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ABSTRACT

Jobless Growth through Creative Destruction: Ireland's Industrial Development Path 1972–2003*

We document the nature of structural changes in employment to understand "jobless" growth in Irish Manufacturing in the aftermath of EEC/EU membership, 1972-2003. By 1972, forty years of protectionism and fifteen years of export promotion induced the coexistence of large exporting plants with import competing plants within 4-digit industries. During trade liberalisation we document persistent horizontal waves of creative destruction, a decline in traditional import competing plants and an expansion in exporting plants, within each sector. This coexisted with rapid vertical waves of creative destruction in small non-exporting plants which supported exporting growth through forward vertical linkages within each sector.

JEL Classification: O30, L20

Keywords: manufacturing employment, structural change, trade liberalisation

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I. Introduction

By 1972, forty years of protectionism and fifteen years of export promotion in Ireland induced the co-existence of large exporting plants with import competing plants within 4-digit industries. With the entry of Ireland into the Anglo-Irish free Trade Agreement in 1966 and into the EEC/EU in 1973, the Irish economy moved away from import-substitution industrialisation towards high value added export oriented production. Jobless growth in manufacturing was anticipated. White (1983) highlighted the goal of the Industrial Development Agency (IDA) in the following: *"The IDA is therefore looking at a concept of industrial development which focuses on the output or income generating capacity of industry. In this concept the role of industry is to generate the maximum possible output and wealth in highly productive enterprises while the main employment benefits are generated and captured outside the manufacturing entities themselves"*.[1]

In this paper we are more interested in the nature of structural change that took place in Irish manufacturing employment over the 1972-2003 period. Over this period of analysis we document persistent horizontal waves of creative destruction in plants: a decline in traditional import competing plants and an expansion in exporting plants, within each sector. Walsh and Whelan (2000) highlight the importance of inherited market orientation within sectors for the evolution of employment in manufacturing – job creation from export growth built on patterns of exports and FDI created by government policies pre-trade liberalisation, while the simultaneous job destruction occurred as a

[1]IDA Director P.A. White (1983) reflects on the first ten year of employment effects of Industrial Policy: *"While there were significant regional changes in manufacturing employment, net manufacturing employment over the entire period increased by 28,000 nationally. This masks the cyclical nature of manufacturing employment and the unprecedented rate of change within industry; thus 92,000 industrial jobs existed in 1981 which were not in existence in 1973 and 81,000 jobs which existed in 1973 were no longer there eight years later (IDA Employment Survey). But the jobs created in the manufacturing enterprise itself are only part of the employment generated by rising output in industry. The expansion of industrial output by 62 per cent and agricultural output by 26 per cent over the decade generated wealth to support approximately 100,000 (IDA Estimate) additional jobs outside their own sectors over the period. Based on input/output data, the IDA estimates that about 75,000 of these jobs can be attributed to wealth generation deriving from manufacturing The indirect income and employment effects of manufacturing activity are thus of outstanding significance"*.

result of the phasing out of import substituting industry created under the old protectionist regime.[2]

This paper examines the role of intra-industry linkages between exporting and *de novo* non-exporting within 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).[3] *Vertical* backward linkages have been less well documented. 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 (for example, in the case that multinationals help their suppliers set up their production facilities to improve the quality of their supplies Lall 1980), 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 find little evidence for them.

The main thrust of this paper is to explore the possibility of *vertical* forward linkages within industries. We argue that innovations by small indigenous suppliers of intermediate inputs are of paramount importance to the performance of exporting firms. *Vertical* waves of creative destruction in *de novo* non-exporting plants are shown to support export growth within sectors. Motivated by the endogenous growth theory of Aghion and Howitt (1992), we show that plant-turnover in *de novo* non-exporting plants (inducing product specific innovations in intermediate goods) supported export growth within sectors, which in turn determined the overall sector performance.

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[2] 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 liberalization gradually expanded. This dualism, created by Government Policies pre-transition, and their subsequent dynamics created output trends.

[3] In the case of Ireland, 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).

II Industrial Policy, Data, and Employment

(i) Policy

Ireland in the 1950s had an industrial base that was cultured on import substitution industrialisation. This was accompanied by export tax incentives and capital grants to attract green field export oriented in new industries, and similar incentives for Irish owned export oriented start-ups.[4] An indigenous exporting base with a FDI presence was in place pre-1973 and its development since then has been governed by similar tax and grant incentives.

While grants by the Industrial Development Agency (IDA) in the run up to EC/EU membership targeted firms with plans to export, including multinationals, high tariff protection for four decades encouraged home-grown firms to concentrate on domestic sales.[5] The aim of import substitution industrialisation was to replace all imports by domestic production. Given the size of the market this led to the entry of many small and inefficient plants protected by trade policy.

By 1966, with reduction of tariffs under the Anglo-Irish Free Trade Area Agreement (AIFTA) in the first phase of trade liberalisation, there was the co-existence of a few large export oriented firms alongside many smaller import competing firms within each sector of manufacturing. McAleese (1971) conjectured that the outlook for import competing plants during the second stage of liberalisation, entry to the EC in 1973 with a phasing down in tariffs until their final abolition in 1978, was bleak.

[4] Tax relief on exports profits was first introduced in 1956. Dr. T. K. Whitaker in 1958 set out the rationale for an export oriented industrial policy. In 1959 the Encouragement of External Investment Act repealed all restrictions on foreign ownership and 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 facilities for exporting firms and "foster the national objective of regional industrial development". The IDA in its Regional Industrial Plan 1973-1977 and the Industrial Plans 1978-82 set out publicly its policies and targets.

[5] 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 the first stage of trade liberalisation was institutionalised in 1966 with the Anglo-Irish Free Trade Area Agreement (AIFTA), the average effective tariff level was nearly four times the level observed in trading partners. During AIFTA effective tariffs were reduced to levels that were twice as high as trading partners.

(ii) Manufacturing Outcomes 1972 – 2003

Figure 1 illustrates a U-shape in manufacturing employment over the period of analysis. From the final phase of trade liberalisation 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) and employment (figure 3) in manufacturing, alongside a persistent but gradual rise in labour productivity (figure 4). Many analysts of Irish Manufacturing explain the U-shape in manufacturing employment as an outcome of the collapse of indigenous manufacturing due to gradual import penetration since 1966 (see O'Malley 1989) and the gradual expansion of FDI plants over the same period (see Barry 1999), we wish to highlight the contribution of indigenous exporting plants and *de novo* small Irish non-exporting plants in driving outcomes.[6]

(iii) 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 from between 4,000 and 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; Regional Location (*Dublin, Border, Midlands, West 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

[6] Walsh and Whelan (2000) could not link trade to plant level performance due to a lack of trade data at the plant level. They did however, provide indirect evidence that 3-digit industry growth and firm turnover were linked to the gradual development of 6-digit exporting product clusters within industries.

all plants as *Exporting* if a plant has any exports over the survey period.[7] 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.[8] Exporting plants can also be classified as *UK Exporting* if the majority of exports go to the UK.

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.[9] There 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)[10]. See Table 2 for this taxonomy of 4-digit sectors.[11]

(iv) The Role of Exporting in Manufacturing Trends

Beneath the U-shape in manufacturing employment, Figures 5 and 6 illustrate the trends by trade orientation and firm type, for both *Home* and *US* industries. The collapse

[7] 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.

[8] 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.

[9] 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.

[10] 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.

[11] 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.

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 in Figure 5.

Within Home industries, the collapse of traditional non-exporting plants is very evident in figure 6 (i). These plants did not switch into exporting, but rather were phased out.[12] Even though 80,000 jobs were lost in traditional non-exporting plants, Home industries employment 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 6 (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 due to the loss of 80,000 jobs in traditional import competing plants and the generation of 80,000 jobs in *de novo* US FDI plants. We intend to show that *de novo* non-exporters clustered around exporting plants (Irish and US) to develop a world leader in manufacturing.

(v) Size, Growth, Survival and Location Characteristics of the Data

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 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 and bigger in employment size compared with non-exporting plants. On average, exporting plants have positive growth in each and every period since 1972.

[12] 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 into designated areas. Finally, we will document a large inter-industry reallocation over time, suggesting that product lines were abandoned.

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) 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 exporting plants within the same industries. We test for such *vertical* linkages in our empirical section.

Table 4 describes the regional dimension of the data within Home and US industries. Meyler and Strobl (2000) detail the Regional Industrial Policy in Ireland back to the 1950s. 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, West, Midlands and other 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. We observe that most of the *de novo* activity of exporters and non-exporters has put jobs into BMW regions away from the Dublin Area (thus the location of traditional non-exporting plants and their demise is not related to these incentives). 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.

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.[13]

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. 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

[13] 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*. 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.

experience. Intra-sector structural change accounted for 55 per cent of the overall job turnover within US 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) *De Novo* Non-Exporting Plants

A key feature of this paper is the role that *de novo* non-exporters play in the performance of exporters within a sector, and hence sector growth. 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) decomposes total plant turnover by plant type and Table 7(ii) gives us the total plant numbers 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. The percentage of *de novo* non-exporting plant turnover attributable to inter- and intra-sector flows (and by default, the net cycle), is shown in Table 8. Most of this plant turnover is within sector (on average, 46% in Home and 43% in US industries).

(viii) Persistency in Employment Patterns within Sectors

We have seen that most of the turnover or structural change taking place in Irish manufacturing over the period 1972 through 2003 was intra-sector. In figure 7 we document the evolution of employment indexed to one in 1972 for each Home and US dominated 4-digit sector. What is surprising is the persistent rise or decline of most US and Home Industries, with no common business cycle exhibited. The exporting

endowment of industries drives persistency in employment patterns (flows) by trade orientation within sectors. Figure 8 illustrates the trends in employment share of exporting plants for each sector. Sectors with greater export orientation pre-1972 tended to be small but enjoyed employment growth in most periods up to 2003.

In Figure 9 we aggregate over 4-digit sectors generally rising and those declining over the 30 years. We see that the majority of jobs were reallocated across 4-digit industries. While intra-sector flows dominate annual job reallocation, taking 30 years of development persistency in net employment changes by sector induce *inter* sector dominance. Those sectors with a greater initial share of exporting come to dominate the declining sectors characterised by a small initial share of exporting.

(ix) A Summing Up

The story of Irish Manufacturing since the 1970s is far more than a simultaneous collapse of indigenous manufacturing in the face of trade liberalisation alongside the gradual expansion of 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.

Finally, while most of the structural change in Irish manufacturing was intra-sector (or in other words, most of the simultaneous expansion and contraction of plants, net of the cycle, took place within sectors), persistency in employment trends with sectors, either continually rising or declining over the period, has resulted in a big inter-sectoral shift, with those sectors having a bigger initial export share dominating.

In what follows we first empirically test for the presence of backward linkages within sectors, and whether the trade orientation of the sector determines firm growth and survival. Yet the main focus of the paper, as we empirically test for the presence of *vertical* forward linkages. As motivated in Aghion and Howitt (1992), we will show that plant-turnover in *de novo* non-exporting plants (inducing product specific innovations in immediate goods) supported export growth within sectors, which in turn determined the overall sector performance.

III EMPIRICAL ANALYSIS

i) Backward Linkages

We model the year-to-year employment growth rates of plants. The key plant level characteristics are initial start-up size, age, export orientation, ownership and grant agency region. We also control for export employment share of 4-digit sectors, 4-digit sectors and time dummies. The regressions are run on a split sample of plants across Home or US industries over the period 1973-2003.

