The elusive quest for balanced regional growth from Barlow to Brexit: Lessons from partitioning regional employment growth in Britain.

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Abstract
The British Government's economic strategy for post-Brexit Britain of achieving balanced regional growth by "driving growth across the whole country" echoes the objectives set by the

Barlow Report of 1940. Nevertheless, regional disparities in employment growth have widened in the intervening years. The regional policies that followed the Barlow Report were heavily influenced by the first of two papers written by G D A (later Sir Donald) MacDougall for the Commission. That first paper, which was included as an appendix to the Report itself, introduced the shift-share methodology to the analysis of regional employment growth. The results demonstrated that regional disparities were largely determined by differences in the regional-mix of industries, with regional differences in industry growth-rates playing a minor role. Moreover the industry-mix effects on regional growth rates were easily identified and had clear policy implications. Consequently post-war regional policy focussed on the contribution of industrial structure to employment growth. However, the shift-share analysis was seriously flawed and the industry-mix effects were greatly overstated. MacDougall's second paper dealt with urban growth, but it too was published in 1940, was set aside by the imperatives of World War II, and has been forgotten. Yet if the comments made on that paper been fully explored, they might have revealed the effects of distance from London on Britain's regional growth disparities.

This article replaces the flawed shift-share methodology with multifactor partitioning (MFP) and applies it to regional employment growth for the period 1971-2012, a span of special interest because it largely coincides with British membership of the European Union (EU). The deficiencies in the second paper are addressed by introducing allometry to measure the employment growth of each region relative to that of Great Britain and then regression analysis to relate the allometries to distance from London. The results of the two sets of analyses highlight the need for a multiple-factor, comprehensive, and integrated approach to regional policy and they provide a benchmark against which to gauge the success of Britain's post-Brexit policy of driving future growth across the whole country.

Keywords; shift share, multifactor partitioning (MFP), allometry, regional policy, Brexit.

Introduction

The British Government's economic strategy for post-Brexit Britain includes the objective of achieving balanced regional growth by "Driving growth across the whole country" (HM Government, 2017:107-117). The marked regional disparities in employment growth and unemployment rates were first brought to wide public attention nearly 80 years ago by the work

of the *Royal Commission on the Geographical Distribution of the Industrial Population*, chaired by Sir Anderson Montague Barlow, although these, and other disparities, can be traced back to the late 19th century if not earlier (Barlow, 1940; Crafts, 2005; Gardiner et al., 2013). The submissions to the Commission, the analysis of employment growth, and the Barlow Report itself all reached the conclusion that regional disparities were primarily a structural problem which required national policies to regulate the location of fast-growth manufacturing industries. The tone was thereby set for regional policy and planning in post-war Britain. Yet achieving regional balance has proved elusive. Disparities in regional employment growth have continued to widen (Martin et al., 2016) and exceed those of other European countries (European Communities, 1999: 3).

A second and related objective of the Barlow Commission was to constrain, or even limit, employment growth in London. Yet the proportion of Britain's employment in London and the South East is little different today than when the report of the Barlow Report was first published. This failure of policy can be traced back in part to data limitations and statistical flaws in the first of two papers written for to the Barlow Commission. This first paper, written by MacDougall but wrongly ascribed to Harry Jones in the Barlow Report, identified the decisive role of industry-mix on regional employment growth using what became known, in modified form, as shift-share analysis (Jones, 1940; MacDougall, 1975; Dunn, 1959 and 1960*;* Ray, 1990: 299-301; Gardiner et al., 2013: 904-907). A second paper on population concentration in London and Britain's other conurbations (MacDougall, 1940) was forgotten as World War II intensified. Thus the opportunity was lost to advance its methodology, and to conceptually link industry mix and regional employment growth to the urban hierarchy and distribution of population. Had both papers been fully developed, a multifactor comprehensive, integrated and more balanced regional policy may have been developed. The objective of this article is to contribute to a more comprehensive understanding of regional disparities through the application of advanced methodologies to both these issues.

This article begins with a brief review of the Barlow Commission's work, followed by an outline of its influence on post-war regional policies and the subsequent direct and indirect regional effects of Britain's accession to the EU. Attention next turns to the use of dynamic multifactor partitioning (MFP) of employment growth and the contribution it makes to our

understanding of regional employment patterns. For consistency, data was explored for 1971-2012 corresponding with earlier work done by others (Gardiner et al., 2013).

The concerns of MacDougall's second paper on regional disparities in urban growth are then reworked to identify empirical regularities in regional employment growth using the general system theory concept of allometry, which measures the growth of employment in each region relative to that of the nation. Quantitative testing of the relationships between the allometries and the results of the MFP provides new insight into the role of distance from London as a factor influencing regional employment and industry growth-rates, while also highlighting the significance of the region effect. This article thereby sheds light on the policy direction needed to achieve more balanced regional growth and opens new avenues for further research on these and related themes

The Royal Commission on the Geographical Distribution of the Industrial Population

The enduring importance to regional/national planning in Britain of the 1940 Barlow Report can never be overestimated (Hall and Tewdwr-Jones, 2010: 57; Roberts, 2007: 113-114). The Barlow Commission was established in 1937 'to inquire into the causes which have influenced the present geographical distribution of the industrial population of Great Britain and the probable direction of any change in that distribution in the future; and to consider what social, economic or strategic disadvantages arise from the concentration of industries or of the industrial population in large towns' (Barlow, 1940 p 1). These were issues of deep national concern, given the very high unemployment rates in parts of the north of England, in South Wales and in Scotland, the disproportionate growth of employment in London, and the importance attached by the Barlow Commission to mining and manufacturing which, "for purposes of exchange, send their products to places outside the area in which they are situated, [and which] may be termed "basic" industries" (Barlow, 1940: 28).

The investigation of the Commissioners on both issues was exhaustive and their report was so authoritative, detailed and compelling that it continues to influence analytical methods and policy thinking. Twenty-nine days of evidence was submitted by Government agencies and NGO's between October 1937 and November 1938. The Board of Trade presented detailed tables demonstrating that different industries had marked differences in their national growth rates, and that different industries had clear regional concentrations. The Board concluded that 'it

is obvious that the industrial population has tended to increase more rapidly in the areas which have attracted the rapidly growing industries than in areas devoted mainly to declining industries' (Wolfe, 1938). These conclusions were supported by a shift-share analysis wrongly ascribed to Jones and actually undertaken by MacDougall (Jones, 1940; MacDougall, 1987: 4).

