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Growing Apart? Structural Transformation and the Uneven Development of British Cities

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Abstract

Structural change is now widely considered to be an important aspect of national economic growth. Yet the issue is not only of relevance at the macro-economic level; it also has a direct bearing on the growth of regions and cities. In this paper we examine the relationship between structural transformation and economic (output) growth across British cities over the last half century. During this time, the British economy has gone through a series of extensive structural transformations, most notably an historical shift from an industrial to a post-industrial structure. But also within the now dominant 'post-industrial' economy some service activities have been growing at a faster rate and appear to be more dynamic, than others. In this paper we show how the structural transformations in the national economy have played out quite differently across British cities, shaping to a considerable extent their divergent growth trajectories over the past five decades. At a broad level, it is possible to distinguish between a number of distinct growth clubs of cities, and these also display significant differences in the extent and direction of structural change and reorientation. However, while differences in structural change have certainly been important in shaping city growth paths, other, 'city-specific', factors appear also to have exerted an influence, and thus require investigation.

Keywords: Cities Structural change Growth

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Growing Apart? Structural Transformation and the Uneven Development of British Cities

1. Introduction

The period since the Oil Crisis of the early 1970s has been one of great structural change in the British economy. Britain has lost much of its industrial base and experienced rapid growth in the service sector. Whilst structural change has affected virtually every aspect of the British economy, perhaps one of the most significant impacts has been on the economic growth of its cities, particularly its large conurbations that owed much of their rapid expansion throughout the eighteenth and nineteenth centuries to Britain's industrialisation. Many of Britain's largest cities have struggled to adjust to a post-industrial economy. As cities have lost manufacturing jobs they have experienced periods of high, often long-term unemployment, and in more recent years whilst there have been more job opportunities these have often been relatively poorly paid, and thus contributed to increased levels of income inequality across British society (Fenton, et al 2008).

Despite the importance of structural change on the growth trajectories of cities, it is perhaps somewhat surprising that there is relatively little in-depth analysis of the phenomenon. In the British case, the most comprehensive analysis to-date appears to have been undertaken some thirty years ago (see Hausner, 1987). At that time, an extensive (ESRC funded) research project considered how British cities, and their hinterlands, had adapted to economic change over the period 1951-1981. More recently, a UK Government Office for Science's Foresight Project on The Future of Cities showed that the growth paths of British cities in recent years has been quite diverse (Martin, Tyler and Gardiner, 2015), a finding reinforced by other recent work (Martin et al., 2016a).

How cities deal with structural transformation over time, and the concomitant changes in conditions and opportunities for their economic growth, are clearly major issues for society and the formulation of policy. Indeed, as the British Government devolves economic powers from central to local government it is important that those tasked with managing city economies understand the basic mechanisms that lie behind change, and what may be the scope for intervention to assist the process in a way that enhances local economic growth. Policy makers need to know the sectors that are declining, those that may be experiencing successful upgrading or 'turning around', and those that are new and growing. They need to know how to assist city economies to adapt and adjust their structures in response to both the challenges and opportunities of a rapidly changing globalised market place.

In this paper we examine how differences among cities in medium to long run growth, and shifts in the growth paths of cities relative to one another, are in part due to differences in

the process, nature and extent of structural transformation.¹ We have taken industrial sectors as the unit of our analysis (rather than, say, types of firms) and have considered structural transformation in Britain as it relates to a process in which some sectors expand relatively quickly and thus increase their relative share of national output, whilst others do the opposite.

We begin by reviewing perspectives on the perceived role of economic structure on the growth of cities in Section 2. We briefly discuss several theoretical perspectives from both economics and economic geography. Structural transformation has so far however received relatively little consideration as a factor in explaining economic growth in cities. Notwithstanding this lack of attention in theories of growth, structural transformation and its uneven geographical effects, has been well documented as an empirical phenomenon. In the 1970s and 1980s many cities in Europe and North America were hard hit by deindustrialisation. And in more recent years, a structural transformation appears to be taking place within the service sector, with some parts of the service sector growing rapidly and showing considerable dynamism, while other parts seem to be more stagnant and lagging in productivity.

Section 3 examines what has happened to the economic growth of Britain's major cities over the last forty-five years using a novel dataset, covering some 85 cities, specifically constructed to reflect functional economically meaningful travel-to-work areas. The cities range in employment size (in 2014) from 5.35 million (London) to 83,400 (Merthyr Tydfil) with employment and output data for 81 sectors of activity for each city. We focus on city growth in output, and show that there have been considerable differences in the growth paths observed. We distinguish three distinct types of performance: those cities that have grown considerably faster than the nation, those that have grown at the national rate and those that have exhibited relative decline in their output growth. We also distinguish the two special cases of London and Aberdeen. London is the United Kingdom's largest city and its capital. Aberdeen has been the centre of the North Sea oil industry over the period. We use this analysis to understand more about how structural change has influenced the patterns of growth observed later in the article.

Section 4 considers structural change in Britain over the period 1971 to 2014. It examines structural change according to whether a sector has increased or decreased its relative share of national output. This enables us to focus on distinct types of transformative change at the sectoral level.

The article then moves in sections 5 and 6 to examine to what extent and in what manner differences in the growth of British cities can be 'explained' by changes in the national

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structure of the British economy. The article adopts a modified version of the conventional shift share approach to assess the contribution of economic structure to the growth trajectories of each of the categories of cities distinguished in Section 3.

Section 7 outlines the impact on employment of structural transformation in the period from 1971-2014. Deindustrialisation has had very marked effects on most cities in Britain, but especially the slowest growing cities have seen very significant losses of employment. This group of cities has never fully recovered from the structural transformation in the 1970s and 1980s, and also the quality and robustness of the employment growth that has been taken place since is very much in question.

We finish with some conclusions in Section 8.

2. Structural Transformation and City Growth

Cities grow for a variety of reasons (see Storper, 2013). Indeed, a large body of economic theory now exists concerned with why economic activity agglomerates in cities, how agglomeration influences productivity, human capital formation, wages and innovation, and the role played by planning systems (the literature is extensive, but see, for example, Fujita and Thisse, 2002; Henderson, 2003; Glaeser, 2008; Glaeser and Gottlieb, 2009; Cheshire et al. 2014). These key insights are most certainly relevant for understanding city growth. However, these literatures have much less to say about the medium to long-term *evolution* of city economies, about structural transformation and its relationship to diverse city growth paths.

Structural transformation refers to the changing sectoral composition of output and employment over time, a stylised fact for which there is copious evidence (Kuznets, 1957, 1971; Pasinetti, 1993; Freeman and Louca, 2001; Cornwall and Cornwall, 1994; Metcalfe, Foster and Ramlogan, 2006; Kruger, 2008). Traditional growth theory always had difficulty incorporating structural change, although the notion has found extensive use within the study of economic development. But for those economists who reject the distinction between development and growth (see Kuznets, 1971; Pasinetti, 1981; Baranzi and Scazzieri, 1990; Rodrik, 2006), and for present-day evolutionary economists (such as Metcalfe, 2003; Metcalfe et al, 2006), structural change or structural transformation is an integral feature of a dynamic modern economy, and the study of 'structural dynamics' necessary for understanding the growth process. As Roncolato and Kucera (2014, p. 399) put it, "sustainable economic geography, particular attention is focused on the path dependence of local economic structures, on the process of new path creation - that is the emergence of new industries and technologies – and on the adaptability and resilience of

local economies (see Martin and Sunley, 2006; Boschma and Martin, 2010; Pike et al, 2010; Bailey and Berkeley, 2014; Martin and Sunley, 2015).

It took the path-breaking work of authors such as Kaldor (1966, 1967, 1968), Kuznets (1973) and Pasinetti (1981, 1993) to move structural change to centre stage in growth theory. Thus according to Kuznets

rapid changes in production structure are inevitable – given the differential impact of technological innovations on the several production sectors, the differing income elasticity of domestic demand for various consumer goods, and the changing comparative advantage in foreign trade (1973, p. 250).

