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Building Export Capabilities by promoting Inter-Firm Linkages: Ireland's Industrial Policy Revisited.

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Abstract

For the period 1972-2003 in Ireland we document a persistent decline in traditional import competing and an expansion in exporting plants, within each sector. Yet, the focus of this paper is to explore the *vertical* linkages between exporting plants and the increasing presence of *de novo* non-exporting plants within industries during this period. Based the capabilities approach of Sutton (2007) and the creative destruction model of Aghion and Howitt (1992) we find evidence that forward dominated backward *vertical* linkages, in that innovation in *de novo* non-exporting plants was a key determinant of export entry, growth and survival within all sectors, while evidence of backward linkages are harder to find.

Keywords: Manufacturing, Structural Change, Trade liberalisation, Export Development and Inter-Firm Vertical Backward and Forward Linkages.

JEL Classifications: O30, L20

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I. Introduction

Understanding the process of industrialization in a developing economy requires an acute awareness of interdependences in productive activities. Linkage effects are an important spur to industrial development, but the nature of these linkage effects may be of relevance to the way we design and understand the process of industrialization. Establishing plants involved in the production of final goods can obviously lead to the demand induced creation of domestic plants involved in the production of inputs (goods or services, which may or may not have been supplied initially from abroad). Hirschmann (1958) describes such a process as *backward linkage effects*. He also highlights the fact however, that when an industry develops and generates such effects, that these may in turn generate *forward linkage effects*. This occurs as the domestic production of inputs attracts more new and expands other plants whose production uses these inputs. In his book, Hirschmann (1958) articulates many reasons why domestic availability is a "more effective spur to further development" than foreign supply: (i) important employment and tax gains outside exporting companies; (ii) improved balance of payments position due to less importing of intermediates; and, (iii) product specific innovations that would lock in exporters to domestic locations and proliferate further use.

The attractiveness of a rich domestic supply of inputs (goods or services) naturally depends upon the capabilities of those firms involved. As Sutton (2007, pg. 2) outlines, " ... 'capability' can be thought of as comprising two elements: a measure of the maximum quality level that the firm can achieve, and a measure of its cost of production (productivity) for each product line. It is a firm's relative capability vis-à-vis its rivals that will turn out to matter…".

In this paper, we examine the importance of linkages, especially forward linkage effects in the development of Irish economic policy since the 1950s, and the subsequent impact on the industrial development path in Ireland over the period 1972 to 2003. Ireland in the late 1950s had an industrial base that was cultured on import substitution industrialization where protectionism for three decades encouraged home-grown firms to replace imports of final goods by domestic production. This led to the entry of plants with

low capabilities protected by trade policy.[1] In the late 1950s, the concept of industrial development changed in emphasis towards export promotion, using financial incentives and enhanced capabilities to support exporting companies, during trade liberalisation. We examine the role that the enhanced capabilities of supporting or input firms, established through industrial policy in the fifties and the sixties, play in the performance of exporting firms over the last three decades.

The main thrust of this paper is therefore to explore the possibility of *vertical* forward linkages within industries, or in other words, the effectiveness of the domestic supply of intermediate goods to enhance export entry, growth and survival since the 1970s. The following section provides a detailed overview of Ireland's industrial policy since the 1950s. Section III provides a description of the data and an analysis of the main features of Ireland's development over the period 1972 – 2003. This provides the motivation for our econometric section (Section IV), where we test for the nature of the linkages between exporting and non-exporting companies within industries. In particular, we highlight the role of forward vertical linkages where non-exporting plants and their capabilities are found to enhance export entry, growth and survival over this period. The last section outlines the conclusion.

II. A Roadmap of Ireland's Industrial Policy

Ireland in the late 1950s had an industrial base that was cultured on import substitution industrialization where protectionism for three decades encouraged home-grown firms to replace imports by domestic production.[2] This led to the entry of plants with low capabilities protected by trade policy.

In the late 1950s, the concept of industrial development changed. The emphasis was on export promotion, using financial incentives and enhanced capabilities to support exporting companies during trade liberalisation. Seán Lemass, one time Taoiseach of

[1] Low capabilities result from a lack of historical product specific sunk cost expenditures (Sutton, 2007).

[2] Using effective measures of protection, McAleese (1971) documents the variance in the degree of protection across 4-digit industrial sectors, although protection in all cases was extremely high by international standards. Before Ireland signed the General Agreement on Tariffs and Trade (GATT) in 1960 and the Anglo-Irish Free Trade Area Agreement (AIFTA) in 1966, the average effective tariff level was nearly four times the level observed in trading partners. During the period 1966-1979 (EC entry in 1973 followed by tariff abolition in 1979), effective tariffs were reduced to levels that were twice as high as trading partners.

Ireland from 1959 until 1966, and Dr. T. K. Whitaker, a civil servant, are credited for an inspirational approach to export oriented industrial policy and are regarded by many as the architects of modern Ireland.[3] Whitaker (2006) gives a great deal of credit to academic members of the Capital Investment Advisory Committee which included Professor Louden Ryan. Ryan (1961) read an important paper on investment criteria in Ireland to members of the *Statistical and Social Inquiry Society of Ireland* in which Whitaker was active. Hirschman (1958) was central to the investment criteria that formed the basis of this paper.

Full tax relief on exports profits was first introduced in 1956.[4] In 1959, the Encouragement of External Investment Act repealed all previous restrictions on foreign ownership.[5] The 1969 Industrial Development Act established the modern Industrial Development Authority (IDA) which came into operation in April 1970. It gave it the power to deploy the full range of export *incentives* and *support* for exporting firms to foster the national objective of regional industrial development.

Michael J. Killeen (1975), Managing Director of the IDA, outlined the two pillars of industrial policy to the *Statistical and Social Inquiry Society of Ireland*: export *incentives* and *supports*. Alongside export tax relief, capital grants were used to attract green field export oriented FDI in new industries, and similar incentives were given to Irish owned export oriented companies that were start-ups.[6] The focus on creating an exporting base from new capital and locating it outside the traditional Dublin Hub was very Schumpeterian in its thinking. There was a realisation that the capabilities in industrial products cultured under protectionism were low, and a shakeout would be

[3] Garvin (2004) notes that the protectionist policies adopted by government in 1932 were based on a paper written by Lemass. Garvin (2004) considers the move away from free trade in the 1930s until 1960 as a major mistake in terms of Ireland's human and economic development. In this paper we document the decline of many import competing companies over the 1970s and early 1980s. This reflects additional costs of the protectionist era. In fact, 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 with AIFTA in 1966, EEC entry in 1973 and tariff abolition in 1978, see Figure 6.2 in O'Malley (1989).

[4] Ireland had to abolish the discriminatory export tax relief as a member of the EEC and introduced a flat ten per cent rate on all manufacturing firms in 1981.

[5] Yet, many UK companies traded nominally under Irish Ownership after independence in 1922.

[6] Start-up grants could be up to 50 per cent of the cost of machinery and equipment and 100 per cent of land and buildings (business parks) in designated BMW regions (Border, Midlands, West Regions). In non-designated regions start-up grants could be up to 33 per cent of the cost of machinery and equipment and 66 per cent of land and buildings.

imminent.[7] As modelled in Sutton (2007), when quality matters and is an outcome of many years of product specific sunk cost expenditures, no level of wage adjustment (or government intervention) can compensate for poor levels of productivity and quality during the initial stages of trade liberalisation. Not only were the Irish policy makers to be commended for their forward thinking, in terms of an understanding that capital is not so mobile or adaptable, but also for actually exercising their political ability to promote *de novo* export companies over import competing incumbents with such incentives.[8]

In terms of *supports* Killeen (1975) states "…. we have come to appreciate that providing the full range of back-up services needed by industry (i.e., in addition to IDA activities, grants and other incentives) is a complex process which depends on a host of development agencies working in a planned and synchronised way….." with respect to the provision of utilities, planning, banking, marketing and so on. Killeen also emphasizes the importance of targeting policy to the development of export oriented service type industries, such as consulting, engineering, computing, and labour market training as well as Research and Development. This translates into the importance of building up a rich supply of core capabilities for exporting plants. In addition to the general equilibrium *supports*, Killeen (1975) highlights the need for downstream linkages to exist inside industries as a core capability that Ireland can offer. Apart from accruement of additional profits and wages, the ability of local companies to embed themselves in the stages of production (processing, supply chain, or R&D) of a particular export product line can result in substantial improvements in capabilities (productivity and quality) of exporting companies leading to their long term presence in Ireland.[9]

Thus, in their concept of industrial policy formulated in the late 1950s Lemass and Whitaker not only anticipated the shakeout of traditional import competing

[7] Economic Theory has taken a long time to understand the curse of product specific investments under protectionism. Roland and Verdier (1999) used such supply-side distortions and disorganisation in the links of production to model a short-term output contraction after market liberalisation and a recovery thereafter in countries coming out of planning. Konings and Walsh (1999) provide empirical evidence of this using firm level data from Ukraine.

[8] Repkine and Walsh (1999) explain trends in industrial output of four CEE countries with initial trade orientation of product lines. Product lines exporting to the CMEA (former Soviet Union) market collapsed while the smaller EU oriented exporting product lines that existed pre market liberalisation gradually expanded. This dualism, created by government policies pre-transition, and their subsequent dynamics created output trends irrespective of government policies post-transition.

[9] Sutton (2000, 2004 and 2007) articulates and models this issue.

manufacturing plants, but they also further understood that export growth would only happen, however great the financial incentives, if a location could offer core capabilities to exporting plants. They understood the relationship between non-exporting and exporting plants would become vertical, and had an acute understanding of the product specific nature of investment that is needed in supports. While such capabilities are hard to build they do lock exporting companies into the industrial structure.

To understand how exporting incentives and supports interplay, we focus this paper on the nature of the intra-industry linkages between exporting and *de novo* non-exporting plants within narrowly defined manufacturing sectors. Much has been written on the role of *horizontal* backward linkages - from foreign multinational firms to indigenous firms. Such positive productivity gains could arise from the movement of trained labour from the foreign to the domestic firm, or competitive pressures which improve the efficiency of the indigenous firms (see Javorcik 2004 for an overview).[10] v*ertical* backward linkages are modelled in Markusen and Venables (1999) model inter-firm linkages between multinationals and indigenous suppliers. These are linkages that arise through contact between domestic suppliers of intermediate goods and their multinational customers – this is where indigenous suppliers learn superior production techniques from the multinationals they supply, or benefit from the demand for higher quality supplies from the multinationals, or benefit from the increased demand for intermediate goods which allow the indigenous firms to reap scale economies. Blalock (2001), Schoors and van der Tol (2001), and Javorcik (2004) find evidence of such positive *vertical* backward linkages. We test for such *horizontal* or *vertical* backward linkages in our data, but the evidence is far from convincing.