FJ (later Sir Frederick) Osborn considered MacDougall's first paper to be the best he had read on industrial location (Osborn and Whittick, 1963: 17) and it had led him to write to the Commissioners:

> So long as the distribution of industry depends solely upon the decision of industrialists, so long must the community as a whole bear the burden of any harmful results of their interests, and if it is inequitable to place the responsibility of safeguarding those interests upon individual industrialists then it is clear that some government machinery must be devised to cope with the situation (Osborn, no date).

The weight carried by Osborn's views is suggested by his letter of 8th April 1957 to Lewis Mumford, in which he claimed to have redrafted some of the key paragraphs of the Report (Hughes, 1972: 271-272). Two minority reports to the main recommendations of the Barlow Report were added, but both these and the main report itself agreed that industry broadly determined its own distribution, that a better future balance and a greater diversity of industry throughout the country were desirable, and that such a policy would require a constructive effort by Government (Barlow, 1940: 202, 217, 221).

The Barlow Commission also noted the failure of the Town and Country Planning Act of 1932 to place planning in a national context. 'It does not and was not intended to influence the geographical distribution of the population'. In particular the Commission noted that the drift of population from the North and West towards the South-East was related to the concentration of the declining industries in the North and West and of the expanding industries in London and South-Eastern England (Barlow, 1940: 28 and 15-16). Employment in the London region had grown at twice the national rate, and accounted for some 40 per cent of the total growth in the national labour force during the period 1923-1937. The Barlow Report concluded that:-

> A reasonable balance of industry and population throughout the country should be the main feature of national policy in the coming years. It is not in the national interest that a quarter or even larger proportion of the population should be concentrated within 20 to 30 miles or so of London (Barlow, 1940 p. 152).

Within a month of its issue in August 1939, the Government made clear its intention to give the Report a thorough and open-minded examination, including the consideration of schemes to introduce controls on the expansion of industry in London (Robinson, 1945: 107). The initial direction of post-war policy was set.

The Influence of the Barlow Report on post-war regional policy

1940-1950: The elaboration and implementation of the Barlow Recommendations.

The Barlow Report triggered a remarkable burst of committee work and report writing on regional policy from 1945 to 1947, followed by an equally remarkable burst of legislative activity from 1945 to 1952. Legislation included the New Towns Act of 1946, the Town and Country Planning Act of 1947 (under whose provisions Industrial Development Certificates could be refused) and the Distribution of Industry Acts of 1945 and 1949 (Manners, 1972, 17-19 and 49; Bowers and Gunawardena, 1977; Cullingworth and Nadin, 2006: 22-3; Hall and Tewdwr-Jones, 2010: 67-68).

Of particular importance to the urban policies were the contributions of Patrick Abercrombie, a member of the Barlow Commission, and Frederick Osborn. Abercrombie (later Sir Patrick) authored the 1944 Greater London Plan, employing MacDougall's shift-share methodology to project employment growth, and co-authored plans for the County of London in 1943, Plymouth in 1943 and Hull in 1945, thereby helping to shape contemporary approaches to planning (Larkham and Adams, 2011).The fundamental objectives of the Greater London Plan were to control the development of housing, industry and communications and to effect substantial decentralization (Robinson, 1945). The Plan divided the metropolis into rings including an inner urban ring where population density was to be reduced by relocating people to seven new towns in an outer ring. The new towns programme was extremely successful (Osborn and Wittick, 1963; Hughes, 1972; Wannop, 1999).The new towns around London are now home to over a million people while other conurbations are surrounded by at least twenty additional new towns.

In retrospect, the Barlow Report and the resulting regional policy placed an unwarranted emphasis on manufacturing to achieve balanced regional growth. This emphasis was supported by the thinking of the Commissioners themselves, by the results of MacDougall's shift-share analysis, and by the classification of employment in the academic literature as basic, or city-

forming, and non-basic, or city-serving (Alexander, 1954; Dickinson, 1964: 64-72). Jones (1944, quoted in Alexander, 1954: 249) later mirrored these views arguing that post-war reconstruction needed to give "priority to basic activities [because] they are the foundation upon which the town is built". Manufacturing policy certainly made a contribution to balanced regional growth as more than half the new factory building between 1945-47 was located in the development areas compared with only five percent pre-war (Hall, 2007: 11 and 17). By 1950 the Barlow recommendations to achieve balanced regional growth were operational and Britain thus became the first country to establish comprehensive regional policies. However, in the formulation of policy, the region effects on industry growth rates were excluded so that the regional policy framework was single-factor and quite independent of the urban policies.

1951-1972: Changing regional policies, funding levels and priorities

A new government in 1951 closed the Ministry of Town and Country Planning's regional offices, thereby undermining effective regional analysis and coordination and ushering in a 'passive' phase of regional policy lasting to 1961 (Scott, 1996). Thereafter, the "Golden Age of Regional Policy" between 1963 and 1970 marked the start of a phase during which there were frequent changes both in policy focus and priority and in programme delivery and funding levels (Wannop, 1995; Hall, 1999: 79-80; Hall, 2007; Hall and Tewdwr-Jones, 2010; Glasson and Marshall, 2007: 20-40; Roberts, 2007: 113-122).

The basic / non-basic concept of regional growth modulated into the growth pole concept (Perroux, 1950; Boudeville, 1966; Parr, 1999). However, manufacturing was still seen as the fly-wheel of regional and national economic growth (Cohen and Zysman, 1987; Fingleton, 1999; Greenhalgh and Gregory, 2005) and there were notable successes in accelerating the growth of manufacturing in the special areas of slow-growth. Moore et al (1986) calculated that from 1960 to 1981, regional policy contributed a net increase of 450,000 manufacturing jobs in the development areas, which in turn probably generated a further 180,000 service jobs (Hall, 2007:17). However, these 'successes' have since been challenged due to the high costs per job created and a belief that many of these jobs would have been created regardless of policy (Chisholm, 2015).

