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Regional economic resilience in Ireland: the roles of industrial structure and foreign inward investment

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This paper examines the resilience of Irish regions during the course of the post-2007 economic crisis, focusing specifically on employment change in firms in receipt of assistance from the Irish government's enterprise development agencies. The paper classifies both regions and sectors in terms of their employment performance both before and during the recession and employs a number of techniques to assess the roles of sectoral composition, firm nationality and other factors in shaping the recession's regional impact. While nationality mix is significant, sectoral composition is seen as having a more important impact on regional employment performance. Other factors also have an important role in some regions, but their precise nature remains unknown.

Keywords: regional resilience; industrial structure; foreign direct investment (FDI); Ireland

Introduction

Recent years have seen a surge of academic interest in the concept of economic resilience, which refers to the ability of national and regional economies to cope with the onset of adverse conditions (Briguglio, Cordina, Farrugia, & Vella, 2008; Christopherson, Michie, & Tyler, 2010; Hassink, 2010; Hill, Wial, & Wolman, 2008; Hudson, 2010; Martin, 2012; Pendall, Foster, & Cowell, 2010; Pike, Dawley, & Tomaney, 2010; Simmie & Martin, 2010). While the incidence of such conditions, in the form of general and sectorally specific recessionary downturns, could be considered to be an inherent feature of the functioning of capitalism, a number of additional factors have combined to generate the recent burgeoning of interest in how economies respond to system shocks. These include globalization processes, which have increased the exposure of national and regional economies to disturbances emanating from other parts of the world; the accelerating pace of technological change and its potentially undermining impact on regional economies dependent on technologies which rapidly become outdated; the expected onset of ecological crises thought to be associated with climate change; and the recent succession of non-climate-related natural disasters. It has also been argued that the accelerating financialization of the global capitalist economy prompts progressively speculative forms of investment leading to increasingly frequent 'bubble' creation and post-bubble crashes (Foster & Magdoff, 2009). The exceptional severity of the financial crisis engendered by the collapse of the US housing bubble has been of particular importance in focusing the

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minds of both academics and policy-makers on issues relating to resilience and prospects for economic recovery in economies across the globe (Bristow, Healy, & Norris, 2014; Martin, Sunley, & Tyler, 2015).

Perhaps an inevitable consequence of the expanding body of literature relating to economic resilience has been a proliferation of differing interpretations of the term's meaning, leading to a lack of definitional and conceptual clarity (Martin, 2012). Thus, while Pike et al. (2010, p. 61) point to the underdeveloped state of theorization of the 'causal agents, relationships and mechanisms' associated with the resilience concept, Pendall et al. (2010) have highlighted the need for empirical exploration of the concept and the development of replicable analytical methods employing reliable qualitative and quantitative data for this purpose. There has, for example, been great variation in the time-frames applied both to the system shocks that test regions' resilience and the length of time over which responses to these shocks are monitored. Thus, shocks have been seen as short, one-off events (such as natural disasters or stock-market crashes), medium-term events (such as the emergence of new competitor technologies or regions), and long-term events (such as the decline of old industrial regions in advanced economies). There has also been much debate over the relative roles of restoration of pre-shock configurations or restructuring of these configurations as forms of post-shock recovery, and the respective impacts of these forms of recovery on long-term regional development trajectories (Martin, 2012).

A related issue is how recovery should be measured, whether in terms of basic indicators such as output, incomes, employment and population or in structural terms such as sectoral reconfiguration or enhanced entrepreneurial activity. This, in fact, is an issue that figures little in much of the recent literature on regional economic resilience, which could be described as being long on theoretical discussion and short on empirical investigation. An exception to this is the work of Ron Martin and colleagues on the impact of successive recessions on employment in the UK regions from the early 1970s to the late 2000s (Fingleton, Garretsen, & Martin, 2012; Gardiner, Martin, & Tyler, 2012; Martin, 2012). Employing a variety of analytical techniques, this research has revealed a complex picture of the regional geography of recessionary impacts and post-recession recovery. There was considerable regional variation in the employment effects of recessions (although less so with respect to the most recent recession) and in rates of post-recession employment recovery, with the spatial patterns of variation differing between recessionary periods. Furthermore, while those regions which experienced least employment loss in the recession of the early 1980s tended to portray the strongest post-recession employment growth, the relationship between these variables, while not as strong, was reversed for the early 1990s recession and its aftermath. Regional differences in sectoral configuration have been a key determinant of the extent of recessionary impact, while for some regions, specific local characteristics (separate from sectoral mix) had significant positive or negative impacts.

The present paper adds to the corpus of empirical explorations of regional economic resilience through an examination of employment trends in state-aided firms in the Irish regions following the onset of the 2007–08 recession. Such firms comprise the key element in the economic base underpinning the respective regional economies. A detailed breakdown by sector and nationality (Irish/foreign) enables us to monitor the performance, during the recession, of the different sectors and nationality groups which combine in varying combinations in the economic bases of the different regions. An examination of pre-recession trends helps to separate immediate recessionary impacts from longer-term development trajectories.

The remainder of the paper comprises, firstly, an exposition of the methodology; secondly, a descriptive account of the patterns of regional and sectoral employment change in state-assisted firms both before and during the recession; thirdly, a section that examines the roles of sectoral and nationality mix in shaping the observed patterns of regional employment performance; fourthly, a section that employs shift–share analysis to throw further light on the roles of sectoral and nationality mix in influencing regional employment change (and which also raises issues concerning the utility of certain aspects of the shift–share technique in this respect); and a final section that summarizes, and draws conclusions from, the main findings.

Method

While other studies have used total regional employment as their basic yardstick for monitoring regional economic change, the analysis here focuses specifically on employment in firms that are in receipt of assistance by one of the four Irish government 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 had a specific development remit for the Mid West region). Hereinafter, these firms are referred to as ‘agency-assisted’ firms. For the purposes of the present analysis, agency-assisted firms in primary activities (a disparate group of little analytical value, disproportionately concentrated in peripheral Gaelic-speaking areas, and accounting for just over 3% of total employment in assisted firms in 2011) have been excluded.