The main thrust of this paper is to explore the possibility of *vertical* forward linkages within industries, or in other words, the effectiveness of domestic supply of intermediate goods or services to enhance entry, growth and survival in export populations. The capabilities approach of Sutton (2007) and the creative destruction model of Aghion and Howitt (1992) have the feature that quality innovations are of paramount importance to endogenous growth. In Aghion and Howitt (1992), the

[10] As dictated by industrial policy, the majority of foreign multinationals do not compete with indigenous firms in local market, but rather use Ireland as export platform (Ruane and Ugur, 2004).

investment into innovation in intermediate inputs is clearly modelled outside incumbent companies and will eventually replace the current suppliers of intermediate inputs with higher quality intermediate inputs.

It is very difficult to measure innovation in supply chains but in this paper we construct an index from turnover in *de novo* non-exporting plants that proxies for innovation rates inside sectors that induces export entry, growth and survival which had a significant impact on Ireland's industrial development since the 1970s.

In summary, Lemass and Whitaker were the architects of Irelands export oriented industrial policy which was seeded back in the late 1950s. The lesson from Ireland's industrial development path suggests that import competition can be expected to have a very damaging impact on industry. Rather than try to restructure or reorient incumbent import competing plants it could turn out to be a better policy to build an exporting base from new capital (or from transferred FDI capital) and locate it outside the traditional hub. This involves managing a massive structural adjustment in employment over many years.

While it is understood that the local investment environment in a country needs to be good, regardless of how great the financial incentives are, for export growth, it is less appreciated that the capabilities of supporting business have to be product specific in a vertically linked industrial structure. Export growth will only compensate for losses in import competing companies if a country has capabilities, general and specific, strong enough to support exporting. Ireland moved from a protectionist era when for three decades non-exporting home firms tried to replace imports of final goods in the domestic market. During the next three decades non-exporting home firms were encouraged to displace imported intermediates with higher quality ones for use in exporting plants. Such supply side capabilities are often forgotten but are necessary for industry to take advantage of trade liberalisation.

III. Data Analysis

(i) The Data

Table 1 summarises the data used in this paper. Our main data source is the Annual Employment Panel Survey carried out by Forfás over the period 1972 to 2003 covering all manufacturing companies. Although the number of plants in operation in a given year varies between 4,000 to almost 7,000, the total number of plants tracked in the data is 27,407. The unit of observation is employment (permanent staff) at the plant level. These are identified by country of ownership (based on majority ownership *Irish, UK, US, or Other Foreign*); Sector (*4-digit NACE industry codes*); Start-up date; from start-up date we classify plants as *Traditional* if set up pre-1973 and *De novo* if set up 1973 or later; and, Regional Location (*Dublin; Border, Midlands, West (BMW); and, South)*.

Within all industries there are both exporting and non-exporting plants. Using trade information for plants in the Forfás annual expenditure survey 1983 - 2003, we label all plants as *Exporting* if a plant has any exports over the survey period.[11] For incumbent plants in 1972 and *de novo* which exited before 1983, we classify as exporting or non-exporting using exporting grant information. *Exporting* is treated as a fixed effect for the period 1972 – 2003 to control for pre-selection effects.[12]

Finally, a foreign versus indigenous dualism has been at the centre of most research on Irish manufacturing. Irish industrial policy since the 1950s clearly targeted green field and export-oriented FDI, mainly US companies, to locate in high-technology 4-digit sectors and away from traditional manufacturing. The economic factors that govern such FDI entry, survival and exit, should be expected to be different to Home industries. For our analysis we can classify our data into *Home* and *US* industries.[13] There

[11] The expenditure survey excludes plants with less than 19 employees up to 1999, although they are included from the year 2000. The annual employment survey generally has the same plant identification number as the annual expenditure survey. We used phone numbers, address and name to match any outstanding plants. Based on an analysis of the expenditure survey of all plants in the year 2003 we work with the assumption that exporting was a rare feature of small plant activity (less than 19 employees) for the period of our study.

[12] There are very few observations where exporters become non-exporters over the period while only 10 per cent of exporters in the 1983-2003 survey came from non-exporting history. The nature of industrial policy encouraged exporting from start-up.

[13] Plants do not operate in 90 4-digit industries in Ireland. In addition, we find a small number of plants in another 70 4-digit industries. This has lead researchers to aggregate up to 3-digit industries. Our strategy is to work with the 4-digit industries that explain 99 per cent of employment in each of the periods between 1972-2003. This excludes 70 small industries and about 300 plants.

are 43 US industries (i.e. with the majority of jobs in a 4-digit industry being US owned between 1972 and 2003), and 58 Home industries (i.e. with the majority of jobs in a 4-digit industry being Irish owned between 1972 and 2003).[14] See Table 2 for this taxonomy of 4-digit sectors.[15]

(ii) Aggregate Manufacturing Employment 1972 – 2003

Figure 1 illustrates a U-shape in manufacturing employment over the period of analysis. From the final abolition of tariffs against ECC members in 1978, there began a decline in manufacturing employment which persisted until 1987, from which point it began to rise once more until 2000. Meanwhile, despite the discrete institutional changes of AIFTA in 1966, EEC entry in 1973, and the abolishment of tariffs in 1978, we observe a steady increase in exports as a share of both output (Figure 2), alongside a persistent but gradual rise in labour productivity in manufacturing (Figure 3) over the entire period. In aggregate, the high value added export oriented production that replaced traditional home oriented production was less employment intensive leading initially to a decline in overall employment.

A simple way to explain the U-shape in manufacturing employment is to point to a dominance in the collapse of indigenous import competing manufacturing, due to gradual import penetration, from 1966 up to 1987 (see O'Malley 1989) with the slow progression of US FDI plants up to 1987 and boom there after (see Barry 1999). We feel that this is too simplistic. In the next section, we highlight the contribution of indigenous exporting plants (traditional and *de novo)* and the capabilities created by *de novo* Irish non-exporting plants that supported exporting plants across all industries whether dominated by indigenous or US exporters.[16]

[14] Each sector has either a majority of Irish owned or majority of US owned plants in terms of their contribution to sector employment. While clearly there are UK and other non-US Foreign owned plants, these do not aggregate up to a majority in any sector.

[15] We observe foreign owned plants in 4-digit Home industries and both home and 'other foreign' ownership in US industries. With regard to Home industries, many UK and European companies were once Irish owned, but the managers of this data set always backdated ownership structure to the most recent. In US 4-digit industries plant ownership structure did not change much over time.

[16] Walsh and Whelan (2000) did not have trade data at the plant level. They did provide indirect evidence that 3-digit industry growth was linked to plant turnover and the gradual development of 6-digit exporting product clusters within industries.

(iii) The Role of Exporting in Manufacturing Trends

Beneath the U-shape in manufacturing employment, Figures 4 (i) and (ii) illustrate the trends by trade orientation and firm type for both *Home* and *US* industries respectively. The collapse of non-exporting (particularly in those sectors dominated by Home ownership) alongside the expansion of exporting (particularly in those sectors dominated by US ownership) over the period of analysis is evident. Within Home industries, the collapse of traditional non-exporting plants is very evident in Figure 4 (i). These plants did not switch into exporting, but rather were phased out.[17] Although 80,000 jobs were lost in traditional non-exporting plants, the overall employment in Home industries only declined by 25,000. This is due to the success of traditional exporters and the emergence of *de novo* exporters and small Irish business over this time period.

Turning to US industries in Figure 4 (ii), we observe 80,000 new jobs created by *de novo* exporters over the period. Traditional plants mostly stayed for the entire period, maintaining their employment levels, while small non-exporting plants clustered around the export activities of multinationals. The initial US FDI base was gradually developed over this period to create employment levels in the late 1990s exceeding those observed in Home industries.

The story of Irish Manufacturing over this period is not simply about the loss of 80,000 jobs in traditional import competing plants and the generation of 80,000 jobs in *de novo* US FDI plants. Capabilities in traditional exporters in both Irish and US dominated industries were good and we intend to show that *de novo* non-exporters in Irish and US dominated industries increased the capabilities of exporters in these industries to become a world leader in manufacturing.

(iv) Plant Size, Entry, Growth, Survival

Within all sectors, for both Home and US industries, we have exporting and non-exporting plants, traditional and *de novo* plants, Irish and Foreign owned plants. Table 3

[17] Timing, location and product issues go against the idea that *de novo* exporting plants came from traditional non-exporting plants. There is a time lag between the collapse of traditional non-exporting and the expansion of *de novo* plants. In addition, *de novo* plants tended to locate outside Dublin in designated areas. Finally, we will document a large inter-industry reallocation over time, suggesting that product lines were abandoned.

presents a summary of plant numbers in the data within Home and US industries, averaged over four groupings of time to reflect the broad business cycles of the economy.

We observe exporting plants to be fewer in number, bigger in employment size and older compared with non-exporting plants. On average, exporting plants have positive growth in each and every period up to 2000 but declines thereafter. Traditional exporting plants, cultured with industrial policy under a protectionist regime, have impressive survival rates, with 72 per cent surviving the entire period in Home industries and 78 per cent in FDI industries. US plants were not footloose.

Traditional non-exporting plants, cultured under a protectionist regime, have extremely poor growth and survival rates over the entire period, with just 26 per cent surviving in Home and 20 per cent in US industries.

In contrast, we see that the mass entry of *de novo* non-exporters are, on average, very small (under 10 employees) and young (due to turnover) Irish plants with positive growth rates over the entire period. *De novo* non-exporting plants became an interesting feature of industries over time. It is very likely that the stock of small *de novo* non-exporters emerged to support the capabilities of exporting plants within the same industries. We test for such *vertical* linkages in our empirical section.

(v) Location Characteristics of the Data

Table 4 describes the regional dimension of the data within Home and US industries. Meyler and Strobl (2000) detail regional industrial policy in Ireland back to the late 1950s. We observe that most of the *de novo* activity of exporters and non-exporters has put jobs into BMW and Southern regions away from the traditional manufacturing hub. The fact that *de novo* non-exporting plants locate in designated export regions is another reason to test for *vertical* linkages between exporters and *de novo* non-exporting plants.

