Journal of the Statistical and Social Inquiry Society of Ireland
Vol. XXIX

THE IMPORTANCE OF STRUCTURAL CHANGE IN INDUSTRY FOR GROWTH

PATRICK PAUL WALSH AND CIARA WHELAN*
Trinity College Dublin and University College Dublin

(*read before the Society, 25 November 1999)*

Abstract: The paper documents ongoing job creation and job destruction within 3-digit Irish manufacturing sectors over the period 1973 to 1994. Within sectors of low-technology manufacturing, this was due to the gradual development of historical export product lines and gradual decline in historical domestic oriented production. In contrast, the structural change in jobs within sectors of high-technology manufacturing resulted from the gradual accumulation of foreign capital with new export product lines and a phasing out of inefficient import substituting industry. Ireland's industrial performance is shown to be an outcome of such path dependent structural change.

Keywords: Manufacturing, Intra-Sector Structural Change, Trade Liberalisation.
JEL Classifications: O30, L20.

1. INTRODUCTION

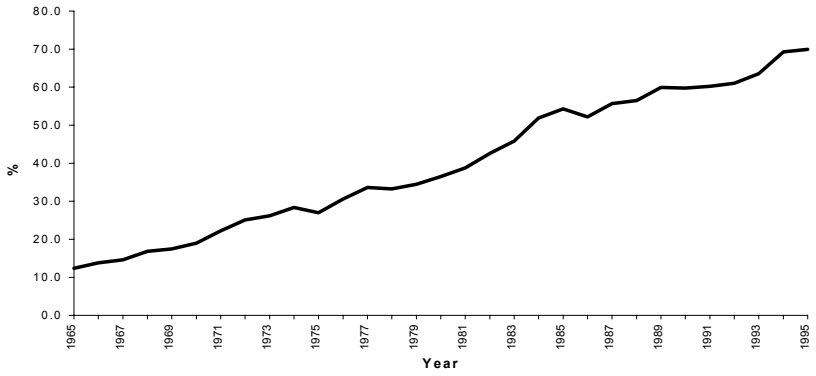
The Irish success story in terms of its unprecedented economic performance over the past decade has attracted a multitude of explanations. These include recent improvements in fiscal stabilisation, the education levels of the labour force, wage moderation and peaceful labour relations, and European Structural Funds (Barry, 1999). Such factors undoubtedly improved the general economic environment and helped the economy to grow. Yet in this paper, we argue that the fundamental determinant of industrial growth in Ireland during the 1990s lies in a path dependent structural evolution of manufacturing from its roots in the 1960s.

The history of Irish manufacturing begins with import substituting industrialisation in the 1930s. For 30 years under a policy of self-sufficiency, Ireland built an indigenous manufacturing base using high *effective* tariff rates (four times higher than trading partners) with a prohibition on Foreign Direct Investment (FDI). The gradual adjustments away from import substitution industrialisation toward export

* The authors are members of the Transition Group, Department of Economics, Trinity College Dublin. We are grateful to participants, discussants and referees for very valuable comments. Special thanks to Dermot McAleese, Frances Ruane, John Sutton and Frank Walsh for detailed comments.

oriented production since 1966 is the core structural change that we focus on in this paper. Figure 1 depicts exports as a share of gross output in manufacturing over the period 1966-1995. This indicates the growing importance of goods for export over domestic produce evident since the first phase of trade liberalisation institutionalised in 1966 upon entry into the *Anglo-Irish Free Trade Area Agreement* (AIFTA). Starting at just over 10 percent in 1965, exports account for 70 percent of manufacturing output by 1995.

Figure 1: Exports as Share of Gross Output in Manufacturing

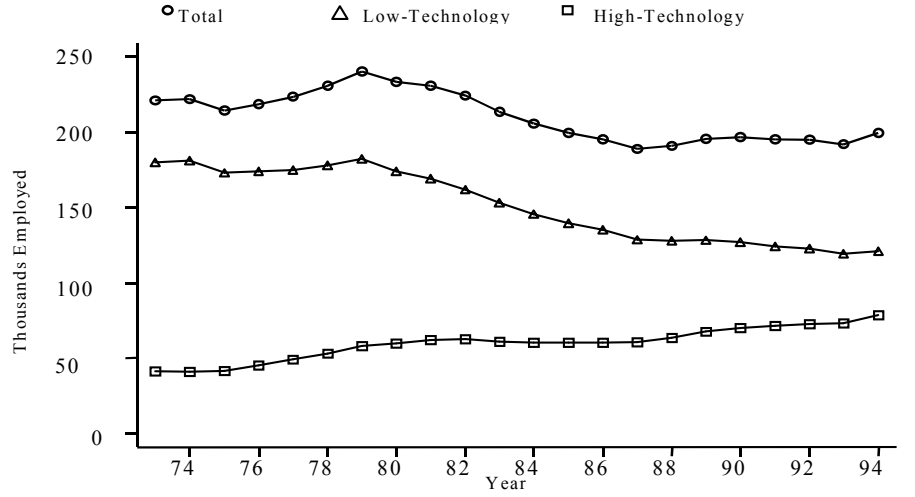


Source: CSO Statistical Bulletin

A notable trend is the steady and gradual growth of the export share over three decades. There have been no detectable deviations from this trend upon entry to the European Community in 1973, which saw a phasing down in tariffs until their final abolition in 1978, or in 1987, which saw the freer movement of goods, capital and people under European Union Single Market Reforms. Such a smooth adjustment to three discrete changes in policy hides immense ongoing structural changes within manufacturing during this period.

The emphasis of structural change to date has been placed on an evident foreign versus indigenous dualism. Barry (1999) documents the rise of foreign and simultaneous decline in indigenous owned manufacturing since 1973. Such a dichotomy is not very useful for a sector analysis of Irish manufacturing, due to the presence of both foreign and indigenous firms within all sectors. Thus, we analyse inter-sector structural changes within a dichotomy of low- (predominantly Irish owned) versus high- (predominantly foreign owned) technology manufacturing. Figure 2 examines the evolution of employment within this dichotomy. Yet, the main focus of this paper will be to highlight path dependencies that exist *within* rather than between 3-digit sectors of low- and high-technology manufacturing.

Figure 2: Evolution of Total Employment Low and High Technology Sectors



Source: Calculations using Forfás Annual Employment Survey

This paper highlights an intra-sector dualism that exists within the low- and high technology sectors. We argue that the tremendous intra-sector structural changes that took place were path dependent and driven by initial conditions that had their roots in government policy making in the years before 1966. As outlined in McAleese (1971), the twin-track approach of self-sufficiency and export promotion adopted by Ireland for three decades up to 1966 cultured a dualistic structure in the market orientation of firms within 3-digit sectors of manufacturing.[1] This describes the co-existence of efficient export-oriented firms with less efficient domestic market oriented firms. Empirically we test the hypothesis that the transition process in Irish manufacturing from protectionism to global markets post-entry to the EU in 1973 is path dependent and rooted in this dualistic structure.

As documented by Repkine and Walsh (1999), we find that Ireland follows a similar structural adjustment path in the face of trade liberalisation to that observed in the manufacturing sectors of *Central and Eastern Europe* (CEE) since 1989. In CEE countries similar dualistic structures within sectors were cultured over the preceding five decades under central planning. Although discrete changes in terms of trade liberalisation occurred both in Ireland and countries of CEE, the adaptation of manufacturing to global markets is a gradual path dependent process of structural change. Within all sectors, historically developed patterns of exports or FDI grew gradually. Simultaneously, within all sectors output produced historically for the domestic market under protectionism declined persistently over time.

Our analysis is motivated by the literature on endogenous growth and international

trade, for example Grossman and Helpman (1991). Comparative advantage during trade liberalisation is endogenously determined by a path dependent history. Initial patterns of international trade and FDI can become increasingly locked-in during trade liberalisation. The empirical methodology follows Repkine and Walsh (1999) who model the path dependent history of sector growth by adapting the endogenous growth model of Aghion and Howitt (1992).

Growth within sectors of Irish manufacturing during trade liberalisation will be endogenously determined by a path dependent history of business activity that built-on initial patterns of exports and FDI. Simultaneously, within all sectors, output produced historically for the domestic market will decline persistently over time. Thus, over the period we observe huge job creation from the development of export and FDI product lines established pre-1973, and the simultaneous destruction of jobs with the gradual phasing out of import competing product lines. Such path-dependent intra-sector structural changes have ultimately been responsible for Irelands industrial growth and the apparent 'jobless growth' in the aftermath of liberalisation.

