provides a Swiss, though contrasting, example, pointing out that Porter's "applause for the revival of the Swiss watch industry... neglects the fact that several of the most famous Swiss brands are now owned by a US company, North American Watch".

local conditions, and moreover, provides a global firm [with] opportunities to take advantage of these" (Jacobs and de Jong, 1991).

The cluster literature contributes to our understanding of why there are differences between the industrial structure in Ireland and that in the European core. If there are advantages to be gained for firms to locate near to other, related firms, then the relative paucity of industrial development in Ireland was itself a factor in reducing Ireland's attractiveness to industrial enterprises. Relative success in encouraging the establishment of subsidiaries of foreign owned firms would not, by itself, increase the general attractiveness of Ireland as a location to firms not receiving the artificial attractions of low tax rates, and capital and training grants. Only if linkages develop among firms can the advantages of agglomeration be reaped.

When these linkages do develop, however, they advantage the participating firms, and differentiate the firms in the cluster and their associated location from firms and areas outside of it. In this way, while clusters can be the means of reducing the gap between one economy and another, they can also be the means of increasing differences between locations within economies.

V. UNEVEN DEVELOPMENT AND CUMULATIVE CAUSATION

Basing their arguments on the theory of comparative advantage, many development economists have contended that contact between more and less developed regions will benefit all parties and lead to convergence of living standards. Other development theorists have argued that such contact leads to increasing disparities. While many of their arguments are not meant to apply within the developed world, some can be deployed to understand uneven development within industrialised regions.

The description above of the interactive effects of economies of scale and the benefits of agglomeration can be seen as a specific instance of a broader class of dynamic interactions. The great institutionalist economist, Gunnar Myrdal, described such interactions as cumulative causation, describing virtuous and vicious circles. Prosperous regions attract labour and capital thereby improving conditions, services and infrastructure which further attracts additional labour and capital. Investment increases demand which then draws further investment. This dynamic can be summarised as success breeds success while failure breeds failure (Sawyer, 1989, pp.422-428). The development task in such instances then becomes the breaking of

vicious circles of underdevelopment and the institution of virtuous circles of further development.¹¹

VI. INDUSTRIAL STRUCTURES

We are now in a position to categorise the different ways in which firms interrelate to form industrial or inter-firm structures. There are four main ways. First, a firm can stand alone. This is where a firm has completely free, open market relationships with its suppliers; completely free, open market relationships with its customers; and it has no horizontal strategic alliances with similar firms. A stand alone firm is a member of no networks, and would generally operate in highly effective markets in which there are, for example, large numbers of buyers and sellers of an undifferentiated product. Such firms are not very common anymore, and are more likely in services such as retail shops than in manufacturing.

Secondly, there are vertical associations of firms. A large number of examples can be found in Ireland. Many indigenous firms form close, vertical relationships with subsidiaries of multinationals. Instances include software manual printing firms, producing manuals for particular software firms like Microsoft or Lotus, and Higgins Engineering in Galway producing components for Thermo King, the refrigerated truck company. In vertical associations the buyer firm will trust the supplier to produce to high quality, with minimum (or zero) faults, and to a particular time schedule. The buyer firm may have one or two such suppliers of the same component, but it will not call for tenders each time it buys. It will simply select one of its small number of preferred suppliers.

Thirdly, there are horizontal associations where groups of firms producing similar products, or different parts of the same product, associate with one another in co-operative relationships. Although there appear to be gains to be derived from this type of inter-firm structure, there are very few identified examples in Ireland. An embryonic association of this type exists in the mid-west region, where a group of small and medium manufacturers of printed circuit boards has discussed the possibility of co-operating so as to obtain better conditions from their buyer companies, usually subsidiaries of multinationals. For similar reasons a group of poultry growers in Monaghan formed an association which confronted their

¹¹ For an interesting application of this kind of analysis to Irish development see Mjoset (1992).
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monopsonistic buyer, Monaghan Poultry Products. However, there are few examples of firms co-operating horizontally in an integrated production system.¹²

Fourth, there are clusters as described in detail above. A cluster is basically a combination of vertical and horizontal associations. Agreements between firms may be formal or informal. Firms may compete against one another in some respects and co-operate in others. Porter (1990) considers a high level of competition to be essential in successful clusters. While there is agreement that competition is important, others consider high levels of both competition and co-operation to be essential for successful industrial structures (de Bandt, 1986). For a group of firms to constitute a cluster, there must be a number of firms producing the same or similar products and a number of other firms that buy from and/or sell to those firms.