(vi) An Analysis of Aggregate Employment Flows

In order to fully understand the dynamics of manufacturing employment flows, we apply the indices developed in Davis and Haltwinger (1992) to compute annual job creation rates *JC* (a weighted sum of the growth rates of all expanding plants *i*), job

destruction rates *JD* (a weighted sum of the absolute growth rates of all declining plants *i*), where growth in plant *i* is given by employment changes *E* according to the following equation,

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

We do this by both Home and US classifications of manufacturing *j*. The annual net change (*NET*) in aggregate employment, the rate of job turnover across plants (*TO*), and the reallocation of employment between plants is (*REALLOC*) for each subsection of manufacturing *j* (j = *Home* or *US)* is calculated as:

$$\begin{aligned} NET_{jt} &= JC_{jt} - JD_{jt} \\ TO_{jt} &= JC_{jt} + JD_{jt} \\ REALLOC_{jt} &= JC_{jt} + JD_{jt} - \left| NET_{jt} \right| \end{aligned} \tag{2}$$

REALLOC shows the percentage of jobs in different plants at the end of the year compared to the start of a year, net of the business cycle – or the simultaneous expansion and contraction of plant employment net of the cycle.

A similar analysis is done by Lawless and Murphy (2008). Table 5 documents the net cycle and job reallocation rates within the pool of jobs in *Home* and *US* industries. We also do some annual job turnover accounting to see the percentage contribution of inter- and intra-sector flows (the contribution of the aggregate cycle is the omitted residual) in job turnover.[18]

Taking the aggregate cycle in Home industries we observe the aggregate cycle explains only, on average, 15 per cent of plant experience. Due to ongoing entry, expansion, contraction and exit at each point in the aggregate cycle we see job reallocation rates across plants in the region of 15 per cent in each and every year.

[18] Inter-sector job reallocation within Home and US industries *j* is measured by summing growth rates at the 4-digit sector level *s* rather than the plant level *i*.in equation (1). The corresponding reallocation rate in equation (2) would then measure reallocation due to the simultaneous expansion and contraction of 4-digit sector employment at the same point in the aggregate cycle. Having the aggregate cycle and the inter-industry reallocation rate, the intra-industry reallocation rate is simply the residual in annual job turnover created by plants.

Structural change in the plant population is ongoing, irrespective of the business cycle. In addition this structural change seems to be mostly within sector, on average 68 per cent. Taking the aggregate cycle in US Industries we observe growth in most of the time periods. Yet the aggregate cycle explains, on average, only 20 per cent of the plant experience. Intra-sector structural change accounted for 55 per cent of the overall job turnover within US dominated industries.

In Table 6 we set out to examine job flows by plant type (exporting, non-exporting, traditional and *de novo* plants) averaging over four blocks of time to reflect the four broad business cycles in the Irish economy. Traditional non-exporting plants (fewer in US industries) are seen to have a poor performance over the entire period. *De novo* non-exporting plants reveal positive net growth rates alongside large plant turnover over the entire period. Exporters are a smaller group of plants with low turnover generating net gains. Overall, even though we observe heterogeneity within plants grouped by such characteristics, on average, trade orientation (trade and industrial policies) seem to have greatly affected the net job flows within 4-digit Home and US industries during this period.

(vii) Plant Turnover and Numbers

A key feature of this paper is the role that *de novo* non-exporters play in the performance of exporters within a sector. We have seen that the mass entry of *de novo* non-exporters are, on average, very small (under 10 employees) Irish plants with positive growth rates and that they tend to locate in designated export regions. Table 7 (i) gives us the total plant numbers by plant type and Table 7 (ii) decomposes total plant turnover by plant type. *De novo* non-exporting plants accounts for an overwhelming proportion of plant turnover and over time account for most of the plant numbers. In the next section we will test whether such renewal of the vertical links of production within sectors can explain export growth.

Summary

The story of Irish manufacturing since the 1970s is far more than a simultaneous collapse of indigenous import competing manufacturing in the face of trade liberalisation alongside the gradual expansion of US FDI plants. While traditional non-exporting plants

had extremely poor growth and survival rates over the period of analysis, traditional (and *de novo*) exporting plants did extremely well in terms of their growth and survival. *De novo* non-exporting plants, though small, gravitated toward designated export locations, have positive growth, and account for most of the total plant turnover in manufacturing. We feel that such non-exporting activity has greatly enhanced capabilities for exporting within vertically linked industrial structures.

In what follows we first empirically test for the presence of inter-firm linkages within sectors. We first test for backward linkages and test whether the accumulation rate of exporters in a sector determines non-exporter performance in terms of entry, growth, and survival. Yet the main focus of the paper empirically tests for the presence of forward linkages. As motivated in Aghion and Howitt (1992), we will show that development of *de novo* non-exporting plants in terms of accumulation (innovation) rates is a key driver of exporter capabilities within sectors in terms of entry, growth, and survival.

IV Empirical Analysis

i) Backward Linkages

Acquiring external capital and technology is an importance channel for firms to increase their profits and productivity level. Therefore, many previous studies argue that the capital stock provided by downstream firms can be vitally important for growth upstream. In this section, we test the existence of backward linkages between non–exporters and exporters in Irish manufacturing.

Most studies employ a Cobb – Douglas production function to estimate backward linkages within industries. The capital stock is usually measured by total output (employment) of downstream firms normalized by total output (employment) of upstream firms (e.g., Blalock, 2001; Javorick, 2004; Liu and Lin, 2004). We augment this approach by assuming that every time an exporter innovates it increases employment. Historical innovations depreciate with age. The stock of innovation is represented by employment size E_{it} in an exporter discounted by age. The possible backward linkage effect is captured by the aggregated stock of export innovations divided by the number of non-exporting companies, N_j, in the sector *k.* We control for vertical backward linkages from exporters *i* to non-exporters *j* within a sector using:

$$linkage_{kt} = \left(\frac{\sum_{i=1}^{M} E_{it} / (1+\delta)^{age}}{N_{jk}} \right) \quad (3)$$

If we wished to test for horizontal linkages between exporters we would use the number of exporters within a sector or the number of all plants of the sector in examining the exporter effects on overall development among non-exporters and exporters. δ denotes the depreciation rate. The backward linkage effects are tested for with in 4-digit sectors. We impose δ = 0.01 for the capital stock provided by exporters. As Nadiri and Prucha (1996) point out, it is not surprising to see that choosing an arbitrary depreciation rate turns out to be the popular strategy for constructing capital stock in applied work. Measuring the depreciation rate poses a challenge, which arises partly from the properties of intangible assets and partly from the lack of data on asset depreciation. In addition, the depreciation rate applied to exporters is much lower than that applied to non–exporters (δ = 0.05), which reflects the low turnover and reallocation effect of exporters.

We model the year–to–year employment growth rate of plants. The key plant level characteristics are initial start–up size, age, ownership and region dummies. Moreover, we include industry and time dummies to account for the effect of the omitted variables, such as the business cycle. We estimate the impact of exporters' sector capital stock on plant level non–exporters' growth and survival to examine possible vertical backward linkages, and on plant level exporters' growth and survival to examine horizontal linkages. In addition, we also estimate the impact to the growth and survival of all plants and examine the effect of the presence of exporters to the overall development within sector. The regressions are run on a split sample of plants across Home or US industries over the period 1973 – 2003. We expect that the disaggregated firm–level panel data combining with long time span will provide robust results.

Assuming a random selection process, we write down the basic regression model as the following:

$$g_{jt} = f\left(Size_{jto}, Age_{jt}, Ownership_{j}, Linkage_{kt-1} \right) \quad (4)$$

where employment growth, g_{jt}, as in equation (1) is a discrete measure of a non-exporting plant j growth that varies year to year with: employment size in year zero $Size_{jto}$, life

cycle $Age_{jt.,}$ ownership (Irish, UK, US or Other) $Ownership_j$, and dummies for region, 4-digit sectors and year dummies.[19] Vertical Backward linkages, $Linkage_{k,t-1}$, are measured by equation (3). Note that we take one year lag of backward effects as an explanatory variable. On the one hand, the linkages via technology transfer and setup of supply chain cannot take place immediately and lag of backward effects play important role in the development of manufacturing (e.g., Liu and Lin, 2004); on the other hand, we use it to control for endogeneity, which stems from the ex ante industry growth (e.g., Stancik, 2007). Do firms with a bigger presence of exporting firms have a positive effect on the growth and/or survival of non-exporting plants? This looks for evidence of backward linkages (*Vertical*) within sectors of Irish manufacturing. It is easy to look for horizontal backward linkages by augmenting equation (3) and using plant level data on exporting firms only. One could augment equation (3) to talk account of the full population of firms and look for mixed backward linkages on all the plants in the sector.

The random selection model depends strongly on the fact that the exit process or the probability of plant survival is not related to any of the explanatory variables. Yet as outlined, the literature to date finds that plant failure rates decline with initial size and age. This sample selection bias can overstate the marginal impact of our explanatory variables. Correcting for such a sample selection bias can theoretically change the sign, magnitude or significance of the relationships found in the non-failing regression. The *Wald test* is used to reject the reported employment growth model that assumes a random selection process.

The unusually long time span of this panel data set allows one to test and control for sample selection in a very effective way. We employ the Heckman (1979) full maximum-likelihood estimation procedure. Our selection model is written down as the following:

$$\begin{aligned} Z_j &= f\left(Size_{jto}, Age_{jt}, Ownership_j, Linkage_k \right) \\ Z_j &= 1 \;\; if \;\; fail_j \neq 1 from \, t_0 \\ Z_j &= 0 \;\; otherwise \end{aligned} \tag{5}$$

The Heckman lambda is computed for each observation in the selected non-failing non-exporting sample and the following regression models the contributions of

[19] The results are similar if one uses a continuous measure of growth.

our explanatory variables to the expected growth rate of non-failing non-exporting plants:

$$g_{jt}\big|_{Z_i=1} = f\left(Size_{ijo}, Age_{jt}, Ownership_j, Linkage_k \quad \lambda_{jt} \right) \qquad (6)$$

where λ_{jt} is Heckman's lambda.

The impact of start-up size on the employment growth while controlling for the business cycle, the life cycle, probability of survival and backward linkages, amongst other factors, is motivated by the failure of Gibrat's Law of Proportionate effect.[20] The failure of Gibrat´s law is motivated by the Jovanovic (1982) theory of firm selection and industry evolution under ex-ante uncertainty concerning the ex-post performance of firms.[21] There is substantial evidence that growth is negatively related to size and age across industries and time (Hall, 1987; Wagner, 1992; Mata, 1994; and Audretsch, 1995).