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

$$g_{it} = f\left(Size_{ito}, Age_{it}, Export_{i}, Ownership_{i}, Exportsize_{st} \right) \quad (3)$$

where employment growth, g_{it}, as in equation (1) is a discrete measure of plant *i* growth that varies year to year with: employment size in year zero $Size_{ito}$, age over time $Age_{it.}$, export versus non-export dummy $Export_i$, ownership (Irish, UK, US or Other) $Ownership_i$, and dummies for grant agency region, 4-digit sectors and year dummies.[14] The employment size of exporting plants within a 4-digit sector $Exportsize_{st}$ controls for the presence of Exporters (Irish or US) within sectors. Do sectors with a bigger presence of exporting firms have a positive effect on the growth and/or survival of firms in that industry? This looks for evidence of backward linkages (*Horizontal* or *Vertical*) within sectors of Irish Manufacturing.[15]

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 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

[14] The results are similar if one uses a continuous measure of growth.
[15] We also looked for evidence of *Vertical* backward linkages only, by regressing the growth and survival of *non-exporting* plants on industry export size, amongst other factors. We find similar results.

maximum-likelihood estimation procedure. Our selection model is written down as the following:

$$
\begin{aligned}
Z_i &= f\left(Size_{ito}, Age_{it}, Export_i, Ownership_i, Exportsize_{st} \right) \\
Z_i &= 1 \;\; if \;\; fail_i \neq 1 \, from \, t_0 \\
Z_i &= 0 \;\; otherwise
\end{aligned}
\tag{4}
$$

The Heckman lambda is computed for each observation in the selected non-failing sample and the following regression models the contributions of our explanatory variables to the expected growth rate of non-failing plants:

$$
g_{it}\big|_{Z_i=1} = f\left(\; Size_{ito}, Age_{it}, Export_i, Ownership_i, Exportsize_{st} \quad \lambda_{it} \right) \tag{5}
$$

where λ_{it} is Heckman's lambda. Identification of the selection process needs instruments (or some other variables) to be significant in the selection equation but not in the conditional growth equation. We use the grant agency region dummies are used for identification of the selection process. Meyler and Strobl (2000) detail the Regional Industrial Policy in Ireland back to the 1950s. Start-up grants towards the cost of machinery and equipment and land and buildings (business parks) were higher in designated regions (Border, Midlands, West, and Southern Regions) up to 1982. Thereafter, strategic effects (non-grant incentives to cluster) of regional location were different. Killen and Ruane (1998) find that the survival rate is longer in designated regions, but performance is not significantly different from non-designated regions. Capital grants may attract plants and encourage them to survive, but do not induce higher performance. This is our IV strategy.

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.[16] 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

[16] 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.

firms.[17] 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 age.

In Table 9 we present the results for Home and US industries respectively, of the selection model and the expected non-failing employment growth model corrected for sample selection. The probability of plant survival is found to have an inverted U-shape in initial size and age. The inclusion of non-linearity in our explanatory variables avoids the criticism that the omitted variable we are controlling for is sample selection and not omitted non-linear forms in our relationships. The positive value of *rho* indicates that the correction process will offset the magnitude of the marginal effects of the explanatory variables previously estimated. The *Wald Test* is used to reject the reported employment growth model that assumes a random selection process.

Across Home industries the 4-digit *sector* exporting size does not affect plant growth or survival. Across US industries the 4-digit *sector* exporting size does not affect plant growth but does effect survival. Thus, there is weak empirical evidence of backward linkages in the data. While indirect effects from the presence of exporters are not found in the data, the direct effect of traditional or *de novo* plant exporting induces significant growth and survival prospects relative to non-exporting plants. Plant level exporting induces stronger survival and growth effects in US compared to Home industries.

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

Ownership is mainly Irish in Home industries, and while foreign plants grow more than Irish, they have lower survival rates when compared to Irish ownership. Compared to the Southern area a presence in a designated West region induces lower survival but not growth.

Ownership is mainly US in US industries, and US plants have better growth and survival prospects relative to other ownership types. Regions do not have an effect on growth and survival so identification comes from the impact of industry exporting on survival that is absence form the growth.

One problem with this type of regression is that the trade orientation dummy at the plant level could be picking out better plants through an endogenous selection process. Non-exporting plants with good growth and survival prospects select themselves into exporting and expand during trade liberalisation while non-exporting plants decline and exit in the face of import competition. This theory is formally written down in Bernard, Eaton, Jensen and Kortum (2000) and Melitz (1999). Bernard and Jensen (1999) find empirical support for the selection mechanism and little support for learning by exporting to explain why exporting plants are more productive than non-exporting plants. The issue for Ireland is different. We already described the nature of trade and industrial policy that created segmentation within each 4-digit industry by 1972. Plants cultured under high levels of protection and producing in a small market had little chance of survival, never mind switching into export markets. This point is highlighted in Porter (1990). Segmentation and a control for pre-selection histories of exporters help circumvent a potential endogenous switching from non-exporting to exporting bias.

ii) Forward Linkages

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 to be 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 emerged to

support the exporting firms within the same industries. We now test for such forward linkages. Table 10 presents the results of our Sector *s* growth model for all sectors, while Table 11 presents the results split by Home and US sub-sections *j* of manufacturing. Empirically we model the following:

$$\ln g_{st} = \alpha + \beta_0 \ln Initial\ SectorSize_{st_0} + \beta_1 \ln ChangeExportShare_{st} + \beta_2 UKExport_{st} + \beta_3 Dublin_{st} + v_s + \varepsilon_{st} \quad (6)$$

Unobserved heterogeneity in sector *s* is controlled for by the inclusion of a unit specific residual, v_s, 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, and year 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 log of initial sector employment is included, as well as its square and cube to allow for non-linearities in the function. In addition, in the overall estimation of all sectors, we include an identifier for whether a sector is a US or Home industry, as previously defined. Regional location is controlled for with those sectors having a majority of employment in Dublin getting a value of 1, and all other sectors getting 0.

A dummy for sectors with a majority of employment due to plants exporting to the UK is included. Thus, sectors with a majority of employment share attributable to plants that export to the UK have a value of 1, with all other sectors (either with no exporting plants or with a majority of employment share attributable to non-exporting plants or plants that export to non-UK countries) receiving a value of 0.

Of key interest in this model is the effect that the (log of) change in export share has on sector performance, where this is measured as the employment of all exporting plants in a sector as a share of total sector employment. This controls for the effect that trade orientation has on the sector. One would expect that an increase in export share would have a positive effect on sector growth – an expansion of the size of exporting firms will improve sector growth. Clearly however, this is endogenous. So we instrument

this variable with initial sector export share of employment (as well as its square and cube to allow for non-linearities), and *de novo* plant turnover.

$$\ln ChangeExportShare_{st} = \alpha + \beta_0 \ln Initial\ ExportShare_{st_0} + \beta_1 DeNovoTurnover_{st} + \beta_2 UKExport_{st} + \beta_3 Dublin_{st} + v_s + \varepsilon_{st} \quad (7)$$

From our descriptive statistics we have shown that there has been persistence in employment, and that sectors with a higher initial export share have tended to expand over time to dominate the sectors with a lower initial export share, which have declined over time. We have also described how *de novo* non-exporting plants, though small, gravitated toward designated export regions, have positive growth, and account for most of the total plant turnover in manufacturing. 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. Innovations 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. Growth in the model is generated by Schumpeterian waves of product creative destruction within a defined sector. *De novo* plant turnover is anticipated to have a positive effect on the sector change in export share – the more vertical innovation in a sector, the bigger the employment share of exporting firms in that sector. This provides evidence of the presence of *vertical* forward linkages within industries.

For all of our results, in Table 10 for all sectors and Table 11 for the Home and US sectors separately, the instruments are exogenous by the Hausman test. For all sectors, initial export share and *de novo* plant turnover has a significant positive effect on the sector change in export share. The change in export share in turn has a positive and significant effect on sector growth. The US industry dummy is also positive and significant in the overall regression. The results for Home sectors are similar – initial export share and de novo plant turnover will induce a bigger change in export share for a

sector, and this in turn drives greater sector growth. While *de novo* plant turnover has a positive effect on the change in export share for US sectors, which drives sector growth, the initial export share is not significant for these sectors. The impact of *de novo* turnover on the change in export share for both Home and US sectors provides empirical evidence for the presence of *vertical* forward linkages in our data.

IV CONCLUSION

This paper highlights the role of Industrial Policies (capital grants and tax relief) targeted at start-ups since the 1950s that created a traditional Home or a US exporting base within all 4-digit industries during the last decades of protectionism. Protectionist trade policy pursued since the 1930s for non-exporting plants induced the co-existence of inefficient traditional non-exporters alongside exporters within 4-digit industries on the eve of EC/EU membership. With trade liberalisation came *horizontal* waves of creative destruction within each sector. The collapse of traditional non-exporting plants is shown to be even more severe than most anticipated. These plants did not switch into exporting, but rather were gradually phased out. The losses were more than recuperated by exporting activities. Alongside this there coexisted *vertical* waves of creative destruction in *de novo* non-exporting plants that supported exporting within each sector. This paper tested for the role that backward linkages played in determining firm growth and survival within sectors. We find that across both Home and US sectors the 4-digit *sector* exporting size does not affect plant growth or indeed plant survival. Thus there is no evidence of backward (either horizontal or vertical) linkages in the data.

Our main focus is on the existence of *vertical* forward linkages within industries. We empirically investigate the hypothesis that innovations by small indigenous suppliers of intermediate inputs are of paramount importance to the performance of exporting firms in US and Home industries. As motivated in Aghion and Howitt (1992), we show that plant-turnover in *de novo* non-exporting plants (inducing product specific innovations in immediate goods) supported export growth within sectors, which in turn determined the overall sector performance. Rather than small Irish Business learning from Exporters, our results suggest that it is the US and Irish exporters that have benefited from product specific innovations in small Irish business, putting the state of Ireland's human capital and technology central to this success story.