Employment and other data for agency-assisted firms are derived from an annual survey conducted by Forfás, the Irish government’s industrial policy advisory agency. These firms accounted for one-sixth of all employment in manufacturing and services in 2011. Agency-assisted manufacturing firms comprised about 80% of all manufacturing employment and 90% of total merchandise exports.¹ Assisted services firms, while representing only 7% of total services employment, accounted for around 70% of all services exports (which, in turn, comprised 49% of total exports in 2011). Assisted firms, therefore, account for the great bulk of national exports. Foreign firms, which account for 55% of all employment in assisted firms, export almost all (95%) of their output. Assisted indigenous firms have a much lower export orientation (just over 50% of output); however, many of these are engaged in import-substituting activities or are deemed to have some strategic or innovative value. Overall, therefore, assisted firms can be regarded as acting as key drivers of economic development at both national and regional levels, and trends in employment in these firms provide a key indicator of regional economic wellbeing.

For the purposes of this paper, employment data for agency-assisted firms by nationality, region and sector for 2001, 2006 and 2011 were extracted from the Forfás survey database. While the year 2006 does not coincide exactly with the onset of the recession (whose effects began to be felt in late 2007), the period 2006–11 does encompass its most severe years, with gross national product (GNP) (which factors out large-scale profit repatriation by foreign firms) falling by 11.7% in real terms in the four years up to 2011, at which point a slow recovery commenced. By contrast, GNP grew by 25.8% between 2001 and 2006. In what follows, the term ‘period’ refers to 2001–11 and ‘sub-period’ to 2001–06 and 2006–11.

A useful feature of the analysis presented here is that it is based on functional rather than administrative regions. As Martin (2012, pp. 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 (as yet unpublished) on commuting fields being conducted at the National Institute for Regional and Spatial Analysis (NIRSA) at Maynooth University to delineate a series of 10 functional regions (‘regional fields’) focused on each region’s main urban centre (with the exception of the residual Midlands region which does not contain a focal urban centre) (Figure 1). These regional fields were defined via a two-stage process. Firstly, a set of ‘local urban fields’ was defined by allocating to each town with an employment base of at least 1000 jobs in 2006 those electoral districts (small-scale census reporting units) which sent more daily commuters to that town than any other town. Secondly, the regional fields were defined by allocating each local urban field to the regional urban centre to which that local urban field sent more commuters than to any other regional centre. Thus, each regional field comprises a set of local urban fields.

Table 1 shows the population of each of these regions in 2006 (the midpoint 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.

A distinctive and important feature of the analysis presented here is that the employment data are disaggregated into fifteen manufacturing and four services sectors. These include those 17 sectors (representing individual Nomenclature statistique des activités économiques dans la Communauté Européenne (NACE) three-digit codes or combinations thereof) which employed 5000 people or more in at least one of the three years 2001, 2006 and 2011, and residual Other Manufacturing and Other Services sectors (which, between them, accounted for approximately 10% of total employment in agency-assisted firms over the 10-year period). The 5000 job threshold marks a clear divide in employment terms between sectors employing in excess of, and less than, this number. The separate identification of the Software and Computer Services, Financial Services, and Other Business Services sectors is particularly useful as, unlike most other services subsectors, in Ireland these are strongly export oriented and account for a large proportion of Ireland’s total exports (42% in 2011).

The analysis that follows examines how the 10 functional regions identified above performed in terms of employment in agency-assisted firms in the largely recessionary 2006–11 sub-period compared with the expansionary 2001–06 sub-period which immediately preceded it. 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 (the so-called ‘counterfactual’ question). One way of approaching this question is to divide both sectors and regions into three ‘growth categories’, i.e. those that lost employment in both the 2001–06 and 2006–11 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 growth category may be regarded as encompassing sectors/regions undergoing long-term decline (LTD) (i.e. they would probably have continued to decline even if the recession had not occurred, although the recession might accelerate the rate of decline). These are referred to hereafter as LTD sectors/regions. The second growth category involves sectors/regions whose growth trajectory was not halted by the recession (although it may have been