As in earlier studies of the literature we find the likelihood of plants surviving being positively related to size and age within 4-digit industries: (Mansfield, 1962; Hall, 1987; Dunne, Roberts and Samuelson, 1989; Audretsch, 1991 and Audretsch and Mahmood, 1995). This has been confirmed for other countries including Portugal (Mata, Portugal and Guimaraes, 1994; Mata, 1994), Germany (Wagner, 1992) and Canada (Baldwin and Gorecki, 1991; Baldwin, 1995; and Baldwin and Rafiquzzaman, 1995). We find that while the rate of plant failure declines with age and size, the same is also true for employment growth rates of non-failing plants. The expected growth rate of plants depends on the net effect of these two forces. In addition strong non-linearities can be expected in the relationship between non-failing employment growth and size and it motivates us to include the square and cube of log of plant initial size as explanatory variables. Identification comes from regional dummies (policies) that seem to increase survival but do not enhance plant growth.

[20] If surviving small firms, even after controlling for their probability of survival, grow faster than large firms, Gibrat's (1931) Law of Proportionate effect is deemed to fail. For a comprehensive review of this literature, see Sutton (1997). This Law states that the expected value of the increment to a firm's size in each period is proportional to the current size of the firm. Hence, proportionate growth rates are independent of firm size.

[21] Extensions of Jovanovic (1982) can be found in Hopenhayn (1992) and Ericson and Pakes (1995)

Firm entry is also an important aspect of efficiency. We employ a logit model to test the impact of a sectors exporters' capital stock on the entry rate of non–exporters (exporters or the entire plant population) into a sector:

$$H_j = f\left(Size_{jto}, Ownership_j, Linkage_k \right)$$
$$H_j = 1 \;\; if \;\; new\, entrant_j \qquad (7)$$
$$H_j = 0 \;\; otherwise$$

On the one hand, the presence of exporters may provide more non-exporting entry opportunities via supply chain, technology absorption, or providing public goods; on the other, it may limit market share and increase the entry difficulty for potential entrants by importing.[22]

In Table 8 we present the test results for the impact of backward linkages of exporters innovation rates within a sector on plant level non–exporters but also on exporters only and all plants. Generally speaking, the backward linkages are not clear and the effects depend on the choice of plant sub–sample. When all plants in the data are included into the sample, backward spillovers have negative and significant effects on both growth and survival. This effect mainly comes from US industries, in which the presence of exporters will significantly decrease the growth and survival possibility of non-exporting plants.

Regression results of the impact exporters at the sector level on the growth, survival, and entry of exporters are presented in the third row, which reflects the horizontal linkages. The sector capital stock scale provided by exporters does not affect exporting plant growth and survival, except that it induces positive survival across Home industries. However, the presence of exporters can induce more entries of exporting plants in both Home and US. Barry, Gorg and Strobl (2003) argue that investors may exhibit a tendency to imitate each other's choice due to uncertainty. Since exporters face greater uncertainty, they may interpret the presence of existing exporting plants as a positive signal of the investment attractiveness. Moreover, clustering may bring about

[22] One problem with this type of regression is that the trade orientation at the plant level could be picking out better plants through an endogenous selection process. However, the nature of Irish industrial policy encouraged exporting from start-up. There are very few observations where exporters become non-exporters over the period while only 10 per cent of exporters in the 1983-2003 survey came from a non-exporting history. Segmentation and a control for pre-selection histories of exporters help circumvent a potential endogenous switching from non-exporting to exporting bias.

knowledge and technology spillover, the increasing availability of specialised labour and a growing pool of specialised input providers. Krugman and Venables (1995) and Venables (1995, 1996) model firms, which are linked through production inputs, may tend to agglomerate geographically.

ii) Forward Linkages

The evidence for backward linkages is not that strong. The capabilities approach of Sutton (2007) and the creative destruction model of Aghion and Howitt (1992) highlight the role of quality innovation in intermediates in endogenous growth. We already saw in our descriptive analysis that the non-exporting base changed dramatically during this period. While exporters mainly grew and survived, we see a clear out of the inherited non-exporting base being replaced by a larger number of smaller plants with high turnover rates. *De novo* non-exporting plants became an interesting feature of industries over time. Though small, these plants gravitate toward designated export regions, have positive growth, and account for most of the total plant turnover in manufacturing. It is very likely that the stock of small *de novo* non-exporters provided the source of core capabilities and innovations to support the exporting plants within the same industries. Therefore, we highlight the role of *de novo* non–exporting plants in the formation of new capitals and innovations and model the forward linkage effect as follows. Every time a non-exporter innovates it increases employment. Again historical innovations depreciate with age. The stock of innovation is represented by employment size E_{jt} in a non-exporter discounted by age. The possible forward linkage is captured by the aggregated stock of non-export innovations divided by the number of exporting companies, N_i, in the sector *k*. We control for vertical forward linkages from non-exporters *j* to exporters *i* within a sector using:

$$linkage_{kt} = \left(\frac{\sum_{i=j}^{N} E_{jt} / (1+\delta)^{age}}{N_{jk}} \right) \tag{8}$$

The forward linkage effects are within 4–digit sectors. As mentioned, we impose $\delta = 0.05$ as the depreciation rate of the capital stock in the population of *de novo* non-exporters investments, which reflects the large reallocation and high turnover in the data.

In Figure 5, we plot the trends of our forward linkage effect and actual data on outsourcing to Irish companies used by exporting plants, for Home, US, and all industries. Irish outsourcing includes raw material and services provided by domestic suppliers to support exporting plants. The highly positive relations in all three graphs show that our new innovation rate cumulated by *de novo* non–exporting plants is positively related to the intermediate inputs requirement of exporting plants, which provides evidence that we are controlling for vertical linkages. Görg and Ruane (2000), building on McAleese and McDonald (1978) and O'Farrell and O'Loughlin (1981), used outsourcing information from the expenditure survey to model backward vertical linkages of exporters (multinationals). The expenditure survey only covers large companies for the 1980s and 1990s. Our employment survey has the full population of firms and let's us look at inter-firm linkages, non-exporting and exporting firms, in more detail.

To test for forward vertical linkages we employ the same estimation procedures as in (5), (6) and (7) with the linkage effect defined in terms of equation (8) and we test for its impact upon exporting plants information, *i's* , when we want evidence of forward vertical linkages. We estimate the impact of *de novo* non–exporters stock of innovation at the sector level on three aspects of exporting plants: growth, survival, and entry of exporters to examine vertical forward linkages, non–exporting plants to examine horizontal linkages, and of all plants to examine the influence upon manufacturing as a whole. In the meanwhile, we run the regressions on plants of Home industries, US industries, and whole Irish Manufacturing, respectively, and look for the evidence of forward linkages (Horizontal or Vertical) within sectors of each sub–sample.

Table 9 shows the test results of forward linkage effects on exporters, non – exporters and all plants in manufacturing, respectively. As shown in the first row, when both exporters and non–exporters are included, overall forward spillovers have positive effects on the performance of manufacturing, especially as it significantly induces more entry of new plants. The positive effects are much clearer across US industries and the coefficients on all three prospects are positive and significant. US industries usually have higher technology level and exporting share and are more productive, which implies that the new capital from *de novo* non–exporters are orientated to support high technology and exporting firms.

Of key interest in the results is the existence of vertical forward linkage, that is, the impact of the presence of *de novo* non-exporters on the performance of exporters. As shown in the second row, the forward linkage effects are positive and significant on all prospects: growth, survival, and entry of exporters across Home industries, US industries, and all industries in manufacturing. It indicates that the supply chain capability and innovation by small indigenous suppliers of intermediate inputs are of paramount importance to the performance of exporting firms. As in Aghion and Howitt (1992), innovations are undertaken in a least cost manner via the entry and exit of firms or by changes in ownership, rather than through product innovation within incumbent firms. With trade liberalisation and the horizontal waves of creative destruction (a decline in traditional import competing plants and an expansion in exporting plants) within each sector, there coexisted vertical waves of creative destruction in *de novo* non-exporting plants. The presence of *de novo* plants has a positive effect on the performance of exporting plants, which accounts for the growth within a defined sector.

Moreover, positive horizontal linkages are found and coefficients on the growth and survival of non – exporters across all sectors are significantly positive. This mainly comes from positive linkages to growth and survival of non–exporters across Home industries and survival of non–exporters across US industries. And it also indicates that technology transfer dominates competition in those aspects.

IV Conclusion

This paper highlights the role of small business supports (alongside capital grants and tax relief) that targeted exporting start-ups since the late 1950s and created a traditional Home or a US dominated exporting base within all 4-digit industries during the last decades of protectionism. In their concept of industrial policy formulated in the late 1950s, Lemass and Whitaker wanted to create an exporting base from new capital and locate it outside the traditional Dublin hub. This policy realised that the capabilities in industrial products cultured under protectionism, was low, and a shakeout would be imminent. As modelled in Sutton (2007), when quality matters and is an outcome of many years of product specific sunk cost expenditures, no level of wage adjustment can compensate for poor levels of productivity and quality. They understand that capital cultured under protectionism may not be so mobile or adaptable. Industrial policy

aggressively promoted *de novo* export companies (including FDI) over import competing incumbents. The collapse of traditional non-exporting plants is shown to be very severe. These plants did not switch into exporting, but rather were gradually phased out. Eventually, the losses were more than recuperated by exporting activities outside the traditional hub after 1987.

Lemass and Whitaker not only anticipated the shakeout of traditional import competing manufacturing plants but they understood that export growth would not happen, no matter how great the financial incentives, if a location could not offer core capabilities to exporting plants via small business supports. They understood that relationship between non-exporting and exporting plants could become vertical and were aware of these opportunities that were presented in Hirschmann (1958). To understand how exporting *incentives* and *supports* interplay we focus on the nature of the intra-industry linkages between exporting and *de novo* non-exporting plants within narrowly defined manufacturing sectors. This paper tested for the role that backward linkages played in determining firm entry, growth and survival within sectors. There is little evidence of vertical backward linkages but we find some evidence of horizontal backward linkages between exporters in the same industry. Our main focus is on the existence of *vertical* forward linkages within industries. We empirically investigate the hypothesis that supplies and innovations by small indigenous suppliers of intermediate inputs are of paramount importance to the performance of exporting plants in US and Home industries. The capabilities approach of Sutton (2007) and the creative destruction model of Aghion and Howitt (1992) have the feature that product specific quality innovations are central to endogenous growth.