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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.
UK Export Dummy: UK Exporting Plant =1 if the majority of exports target the UK when the export data is observed, zero otherwise.
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 (SD)		Mean Growth (SD)		Plant Numbers	Mean Employment (SD)		Mean Growth (SD)	
1973-1979										
Total	**3776**	**39**	**(91)**	**0.012**	**(0.03)**	**989**	**72**	**(170)**	**0.043**	**(0.03)**
Exporting	**597**	**86**	**(148)**	**0.043**	**(0.04)**	**299**	**155**	**(267)**	**0.066**	**(0.04)**
Irish Traditional	388	91	(166)	0.016	(0.02)	70	74	(116)	0.010	(0.02)
Irish DeNovo	112	40	(58)	0.452	(0.68)	25	59	(165)	0.085	(0.17)
FDI Traditional	72	139	(133)	0.011	(0.03)	121	257	(361)	0.015	(0.04)
FDI DeNovo	25	71	(119)	0.190	(0.35)	82	100	(130)	0.618	(0.50)
Non-Exporting	**3179**	**30**	**(74)**	**-0.003**	**(0.03)**	**691**	**36**	**(80)**	**-0.001**	**(0.05)**
Irish Traditional	2271	30	(70)	-0.029	(0.03)	407	30	(67)	-0.061	(0.04)
Irish DeNovo	657	12	(25)	0.440	(0.46)	146	18	(49)	0.291	(0.45)
FDI Traditional	182	92	(164)	-0.069	(0.08)	89	85	(147)	-0.048	(0.05)
FDI DeNovo	70	48	(81)	0.308	(0.21)	49	43	(56)	0.556	(0.65)
1980-1987										
Total	**4946**	**25**	**(67)**	**-0.045**	**(0.10)**	**1553**	**53**	**(134)**	**-0.001**	**(0.16)**
Exporting	**902**	**66**	**(114)**	**0.004**	**(0.20)**	**523**	**125**	**(201)**	**0.022**	**(0.17)**
Irish Traditional	377	83	(161)	-0.038	(0.20)	69	75	(100)	-0.022	(0.25)
Irish DeNovo	364	36	(46)	0.103	(0.40)	104	33	(68)	0.106	(0.78)
FDI Traditional	70	119	(105)	-0.058	(0.31)	119	251	(321)	-0.028	(0.21)
FDI DeNovo	91	77	(103)	0.112	(0.05)	231	118	(147)	0.081	(0.45)
Non-Exporting	**4044**	**16**	**(45)**	**-0.088**	**(0.21)**	**1030**	**17**	**(43)**	**-0.080**	**(0.45)**
Irish Traditional	1579	24	(57)	-0.122	(0.22)	269	20	(45)	-0.147	(0.61)
Irish DeNovo	2281	8	(15)	0.030	(0.06)	605	8	(16)	0.043	(0.58)
FDI Traditional	78	75	(134)	-0.209	(0.13)	48	61	(99)	-0.206	(0.43)
FDI DeNovo	107	29	(56)	-0.121	(0.17)	107	39	(68)	-0.037	(0.27)
1988-1997										
Total	**4619**	**23**	**(15)**	**0.003**	**(0.18)**	**1796**	**54**	**(142)**	**0.036**	**(0.15)**
Exporting	**1145**	**57**	**(82)**	**0.018**	**(0.16)**	**721**	**119**	**(204)**	**0.041**	**(0.12)**
Irish Traditional	331	76	(115)	-0.011	(0.18)	60	77	(87)	-0.004	(0.30)
Irish DeNovo	631	41	(49)	0.064	(0.19)	217	40	(56)	0.083	(0.30)
FDI Traditional	47	103	(84)	-0.043	(0.73)	109	234	(328)	-0.017	(0.30)
FDI DeNovo	136	74	(90)	0.014	(0.35)	335	141	(205)	0.070	(0.19)
Non-Exporting	**3473**	**11**	**(27)**	**-0.022**	**(0.28)**	**1075**	**11**	**(30)**	**-0.004**	**(0.57)**
Irish Traditional	883	19	(43)	-0.050	(0.27)	135	13	(24)	-0.105	(0.55)
Irish DeNovo	2480	8	(51)	0.011	(0.33)	822	7	(13)	0.010	(0.55)
FDI Traditional	28	47	(61)	-0.082	(0.11)	26	35	(47)	-0.047	(0.54)
FDI DeNovo	83	19	(30)	-0.062	(0.41)	93	37	(80)	0.035	(0.76)
1998-2003										
Total	**4145**	**27**	**(55)**	**-0.006**	**(0.21)**	**1819**	**67**	**(196)**	**0.001**	**(0.50)**
Exporting	**1218**	**59**	**(81)**	**-0.013**	**(0.27)**	**822**	**132**	**(275)**	**-0.005**	**(0.54)**
Irish Traditional	296	75	(114)	-0.033	(0.25)	54	76	(79)	-0.035	(0.45)
Irish DeNovo	747	47	(58)	0.008	(0.28)	300	42	(60)	0.006	(0.45)
FDI Traditional	34	103	(101)	-0.042	(0.54)	95	218	(272)	-0.028	(0.30)
FDI DeNovo	141	74	(82)	-0.028	(0.62)	374	191	(363)	0.002	(0.69)
Non-Exporting	**2927**	**13**	**(31)**	**0.006**	**(0.24)**	**997**	**14**	**(38)**	**0.035**	**(0.49)**
Irish Traditional	615	22	(47)	-0.022	(0.21)	82	12	(20)	-0.041	(0.46)
Irish DeNovo	2243	11	(24)	0.026	(0.34)	811	9	(17)	0.054	(0.20)
FDI Traditional	16	52	(65)	-0.049	(0.22)	18	32	(38)	-0.132	(0.83)
FDI DeNovo	54	19	(28)	-0.018	(0.73)	87	56	(104)	0.040	(0.46)

***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 Turnover Rate by Firm Type**

year	Total Turnover	Traditional Non-Export	Denovo Non-Export	Traditional Export	Denovo 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 7(ii)*: Plant Numbers by Firm Type**

	Traditional Non-Export	Denovo Non-Export	Traditional Export	Denovo 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 8 **: De novo Non-Exporting Plant Turnover Rates, % Turnover that is Intra- and Inter-sector (and by default, that is due to the net cycle)**

	Home industries			US industries		
Year	**Turnover**	**INTRA**	**INTER**	**Turnover**	**INTRA**	**INTER**
1973	0.055	1.7%	0.0%	0.068	0.0%	0.0%
1974	0.047	9.0%	1.3%	0.063	8.0%	0.0%
1975	0.046	29.5%	2.6%	0.055	21.7%	8.7%
1976	0.059	20.0%	2.0%	0.051	27.3%	9.1%
1977	0.091	18.0%	0.6%	0.072	20.0%	0.0%
1978	0.086	24.6%	1.2%	0.083	19.0%	0.0%
1979	0.088	19.1%	2.3%	0.096	22.2%	2.0%
1980	0.088	25.3%	1.7%	0.113	28.6%	1.6%
1981	0.102	41.5%	0.5%	0.110	33.6%	6.0%
1982	0.090	49.1%	5.5%	0.088	31.6%	12.3%
1983	0.096	66.4%	3.7%	0.122	52.4%	17.1%
1984	0.109	52.2%	19.8%	0.136	54.3%	40.9%
1985	0.123	63.1%	19.9%	0.165	46.2%	16.2%
1986	0.131	73.0%	19.1%	0.155	60.9%	24.3%
1987	0.117	69.2%	21.9%	0.147	56.2%	15.9%
1988	0.133	66.8%	25.0%	0.149	63.6%	20.3%
1989	0.102	55.8%	34.9%	0.131	56.7%	35.2%
1990	0.083	52.3%	25.7%	0.099	51.6%	39.0%
1991	0.094	63.0%	17.3%	0.107	47.6%	27.1%
1992	0.090	51.8%	12.5%	0.106	63.2%	9.8%
1993	0.101	53.3%	38.6%	0.106	61.9%	17.5%
1994	0.068	55.1%	20.5%	0.085	54.0%	25.4%
1995	0.082	57.2%	29.0%	0.106	59.4%	38.7%
1996	0.072	56.9%	24.3%	0.072	50.5%	43.0%
1997	0.069	67.1%	21.4%	0.080	52.1%	47.1%
1998	0.057	61.1%	20.2%	0.063	44.2%	54.7%
1999	0.039	49.6%	21.4%	0.050	42.1%	39.5%
2000	0.055	53.0%	41.1%	0.074	59.8%	26.8%
2001	0.050	51.2%	13.4%	0.071	55.7%	37.7%
2002	0.059	38.8%	16.0%	0.072	51.4%	35.5%
2003	0.036	36.9%	18.0%	0.060	55.7%	27.3%
MEAN		**46.2%**	**15.5%**		**43.6%**	**21.9%**

Table 9 : **Empirical Results for Home Industries**

Home Industries: Overall - Heckman Selection Model

Clustered (Nace4)=58	1973-2003 Expected Growth		1973-2003 Selection	
Start-up Size	-.0005836	(9.26)*	.0048051	(2.61)*
Start-up Size^2	9.29e-07	(6.58)*	-.000037	(2.67)*
Start-up Size^3	-3.50e-10	(5.48)*	6.32e-08	(2.40)*
age	-.0350393	(14.43)*	2.665605	(20.32)*
age^2	.002016	(12.10)*	-.2132245	(17.51)*
age^3	-.0000348	(10.36)*	.004758	(12.75)*
Industry Export Size	-.0086852	(0.45)	.0779536	(0.38)
UK Export Market	.0241459	(7.68)*	.0602578	(1.67)
Plant Non-Export De Novo	.0086573	(2.60)*	.4502383	(2.90)*
Plant Export Traditional	.0345486	(10.41)*	.6079535	(3.83)*
Plant Export De Novo	.0603502	(18.84)*	.482314	(3.18)*
Dublin	-.0002073	(0.08)	.0465993	(1.32)
Border	-.0003069	(0.14)	-.0570971	(1.34)
Midlands	.0030796	(0.96)	-.0075187	(0.17)
West	.0036231	(0.10)	-.1097336	(2.57)*
UK	-.0006359	(0.10)	.0974795	(0.75)
US	.0167519	(3.05)*	-.0436108	(0.37)
Irish	-.0097341	(2.23)*	.2062781	(2.50)*
Constant	.0947377	(5.80)*	-2.772508	(2.34)*
Rho	**.1361632**			
Lambda	**.0391662**			
Year Dummies	**Yes**			
Nace4 Dummies	**Yes**			
No. Obs	**120936 (C =9776 ; U =111160)**			
Log Likelihood	**-24360.135**			
Wald Test	**$\chi^2(1)$ =181.09 Pr>χ^2 = 0.0000**			

US Industries: Overall - Heckman Selection Model

Clustered (Nace4)=43	1973-2003 Expected Growth		1973-2003 Selection	
Start-up Size	-.0005167	(8.81)*	.00009532	(0.46)
Start-up Size^2	5.78e-07	(6.93)*	-.000011	(1.04)
Start-up Size^3	-1.51e-10	(6.20)*	2.36e-08	(1.51)
age	-.0608219	(9.64)*	3.228687	(11.28)*
age^2	.0034898	(9.21)*	-.240102	(7.13)*
age^3	-.0000606	(8.91)*	.0049188	(4.79)*
Industry Export Size	-.0054277	(0.18)	.2865459	(1.89)*
UK Export Market	.0155323	(3.22)*	.071434	(0.84)
Plant Non-Export De Novo	-.0021548	(0.27)	1.071932	(4.02)*
Plant Export Traditional	.0644072	(10.70)*	4.455475	(28.9)*
Plant Export De Novo	.0802478	(12.84)*	1.103589	(3.77)*
Dublin	.0023406	(0.51)	.0839801	(1.38)
Border	.000101	(0.02)	-.016632	(0.20)
Midlands	-.0005501	(0.06)	-.0287129	(0.31)
West	.0029742	(0.67)	-.0484611	(0.95)
UK	-.0089952	(1.61)	.1551035	(1.13)
US	.0219389	(3.52)*	.5759233	(6.06)*
Irish	-.0114607	(1.79)	.0341619	(0.44)
Constant	.2775163	(5.47)*	-3.723941	(1.68)
Rho	**.1214069**			
Lambda	**.037457**			
Year Dummies	**Yes**			
Nace4 Dummies	**Yes**			
No. Obs	**41515 (C =3769 ; U =37746)**			
Log Likelihood	**-10850.501**			
Wald Test	**$\chi^2(1)$ =158.21 Pr>χ^2 = 0.0000**			

Table 10 : **Empirical Results for Sector growth**

All Sectors: Overall Random Effect Instrumented by Plant Turnover Rate

ln Sector Growth Rate *all variables are logs (except dummy)	**1973-2003 (Random Effect)**		**1973-2003 Change of Export Share**	
Change of Export Share	1.605609	(4.46)*		
Initial Sector Size	-.0200997	(4.31)*		
Initial Sector Size^2	.0013581	(0.48)		
Initial Sector Size ^{3}	.0001694	(0.99)		
Initial Sector Export Share			.0466992	(2.75)*
Initial Sector Export Share ^{2}			.0180937	(1.66)
Initial Sector Export Share ^{3}			.0021595	(1.16)
De Novo Plant Turnover			.0018547	(4.05)*
UK Export Dummy	-.0063068	(0.52)	.0073693	(1.45)
Dublin Employment Dummy	-.0192506	(1.37)	-.0054282	(0.81)
US Industry Dummy	.041317	(3.01)*	-.0202713	(3.86)*
Constant	.1106925	(4.18)*	.0350312	(2.20)*
Year Dummies	Yes		Yes	
R^2	0.3154		0.0457	
No. Obs	2739		2739	

