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Regional Economic Resilience in Ireland: The Roles of Industrial Structure and Foreign Inward Investment

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Abstract

This paper examines the resilience of Irish regions during the course of the current economic crisis, focussing specifically on employment in firms in receipt of assistance from the Irish enterprise development agencies. The paper proposes and employs a range of statistical indices, including the Ray-Srinath shift-share model, to identify the role of industrial structure, true regional factors and nationality mix, in regional employment performance. The analysis shows that nationality mix has an important impact on regional growth performance. This impact is, however, not clearcut. The foreign sector can have a positive as well as a negative effect on regional employment.

Introduction

The current international economic crisis has stimulated considerable academic interest in how national and regional economies have been reacting to the crisis, and in identifying the factors which underpin the variability of responses in this respect. The term "economic resilience" has been commonly applied to how well, or how badly, individual economies have responded to the shocks to their systems arising from the impact of recession.

At first glance, this may appear to be a fairly straightforward concept, but when teased out it tends to become increasingly complex. Thus Hill et al. (2008, p. 4) define resilience as 'the ability of a region [. . .] to recover successfully from shocks to its economy". However, what does "recovery" mean in this sense? Does it mean to resume the pre-shock sectoral/structural configuration and/or income/output level or to undergo internal structural/organisational changes which restore previous income/output levels? The Hill et al. definition also appears to exclude regions which manage to avoid negative impacts of recession and therefore have nothing to recover from. This raises the issue of including resistance to recession within the compass of a broad definition of the resilience concept.

The strict definition of resilience as defined in physics ("The ability of a material or body to resume its original shape following deformation arising from the application of compressive force") implies resumption of pre-shock configuration. We term this property *recoil capacity*. However, in the case of regional economies, it is very unlikely that recovery from external shock will produce an economic configuration identical to that which existed before.

A key analytical question, therefore, relates to how the configuration of the regional economy becomes altered as a result of shock and how this reconfiguration shapes the region's future developmental trajectory.

It is in this context that Martin has borrowed the concept of *hysteresis* (i.e. The process whereby external shocks induce internal structural changes) from the discipline of ecology, arguing that

> "If the shock is severe enough, it may alter the behaviour of economic agents, change the sectoral composition of the economy and set the economy on a new trajectory of path-dependent development" (Martin, 2012, 8)

The ability of regions to respond to shocks via constructive internal reconfiguration is very variable, depending on such factors as flexibility, capacity for innovation, good organisational and governance structures, and presence of abundant social capital. There are many regions which, lacking such qualities, never recover from the impact of external shocks – many of the old industrial regions in northern England, Wales and Scotland come to mind in this respect.

Martin also raises the possibility that certain regions may be little affected by external shocks due to their ability to resist the impacts of the shocks in question. In physics, resistance is defined as "The ability of a body to resist deformation when an external force is applied." In the economic sphere, Martin (2012, 11) defines ***regional resistance*** as: "The vulnerability or sensitivity of a regional economy to disturbances and disruptions, such as recessions". Martin suggests that regions with diverse sectoral structures, or vibrant organisational structures, will be less vulnerable to external shocks, especially where these are sectorally specific. A good example of a sectorally-specific shock was the emergence of China in the early 2000s as a major global competitor in electronics hardware markets. This had a major impact on some western economies in which production for these markets was well developed. Ireland was a major casualty here because of the high level of concentration of electronics manufacturing which had developed there in the 1980s and 1990s.

However, even in general recessions such as that through which we are currently experiencing, the sectoral impact can be quite variable. Spending on healthcare, for example, tends to be resistant to economic downturns and this has helped Ireland in the current recession because of the strong healthcare presence in Irish manufacturing. And, where regions have a particular specialism in sectors which fare well in recessionary times, those regions in turn tend to do well, as we shall demonstrate presently.

We can therefore combine the concepts of recoil, hysteresis and resistance into a single definition of regional resilience i.e. the ability of a region to resist, cope with, or recover from, the application of a disruptive shock.

Martin (2012) suggests that there are four dimensions involved in measuring regional resilience:

1. Resistance to shocks
2. The degree to which recovery from shock involves renewal/resumption of previous growth paths
3. The degree to which recovery from shock involves internal restructuring
4. The speed and extent of recovery from shock

These determinants combine in very different ways in different regions, leading to a very varied geography of regional resilience. The remainder of this paper consists of an exploratory outline of how Ireland's regions have been coping during the course of the current economic crisis, focusing specifically on employment in firms in receipt of assistance from the Irish government's enterprise development agencies. Following a brief account of the methodology used, we present a range of regional performance indicators for the Irish regions. This is followed by a shift-share analysis of regional employment change. The final section presents the main conclusions.

Methodology

Rather than looking at overall employment performance, our analysis focuses specifically on employment in firms which are, or have been, in receipt of assistance by one of the four state agencies involved in enterprise promotion and development – the Industrial Development Agency (responsible for promoting inward investment in Ireland), Enterprise Ireland (responsible for promoting indigenous enterprise), Údarás na Gaeltachta (responsible for promoting development in the Gaelic-speaking districts, mainly on the western seaboard) and Shannon Development (which has a specific development remit for the Mid West region).

For the most part, the assistance provided by these agencies is directed at exporting or import-substituting firms, or firms which otherwise are deemed to have some strategic or innovative value. Thus, while the firms in question only account for 20% of total employment, they can be regarded as acting as key drivers of economic development at both national and regional level. It may also be noted that the indigenous sector remains primarily focused on serving the domestic market and therefore is more likely to have been affected by the recession than the foreign sector, the vast bulk of whose output is exported and which

accounts for over 90 per cent of total exports. This is because the recession mainly impacted on the Irish economy via the collapse of the bloated construction sector, employment in which fell by two thirds between 2007-2013. The knock-on effects of this contraction saw real domestic demand declining by one fifth. By contrast, following a minor fall in 2008-2009, by 2012 exports of goods and services were 8.3% higher, in real terms, than in 2007.

Employment data for agency-assisted firms were extracted from the database maintained by Forfás, the Irish government's industrial policy advisory agency, which conducts an annual employment survey of such firms. We are grateful to Dr. Jonathan Healy at Forfás for providing access to this database. The data provide information on employment by firm by location, sector and nationality for 2001, 2006 and 2011. While the year 2006 does not coincide exactly with the onset of the recession, the period 2006-2011 does encompass the most severe years of the current recession, with GNP (which factors out large-scale profit repatriation by foreign firms) falling by 11.7 per cent in real terms in the four years up to 2011, at which point a slow recovery commenced. By contrast, GNP grew by 25.8 per cent between 2001-2006. For the purposes of the present analysis, assisted firms outside the manufacturing and services firms (mainly in construction and primary activities and accounting for just over three per cent of total employment in state-assisted firms in 2011) have been excluded. In what follows, the term "period" refers to 2001-2011, and "sub-period" to 2001-2006 and 2006-2011.