Likewise, in Pasinetti's scheme, structural change is conceived as a multi-sectoral economy evolving through time under the influence of technical progress and changes in final demand consumption. Technical change occurs unevenly among sectors, so that the rate of change of productivity differs from sector to sector (and by implication from region to region).² Correspondingly, demand changes at different rates among different products. Moreover, technical change may take the form of the introduction of new products, and hence the emergence of new activities and new sectors. In short, structural dynamics are inherent to the growth process. In Kaldor's seminal works on economic growth theory, manufacturing was assigned particular importance as the driver of economic growth primarily because it has greatest potential for dynamic returns to scale (Kaldor, op cit; see also Thirlwall, 1983), the implication being that a shift to services could well slow down productivity growth. In a later contribution, Baumol et al (1989) discuss the considerable diversity of productivity developments that can be observed across industries and sectors, and emphasise not only the fact that structural change is an ongoing long-run phenomenon, but also that productivity growth is particularly relevant in the long run.

Empirically, structural transformation has in recent decades been particularly apparent and disruptive through the process of deindustrialisation. Deindustrialisation refers to the contraction and decline of the weight of manufacturing industry within an economy (Martin and Rowthorn, 1986; Pike, 2009). This may only be a relative decline (loss of importance of manufacturing as a proportion to other sectors), but there may also be an absolute decline (decline in output and employment). In many of the most advanced economies in Western Europe and North America a relative decline of manufacturing. But especially after the first oil crisis of 1973, the pace of change accelerated, and in many traditional segments of manufacturing (such as steel, shipbuilding, heavy engineering, car manufacturing, chemicals, etc.) an absolute decline in employment (and in some sectors, also output) set in.

² Interestingly, in explaining the stimulus for his new theory, Pasinetti attributed it in part to "the extremely uneven development – from sector to sector, from region to region – of the environment in which I lived (postwar Europe) at the time I began my training in economics" (Pasinetti, 1981; p. xi).

This coincided with large-scale rationalisation- and modernisation-operations with concomitant downsizing and plant-closings (Bluestone and Harrison, 1982).

The 'maturity thesis' regarding deindustrialisation postulates that the relative decline of manufacturing is a 'natural' consequence of rising incomes and living standards, as consumer demand shifts from manufactured goods to services of various kinds (Rowthorn, 1986; Hudson, 2011). This parallels some of the theoretical insights of Kuznets, Pasinetti, and Kaldor cited earlier. In addition, as economies develop, their comparative advantages vis-à-vis other economic activities which correspond with higher wages and higher skill-levels (Pike, 2009; Hudson, 2011). Forms of manufacturing which mainly rely on cheap and semi-skilled labour will then move to other places where wages, living standards and overall levels of education are lower. These factors have meant that – in economically advanced nations – the scope for output growth in manufacturing has been smaller than in other sections of their economies. Moreover, technological change and productivity improvements have meant that employment in industry has fallen drastically, as a consequence of on-going automation and the increasing importance of economies of scale.

Some of these patterns of deindustrialisation seem to be mirrored by recent trends of structural transformation within the service sector. Some tradeable parts of the service sector – in particular those providing 'innovation jobs' (Moretti, 2013), such as IT, life sciences, finance, advertising, design, entertainment, etc. – exhibit considerable dynamism and show continuing growth in employment and output. Other segments of the service sector, such as personal services, leisure activities health care, and education, have been more stagnant in terms of the application of new technologies; and while experiencing substantial employment growth they have shown much slower productivity advance (Berger and Frey, 2016; LSE Growth Commission, 2017). How far new advances in digitalisation, robotics and machine learning, will threaten jobs in these activities is an increasingly pertinent issue (Berger and Frey, 2016; Baldwin, 2016). But some recent accounts have argued that mature economies such as the UK are experiencing a dominant shift of employment to low-productivity, non-tradable services, and that this can be described as 'growth-reducing structural change' as it will weaken future innovation and productivity growth (Rodrik, 2016). The balance between different types of service industry growth is clearly crucial.

These structural transformations have affected different cities and regions differently across Europe and North America. Certain places in which manufacturing formed the backbone of their economy were especially badly affected by deindustrialisation, undergoing serious falls in industrial employment. After the initial shock in the 1970s and 1980s, some of these places managed to find renewed growth in advanced manufacturing and service industries; but recovery has been very uneven (Birch et al., 2010; Power et al., 2010; Hobor, 2013; Cowell, 2015). In part, the success with which cities have reorientated their economies has depended on policies adopted during and after deindustrialisation, and the institutional structures within which cities and regions operate (especially with regard to the powers and resources available at the subnational level). Indeed, particular macro-economic policies – such as measures to protect the value of the currency and a lack of an industrial strategy together with weak regional policies and an economic governance structure which is exceptionally centralised, have undoubtedly contributed to the particular intensity and high degree of disruption of deindustrialisation in the United Kingdom (Martin, 1986; Pike 2009; Birch et al., 2010; McCann, 2016). But many other factors also appear important in coping effectively with structural transformations, such as location, human capital formation, the knowledge and innovation base, agglomeration effects, infrastructure connections, entrepreneurial culture, etc. These determine whether an urban economy manages to develop new activities that incorporate important and dynamic functions (i.e. especially 'innovation jobs') in national and international value chains, reducing its dependence on 'branch plants', public sector expenditure, and low-productivity services (Massey, 1995; Moretti, 2013; Baldwin, 2016; Storper et al., 2015). Such activities will then also contribute to its tradeable base and generate additional income within the economy of the city, driving employment and output in other activities through multiplier effects (Rowthorn, 2010; Moretti, 2013; Martin et al., 2016a). A growing body of work in economic geography has examined how industries emerge from related and antecedent sectors. It has been argued that those cities that possess a platform of technologically related industries are better able to diversify and adapt their economies by spawning more new sectors and industries (Frenken and Boschma, 2007; Neffke et al, 2011). However, many of the claims about the ways in which the diversification and branching of industrial structures shape long-term urban growth have not been tested empirically.

What is clear, then, is that the growth path of a given city will be the outcome of a complex and evolving interaction of 'external' (national and indeed global) factors and city-specific factors and conditions. Following Metcalfe et al (2006), we can think of a city's economy as being an ensemble' of activities – a structural ensemble – that is constantly changing as a result of this interaction. Such a structural ensemble can be examined and decomposed in different ways, of course. Our analysis has taken industrial sectors as the primary units of a city's structural ensemble. However, it is entirely plausible to distinguish other constituent elements, like types (or sizes) of firms or occupational composition. Ultimately, structural change will involve several such dimensions: for example, the decline of manufacturing jobs is almost certain to lead to the decline or even disappearance of certain types of occupation. Nevertheless, given our interest is in the 'great transformation' from an industrial to a postindustrial economy, we focus attention here on sectors.³ The differential growth of a city's firms and industrial sectors imparts structural transformation, while the aggregate pattern of that transformation will shape a city's growth path, relative to other cities. An ensemble

³ We also have constructed time series on the occupational structures of our 85 cities, from 1971 to 2014. The analysis of this aspect of city growth and change will form the basis of another paper.

approach suggests that the development of industries in a particular city may be strongly or weakly inter-related (e.g. through demand linkages, skills and knowledge spillovers) so that the performance of an industry in a particular urban area may depend on how it is set within and interacts with a wider group of local industries.