Variables *all variables are logs (except dummy)	**Obs**	**Mean**	**Std.Dev**
Sector Growth	3018	.001098	.1450561
Change of Export Share	2893	-.0173387	.1255278
De Novo Plant Turnover	3018	-5.02299	5.618854
Initial Sector Export Share	2788	-1.159666	.8591044
Initial Sector Size	2928	-.1045953	1.465865
UK Export Dummy	3018	.4718357	.4959758
US Industry Dummy	3018	.4360504	.4992889
Dublin Dummy	3018	.1719682	.3774153

- **By Hausman test, the instruments are exogenous.**

Table 11 : **Empirical Results for Sector growth by Home and US industries**

(i) Home Industries: Random Effect Instrumented by Plant Turnover Rate

ln Sector Growth Rate *all variables are logs (except dummy)	**1973-2003 (Random Effect)**		**1973-2003 Change of Export Share**	
Change of Export Share	1.3238	(3.76)*		
Initial Sector Size	-.017035	(4.07)*		
Initial Sector Size^2	.002276	(0.99)		
Initial Sector Size ^{3}	.000212	(1.51)		
Initial Sector Export Share			.0469926	(2.44)*
Initial Sector Export Share ^{2}			.0162471	(1.37)
Initial Sector Export Share ^{3}			.0016868	(0.86)
De Novo Plant Turnover			.0017337	(3.26)*
UK Export Dummy	.01341	(1.08)	.0048149	(0.83)
Dublin Employment Dummy	-.01828	(1.14)	-.005347	(0.63)
Constant	.08446	(3.21)*	.0488591	(2.64)*
Year Dummies	Yes		Yes	
R^2	0.4354		0.0495	
No. Obs	1621		1621	

Variables *all variables are logs (except dummy)	**Obs**	**Mean**	**Std.Dev**
Sector Growth	1702	-.0046038	.132425
Change of Export Share	1677	-.0098819	.1068648
De Novo Plant Turnover	1702	-4.897099	5.438621
Initial Sector Export Share	1641	-1.35419	.9207248
Initial Sector Size	1702	-8.005566	3.923732
UK Export Dummy	1702	.6180964	.4859959
Dublin Dummy	1702	.1210341	.3262627

*** By Hausman test, the instruments are exogenous.**

(ii) US Industries: Random Effect Instrumented by Plant Turnover Rate

ln Sector Growth Rate *all variables are logs (except dummy)	**1973-2003 (Random Effect)**		**1973-2003 Change of Export Share**	
Change of Export Share	2.261764	(2.63)*		
Initial Sector Size	-.017739	(0.67)		
Initial Sector Size^2	-.011627	(0.71)		
Initial Sector Size ^{3}	-.012148	(0.68)		
Initial Sector Export Share			.092258	(1.69)
Initial Sector Export Share ^{2}			.072985	(1.31)
Initial Sector Export Share ^{3}			.017726	(1.14)
De Novo Plant Turnover			.001869	(2.20)*
UK Export Dummy	-.035978	(1.56)	.009241	(0.92)
Dublin Employment Dummy	-.023456	(0.89)	-.00493	(0.43)
Constant	.213829	(3.26)*	.005183	(0.18)
Year Dummies	Yes		Yes	
R^2	0.3124		0.0754	
No. Obs	1118		1118	

Variables *all variables are logs (except dummy)	**Obs**	**Mean**	**Std.Dev**
Sector Growth	1316	.0084722	.1596698
Change of Export Share	1216	-.0276225	.1468685
De Novo Plant Turnover	1316	-5.185817	5.841781
Initial Sector Export Share	1147	-.8813625	.6708575
Initial Sector Size	1316	-.2996476	1.324189
UK Export Dummy	1316	.2826748	.450470
Dublin Dummy	1316	.2378419	.4259237

*** By Hausman test, the instruments are exogenous.**

***Figure 1*: Evolution of Manufacturing Employment**

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

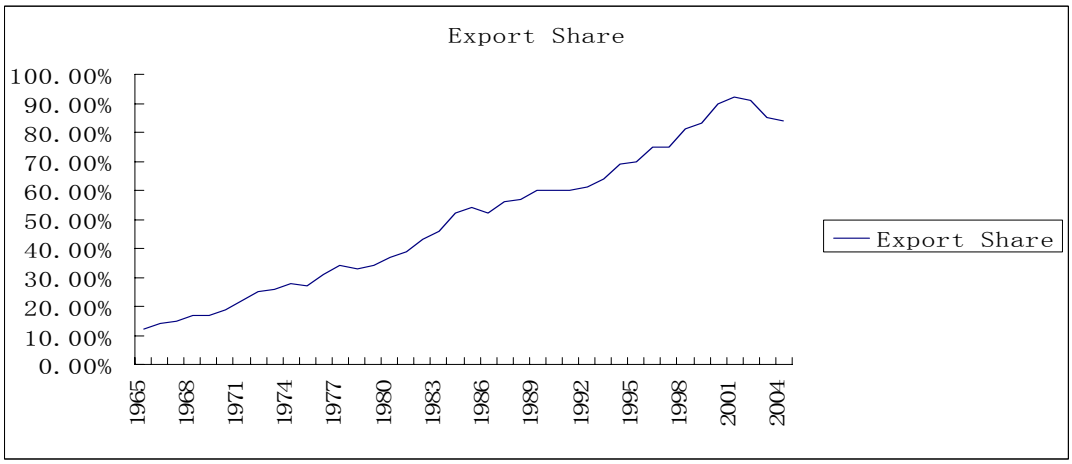


***Figure 3*: Exports as a Share of Gross Employment in Manufacturing**

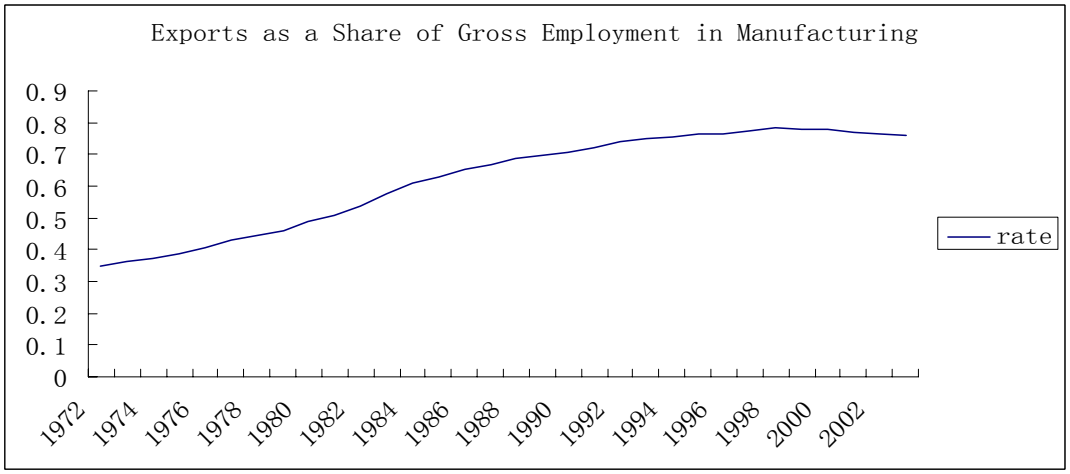
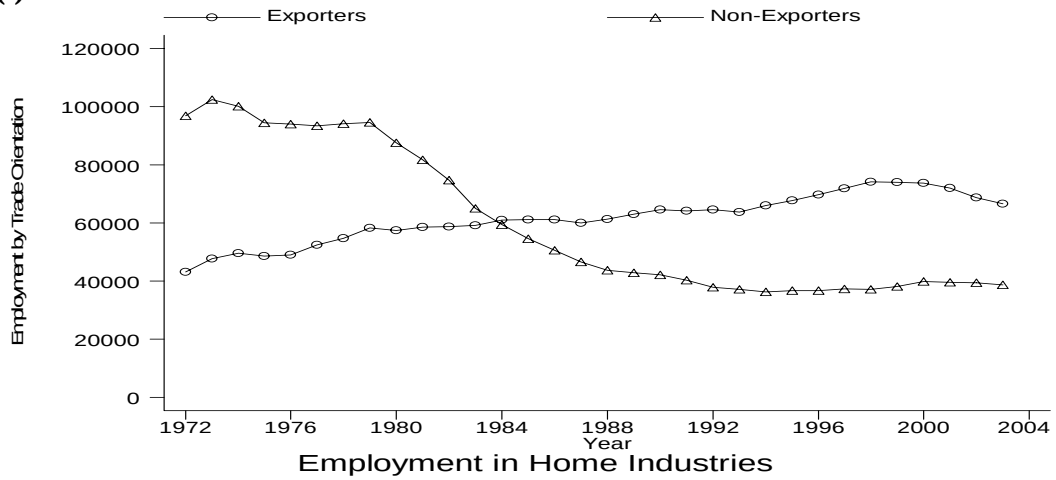


***Figure 4*: Labour Productivity (Output per Worker)**

***Figure 5*: Evolution of Employment by Trade Orientation**

(i) – Home Industries



(ii) – US Industries

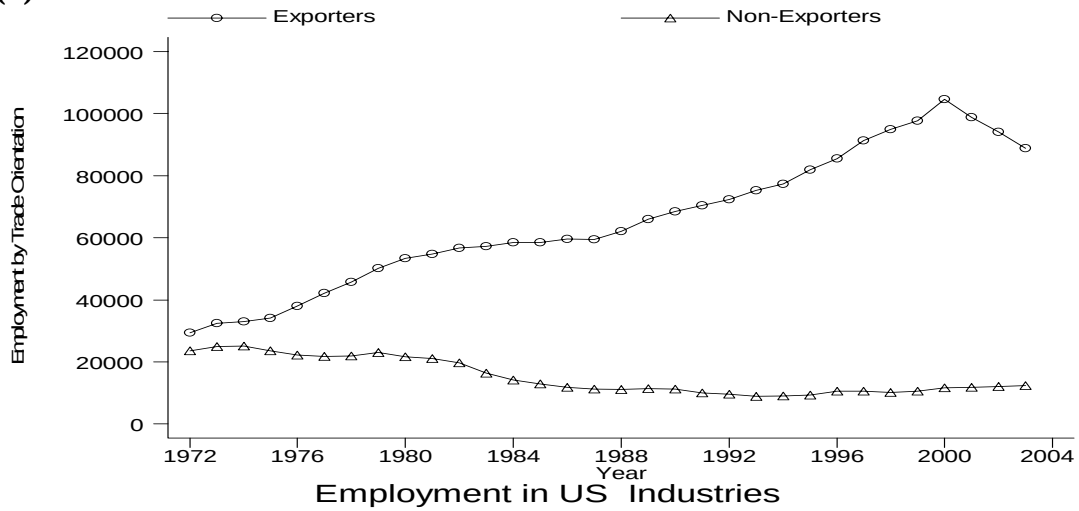
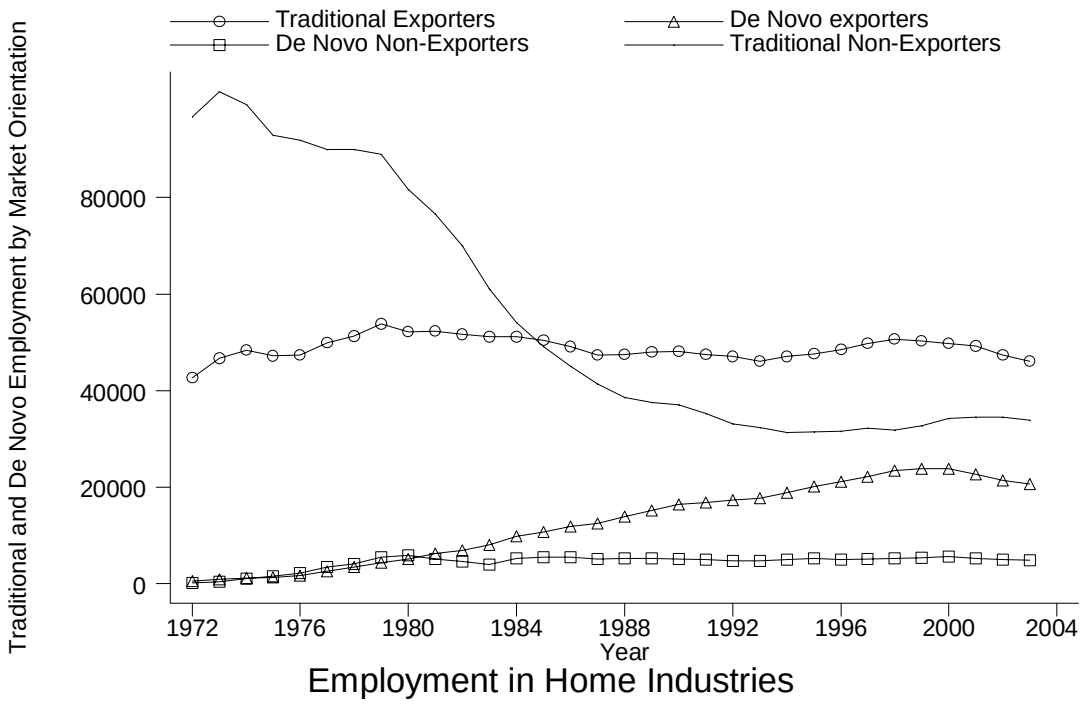