A useful feature of the analysis presented here is that it is based on functional rather than administrative regions. As Martin (2012, 13-14) has observed: "The regions and localities we study are rarely functionally meaningful economic entities, but instead are often demarcated—for data collection, administrative or political reasons—along somewhat arbitrary lines." This paper has used information from a research project on commuting fields being conducted at the National Institute for Regional and Spatial Analysis (NIRSA) at the National University of Ireland Maynooth to delineate a series of ten functional regions focused on each region's main urban centre (with the exception of the residual Midlands region which does not contain a focal urban centre) (See Figure 1). Table 1 shows the population of each of these regions in 2006 (the mid-point of the period used for the empirical analysis) and of the focal urban centre after which each region has been named (with the exception of the Midlands region). The relatively small populations of three largely rural western regions and their focal centres (Letterkenny, Sligo, Tralee) may be noted.

The analysis which follows examines how these regions performed in terms of employment in state-assisted firms in the largely recessionary 2006-2011 sub-period compared with the

expansionary 2001-2006 sub-period. It is, of course, difficult to interpret the regional impact of the recession in the absence of knowledge of how the regions would have performed in the absence of recession. One way of approaching this question is to divide both sectors and regions into those which lost employment in both the 2001-2006 and 2006-2011 sub-periods, those which gained employment in both periods, and those which gained employment in the first period and lost employment in the second period. The first category could be regarded as encompassing sectors/regions undergoing long-term decline (i.e. they would probably have continued to decline even if the recession had not occurred, albeit possibly at a slower rate). These are referred to hereafter as LTD (long-term decline) sectors/regions. The second category involves sectors/regions whose growth trajectory was not halted by the recession (although it may have been slowed down). These are referred to as LTG (long-term growth) sectors/regions. The third category refers to sectors/regions whose growth trajectory was reversed during the recession, but which might recover once relatively "normal" conditions return. These are referred to as RS (recession-sensitive) sectors/regions. In the analysis to follow, these categories are referred to as "growth" categories. While this is a rather crude classification, it does appear to have some heuristic usefulness, as shown below.

Patterns of sectoral/regional employment change

Before presenting the detailed tables on sectoral and regional employment change, in order to provide broad context two tables are included showing broad national trends in employment in state-assisted firms. Table 2 shows that total employment in these firms grew moderately (1.6%) between 2001-2006 and then fell much more strongly (9.4%) in 2006-2011. Employment in indigenous firms displayed above-average growth in the earlier sub-period and above-average decline in the later sub-period. Employment in foreign firms fell marginally (0.3%) in the first sub-period (due in large part to the aforementioned decline in the electronics sector in this period) while its rate of decline in the second sub-period was slower than for indigenous firms. The foreign sector's share of total employment therefore fell slightly in 2001-2006 and then recovered somewhat in 2006-2011, but hovered just over 50% throughout the period.

Table 3 subdivides total employment into manufacturing and services components. These components show contrasting trajectories over the period, with manufacturing employment falling throughout (albeit at a much faster rate in the second sub-period) and services employment growing throughout (albeit at a much slower rate in the second sub-period). Thus, the manufacturing share of total employment fell from 72.8% in 2001 to 64.2% in

2011. This had important implications for the indigenous/foreign division of employment, as foreign firms accounted for a minority (49.5%) share of manufacturing employment but had a dominant (60.3%) share of services employment in 2001, although stronger growth in indigenous services employment saw the foreign share fall to 56.8% in 2011.

Tables 4-6 show employment change between 2001-2011 in those sectors falling, respectively, into the LTD, LTG and RS growth categories. This encompasses the 17 sectors which employed 5,000 or more people in at least one of the years 2001, 2006 and 2011, along with the two (rather disparate) residual categories of Other Manufacturing and Other Services. Combined, the latter two sectors accounted for approximately ten per cent of all employment throughout the period. Of the 19 sectors, only four (including the residual Other Services sector) are services sectors. This partly reflects the specific sectoral targeting of the enterprise development agencies (especially the IDA) but also the general lack of progress in developing taxonomies of services sub-sectors by statistical agencies. Thus, the large Software and Computer Services sector embraces several distinctive activities in a single category.

Eleven of the 19 sectors (accounting for 53.3% of total 2001 employment but only 37% in 2011) fell into the LTD category – all of them in manufacturing (Table 4, in which sectors are listed in descending order of decline rate over the period). The overall decline rate for these sectors rose from 15.5% in 2001-2006 to 24.33% in 2006-2011, but these aggregate rates mask major intersectoral variations. The Textiles etc. sector had by far the highest decline rate in the first sub-period and continued to decline strongly in the second sub-period. The Printing, Electrical Engineering and Electronics sectors had above-average decline rates in both sub-periods. The sharp acceleration in decline rates in the second sub-period for the Furniture, Cement & Concrete and Metals & Engineering sectors is undoubtedly linked to the collapse of the construction sector post-2007. The relatively low decline rates of the two food sectors shown in Table 4 may also be noted, with Dairy Processing going against the overall trend in portraying a sharply reduced rate of decline in the second sub-period.

Just four sectors (of which three were in Services) are included in the LTG category, whose share of total employment rose from 29% in 2001 to 43.5% in 2011 (Table 7). The spectacular growth of the Financial Services and Other Business Services sectors in the first sub-period was severely curtailed in the second, but remained relatively strong (especially Financial Services). Medical Devices also experienced a sharp contraction in growth rate, whereas the Software and Computer Services sector's already modest growth rate appears to have been little affected by the onset of recession.

Of the four sectors (three in manufacturing) in the RS category (Table 6), Timber Processing was particularly impacted by the recession – again undoubtedly arising from the sector's strong links with construction. The other three sectors in the table all experienced decline rates in the second sub-period which were lower than the rates of increase in the first sub-period. A notable feature of this table is that, apart from the fact that it portrayed employment growth in the first sub-period, in contrast to the LTD sectors, its overall rate of decline in the second sub-period was much lower than for the LTD sectors (particularly when the Timber Processing sector is excluded). Thus, these sectors were, overall, less impacted by the recession, suggesting that they are, indeed, recession-sensitive, with better prospects of recovering post-recession.

As all regions experienced employment decline in the 2006-2011 sub-period, none falls into the LTG category. Tables 7 and 8 show employment change in those regions falling, respectively, into the LTD and RS categories. The four regions in the LTD category (Table 7) were, in employment terms, the four smallest of the ten regions, accounting for just 13.1% of total employment in 2001 (and 10.5% in 2011). These are all predominantly rural regions, with small regional "capitals" (or none at all in the case of Midlands), and with three of the four located in the traditionally underdeveloped western part of the country.

The regions in the RS group present quite a varied picture. Cork had the strongest overall performance, with the strongest growth rate in 2001-2006 and the weakest decline rate in 2006-2011, while Limerick's performance was the weakest, combining the slowest growth in 2001-06 and fastest decline in 2006-2011 (the latter mainly accounted for by the loss of 1,900 jobs following the closure of the large Dell manufacturing facility in Limerick City in 2009). While both Dublin and Galway had below-average growth in 2001-2006 and below-average decline in 2006-2011, the opposite was the case with Waterford and Dundalk.

Explaining regional employment performance

Having shown the varying overall sectoral and regional performances over the review period, the paper now examines the extent to which regional performance in the two sub-periods may have been linked to regional sectoral mix, paying particular attention to the second, recessionary, sub-period. Table 9 shows, for each region, the division of employment between the three growth categories for 2001 and the region's overall employment performance between 2001-2006. This allows us to assess the extent to which the sectoral mix at the beginning of the sub-period may have influenced actual employment performance by region during the sub-period in question.