One government achievement was the major investment made in the car industry in Merseyside (Hall, 1999: 79), though another branch plant established on Clydeside with

government grants was a complete failure (Casson, 1986). Moreover, attempts to increase the efficiency of manufacturing by encouraging mergers through the Industrial Reorganization Corporation led to the establishment of a branch-plant economy in the north, and it was these branch plants, often distant from the company headquarters, that were most vulnerable to closure, particularly in later years (Kirkham and Watts, 1988).

Furthermore job creation was increasingly led by the service sector and the rapid increase in office employment in London attracted particular attention (Hall, 1987; Goddard, 2015). Service employment did expand in the coalfield regions, but too slowly to compensate for job losses in mining (Beatty et al., 2007: 1665-1667). Accordingly, the Location of Offices Bureau was established in 1963, followed by the introduction of "office development permits" under the Control of Offices and Industrial Development Act of 1965 in order to encourage the relocation of office employment out of London. Predictably, these legislative attempts to achieve more balanced regional growth were unsuccessful: some three quarters of the firms simply moved from London to the South East (Hall, 1999: 80).

In reviewing the success of government policies on the eve of Britain's entry into the European Economic Community (EEC, the precursor of the European Union), Manners (1972: 61-62) noted that the less prosperous regions still had high levels of structural unemployment, high outmigration, an over-reliance on declining industries, and exhibited few signs of achieving self-perpetuating growth.

The EEC / EU and regional policy after 1973

Barlow's influence on regional planning was eclipsed in the 1970s by two significant events. The accession of the UK to the EEC on January 1, 1973 and the oil crisis which followed in October later that year. Thus 1973 marked the end of Britain's long post-war economic boom as sluggish economic growth and increasing rates of unemployment spread across the whole country (Bachtler and Michie, 1993; Martin, 1997: 239; Hall, 1999). From 1970 to 1990, Britain's assisted areas budget was progressively reduced and the number of assisted areas was halved; Office Development Permits (ODPs) and Regional Development Grants (RDGs) were abolished; and Industrial Development Certificate (IDC) controls eased (Bachtler and Michie, 1993; Hall, 1999: 82-83). Policy focused instead on inner cities that had lost manufacturing and other jobs (Hall and Tewdwr-Jones, 2010: 95; Armstrong and Taylor 2000). What regional policy remained

was increasingly funded and controlled at European level with the UK serving as 'gatekeeper' (Bache, 1999).

The adoption of the EEC's Regional Policy was initiated in 1975 as a condition of UK membership (Miller, 2015).The Single European Act (SEA) of 1986 outlined two principal objectives: "the development and structural adjustment of regions whose development is lagging behind and the conversion of declining industrial regions" (European Communities, 1987). A sequence of six to eight-year programmes followed, beginning in 1989 (EU, 2008). From 1989 to 2007, Objective 1 regions (lagging regions with per capita GDP below 75% of the EU average) received the bulk of the European Regional Development Fund (ERDF) support. As policy evolved in subsequent programmes, the emphasis was placed on achieving greater competitiveness (2007-2013) and on the promotion of social inclusion (2014-2020).

As the EU reassessed regional eligibility with each programme, some British regions did benefit from Objective 1 status from time to time, notably peripheral regions such as Merseyside during the 2000-2006 programme and Cornwall and Scilly, West Wales and the Valleys, and the Scottish Highlands and Islands in the 2007-2013 programme. Other regions were eligible for Objective 2 funding as the EU, like the Barlow Report, emphasized the importance of aiding manufacturing in declining regions. Indeed one EU report began: "Now more than ever, Europe needs industry and industry needs Europe" (EU, 2010).The Confederation of British Industry (CBI) also believed that only jobs in (manufacturing) industry were productive (MacDougall, 1987: 235-236). This attitude explains why regional policies in almost all countries included grants to influence the location of manufacturing (OECD, 1979). However, British manufacturing employment had fallen by two thirds between 1973 and 2012 so that the sector had lost its policy leverage. Meanwhile, EU regional policy increasingly moved to a broad social and environmental approach (European Communities, 1999: 9) which seriously undermined its economic effectiveness (Armstrong, 1996).

There is also evidence that EU membership indirectly increased Britain's regional disparities as South East England gained the most from improved access to the continental market. The importance of accessibility to market was recognised in the Barlow Report (1940: 48) and quantified as 'market potential' by Harris (1954). The market potential concept, which is based on the gravity model in physics, was first applied to Britain by Clark (1966) and Clark et al. (1969); and calculated for Britain with and without access to the continent by Manners (1972:

12). However, market potential models lack the precision needed to make a definitive estimate of the impact of EU membership on regional growth disparities or on EU trade (Gudgin et al. 2017: 17). Instead the growing economic dominance of the South East following EU membership is most simply illustrated by the changes in the ranking of British ports by trade volume (Overman and Winters, 2004, 2005). Dover tripled its share of manufactured exports to move from fifth to first place between 1970-72 and 1990-1992, while Liverpool lost its place in the top five. The Channel Tunnel, opened in 1994, which was both a stimulus and a response to this improved market access, again had a larger impact on the south, particularly London (Thomas and O'Donoghue, 2013), than on the north (Keeble et al., 1982). In fact, in 2014 just 3 regions – none of the Northern or Peripheral regions - West Midlands, East of England and East Midlands accounted for over 50% of exports going through the tunnel (Ernst and Young, 2016). Whether because of these indirect effects or for other reasons, regional disparities in Britain have widened since 1973 to become the largest in the EU. The four southern regions with 44.4% of Britain's employment in 1971 had 68.2% of Britain's employment growth from 1971 to 2012. The five northern regions with 39.8% of Britain's employment in 1971 had only 16.8% of the growth. Hence the concern expressed in the Government Green Paper (HM Government, 2017: 107-117) to drive growth across the country. Achieving that aim will require a new regional development model (Martin et al., 2016) beginning with a reassessment of the analysis that underpinned the Barlow Report.