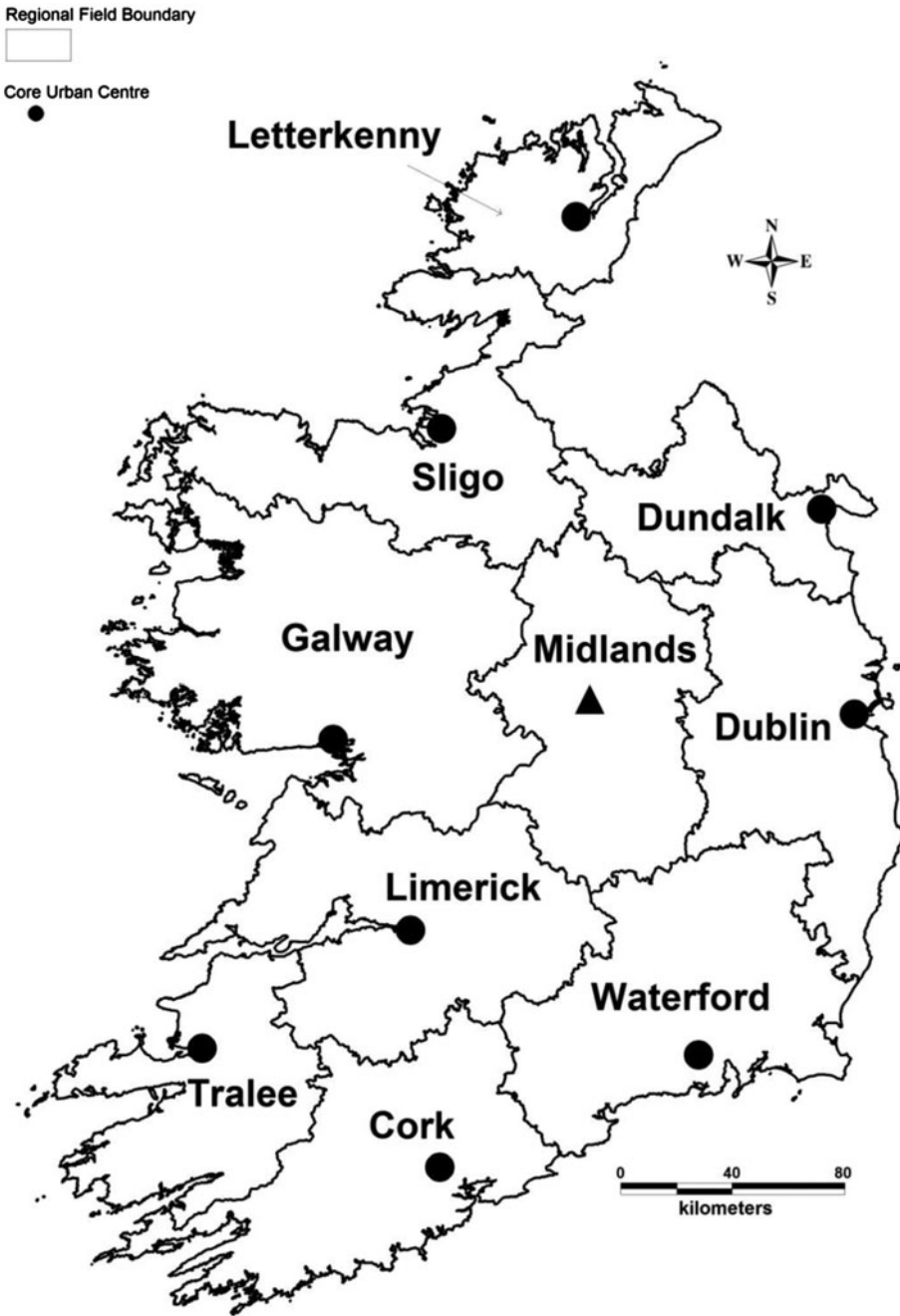


Figure 1. Regional urban centres and their fields of influence.

slowed down). These are referred to as long-term growth (LTG) sectors/regions. The third growth category refers to sectors/regions whose growth trajectory was reversed during the recession, and which might have continued to grow in the absence of recession. If the latter is the case, then these sectors/regions might be expected to

Table 1. Regional population data, 2006.

Region	Regional population	Regional centre population
Cork	476,057	190,384
Dublin	1640,270	1045,769
Dundalk	281,005	35,085
Galway	353,793	72,729
Letterkenny	119,721	17,586
Limerick	382,774	90,757
Midlands	257,328	No single regional centre
Sligo	162,438	19,402
Tralee	147,325	22,744
Waterford	419,137	49,213

Source: Central Statistics Office.

resume growth once relatively ‘normal’ conditions return. These are referred to as recession-sensitive (RS) sectors/regions.

While this is a rather crude classification, it does appear to have some heuristic usefulness, as shown below. The next section identifies those sectors and regions falling into the three growth categories employed here and sets out their respective employment performances in the two sub-periods. The following section then examines the relationship between regional employment performance during the recession and prior regional sector and nationality mix, using a number of indexes for this purpose. The roles of sectoral and nationality mix are further explored using shift–share analysis, which subdivides aggregate regional employment change into a number of discrete components. The particular shift–share technique used, multifactor partitioning, divides employment change into four main components: a national effect (related to overall employment trends in the national economy); a sectoral-mix effect (related to the differing growth rates and relative sizes of sectors at regional level), a region–industry effect (where particular regions offer specific advantages for specific sectors), and a regional effect (which measures the general positive or negative effect a region exerts on all sectors contained therein). These effects are measured during the recessionary sub-period for all firms, and then for Irish and foreign firms separately.

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 agency-assisted firms. Table 2 shows that total employment in these firms grew moderately (1.6%) between 2001 and 2006 and then fell much more strongly (9.4%) in 2006–11. 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 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 2001–06 and then recovered somewhat in 2006–11, 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

Table 2. Aggregate employment change in agency-assisted firms, 2001–11.

	2001	2006	% Change, 2001–06	2011	% Change, 2006–11
Total employment	335,435	340,839	1.6	308,753	–9.4
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	

Table 3. Employment change by broad sector, 2001–11.

	2001	2006	% Change, 2001–06	2011	% Change, 2006–11
Manufacturing employment	244,091	227,390	–6.8	185,356	–18.5
Manufacturing share of total employment (%)	72.8	66.7		64.2	
Foreign share of manufacturing employment (%)	49.5	48.0		48.7	
Services employment	91,344	113,449	24.2	123,397	8.8
Services share of total employment (%)	27.2	33.3		35.8	
Foreign share of services employment (%)	60.3	58.4		56.8	

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 of this sector fall to 56.8% in 2011.

Table 4 shows employment change between 2001 and 2011 in those sectors falling, respectively, into the LTD, LTG and RS growth categories. Eleven of the 19 sectors (accounting for 53.3% of total 2001 employment but only 37% in 2011) fell into the LTD category – all in manufacturing. The overall decline rate for these sectors rose from 15.5% in 2001–06 to 24.3% in 2006–11, suggesting that a decline process already in train was accelerated by the recession. The Textiles sector actually experienced a slowdown in its rate of decline in the second sub-period, but this came in the wake of a particularly severe contraction in the preceding sub-period, in which the sector lost over one half of its initial job complement. 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 and Concrete and Metals and Engineering sectors was undoubtedly linked to the collapse of the Irish construction sector post-2007. The relatively low decline rates in the second sub-period 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.

Table 4. Employment in long-term decline (LTD), long-term growth (LTG) and recession-sensitive (RS) sectors, 2001–11.