Dublin and Galway are shown to have unusually low concentrations of employment in LTD sectors and high concentrations of LTG sector employment. The disproportionately large size of the Dublin region has distorted the national averages for these sectors, in that most regions had a concentration of LTD employment in excess of 60% and a concentration of LTG employment of less than 20% (in comparison with national averages of 53.3% and 29%, respectively). The table shows little evidence that the relative concentrations of LTD/LTG employment in 2001 influenced the size and direction of employment change between 2001-2006. Thus, the two regions with by far the highest concentrations of LTD employment in 2001 (Dundalk and Letterkenny) had very different subsequent change experiences, with Dundalk showing strong positive growth and Letterkenny a high rate of decline. Cork had the highest rate of growth over the sub-period, despite having a relatively low concentration of LTG employment in 2001. This impression is borne out by very low Pearson correlation coefficients between the rate of employment change, on the one hand, and the concentrations of employment in the LTD and LTG categories (i.e. -0.14 and 0.005, respectively). Thus, for this sub-period (in any case), there appears to be little evidence of a link between the distribution of employment growth categories and subsequent employment change.

However, Table 10 shows some evidence of a link between employment performance and prior sectoral mix for the sub-period 2006-2011, with those regions with a low proportion of LTD employment and a high proportion in LTG employment in 2006 experiencing low rates of employment decline and vice versa. Thus, Dublin and Galway, with by far the highest shares of LTG employment and lowest shares of LTD employment, also portray very low levels of employment decline in 2006-2011. Meanwhile, Limerick and Midlands, with high shares of LTD employment, portray by far the highest rates of employment decline.

This is borne out by much stronger correlation coefficients between rate of employment change and shares of LTD/LTG employment (-0.71 and 0.59, respectively). While the small number of cases involved in these calculations is acknowledged, the results, it is argued, are indicative and heuristically useful. Indeed, the correlations would be much stronger were it not for the existence of one anomalous case (i.e. Cork) which, despite a relatively high proportion of LTD employment and a low LTG proportion, still had the lowest rate of employment decline between 2006-2011.

Martin (2012) has devised a simple resistance index which compares a region's rate of employment decline during a recession with the national rate, so that regions with an index value in excess of one have a relatively low resistance to the negative effects of recession and vice versa. This index has been computed for the Irish regions and is shown in the Table 10.

This shows the Midlands and Limerick as having the highest indexes (least resistance) with Cork, Galway and Dublin the only regions with below-average indexes (highest resistance). However, this index is a post-hoc index which takes no cognisance of pre-recession regional structures and in itself has no explanatory power.

A potentially more useful resistance index with possible predictive power computes the pre-recession share of LTG employment as a proportion of the LTD share. One might expect that regions with a high share of LTG employment relative to LTD employment would portray a superior subsequent employment performance. This Breathnach/van Egeraat/Curran (abbreviated to BVEC) resistance index (in which a value in excess of 1 suggests above-average resistance) for 2006 is shown in Table 10. This again shows the strong position of Dublin and Galway relative to the other regions, as reflected in their superior employment performance in 2006-2011. The correlation coefficient between this index and employment change for the sub-period suggests strong predictive power (0.64 with Cork included; 0.79 with Cork excluded).

An additional BVEC "resilience" index has also been included in Table 10. This combines both LTG and RS employment, the rationale being that recession-sensitive sectors should have a good chance of recovering in the post-recession period. This index therefore is the ratio of employment in these two categories (combined) to LTD employment. This is termed a "resilience" index, as it combines two of the key indicators of resilience identified earlier in this paper i.e. resistance (share of LTG employment) and recovery (share of RS employment). As shown in Table 10, this index suggests that Dublin and Galway's prospects of post-recession recovery are particularly strong, with a remarkable five of the ten regions clustered around an index value of 1, leaving them in a somewhat ambivalent situation. Dundalk appears to have the poorest prospects of recovery, followed by Limerick and Midlands. While one would expect the RS component to kick in post-recession (i.e. after 2011), the resilience index is a better predictor than the resistance index of employment performance in 2006-2011 (R = 0.69 with Cork included and 0.85 with Cork excluded). This is to be expected since, as adverted to above, RS sectors had a substantially lower rate than LTD sectors in the sub-period in question.

The Cork anomaly

Cork's anomalous position in these tables suggests the presence of specifically local effect(s) which are distorting the region's employment performance. This merits a closer examination of this region's employment structure. According to the Forfás database, Electronics

manufacturing was Cork's leading sector in 2006, accounting for 15.6% of total employment – over twice the national average of 7.5%. While, nationally, employment in this sector fell by 27.6% in the sub-period 2006-2011, for Cork the rate of decline was only 4.6%. A partial explanation for this anomaly arises from the nature of recent employment change in Cork's two main employers in the sector, the computer firm Apple and EMC, which makes data storage products.

Both of these firms established manufacturing operations in Cork in the 1980s; subsequent expansion brought combined employment in the plants to approximately 4,000 in 2011. However, expansion after 2000 mainly involved the addition of service functions such as sales, customer support, logistics, software and R&D which supported these firm's activities abroad and were not directly linked with the existing manufacturing functions (indeed, Apple greatly scaled back its manufacturing operation in the late 1990s). While these functions now dominate employment in both plants, they remain classified as electronics manufacturing plants.

Thus, to a large extent the strong relative performance of the electronics sector in the Cork region arises from the growth of services functions rather than electronics manufacturing as such. If allowance were to be made for the services components of the workforce in these two plants, the share of electronics in the overall Cork workforce would fall very considerably, while that of services employment (mainly Software & Computer Services and Other Business Services) would increase accordingly. Thus, the balance between the shares of LTD and LTG employment for Cork in Table 10 would narrow very considerably, the consequent alterations in the region's resistance and resilience indexes.

The role of the foreign sector in explaining regional employment performance

A potentially significant factor in determining regional economic resilience is the role of the foreign sector, which is generally associated with greater dynamism and technological sophistication than the indigenous sector. Table 11 shows the proportion of employment in each region accounted for by foreign firms, and also the rate of foreign-firm employment decline in each region between 2006-2011. The foreign-firm share of employment ranges from a high of 59.6% (Cork) to a low of 25.7% (Tralee). There is some indication of a link between foreign firm presence and employment performance in that the three regions with by far the best employment performance in the sub-period (Cork, Dublin, Galway) are among the four regions with the highest proportion of employment in foreign firms. At the same time, the region with the second highest foreign firm presence (Limerick) also had the second

worst employment performance. This anomaly can be attributed largely to the post-2006 closure of the large Dell manufacturing plant in Limerick, pointing to the impact events in a single firm can have on regional performance. Excluding Limerick, the correlation coefficient between foreign-firm share and rate of employment decline is quite strong at 0.74 (with Limerick included, the coefficient is a weak 0.46).

Table 12 shows the post-2006 employment performance of those sectors dominated (i.e. 70+% of total employment), respectively, by foreign firms and by Irish firms. Of the five foreign-dominated sectors, three fall in the LTG category, with one each in LTD and RS. Of the nine Irish-dominated sectors, five fall in the LTD category, with three in RS and one in LTG. In four of the five "intermediate" sectors (where neither foreign nor Irish firms account for over 70% of employment) – all of which fell in the LTD category (Table 13) – the post-2006 employment performance was superior for Irish firms in these sectors. Thus, whereas overall there is some evidence that foreign firms tend to be found in more robust sectors, the relationship between the two is by no means clearcut. One might therefore conclude that it is the sectoral mix, *per se*, more than the nationality mix which has the main impact on regional growth performance.