In the next section we review the historical evolution of dualistic structures within sectors in CEE countries and Ireland pre-transition. Section three describes our various data sources, while section four documents the nature of structural change in Irish manufacturing during the transition period. Econometric evidence for our methodological approach is provided in section five and concluding comments in the final section.

2. THE HISTORICAL EVOLUTION OF FIRMS

This section documents the structural adjustment path observed in the manufacturing sectors of CEE countries since 1989 and the importance of initial conditions in determining such. We consider the similarity in initial conditions, or dualistic structures, in Irish manufacturing in 1966 before trade liberalisation and the potential effect of such on the microeconomic structural adjustment path of manufacturing during the subsequent thirty years.

Initial Conditions and Dualism in Manufacturing

One aspect of initial conditions in CEE countries is that all sectors of manufacturing inherited two species of firms induced by government policy implemented over many decades. Coming out of central planning all sectors hosted State firms that evolved traditionally either by exporting into the artificial *Council for Mutual Economic Assistance* (CMEA) market, as part of the former Soviet Union, or by exporting into the EU market through historical links.

Taking the former species first. The Soviet Union, in a drive for self-sufficiency, planned an artificial CMEA market over five decades. In the absence of

competition, efficiency depended on the ability of specialisation to exploit scale economies. All CEE countries hosted, in all 3-digit sectors of manufacturing, different clusters of large monopolistic producers that traditionally supplied the CMEA market. This specie of firm had no experience in global markets and had become highly inefficient under long years of planning. Incentives for innovation under central planning were low and products had become, by international standards, very outdated. The long historical evolution of CMEA oriented products made it unlikely that firms with such an inheritance could adapt its capital and labour to produce viably on global markets in the face of trade liberalisation. In the early days of transition many worried about the ability of such firms to survive on global markets for this reason. This is aptly summarised by Aghion, Blanchard and Burgess (1994, p. 1330) as follows:

"Among production activities, changes in relative prices and the loss of CMEA markets, imply that some are and will remain loss making and must therefore be closed. The others may be viable, but not without labour shedding and the infusion of new, more modern capital"

In addition to firms with such an inheritance, CEE countries also cultured a separate species of firm, across all sectors of manufacturing, which historically exported into the EU market under central planning. Unlike *Commonwealth of Independent States* (CIS) countries, CEE governments negotiated strong trade links with EU partners over the 1970s and 1980s. Due to the low standards in the quality of final goods in CEE, trade links were primarily established in intermediate goods produced under foreign licence. The historical evolution of such firms inheriting experience in trade with the EU would clearly be expected to allow them to adapt and survive on global markets with the introduction of trade agreements reducing trade restrictions with the EU, as outlined in Rodrik (1994).

McAleese (1971) reveals that a similar dualistic structure evolved in Ireland up to 1966. A feature of Irish industry before trade liberalisation was the co-existence of high rates of protection and high export/production ratios within four-digit manufacturing.[2] A dualistic structure of Irish industry can be observed within sectors whereby highly efficient export-oriented firms produced side-by-side with less efficient domestic market oriented firms. The emergence of this dualistic structure was attributed to two factors: industrial policy towards exporting firms, and the system of protection. Grants by the Irish *Industrial Development Authority* (IDA) over the previous fifteen years were solely targeted at firms with plans to export, including multinationals. Low export tax relief and high tariff protection encouraged domestic oriented firms to concentrate on domestic sales.

Firms already viable on export markets were expected to survive the effects of EC entry in 1973. Under free trade, however, the domestic oriented firms after three decades of protection would find themselves exposed, for the first time since establishment, to unrestricted competition from British and European producers.

McAleese (1971) predicted employment loss across all 4-digit sectors as a consequence of many firms within sectors being solely domestic market oriented for more than three decades.

Government policy in Ireland and CEE countries thus cultured similar pre-transition initial conditions. Each sector of industry hosted firms that evolved within protected environments for long periods of history and others that historically evolved on global markets, despite the trade restrictions. The core issue addressed in this paper is whether the structural adjustment path in the adaptation of Irish manufacturing sectors to global markets was driven by such an inheritance. Could firms cultured in protected markets survive the global environment? Would the reductions of tariffs on exports induce an expansion in export production strong enough to recoup employment losses in historically protected firms?

The Structural Adjustment Path in the Transition Process of CEE Countries

Repkine and Walsh (1999) highlight the importance of the pre-transition evolution of trade patterns, government policy induced dualism, within sectors of manufacturing. Modelling the dynamics of industrial output across sectors of CEE countries, they estimate the recovery in industrial output over the period 1989-1996 to be driven solely by product lines that were developed for EU export before transition in 1988. Rodrik (1994) also noted that the re-orientation of products previously directed to CMEA to the EU market was not a prominent feature of the transition period. Increasing Schumpeterian waves of business activity induced the growth in such EU oriented product lines.[3] Alongside these developments, Repkine and Walsh estimate a rapid collapse in previously CMEA oriented output by sector of industry in each country.

In the remaining sections of this paper we highlight the importance of the inherited market orientation within sectors in shaping the evolution of employment within Irish manufacturing sectors in the aftermath of trade liberalisation. Although discrete changes in terms of trade liberalisation occurred in Ireland since 1966, the structural adjustment path of manufacturing to global markets is a gradual path dependent process. We set out to show that Ireland's job creation from export growth is a path dependent history that built on patterns of exports and FDI created by government policies pre-trade liberalisation. The apparent 'jobless growth' in the aftermath of liberalisation was due to the simultaneous job destruction resulting from the gradual phasing out of import substituting industry created under the old protectionist regime.

3. MAIN DATA SOURCES AND FEATURES

Data Sources

There are three main data sources relied upon in the paper the Forfás annual employment panel survey, Eurostat trade data and the Central Statistics Office census on industrial production.

(i) *Forfás Annual Employment Panel Survey*: Our main data source is the annual employment panel survey carried out by Forfás over the period 1973 to 1994 covering all manufacturing companies. The response rate to the survey exceeds 99 percent. The unit of observation is employment at the plant level, identified by Irish and Foreign ownership and 3-digit NACE-CLIO sector codes. The appearance and disappearance of a positive employment figure in the annual survey defines plant entry and exit, respectively. Traditional firms describe all those present in the market in 1973, while *de novo* firms describe firms entering post 1973. Low- technology and high-technology sectors are identified by the Davies and Lyon's (1994) 3-digit NACE industrial code classification.

(ii) *Eurostat Trade Data*: Eurostat trade database provides annual data on export flows by product categories between Ireland, European Union and some 200 non-European Union countries. These export flows were retrieved in value terms in thousands of *European Currency Units* (ECUs) and in metric tonnes at the 3-digit NACE-CLIO sector level and at the 6-digit NIMEXE product level from 1976 through to 1994.[4] Trade figures from 1973 through to 1975 were obtained from external trade in the CSO *Statistical Bulletin* at a 4-digit SITC level. These were converted to the corresponding 3-digit NACE CLIO sectors to complete the run of trade data for the period 1973-1994 at this level.

(iii) *CSO Census of Industrial Production*: The Census of Industrial Production provides us with data on the value of gross output converted to thousands of ECUs and to 3-digit NACE-CLIO product level in 1973.

Main Features of the Data

In Table 1 we provide a summary of the Irish manufacturing data. The fact that the plants are tracked over twenty-one years is an extremely attractive feature of the data. There were a total of 4,609 plants in Irish manufacturing in 1973. In 1994 this had increased to a total of 5,830 non-failing plants, which includes only 30 percent of the 1973 stock. The data set records another 7,374 plants that failed during the period 1973 to 1994. While the number of traditional plants (established pre-1973) have been falling, de novo plants (new entrants post-1973) gradually dominate the stocks and flows of the plant population over time.

(i) Low -Technology Manufacturing

Low-technology manufacturing dominates in 1973, accounting for 86 percent of total employment and 86 percent of total plants in Irish manufacturing. While this sub-section maintained 67 percent of its 1973 employment level in 1994, its employment share of total Irish manufacturing declined to 61 percent and plant share to 73 percent over this period. Examining differential ownership patterns within the low-technology industries, it becomes apparent that indigenous firms dominate. In 1994, 74 percent of employment in low-technology industries was in Irish owned plants. The survival rate of traditional firms (established pre-1973) over the period 1973-1994 was 36 percent. Similar patterns of decline are observed both for Irish indigenous and Foreign owned traditional plants over the period.