Multifactor Partitioning (MFP) and the declining importance of industry-mix

The mathematical flaws in the first paper of G D A (later Sir Donald) MacDougall for the Barlow Commission, which introduced shift-share, have been detailed elsewhere and a corrected multifactor partitioning (MFP) model has been developed (Ray, 1990; Lamarche et al., 2003, Ray et al., 2012; Gardiner et al., 2103; Ray et al., 2017, Johnston and Huggins, 2017). MacDougall's most serious error was to include the national growth rate of 22.3% for the period 1923-37 in with the industry-mix effect, a conceptual error corrected in the Dunn shift-share model (Table 1). Thus corrected, the region effect (termed differential growth by MacDougall) for this period is larger for Mid Scotland than is the industry-mix. It is of interest then that MacDougall, writing much later, noted that his shift-share analysis had underestimated the

importance of Mid-Scotland's region effect and of the impact of the indifferent owner-management on employment growth in this, his home region (MacDougall, 1987: 4).

Table 1 here

Tracking the MFP results for all regions and economic sectors annually from 1971-2012, reveals that the region effects increased progressively over the period (Gardiner et al., 2103). They were much larger than industry-mix in all but two regions: the West Midlands and the Yorkshire-Humber Regions (Figure 1). The shift-share model, using the Dunn formulation, gives higher industry-mix results for three regions, West Midlands Yorkshire-Humberside and Wales.

Figure 1 here

The waning importance of the industry-mix effect reflects in part the diminishing proportion of the labour force in the goods-producing industries. This fell at an annual rate of approximately 1.8% from 1923-1937 and 1.6% per year from 1971-2012. Much of the post-war decline in the goods-producing industries occurred during the severe recessions of 1980-1983, 1991-1993 and 2009-2010 in each of which the goods-producing industries averaged an annual decline of 5% compared with 1% in the service industries (Figure 2). Consequently the goods-producing industries amplified the regional impact of economic shocks while service-based sectors acted as shock absorbers. Moreover the goods-producing industries continued to decline, though at the smaller rate of about 1% a year, in the intervening growth periods. Only the service group recovered after recessions growing by 1.5 or 2 percent a year (Blanchard and Summers, 1986; Hall, 1987, Jenkins, 2010; Martin, 2012), though there have, of course, been large differences in the growth rates among the service industries, with the highest rates occurring in the business services and the leisure industries (Johnston and Huggins, 2017).

Figure 2 here

Partitioning the industry-mix and region effects separately for each of the three recessions suggests that their geographic footprints were forged by differences in the region effects, not in their industry-mix (Figure 3). The industry-mix effects did increase during each recession but remained very much smaller than the region effects in all but a few regions. That is, inter-regional differences in industry-mix were less important than regional differences in the employment decline of individual industry-groups. A telling example is provided by the contrast in the 2008-2009 recession between the fortunes of Northern Rock, a bank headquartered in the North East, and the major London banks (Dawley et al., 2014).

The region effects had sharply contrasting regional patterns at each recession. The region effects in the early 1980's recession followed the expected trend decreasing progressively with distance from London (r = -0.70) (Figure 2). This south-north trend was reversed in the recession of the early 1990's as high interest rates to support Britain's membership in the European Exchange Mechanism affected families in the south with large mortgages (Taylor and Bradley, 1994; Lee, 2014). Consequently, the region effects actually increased with distance from London (r = +0.92). The Great Recession of 2008-2009, triggered by the global banking crisis, affected all regions with much the same severity and there is no systematic regional pattern in the region effects.

The industry-mix effects of 1990-1992 closely paralleled those of the 1980's recession (r = +0.86) but neither were related to distance from London. The regional distribution of industry-mix values during the Great Recession of 2009-2010 was related neither to the earlier recessions nor to distance from London. Thus whether we consider employment growth for the total 1971-2012 period, or regional resilience to the severe economic shocks of 1980-83 and 1991-93, the region effects have played a larger role than industry-mix in accounting for regional disparities in employment growth.

Figure 3 on next full page

MacDougall's second Barlow paper and regional allometric growth

MacDougall's second paper for the Barlow Commission analysed the growing population concentration in London and other urban areas calculating growth through time. At its

presentation to the Royal Statistical Society, E C Rhodes commented that urban (or regional) growth can be expressed as a ratio of the national growth using Gibrat's Law of Proportionate Effect (MacDougall, 1940 pp.52-54) instead of through time directly. Gibrat's Law belongs to a family of power formulae known in general system theory as allometry (Naroll and von Bertalanffy, 1956). A system is an interrelated whole that functions through the interdependence of the parts, as with individual regions that together comprise the national economy. The allometric growth rate of one part of the system, "y", is measured relative to the growth of the whole system, "x", or to another part (Zipf, 1949; Nordbeck, 1971; Woldenberg, 1971; Lee, 1989; Batty et al., 2008).Where the data are log transformed, the allometries of the system parts are given by the α's in the equation: $\log y = \log k + \alpha \log x$. The alpha's (α's) are a time-independent function of system growth in which the growth of each part is measured relative to the whole. The growth of the part remains in constant ratio to the whole regardless of whether the whole system is growing or declining, and at whatever speed these changes are occurring.

In general, allometric growth may involve compensatory adjustments in the proportions of the parts required to maintain the efficient operation of the system, as in biological organisms. Differences in regional allometries, in contrast, are measures of their competitive advantage. Consider the allometries for three regions from 1982 to 2012 (Figure 4). The coefficients of determination of the trend lines for these three (and all the other regions) are above 0.88 during this period even though it includes the Great Recession. Regional employment growth thereby remained highly correlated with national trends during years of growth and decline, revealing the importance of national growth rates to regional trends, though with regional differences in the allometric growth rate. The South East has an allometry of 1.32: it's employment grew at a rate 32% faster than the national rate; the North East, with an allometry of 0.62 grew 38% below the national rate, and the East Midlands region almost tracked the national rate ($\alpha = 1.0$). The competitive advantage of the South East over the North East is given quantitative expression by the difference in their allometries of employment growth.