One final dimension of regional resilience to be explored in this section is the extent to which job losses in declining sectors are being replaced by job gains in expanding sectors. A region could appear to be improving its industrial structure despite experiencing job losses in what are, at national level, LTG sectors, if the rate of job loss in these sectors is lower than that in LTD sectors (thus allowing the employment share of LTG sectors to rise vis-à-vis LTD sectors. It is obviously preferable if structural improvement arises from a situation where jobs lost in LTD sectors are being replaced by job gains in LTG sectors.

Table 14 shows how the overall shares of LTD and LTG employment changed by region between 2006 and 2011, the absolute change in LTD and LTG employment over the sub-period, and LTG gains as a proportion of LTD losses. All regions portray a fall in the share of LTD employment (albeit marginal in two cases) and a rise in the LTG share. Two regions (Limerick and Sligo) experienced a fall in both LTD and LTG employment, but in both cases the rate of LTD fall was higher, leading to a relative improvement in industrial structure. Of the remaining regions, only one (Cork) gained more LTG employment than it lost in LTG employment. For reasons advanced earlier, the share of LTD employment in this region is distorted upwards and that for LTG downwards. If the anomaly underpinning these distortions were corrected (through the transfer of employment from Electronics to services), the gap between LTD loss and LTG gain would be even wider (assuming that the recent job

growth which has occurred in the firms in question has been mainly in services) and therefore the LTG/LTD ratio would be even greater. Galway (0.57) and Dublin (0.51) have the next highest rates of LTD replacement, followed by Letterkenny (although in the latter case the absolute numbers involved are small). For the remaining four regions, LTG compensation for LTD job losses has been very limited.

Shift-Share Analysis

Shift-share analysis adds an extra dimension to the analysis of regional employment change, particularly through its ability to model more accurately the role of sectoral mix in influencing the change process. For example, in the tables used thus far in the paper, the fact that a region has a certain amount of employment in LTD and LTG sectors does not allow for the fact that these sectors show different rates of change, both nationally and at regional level, and between foreign and indigenous firm groups. Shift-share analysis addresses these variations.

The traditional shift-share analytic approach divides regional employment change over a period into three components – a *national* component (i.e. the change which would have occurred in regional employment if all regional sectors experienced the same rate of change as overall national employment over the period), a *regional industry-mix* (i.e. sectoral composition) component (i.e. the change which would have occurred in regional employment if each regional sector experienced the same rate of change as national employment in the sector in question), and a residual element which is usually interpreted as a *regional* component (i.e. employment change attributable to specific local circumstances having a bearing on regional performance e.g. regional policy measures or general regional productivity). It has been argued that this decomposition is fundamentally flawed as it ignores the possibility of industry-region interaction effects and how this interaction can affect both the industry-mix and the regional share components (Ray, 1990; Gardiner et al., 2012).

Ray (1990) and Lamarche et al. (2003) have developed a technique known as Multi-Factor Partitioning (MFP), which addresses this shortcoming of traditional shift-share analysis. The Ray-Srinath shift-share model divides both the traditional industry-mix and regional components into two sub-components. The traditional industry-mix component is adjusted for an *allocation effect* which identifies the employment change which would have occurred in each region if the region's distribution of employment between sectors was the same as the national distribution. Proportionately this effect is the same for all regions and tends to be

small. Subtracting this from the traditional industry-mix component gives what the Ray-Srinath model terms the "pure" industry-mix effect. The traditional regional component is broken down into a "pure" regional effect which impacts (either positively or negatively) equally on all sectors within a region and a *region-industry interaction effect* which impacts on individual sectors within a region. A positive "pure" regional effect may be referred to as a regional competitiveness effect although the meaning of competitiveness is problematic (Gardiner et al., 2012). The region-industry interaction effect captures the distinctive location advantages of a region for particular sectors which apply over and above the pure regional effect, as might be expected to be present, for example, in the case of specialised industrial clusters. The region-industry interaction effect is thus linked to the region as well.

Figures 2-4 decompose employment change in the 2006-2011 sub-period in, respectively, all, foreign and indigenous state-assisted firms by region into the five Ray-Srinath change components. This gives an overall picture of how the different effects contributed to the regions' reactions to the sharp recessionary conditions which obtained in this sub-period. Further insights into these patterns are obtained by inspecting the varying contributions made by the 19 sectoral groups (not shown in the table) to each regional configuration. The segments of the regional columns are presented as proportions of regional employment of the respective firm groups at the beginning of the sub-period. The use of proportions means that the national and allocation components are equal for all regions. Thus, interregional differences arise from the other three components. Tables 15-17 show the proportions applying to each column segment shown in the corresponding figures. In Figures 2-4, those segments appearing above the horizontal 0% line exert a positive effect on regional employment change and those below the line a negative effect. The balance between the two is shown in the last column of the accompanying tables.

All regions experienced overall employment decline over the sub-period, ranging from -1.8% (Cork) to -26.1% (Midlands). For all regions, the negative national component (-9.4%) in the shift-share tables was only partially offset by a positive allocation component of 3.1%. All regions except Dublin were negatively impacted by an unfavourable industry-mix component (denoted "Industry" in the tables and figures). This reflects the concentration of high-growth sectors in Dublin: in 2006 that region's combined share of the four long-term growth sectors (Software & Computer Services, Financial Services, Other Business Services and Medical Devices) came to 70.9% compared with its 42.7% share of total employment in state-assisted firms. For the other regions, the negative impact of the industry-mix component was quite variable, ranging from -3.0% (Tralee) to -11.5% (Midlands). The high negative industry-mix

effect for Midlands reflects the disproportionate concentration in this region of three sectors (Metals & Engineering, Timber Processing and Cement & Concrete Products) which in 2006 accounted for 31.7% of regional employment, almost three times the national average, and whose combined rate of decline in 2006-2011 (32.4%) was well over three times the national average. However, to the extent that all three of these sectors are strongly related to the construction sector, they were particularly impacted by the construction-driven recession and might be expected to rebound in a post-recession recovery.

The pure regional effect rate captures the range of region-specific factors that influence all industries in the region equally. This rate is positive in five of the regions and it has a particularly strong positive effect on employment in Cork and Galway adding 21.9% and 10.1% to the 2006 employment levels respectively. It was the main factor driving the relatively favourable employment performance of these two regions over the sub-period. By contrast, the pure regional effect rate has a negative impact in the Dublin, Tralee, Limerick and Sligo regions. A particularly strong negative pure regional share component is evident for Limerick where it took 15.3% of the 2006 employment level.

A further feature of Figure 2 is that all regions, with the exception of Limerick, were negatively impacted (although quite variably) by the region-industry interaction effect (denoted "Interaction" in the figure). This effect reflects the location advantages of a given region for each particular industry which apply over and above the pure regional effect. In the regions with a positive pure regional effect rate, this positive component is at least partly counterbalanced by a negative region-industry interaction component. Since both rates are linked to the region it is of interest to consider the combined effect. The combined pure regional/region-industry interaction effect is greatest in the Limerick region (-12.6%). It is positive in the Cork (9.2%), Galway (5.9%) and Waterford (1.6%) regions.