In 1994, 66 percent of the plants were de novo (established post-1973) accounting for 44 percent of the jobs. De novo plants were small, Irish owned, usually subcontracted by larger firms and many only survived for short spells [see Walsh, (2000)]. They account for 61 percent of the plant records or throughputs in low-technology sectors during the defined period. In addition we observe that low-technology manufacturing industries did attract some large foreign multinational plants over the transition period although in general foreign ownership was a relatively small feature of the employment stocks and flows of low-technology manufacturing.

Table 1: Summary of Irish Manufacturing Data

	Low-Technology		**High-Technology**	
	Indigenous	***Total***	***Indigenous***	***Total***
Total Plants in 1973				
Number of Plants	3533	3946	472	663
Employment Levels	131809	180200	17856	41186
Traditional Plants 1994				
Number of Plants	1317	1437	183	283
Employment Levels	48855	67780	6739	20694
***De novo* Plants 1994**				
Number of Plants	2630	2812	919	1298
Employment Levels	40521	53314	14272	57798
Sector Throughputs (1973-1994)				
Total Plant Throughput	9355	10193	2204	3011
De novo Plants	5822	6247	1732	2348

Source: Calculations using Forfás Annual Employment Survey

(ii) High -Technology Manufacturing

Although only accounting for 14 percent of total employment and of total plants in Irish manufacturing in 1973, the high-technology sub-section had grown to 190 percent of its 1973 employment level in 1994. Its employment share of total Irish manufacturing increased to 39 percent and plant share to 27 percent in 1994. Within the high-technology industries, the importance of foreign ownership becomes apparent. In 1973, 56 percent of employment was in Foreign owned plants. By 1994, 73 percent of employment was in Foreign owned plants. The survival rate of traditional firms in high-technology manufacturing over the period 1973-1994 was 58 percent in Foreign owned plants and 38 percent in Irish-owned plants. In 1994, 82 percent of the plants were de novo and accounted for 74 percent of the jobs and 78 percent of the plant throughput in the high-technology sector. De novo plants were comprised of two very different kinds of firms: large de novo foreign export oriented plants and small Irish owned plants.

From an initial structure of large firms (either export promoting or import competing) within all sectors, we observe the gradual emergence of de novo Irish-owned small business. By 1994, such small de novo Irish-owned small business co-existed alongside large plants within all sectors of manufacturing. This is an interesting feature of the intra–sector structural changes that we document in the next section. Prior to this analysis, however, we first document the evolution of inter-sector structural changes.

4. STRUCTURAL CHANGE IN IRISH INDUSTRY

Inter-Sector Job Reallocation

Using the Forfás annual employment panel survey over the period 1973 to 1994, we analyse the degree of structural change in the 3-digit NACE-CLIO sector composition of low- and high-technology employment. To this end we apply the indices developed in Davis and Haltwinger (1992). We calculate a discrete measure of growth in employment over the period t-1 to t in the 3-digit NACE CLIO sector i within the low- or high-technology subsections of manufacturing j as follows:

$$g_{ijt} = \left(\frac{E_{ijt} - E_{ijt-1}}{(E_{ijt} + E_{ijt-1})/2} \right) \tag{1}$$

To examine the contribution of expanding and declining sectors to overall employment within low- or high-technology manufacturing, we sum the growth rates of each growing sector (POS), weighted by sector employment size S_{ijt}, and sum the absolute growth rates of each declining sector (NEG) weighted by S_{ijt},

$$POS_{jt} = \sum_{i=1}^{n} S_{ijt} g_{ijt} \qquad if\ g_{ijt} > 0,$$

and (2)

$$NEG_{jt} = \sum_{i=1}^{n} S_{ijt} \left| g_{ijt} \right| \qquad if\ g_{ijt} < 0.$$

The annual net change, NET_{jt}, in aggregate employment in the low- or high-technology subsection of manufacturing is a net outcome that is induced by employment growth in rising sectors being offset by employment declines in declining sectors.[5] The reallocation of employment between sectors is captured by the reallocation index, RES_{jt}, calculated as follows:

$$\begin{aligned} NET_{jt} &= POS_{jt} - NEG_{jt} \\ RES_{jt} &= POS_{jt} + NEG_{jt} - \left| NET_{jt} \right| \end{aligned} \tag{3}$$

In Table 2 we record the average year-to-year employment growth rates, the contribution of rising and declining sectors to the overall net changes in employment, and the excess reallocation of employment between sectors within low- and high-technology sectors of manufacturing. We average the annual changes over three periods, 1973-1978, 1979-1987 and 1988-1994.

Table 2: Reallocation of Jobs Across 3-Digit Sectors Over Time

	1973-78	1979-87	1988-94
Low-Technology Sectors			
Job Creation Rate in Expanding Sectors	.03	.01	.02
Job Destruction Rate in Declining Sectors	.03	.05	.03
Average (Size Weighted) Growth rate	.00	-.04	-.01
Between Sector Job Reallocation Rate	.06	.02	.03
High-Technology Sectors			
Job Creation Rate in Expanding Sectors	.08	.05	.05
Job Destruction Rate in Declining Sectors	.02	.03	.01
Average (Size Weighted) Growth rate	.06	.02	.04
Between Sector Job Reallocation Rate	.04	.06	.02

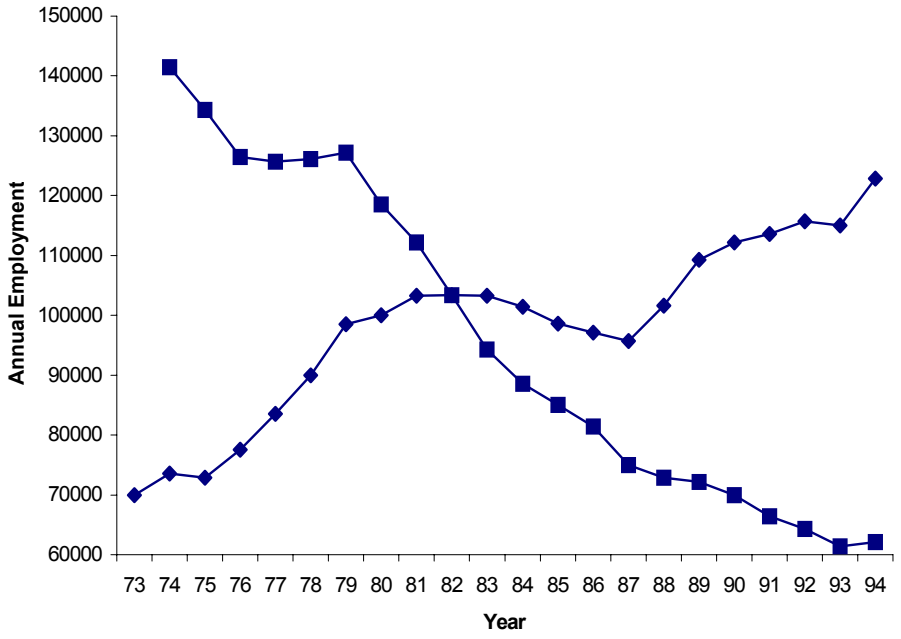
Source: Calculations using the Forfás Annual Employment Survey

In the first period we observe no net change in low-technology manufacturing employment. This hides an annual average reallocation of 6 percent of the employment stock across 3-digit low-technology sectors in each year over the period 1973-1978. The annual average reallocation of jobs declined to 2 and 3 percent in the periods 1979-1987 and 1988-1994 respectively. Although low-

technology manufacturing has been in decline on average, there has been simultaneous rising and declining sectors in each year up to 1994. In high-technology manufacturing we observe positive net growth rates in all periods. This also disguises significant average job reallocation rates of 4 percent in each year during the period 1973-1978 and 6 and 2 percent each year during the periods 1979-1987 and 1988-1994 respectively. The reallocation of jobs across sectors was a stronger feature of the high-technology sectors.

Persistent rise or decline in employment levels since 1973, with reference to business cycle, is exhibited for most individual 3-digit sectors of manufacturing with few exceptions. In Figure 3 we track the employment level in all 3-digit sectors that have been rising over the period against those that have been in decline. Overall the accumulated shifts across sectors over time has been persistent. Compared to 1973 the majority of jobs in 1994 are hosted in very different 3-digit sectors of manufacturing. Yet, while inter-sector adjustment was an important feature in the Irish economy, the following sections suggest that inter-sector adjustment was an outcome of intra-sector changes over the transition period.