Figure 4 and Figure 5 here side by side

In systems where the parts have fixed locations relative to one another, as in biological organisms and geographic regions, interest focuses on the relationships between growth and form

and on evidence of systematic relative growth gradients (Huxley, 1932; Thompson, 1961). Allometric growth gradients may increase outward with distance from the primary growth centre, as in the diffusion of innovation (Ray et al., 1974). A 'Law of the Retarding Lead' applies in such cases as early innovators pay the price of precocious adoption, deal with the teething problems of a new product, and become locked into earlier, less efficient technologies (Levesque, 1986, pp.15-18 and 129-132). Conversely, the allometries decrease outward from a primate city, (Morrill, 1968) as with London which serves as a hub of research and continuing innovation; the centre of decision making, both governmental and business; a leading financial capital, the focus of economic opportunity; the place with Britain's highest market potential and a world class city.

The regional allometries of employment growth decrease with increasing distance from London thereby clearly identifying a north-south **growth-disparity gradient** (Figure 5). The southern regions benefit from the overspill of workers and employment from London and achieve higher allometries than would be expected given their distances from the capital. Wales and Scotland have also achieved higher allometric growth rates than expected, benefiting perhaps from their political status.

Figure 6 here

The allometries comprise the components of regional employment growth, so the region effect is also inversely related to distance from London ($r = -0.637$, with London excluded) (Figure 6).That is, any given industry will tend to have a lower growth rate the further it is located from London. This inverse relationship between industry growth rates and distance from London is important because it identifies a progressive loss of competitive advantage with the friction of increasing distance from London. Warren explained this friction of distance as follows: "Problems of the distance from southern England remain, in particular the lack of speedy access to and direct contact with suppliers, the absence of a local ancillary trade complex and the psychology of distance. The way in which the entrepreneur thinks about these matters is as important as the way in which in fact it touches his pocket" (Warren, 1972: 385). Warren was writing about the North East in an earlier period but his comments still apply generally to all

regions today. Distance is thus an important component of the region effect and it helps to explain why regional disparities remain so deeply entrenched.

Conclusions

Regional disparities in Britain have continued to widen since World War II despite concerted policies to achieve balanced regional growth. This failure can be traced in part to the legacy of two papers written for the Barlow Commission (Barlow, 1940) by MacDougall, the first badly flawed but with a continuing impact on regional analysis and policy; and the second, overshadowed and forgotten with the imperatives of World War II (Jones, 1940; MacDougall, 1940). The first paper introduced shift-share analysis and applied it to the period 1923-37. The results reinforced the central conclusion of numerous submissions to the Commission, namely that regional disparities in employment growth were a structural problem requiring national policies to regulate the location of fast-growth industries. Further work on the subject of the second paper might well have led to a better understanding of the role of the region effect and the importance of interaction with London as a key factor influencing regional economic growth.

An earlier study by Gardiner et al. (2013) has tracked the industry-mix and region effects for the period from 1971-2012 using dynamic multifactor partitioning, which corrects the mathematical errors in shift-share analysis. The results document the growing dominance of the region effects. The changing relative importance of the region and industry-mix effects has important analytic and policy implications. The region effects measure aggregate regional differences in the growth performance of individual industries. As these differences increase in size, it becomes just as important to correct the industry growth-rates for disproportionalities in their regional distribution as to correct regional growth-rates for differences in their industry composition. In short, the shift-share regional values, which fail to standardise industry data for disproportionalities in their regional distribution, become increasingly unreliable.

The Barlow Report placed considerable importance on manufacturing as the key policy lever to achieve balanced regional growth. This emphasis was supported by the numerous submissions to the Commission; the results of the shift-share analysis; and the distinction in the academic literature between goods-producing industries as basic, city-forming employment and

of service employment as non-basic, city-serving. If, as thought, the region effect was small, then relocating fast-growth manufacturing employment to slow-growth regions would have minimal impact on national growth rates. However, the growing recognition of the importance of the region effect has confirmed the link between the location of manufacturing industry and national growth rates. In addition, the employment shift from goods production to services has reduced the policy leverage of the manufacturing sector.

The analysis in the Barlow Report of employment growth rates for a single period may lead to the impression that the industry-mix and region effects are fixed regional attributes. Tracking the components of employment growth annually from 1971 to 2012 reveals major contrasts between periods of national economic growth and recession. Recessions impact the goods-producing industries particularly severely. Hence the goods industries amplify the regional impact of economic shocks, in contrast to the service industries which act as shock absorbers.

Traditional regional policies have failed to take account of the continuing shift in employment to the service industries. It might have been expected that this shift would reduce regional differences in both the impact of recessions and in employment growth rates. **However,** regional disparities in the growth rates of all industries in general have continued to widen. The impact of industry-mix on regional growth disparities is too large to ignore, but the focus of attention needs to be on the wide regional disparities across the nation in the growth rates of individual industries and on the factors responsible, rather than on the distribution of the industries themselves. In part as a result of these failures, some regional economies are weaker and more dependent on external support than they had been at the time of the Barlow Report, despite some 70 years of policies designed to bring in employment, improve infrastructure and diversify the industrial base of slow-growth, or lagging, regions.

The importance and nature of the region effect might have emerged had a comment made at the presentation of MacDougall's second paper been properly followed up with further research. That paper dealt with the concerns of the Barlow Commission over the growing concentration of population in London. Regional employment growth is commonly expressed as a percentage rate of growth over a given time period. This article follows up on the comment in MacDougall's second paper, and uses allometric growth rates. Allometries measure regional growth in relation to the national growth. They thus provide a time-independent growth index for

each region. These allometric growth ratios decrease with distance from London, thus identifying a **growth disparity gradient** across the nation.

The region effects are more closely correlated with the allometries of employment growth and with distance from London than are the industry-mix effects. The region effects thus serve as indirect measures of each region's accessibility to London with its specialised services, supplies and markets. Although improvements in the national transportation system, such as the construction of motorways, do improve regional accessibility, the limited evidence available suggests that they may increase London's aggregate accessibility the most, thereby further disadvantaging peripheral regions. Detailed regional studies are needed to examine the effects of distance from London on the growth rates of regional industries, unemployment rates and incomes. The allometry of regional unemployment rates may well be related to the region and industry-mix effects in the same way as is employment growth. The implications of these results for post-Brexit Britain are beyond the scope of this article, but the results underline the importance of the region effects as a critical element of any future regional policy and provide a benchmark against which to judge the success of post-Brexit regional policies.