What is to be analysed and explained are the differential growth rates of output, employment and productivity across an industrial ensemble – here the sectoral ensemble of a city. Without differential growth there is no structural change, no evolution of the sectoral shares of city output, employment or productivity. If the growth rate of output in sector *i* in city *j* is denoted by g_{ij} , the growth rate of aggregate output in the city by g_{j} , and the growth rate of the share of sector *i* in the total output of the city by s_{ij}^g , then by definition

$$s_{ij}^g = g_{ij} - g_j$$

and similarly for employment

$$s_{ij}^e = e_{ij} - e_j$$

Obviously, if all growth rates, g_{ij} (or e_{ij}), are equal, the case of proportional growth, the output (employment) structure of a city is frozen, and there is no structural change or transformation. Further,

$$s_{ij}^e + q_{ij} = s_{ij}^g + q_j$$

where q_{ij} and q_j are the growth rates of productivity in sector *i* in city *j* and total city productivity respectively. Consequently, in an industry in which productivity increases at the city average rate, the output share of that sector will change at the same rate as its employment share. Hence proportionate growth implies that all sectors in a city have a common rate of productivity growth, which is unlikely to be the case. The key point is that the differential growth rates of the sectors making up a city's industrial ensemble, and what makes those growth rates differ, are of central importance in shaping that city's aggregate growth path over time and in relation to that of other cities.

3. City Growth Evolutions

In order to examine the patterns of change across British cities we focus on cumulative differential growth, whereby, starting in our base year 1971, we subtract from each city's growth rate in each year the corresponding national (Great Britain) rate, and cumulate these differences over time (see Blanchard and Katz, 1992, for the development of this approach). The overall performance of the 85 cities, measured in terms of their cumulative differential growth in output and employment over 1971-2014, is shown in Figure 1.

Figure 1: Output growth and Employment growth over 1971-2014 in terms of cumulative percentage point deviation from national growth, for 85 British cities (including line of best fit and R²)



Cumulative deviation GVA - 1971-2014

Note: Southern cities defined as those in the following regions: London, South East, East of England, South West and East Midlands. Northern cities defined as those in the West Midlands, Yorkshire-Humberside, North West, North East, Scotland and Wales.

A number of features emerge. It is clear that the differential growth of both output and employment across cities has been substantial. Further, the patterns for output and employment are closely correlated: those cities that have experienced the fastest rates of growth of employment also tend to be those that have recorded the fastest rate of growth of employment, and vice versa. Some cities, such as Milton Keynes, Northampton, Telford, Crawley and Swindon have experienced average growth rates in their GVA and employment far exceeding the national average (and totalling to a cumulative differential of over 30-40 percent over the period). Other cities, such as Liverpool, Glasgow, Newcastle, Birmingham, and Sheffield have grown well below the national rate in both output and employment. Still other cities have tracked national growth. Notwithstanding the high correlation between output and employment growth, however, some cities show a much slower performance in employment than in output, such as Sunderland, Middlesbrough, Manchester and Huddersfield. Still other cities seem to experience much stronger employment growth compared to GVA growth, such as Colchester, Chelmsford, Plymouth and Southend. Another feature is that many of the fastest growing cities have been in the southern half of Britain (roughly south of a line between the Severn and Humber), and most of the slowest growing have been in the north. Notable exceptions to the latter group are Aberdeen (which has benefited from the North Sea oil industry), Telford (a New Town in Shropshire), Leamington Spa and Crewe. It is perhaps not inappropriate to refer to the pattern evident in Figure 1 as closely corresponding to the conventional depiction of Britain's economic geography as mapping out a broad North-South' divide (Martin 1988; Lewis and Townsend, 1989; Rowthorn, 2010; Martin et al., 2016b).

To assist analysis, the cities were grouped in terms of their output growth trajectory experience relative to the average national growth rate: namely, according to whether they had a cumulative differential growth significantly above, similar to, or significantly below, the national level over the period. A bandwidth of half a standard deviation below and half a standard deviation above the national rate was used to make this classification. We have separated out the experience of London due to its relative size, and of Aberdeen because of its relatively unique experience propelled by the exploitation of North Sea oil. We thus identify five groups – or Clubs – and a residual group of non-urban TTWAs. Table 1 shows which cities are in which Club.

Table 1:	Clubs of British cities defined according to their relative GVA growth trajectory
	using half a standard deviation (unweighted) to distinguish above average and
	below average.

Club I	GVA +	Milton Keynes, Northampton, Basingstoke, Swindon, Telford,
		Leamington Spa, Crawley, Peterborough, Chichester, Tunbridge Wells,
(27 cities)		Mansfield, Reading, Guildford, High Wycombe & Aylesbury, Derby,
		Crewe, Norwich, Chesterfield, Bournemouth, Exeter, Cambridge, Slough
		& Heathrow, Lincoln, York, Southampton, Eastbourne, Ipswich
Club II	GVA 0	Trowbridge, Dunfermline & Kirkcaldy, Wakefield, Shrewsbury, Halifax,
		Blyth & Ashington, Colchester, Kettering & Wellingborough, Oxford,
(33 cities)		Stevenage, Gloucester, Doncaster, Leeds, Bristol, Nottingham,
		Chelmsford, Falkirk & Stirling, Luton, Leicester, Worcester &
		Kidderminster, Chester, Southend, Sunderland, Barnsley, Warrington &
		Wigan, Huddersfield, Brighton, Edinburgh, Bedford, Preston, Durham &
		Bishop Auckland, Bradford, Manchester
Club III	GVA -	Portsmouth, Coventry, Cardiff, Hull, Newport, Medway, Merthyr Tydfil,
		Motherwell & Airdrie, Middlesbrough & Stockton, Sheffield, Blackburn,
(23 cities)		Plymouth, Newcastle, Birmingham, Dudley, Birkenhead, Blackpool,
		Stoke-on-Trent, Dundee, Swansea, Glasgow, Wolverhampton, Liverpool
London		London
Aberdeen		Aberdeen
Non-urban		TTWAs which are not classified as cities
TTWAs		

Figure 2 shows the evolution of the growth of GVA relative to the nation for the Clubs from 1971 until 2014. We have excluded Aberdeen as an outlier. Figure 3 then displays what this has implied for the average annual growth rates over the period; with also an indication of the dispersion between maximum and minimum for the growth rates within each club.







Figure 3: Annual compound growth rates for GVA over 1971-2014: average for clubs, with spread between maximum and minimum within clubs

The relative fast growing city Club I had an average growth rate of 2.76% (Figure 3) but some cities within the club did better than that, achieving almost 4.5%. The overall average growth of Club I cities exceeded that of London by a significant margin, and that of the non-urban travel to work areas. The club grew over a third faster than the Club II that tracked the national rate. Club II had relatively little dispersion within it. Club III grew at around half the rate of Club I at 1.42%, and there was wide club dispersion with the weakest performer growing at half the club average.

The cities in Club I have thus been characterised by very strong overall growth in output throughout the period of study; though this seems to have levelled off somewhat in the last 15 years of the period under investigation. This club includes Milton Keynes, Northampton, Telford, Peterborough, Reading, Cambridge, and Southampton. Several of these cities were promoted as New Towns and assisted by British spatial policy to become centres of growth. The New Town approach was to facilitate a planned approach to economic development whereby a Development Corporation was established with extensive powers relating to land assembly and the provision of infrastructure in order to promote economic development. The evidence suggests that they may have been quite successful in this respect. Club II has tracked the growth of the nation quite closely and includes cities like Oxford, Leeds, Bristol, Nottingham, Leicester, and Manchester. Club III comprises 23 cities that have more or less consistently grown well below the national rate. This club comprises many of the oldest

industrial areas and includes Cardiff, Middlesbrough, Sheffield, Newcastle, Birmingham, Swansea, Glasgow, and Liverpool.

London shows a particularly interesting growth trajectory throughout the study period. After a period of relative decline up until the mid 1980s it then 'turned-around' and has grown relatively more quickly than that of the national average since. It is also of interest to note that the TTWA residual group has tended to grow slightly above the national average over the study period, in line with the relatively better performance of near accessible areas around the cities in the post-war period, as documented by Keeble and Tyler (1995).