Ongoing *vertical* waves of creative destruction in *de novo* non-exporting plants are shown to support export entry, growth and survival within sectors. Ongoing innovation in supply chains puts the state of Ireland's human capital and technology central to the successful building up of an export oriented industrial base. Local supply side capabilities are needed to exploit the opportunities offered by trade liberalization. This aspect of Ireland's industrial policy is highlighted in this paper.

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Table 1 **: Data Summary**

Annual Employment Panel Survey carried out by Forfás over the period 1972 to 2003, covering all manufacturing companies.
Plant Throughput: 27,407 plants.
Employment: Number of permanent staff at the plant level
Sectors: 4-digit NACE 1993 REV.1 (Nomenclature of Economic Activities in the European Union).
Ownership Dummies: Endpoint Majority (>50%) Ownership. Four types Irish, UK, US and other Foreign.
US Industries (US Dummy): =1, if the majority (>50%) of jobs in a 4-digit sector are US owned between 1972-2003 (43 sectors) and zero otherwise (58 sectors).
Start-up date: Actual Year of Incorporation.
Start-up size: For entry post 1972 employment in the first year and for entry pre 1972 employment in 1972**.**
Export Dummy: Exporting Plant =1 if the plant exports any amount using the Annual Expenditure Survey 1983-2003, zero otherwise. For incumbent plants in 1972 and new entrants during 1972-1982 that exited before 1983, with > 19 employees, we tagged using grant information. Exporting is treated as a fixed effect for the period 1972-2003 to control for pre-selection effects.
Traditional Firm Dummy: Traditional Plant = 1 if born before 1973, zero otherwise.
Region Dummies: Dublin, South, Border, Midlands and West regions.
Dublin Employment Dummy: Dublin Employment Dummy=1 if majority (comparing the other areas) of jobs in a 4-digit sector come from Dublin.
West Employment Dummy: West Employment Dummy=1 if majority (comparing the other areas) of jobs in a 4-digit sector come from west area.
Plant Turnover Rate: Plant Turnover Rate induced by all entry and exit in each year.

***Table 2*: Sector Share of Total Employment in 2003**

Nace	Description of Sectors	Share
	HOME INDUSTRIES	
1500	food products	0.32%
1511	Production and preserving of meat	4.76%
1512	production And preserving of Poultry meat	0.04%
1513	Production of meat and poultrymeat products	0.61%
1520	Processing and preserving of fish and fish products	1.05%
1533	Processing and preserving of fruit and vegetables n.e.c.	0.91%
1551	Operation of dairies and cheese making	4.64%
1561	grain mill products	0.79%
1571	prepared feeds for farm animals	0.94%
1581	bread; fresh pastry goods and cakes	2.50%
1598	Production of mineral waters and soft drinks	1.32%
1722	Woollen-type weaving	0.90%
1740	made-up textile articles except apparel	1.06%
1754	other textiles n.e.c.	0.25%
1820	other wearing apparel and accessories	4.42%
1822	other outerwear	0.71%
1910	Tanning and dressing of leather	0.47%
1920	luggage handbags and the like saddlery and harness	0.14%
1930	footwear	0.98%
2010	Sawmilling and planing of wood; impregnation of wood	0.95%
2030	Builders carpentry and joinery	1.05%
2040	wooden containers	0.12%
2051	other products of wood	0.37%
2112	paper and paperboard	0.93%
2125	other articles of paper and paperboard n.e.c.	0.16%
2213	Publishing of journals and periodicals	1.33%
2222	Printing n.e.c.	2.86%
2224	Composition and plate-making	0.16%
2320	refined petroleum products	0.14%
2420	pesticides and other agro-chemical products	0.51%
2524	other plastic products	2.52%
2610	glass and glass products	1.47%
2611	flat glass	0.09%
2621	ceramic household and ornamental articles	0.50%
2640	bricks tiles and construction products in baked clay	0.40%
2651	cement	0.33%
2661	concrete products for construction purposes	2.43%
2670	Cutting shaping and finishing of stone	0.48%
2682	other non-metallic mineral products n.e.c.	0.56%
2743	Lead zinc and tin production	0.08%
2800	Manufacture of Fabricated Metal Products, Except Machinery and Equipment	0.08%

2811	metal structures and parts of structures	1.52%
2812	Builders carpentry and joinery of metal	0.30%
2822	central heating radiators and boilers	0.22%
2851	Treatment and coating of metals	0.09%
2862	tools	0.25%
2870	other fabricated metal products	0.11%
2873	wire products	0.20%
2875	other fabricated metal products n.e.c.	4.07%
2920	other general purpose machinery	0.15%
2932	other agricultural and forestry machinery	0.66%
3410	motor vehicles	0.86%
3420	bodies (coachwork) for motor vehicles; trailers and semi-trailers	0.35%
3511	Building and repairing of ships	0.55%
3610	Manufacture of Furniture	0.11%
3612	office and shop furniture	0.24%
3614	other furniture	1.98%
3663	Other manufacturing n.e.c.	0.78%

US INDUSTRIES

1583	Sugar	0.77%
1584	cocoa; chocolate and sugar confectionery	1.37%
1589	other food products n.e.c.	1.27%
1591	distilled potable alcoholic beverages	0.64%
1594	cider and other fruit wines	0.02%
1596	Beer	1.56%
1600	tobacco products	0.76%
1710	Preparation and spinning of textile fibres	0.12%
1711	Preparation and spinning of cotton-type fibres	0.56%
1751	carpets and rugs	0.85%
1772	knitted and crocheted pullovers cardigans and similar articles	1.69%
1823	Underwear	0.44%
2020	veneer sheets; plywood laminboard particle board fibre board and other panels an	0.28%
2415	fertilizers and nitrogen compounds	0.53%
2430	paints varnishes and similar coatings printing ink and mastics	0.43%
2442	pharmaceutical preparations	3.65%
2452	perfumes and toilet preparations	0.75%
2466	other chemical products n.e.c.	1.12%
2470	man-made fibres	0.66%
2513	other rubber products	0.81%
2681	Production of abrasive products	0.16%
2710	basic iron and steel and of ferro-alloys (ECSC)1	0.07%
2840	Forging pressing stamping and roll forming of metal; powder metallurgy	0.28%
2924	other general purpose machinery n.e.c.	1.38%
2952	machinery for mining quarrying and construction	0.61%

2953	machinery for food beverage and tobacco processing	0.39%
2956	other special purpose machinery n.e.c.	0.26%
2971	electric domestic appliances	1.15%
3002	computers and other information processing equipment	4.37%
3110	electric motors generators and transformers	1.20%
3130	insulated wire and cable	0.95%
3150	lighting equipment and electric lamps	0.36%
3162	other electrical equipment n.e.c.	1.46%
3220	television and radio transmitters and apparatus for line telephony and line tele	1.82%
3230	television and radio receivers sound or video recording or reproducing apparatus	0.82%
3310	medical and surgical equipment and orthopaedic appliances	3.41%
3320	instruments and appliances for measuring checking testing navigating and other p	0.89%
3340	optical instruments and photographic equipment	0.69%
3430	parts and accessories for motor vehicles and their engines	2.70%
3530	aircraft and spacecraft	1.29%
3622	jewellery and related articles n.e.c.	0.47%
3650	games and toys	0.33%
3662	brooms and brushes	0.16%

Table 3: **Summary Statistics of the Data**

	HOME INDUSTRIES				US INDUSTRIES			
	Plant Numbers	**Mean Employment**	**Mean Growth**	**Mean Age**	**Plant Numbers**	**Mean Employment**	**Mean Growth**	**Mean Age**
1973-1979								
Total	**3776**	**39**	**0.012**	**7.6**	**989**	**72**	**0.043**	**8.7**
Exporting	**597**	**86**	**0.043**	**15.2**	**299**	**155**	**0.066**	**11.8**
Irish Traditional	388	91	0.016	28	70	**74**	0.010	21.8
Irish *De Novo*	112	40	0.452	2.5	25	59	0.085	2.4
FDI Traditional	72	139	0.011	17.5	121	257	0.015	18.6
FDI *De Novo*	25	71	0.190	2.3	82	100	0.618	2.5
Non-Exporting	**3179**	**30**	**-0.003**	**4.4**	**691**	**36**	**-0.001**	**5.8**
Irish Traditional	2271	30	-0.029	17.7	407	30	-0.061	8.4
Irish *De Novo*	657	12	0.440	2.2	146	18	0.291	2.3
FDI Traditional	182	92	-0.069	14.3	89	85	-0.048	18.1
FDI *De Novo*	70	48	0.308	2.3	49	43	0.556	2.5
1980-1987								
Total	**4946**	**25**	**-0.045**	**6.9**	**1553**	**53**	**-0.001**	**7.5**
Exporting	**902**	**66**	**0.004**	**12.9**	**523**	**125**	**0.022**	**11.3**
Irish Traditional	377	83	-0.038	35.7	69	75	-0.022	29.3
Irish *De Novo*	364	36	0.103	5.8	104	33	0.106	5.1
FDI Traditional	70	119	-0.058	24.8	119	251	-0.028	25.8
FDI *De Novo*	91	77	0.112	5.4	231	118	0.081	6.3
Non-Exporting	**4044**	**16**	**-0.088**	**5.4**	**1030**	**17**	**-0.080**	**5.2**
Irish Traditional	1579	24	-0.122	25.2	269	20	-0.147	15.7
Irish *De Novo*	2281	8	0.030	4.9	605	8	0.043	4.3
FDI Traditional	78	75	-0.209	21.6	48	61	-0.206	26.7
FDI *De Novo*	107	29	-0.121	4.9	107	39	-0.037	5.3
1988-1997								
Total	**4619**	**23**	**0.003**	**10.9**	**1796**	**54**	**0.036**	**10.7**
Exporting	**1145**	**57**	**0.018**	**15.4**	**721**	**119**	**0.041**	**14.4**
Irish Traditional	331	76	-0.011	44.6	60	77	-0.004	38.3
Irish *De Novo*	631	41	0.064	10.3	217	40	0.083	9.2
FDI Traditional	47	103	-0.043	32.8	109	234	-0.017	34
FDI *De Novo*	136	74	0.014	10.1	335	141	0.070	11.1
Non-Exporting	**3473**	**11**	**-0.022**	**9.3**	**1075**	**11**	**-0.004**	**8.1**
Irish Traditional	883	19	-0.050	35.2	135	13	-0.105	23.8
Irish *De Novo*	2480	8	0.011	9	822	7	0.010	7.5
FDI Traditional	28	47	-0.082	27	26	35	-0.047	39.4
FDI *De Novo*	83	19	-0.062	9.4	93	37	0.035	9
1998-2003								
Total	**4145**	**27**	**-0.006**	**15.5**	**1819**	**67**	**0.001**	**14.1**
Exporting	**1218**	**59**	**-0.013**	**19.6**	**822**	**132**	**-0.005**	**17.6**
Irish Traditional	296	75	-0.033	52.3	54	76	-0.035	46.2
Irish *De Novo*	747	47	0.008	15.1	300	42	0.006	12.7
FDI Traditional	34	103	-0.042	40.8	95	218	-0.028	41.3
FDI *De Novo*	141	74	-0.028	15.2	374	191	0.002	15.1
Non-Exporting	**2927**	**13**	**0.006**	**13.7**	**997**	**14**	**0.035**	**11.2**
Irish Traditional	615	22	-0.022	44.2	82	12	-0.041	25.6
Irish *De Novo*	2243	11	0.026	13.4	811	9	0.054	10.8
FDI Traditional	16	52	-0.049	37.1	18	32	-0.132	46.3
FDI *De Novo*	54	19	-0.018	13.4	87	56	0.040	10.9