Sector	2001	2006	2011	% Change, 2001–06	% Change, 2006–11	% Change, 2001–11
<i>LTD sectors</i>						
Textiles, clothing, leather	12,206	5580	3739	-54.3	-33.0	-69.4
Furniture	5666	5161	2858	-8.9	-44.6	-49.6
Printing/reproduction of recorded media	5938	4405	3083	-25.8	-30.0	-48.1
Cement and concrete products	5808	5719	3212	-1.5	-43.8	-44.7
Other manufacturing	20,446	16,670	11,312	-18.5	-32.1	-44.7
Electrical engineering	9106	6824	5063	-25.1	-25.8	-44.4
Electronic products	30,950	25,654	18,572	-17.1	-27.6	-40.0
Metals and engineering	36,421	33,898	24,589	-6.9	-27.5	-32.5
Plastic and rubber products	10,148	8753	6905	-13.7	-21.1	-32.0
Dairy processing	10,076	8623	7963	-14.4	-7.7	-21.0
Other food and 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			
<i>LTG sectors</i>						
Financial services	9326	18,794	24,090	101.5	28.2	158.3
Other business services	6159	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 and computer services	61,148	65,000	68,458	6.3	5.3	12.0
Total	97,327	122,509	134,389	25.9	9.7	38.1
LTG share of total employment	29.0	35.9	43.5			
<i>RS sectors</i>						
Timber processing	6834	7679	4180	12.4	-45.6	-38.8
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
Pharmaceuticals	24,344	26,858	24,209	10.3	-9.9	-0.6
Total	59,371	67,255	60,008	13.3	-10.8	1.1
RS share of total employment	17.7	19.7	19.4			

Most of the LTD sectors listed in Table 4 are, predictably, in traditional, low-tech, sectors. The sharp decline in employment in Electronic Products, which was a key contributor to Ireland's rapid economic growth in the 1990s, is attributable to the impact of the dot.com crash of 2000 followed by the emergence of China as a major low-cost producer of such products in the 2000s. The relocation of Electrical Engineering production to developing economies has been a more long-established phenomenon. Much of the decline in Printing/Reproduction of Recorded Media is due to the movement

away from printed manuals and packaged disks in the software industry, as production of these products had been a major element of the early development of this industry in Ireland.

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. In all cases, there was a reduction in growth rate in the second sub-period compared with the first, attesting to the stifling effect of the recession. At the same time, it seems unlikely that the spectacular growth rates of the Financial Services and Other Business Services sectors in the first sub-period would have been sustained in the second sub-period, even in the absence of recession. That said, the high growth rate of the Financial Services sector in the face of recession is notable. It is also noticeable that the modest growth rate of the already well-developed Software and Computer Services sector in the first sub-period was only slightly reduced in the second sub-period.

Of the four sectors (three in manufacturing) in the RS category, 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 much lower than for most of the LTD sectors. Thus, these sectors were 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 2006–11 sub-period, none falls into the LTG category. Table 5 shows the employment performance of those regions in the LTD and RS categories. All four LTD regions (and especially the Midlands region) experienced accelerated decline in 2006–11. These were, in employment terms, the four smallest 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); three are located in the traditionally underdeveloped western part of the country.

Table 5. Employment in regions in long-term decline (LTD) and recession-sensitive (RS) regions, 2001–11.

Region	2001	2006	2011	% Change, 2001–06	% Change, 2006–11	% Change, 2001–11
<i>LTD regions</i>						
Tralee	9207	8028	6578	-12.8	-18.1	-28.6
Midlands	15,320	15,154	11,204	-1.1	-26.1	-26.9
Letterkenny	7133	6321	5317	-11.4	-15.9	-25.5
Sligo	12,282	11,279	9408	-8.2	-16.6	-23.4
Total LTD regions	43,942	40,782	32,507	-7.2	-20.3	-26.0
<i>RS regions</i>						
Limerick	34,141	34,242	26,082	0.3	-23.8	-23.6
Dundalk	15,144	16,265	13,553	7.4	-16.7	-10.5
Waterford	31,289	33,107	29,498	5.8	-10.9	-5.7
Dublin	144,601	145,615	138,337	0.7	-5.0	-4.3
Galway	26,676	27,712	26,434	3.9	-4.6	-0.9
Cork	39,642	43,116	42,342	8.8	-1.8	6.8
Total RS regions	291,493	300,057	276,246	2.9	-7.9	-5.2

The regions in the RS group present quite a varied picture. Cork had the strongest overall performance, with the strongest growth rate in 2001–06 and the weakest decline rate in 2006–11, and was the only region with a higher level of employment in 2011 than in 2001. Limerick's performance was by far the weakest, combining the slowest growth in 2001–06 and fastest decline in 2006–11. While both Dublin and Galway had below-average growth in 2001–06 and below-average decline in 2006–11, the opposite was the case with Waterford and Dundalk.

Explaining regional employment performance

Having shown the varying overall sectoral and regional employment performances, the paper now examines the extent to which regional performance may have been linked to regional sectoral mix, paying particular attention to the second, recessionary, sub-period. A feature of Table 4 is the great variation between sectors in terms of the extent to which they have been impacted by the recession. Accordingly, the varying sectoral mixes of the different regions will have a major bearing on these regions' respective employment performances between 2006–11. Table 6 shows (in columns 2–5) for each region, the division of employment between the three growth categories for 2006 and the region's overall employment performance between 2006 and 2011. 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.

Table 6 shows some evidence of a link between employment performance and prior sectoral mix. 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 2006–11. Meanwhile, Limerick and Midlands, with high shares of LTD employment, portray by far the highest rates of employment decline. This is supported by quite strong Pearson 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

Table 6. Growth category distribution and employment change, 2006–11.