4. Structural Transformation in the British Economy

As already noted earlier, the United Kingdom was the first major industrial nation to experience a strong relative decline in the growth of its manufacturing sector, a process that began in the mid-1960s, some time before the same process affected other nations (Rhodes, 1986). It has also been the case that the United Kingdom has experienced the greatest relative employment decline in the sector of all its major competitors (Townsend, 1983). Figure 4 shows the broad pattern of output change in Britain over the period for larger aggregations of the 81 sectors (see Appendix). The differential growth performance across sectors reveals the scale of the change in the last five decades. As Table 2 shows, over the period overall output in the national economy has grown by around 150% since 1971. As outlined in section 2, sectors that have grown below the national average growth rate, will have seen their share in national output decrease, while sectors that have grown at a faster pace, will have expanded their share. Growth of output in manufacturing sectors, including high-tech has been far below the average, and hence their share has fallen: in some cases (especially in metals and textiles) output has actually declined. The sectors in which output has grown considerably faster than the British average - and hence now represent a larger share of output - have been oil and gas extraction, retail and personal services and especially Knowledge Intensive Business Services (KIBS).

The process of deindustrialisation has resulted in manufacturing declining from nearly 22% of output in 1971 to just over 10% of output in 2014. But also within the services some sections of the service economy (especially the Knowledge Intensive Business Services and to a lesser extent retail and personal services) have been growing at a faster rate than other sections. The share of services (both private and public) went from about 50% of output in 1971 to 68% in 2014; but within services, KIBS increased its share of total service output from about a quarter to nearly half.



Figure 4: Sectoral growth across the British economy 1971-2014

 Table 2:
 Sectoral change across the British economy over 1971-2014

	Indexed change in GVA in 2014 (base 1971=100)	Indexed change of broad sector group relative to growth of GB
Agriculture and fishing	158.6	63.6
Coal and Other mining	76.6	30.7
Oil, Gas and Mining support	400.9	160.7
Metals and related	75.0	30.1
Textiles and related	34.2	13.7
Light manufacturing	124.8	50.0
High tech manufacturing	160.1	64.2
Utilities	226.9	90.9
Construction	150.8	60.4
Transport and logistics	236.8	94.9
Retail and personal services	313.1	125.5
Knowledge Intensive Business Services	656.0	262.9
Public services	197.8	79.2
Total	249.5	100.0

We can now identify the sectors which have managed to grow above average over the period from 1971-2014 (and thus have seen an expansion of their share), and those which have performed below average (and hence will have decreased their share). Moreover, we can further distinguish between sectors according to their labour productivity performance, which reflects their dynamism and capability to generate high-value employment. Figure 5 shows the 81 sectors plotted according to their annual average output growth and growth in productivity over the 1971-2014 period. We can distinguish between four performance

types, which are listed in Table 3. The first group contains those sectors that have had a growth of output and productivity below the national average. This includes large sectors such as public administration and defence, education, and construction. The second group has had slow output growth, but above the national average productivity growth compared to the national average as a result of employment loss. This group includes most of manufacturing. The third group has had faster growth of output but slower productivity growth than the national average. This includes most personal services, health care, and several of the KIBS. The fourth group are those that have experienced relatively faster output and also productivity growth, and are thus the most impressive performers across the sectoral groups. This group encompasses most of the KIBS, retail, pharmaceuticals, and oil and gas extraction.





Performance type	Sectors	GVA change	Productivity	Employment
			change	change
GVA below average,	Public administration and defence	1.07% on	0.41% on	0.66% on
Productivity below	Education	annual basis	annual basis	annual basis
average	Construction			
	Wholesale trade	58.2% over	19.4% over	32.5% over
	 Accommodation and other leisure 	period	period	period
	services			
GVA below average,	 Most manufacturing 	0.33% on	2.85% on	-2.45% on
Productivity above	 Electricity and gas supply 	annual basis	annual basis	annual basis
average	 Water transport 			
	 Insurance and pensions 	15.1% over	235.0% over	-65.6% over
		period	period	period
GVA above average,	 Most personal services 	3.74% on	1.12% on	2.59% on
Productivity below	 Health care, residential care, and 	annual basis	annual basis	annual basis
average	social work			
	• Some KIBS	384.4% over	61.6% over	199.7% over
	 Warehousing 	period	period	period
	 Waste disposal and management 			
GVA above average,	 Most KIBS (including information 	3.69% on	3.03% on	0.64% on
Productivity above	services, computer programming,	annual basis	annual basis	annual basis
average	telecommunications, scientific			
	research, and financial services)	374.5% over	260.2% over	31.7% over
	Retail	period	period	period
	Pharmaceuticals			
	• Oil and gas extraction, and support			
	activities			
	Land transport			
	Air transport	2.450/	4 500/	0.550/
Total for Great		2.15% on	1.59% on	0.55% on
Britain		annual basis	annual basis	annual basis
		140 E% over	08.6% over	26.9% ovor
		145.5% UVEI	period	20.0% Uver

 Table 3:
 Sectoral change across the British economy

5. Structural Transformation in British cities

This section is concerned to assess the how the structural transformation discussed in the previous section, has played out over the various cities in Great Britain. The economic growth prospects of cities will be importantly conditioned by the initial presence of certain sectors at the beginning of the period, and the general development of sectors over the period. Hence we will first look at how economic activities were distributed over the country in 1971 and how this has changed over the period until 2014. We will then analyse what this has meant for changes in GVA for the cities from 1971 until 2014.

Table 4 shows the economic structure of the clubs of cities in 1971. Clearly manufacturing was still a relatively important segment of the economy, with nearly 22% of the output in the nation. It is also clear that there was an overrepresentation of manufacturing – which as highlighted in section 4, has grown very little – in Clubs II and III, with Club II also specialising

more in textiles and Club III more in metals and related industries. Private services – where a lot of the growth has taken place in the subsequent period – made up about 37% of the British economy in 1971. There is not that much disparity between the economic structures of the various types of cities and also the non-urban TTWAs in this respect. Also, private services had comparable share between the three main clubs of cities and in the non-urban TTWAs. The exception here is London, in which private services formed a much greater share (51%), mainly because of a far greater share of Knowledge Intensive Business Services (although transport and logistics also had a larger share than in the national economy). Hence London seemed to have been somewhat better placed to benefit from the structural transformations that were going to occur in the next decades, whereas Clubs II and III were at a comparative disadvantage. For the sake of contrast and of completeness, we have included Aberdeen as well in this table.

	London				, Non	Abor	Great	, Total
	London		GVA 0	GVA -	urban	deen	Britain	GVA
		UVA I	GVAU	UVA-	TTWAs	ucchi	Dintain	1971
Broad sector groups								
Agriculture and	0.2%	1.4%	0.8%	0.7%	2.2%	3.9%	1.0%	5,218
fishing								,
Coal and Other	0.2%	0.2%	0.4%	0.2%	1.0%	0.0%	0.4%	2,074
mining								
Oil, Gas and Mining	0.3%	0.1%	0.4%	0.1%	0.4%	0.3%	0.3%	1,430
support								
Metals and related	2.1%	3.7%	3.5%	7.4%	5.4%	1.2%	4.4%	23,959
Textiles and related	1.4%	1.3%	4.1%	1.6%	2.3%	0.9%	2.2%	12,029
Liebt an en offentione	F 20/	0.50/	0.40/	0.50/	0.50/	4.6.20/	0.40/	40 700
Light manufacturing	5.3%	8.5%	8.4%	9.5%	8.5%	16.3%	8.1%	43,/33
High tech	1 3%	8 1%	0.2%	10 5%	5.2%	1 7%	7 7%	11 652
manufacturing	4.370	0.170	9.270	10.570	5.570	1.770	1.170	41,055
Utilities	1.1%	2.4%	3.0%	2.8%	3.1%	4.7%	2.5%	13,485
• • • • • • • • • • • • • • • • • • • •	212/0	,•	0.070	2.070	012/0		2.070	10,100
Construction	10.3%	10.5%	10.7%	11.5%	11.7%	13.2%	10.9%	59,022
Transport and	15.1%	12.4%	10.7%	10.9%	10.7%	12.2%	11.9%	64,362
logistics								
Retail and personal	11.2%	13.8%	13.5%	12.1%	14.7%	11.2%	12.9%	69,463
services								
Knowledge Intensive	24.7%	9.1%	8.6%	9.0%	7.6%	8.7%	12.0%	64,529
Business Services								
Public services	23.9%	28.3%	26.5%	23.6%	27.1%	25.7%	25.7%	138,334
Doutourso turos								
GVA below average	11 10/	11 90/	17 6%	41.0%	17 0%	11 7%	12 7%	225 659
Prod below average	44.470	44.0%	42.0%	41.0%	47.9%	44.770	45.7%	255,056
GVA below average	16 5%	23.4%	26.2%	31.2%	23.6%	27.4%	24.6%	132 637
Prod above average	10.570	23.470	20.270	51.270	25.070	27.470	24.070	152,057
GVA above average.	19.8%	16.2%	15.5%	13.9%	14.0%	12.0%	15.9%	85.590
Prod below average	1010/0	1012/0	1010/0	2010/0	1 11070	1210/0	2010/0	00,000
GVA above average,	19.3%	15.6%	15.7%	13.9%	14.5%	15.8%	15.8%	85,406
Prod above average								
Total GVA 1971	111,959	84,466	133,067	130,019	76,202	3,579	539,291	539,291
	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)	
Share of Club in 1971	20.8%	15.7%	24.7%	24.1%	14.1%	0.7%	100.0%	