We now consider the role of ownership. Tables 16-17 and Figures 3-4 present the data for foreign and Irish firms separately. In seven of the ten regions, the industry-mix effect operates in the same direction for the foreign and Irish segments. Cork exhibits a negative industry-mix effect for foreign firms (-9.1%) while the effect for Irish firms is marginally positive (0.2%). Tralee is the only region with strongly contrasting industry-mix effect rates for foreign (-26.7%) and Irish (2.9%) segments. This is in line with the earlier conclusion that it is the sectoral mix, per se, more than the nationality mix which has the main impact on regional growth performance.

Foreign and indigenous firms exhibit strikingly contrasting regional effect rates. The strong positive pure regional effect for Cork, identified for all firms, is entirely linked to the foreign

segment. Cork exhibits a strongly positive pure regional effect for foreign firms (46.3%) while the pure regional effect for Irish firms is negative (-2.9%). Letterkenny exhibits similar results. By contrast, the positive pure regional effect rate for Waterford, identified in relation to all firms, is entirely linked to the indigenous segment (15.0%). Waterford exhibits a negative pure regional effect rate for foreign firms (-10.3%). Sligo, Dundalk and Tralee are further examples of how, within a given region, pure regional effect rates can exert contrasting influences in indigenous and foreign segments. One might therefore conclude that the nationality mix has an important effect on regional growth performance, but that its effect is not clearcut. Whereas the extant literature generally associates the foreign sector in Ireland with greater dynamism than the indigenous sector, the results suggest that the foreign sector can have a positive as well as a negative effect on regional growth performance.

Conclusions

This paper has examined how Ireland's regions have been coping during the course of the current economic crisis. Regional variations in economic resilience in Ireland, as reflected in employment performance in state-assisted firms in the period 2006-2011, were the product of a complex set of interacting factors, including regional sectoral structure, nationality mix and regional competitiveness.

It has been shown how part of the differences in regional growth performance can be explained by intersectoral variations in employment performance in combination with regional variations in the mix of growing and declining sectors. The paper has provided some evidence of a link between employment performance and prior sectoral mix for the sub-period 2006-2011, with those regions with low proportions of long-term decline employment and a high proportion in long-term growth employment in 2006 experiencing low rates of employment decline and vice versa. In this context the paper introduces the BVEC resistance and BVEC resilience indices for regional employment performance, both of which are show to have greater predictive power than the resistance index proposed by Martin (2012).

In relation to the role of nationality mix, extant literature on Ireland generally associates the foreign sector with greater dynamism and technological sophistication than the indigenous sector. The paper presents some evidence of a positive link between the proportion of employment in foreign firms and regional employment performance. However, a substantial part of this link can be explained by sectoral mix (although the relation between nationality and sector is by no means clearcut). One might therefore conclude that it is sectoral mix, *per se*, more than the nationality mix which has the main impact on regional growth performance.

The Ray-Srinath shift-share analysis adds an extra dimension to the analysis of regional employment performance. It more accurately identifies and quantifies the role of the industry mix and distinguishes between a "pure" regional effect and a region-industry interaction effect. The pure regional effect can be linked to regional competitiveness. The findings of the shift-share analysis support the preceding analysis. Industry mix was shown to be an important part of the explanation of regional employment performance. However, in some regions a substantial part of the employment performance is due to the pure regional competitiveness effect. In some regions, notably Cork, Limerick and Galway, the competitiveness effect rate is greater than the industry mix effect rate.

The shift-share analysis for the individual nationality segments shows that the nationality mix has an important impact on regional growth performance. This impact is, however, not clearcut. Whereas the extant literature generally associates the foreign sector in Ireland with greater dynamism than the indigenous sector, the results suggest that the foreign sector can have a positive as well as a negative effect on regional growth performance.