Figure 3: Evolution of Employment by Aggregate Declining and Rising Sectors



Source: Calculations using Forfás Annual Employment Survey

Intra-Sector Job Reallocation

By calculating the indices (1) to (3) at the level of the firm i rather than at the level of 3-digit sectors i within low- and high-technology manufacturing, we calculate the annual job reallocation rate across firm populations over time. Our calculations are presented in Table 3. The annual reallocation rate of jobs across firms in low-technology manufacturing represents, on average, 16, 14 and 16 percent of the low-technology employment pool in each year during the periods 1973-1978, 1979-1987 and 1988-1994 respectively. A similar picture emerges within high-technology manufacturing where the annual reallocation rate of jobs across firms is, on average, 12, 18 and 14 percent of the high-technology employment pool in the respective periods. Of immense interest, however, is the fact that the vast majority of job reallocation across firms takes place within 3-digit sectors of low- and high-technology manufacturing over each period, and not between sectors. Within sectors, whether in low- or high-technology manufacturing, firms are simultaneously expanding and contracting in every year of the data set in the aftermath of trade liberalisation. Such heterogeneity in firm performance within 3-digit sectors is the core feature of the data that we set out to explain.

Table 3: Reallocation of Jobs Across Firms Over Time

	1973-78	1979-87	1988-94
Low-Technology Sectors			
Job Creation Rate	.08	.07	.08
Job Destruction Rate	.08	.11	.09
Growth Rate	.00	-.04	-.01
Job Turnover Rate	.16	.18	.17
Job Reallocation Rate	.16	.14	.16
Within Sectors	63%	86%	81%
Between Sectors	37%	14%	19%
High-Technology Sectors			
Job Creation Rate	.12	.11	.11
Job Destruction Rate	.06	.09	.07
Growth Rate	.06	.02	.04
Job Turnover Rate	.18	.20	.18
Job Reallocation Rate	.12	.18	.14
Within Sectors	67%	67%	86%
Between Sectors	33%	33%	14%

Source: Calculations using Forfás Annual Employment Survey

Intra-Sector Traditional and De Novo Firms

In Figure 4, we observe the gradual decline in traditional plant employment within both low- and high-technology manufacturing. The decline in traditional plant employment hides the ongoing expansion of certain plants that survived trade liberalisation alongside the decline of the majority of other plants, as we will document in our job flow analysis of traditional employment.

Simultaneously, we observe an increase in de novo employment in Figure 4 that is apparent for both low- and high-technology manufacturing. Plant numbers in all sectors are swelled by increases in the numbers of small Irish-owned plants. In all sectors, smaller Irish owned de novo plants emerge to co-exist in large numbers alongside larger plants. Irish de novo firms are primarily small, 90 percent with less than 40 employees, that mainly subcontract to the larger firms and explain the majority of plant turnover within sectors, see Walsh (2000) for more detail. In addition, in high-technology manufacturing sectors large de novo multinationals are present.

Such aggregate employment patterns in Figure 4 by traditional and de novo firms emerge within all 3-digit sectors of low- and high-technology manufacturing. Given the evolution of employment stocks within sectors, we now turn to a flow analysis of jobs within sectors.

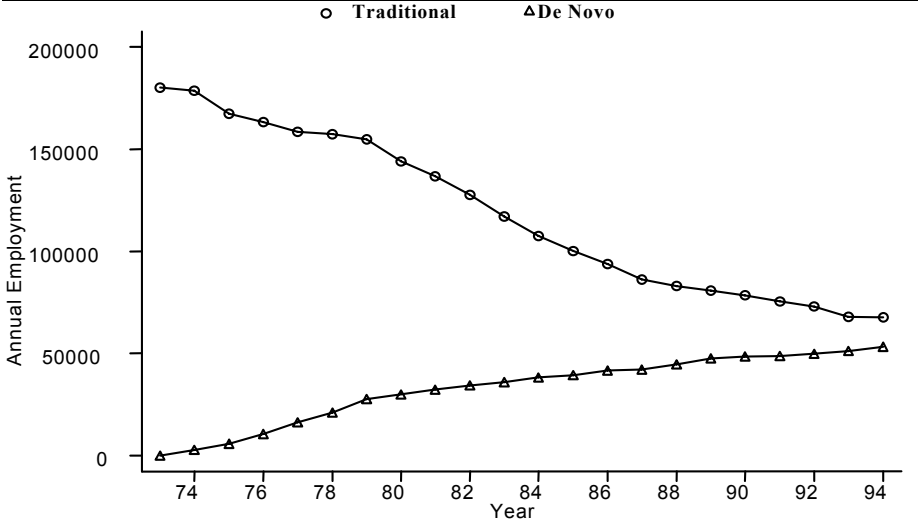
Job Flows within Sectors

Table 4 decomposes job turnover rates over our three intervals into contributions made by firm expansions (including new entrants), contractions and exits, by (home/foreign) ownership and traditional/de novo firms.

Within low-technology manufacturing Irish owned firms make the main contributions to annual job turnover over the twenty-one years. De novo and traditional firm expansion rates and traditional firm contraction and exit rates were key contributors to job turnover. It is worth emphasising the job creation of small de novo and some traditional large firms alongside the continual job destruction of other traditional large firms within low-technology manufacturing.

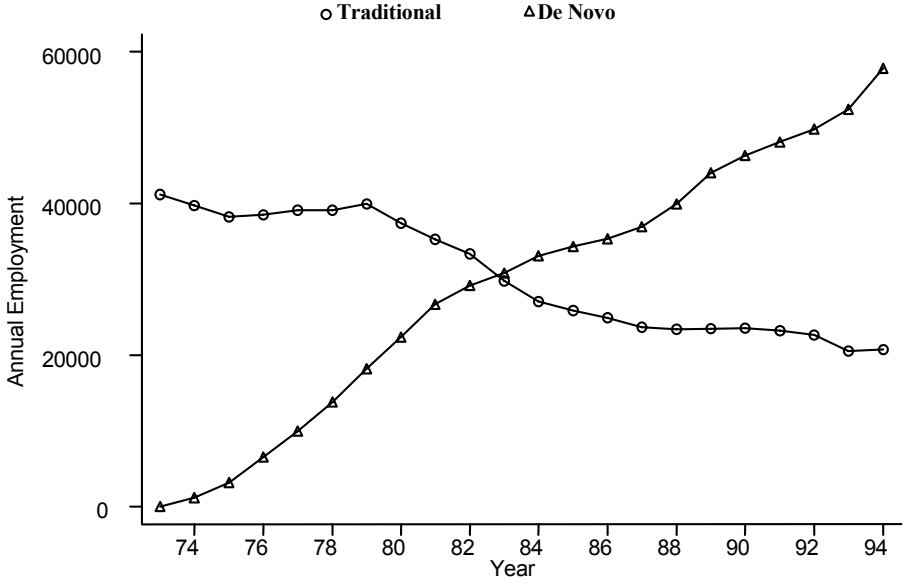
In the following section we explain such structural changes by the initial dualistic market orientation structures of firms across all 3-digit sectors. Export oriented firms expanded within the same product lines as those observed in 1973 inducing greater degrees of small de novo activity. The simultaneous contraction of other firms within sectors in low-technology manufacturing is explained by the continual decline of traditional firms operating in declining domestic oriented product lines.