Table 4:Economic structure in clubs of cities in 1971, with total GVA in 1971 for broad
groups of sectors and for clubs (in million £s, 2011 Current Market Value)

Figures 6 to 10 show how the relative distribution of broad types of sectors over the clubs changed over time, by displaying the development of the location quotients. Agriculture and fishing, coal and other mining, and oil and gas extraction, are excluded as these made up relatively small shares of the British economy, and are moreover activities that mainly take place outside of cities.

London already had relatively low concentrations of manufacturing activity, and these have been falling further over the period. The very high concentrations of output in Knowledge Intensive Business Services have remained high. But interestingly, the relative share declined somewhat over the 1970s before being restored in the 1980s probably because of the cessation of government policy activity designed to disperse office-based activity from London to its surrounding areas. Towards the end of the 1990s, the relative concentration began to fall somewhat again. London has experienced a marked drop in the concentration of output in transport and logistics and the public sector throughout the period.

The cities in the fast-growing Club I had somewhat lower concentrations of manufacturing initially. But they have increased their relative concentration in high tech manufacturing over the period, particularly after the mid-1990s (Figure 7). These cities have noticeably increased their relative concentration in transport and logistics and also Knowledge Intensive Business Services, whilst their share of public service output has gone down.

The cities in Club II, Figure 8, have historically been characterised by relatively greater concentration of textile related activity, which – even though this sector has declined very significantly at the national level – has remained concentrated in these cities. In terms of private services (as well as other types of manufacturing) there seems to be a convergence taking place, in which the cities in Club II increasingly emulate the economic structure of the nation as a whole.

The cities in Club III were historically characterised by a relatively high share of manufacturing, in particular of manufacturing in metal related industries, as is clear from Figure 9. This pattern has persisted. As noted manufacturing output has grown only very little over the period, hence there may be an indication that the comparatively high concentrations of manufacturing have contributed to the slow growth of these cities in general. The more fast growing private services remain underrepresented in the cities in Club III, and this is especially true for the Knowledge Intensive Business Services. By contrast, public services seem to have increased their share in these cities considerably relative to the nation as a whole. This may have provided something of a compensating development, but an increasing dependence on public services carries its own problems as a basis for sustained high growth over the long term.

Figure 10 makes clear that manufacturing is increasingly concentrated outside of the cities, in less urbanised and rural locations. Knowledge Intensive Business Services still seem to have a clear predilection for cities however, and the concentration of KIBS in more rural parts of the country has remained quite low.



Figure 6: London: Location quotients for broad groups of sectors based on GVA-shares

Figure 7: Club I (GVA +): Location quotients for broad groups of sectors based on GVAshares.





Figure 8: Club II (GVA 0): Location quotients for broad groups of sectors based on GVAshares.

Figure 9: Club III (GVA -): Location quotients for broad groups of sectors based on GVAshares.





Figure 10: Non-urban TTWAs: Location quotients for broad groups of sectors based on GVA-shares

These developments in the geographical distribution of industries over Great Britain are also reflected in the sectoral breakdown of changes in output across the various clubs over the period. Table 5 and Table 6 show the breakdown of output change over the period. Table 5 exhibits which sections of the economy experienced negative output change - i.e. decline in output - over the period. At the bottom of the table, the total absolute decline in each of the clubs is presented, which is broken down into the percentage contribution of each broad sector group and again of each sector performance type. Table 6 presents a similar breakdown for positive output change – in other words, growth in GVA – and shows the primary sources of growth in each of the clubs. Added together the negative change in Table 5 and positive change in Table 6, will represent the overall (net) GVA growth over the period for each club.

With regard to negative output change, it is clear that London and the cities in Club III have had to deal with more decline in their sectors than other parts of the country. In both cases this was due to substantial losses of output in manufacturing, which perhaps also had a further negative effect on transport and logistics. In London, furthermore, public administration and defence have lost output. In Club III, some parts of its metal related industry (in particular basic steel making and manufacture of metal products) and of its high tech manufacturing (especially production of motor vehicles and of machinery) have sustained heavy losses. In Club II the dramatic decline of the textile industry in Britain is clearly noticeable, but other segments in manufacturing have not suffered as much as in Club III and in London.

There have been very large differences in the capacity to generate output growth between the clubs over the period. On the one hand, there are the well-performing cities in Club I and London, which have seen a lot of expansion across their economies. On the other hand, there are the poorly performing cities in Club III, which in addition to experiencing more decline in output, have also not been able to generate much output growth compared to other cities. Club II and non-urban TTWAs, have been tracking the national average in this respect. It is also immediately clear from this table that very little growth has come from manufacturing, with the exception perhaps of some parts of high tech manufacturing (mainly pharmaceuticals, production of computers, and of motor vehicles) in Club I and nonurban TTWAs. By far the greatest share of growth in all the clubs has been in private services, especially KIBS and to a lesser extent retail and personal services. In London, KIBS account for around two thirds of positive change in output. Also Club I shows a greater increase of output because of growth in KIBS than the other clubs. The nature of the growth of KIBS between London and the cities of Club I is somewhat different though; with growth in London more driven by financial services, legal and accounting, and entertainment industries, and Club I more dominated by IT services and real estate activities. Club III is lagging behind somewhat in terms of the share of its growth due to KIBS. Club III by contrast shows a much greater share due to expansion of public services, especially health care and education. These developments then also explain the greater share of higher productivity growth activities in the output growth of London and Club I; while in Club III somewhat more of its growth is constituted of sectors with lower productivity growth.

0	London	Club It			Non	Abor	Great	Total
	London	GVA +	GVA 0	GVA -	urban	deen	Britain	neg. GVA
				•••	TTWAs	ucch	Dintain	change
Broad sector groups								0.
Agriculture and fishing	0.6%		0.2%	0.3%		22.1%	0.5%	-171
Coal and Other mining	1.4%	1.4%	6.3%	0.9%	7.4%		2.7%	-973
Oil, Gas and Mining support			7.2%	1.0%	0.5%		1.9%	-672
Metals and related	16.6%	25.5%	11.1%	33.4%	50.9%	6.5%	24.9%	-8,860
Textiles and related	11.3%	27.2%	51.3%	10.5%	35.8%	6.1%	22.2%	-7,917
Light manufacturing	21.1%	20.0%	7.2%	12.7%	2.7%	56.9%	13.9%	-4,944
High tech manufacturing	28.1%	7.6%	7.3%	28.5%			20.1%	-7,173
Utilities	3.4%	18.4%	9.4%	6.9%	2.7%		6.7%	-2,395
Construction								0
Transport and logistics	9.2%			5.8%			4.7%	-1,659
Retail and personal services								0
Knowledge Intensive Business Services						8.4%	0.1%	-25
Public services	8.3%						2.3%	-822
Performance types								
GVA below average, Prod below average.	14.5%	18.4%	9.8%	9.1%	41.5%	6.5%	14.0%	-4,981
GVA below average, Prod above average	85.5%	81.6%	82.9%	89.9%	58.0%	82.5%	84.0%	-29,914
GVA above average, Prod below average			0.2%				0.0%	-12
GVA above average, Prod above average			7.2%	1.0%	0.5%	11.0%	2.0%	-704
Total negative GVA	-9,928	-2,169	-7,364	-12,889	-2,963	-298	-35,611	-35,611
GVA in 1971	111,959	84,466	133,067	130,019	76,202	3,579	539,291	
Negative GVA-change as % of GVA in 1971	-8.9%	-2.6%	-5.5%	-9.9%	-3.9%	-8.3%	-6.6%	