***Figure 6*: Evolution of Employment by Firm Type**

(i) – Home Industries



(ii) – US Industries

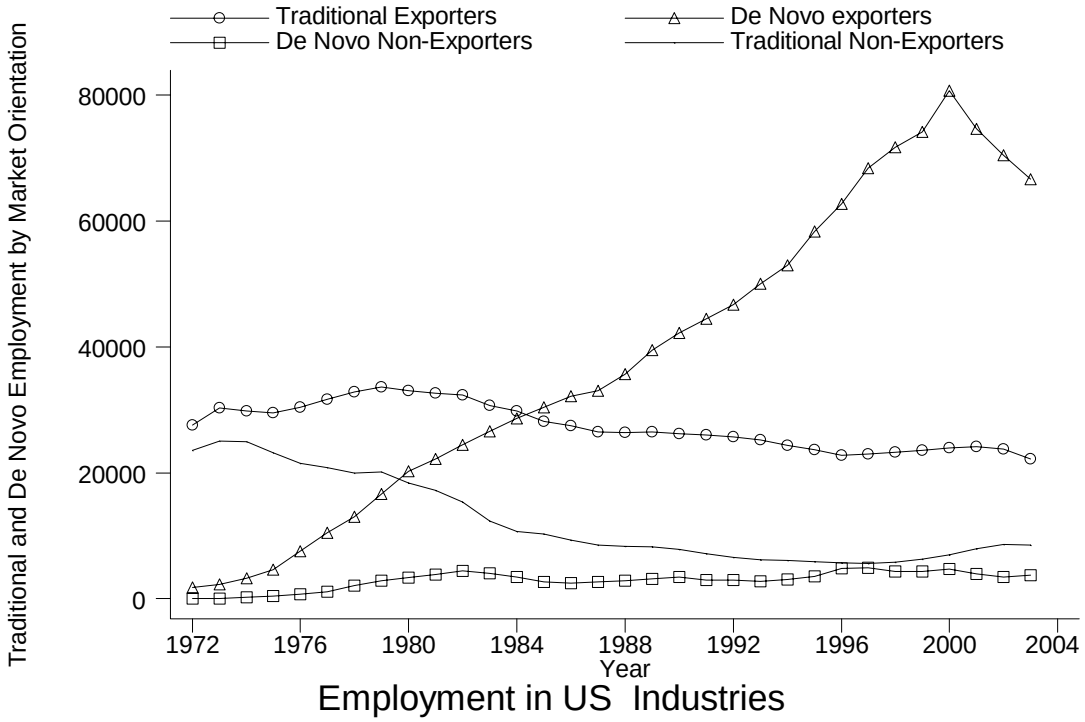
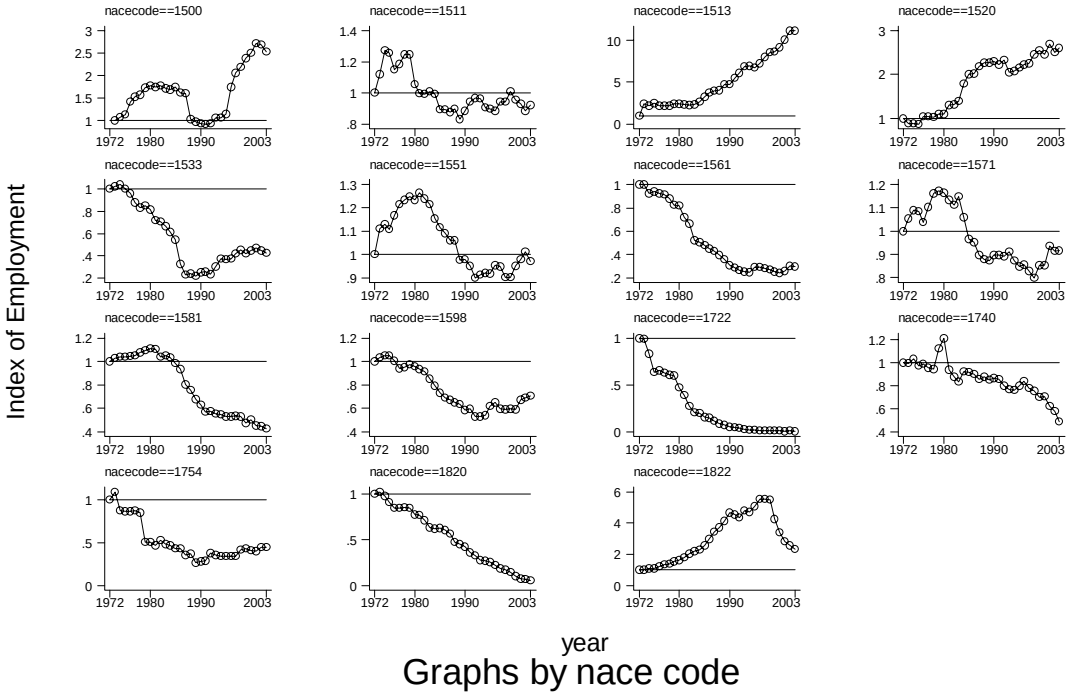
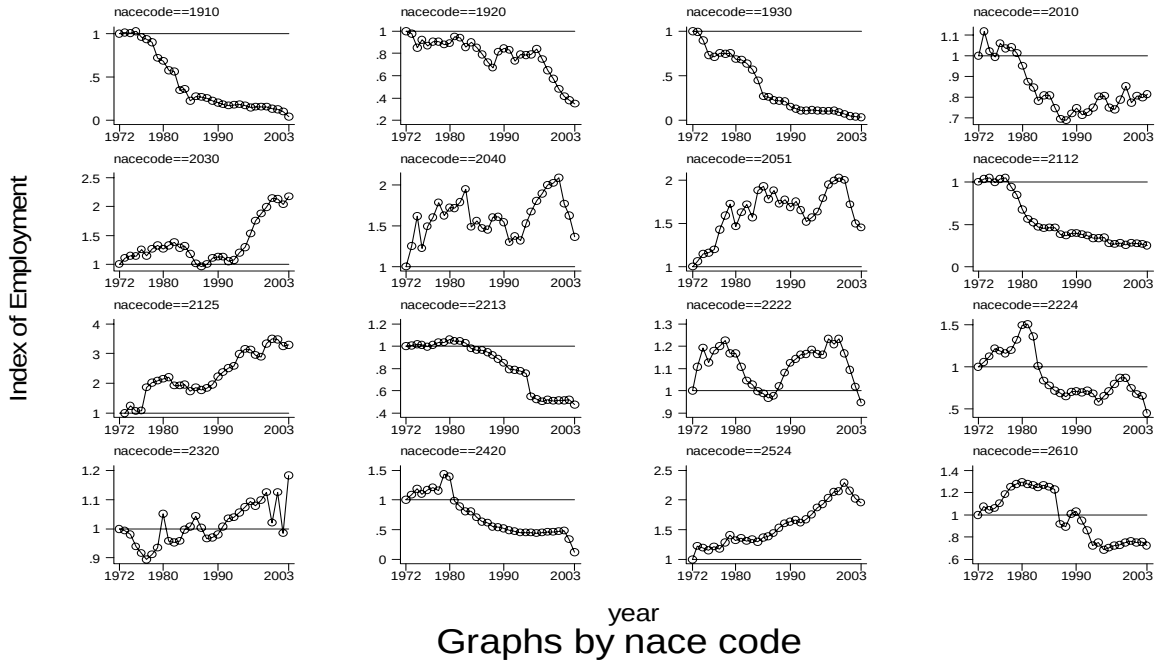
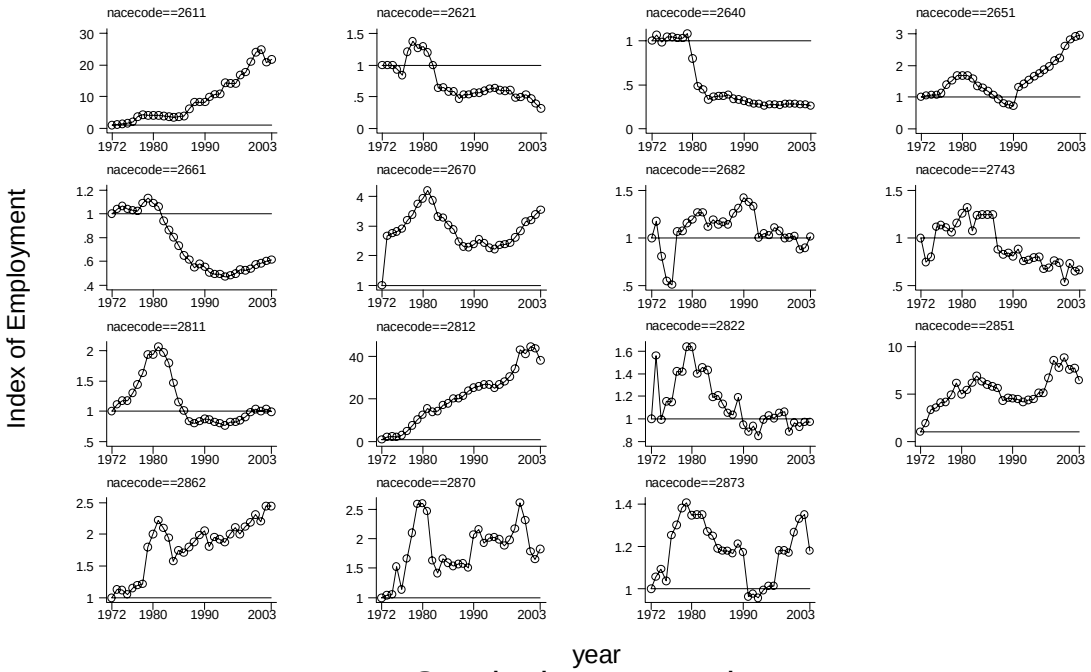


Figure 7: **Evolution of Employment by Sector. Sector Employment Normalized to 1 in 1972**