Figure 4a: Employment Evolution in Low-Technology Industry by Firm Type



Source: Calculations using Forfás Annual Employment Survey

Figure 4b: Evolution of Employment in High Tech Industries by Firm Type



Source: Calculations using Forfás Annual Employment Survey

Table 4: Contributions to Job Turnover Rates Across Firms Over Time

		1973-78	1979-87	1988-94
Low-Technology Job Turnover Rate		*.16*	*.18*	*.17*
Home Ownership Share		**69%**	**76%**	**77%**
De novo	Home Expansions	10%	18%	26%
	Home Contractions	1%	6%	10%
	Home Exits	1%	5%	8%
Traditional	Home Expansions	23%	13%	12%
	Home Contractions	26%	23%	15%
	Home Exits	8%	11%	6%
Foreign Ownership Share		**31%**	**24%**	**23%**
De novo	Foreign Expansions	7%	6%	5%
	Foreign Contractions	1%	2%	3%
	Foreign Exits	1%	1%	2%
Traditional	Foreign Expansions	9%	4%	5%
	Foreign Contractions	9%	8%	5%
	Foreign Exits	4%	3%	3%
High-Technology Job Turnover Rate		*.18*	*.20*	*.18*
Home Ownership Share		**32%**	**34%**	**36%**
De novo	Home Expansions	7%	13%	15%
	Home Contractions	1%	4%	6%
	Home Exits	0%	3%	4%
Traditional	Home Expansions	9%	4%	5%
	Home Contractions	12%	7%	4%
	Home Exits	3%	3%	2%
Foreign Ownership Share		**68%**	**66%**	**64%**
De novo	Foreign Expansions	27%	30%	36%
	Foreign Contractions	1%	8%	13%
	Foreign Exits	0%	5%	3%
Traditional	Foreign Expansions	21%	7%	5%
	Foreign Contractions	16%	13%	6%
	Foreign Exits	2%	3%	1%

Source: Calculations using Forfás Annual Employment Survey

Within the high-technology sector both de novo large foreign owned and de novo small Irish owned firms are important job creators, explaining 51 percent of annual job turnover in the period 1988-1994. While some traditional firms did expand, we observe continual declines for the majority of these firms, particularly in the period 1973-1978. Rather than having some traditional firms expanding and others

contracting, the turbulence within high-technology sectors was mainly due to the expansion of large de novo foreign firms creating new product lines for export and of small de novo Irish firms, alongside the continual decline of traditional firms. Although this resulted in the introduction of completely new product lines for export within high-technology manufacturing we see the gradual build up in the accumulation of foreign capital and small business activity in such sectors.

Intra-Sector Persistence in Export and FDI Flows

For each 3-digit sector one can document the evolution of employment and the volume of exports in metric tonnes, both series normalised to 100 in 1973. This reveals a trend of persistent growth in exports over time, irrespective of whether the sector was declining or rising in terms of employment. The growing importance of goods for export over domestic production illustrated in Figure 1 is a feature of all 3-digit sectors.

One salient feature of the export data in low-technology industries is the lack of re-orientation of product lines for export over time. Using 6-digit product classifications from Eurostat one can track the share of products exported in 1976 to their export share in 1994 within low- and high-technology manufacturing subsections. Exports in 1976 were clustered into a narrow range of 6-digit product lines. In 1994, exports remained clustered in these same product lines. The results illustrate that the low-technology product lines exported have not changed since 1976, although their total exports have grown persistently overtime. Growth in exports is due solely to the development of product lines that were exported pre-1973.

Exports in high-technology industries were also clustered into a narrow range of 6-digit product lines in 1976. However, tracking exports over time reveals that only 35 percent of the products exported in 1994 were still exported in 1976. The expansion of exports was assisted by a huge increase in the number of new product lines developed for export, mainly due to the arrival of de novo foreign multinationals. An important feature within high-technology manufacturing is the accumulation of foreign capital into the same 3-digit sectors that had a tradition in hosting FDI going back to 1973 and before.

A Summing Up

The analysis of structural change motivates the empirical testing of the following propositions. Within low-technology manufacturing, persistent job creation results from the gradual development of historical export product lines by traditional firms supported by increasing small-scale indigenous de novo activity. Within high-technology manufacturing, persistent job creation resulted from the gradual development of historical FDI clusters supported by increasing amounts of small indigenous de novo activity. Simultaneously, in both low- and high-tech sectors persistent job destruction results from traditional import competing firms' decline.

5. ECONMETRIC ANALYSIS OF SECTOR GROWTH

We assume that within each 3-digit sector of manufacturing, both low- and high-technology, there are product lines coming from fundamentally different evolutionary paths since the late 1960s. Within manufacturing the historical process that created export and domestic-oriented product lines within sectors is taken as given. Trade liberalisation induces a permanent positive demand shock for export-oriented production. The permanent loss in protection induces a negative investment demand shock for domestic-oriented production. Our empirical analysis uses the methodology of Repkine and Walsh (1999) who model the path dependent history of sector growth by adapting the model of Aghion and Howitt (1992). Growth within sectors of Irish manufacturing during trade liberalisation will be endogenously determined by a path dependent history of business activity that builds on the initial patterns of exports and/or FDI. Simultaneously, within all sectors, we allow for output produced historically for the domestic market to decline persistently over time. Repkine and Walsh (1999) outline a model of sector growth during trade liberalisation that is endogenously determined by a path dependent history of plant turnover locked-in by permanent asymmetric trade shocks across products of sector. The model shows how plant turnover is only a feature of expanding product lines in the face of a once-off but permanent positive demand shock induced by trade liberalisation. In the case of a negative demand shock, output declines with little or no plant turnover.

We set out to decompose sector employment growth into that driven by the aggregate cycle, inter-sector shifts and intra-sector changes. We model intra-sector changes with greater business activity in growing export-oriented product lines and the decline in domestic oriented production within sectors as unobserved deterministic heterogeneity. The former is modelled using annual rates of de novo plant turnover, which excludes the exits of traditional firms, that was on average 10 per cent of the plant population. Small Irish de novo business, account for greater than 90 per cent of de novo plant turnover. The latter is modelled as deterministic unobservable heterogeneity using panel data modelling techniques. In columns two and four of Table 5, for low- and high-technology manufacturing subsections respectively, de novo plant turnover is instrumented using initial foreign presence, initial sector size, initial export share of gross output, sector and year dummies.

Within low-technology manufacturing, the rate of annual business activity during the transition period was highest in sectors that had a greater export share in gross output in 1973, among other factors. Export share of output in 1973 is an empirical proxy for the scale of permanent positive demand shocks, due to EU entry, on low-technology sectors, creating a path dependency in plant turnover within well established export product line clusters. Initial foreign share was not significant at the 5 per cent level. Within high-technology manufacturing, the rate of business activity during the transition period was highest in sectors that had a greater foreign

presence in 1973, a greater export share in gross output in 1973, and in sectors that were relatively large in 1973, among other factors. The latter proxy for the scale of permanent positive demand shocks, due to EU entry, on high-technology sectors, creating a path dependency in plant turnover along established FDI clusters.

Given the persistence in historical export product lines in low-technology sectors and FDI flows in high- technology sectors, our regression results and theory outlined in Repkine and Walsh (1999), imply that year to year business activity rates in de novo plants were mainly within exported oriented products within sectors. Using the predicted values of the de novo plant turnover rate, we proceed to model growth in sector i in sub-section j of manufacturing during the interval t-1 to period t in columns one and three of table 5 for low- and high-technology manufacturing respectively. We decompose sector growth into that determined by the observable business turnover in export-oriented output (induced by path dependencies in a sectors inherited export and/or FDI patterns) among other factors, and into unobservable but deterministic sector developments, i.e. market decline in non-export-oriented production, and a random element. The growth model is thus written as follows,

$$Growth_{ijt} = \alpha + \beta_0 Initial\ Size_{ijt_0} + \beta_1 DeNovo\ Activity_{ijt} + \beta_2 D_t + v_{ij} + \varepsilon_{ijt} \quad (4)$$

Unobserved heterogeneity in sector i and sub-section j is controlled for by the inclusion of a unit specific residual, v_{ij}, that is comprised of a collection of factors not in the regression that are specific to sectors and constant over time. For example, we have no data to control for factors that induce the decline of firms in a sector that traditionally sold into domestic markets. The initial size, intercept, time and sector dummies, in addition to the random effects, are included in the regression to control for and estimate the evolution of such unobservable deterministic factors over time.

The random effect specification is justified in all cases on the basis of a Hausman test. The models in column one (low-technology) and column three (high-technology) have strong predictive power, particularly in cross-section variations in sector growth. Although not reported the year dummies are significant reflecting macroeconomic cycles, particularly for the low-technology subsection of manufacturing. Initial sector size in 1973 also has a significant impact on sector growth in both models. Inter-sector adjustments have a role in the evolution of sector output over the period.

The smaller sectors in 1973 did perform better over the period. The instrumented de novo business activity is found to have a significant positive impact on sector growth both for low- and high-technology manufacturing sub-sections. This indicates that, within each sector, business activity within export-oriented output generated increasing sector growth during Ireland's adaptation to the global market.

In addition however, different but declining, non-export output dynamics within sectors are captured by our unobserved deterministic controls for heterogeneity, time, sectors and random effects.