Table 5:Breakdown of negative GVA change (million £s, 2011 CMV), by broad sector
groups and performance types for clubs of cities; 1971-2014

	London	Club I:	Club II:	Club III:	Non-	Aber-	Great	Total
		GVA +	GVA 0	GVA -	urban TTWAs	deen	Britain	pos. GVA
Broad sector groups					110045			enunge
Agriculture and fishing		0.5%	0.3%	0.2%	1.2%		0.4%	3,229
Coal and Other mining	0.1%	0.1%	0.1%			0.3%	0.1%	488
Oil, Gas and Mining support	0.1%	0.3%			0.1%	32.0%	0.6%	4,975
Metals and related		0.3%	0.4%		1.2%	1.3%	0.3%	2,882
Textiles and related						0.0%	0.0%	4
Light manufacturing	0.2%	1.4%	2.2%	0.9%	5.8%	2.4%	1.9%	15,780
High tech manufacturing	0.3%	5.8%	3.1%	4.8%	6.9%	3.0%	3.8%	32,190
Utilities	1.4%	2.5%	2.6%	2.9%	2.8%	0.9%	2.3%	19,506
Construction	2.2%	4.7%	4.5%	1.1%	5.1%	2.0%	3.6%	29,984
Transport and logistics	7.2%	14.5%	11.2%	9.9%	10.4%	8.7%	10.7%	89,726
Retail and personal services	12.4%	17.5%	19.8%	20.1%	20.6%	15.0%	17.6%	148,014
Knowledge Intensive Business Services	66.0%	39.1%	37.8%	34.6%	26.3%	25.7%	42.6%	358,813
Public services	10.0%	13.3%	18.0%	25.4%	19.5%	8.7%	16.2%	136,100
Performance types								
GVA below average, Prod below average.	13.2%	18.5%	18.5%	15.8%	19.6%	11.3%	18.5%	142,168
GVA below average, Prod above average	1.4%	7.3%	6.4%	3.5%	13.1%	7.0%	7.3%	49,959
GVA above average, Prod below average	42.6%	34.7%	39.6%	43.8%	35.9%	26.0%	34.7%	328,999
GVA above average, Prod above average	42.8%	39.4%	35.5%	37.0%	31.4%	55.7%	39.4%	320,565
Total positive GVA	203,378	190,442	192,694	121,695	121,239	12,243	841,691	841,691
change	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)	·
GVA in 1971	111,959	84,466	133,067	130,019	76,202	3,579	539,291	
Positive GVA-change as % of GVA in 1971	181.7%	225.5%	144.8%	93.6%	159.1%	342.1%	156.1%	

Table 6:Breakdown of positive GVA change (million £s, 2011 CMV), by broad sector
groups and performance types for clubs of cities; 1971-2014

6. Contribution of Structural Factors to the Growth of British Cities

The foregoing analysis would seem to suggest that output growth in cities has been strongly influenced by their initial sectoral structure and how that structure then changes over time; in other words, economic structure would appear to be a key determinant of city output growth. However, the performance of sectors is not uniform throughout the country, and thus the growth of cities may be importantly affected by sectors doing significantly better or worse in some cities than would be expected based on their national performance. The

expansion or decline of some sectors can thus be concentrated in some cities while bypassing others. Hence a city's structural ensemble and how that ensemble changes over time will only partially explain the growth of cities. Other factors will be important, such as differences in levels of innovation and entrepreneurship, as well as the geographical spread of the types of functions within sectors (head offices, R&D, administration, production, etc.). These differences may in turn reflect local advantages in terms of human capital, agglomeration, policy and governance, etc. (Martin et al., 2016a). To explore the relative contribution of structural versus other, city-specific 'competitiveness' factors, we use a dynamic shift share analysis.

Shift share has been used extensively and there is a large literature discussing its application and relative strengths and weaknesses. Prominent amongst the literature is the work of Fothergill and Gudgin (1984), Selting and Loveridge (1990, 1992) and Loveridge and Selting (1998). A standard criticism is that the choice of weights used to represent the structural base influence the results. In an attempt to overcome this research has relied on dynamic versions that have the advantage over conventional models of allowing both growth rates and economic structure to change, rather than being pivoted on a set of weights at a particular point in time. Examples of this approach include Barff and Knight (1988), Chern et al. (2002) and Fritz and Streicher (2005). More recently, attention has been focused on incorporating regression analysis into shift share, with examples including Blien et al. (2013).

We adopted the dynamic shift share decomposition procedure as used in Gardiner et al. (2013). This has the advantage of recording and updating the levels of sectoral composition and the changes within this on an annual basis, so the point of reference to distinguish between structural effects and local city-specific effects is allowed to shift over time. It also provides additional information on dynamic transition, which could not be obtained from the standard comparative-static shift-share method. The analysis has been conducted at an 81 sectoral level.

The classic shift-share approach decomposes temporal change in a variable into three additive effects:

(i) National component (NC)	the change that would occur if all regions' sectors grow at national rate
(ii) Structure effect (SE)	the change that would occur if all regions' sectors grow at national sector rate (minus, or conditional on, the national share effect)
(iii) Local effect (LE)	the difference between the actual change and the sum of national and industry shifts, i.e. a residual designed to capture local-specific factors such as competitiveness, concentration of higher value functions, local policy, etc.

More formally, if we consider a variable X, defined over industry i, region r and time t, a temporal change between time t and t+n can be written as:

$$X_{ir}^{t+n} - X_{ir}^{t} = \Delta X_{ir}^{t+n} = NC_{ir}^{t+n} + SE_{ir}^{t+n} + LE_{ir}^{t+n}$$

Each of these three components can be expressed as follows:

$$NC_{ij} = X_{ij} * g_n$$

$$SE_{ij} = X_{ij} * (g_{in} - g_n)$$

$$LE_{ij} = X_{ij} * (g_{ir} - g_{in})$$

Where:

g = the growth of the variable X over the pre-defined time period (between t+n and t); $g_n =$ the national (percentage) growth of variable X during this period,

 g_{in} = the national (percentage) growth by industry i of variable X during this period; and g_{ir} = the regional (percentage) growth by industry i of variable X during this period.

By summing over all industries in any given city, we arrive at the overall national, industrial mix and residual shift components:

$$NC_{j}^{t+n} = \sum_{i} X_{ij}^{t} * g_{n} \qquad SE_{j}^{t+n} = \sum_{i} X_{ij}^{t} * (g_{in} - g_{n}) \qquad LE_{j}^{t+n} = \sum_{i} X_{ij}^{t} * (g_{ij} - g_{in})$$

Using the dynamic version of the technique, and thus decomposing city changes in output on a year-by-year basis, we were able to investigate the contribution that changes in economic structure have made to each city Club's output growth differential over time. This differential growth already incorporates the national component, hence we focus on the contribution of the structure effect and local effect to the positive or negative gap in performance compared to national growth. Moreover, in order to see how matters evolve over the study period, we can track the relative contributions of the structure effect and local effect in the cumulative development of this gap over time. Figure 11 shows the results.