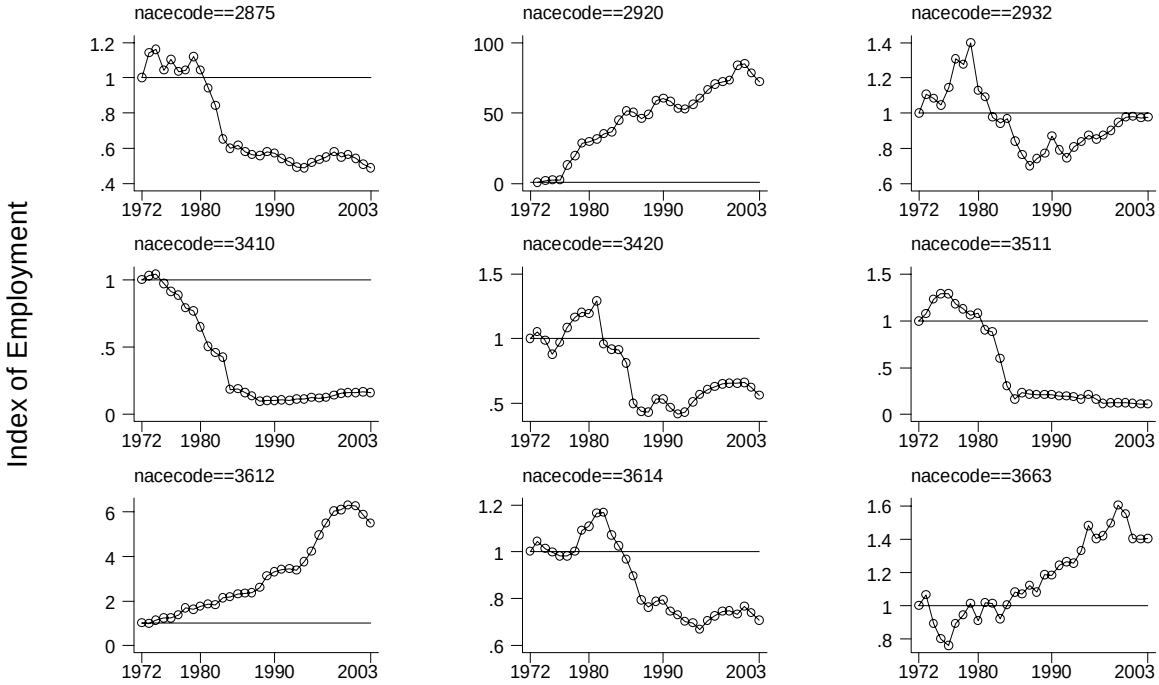
(i) - Home Industies





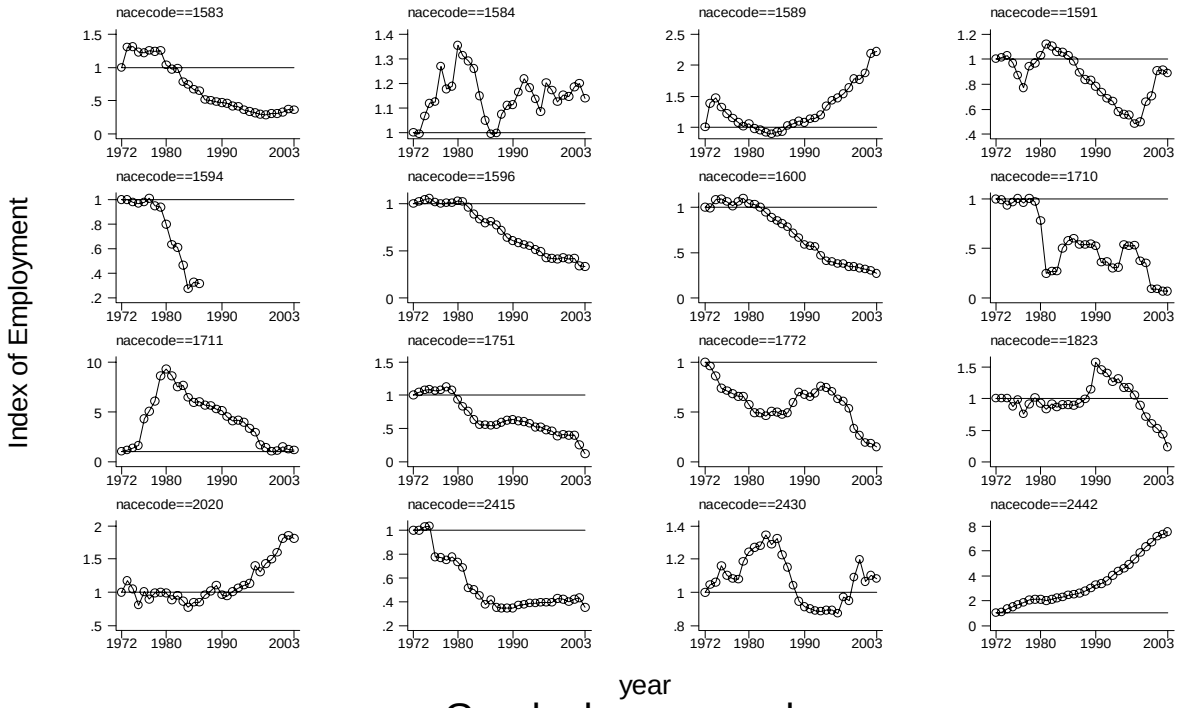


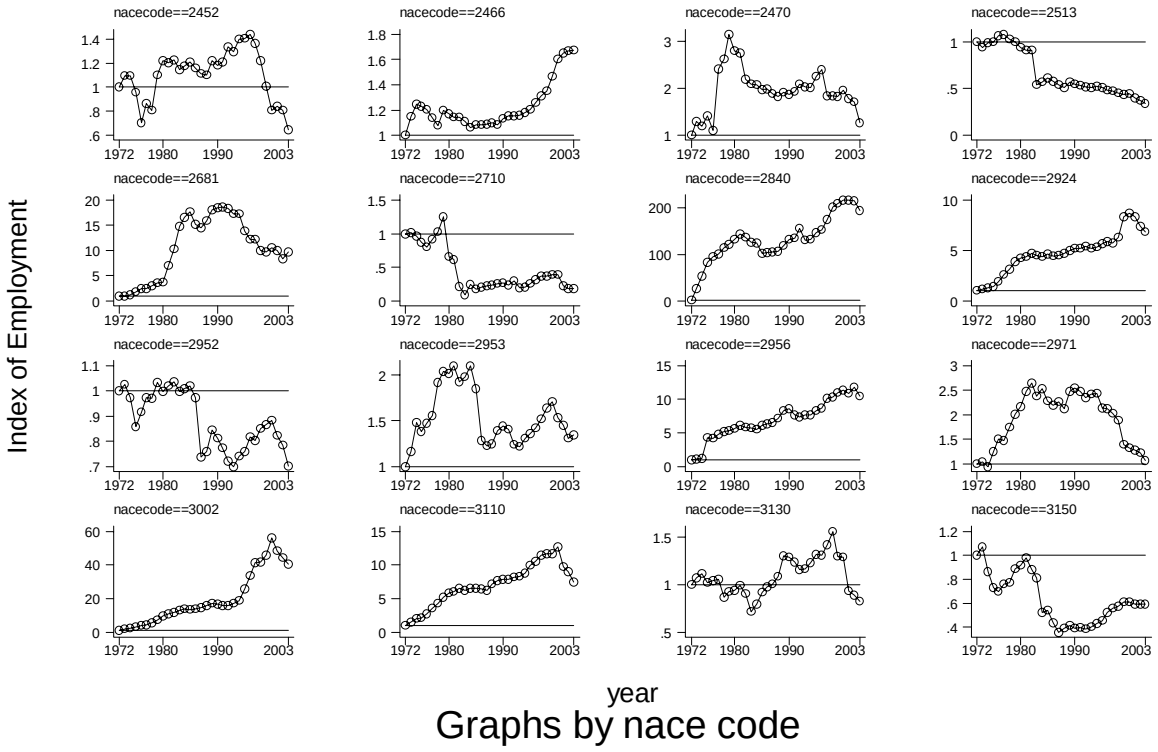
Graphs by nace code



Graphs by nace code