There is a great deal of evidence that successful firms are those that, particularly through horizontal associations and clusters, have close relationships with other firms. Among the regions where evidence can be found to support this proposition are Emilia Romagna and Abruzzo in Italy, West Jutland in Denmark, and Wales (Cooke, 1996; Dunford and Hudson, 1996). In all these places there are high levels of horizontal association, where groups of small firms co-operate in becoming internationally competitive. They have come to be called "industrial districts", particularly in Emilia Romagna. In Wales, clusters have formed including indigenous Welsh firms and subsidiaries of MNCs, including many Japanese MNCs. All these regions have performed extremely well in terms of industrial growth and competitiveness, well above the European average.

There is investment in creating such inter-firm structures which improve the competitiveness of the final product. This reduces the 'footloose-ness' of the MNC participants, and increases their linkages with local industrial structures. However, it also often increases the dependence of the local suppliers on the demand of the multinational.

VII. APPLICATIONS TO IRELAND

We have shown above that one of the factors leading to a change in international trade theory was the observed results of European integration. International trade within Europe increased - as expected - as a result of the creation of the Common

¹² For possibilities, see below, p.15.

Market. However, the way in which that increase occurred was different from what had been expected. An important element in the increase was intra-industry trade, in addition to inter-industry trade. Rather than, say, Germany specialising in car production, and importing refrigerators and washing machines from Italy, both countries continued to produce both types of products. Much of the increase in trade following the creation of the Common Market was accounted for by increase of both exports and imports within industries. Ireland was no exception. Ireland's accession to membership of the EC in 1973 was followed by an increase in trade with Europe, and a decline in Ireland's dependence on the UK as a trading partner. A significant part of the increase in trade was primarily accounted for by intra-industry trade (McAleese, 1976; Brühlhart and McAleese, 1995).

There are questions about how intra-industry trade is calculated. It could be argued, for example, that the more disaggregated the industrial categories, the less intra-industry, and the more inter-industry trade will be found. Recent work by Brühlhart and McAleese (1995) shows, however, that "even at a very high level of statistical disaggregation" there are "considerable amounts of intra-industry trade (IIT) in Ireland's external trade, particularly in the manufacturing sectors."

The fact that Ireland's increase in trade with Europe following its membership of the EU was accounted for in part by intra-industry trade does not mean that European integration had no impact on Ireland's industrial structure. Using the formula for revealed comparative advantage (RCA)¹³, Thornhill (1988) showed that, during the 1970s, Ireland's comparative advantage shifted strongly away from resource-based and low-skill intensive industries, and towards high-skill, capital intensive industries. He identified three main industries accounting for this change: food preparations (not elsewhere specified); organic chemicals; and office machines. The RCA approach clearly shows the increasing importance of several industries in Ireland's industrial structure and exports. Thornhill's explanations for these results focus primarily on the nature of foreign direct investment (FDI). MNCs had set up a number of subsidiaries in these industries, and in particular in the most important of them, organic chemicals and office machines. Thornhill does not distinguish between Ireland's EC and non-EC trade, nor does he suggest that membership of the EC may

¹³ RCA index = $[(x_i/x_{iw})/(x_m/x_{mw})] 100$, where x_i is the value of exports of product i from Ireland; x_{iw} is the value of "world" exports of product i ; x_m is the value of exports of all manufactures from Ireland; and x_{mw} is the value of "world" exports of all manufactures.

have had an impact on the nature of FDI. Rather, he suggests only that Ireland's level of development resulted in the change in the nature of the FDI. We will consider in later sections the validity of this omission.

In the mid-1980s Ireland's intra-industry trade stopped growing, and began to decline. Inter-industry specialisation increased, in contrast with the "higher intra-industry specialisation observed at the earlier stages of Irish trade liberalisation" (Brühlhart and McAleese, 1995). This inter-industry specialisation, Brühlhart and McAleese find, was into "highly trade-oriented and highly productive sectors". (These are the same as the high-skill, highly capital intensive sectors referred to by Thornhill.) Moreover, Ireland's intra-industry trade has in general been higher with fellow EC members than with non-members, and the decline in intra-industry trade in the mid-1980s was sharper in relation to intra-EC trade than rest-of-the-world (ROW) trade. This represents an intensification in the 1980s of the trend noted by Thornhill - the increasing sophistication of industry in Ireland. Brühlhart and McAleese were the first to note that the increase in trade in the products of the advanced sectors is more pronounced in relation to Ireland's trade with EC partners than with the ROW. This suggests that there is something about Ireland's relationship with the EC that has contributed to these changes in Ireland's industrial structure.