***Table 4*: Employment Structure of Home and US Industries: Dublin, BMW and South.**

	1972	1987	1997	2000	2003
WITHIN TRADITIONAL 4-DIGIT INDUSTRIES					
OVERALL EMPLOYMENT	140084	106548	109323	113540	105421
Dublin %	**36**	**26**	**23**	**22**	**21**
Traditional Exporters %	*11*	*10*	*8*	*7*	*6*
De novo Exporters %		*5*	*7*	*7*	*6*
Traditional Non-Exporters %	*25*	*7*	*3*	*3*	*3*
De novo Non-Exporters %		*4*	*5*	*5*	*5*
BMW and South %	**64**	**74**	**77**	**78**	**79**
Traditional Exporters %	*19*	*21*	*18*	*16*	*16*
De novo Exporters %		*20*	*33*	*34*	*35*
Traditional Non-Exporters %	*45*	*17*	*11*	*10*	*10*
De novo Non-Exporters %		*16*	*16*	*17*	*19*
WITHIN US -DIGIT INDUSTRIES					
OVERALL EMPLOYMENT	60559	81133	115757	131450	115469
Dublin %	**48**	**29**	**23**	**25**	**22**
Traditional Exporters %	*30*	*16*	*9*	*9*	*9*
De novo Exporters %		*7*	*11*	*10*	*9*
Traditional Non-Exporters %	*18*	*3*	*1*	*1*	*0.5*
De novo Non-Exporters %		*2*	*2*	*5*	*3*
BMW and South %	**52**	**71**	**77**	**75**	**78**
Traditional Exporters %	*29*	*21*	*14*	*11*	*10*
De novo Exporters %		*39*	*56*	*57*	*58*
Traditional Non-Exporters %	*22*	*23*	*1*	*1*	*0.5*
De novo Non-Exporters %		*8*	*7*	*7*	*9*

Table 5 : **Job Flows in Home and US industries:**
Net Employment Growth, Reallocation Rates, % of Turnover that is Inter- and Intra-sector (and by default, that is due to the net cycle)

	Home Industries				US Industries			
Year	**NET**	**REALLOC**	**% INTER**	**% INTRA**	**NET**	**REALLOC**	**% INTER**	**% INTRA**
1973	7.4	5.7	2.4	41.3	9.1	4.0	9.5	25.0
1974	1.6	10.7	45.1	52.9	1.2	13.0	45.3	48.0
1975	-4.3	11.6	8.6	62.3	-1.1	17.1	42.0	51.0
1976	0.1	16.3	35.2	64.6	4.1	13.9	36.4	40.6
1977	1.8	15.5	19.2	69.6	5.8	11.8	18.5	48.9
1978	1.8	12.4	15.3	70.1	5.1	10.6	23.6	41.8
1979	2.9	12.8	19.0	64.3	6.8	9.2	11.2	45.9
1980	-5.3	13.6	9.7	62.6	1.9	16.2	40.0	48.2
1981	-3.0	15.8	20.1	62.2	1.3	14.3	38.3	53.8
1982	-4.6	12.9	7.2	64.0	0.6	15.5	35.3	59.9
1983	-6.6	13.9	9.4	56.0	-2.9	16.7	25.6	59.5
1984	-2.6	17.2	22.8	61.2	0.0	18.7	39.5	59.9
1985	-3.4	16.0	18.8	61.3	-1.3	15.5	32.8	58.8
1986	-3.1	17.2	10.6	71.4	0.2	14.1	34.7	64.4
1987	-4.2	16.5	15.2	62.0	-0.6	14.0	32.7	62.9
1988	-1.0	18.3	24.8	68.1	4.1	11.2	21.5	51.9
1989	0.9	18.2	31.4	64.5	4.7	10.6	18.6	49.6
1990	0.7	15.7	27.7	67.7	2.7	14.3	18.6	64.2
1991	-2.2	15.5	23.2	65.0	1.5	13.7	26.5	63.2
1992	-1.9	15.4	18.0	70.2	1.4	13.9	24.3	66.2
1993	-1.4	15.2	22.4	68.4	2.2	13.8	20.7	65.0
1994	1.5	14.1	19.4	71.4	2.9	13.9	22.8	59.5
1995	2.0	14.1	23.7	63.5	5.4	11.5	21.4	46.2
1996	1.8	14.1	24.5	63.7	4.3	12.6	29.3	44.4
1997	2.6	13.0	22.1	60.7	5.3	10.3	22.4	42.8
1998	1.7	13.5	21.8	66.8	2.6	13.9	21.6	61.6
1999	0.9	15.9	33.8	60.7	5.8	14.1	32.4	53.3
2000	1.1	16.0	34.2	59.2	7.2	12.0	19.5	42.3
2001	-1.7	14.0	26.9	62.3	-5.2	15.0	32.6	43.6
2002	-3.0	14.6	22.0	60.7	-4.1	13.3	23.5	52.3
2003	-2.6	13.7	25.3	58.2	-3.7	11.4	22.5	51.4

Table 6: **Home and US Industries Flows**

Home, Yearly Average	**1973-1979**	**1980-1987**	**1988-1997**	**1998-2003**
OVERALL				
Job Creation Rate	8.0	7.7	8.6	7.9
Job Destruction Rate	7.3	11.8	8.3	8.5
Net	***0.7***	***-4.1***	***0.3***	***-0.6***
EXPORTERS BY FIRM TYPE				
Traditional Exporters Job Creation Rate	1.6	1.1	1.3	1
Traditional Exporters Job Destruction Rate	1.3	2.4	1.8	1.8
Traditional Exporters Net	***0.3***	***-1.3***	***-0.5***	***-0.8***
De novo Exporters Job Creation Rate	1.0	2.4	3.7	3.4
De novo Exporters Job Destruction Rate	0.2	0.9	2.0	3.4
De Novo Exporters Net	***0.9***	***1.5***	***1.6***	***0.0***
NON-EXPORTERS BY FIRM TYPE				
Traditional Non-Exporters Job Creation Rate	2.9	1.1	0.7	0.7
Traditional Non-Exporters Job Destruction Rate	5.2	5.6	1.7	1.0
Traditional Non-Exporters Net	***-2.4***	***-4.5***	***-1.0***	***-0.3***
De novo Non-Exporters Job Creation Rate	2.5	3.1	2.9	2.7
De novo Non-Exporters Job Destruction Rate	0.6	2.9	2.8	2.2
De Novo Non-Exporters Net	***1.9***	***0.2***	***0.1***	***0.5***
US, Yearly Average	**1973-1979**	**1980-1987**	**1988-1997**	**1998-2003**
OVERALL				
Job Creation Rate	10.3	8.3	9.8	8.5
Job Destruction Rate	6.5	8.4	6.3	9.2
Net	***3.6***	***-0.1***	***3.5***	***-0.6***
EXPORTERS BY FIRM TYPE				
Traditional Exporters Job Creation Rate	3.0	1.3	1.3	0.9
Traditional Exporters Job Destruction Rate	2.2	2.5	1.7	1.4
Traditional Exporters Net	**0.7**	***-1.1***	***-0.4***	***-0.5***
De novo Exporters Job Creation Rate	3.9	4.6	6.7	5.8
De novo Exporters Job Destruction Rate	0.3	1.8	2.7	6.3
De Novo Exporters Net	***3.6***	***2.8***	***4.0***	***-0.5***
NON-EXPORTERS BY FIRM TYPE				
Traditional Non-Exporters Job Creation Rate	1.4	0.3	0.1	0.0
Traditional Non-Exporters Job Destruction Rate	2.9	2.1	0.4	0.2
Traditional Non-Exporters Net	***-1.5***	***-1.8***	***-0.3***	***-0.1***
De novo Non-Exporters Job Creation Rate	2.0	2.1	1.6	1.8
De novo Non-Exporters Contraction Rate	0.5	2.0	1.5	1.4
De Novo Non-Exporters Net	***1.3***	***0.1***	***0.1***	***0.5***

***Table 7(i)*: Plant Numbers by Firm Type**

	Traditional Non-Export	***De novo* Non-Export**	**Traditional Export**	***De novo* Export**	**Total**
1973	3,316	254	653	75	4,298
1974	3,213	444	652	25	4,434
1975	3,078	585	650	166	4,479
1976	2,947	775	651	219	4,592
1977	2,808	1,131	650	301	4,890
1978	2,691	1,449	651	380	5,171
1979	2,585	1,812	651	448	5,496
1980	2,479	2,194	651	525	5,849
1981	2,335	2,554	651	613	6,153
1982	2,189	2,820	650	671	6,330
1983	2,025	3,017	645	736	6,423
1984	1,886	3,307	638	827	6,658
1985	1,757	3,536	625	917	6,835
1986	1,606	3,630	617	988	6,841
1987	1,510	3,746	598	1,049	6,903
1988	1,397	3,747	588	1,111	6,843
1989	1,306	3,733	576	1,163	6,778
1990	1,221	3,653	564	1,221	6,659
1991	1,146	3,554	555	1,246	6,501
1992	1,089	3,411	547	1,301	6,348
1993	1,014	3,391	539	1,344	6,288
1994	957	3,345	534	1,385	6,221
1995	903	3,336	529	1,433	6,201
1996	868	3,313	521	1,477	6,179
1997	818	3,284	514	1,516	6,132
1998	790	3,264	507	1,583	6,144
1999	776	3,260	497	1,584	6,117
2000	753	3,254	486	1,591	6,084
2001	724	3,174	473	1,572	5,943
2002	679	3,112	461	1,542	5,794
2003	656	3,102	445	1,497	5,700