(ii) – US Industries





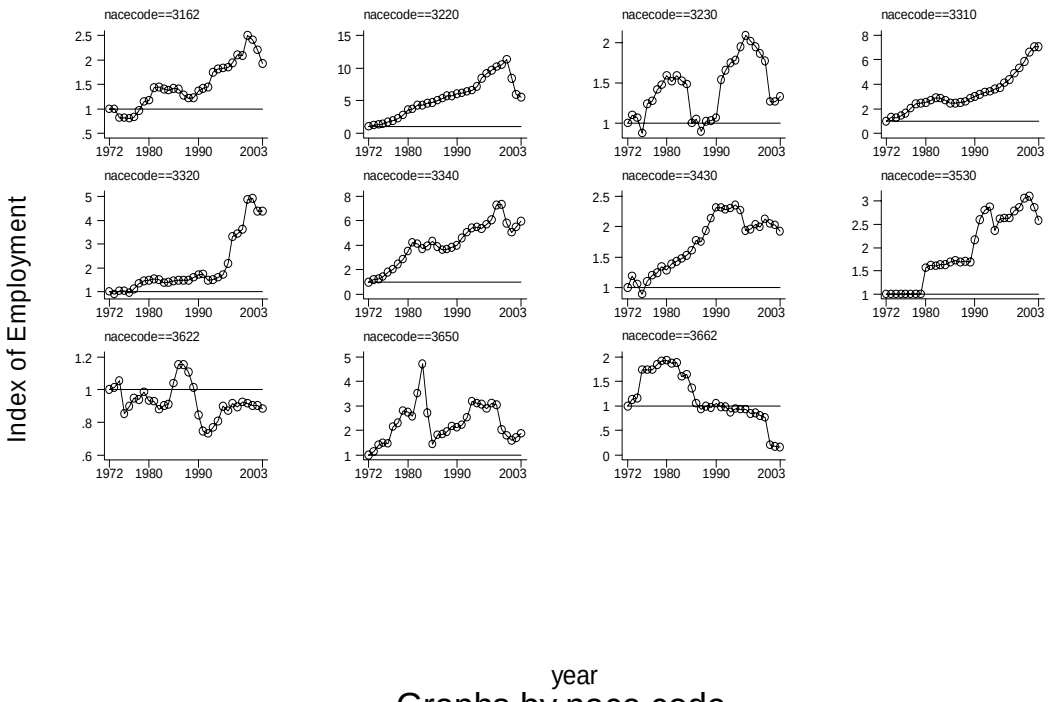
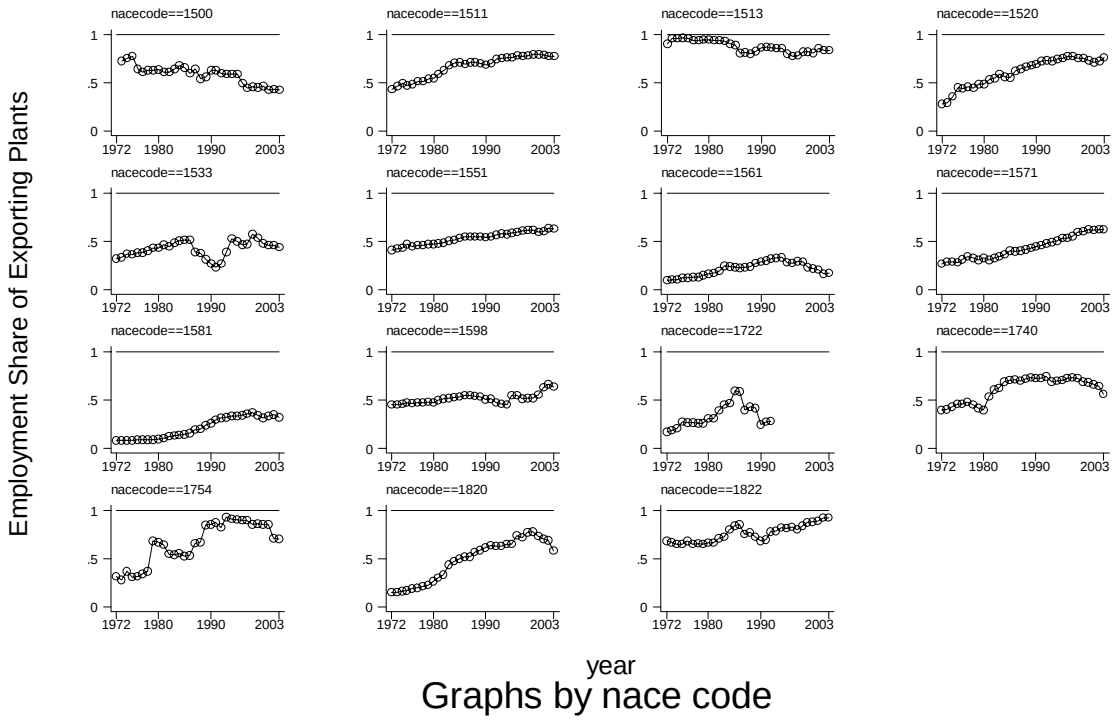
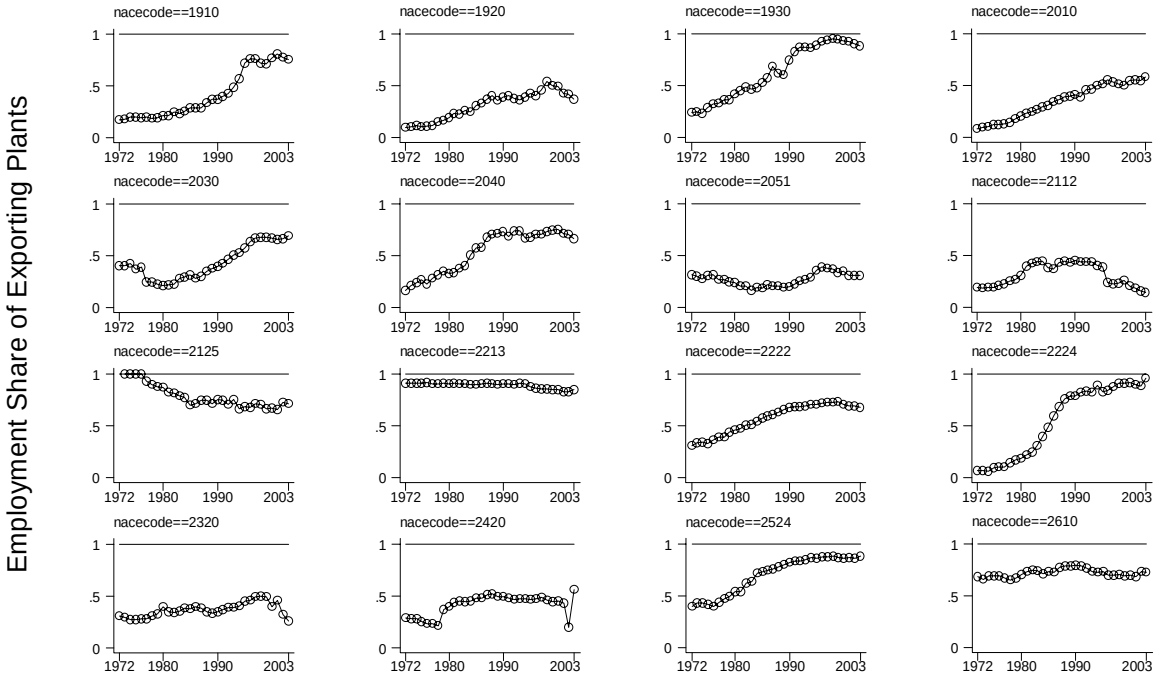
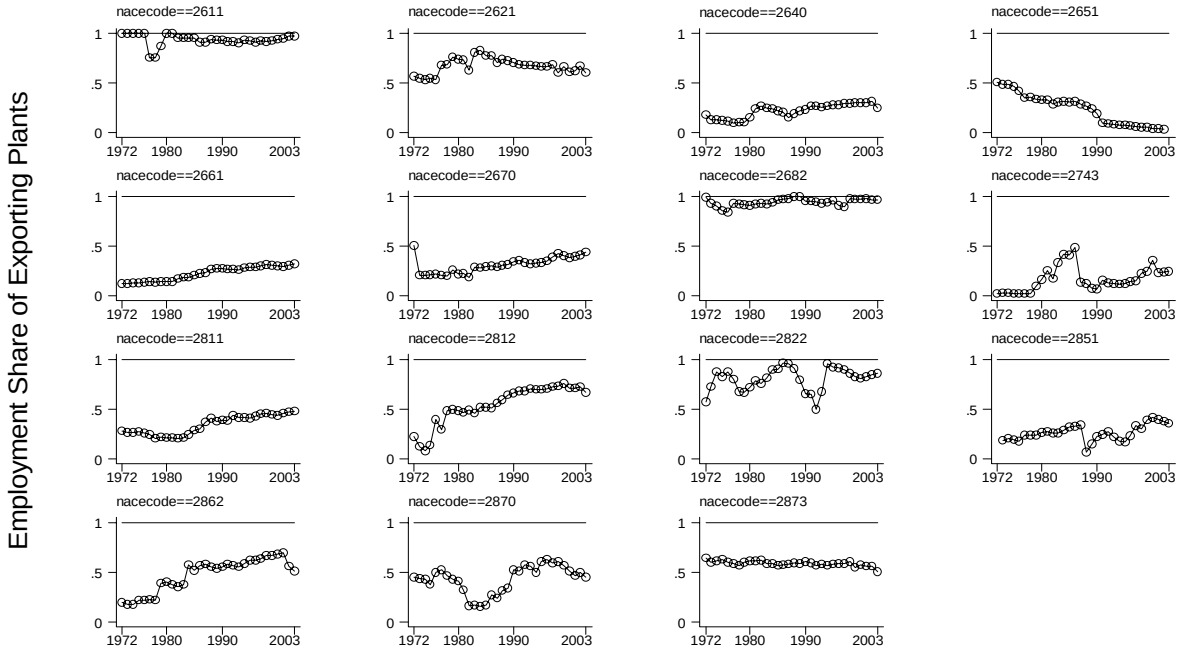