Table 5: Regression Results on Sector Growth and Plant Turnover

	Low-Tech. Sector Growth	Low-Tech. De novo Plant Turnover	High-Tech. Sector Growth	High-Tech. De novo Plant Turnover
R^2 (Within)	0.10		0.12	
R^2 (Between)	0.50		0.41	
R^2 (Overall)	0.11	0.12	0.15	0.13
Constant	-0.01	0.03	-0.06	0.7
	(0.2)	(1.5)	(1.3)	(2.5)*
Initial Size	-0.01	0.01	-0.01	0.01
	(2.2)*	(1.8)	(2.0)*	(2.9)*
Initial Foreign		0.02		0.05
		(1.7)		(2.2)*
Initial Export Share		0.17		0.10
		(4.0)*		(3.0)*
De novo Plant	1.10		1.3	
Turnover	(3.6)*		(2.6)*	
Year Dummies	Yes	Yes	Yes	Yes
Clio 2 Dummies	Yes	Yes	Yes	Yes
Random Effects	Yes	No	Yes	No
Observations	1320	1320	640	640
Hausman test	$\chi2(20) = 4.2$		$\chi2(20) = .02$	
Heteroscedascity	$\chi2(36) = 28$		$\chi2(28) = 26$	
AR1	$\chi2(1) = 0.01$		$\chi2(1) = 0.01$	
AR4	$\chi2(4) = 2.1$		$\chi2(4) = 0.08$	

Notes: t-statistics in parenthesis and * indicates significance at the 5% level. Growth Models are Random Effects models using predicted values of *De novo* plant turnover while plant turnover models estimated by Ordinary Least Squares.

In Table 6 the employment growth rate in (4) by sector i and sub-section j is decomposed into that portion estimated to have been induced by greater de novo turnover in export product lines, and deterministic unobservable factors related to the collapse of product lines produced for the former protected domestic market. We sum over sectors, weighting by sector size, in each year to get the contribution of export and non-exported production to aggregate employment growth.

Table 6: Reallocation of Jobs Export and Domestic Market Orientation

	1973-78	1979-87	1988-94
Low-Technology Sectors			
Export Oriented Job Creation Rate	.07	.07	.09
Import Competing Job Contraction Rate	.07	.11	.10
Average Growth rate	.00	-.04	-.01
High-Technology Sectors			
Export Oriented Job Creation Rate	.13	.14	.13
Import Competing Job Contraction Rate	.07	.12	.09
Average Growth Rate	.06	.02	.04

Source: Calculations using the Results from Table 5

The growth model predicts that most of the annual structural change in employment across firms can be explained by persistent job creation in export oriented product lines and job destruction in import competing product lines, *within* sectors in both low- and high-technology subsections of manufacturing. Within low-technology sectors, the annual average job creation was 7, 7 and 9 per cent of the employment pool in the periods 1973-1979, 1979-1987 and 1988-1994 respectively. This compares with 13, 14 and 13 per cent of high-technology employment.

Our results support the thesis that the engine of job creation has been the gradual development of historical indigenous export markets alongside multinational exports markets *within* 3-digit manufacturing sectors. The apparent 'jobless growth' in the aftermath of liberalisation was due to the simultaneous job destruction resulting from the gradual phasing out of import substituting industry.

6. CONCLUDING REMARKS

We document that sector employment growth during trade liberalisation was endogenously determined by a intra-sector path dependent history of business activity that developed within historical export and/or FDI clusters, and a simultaneous gradual decline in output produced historical for the domestic market. The analysis is motivated by the mechanisms found in international trade endogenous growth models. The results proffer a striking relationship between structural change in the nature of jobs, industrial growth and exposure to international trade.

Our analysis highlights the importance of moving away from an indigenous and foreign firm dualism that has dominated the analysis of Irish manufacturing to the evolution of export promoting and import competing production *within* sectors of Irish manufacturing. The analysis also highlights how the increasing dominance of export production has resulted in the creation of many jobs in small Irish business across all sectors of manufacturing. Finally, the analysis sheds some light on the

puzzling observation that while industrial production in 1994 was four times higher than in 1973, employment remained relatively stable. This has frequently been described as the 'jobless growth' phenomenon. Our analysis clearly illustrates the continual creation of jobs in export oriented product lines of similar magnitude to the growth in industrial production over this period. The apparent 'jobless growth' results from the simultaneous gradual destruction of jobs in import competing product lines within sectors that were created under the old protectionist regime pre-liberalisation.

The basic evolutionary mechanisms outlined in this paper support modern endogenous growth theories of path dependencies in trade and FDI clusters. One must go within 3-digit sectors of manufacturing to find path dependencies while making a clear distinction between indigenous export flows and FDI induced export flows. We model the evolution of structure within 3-digit Irish manufacturing sectors with no regard for sector specific strategic interaction between firms, factor endowments or economies of scale, but rather with a focus on the path dependent history of intra-sector structural change in the aftermath of trade liberalisation.

Endnotes

1. The classification system used is that of the NACE-CLIO industrial classification.
2. Using effective measures of protection McAleese (1971) documents that while the degree of protection varied across sectors, protection in all cases was extremely high by international standards. Before the Anglo-Irish Free Trade Area Agreement in 1966 the average effective tariff level was nearly four times the level observed in trading partners. In the run up to EC entry in 1973 the average effective tariff level still remained more than twice the level observed in trading partners.
3. Schumpterian waves of business activity refers to the simultaneous entry and exit of firms induced by the introduction of new innovation. Efficiency is gained by the entry of newly innovating firms, which force the exit of incumbents, rather than by the restructuring of incumbents.
4. NIMEXE is a narrowly refined 6-digit product classification nomenclatura used by Eurostat.
5. A 10 percent growth rate is generated when all sectors grow by 10 percent. It can also be an outcome of some sectors growing faster than 10 percent which is offset by negative growth rates in other sectors. The latter example creates a structural change in the employment shares of sectors and turnover in excess of that needed to generate a net change of 10 per cent.

References

Aghion, P. and P. Howitt, 1992. "A Model of Growth through Creative Destruction", *Econometrica,* Vol. 60, pp.323-351.

Aghion, P., O. Blanchard, and R. Burgess, 1994. "The Behaviour of State Firms in Eastern Europe, Pre-Privatisation", *European Economic Review,* Vol. 38, pp.1327-1349.

Barry, F., 1999. *Understanding Ireland's Economic Growth*, MacMillan Press Ltd.

Davies, S. and B. Lyons, 1996. *Industrial Organisation in the European Union,* Clarendon Press.

Davis, S. and J. Haltwinger, 1992. "Gross Job Creation, Gross Job Destruction and Employment Reallocation", *Quarterly Journal of Economics*, Vol 107, pp 819-863.

Grossman, G. and E. Helpman, 1991. *Innovation and Growth in the Global Economy*, MIT Press.

McAleese, D., 1971. "Effective Tariffs and the Structure of Industrial Protection in Ireland", *The Economic and Social Research Institute*, General Research Series Paper No.62, June, Dublin.

Repkine, A. and P.P. Walsh, 1999. "Evidence of European Trade and Investment U-Shaping Industrial Output in Bulgaria, Hungary, Poland and Romania", *Journal of Comparative Economics,* Vol. 27, pp.730-752.

Rodrik, D., 1994. "Foreign Trade in Eastern Europe's Transition: Early Results" in O. Blanchard, K. Froot and J. Sachs (eds.), *The Transition in Eastern Europe.* Vol. 2, pp.319-356, University of Chicago Press.

Walsh P.P., 2000. "Sunk Costs and the Growth and Failure of Small Business", *Trinity Economic Papers*, No. 2, Trinity College, Dublin.

DISCUSSION

Dr. Eoin O'Malley: I would like to propose a vote of thanks to the authors for their paper, which I found extremely stimulating and thought provoking. The core of the paper's argument is that, in the transition from protection to free trade, the performance of different industries or firms in Ireland depended very much on their initial starting position. Those that were very largely producing for the domestic market tended to go into decline. But those that were already exporting significantly at the start of the transition period tended to grow, while growth also came from new foreign direct investment. I find this argument generally quite convincing, and it could have important implications for other countries that are contemplating a similar transition. The issue for them is do they have the initial conditions required to benefit from freer trade? Or can they expect to attract very substantial new foreign direct investment in internationally traded production?

There is also a part of the argument in the paper that seems to me more questionable. This is the argument that innovations introduced by new or de novo small firms, supplying inputs to larger firms, were major influences in generating growth in the growing sectors. I find this particular part of the argument not very convincing, but I will return to this issue later.