The findings in the case of London are clear. Throughout the period, London benefited from its particular economic structure; that is to say, London has benefited from having a high proportion of nationally fast growing sectors. However, London has certainly not managed to benefit as much as expected, as the structure effect was offset by a negative local effect, which held on persistently over many years until the mid-1990s. But in recent years this local effect has become strongly positive, making up for much of the accumulated losses with regard to the potential growth of London in the decades before (see Figure 2).

The structural effect also appears substantial in explaining the slow growth of the cities in Club III. Throughout the period, these cities have been at a disadvantage because of the composition of their economies, and especially until the mid 1980s this appears to explain about half of the negative gap in output growth with the nation as a whole. However, the negative impact of the local effect has been at least as large, and has only increased over time compared to the structural effect. This means that cites in this Club have not only lagged because they have an unfavourable mix of sectors, but that in general those sectors underperform compared to the performance of the sectors for the nation as a whole. This suggests that the various factors that influence a city's overall competitiveness have become increasingly unfavourable.

Club II and the non-urban TTWAs also had to cope with negative impacts of their industrial structure over the period, especially after the early 1980s. But these cities and non-urban TTWAs managed to compensate for this negative structure effect through a positive local effect for most of the period. Hence the performance of the sectors that are present in these locations has on the whole been better than expected.

The strong growth of the Club I cities has almost entirely been due to highly positive local effects: the sectors in these cities have strongly outperformed the national average trends in those sectors. Only from the mid-1990s onwards does a modest positive structure effect emerge, as a result of a higher concentration of high-growth sectors. But the local effect clearly dominates, and seems to reflect a growing competitive advantage of these cities compared to other parts of Great Britain, although this advantage seems to have stabilised following the onset of the financial crisis in 2008.

Figure 11. The contribution of economic structure and of local factors to differential output growth relative the GB across the City Clubs, in GVA (billion £s, 2011 CMV) based on 81 sectors









Club II



Club III







7. Implications of Structural Transformation in British Cities for Employment

Thus while structural transformation goes some way in accounting for the observed patterns of output growth across cities, a full explanation would need to examine the host of factors and processes that are subsumed under the 'local effect' identified above. This is beyond the scope of this paper. However, also of interest are the implications of the patterns of output growth, for city employment trends. As we saw in Figure 1, there is a reasonably close correlation between output growth and employment growth across British cities. Tables 7 and 8 explore this relationship further, and show the breakdown of employment changes in the city clubs across broad sector groups and across sector performance types. The general picture is very similar to the one painted in section 5 (in terms of GVA), with the same patterns of growth and decline in the various Clubs and sectors. But much more than when examining output, the churn between and within different segments of the economy comes into view. From an employment perspective, the scale of the process of structural transformation over the past five decades is quite remarkable. Even within parts of the economy which exhibit substantial growth of output – such as transport and logistics, public services, utilities, and to a much lesser extent KIBS (with some job loss in insurance & pensions) – considerable movements take place, which are not visible when looking at changes in GVA alone.

Also the uneven effects of the process of structural transformation need to be highlighted. The decline in employment due to job loss in various sectors (especially in manufacturing), seems to have been particularly large in Club III, London, and Club II. But then London and Club II (and furthemore the non-urban TTWAs) seemed to have gained a lot of new employment in other other sectors (mainly services), following the national pattern in this respect. Employment in Club I clearly grew a lot faster than the average. Club III however has, by 2014, not even fully recovered from the losses of employment it sustained already in the 1970s and 1980s.

The focus on employment moreover further highlights differences in productivity across sectors, and also across cities. Those sectors where there has been relatively favourable output and productivity growth, compared to the nation, mainly most of the KIBS, are of particular interest. About 40% of the growth in output in Great Britain over the period from 1971 until 2014 has come from these sectors, yet they have contributed less than 20% of the growth in employment. By far the most employment growth has been in sectors which have indeed also grown relatively fast in output, but in which the increase of output per job – labour productivity – has been below average (such as personal services, health and social care, and warehousing). The remaining source of employment growth has been in sectors which have experienced low output growth and consequently also low productivity growth (such as education, construction, and accommodation and leisure).

Moreover, the geographical distribution of the growth of high value-added employment across the cities is again quite uneven, being concentrated in Club I and London. In contrast,

they have only constituted a small part of employment growth of the cities in Club III, in which employment gains have instead consisted disproportionally of jobs in sectors which have experienced below average growth in productivity. Thus, structural transformation in the British economy also seems reflected in divergent growth of productivity across cities, and thus ultimately real incomes. The divergent development of productivity across British cities – a critical issue attracting increasing attention from the UK Government in relation to its new Industrial Strategy (HM Treasury, 2017) – is examined in Martin et al. (2017).

	London	Club I:	Club II:	Club III:	Non-urban	Aberdeen	Great
		GVA +	GVA 0	GVA -	TTWAs		Britain
Broad sector groups							
Agriculture and	-7,612	-53,847	-82,352	-50,453	-88,113	-9,369	-291,746
fishing	(0.6%)	(6.5%)	(4.5%)	(2.3%)	(13.5%)	(23.1%)	(4.3%)
Coal and Other	-4,443	-20,452	-63,159	-43,264	-56,746	-2	-188,066
mining	(0.4%)	(2.5%)	(3.4%)	(2.0%)	(8.7%)	(0.0%)	(2.8%)
Oil, Gas and Mining	-3,872	-6,366	-31,055	-30,216	-33,415		-104,924
support	(0.3%)	(0.8%)	(1.7%)	(1.4%)	(5.1%)		(1.5%)
Metals and related	-86,087	-105,851	-177,467	-492,408	-78,834	-281	-940,928
	(6.8%)	(12.8%)	(9.6%)	(22.7%)	(12.0%)	(0.7%)	(13.8%)
Textiles and related	-69,172	-76,772	-504,546	-173,599	-138,716	-4,593	-967,398
	(5.5%)	(9.2%)	(27.3%)	(8.0%)	(21.2%)	(11.3%)	(14.2%)
Light manufacturing	-205,669	-208,146	-344,002	-514,838	-75,315	-21,574	-1,369,544
	(16.3%)	(25.1%)	(18.6%)	(23.7%)	(11.5%)	(53.1%)	(20.1%)
High tech	-358,618	-235,059	-429,749	-520,908	-78,246		-1,622,580
manufacturing	(28.4%)	(28.3%)	(23.2%)	(24.0%)	(11.9%)		(23.8%)
Utilities	-52,850	-32,128	-66,685	-64,471	-30,795	-530	-247,459
	(4.2%)	(3.9%)	(3.6%)	(3.0%)	(4.7%)	(1.3%)	(3.6%)
Construction				-63,292			-63,292
				(2.9%)			(0.9%)
Transport and	-296,847	-6,608	-27,239	-161,892	-15,832	-982	-509,400
logistics	(23.5%)	(0.8%)	(1.5%)	(7.5%)	(2.4%)	(2.4%)	(7.5%)
Retail and personal	-4,827						-4,827
services	(0.4%)						(0.1%)
Knowledge Intensive	-36,978		-9,123	-22,305	-9,552	-3 <i>,</i> 285	-81,243
Business Services	(2.9%)		(0.5%)	(1.0%)	(1.5%)	(8.1%)	(1.2%)
Public services	-133,924	-84,856	-114,320	-32,893	-49,334		-415,327
	(10.6%)	(10.2%)	(6.2%)	(1.5%)	(7.5%)		(6.1%)
Performance types							
GVA below average,	-212,177	-102,143	-137,965	-164,340	-65,962		-682,587
Prod below average.	(16.8%)	(12.3%)	(7.5%)	(7.6%)	(10.1%)		(10.0%)
GVA below average,	-783,682	-685,773	-1,557,262	-1,865,149	-547,333	-33,855	-5,473,054
Prod above average	(62.2%)	(82.6%)	(84.2%)	(85.9%)	(83.6%)	(83.4%)	(80.4%)
GVA above average,	-948		-378				-1,326
Prod below average	(0.1%)		(0.0%)				(0.0%)
GVA above average,	-264,092	-42,169	-154,092	-141,050	-41,603	-6,761	-649,767
Prod above average	(20.9%)	(5.1%)	(8.3%)	(6.5%)	(6.4%)	(16.6%)	(9.5%)
Total negative	-1,260,899	-830,085	-1,849,697	-2,170,539	-654,898	-40,616	-6,806,734
employment change	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)
Employment in 1971	4,536,668	3,892,775	6,660,088	6,653,791	3,746,650	156,233	25,646,205
Negative empl change as % of employment in 1971	-27.8%	-21.3%	-27.8%	-32.6%	-17.5%	-26.0%	-26.5%