***Figure 8*: Employment Share of Exporting Plants by 4-Digit Sector**
(i) – Home Industries

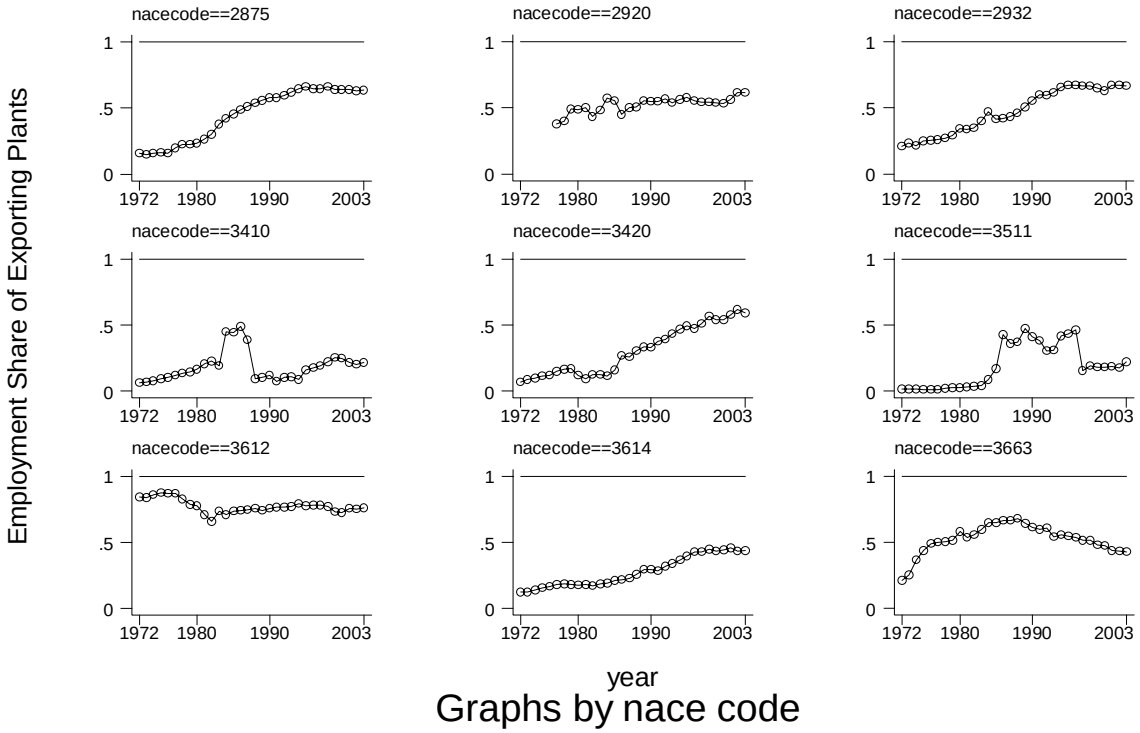




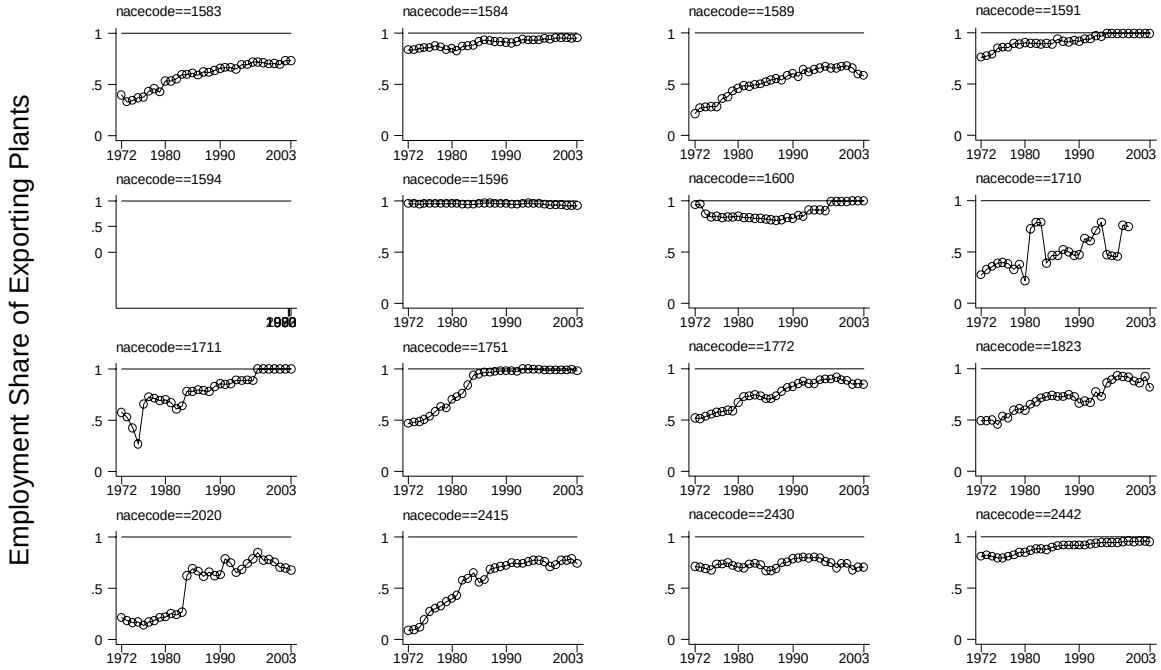
Graphs by nace code

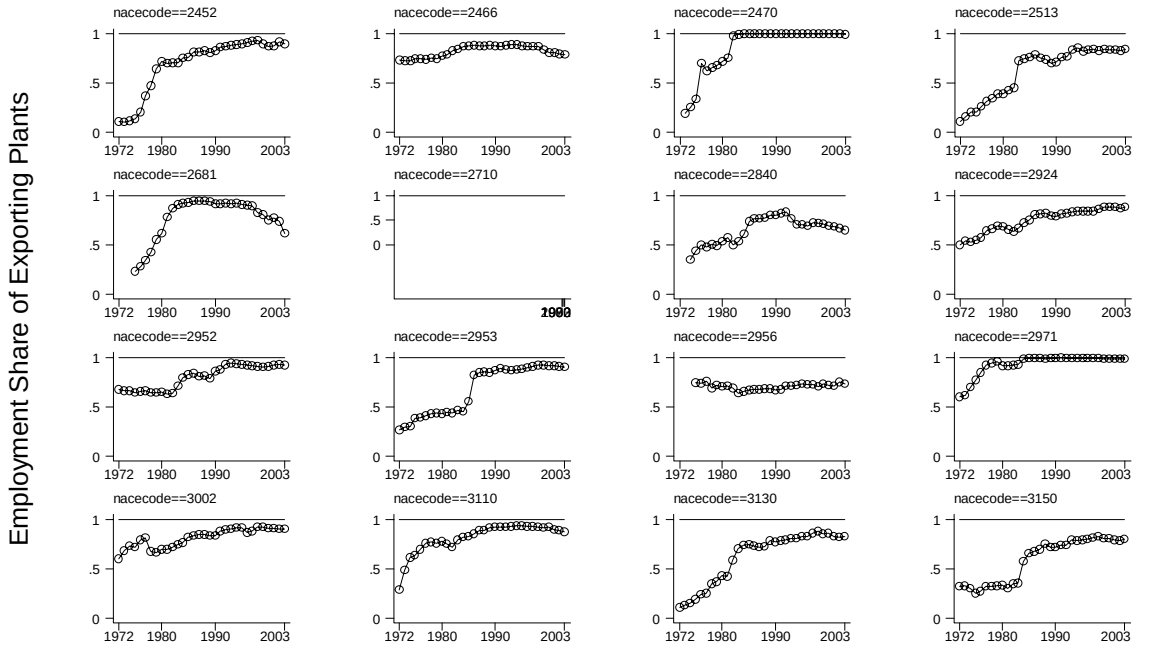


Graphs by nace code



(ii) – US Industries


Employment Share of Exporting Plants
nacecode==1583
nacecode==1584
nacecode==1589
nacecode==1591
nacecode==1594
nacecode==1596
nacecode==1600
nacecode==1710
nacecode==1711
nacecode==1751
nacecode==1772
nacecode==1823
nacecode==2020
nacecode==2415
nacecode==2430
nacecode==2442
0
.5
1
1972
1980
1990
2003
year
Graphs by nace code


Employment Share of Exporting Plants
nacecode==2452
nacecode==2466
nacecode==2470
nacecode==2513
nacecode==2681
nacecode==2710
nacecode==2840
nacecode==2924
nacecode==2952
nacecode==2953
nacecode==2956
nacecode==2971
nacecode==3002
nacecode==3110
nacecode==3130
nacecode==3150
0
.5
1
1972
1980
1990
2003
year
Graphs by nace code

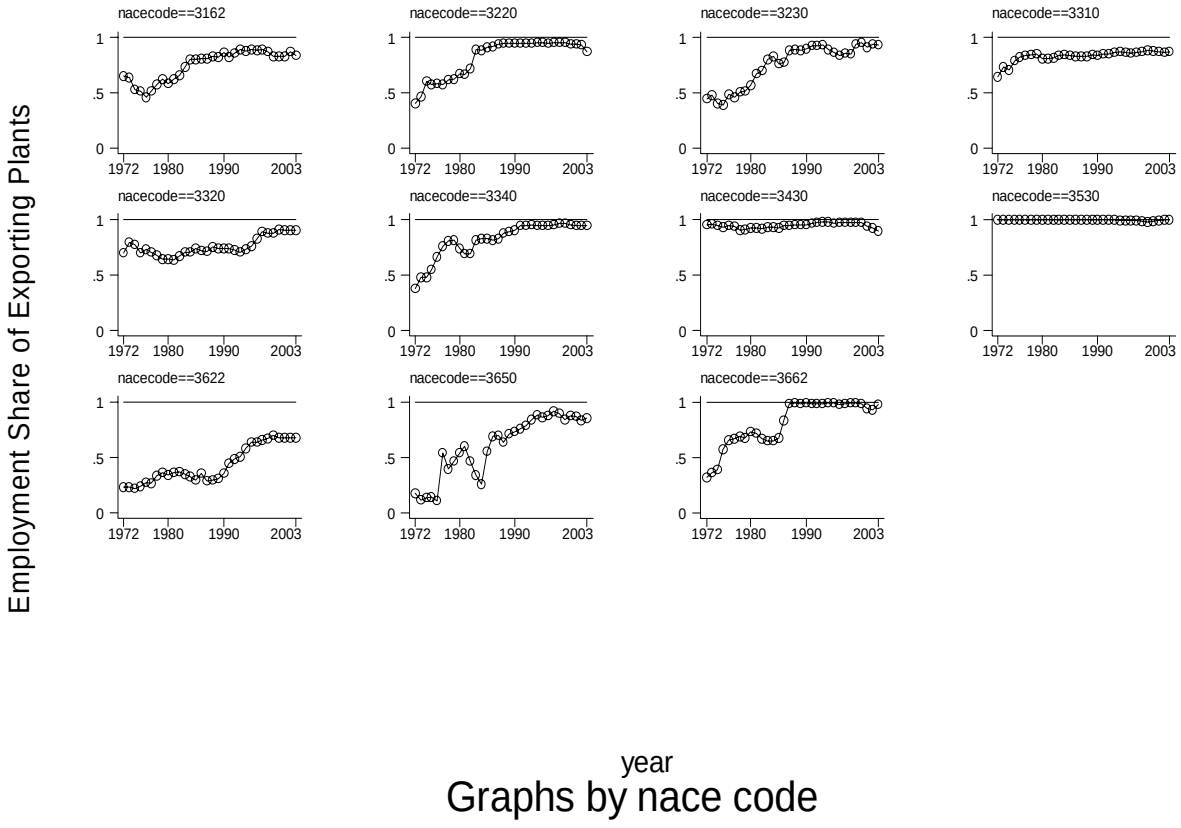
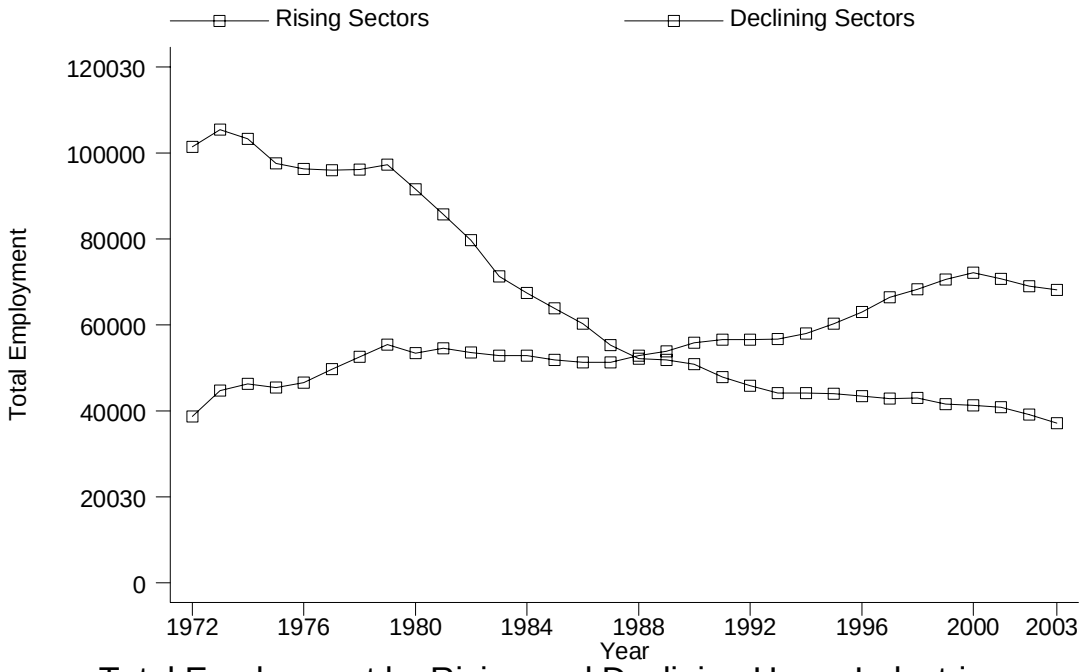
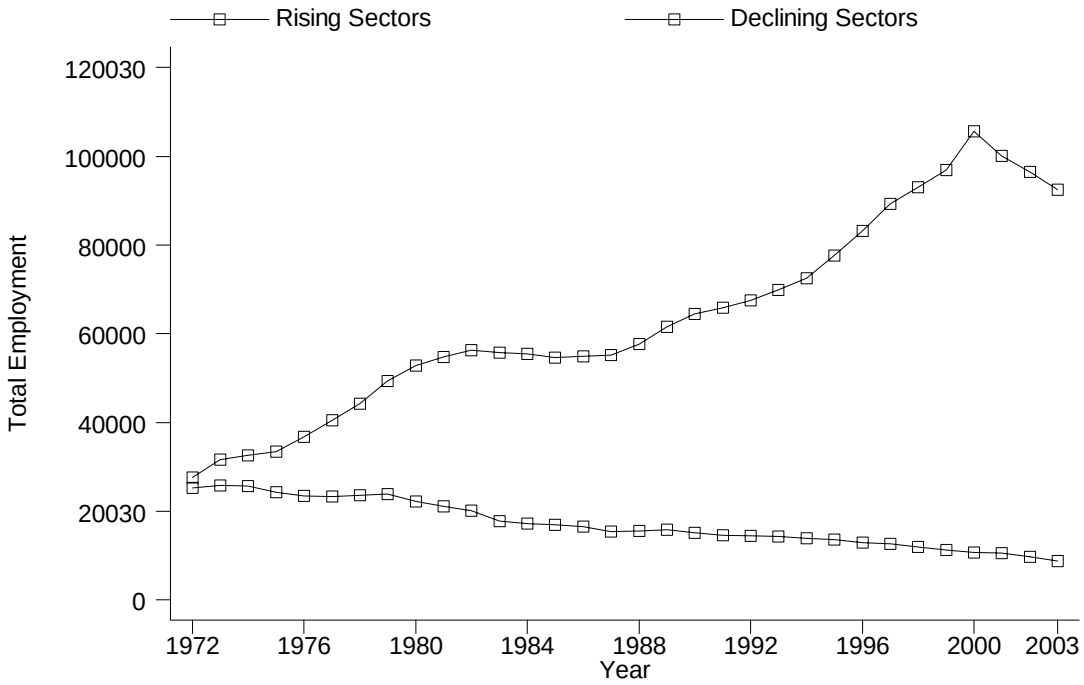

Employment Share of Exporting Plants
nacecode==3162
nacecode==3220
nacecode==3230
nacecode==3310
nacecode==3320
nacecode==3340
nacecode==3430
nacecode==3530
nacecode==3622
nacecode==3650
nacecode==3662
0
.5
1
1972
1980
1990
2003
year
Graphs by nace code

***Figure 9*: Evolution of Employment by a sum over Rising and Declining Sectors**



Total Employment by Rising and Declining Home Industries



Total Employment by Rising and Declining US Industries