The Government's Green Paper on *Building our Industrial Strategy* (2017) goes beyond the scope of the Barlow Report, being concerned not only with disparities in employment growth but also with the notable regional disparities in educational levels and skill gaps; in productivity levels; and in regional funding levels for innovation and infrastructure provision. More analysis is needed to identify whether these too are related to distance from London and whether they are additional dimensions of the region effect. A fuller understanding of the region effect on disparities in economic growth is undoubtedly an essential first step for establishing successful policies to achieve the Government's goal of driving growth across the country.

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Table 1: The shift-share analysis of regional employment growth 1923-37 as calculated by MacDougall and amended using the Dunn formulation.

Region	Actual Growth (%)	Regional Share	Industry-Mix 1 (MacDougall 1940)	Industry-Mix 2 (Dunn 1959)
London & Home Counties	42.7	1.4	40.2	17.9
Midlands	28.2	1.0	29.2	6.9
West Riding Yorks	15.0	7.6	8.9	-13.4
Mid Scotland	**9.6**	**-10.1**	**18.1**	-4.2
Lancashire	7.6	-3.9	11.1	-11.2
Northumberland	4.7	-1.3	3.6	-18.7
Glamorgan & Monmouth	-4.3	-5.6	0.5	-21.8
Great Britain	22.3	0.0	0.0	0.0

Note: The table is taken from the Barlow Report p. 274 with the exception of the industry mix 2 values. Industry-mix 1 values are as given by MacDougall, and include the national growth of 22.3%. Industry-mix 2 values are an adjusted figure using the Dunn model, with the national growth rate subtracted from the industry-mix.

FIGURES

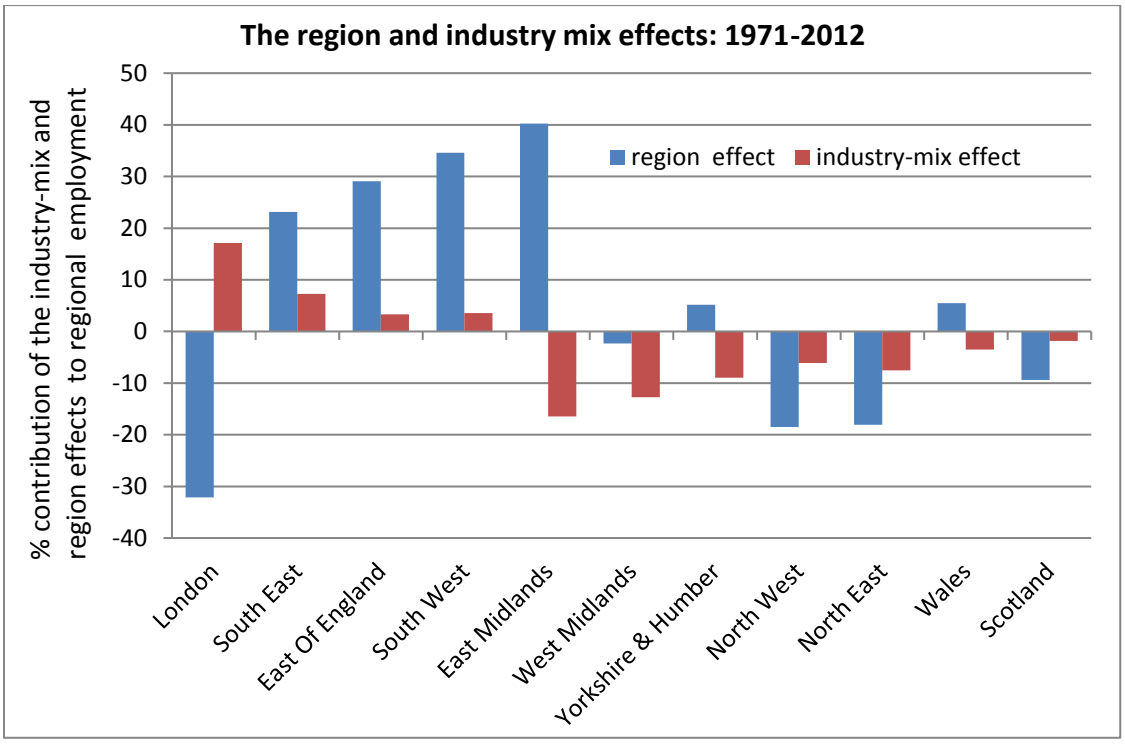

Figure 1 The MFP region and industry-mix effects on employment growth: 1971-2012

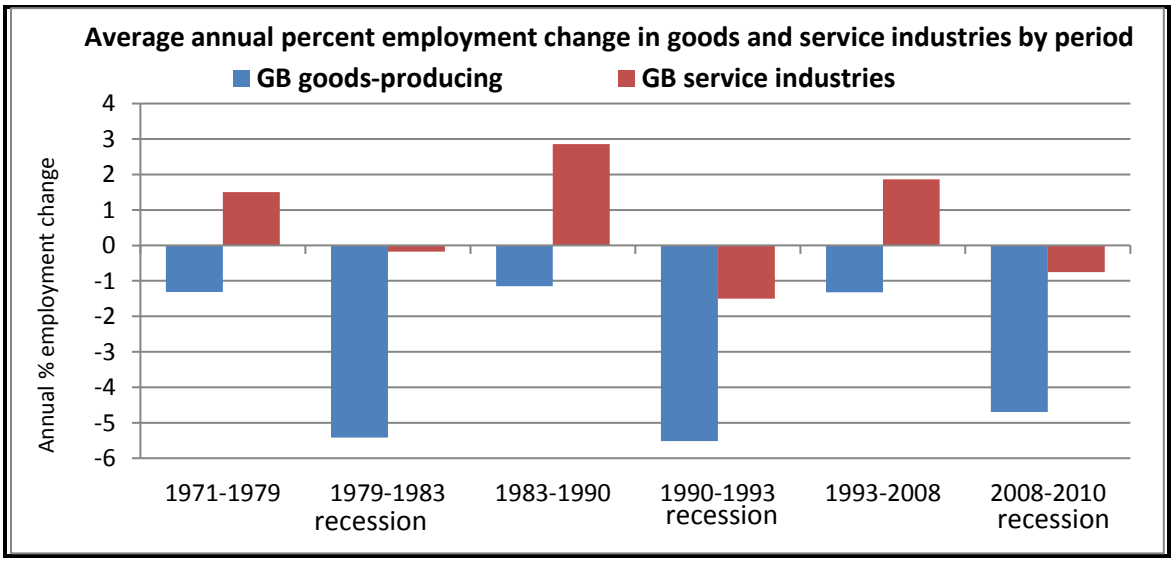

Figure 2: The contrasting performance of employment growth in the goods and service industries during periods of growth and recession.