Region	% Employment by growth category 2006			% Change, 2006–11	Sensitivity index ^a	Resistance index ^b	Resilience index ^c
	LTD	LTG	RS				
Cork	49.8	27.5	22.8	–1.8	0.23	0.55	1.01
Galway	35.6	44.7	19.8	–4.6	0.58	1.26	1.81
Dublin	36.0	47.4	16.7	–5.0	0.63	1.32	1.78
Waterford	50.1	22.6	27.3	–10.9	1.38	0.45	1.00
Letterkenny	51.8	25.8	22.4	–15.9	2.01	0.50	0.93
Sligo	49.8	32.1	18.1	–16.6	2.10	0.64	1.01
Dundalk	61.7	14.0	24.3	–16.7	2.11	0.23	0.62
Tralee	49.7	18.2	32.2	–18.1	2.29	0.37	1.01
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
National	44.3	35.9	19.7	–7.9	1.00	0.81	1.26

Notes: ^aRegional employment change divided by national employment change (after Martin, 2012).

^bLTG employment divided by LTD employment.

^cLTG plus RS employment divided by LTD employment.

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 2006–11. The nature of this anomalous case is examined further below.

Indexes of regional employment change

Martin (2012) devised a simple index to facilitate comparison between the British regions in terms of the extent to which employment in each was affected by the onset of recession. This ‘sensitivity’ index divides a region’s rate of employment decline during the recession by the national rate, so that regions with an index value in excess of one had a relatively high sensitivity to the negative effects of recession and vice versa. This is a post-hoc index that takes no cognisance of pre-recession regional structures and in itself has no explanatory power. Two potentially more useful alternative indexes which utilize the sectoral growth categories employed above and possess possible predictive capabilities are proposed here. These are based on the distinction between two concepts widely reported in the literature i.e. regional *resistance*, which refers to a region’s capacity to withstand external shocks; and regional *resilience*, which refers to a region’s ability to recover where it has been impacted negatively by an external shock (e.g., Martin, 2012).

The first of these indexes, termed the ‘resistance’ index, divides the share of employment in each region taken by LTG sectors by the share taken by LTD sectors in 2006. One might expect that regions with a high share of LTG employment relative to LTD employment would be more resistant to employment loss during recession. The second index, termed a ‘resilience’ index, divides, for each region, the combined shares of both LTG and RS employment by the share of LTD employment. The rationale here is that both LTG and RS sectors should have a better chance than LTD sectors of recovering employment in the post-recession period. Regions with high proportions of LTG/RS employment, therefore, should portray higher post-recession resilience than regions with high proportions of LTD employment.

The values for these three indexes for each of the Irish regions are shown in columns 6–8 of Table 6. The sensitivity index shows Cork, Galway and Dublin as the only regions with rates of employment loss below the national rate during 2006–11 while both Limerick and Midlands experienced rates of loss of over three times the national average. These groups of regions represent the different ends of the spectrum of sensitivity to recession. As regards the resistance index, Galway and Dublin were the only regions with more LTG than LTD employment in 2006 and therefore the only regions with an index value in excess of one. On this measure, Dundalk was the region with least resistance, due to its low share (14.0%) of LTG employment and high share (61.7%) of LTD employment. Three other regions (Midlands, Tralee and Waterford) had index values below 0.5. Cork’s anomalous position is again in evidence here, its relatively strong employment performance contrasting with its low resistance index (0.55). 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).

The resilience index suggests that Dublin and Galway’s prospects of post-recession recovery are particularly strong: with two thirds of 2006 employment in both cases in LTG and RS sectors, they have by far the highest index values. Five of the other 10

regions are clustered around an index value of 1, leaving them in a somewhat ambivalent situation. Dundalk (with 61.7% of employment in LTD sectors) has the poorest prospects of recovery according to this index, followed by Limerick and Midlands. Strictly speaking, one would need to wait until several years of sustained post-recession recovery had elapsed to test the efficacy of the resilience index; however, as it happens this index is a better predictor than the resistance index of regional employment performance in 2006–11 ($R = 0.69$ with Cork included and 0.85 with Cork excluded).

The Cork anomaly

Cork's anomalous position in these tables is, to a considerable extent, attributable to problems with employment categorization in two of the region's largest plants. 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 2006–11, for Cork the rate of decline was only 4.6%. The region's two main employers in this sector are Apple and EMC, both of which established manufacturing operations in Cork in the 1980s, with subsequent expansion bringing combined employment in the plants to approximately 4000 in 2011. However, expansion after the year 2000 mainly involved the addition of service functions such as customer support, logistics, and software which were not directly linked to the existing manufacturing functions (indeed, Apple greatly scaled back its manufacturing operation). 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 considerably, while that of services employment (mainly Software and Computer Services and Other Business Services) would increase accordingly. Thus, the balance between the shares of LTD and LTG employment for Cork would narrow very considerably, with consequent alterations to 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 7 shows the proportion of employment in each region accounted for by foreign firms, and also the rate of total employment decline in each region between 2006–11. 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 closure in 2009 of the Dell manufacturing plant in Limerick, with the loss of 1900 jobs, pointing to the impact events in a single large

Table 7. Foreign firms' share of employment 2006 and total employment change, 2006–11 (%).

Region	Foreign firm % of employment, 2006	Total employment change (%), 2006–11
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

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 8 shows the post-2006 employment performance of those sectors dominated (i.e. $\geq 70\%$ of total employment), respectively, by foreign firms and by Irish firms. Of the five foreign-dominated sectors, three fall in the LTG category, compared with just one out of nine Irish-dominated sectors. The three Irish-dominated sectors which experienced the heaviest employment losses (Timber, Furniture and Cement) are all strongly connected to the highly cyclical construction sector which holds out some hope of post-recession recovery. While the foreign sector, therefore, appears to possess greater resilience, it is not entirely immune from long-term decline, as foreign firms dominate the high-tech but rapidly shrinking Electronics sector.