***Table 7(ii)*: Plant Turnover Rate by Firm Type**

year	Total Turnover	Traditional Non-Export	*De novo* Non-Export	Traditional Export	*De novo* Export
1973	0.088	19.3%	65.4%	0.3%	15.0%
1974	0.085	28.8%	58.4%	0.3%	12.5%
1975	0.086	35.0%	56.1%	0.3%	8.6%
1976	0.099	32.1%	57.5%	0.0%	10.4%
1977	0.134	23.6%	65.3%	0.0%	11.1%
1978	0.124	20.1%	68.8%	0.0%	11.0%
1979	0.122	17.6%	73.8%	0.0%	8.6%
1980	0.126	16.3%	73.9%	0.0%	9.8%
1981	0.144	18.2%	72.1%	0.0%	9.7%
1982	0.123	20.4%	72.8%	0.0%	6.8%
1983	0.139	20.4%	73.3%	0.6%	5.7%
1984	0.150	15.2%	77.0%	0.8%	7.0%
1985	0.171	12.8%	77.6%	1.3%	8.4%
1986	0.175	14.0%	77.9%	0.7%	7.4%
1987	0.156	10.1%	80.0%	2.1%	7.8%
1988	0.168	11.0%	81.6%	1.0%	6.4%
1989	0.136	11.1%	80.4%	1.5%	7.0%
1990	0.115	11.8%	76.3%	1.8%	10.0%
1991	0.118	10.9%	82.2%	1.2%	5.7%
1992	0.119	8.9%	79.0%	1.2%	10.9%
1993	0.128	10.9%	79.7%	1.2%	8.2%
1994	0.096	11.2%	75.8%	1.0%	12.0%
1995	0.112	9.3%	79.0%	0.9%	10.8%
1996	0.092	7.5%	77.8%	1.1%	13.5%
1997	0.097	9.9%	74.8%	1.0%	14.3%
1998	0.080	7.3%	73.8%	1.0%	17.9%
1999	0.058	4.9%	72.9%	2.5%	19.7%
2000	0.078	5.8%	78.2%	2.1%	13.9%
2001	0.078	8.0%	72.4%	2.9%	16.6%
2002	0.088	10.2%	71.8%	1.9%	16.1%
2003	0.062	7.8%	70.8%	4.6%	16.7%

Table 8 **Empirical Results for the Backward Linkages from Exporter presence in a sector to plant level Growth, Survival, and Entry of Non – exporters, Exporters, and All Plants in the Manufacturing.**

	All Plants in Both Home and US			Home			US		
	Growth	**Survival**	**Entry**	**Growth**	**Survival**	**Entry**	**Growth**	**Survival**	**Entry**
Export Linkages All Plants	-0.503* (0.149)	-0.239* (0.081)	-0.061 (0.413)	0.794 (3.535)	0.130 (0.844)	1.181 (1.777)	-0.237* (0.108)	-0.084* (0.068)	-0.263 (0.433)
	Rho=0.9535 Lambda=1.9477 No.Obs=159,653 (C=9,907;U=149,746)			Rho=0.9901 Lambda=4.5395 No.Obs=118,200 (C=6，761;U=111,439)			Rho=0.3536 Lambda=0.3508 No.Obs=41,453 (C=3,146;U=38,307)		
Export Linkages Non-Exporters	-0.160* (0.047)	-0.090* (0.031)	0.038 (0.114)	0.324 (4.525)	0.012 (1.254)	0.557 (0.705)	-0.077* (0.038)	-0.066* (0.031)	-0.038 (0.987)
	Rho=0.8997 Lambda=1.2980 No.Obs=121,928 (C=8,406;U=113,522)			Rho=0.9969 Lambda=4.5395 No.Obs=95,731 (C=5,986;U=89,745)			Rho=0.7271 Lambda=0.7569 No.Obs=26,197 (C=2,420;U=23,777)		
Export Linkages Exporters	-0.0619 (0.048)	0.008 (0.043)	0.721* (0.214)	-0.095 (0.059)	0.108* (0.037)	2.028* (0.551)	-0.038 (0.065)	-0.023 (0.052)	0.500* (0.208)
	Rho=0.0997 Lambda=0.0989 No.Obs=37,710 (C=1,486;U=36,224)			Rho=0.0378 Lambda=0.0359 No.Obs=22,462 (C=768;U=21,694)			Rho=0.0810 Lambda=0.0840 No.Obs=15,248 (C=718;U=14,530)		

Table 9 **Empirical Results for the Backward Linkages from *De-Novo* Non-Exporter presence in a sector to plant level Growth, Survival, and Entry of Non – exporters, Exporters, and All Plants in the Manufacturing.**

	All Plants in Both Home and US			**Home**			**US**		
	Growth	**Survival**	**Entry**	**Growth**	**Survival**	**Entry**	**Growth**	**Survival**	**Entry**
Export Linkages All Plants	10.031 (93.731)	2.645 (24.932)	2.172* (1.329)	0.120 (3.577)	0.027 (0.727)	2.161 (2.227)	1.150* (0.534)	1.031* (0.391)	2.259* (1.658)
	Rho=0.9707 Lambda=2.456 No.Obs=159,653 (C=9,907;U=149,746)			Rho=0.9827 Lambda=2.746 No.Obs=118,200 (C=6,761;U=111,439)			Rho=0.4960 Lambda=0.4857 No.Obs=41,453 (C=3,146;U=38,307)		
Export Linkages Exporters	0.432* (0.122)	0.210* (0.089)	2.917* (0.452)	0.306* (0.134)	0.182* (0.103)	3.088* (0.806)	0.608* (0.162)	0.254* (0.169)	2.873* (0.478)
	Rho=0.0999 Lambda=0.0984 No.Obs=37,710 (C=1,486;U=36,224)			Rho=0.0414 Lambda=0.039 No.Obs=22,462 (C=768;U=21,694)			Rho=0.0638 Lambda=0.0653 No.Obs=15,248 (C=718;U=14,530)		
Export Linkages Non - exporters	0.591* (0.217)	0.769* (0.253)	-3.041 (2.050)	9.635* (3.193)	1.757 (3.183)	-5.966 (4.177)	0.377 (0.404)	0.749* (0.330)	-1.511 (1.827)
	Rho=0.7879 Lambda=0.8904 No.Obs= 121,929 (C=8,406;U=113,522)			Rho=0.9961 Lambda=4.4120 No.Obs=95,731 (C=5,986;U=89,745)			Rho=0.7279 Lambda=0.7585 No.Obs=26,197 (C=2,420;U=23,777)		