Thornhill (1988) shows three main industries in relation to which Ireland apparently had a RCA in the 1970s: food preparations (not elsewhere specified); office machinery; and organic chemicals. Brühlhart and McAleese (1995) show seven industries which had pronounced positive patterns of specialisation in the period 1985 to 1990: office and data processing machines; pharmaceuticals; radio/TV/sound equipment; cocoa, sweets; miscellaneous processed foodstuffs; domestic chemicals and man-made fibres; and spirit distilling, compounding. Given that Brühlhart and McAleese used a more disaggregated data set, there is a great deal of similarity between the two sets of industries found to be those in which Ireland has a "revealed" comparative advantage.

All of the main international trade theories discussed above would have predicted specialisation and resultant concentration of resources in one or a few industries. From the work of Porter and others, as discussed above, the question arises as to whether or to what extent these concentrations can be explained by traditional comparative advantage, economies of scale and proximity, or the benefits of industrial agglomeration and clustering.

We will consider in turn the three industrial groupings discussed above: food, chemicals/pharmaceuticals and computers/electronics. As O'Donnellan (1994) has shown, each of these exhibits some characteristics of a Porterian cluster. In particular, they all have shares of sectoral world exports greater than Ireland's overall share of world exports. Of these, only food also showed evidence of a high level of what he calls "systematic clustering" - highly clustered on the basis of a number of different definitions of clustering. The different definitions of clustering used by O'Donnellan (1994) are: a) trade share;¹⁴ b) concentration of purchases within own sector; c) domestic share of purchases; d) domestic share of sales; e) concentration of firms within counties; f) concentration of employment within counties; g) association of sectors within regions; and, h) share of UK/Irish industrial employment. Some food-related sub-sectors appear under all these definitions with the exception of d) and g). Chemicals/pharmaceutical sub-sectors appear only under a), e), f) and g). Computers/electronics sub-sectors appear only under a) and e). He goes on to argue that there is little evidence of the productivity and/or innovation enhancing effects with which clustering is supposed to be associated, not even for the food sector.

From the point of view of the revisionists of traditional trade theory, O'Donnellan's results for the food sector send a mixed message. On the one hand, there is evidence of clustering. On the other hand, it would appear that the origin of any specialisation in this sector would have more to do with comparative advantage, specifically HOS comparative advantage. The proximity to intensively used raw materials in agriculture must be a large part of any explanation of the success of this sector.

The failure to discover clustering in the chemical/pharmaceutical industry is not surprising. This industry is one which has resulted from artificial incentives being offered to MNCs to set up subsidiaries in Ireland (Jacobson, 1991, p.56). In general, they import bulk chemicals, process them, and re-export them in bulk. Few firms have developed linkages with indigenous firms or with one another. Their continued presence in Ireland is based on low corporate tax rates, and, at least until recently, the relatively lax monitoring of the firms for environmental pollution. As the EU

¹⁴ Sector's share of world exports more than four times Irish national average shares. Note that all the definitions are based on data from the mid- and late 1980s; a repeat of O'Donnellan's research based on more recent data could give different results.

begins to require a harmonisation of tax rates and environmental standards rise, the continuation of a concentration of this industry in Ireland will be called into question.

The failure to find evidence of clustering in the computer/electronics sector is more doubtful. Some of O'Donnellan's criteria, such as domestic purchases and sales cannot be applied to an internationally oriented export industry. The history of the high technology sector contains the paradigmatic examples of clustering in Silicon Valley and the Route 128 area in Massachusetts. It seems unlikely that the continued attractiveness of Ireland for inward high technology investment is unrelated to the presence of existing firms in this sector. There are also concrete examples of high levels of linkage in this sector, as among firms supplying inputs into Apple's production processes in Cork. This industry in Ireland began with similar artificial attractions to those which brought the chemical/pharmaceutical MNCs to Ireland. However, this may now have developed into an example of a "created" comparative advantage, with the availability of high levels of relevant skills a consequence of a conscious policy of focusing education and training as well as IDA attention in this sector.

At a more general level, there are a number of reasons why studies such as O'Donnellan's may find it difficult to identify clustering in the Irish case. First, it is possible that the reduction in transport and communications costs has increased the area within which agglomeration must take place for economies to be reaped. This would be consistent with Kennedy's (1991, p.99) view that:

Ireland, as a member of an increasingly integrated European Community, is becoming more akin to a small region within a large country. In general a region will display a much lower degree of linkage than the country of which it forms part, and the smaller the region the lower the overall degree of intra-regional linkage.

It is likely in relation to information, for example, that the costs of transmission are similar from Ireland to Bonn and from Munich to Bonn. This enhances the possibility of firms in Ireland participating in a European cluster.