Table 8. Growth performance of sectors by foreign/Irish domination, 2006–11

Sector	Growth category	Total employment, 2006	Foreign %	Employment change (%), 2006–11
<i>Foreign-firm dominated</i>				
Financial services	LTG	18,794	71.4	28.2
Medical devices	LTG	26,128	89.5	6.7
Software etc.	LTG	65,000	79.1	5.3
Pharmaceuticals	RS	26,858	86.6	-9.9
Electronics	LTD	25,654	88.2	-27.6
<i>Irish-firm dominated</i>				
Other business services	LTG	12,587	4.4	10.9
Other services	RS	17,068	5.3	-1.0
Meat processing	RS	15,650	3.9	-5.9
Dairy processing	LTD	8623	7.8	-7.7
Printing etc.	LTD	4405	10.1	-30.0
Textiles etc.	LTD	5580	20.4	-33.0
Cement etc.	LTD	5719	9.5	-43.8
Furniture	LTD	5161	3.0	-44.6
Timber	RS	7679	12.0	-45.6

Thus, whereas overall there is some evidence that foreign firms tend to be found in more resilient sectors, the relationship between the two is by no means clear-cut. 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.

Job replacement patterns

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 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 9 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 (except in the cases of Limerick and Sligo, where LTG losses meant that this measure was not applicable). All regions portrayed a fall in the share of LTD employment (albeit marginal in two cases) and a rise in the LTG share. While Limerick and Sligo experienced a fall in both LTD and LTG employment, 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 LTD 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 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, compensation for LTD job losses through growth in LTG sectors has been very limited.

Table 9. Regional LTD/LTG replacement rates.

	LTD (%), 2006	LTD (%), 2011	LTG (%), 2006	LTG (%), 2011	LTD change, 2006–11	LTG change, 2006–11	Δ LTG (%)/ Δ LTD
Cork	49.8	42.9	27.5	36.8	-3288	3718	1.13
Dublin	36.0	28.9	47.4	54.4	-12,356	6265	0.51
Dundalk	61.7	55.1	14.0	19.3	-2558	333	0.13
Galway	35.6	27.2	44.7	52.6	-2671	1533	0.57
Letterkenny	51.8	49.3	25.8	34.5	-654	208	0.32
Limerick	56.7	52.5	28.5	33.1	-5724	-1137	n.a.
Midlands	55.8	50.8	20.3	28.4	-2769	109	0.04
Sligo	49.8	49.4	32.1	36.1	-969	-224	n.a.
Tralee	49.7	49.1	18.2	23.8	-754	109	0.14
Waterford	50.1	39.4	22.6	28.6	-4976	966	0.19
Ireland	44.3	37.0	35.9	43.5	-36,719	11,880	0.32

Note: n.a., Not applicable (see text).

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. The traditional shift–share approach divides regional employment change over a period into three components or ‘effects’ – a *national* effect (i.e. the change which would have occurred if all regional sectors experienced the same rate of change as overall national employment over the period), an *industry-mix* (i.e. sectoral composition) effect (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 *minus* the national component), and a residual element (the difference between the actual employment changes in sectoral employment and the sum of the national and industry-mix components) which is usually interpreted as a *regional* effect (i.e. employment change attributable to specific local circumstances which impact on regional performance regardless of sectoral composition e.g. regional policy measures or general regional productivity) (Lamarche, Srinath, & Ray, 2003).

A further elaboration of the shift–share technique known as multifactor partitioning, originally developed by Ray (1990), further divides both the traditional industry-mix and regional components into two subcomponents each (Lamarche et al., 2003). Firstly, the traditional industry-mix effect 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 can be termed the ‘pure’ industry-mix effect.

Secondly, the traditional regional effect is adjusted for the fact that particular sectors may experience specific advantages (or disadvantages) through being located in particular regions. This *region–industry interaction* effect involves measuring, for each sector within a region, the difference between actual employment change over a period in that sector and the change which would have occurred if employment in the region had been the same as for that sector nationally. If a sector in a region is performing more strongly than that sector nationally, this indicates that circumstances conducive to that sector obtain in the region in question (as might be the case with the agglomeration economies which are generated around sectorally specialized industrial clusters). The reverse applies where a regional sector portrays a weaker employment performance than that sector nationally. Aggregating this effect for all sectors gives the overall region–industry interaction effect for the region. Subtracting this from the traditional regional effect gives the ‘pure’ regional effect which refers to regional conditions which impact equally on *all* sectors in a region. The regional effect is frequently seen as a measure of general regional competitiveness (or lack of it) but what actually constitutes such competitiveness cannot be determined from the shift–share analysis itself and is a matter of surmise on the part of commentators. The industry-mix and region–industry interaction effects at regional level are the sum of these effects at sectoral level; thus, a small regional value could be the outcome of substantial positive and negative values at sectoral level cancelling each other out. It is therefore important to have regard to these sectoral values when interpreting overall regional performance in shift–share analysis. These potentially problematic aspects of shift–share analysis are addressed further in what follows.

Figures 2–4 (in which the vertical axes represent rates of employment change) decompose regional employment change in Ireland in the 2006–11 sub-period for all,

foreign, and Irish firms (respectively) into the five separate change components identified above. This gives an overall picture of how the different effects contributed to the regions' employment performances during the recessionary conditions which obtained in this sub-period. In order to allow for regional variation in total employments sizes, the segments of the regional columns are presented as proportions of total regional employment 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: the 'pure' regional industry-mix effect (identified as 'Industry' in Figures 2–4), the 'pure' regional effect ('Region') and the region–industry interaction effect ('Interaction'). 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.

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. This reflects the concentration of high-growth sectors in Dublin: in 2006 that region's combined share of national employment in the four LTG sectors (Software and Computer Services, Financial Services, Other Business Services and Medical Devices) came to 70.9% compared with its 42.7% share of total employment in agency-assisted firms. The Midlands had by far the highest negative industry-mix effect (-11.5%) reflecting the disproportionate concentration in this region of three sectors (Metals and Engineering, Timber Processing and Cement and 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 2006–11 (32.4%) was well over three times the national average.