As I said, I found the general thrust of the argument quite convincing, but I have a few comments or qualifications. When I read the paper first, I was somewhat concerned about the timing attributed to the Irish transition, since the paper in effect treats the transition to free trade as beginning in 1973. There is some logic in this choice since that was the year when Ireland joined the EU; the choice of 1973 for beginning the analysis also seems to be at least partly dictated by data constraints. But it seems to me that the real beginning of the transition to free trade was before EU entry. The Anglo-Irish Free Trade Area agreement came into effect in 1966 and this was a major step in beginning the dismantling of Irish protection. If one examines the trend in the share of the Irish domestic market taken by "competing" imports of manufactured products, one can see only a slow and erratic increase in the market share of competing imports in the period 1960-67. There was, however, a much more rapid and continuous increase in the share of competing imports for many years after 1967, see Figure 6.2 in O'Malley (1989). This indicates that the introduction of the Anglo-Irish Free Trade Area in 1966 had real effects in beginning the transition to free trade.

But the question is does this have serious implications for the paper's analysis? On reflection, I think that it does not invalidate the paper's analysis to any great extent. By starting the analysis of the experience of industrial sectors in 1973, the paper would be missing some of the earliest effects of the transition to free trade. But the dismantling of protection was not complete until well after 1973, and the rising trend in the market share taken by competing imports continued long after that date. Therefore the paper's analysis should still be picking up substantial effects of the

transition to free trade.

Another related point is that the paper uses data from 1976 for the purpose of identifying the degree of export-orientation of different sectors early in the transition period. An objection to this could be that, by 1976, almost half of Ireland's industrial exports were actually coming from new foreign-owned companies which had started up over the previous 15 years or so, see Table 6.5 in O'Malley (1989). Thus, these foreign companies were mostly established during the transition period in fact, if we date the beginning of the transition to 1966. Therefore, it might be argued, 1976 data on the export-orientation of different sectors would not provide a good representation of the situation early in the transition period, before all the new foreign investment arrived.

I think, however, the paper largely gets around this potential objection since it divides the sectors into two groups - "homogeneous" and "high technology". In the homogeneous group, the large majority of firms and employment are indigenous, so that new foreign-owned arrivals before 1976 do not greatly affect their position. And this group of homogeneous sectors does show the trend argued in the paper, namely, that sectors with relatively high export-orientation tended to grow while those with relatively low export-orientation tended to decline.

Table 1: Trends in Irish Industry Pre and Post EU Entry

Industry	Increase in Competing Imports' Market Share, 1967-79 (% p.a.)	Employment Change in Firms Established Before EU Entry 1973-80, (%)
Clay, Glass & Cement	0.2	6.5
Drink & Tobacco	0.3	1.1
Food	0.5	-2.1
Paper & Printing	1.4	-2.0
Other Manufacturing	1.4	-14.2
Wood & Furniture	2.0	-16.0
Metals & Engineering	2.3	-8.7
Chemicals	2.3	-27.1
Textiles	2.8	-39.9
Clothing & Footwear	4.6	-36.3
TOTAL	1.2	-12.8

Source: O'Malley (1989), Table 6.6.

Table 1 shows some trends that tend to support the main argument of the paper, while also suggesting a qualification to it. The right-hand column in the table shows employment change in 1973-80 in Irish-owned manufacturing firms that were already established by 1973. So no new start-up enterprises are included here. It can be seen that there was generally quite a substantial decline in this employment,

with the exceptions being the four sectors at the top of the table, which had either modest growth or only very slight decline. The experience of two of these four sectors, Food and Drink & Tobacco, was very much in line with the argument of the paper, since these two sectors had been relatively highly export-oriented back in the 1960s. The other two sectors - Clay, Glass & Cement and Paper & Printing - were not particularly highly export-oriented, and yet their employment trend was much better than average.

The reason why these two sectors fared relatively well was because they were largely naturally protected or non-traded types of industries. In the case of Clay, Glass & Cement, most of the products concerned were building materials with low value relative to weight, and hence they are generally not traded much over long distances. In Paper & Printing, much of the output was newspapers, magazines and general printing, in which local knowledge and close contact with the local market gives an advantage over more distant competitors. Thus, although these sectors had a relatively low export-orientation, they also had relatively strong resistance to competing imports, as shown in the first column of Table 1. Consequently, their employment trend was relatively strong.

This suggests that naturally protected or non-traded industries can be seen as exceptions to the general rule argued in the paper. This is a point of some significance since the broad Clay, Glass & Cement category in Table 1 corresponds to eight NACE 3-digit sectors, and the Paper & Printing category corresponds to four NACE 3-digit sectors. There would also be other naturally protected NACE 3-digit sectors, such as bread and soft drinks, as well as others which correspond to parts of the broad categories Metals & Engineering and Wood & Furniture in Table 1. This point about non-traded industries does not invalidate the general argument in the paper. Rather it merely suggests that there are a set of sectors which are exceptions to the general rule. If these were identified and treated as a separate group, perhaps the argument of the paper would actually be strengthened as it applies to the remaining sectors.

Another point about Table 1 concerns the increase in the share of competing imports in the home market, which is shown in the first column of the table. The industries are ranked in Table 1 according to the pace of the rise in market share taken by competing imports. It can be seen in the table that the strength of the rise in competing imports was strongly associated with the degree of employment decline in existing indigenous firms. This indicates that existing indigenous firms in sectors that lost out most to competing imports generally did not compensate sufficiently by increasing their exports, and so they tended to go into sharp decline. The rise in competing imports was the decisive influence on their growth or decline, and free trade conditions did not transform them into competitive exporters, at least not during the time frame covered in Table 1. This is a somewhat different perspective from that presented in the paper, but I think that it is quite consistent with the paper's argument.

Finally, the part of the paper that I have most doubts about is the argument that new (or de novo) small manufacturing firms mainly supply inputs to larger industrial firms, and that innovations introduced by the new small firms had a major influence on growth in the larger firms in growing sectors. There seem to be several potential flaws in this.

First, it is pointed out in the paper that small industrial firms generally are not very export-oriented, and it is concluded that therefore new small industrial firms are mainly suppliers of inputs to larger industrial firms. However, this does not necessarily follow. Even if the new small firms are not highly export-oriented, they could be exporting, say, 20 percent of their output. They could also be selling significant proportions of their output to consumers, or to the agriculture, construction or services sectors. Hence they are not necessarily mainly engaged in supplying inputs to larger industrial firms.

Second, the paper seems to simply assume that a high rate of plant turnover, with a high rate of start-ups, is equivalent to or necessarily implies a high rate of innovation. I think this is doubtful. No doubt some new small firms are exceptionally innovative, but many of them may be doing nothing particularly innovative. Perhaps the view on this in the paper can be sustained, but it would require some evidence to be really convincing.

Third, even if it is true that new small firms mainly supply larger industrial firms, and that they are exceptionally innovative, it does not necessarily follow that this is mainly of benefit to larger industrial firms in the same sectors. The small firms could be mainly supplying to larger industrial firms in other sectors. For example, small suppliers of plastic components would be providing inputs to larger firms in sectors such as electronic products, healthcare equipment or motor vehicles, and not necessarily in the main to larger firms in the plastic processing sector. I am sure that there are many other such examples.

However, apart from these particular doubts, I did find the paper very interesting, thought provoking and convincing in very important respects.

Reference

O'Malley, E., 1989. *Industry and Economic Development: The Challenge for the Latecomer*, Dublin: Gill and Macmillan.

Mr. Dan Flinter: I am delighted to propose a vote of thanks to the authors. The paper is to be welcomed because it focuses attention on some key aspects of industrial development policy. I have confined my comments to the three main points.

In relation to the methodology used in the paper to differentiate homogenous and high technology sectors, I would suggest that it might be questionable in the context of the Irish industrial structure. The approach in the paper implies, for example, that all firms in the information, computers and telecommunications (ICT) sector would automatically be classified as high technology even though the business activity in Ireland may be primarily focused on assembly and logistics. Many ICT firms in Ireland are subsidiaries of international companies where some of the core parts of their business systems, such as research and development, are located elsewhere in the world. I would suggest also that using plant turnover as a proxy for innovation is less than adequate. There are more appropriate data now available to measure the performance of firms in relation to research and development.