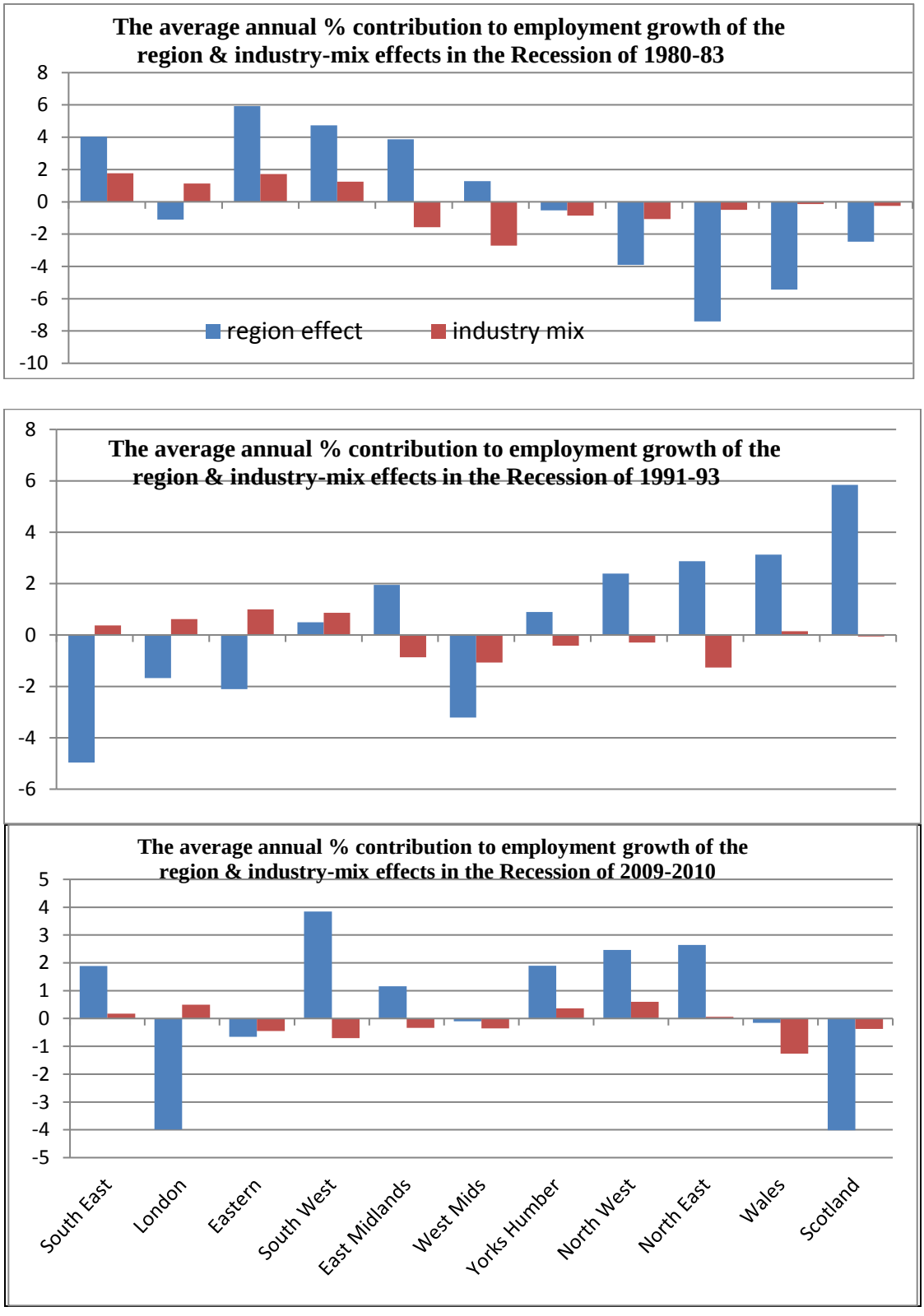

Figure 3. The industry and region effects during three periods of recession

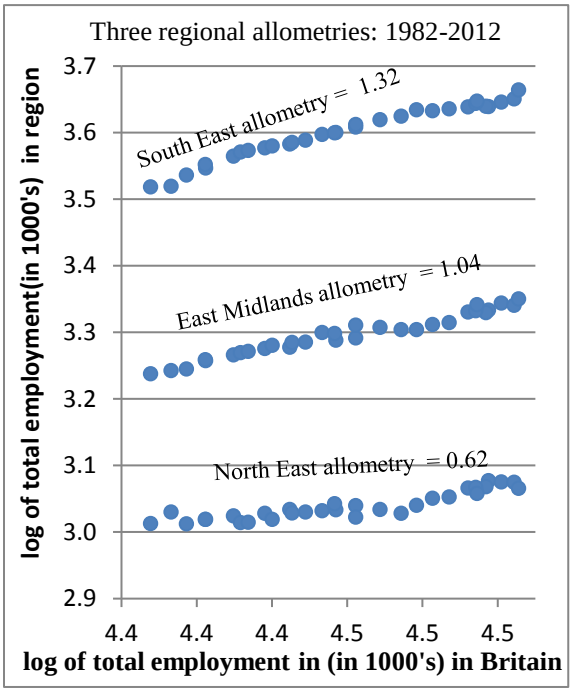

Figure 4. Employment growth allometries: 1982-2012: three selected regions

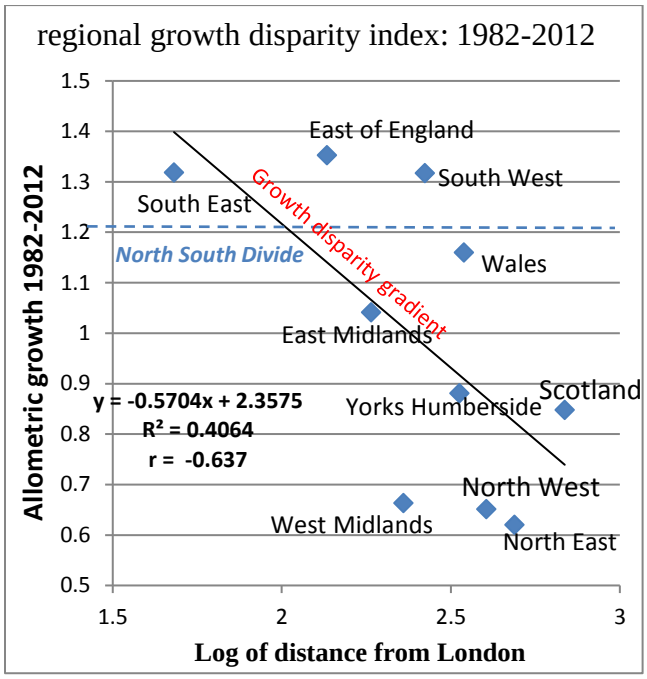

Figure 5. The North-South growth disparity index

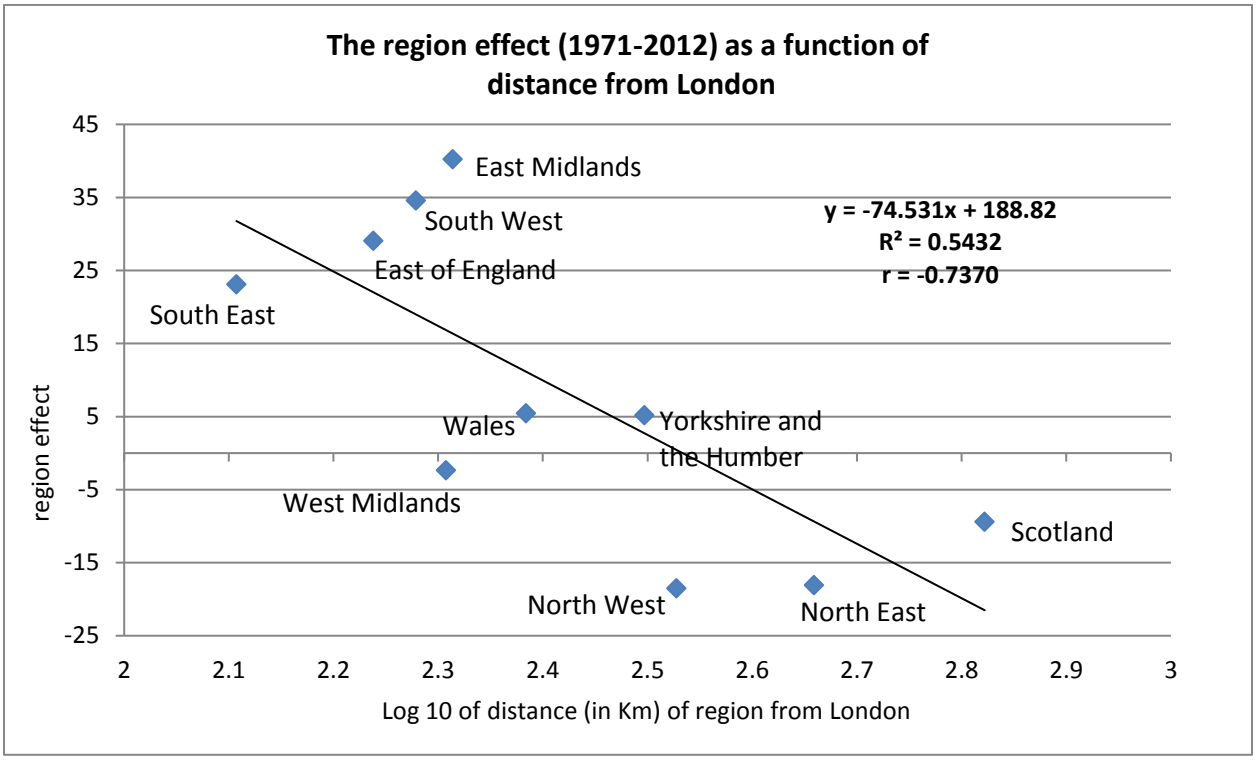

Figure 6. The Region effect (1971-2012) as a function of distance from London (with London excluded).

Appendix

Two-digit SIC industry groupings used for the data analysis

	Two-digit industry codes
Industry name	(SIC 2003)
Agriculture, etc.	01, 02, 05
Mining and quarrying	10, 11, 12, 13, 14
Food, drink and tobacco	15, 16
Textiles, clothing and leather	17, 18, 19
Wood and paper	20, 21
Printing and publishing	22
Fuels and chemicals	23, 24
Rubber and plastic products	25
Non-metal and mineral products	26
Basic metals and metal products	27
Mechanical engineering	28, 29
Electronic, electrical and instrument engineering	30, 31, 32, 33
Motor vehicles	34
Other transport equipment	35
Other manufacturing	36, 37
Electricity, gas and water	40, 41
Construction	45
Distribution	50, 51
Retailing	52
Hotels and catering	53
Transport and communications	60, 61, 62, 63, 64
Banking and finance	65
Insurance	66
Other business services	67, 68, 70, 71, 72, 73, 74
Public administration and defence	75
Education and health	80, 85
Other services	90, 91, 92, 93, 95, 96, 97, 99

Workplace based employment data comes from UK Office of National Statistics employment surveys and held by NOMIS. The data and the industry groupings were compiled and shared by B Gardiner, R Martin, P. Sunley and P Tyler (2013), Appendix p.928.