***Figure1*: Evolution of Manufacturing Employment**

***Figure 2*: Exports Share of Gross Output in Manufacturing**

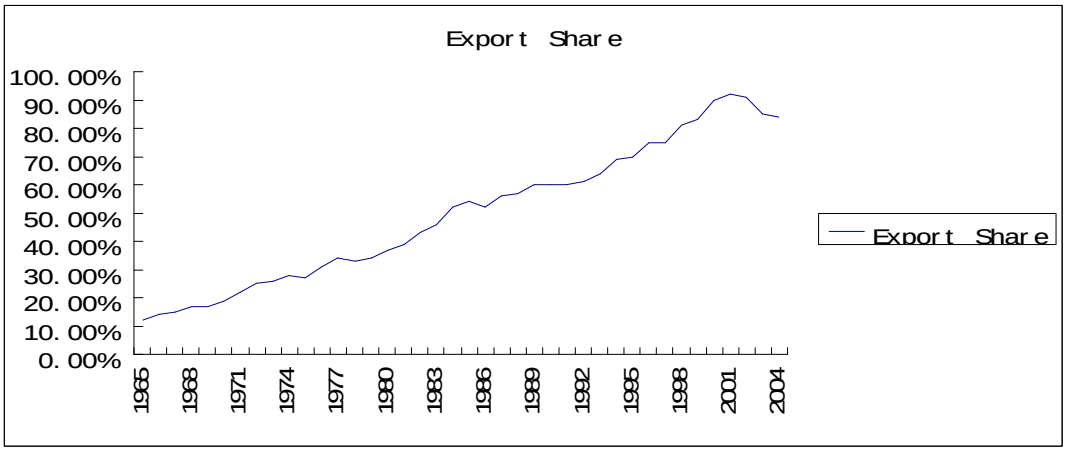


***Figure 3*: Labour Productivity (Output per Worker)**

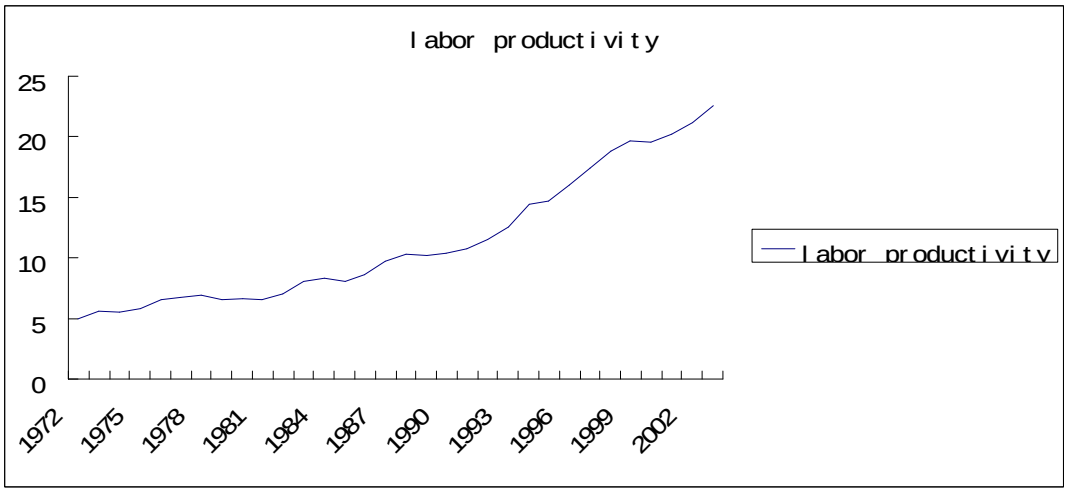
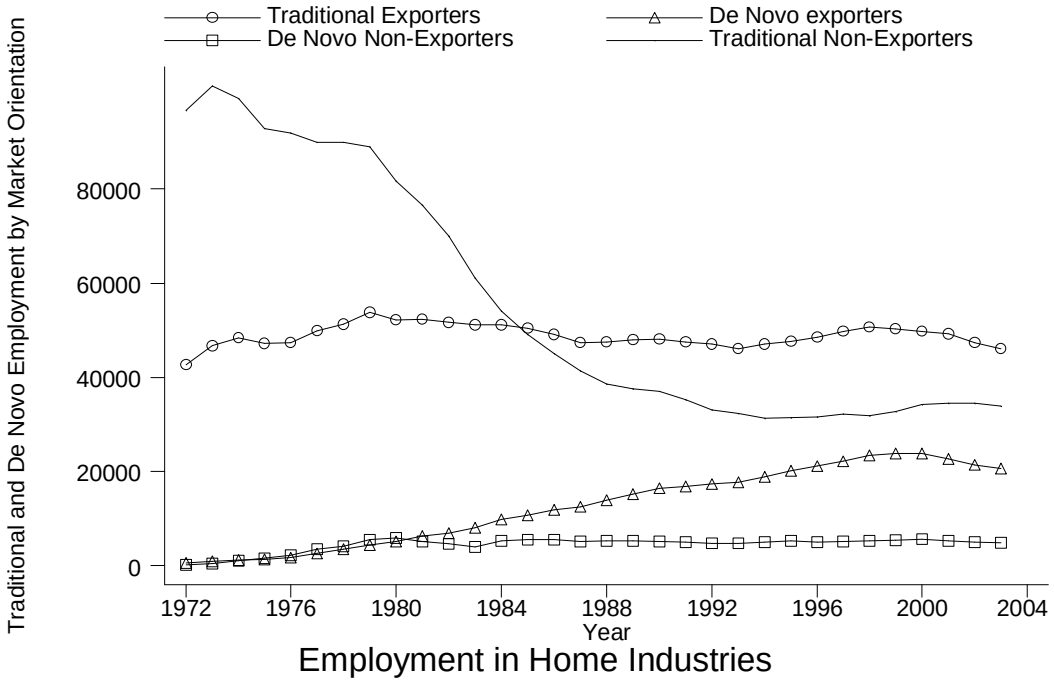


***Figure 4*: Evolution of Employment by Trade Orientation**

(i) Home Industries



(ii) – US Industries

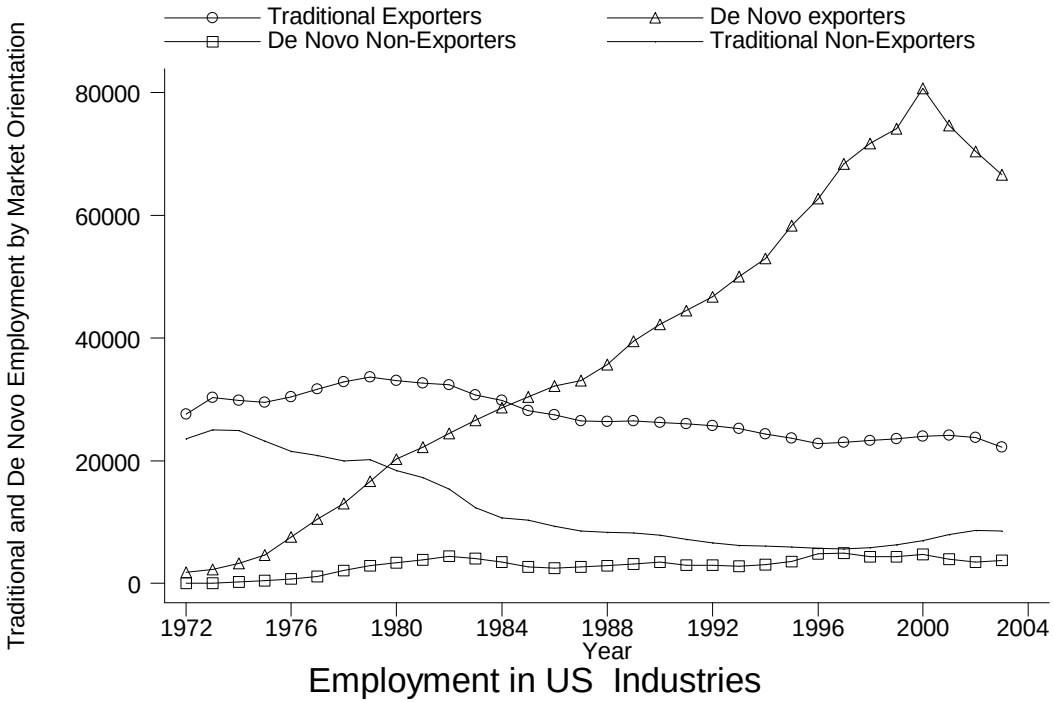
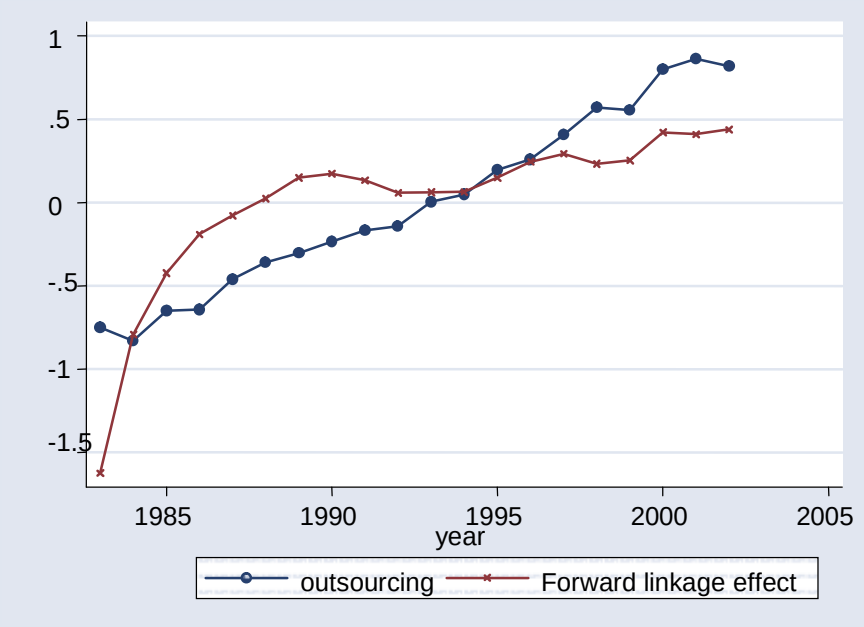
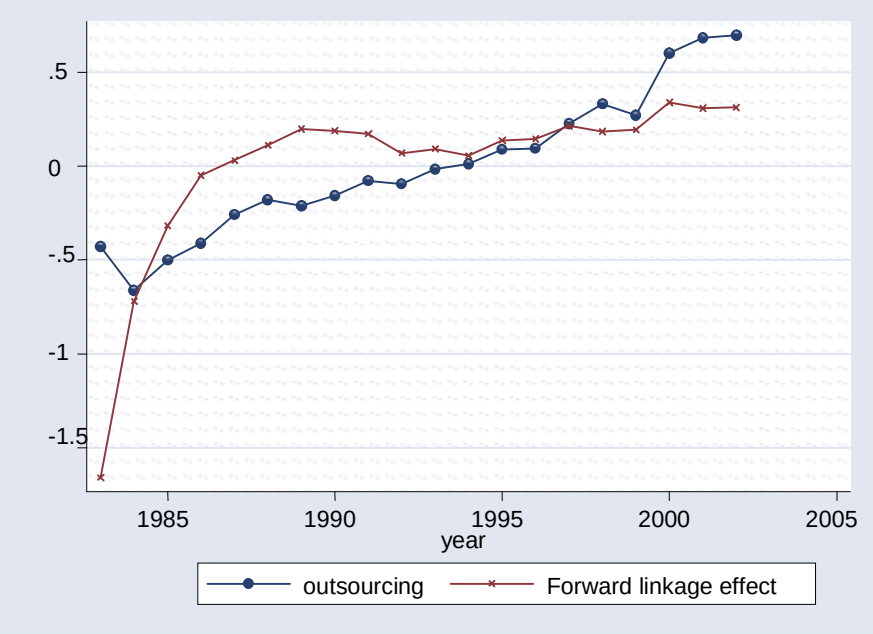


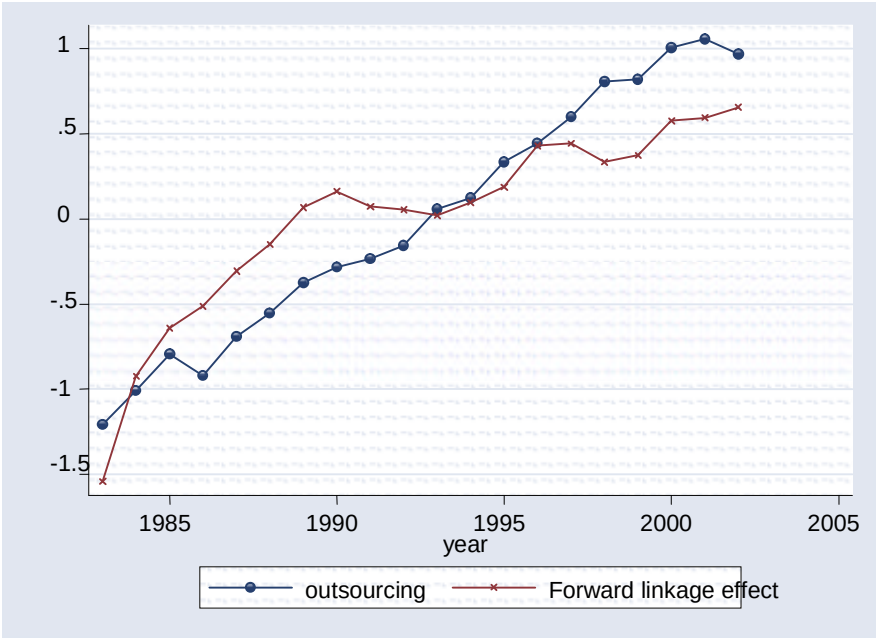
***Figure 5*: Irish Outsourcing and Forward linkages effect (in log)**
(i) Overall



(ii) Home



(iii) US


1
.5
0
-.5
-1
-1.5
1985
1990
1995
2000
2005
year
outsourcing
Forward linkage effect