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FIGURES

Figure 1: Regional fields

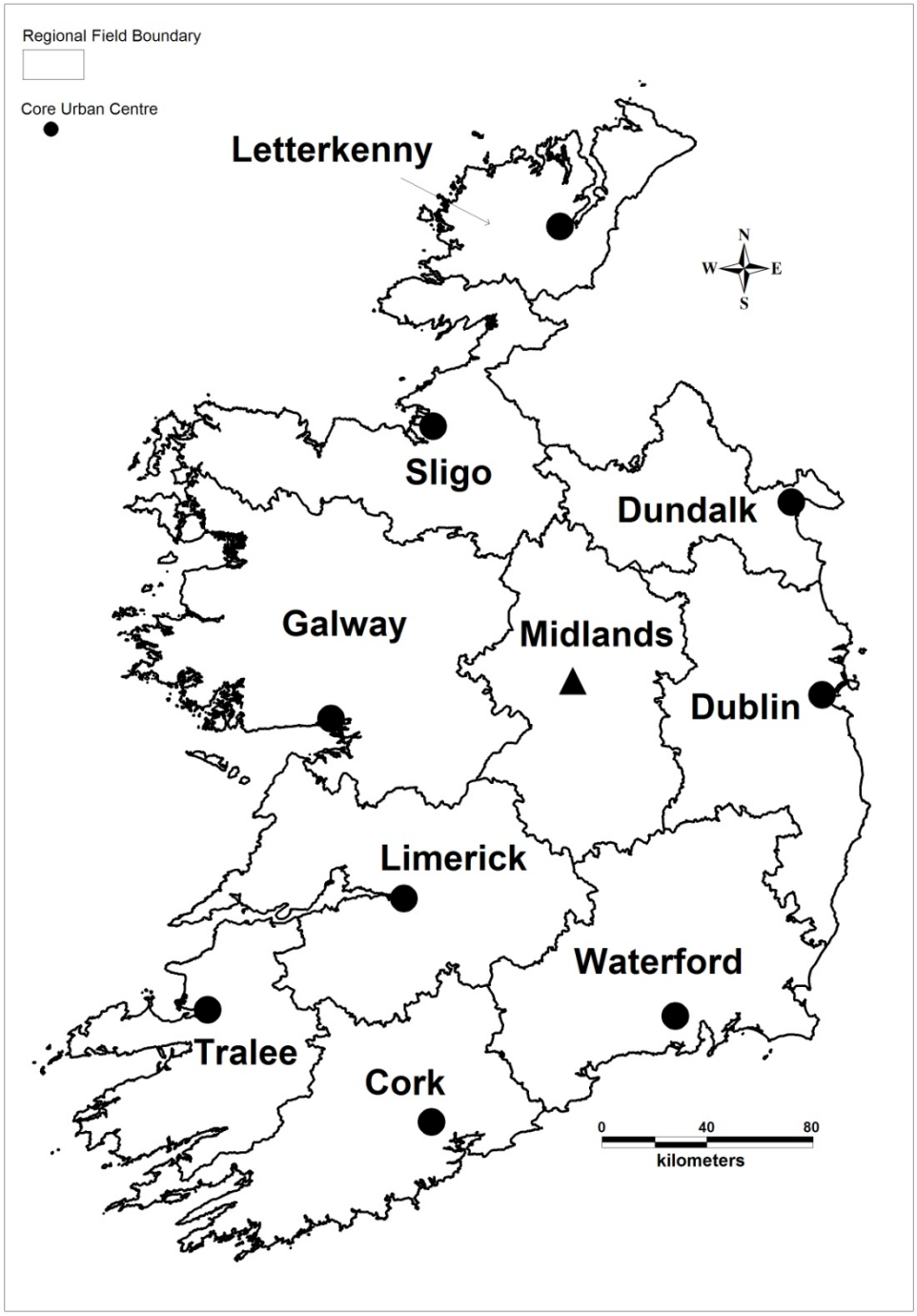
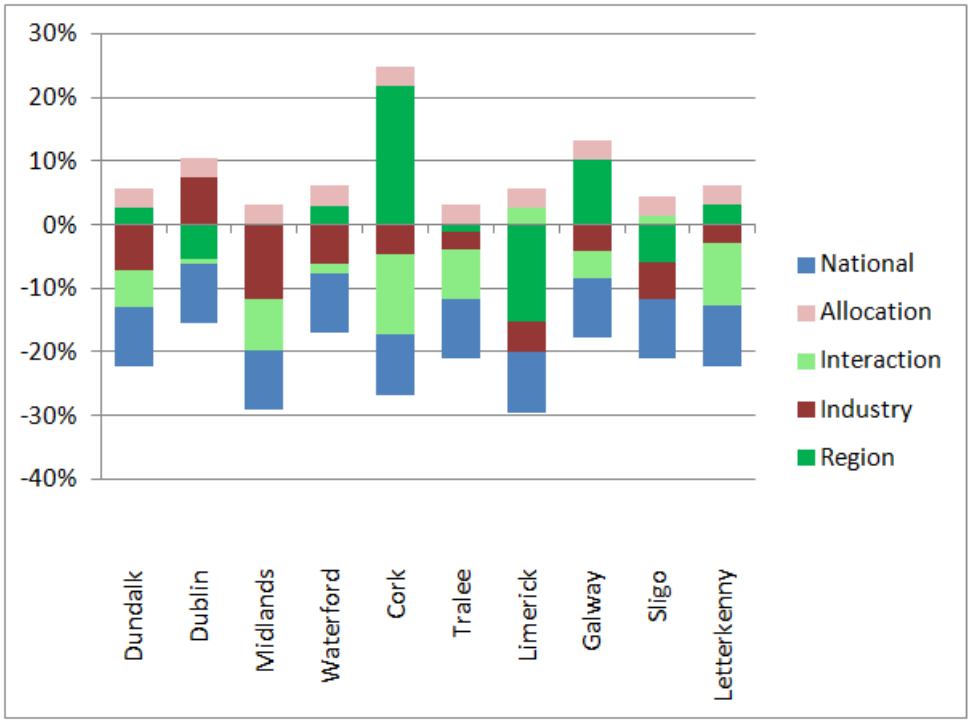
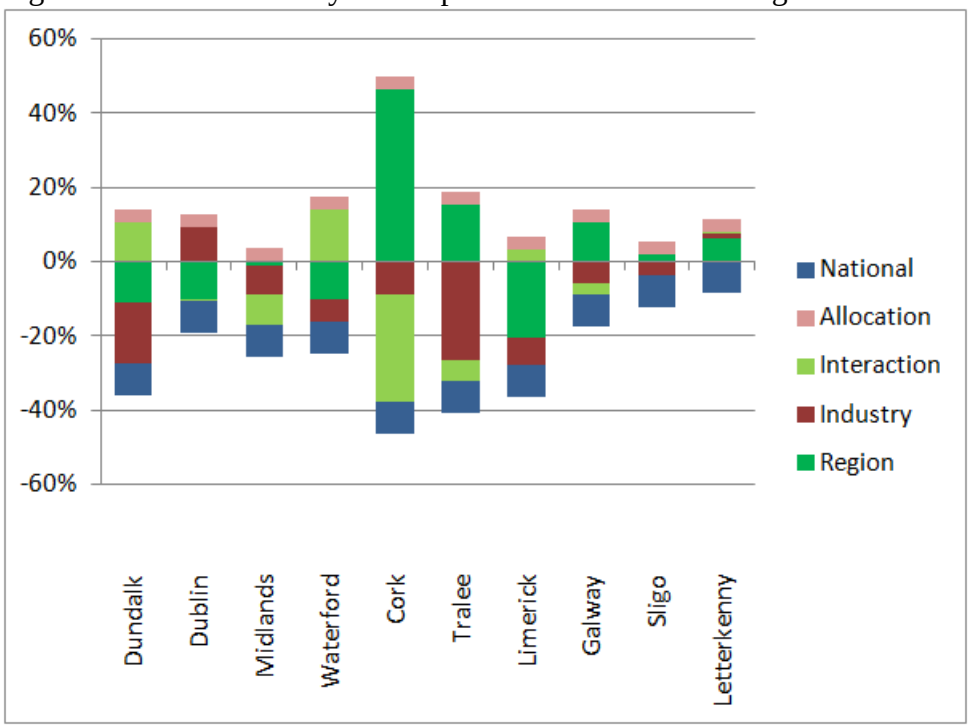


Figure 2: Shift-share analysis components 2006-2011: All firms



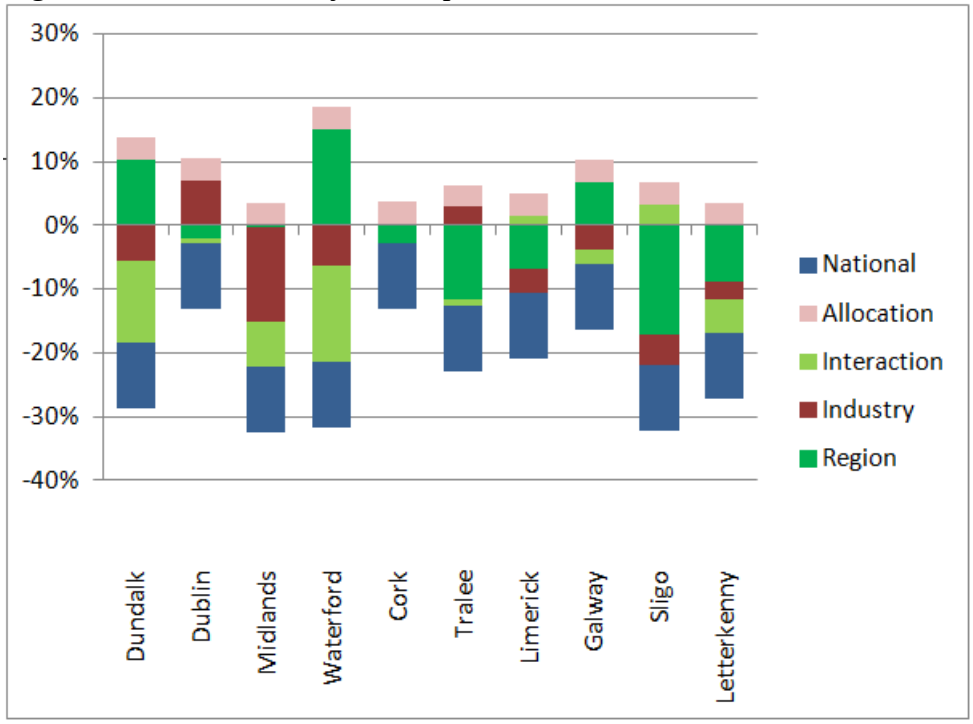
Source: calculations based on Forfás employment survey