The region–industry interaction effect, which captures the (dis)advantages of particular regions for particular sectors, was positive (although small) for just two regions (Limerick and Sligo). Limerick's modestly positive interaction effect involved strong

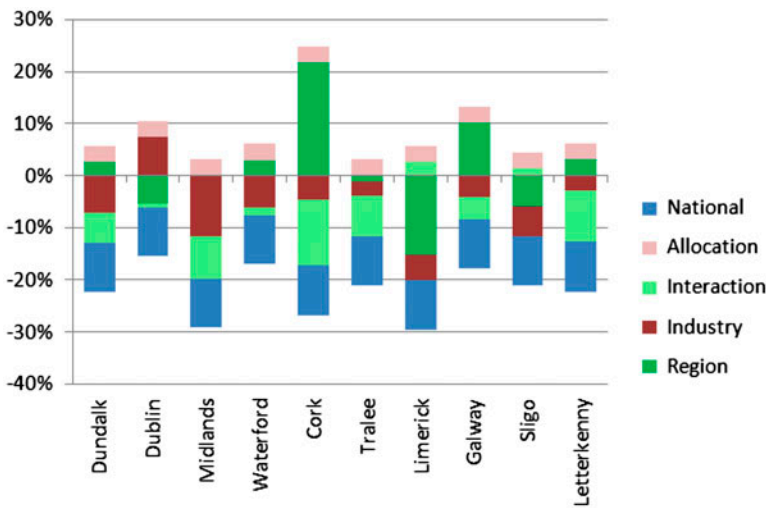


Figure 2. Shift–share analysis components, 2006–11: all firms.

positive contributions from the Medical Devices and Metals and Engineering sectors (both of which outperformed their national counterparts) being largely counteracted by the negative contribution of the Software and Computer Services sector, which expanded at national level but contracted sharply in Limerick. The region–industry interaction effect was a substantial contributor to overall employment change in five of the eight regions where this effect was negative, and particularly so in the case of Cork, where it represented 12.7% of total 2006 employment.

One third of Cork's interaction effect was contributed by the Chemicals/Pharmaceuticals sector, which accounted for 15.1% of regional employment in 2006 (almost twice the national average) but whose rate of decline in 2006–12 (–14.1%) also greatly exceeded the national rate of decline for the sector (–9.9%). Thus, while the high initial concentration of the sector in this region would suggest that a location in Cork was particularly advantageous in the past, during the recessionary period the reverse was the case. These examples point to the importance of disaggregating the overall regional measure in order to identify its main contributory sectors.

Distinctive features of Figure 2 are the strongly positive regional effects (which capture the range of region-specific factors that influence all industries in a region equally) of Cork and (to a lesser extent) Galway and Limerick's strongly negative regional effect. In the case of Cork, this effect (representing 21.9% of 2006 regional employment) comfortably exceeds the combined industry-mix and region–industry interaction effects (both negative) and largely accounts for this region having the best overall employment performance of all the Irish regions in 2006–11. Neither the factors accounting for these effects, nor the reasons why they should vary so much between what are adjoining regions, are readily apparent. Where, as in these cases, the regional effect is the main contributor to employment change, the interpretation problems associated with this effect constitute a tantalizing aspect of shift–share analysis.

It is interesting to find that the regional effect is both negative and sizeable (5.4% of 2006 employment) in the case of the metropolitan region of Dublin. One might have expected this region's superior urbanization economies (e.g. availability of general support services and technical infrastructure) to produce a strong positive effect, but it may be that these are more than counterbalanced by diseconomies such as high property prices and transport congestion. It is notable in this respect that Gardiner et al. (2012) also identified a negative regional effect in the case of London in recent decades.

Further insight into regional employment performance during 2006–11 is obtained by disaggregating the data into foreign and Irish components (Figures 3 and 4). This reveals a range of substantial differences between these two components, particularly in relation to regional effects. The general trends for the industry-mix effect are largely the same for the two components, with the exception of Midlands, where the negative effect for Irish firms is much greater than for foreign, and Tralee, where a small positive effect for Irish firms contrasts with a large (26.7% of 2006 foreign-firm employment) negative effect for foreign firms. The limited foreign/Irish regional variation in industry-mix in evidence here corroborates the conclusion reached above that sectoral mix, per se, impacts more on regional employment performance than nationality mix.

Key differences between foreign and Irish firms as regards industry–region interaction effects can be seen for Dundalk and Waterford (where substantial positive effects for foreign firms contrast with large negative effects for Irish firms) and for Cork (where it is the foreign sector which portrays a large negative effect with the effect for Irish

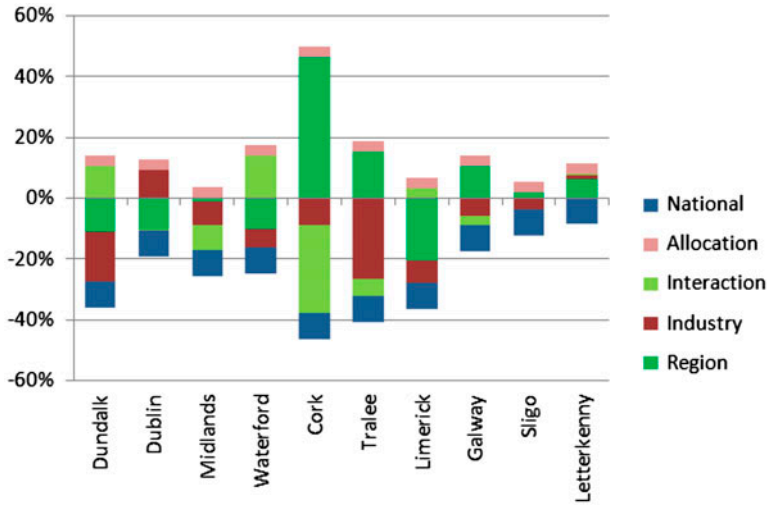


Figure 3. Shift-share analysis components, 2006–11: foreign firms.