Not withstanding the above comments I do agree with the key conclusion. It takes time to develop a successful indigenous sector especially after major dramatic changes. The successful firms I have observed have three things in common:

1. Deep knowledge of chosen market
2. Access to technology
3. Operational capability

However, they also have a fourth, and much rarer, characteristic – the ability to change their business. Most businesses find it very difficult to effect the radical change that allows them to adapt to a new environment. The history of the computer industry illustrates this point, where few leading firms have managed to survive a change in the industry's technological paradigm with their leadership position intact.

My final comments highlight some public policy issues prompted by the paper. We need for example to understand better how we can help to shorten the "company learning curve". A further issue that needs to be developed is in understanding how we can embed technology into firms more effectively. Equally the continued development of the venture capital sector and access to development capital are vital ingredients for long-term success.

I would like to second the thanks to the speakers for an interesting paper.

Mr. Edgar Morgenroth: I would like to join the discussants in congratulating Paul and Ciara on their paper. Overall the paper makes an important contribution and raises many interesting issues. I would however like to make some comments.

The paper shows that firms that are inward orientated and do not compete in international markets performed poorly, while those that are export orientated do well. This result is explained using an endogenous growth model where growth is driven by Schumpeterian waves of product innovation and where firms are either

export orientated or inward orientated with this structure being the result of policy. Trade liberalisation cause an investment shock which results in the increased investment in research among the export oriented firms which induces increased intermediate good innovation and thus leads to growth. In terms of production technology the model relies on decreasing returns to scale.

However, an alternative explanation can be put forward using the results form 'new' trade theory which are based on increasing returns to scale. Since increasing returns can only be exploited with higher levels of production these are a function of market size. In other words those firms which only service a small local market will not be able to exploit these increasing returns. This should not matter to the performance of these firms in a closed economy setting. However, with opening up of free trade these firms are exposed to foreign competition, which is producing subject to increasing returns yielding a cost advantage, even when transport costs are taken into account. As a consequence of such competition these inward orientated firms will become unprofitable and will eventually exit. Exporting firms on the other hand benefit from increasing returns and therefore should grow more quickly and survive longer. An interesting feature of this explanation is that it can be further developed to account for the spatial differentiation of industries.

Another explanation that is closely related to the previous one is that of growth through specialisation that is driven by the extent of the market. Of course, Adam Smith first put this idea forward over two hundred years ago. Here trade liberalisation increases the size of the market that allows the production process to be broken down into smaller processes thus yielding returns to specialisation that drive growth. Firms, which are inward orientated, cannot avail of returns to specialisation and will therefore perform badly.

These arguments suggest that the size of the local market might be of crucial importance to the performance of inward orientated firms particularly if these produce goods that meet local tastes. Thus inward orientated firms that serve a large domestic market should perform well while those serving a small domestic market will be forced to exit.

Professor Frances Ruane: Let me begin by thanking Dr. Walsh and Dr. Whelan for their paper to the Society. It represents an interesting new way of examining the process of industrial development in Ireland in the 1970s.

Most studies of the evolution of manufacturing in Ireland have looked at the process in terms of the decline of indigenous industry in the traditional sectors following the adjustment to free trade and the expansion of FDI firms in the modern sectors. In terms of nomenclature, the traditional sectors were identified as being low technology (low tech) while the modern sectors were seen as high technology (high tech) sectors.

This paper suggests, if I understand the arguments properly, that the process of structural adjustment in the low-technology sectors was not simply one of homogenous decline. Rather the process was one wherein the exporting low technology firms survived and prospered because they would cope with free grade, whereas the firms that were oriented towards the domestic market declined. Among firms in high technology sectors, there has been a similar pattern - expansion has occurred in export oriented FDI companies and declined in those focused on the domestic market.

Ideally to analyse the impact of trade liberalisation, we should have data on the employment and export patterns of individual firms throughout the period from the mid-1950s to the mid-1990s. This would cover the period from when new export-oriented firms began to be established in response to the introduction of tax incentives for exporting firms, right through the 1960s and 1970s when tariffs were reduced, and on to the 1980s and into the 1990s when the process of full adjustment to free trade culminated in the EU culminated in the establishment of the Single European Market. No such data sets exists, however, and the approach adopted by the authors represents a courageous and ambitious attempt, using a combination of firm level employment data and dis-aggregated sectoral trade data, to try to replicate studies undertaken of recent trade liberalisation in Eastern European countries, where such data are available. These studies found that those plants whose output was exported into the protected CMEA market prior to 1990 declined following trade liberalisation, while plants which were EU orientated prior to 1990 have expanded since then. This points to the importance of market forces prior to liberalisation on ex post developments.

The paper identified two types of sectors (high tech/low tech), two groups of firms (traditional and de novo), and within these two nationalities (indigenous and foreign). The high tech/low tech dichotomy is based on a well-known definition between Davis and Lyons. It would be useful if the David and Lyons classification were listed in an appendix to make the paper more readily comprehensible. It is not necessarily the case that all would agree on the appropriateness of this classification in an Irish context, raising the issue of whether the results in the paper might be sensitive to this classification. Further, as noted by Dan Flinter, it may be the case that a better classification is to distinguish high tech activities from high tech sectors, as it is quite possible to have low-tech production activities within a so-called high tech sector. The authors are also limited in that the data cannot distinguish between different types of foreign-owned firms. Thus UK and US plants are aggregated, where the former have been orientated to the domestic market and the latter almost exclusively having a foreign market orientation from the time of their establishment. Yet a further limitation of the data is that it necessitates traditional firms being defined as those which were established by 1973 while de novo firms are defined as those established since 1973. Again, this classification is due to the limitations of the data, but it is unfortunate as by 1973 Ireland had been promoting for over fifteen years the establishment of new, both indigenous and

foreign, export-oriented firms and the expansion of existing export-oriented firms into export markets.

In effect, by comparison with the studies of the CEE countries, the Irish data are weak in their potential to provide evidence to support the authors maintained hypotheses. Furthermore, the definition of the transition period is not ideal, as arguably it should have begun in the late 1960s rather than the early 1970s. Already by 1973 there were a lot of de novo plants already established which are classified here as traditional firms and many traditional firms had already closed in response to their failure to be competitive in the new lower tariff environment.

While the data are not ideal the authors have optimised their potential. They combine plant level employment data from 1973, sectorally identified at a highly dis-aggregated level, with comparably dis-aggregated export data, starting in 1976, to provide a new way of looking focus to looking at structural adjustment in Irish manufacturing by linking employment change to the degree of export orientation of different 3- and 4-digit sectors. Again, further detail on the sectoral decomposition might be a helpful addition to the paper.

The authors summarize an econometric analysis that I believe needs greater detailed explanation. The authors interpret their results as indicating it is the large and not the small de novo firms that are exporting. I find this argument somewhat difficult to 'square' with the operation of policy and the export ratios of indigenous firms in the Irish manufacturing sector. If it is the case then there is certainly concern to be expressed about the sustainability of recent industrial policy. The high turnover rates of indigenous de novo companies is to be expected, however, as is therefore not nearly as serious a source of concern.

Let me conclude by commending this paper as an excellent contribution to discussion of Irish industrial policy and congratulate the authors on their contribution and the Society on its wisdom in inviting such a valuable addition to research on this area.

Reply to the Discussion

We would like to thank to the discussants and the Society for interesting and valuable comments on our paper. It is generally accepted by the discussants that path dependencies in FDI and exports clusters pre-liberalisation are important determinants of the persistent move away from import competing and toward export oriented production within sectors. Moreover, that the dichotomy highlighted in our analysis focuses on the dualism in trade orientation within sectors gives richer insights and analytical results than the standard indigenous versus foreign dualism. In addition, it seems to be accepted that this process of structural change within sectors has been very gradual since the onslaught of trade liberalisation beginning in

1966. We agree that it is only in the period post 1994 that the job losses stemming from import substituting industrialisation have ended.

The contentious issue centres on the role of small de novo activity and the exact theoretical mechanism that maps these path dependencies to sector growth. The authors are happy to allow a more general interpretation of the business activity index. It does not have to be strictly interpreted as supplier turnover or innovation undertaken in small business. It could equally reflect natural ongoing changes in the vertical and horizontal structures of firm populations in expanding product lines that flourish during trade liberalisation. However, we accept that the precise mechanisms that lock in export and FDI clusters and induce them to grow are important and deserve future research. We hope that this paper has identified a roadmap for this further research.