Second, evidence of economies of agglomeration may be hidden in the aggregation of the data. Clustering may be taking place on a smaller scale of operations. For example, vertical associations of firms, by definition narrower than clusters, may

exist, and may engender economies of agglomeration and/or of association. As O'Donnellan (1994, p.230) puts it,

there may well be more subtle and localised clustering happening in some sectors that does make a difference to performance and that should be reinforced by government support for local specialised infrastructure. Possible examples are the dairy industry in Munster, computers and chemicals in Cork, clothing in Donegal, aerospace in Shannon/Limerick, furniture in Navan, and some sectoral pockets of firms in Dublin.

Sub-sectors on which research has been done, and where significant evidence of localised economies of very localised agglomeration and/or association exists, include the software manual printing industry in Dublin (Jacobson and O'Sullivan, 1994) and the wooden furniture industry in Co. Monaghan (Mottiar, 1996; Jacobson and Mottiar, 1996).

These apparently contradictory explanations for the absence of Porterian clusters are, in fact, reconcilable. On the one hand, as defined by Porter, clusters may require larger economies than Ireland's; O'Donnellan considers the UK and Ireland as an economic area within which clusters might exist, while Kennedy goes even further to consider linkages within the European Community as a whole. On the other hand, small groups of small and medium enterprises (SMEs), as in the software manual printing industry, have sprung up to service subsidiaries of multinationals in Dublin, despite the existence of equivalent firms elsewhere in Europe. The point is that in some cases there are relatively few disadvantages to different parts of a cluster being widely dispersed, for example, where the product has a high value-to-weight ratio. In other cases, there are high costs of transportation and/or high economies of proximity, for example, where just-in-time inventories require close monitoring of the supplier by the buyer.

VIII. CONCLUSIONS

All brands of trade theory suggest that development in the context of an international market is likely to be 'lumpy', that is concentrated in a few sectors and places rather than taking place smoothly across the board. In these circumstances, industrial development must rely on attracting lumps of economic activity within the borders of

the state. The debate over industrial policy is about whether a process of specialisation through comparative advantage will arise from purely market driven transactions, or whether there is a role for the state in encouraging the agglomeration of economic activity.

Ireland's experience in the food sector provides some evidence for the comparative advantage perspective, though agriculture can hardly be said to be devoid of government intervention. The success in attracting investment in the electronics/computer sector, a leading industry which may lay the foundations for further development, is a striking instance of the potential relevance of industrial policy. By contrast, Ireland's flirtation with the chemical industry may prove relatively short-lived as well as ill-advised. Its incompatibility with the "green" image Ireland wishes to project in marketing its food and providing lifestyle amenities for high tech. foreign investors militates against further development in this field.

If this analysis is correct, then Ireland's recent success as the "emerald tiger" (*Newsweek*, 1996), to the extent that it is dependent on sectors like chemicals/pharmaceuticals, is likely to be fragile. To the extent that it is dependent on the processes by which Ireland has specialised into the food and electronics/computers sector, it is likely to be more lasting. Even in these sectors there are significant challenges, such as the decline in funds available to agriculture through the Common Agricultural Policy, and the competition to electronics/computers from low cost third world producers. This last includes some countries like India where there are increasingly high levels of such skills as software design and development and an English speaking workforce.

The policy conclusions which may be drawn from Irish experience include the identification of those sub-sectors in which there are no incentives for agglomeration or, in contrast, incentives for dispersal. Relatively costly attempts to encourage linkages in these sub-sectors must be avoided. More positively, it will be important to identify localised clusters and sub-clusters - industrial districts, networks and filieres (Jacobson and Andréosso-O'Callaghan, 1996, Ch.3) - and encourage them through appropriate physical and financial infrastructures. It is particularly important to provide general incentives for higher levels of co-operation among Irish firms.¹⁵ In

¹⁵ "There has historically been hardly any long-term cooperation between Irish small firms in the provision of purchasing, marketing, financial services or through supply linkages" (O'Sullivan, 1995, p.386).

our view, without such development, Irish economic success is unlikely to be sustained in the long run.

If one problem for policy is encouraging or attracting 'lumps' (centres of development) within the economy, a complementary problem is the encouragement of development in the economic spaces between the lumps. Traditional perspectives have assumed that development would spread organically through the expansion of the market which would result from increased economic activity and rising incomes. This kind of process was behind the balanced development of the pioneering capitalist economies of Europe and America. A different prospect faces late industrialisers in the context of a global economy. Even heavily clustered industries will link backwards to intermediate good suppliers and forwards to industrial customers across borders. While prosperity is partially based on international exporting, it is also true that a significant portion of the resulting increase in incomes will in turn be spent abroad. It follows that, even in the face of substantial success, economic prosperity will be unevenly spread. Continuing high levels of unemployment in Ireland following several years of more than healthy growth can be partially attributed to this factor. Public intervention designed to spread the benefits of growth will be necessary. Local development policies, increased public employment, and more generous social welfare provision must play a part in this effort.

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