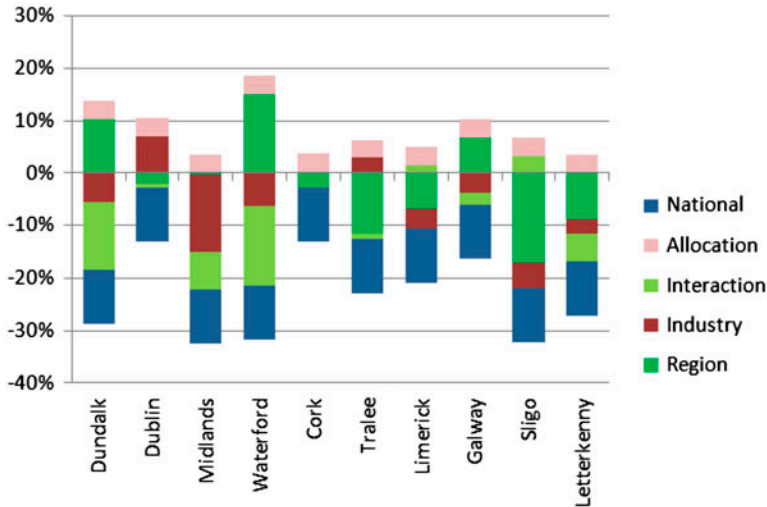


Figure 4. Shift-share analysis components, 2006–11: Irish firms.

firms being negligible). As regards regional effects, there are major and contrasting trends in six of the 10 regions, in four of which the trend is positive for foreign firms and negative for Irish firms, with the reverse obtaining in the other two regions.

The foreign/Irish differences in effects are particularly striking for Cork and Waterford. In Waterford, for foreign firms there are modest positive interaction and negative regional effects whereas for Irish firms the corresponding effects are much larger and in the opposite direction. In Cork, whereas for foreign firms there is a very large positive regional effect and a large negative interaction effect, for Irish firms these effects are small or negligible.

Conclusions

This paper has examined how Ireland's regions coped during the course of the post-2007 economic recession, as measured in terms of employment in firms in receipt of assistance from the state's enterprise agencies. A 19-sector taxonomy was used, with both regions and sectors being classified in terms of those which declined both before and during the recession, those which grew in both periods, and those which grew before, and declined during, the recession. Of the 10 regions, four experienced pre-recession employment decline which accelerated with the onset of recession. These were all rural/peripheral regions with small employment totals. The other six regions experienced varying degrees of pre-recession growth and decline following recession onset.

Two indexes – a resistance index based on the balance between sectors which grew both before and during the recession and sectors which declined in both periods, and a resilience index based on the balance between, on the one hand, sectors which grew in both periods and sectors which experienced pre-recession growth and contraction during the recession, and, on the other, those which declined in both periods – were proposed which sought to link regional employment change during the recession to pre-recession sectoral composition. Both indexes (but especially the second) showed a strong association between sectoral mix and employment change.

Three regions – Dublin, Cork and Galway – were found to have been least affected by recession due, to a large extent, to their disproportionate shares of sectors with superior growth performances (and after allowance is made, in the case of Cork, for inadequate sectoral classification of some major employers). These regions also had a higher rate of replacement of jobs lost in declining sectors by jobs in expanding sectors. While foreign firms were more likely to be found in the latter sectors, there were also foreign-dominated sectors with weak growth performance and Irish-dominated sectors with good growth performance. It is concluded, therefore, that it is the sectoral mix, per se, more than the nationality mix which has the main impact on regional growth performance. This points to the importance of sectoral selectivity in the attraction of inward investment to the Irish regions.

The application of shift–share analysis to the employment data cast further light on the inter-regional pattern of employment change during the recessionary period, particularly in terms of sectoral composition and the extent to which particular regions possessed sectors whose growth performances varied significantly from national norms. This analysis showed Dublin to be the only region to be affected positively by superior sectoral composition during the recession period whereas Cork's and Galway's relatively good employment performance in this period was largely attributable to the general regional effects as identified by the analysis. The regional effect was also found to be a major source of difference between foreign and Irish firms in the majority of regions, but in different ways in different regions, with the effect being positive for foreign firms and negative for Irish firms in some regions, and the other way around in others.

Overall, the shift–share analysis produced a complex picture of interregional variation in the components of employment change, with no broad patterns discernible. At the same time, the analysis pointed to the need for care in interpreting the findings generated by the technique. While the identification of a region–industry interaction effect represents a very useful enhancement of the technique, it is important to disaggregate the overall effect for each region in order to assess the varying sectoral contributions to this effect. Where regional sectoral performances are found to differ markedly from their national counterparts, further research is required to provide explanations for these

differences. This applies a fortiori to the interpretation of the regional effect, especially where it appears as a major component of overall regional change, as was the case for many of the Irish regions in the analysis reported here. The vagueness of the effect, and the wide range of possible contributory factors (which in turn may vary markedly between regions), render interpretation of its meaning quite problematic. Some researchers (e.g., Baxendine, Cochrane, & Poot, 2005; Nogueira & Lopes, 2008) have sought to address this issue by regressing the regional effect on selected indicators such as education/skill levels, market size and distance from metropolitan centres. However, further problems with this are the sheer range of regional indicators which could impact on regional competitiveness and the fact that many of these (inter-firm interaction, knowledge spillovers, regional policies) may not be readily quantifiable (if at all). Space constraints have ruled out the inclusion of such second-stage research in the present paper.

A further area requiring follow-up research arises from a key assumption underpinning this paper *viz.* that the performance of agency-assisted firms is the major determinant of the overall economic well-being of the Irish regions. Therefore one would expect the varying performances of the regions during the recessionary period reported here to be reflected in indicators as unemployment, labour force participation and migration rates in the years immediately following the recession (which ended in Ireland nationally in 2011). Given the time lag required for such impacts to work themselves out and the fact that data at the requisite spatial scale will not be available until the publication of the 2016 population census, analysis of post-recessionary adjustments in the Irish regions will have to wait until then.

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Note

1. As Forfás data are not directly comparable with national accounts data published by the Central Statistics Office, approximate proportions are given here.

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