Figure 3: Shift-share analysis components 2006-2011: Foreign firms



Source: calculations based on Forfás employment survey

Figure 4: Shift-share analysis components 2006-2011: Irish firms



Source: calculations based on Forfás employment survey

TABLES

Table 1: Regional population data (2006)

Region	Regional Population	Regional Centre Population
Cork	476,057	190,384
Dublin	1,640,270	1,045,769
Dundalk	281,005	35,085
Galway	353,793	72,729
Letterkenny	119,721	17,586
Limerick	382,774	90,757
Midlands	257,328	NA
Sligo	162,438	19,402
Tralee	147,325	22,744
Waterford	419,137	49,213

Source: Central Statistics Office

Table 2: Aggregate employment change in assisted firms

	2001	2006	% Ch 01-06	2011	% Ch 06-11
Total Employment in Assisted Firms	335,435	340,839	1.6	308,753	-9.4
% National Employment	19.5	16.9		16.3	
Irish firm employment	159,481	165,438	3.7	148,409	-10.3
Foreign firm employment	175,954	175,401	-0.3	160,344	-8.6
Foreign %	52.5	51.5		51.9	

Source: calculations based on Forfás employment survey

Table 3: Employment change by broad sector

	2001	2006	% Ch 01-06	2011	% Ch 06-11
Manufacturing Employment	244,091	227,390	-6.8	185,356	-18.5
Mfg Share of Total Empl (%)	72.8	66.7		64.2	
Foreign share of Mfg Empl (%)	49.5	48.0		48.7	
Services Employment	91,344	113,449	24.2	123,397	8.8
Services Share of Total Empl (%)	27.2	33.3		35.8	
Foreign Share of Services Empl (%)	60.3	58.4		56.8	

Source: calculations based on Forfás employment survey

Table 4: Employment in sectors in long-term decline (LTD)

Sector	2001	2006	2011	% Ch 01-06	% Ch 06-11	% Ch 01-11
Textiles, Clothing, Leather	12,206	5,580	3,739	-54.3	-33.0	-69.4
Furniture	5,666	5,161	2,858	-8.9	-44.6	-49.6
Printing/Reproduction of Recorded Media	5,938	4,405	3,083	-25.8	-30.0	-48.1
Cement & Concrete Products	5,808	5,719	3,212	-1.5	-43.8	-44.7
Other Manufacturing	20,446	16,670	11,312	-18.5	-32.1	-44.7
Electrical Engineering	9,106	6,824	5,063	-25.1	-25.8	-44.4
Electronic Products	30,950	25,654	18,572	-17.1	-27.6	-40.0
Metals & Engineering	36,421	33,898	24,589	-6.9	-27.5	-32.5
Plastic & Rubber Products	10,148	8,753	6,905	-13.7	-21.1	-32.0
Dairy Processing	10,076	8,623	7,963	-14.4	-7.7	-21.0
Other Food & Beverages	31,972	29,788	27,060	-6.8	-9.2	-15.4
Total	178,737	151,075	114,356	-15.5	-24.3	-36.0
LTD share of total employment	53.3	44.3	37.0			

Source: calculations based on Forfás employment survey

Table 5: Employment in long-term growth sectors (LTG)

Sector	2001	2006	2011	% Ch 01-06	% Ch 06-11	% Ch 01-11
Financial Services	9,326	18,794	24,090	101.5	28.2	158.3
Other Business Services	6,159	12,587	13,957	104.4	10.9	126.6
Medical Devices	20,694	26,128	27,884	26.3	6.7	34.7
Software & Computer Services	61,148	65,000	68,458	6.3	5.3	12.0
Total	97,327	122509	134,389	25.9	9.7	38.1
LTG share of total employment	29.0	35.9	43.5			

Source: calculations based on Forfás employment survey

Table 6: Employment in "recession-sensitive" sectors (RS)

Sector	2001	2006	2011	% Ch 01-06	% Ch 06-11	% Ch 01-11
Other Services	14,711	17,068	16,892	16.0	-1.0	14.8
Meat Processing	13,482	15,650	14,727	16.1	-5.9	9.2
Pharmachems	24,344	26,858	24,209	10.3	-9.9	-0.6
Timber Processing	6,834	7,679	4,180	12.4	-45.6	-38.8
Total	59,371	67,255	60,008	13.3	-10.8	1.1
RS share of total employment	17.7	19.7	19.4			

Source: calculations based on Forfás employment survey

Table 7: Employment in regions in long-term decline (LTD)

Region	2001	2006	2011	% Ch 01-06	% Ch 06-11	% Ch 01-11
Midlands	15,320	15,154	11,204	-1.1	-26.1	-26.9
Tralee	9,207	8,028	6,578	-12.8	-18.1	-28.6
Sligo	12,282	11,279	9,408	-8.2	-16.6	-23.4
Letterkenny	7,133	6,321	5,317	-11.4	-15.9	-25.5
Total	43,942	40,782	32,507	-7.2	-20.3	-26.0

Source: calculations based on Forfás employment survey

Table 8: Employment in "recession-sensitive" regions (RS)

Region	2001	2006	2011	% Ch 01-06	% Ch 06-11	% Ch 01-11
Dundalk	15,144	16,265	13,553	7.4	-16.7	-10.5
Dublin	144,601	145,615	138,337	0.7	-5.0	-4.3
Waterford	31,289	33,107	29,498	5.8	-10.9	-5.7
Cork	39,642	43,116	42,342	8.8	-1.8	6.8
Limerick	34,141	34,242	26,082	0.3	-23.8	-23.6
Galway	26,676	27,712	26,434	3.9	-4.6	-0.9
Total	291,493	300,057	276,246	2.9	-7.9	-5.2

Source: calculations based on Forfás employment survey

Table 9: Growth category distribution and employment change 2001-2006

Region	% Empl by growth category 2001			% Ch 01-06
	LTD	LTG	RS	
Cork	56.9	19.0	24.2	8.8
Dublin	44.9	41.7	13.4	0.7
Dundalk	75.0	4.2	20.8	7.4
Galway	45.0	35.1	19.9	3.9
Letterkenny	69.0	16.5	14.4	-11.4
Limerick	64.7	19.5	15.9	0.3
Midlands	58.6	15.3	26.1	-1.1
Sligo	60.4	24.6	15.0	-8.2
Tralee	60.2	14.7	25.1	-12.8
Waterford	60.5	15.9	23.5	5.8
National	53.3	29.0	17.7	1.6

Source: calculations based on Forfás employment survey

Table 10: Growth category distribution and employment change 2006-2011

Region	% Empl by growth category 2006			% Ch 06-11	Martin Resistance Index	BVEC Resistance Index	BVEC Resilience Index
	LTD	LTG	RS				
Cork	49.8	27.5	22.8	-1.8	0.23	0.55	1.01
Dublin	36.0	47.4	16.7	-5.0	0.63	1.32	1.78
Dundalk	61.7	14.0	24.3	-16.7	2.11	0.23	0.62
Galway	35.6	44.7	19.8	-4.6	0.58	1.26	1.81
Letterkenny	51.8	25.8	22.4	-15.9	2.01	0.50	0.93
Limerick	56.7	28.5	14.7	-23.8	3.01	0.50	0.76
Midlands	55.8	20.3	23.9	-26.1	3.30	0.36	0.79
Sligo	49.8	32.1	18.1	-16.6	2.10	0.64	1.01
Tralee	49.7	18.2	32.2	-18.1	2.29	0.37	1.01
Waterford	50.1	22.6	27.3	-10.9	1.38	0.45	1.00
National	44.3	35.9	19.7	-7.9	1.00	0.81	1.26

Source: calculations based on Forfás employment survey

Table 11: Foreign firms' share of employment 2006 and total employment change 2006-2011 (%)

Region	Foreign firm % of empl 2006	Total Empl Ch % 06-11
Cork	59.6	-1.8
Limerick	58.4	-23.8
Galway	57.0	-4.6
Dublin	55.7	-5.0
Sligo	47.8	-16.6
Waterford	40.6	-10.9
Midlands	38.9	-26.1
Letterkenny	29.0	-15.9
Dundalk	25.8	-16.7
Tralee	25.7	-18.1
Ireland	51.5	-7.9

Source: calculations based on Forfás employment survey

Table 12: Growth performance of sectors by foreign/Irish domination

Sector	Growth Category	Total Empl 2006	Foreign %	Empl Ch% 06-11
Foreign-firm dominated				
Medical Devices	LTG	26,128	89.5	6.7
Electronics	LTD	25,654	88.2	-27.6
Pharmachems	RS	26,858	86.6	-9.9
Software etc.	LTG	65,000	79.1	5.3
Financial Services	LTG	18,794	71.4	28.2
Irish-firm dominated				
Furniture	LTD	5,161	97.0	-44.6
Meat Processing	RS	15650	96.1	-5.9
Other Business Services	LTG	12,587	95.6	10.9
Other services	RS	17,068	94.7	-1.0
Dairy Processing	LTD	8623	92.2	-7.7
Cement etc	LTD	5719	90.5	-43.8
Printing etc.	LTD	4,405	89.9	-30.0
Timber	RS	7,679	88.0	-45.6
Textiles etc	LTD	5580	79.6	-33.0

Source: calculations based on Forfás employment survey

Table 13: Growth performance of intermediate sectors (see text)

Sector	Growth Category	Total Empl 2006	Foreign %	Foreign empl Ch % 06-11	Irish empl Ch % 06-11
Electrical Engineering	LTD	6,824	52.4	-36.9	-13.7
Plastics	LTD	8,753	43.0	-17.7	-23.7
Other Mfg	LTD	16,670	40.2	-39.6	-27.2
Other Food & Bev	LTD	29,788	35.8	-15.3	-5.7
Metals & Engineering	LTD	33,898	31.6	-30.6	-26.0

Source: calculations based on Forfás employment survey

Table 14: Regional LTD/LTG replacement rates

	LTD % 06	LTD % 11	LTG % 06	LTG % 11	LTD Ch	LTG Ch	LTG % LTD
Cork	49.8	42.9	27.5	36.8	-3,288	3,718	1.13
Dublin	36.0	28.9	47.4	54.4	-12,356	6,265	0.51
Dundalk	61.7	55.1	14.0	19.3	-2,558	333	0.13
Galway	35.6	27.2	44.7	52.6	-2,671	1,533	0.57
Letterkenny	51.8	49.3	25.8	34.5	-654	208	0.32
Limerick	56.7	52.5	28.5	33.1	-5,724	-1,137	NA
Midlands	55.8	50.8	20.3	28.4	-2,769	109	0.04
Sligo	49.8	49.4	32.1	36.1	-969	-224	NA
Tralee	49.7	49.1	18.2	23.8	-754	109	0.14
Waterford	50.1	39.4	22.6	28.6	-4,976	966	0.19
Ireland	44.3	37.0	35.9	43.5	-36,719	11,880	0.32

Source: calculations based on Forfás employment survey

Table 15: Shift-share analysis components 2006-2011: All firms

RF Name	Region	Industry	Interaction	Allocation	National	Total
Dundalk	2.63%	-7.21%	-5.75%	3.07%	-9.41%	-16.67%
Dublin	-5.40%	7.48%	-0.73%	3.07%	-9.41%	-5.00%
Midlands	-0.10%	-11.53%	-8.08%	3.07%	-9.41%	-26.07%
Waterford	3.03%	-6.19%	-1.39%	3.07%	-9.41%	-10.90%
Cork	21.88%	-4.68%	-12.65%	3.07%	-9.41%	-1.80%
Tralee	-1.04%	-2.95%	-7.73%	3.07%	-9.41%	-18.06%
Limerick	-15.27%	-4.86%	2.64%	3.07%	-9.41%	-23.83%
Galway	10.11%	-4.16%	-4.22%	3.07%	-9.41%	-4.61%
Sligo	-6.00%	-5.67%	1.33%	3.07%	-9.41%	-16.59%
Letterkenny	3.09%	-2.96%	-9.83%	3.07%	-9.41%	-15.88%

Source: calculations based on Forfás employment survey

Table 16: Shift-share analysis components 2006-2011: Foreign firms

RF Name	Region	Industry	Interaction	Allocation	National	Total
Dundalk	-10.90%	-16.42%	10.64%	3.51%	-8.60%	-21.77%
Dublin	-10.01%	9.06%	-0.80%	3.51%	-8.60%	-6.84%
Midlands	-1.04%	-7.76%	-8.44%	3.52%	-8.60%	-22.04%
Waterford	-10.30%	-5.88%	13.83%	3.51%	-8.60%	-7.44%
Cork	46.27%	-9.05%	-28.74%	3.51%	-8.60%	3.39%
Tralee	15.19%	-26.69%	-5.59%	3.51%	-8.60%	-22.18%
Limerick	-20.43%	-7.30%	3.36%	3.51%	-8.60%	-29.47%
Galway	10.66%	-5.72%	-3.27%	3.51%	-8.60%	-3.42%
Sligo	1.81%	-3.78%	0.06%	3.51%	-8.60%	-6.85%
Letterkenny	6.13%	1.53%	0.26%	3.51%	-8.60%	2.83%

Source: calculations based on Forfás employment survey

Table 17: Shift-share analysis components 2006-2011: Irish firms

RF Name	Region	Industry	Interaction	Allocation	National	Total
Dundalk	10.30%	-5.54%	-12.87%	3.49%	-10.29%	-14.90%
Dublin	-2.12%	6.94%	-0.71%	3.49%	-10.29%	-2.69%
Midlands	-0.31%	-14.91%	-7.01%	3.49%	-10.29%	-29.03%
Waterford	14.97%	-6.28%	-15.15%	3.49%	-10.29%	-13.26%
Cork	-2.88%	0.19%	0.03%	3.49%	-10.29%	-9.45%
Tralee	-11.63%	2.87%	-1.07%	3.49%	-10.29%	-16.64%
Limerick	-6.95%	-3.71%	1.56%	3.49%	-10.29%	-15.90%
Galway	6.73%	-3.84%	-2.28%	3.49%	-10.29%	-6.20%
Sligo	-17.12%	-4.87%	3.17%	3.50%	-10.29%	-25.49%
Letterkenny	-8.97%	-2.55%	-5.45%	3.50%	-10.29%	-23.55%

Source: calculations based on Forfás employment survey