Table 7:Breakdown of negative employment change, by broad sector groups and
performance types for clubs of cities; 1971-2014

· · · · · · · · · · · · · · · · · · ·	London	Club I:	Club II:	Club III:	Non-urban	Aberdeen	Great
	20110011	GVA +	GVA 0	GVA -	TTWAs	,	Britain
Broad sector groups							
Agriculture and	1,542	2,225	9,974	3,533	26,307		43,581
fishing	(0.1%)	(0.1%)	(0.3%)	(0.2%)	(1.1%)		(0.3%)
Coal and Other						243	243
mining						(0.1%)	(0.0%)
Oil, Gas and Mining		1,412				30,822	32,234
support		(0.0%)				(18.2%)	(0.2%)
Metals and related			1,874	646	1,988	2,348	6 <i>,</i> 856
			(0.1%)	(0.0%)	(0.1%)	(1.4%)	(0.1%)
Textiles and related							
Light manufacturing	840					1,745	2,585
	(1.0%)					(1.0%)	(0.0%)
High tech					596	3,493	4,089
manufacturing					(0.0%)	(2.1%)	(0.0%)
Utilities	14,993	25,952	29,582	26,763	21,819	599	119,708
	(0.7%)	(0.8%)	(0.8%)	(1.2%)	(0.9%)	(0.4%)	(0.9%)
Construction	4,014	132,563	109,510		100,235	3,129	349,451
	(0.2%)	(3.9%)	(3.1%)		(4.2%)	(1.9%)	(2.6%)
Transport and	9,459	269,001	163,857	56,397	120,105	7,807	626,626
logistics	(0.5%)	(8.0%)	(4.6%)	(2.6%)	(5.1%)	(4.6%)	(4.6%)
Retail and personal	463,845	907,323	905,220	517,827	691,876	37,324	3,523,415
services	(22.4%)	(27.0%)	(25.5%)	(24.1%)	(29.3%)	(22.1%)	(25.8%)
Knowledge Intensive	1,175,802	1,192,231	1,257,638	660,621	589,942	50,374	4,926,608
Business Services	(56.7%)	(35.4%)	(35.5%)	(30.7%)	(25.0%)	(29.8%)	(36.0%)
Public services	402,386	835,846	1,068,706	884,087	809,794	31,070	4,031,889
	(19.4%)	(24.8%)	(30.1%)	(41.1%)	(34.3%)	(18.4%)	(29.5%)
Performance types							
GVA below average,	368,785	860,358	821,478	432,754	640,595	27,844	3,151,814
Prod below average.	(17.8%)	(25.6%)	(23.2%)	(20.1%)	(27.1%)	(16.5%)	(23.1%)
GVA below average,	1,108	7,800			15,749	7,576	32,233
Prod above average	(0.1%)	(0.2%)			(0.7%)	(4.5%)	(0.2%)
GVA above average,	1,280,866	1,734,371	2,147,743	1,480,757	1,300,643	67,960	8,012,340
Prod below average	(61.8%)	(51.5%)	(60.6%)	(68.9%)	(55.0%)	(40.2%)	(58.6%)
GVA above average,	422,122	764,024	577,140	236,363	405,675	65,574	2,470,898
Prod above average	(20.4%)	(22.7%)	(16.3%)	(11.0%)	(17.2%)	(38.8%)	(18.1%)
Total positive	2,072,881	3,366,553	3,546,361	2,149,874	2,362,662	168,954	13,667,285
employment change	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)
Employment in 1971	4,536,668	3,892,775	6,660,088	6,653,791	3,746,650	156,233	25,646,205
Positive empl	45.7%	86.5%	53.2%	32.3%	63.1%	108.1%	53.3%
change as % of							
employment in 1971							

Table 8: Breakdown of positive employment change, by broad sector groups and
performance types for clubs of cities; 1971-2014

8. Conclusions

Structural change is an ongoing process in dynamic economies. What the foregoing analysis demonstrates is that the profound structural transformations in the British since the beginning of the 1970s have played out quite differently across the country's various cities, shaping to a significant extent their divergent growth trajectories. Moreover the relative importance of structural change compared to other determinants of growth has varied across different types of city.

The cities in Club I (mainly cities in the South of England) – and London - have benefitted substantially from structural transformation, and have seen strong growth on the back of high-growth sectors, especially KIBS. In contrast, the cities in Club III (mainly cities in the North of England, Wales and Scotland) have seen decline or little growth in the traditional mainstays of their economy (mainly in manufacturing), and at the same time have been insufficiently able to grow and attract high-value private service activities. A third group of cities – Club II (those that have grown at more or less the national rate) – also have had to cope with the negative effects of structural change (though on average not quite to the same extent), but fared much better, and managed to make a relatively successful transition to a post-industrial economy, albeit with deep new patterns of inequality and labour market divisions. Non-urban TTWAs have on the whole had to face less of the negative impacts of change in the economic structure; moreover they actually seem to have profited to some extent from some manufacturing moving out of cities. Furthermore, the growth in private and public services in such areas has in general been on a par with the average for the nation. However, structural factors cannot in themselves account for the strong growth of cities in Club I, and many cities in Club II (and the non-urban TTWAs) also managed to deal with structural transformation better than Club III. Moreover, these factors are also insufficient to explain the very lacklustre performance of London until the turn of the century with a sudden turn-around in its fortunes thereafter, as well as the full extent of the lagging growth in Club III cities.

These results imply that the economic trajectories of cities are the complex and uneven outcomes of three fundamental sets of processes, all of which are interactive and potentially shaped by their policy and institutional contexts. These processes have often been distinguished in recent analyses of productivity growth. The first are those structural changes in output and employment shares which we have analysed here in depth. They centre on what we might term *between-sector changes* and refer to the rise of some industries and the decline of others. Our analysis has demonstrated the importance of these processes in some cities and has allowed us to understand the extent to which post-industrial transition produces growth-reducing structural change in some categories of city.

A second set of processes concerns *within-sector changes* and includes the way in which different parts of the same industry change and evolve over time. They highlight the way in which different firms within the same industry may have different productivity and innovation capabilities and track records. Cities host firms that are classified as belonging to the same industry but are actually quite different in their capabilities, employment, business models and strategies, and these 'within-sector' effects will also contribute to divergent economic performances. Our findings on the importance of 'local effects' in some types of cities may well indicate in part that these 'within-sector' effects also have a significant and growing spatial dimension. There are certainly many theoretical arguments which support and envisage this, as they suggest that globalisation and new supply chains and divisions of labour are widening differences between firms within industries and creating new types of

specialisations in terms of functions, tasks and capabilities rather than entire sectors (Massey 1995; Baldwin, 2016). Different rates of entrepreneurship and firm demographics, as well as investment and foreign ownership, may also be reinforcing these spatial variations.

However, a third set of processes centring on the *development of cities' local supply factors* are also interacting through time with both of these two types of industrial change. We know that there are important differences in the capabilities of cities to offer firms an attractive business environment through the supply of both appropriate 'hard and soft' infrastructure and the development of a local labour force sought by knowledge intensive and tradable industries. As we have argued elsewhere (Martin, et al 2016a) local areas start with an inherited pattern of land use and a resource base and institutions that were tailored to another era and the legacy of the past weighs heavily on their ability to adjust to new economic futures. Thus, the Club III cities tend to be amongst the oldest industrial cities with infrastructure, labour forces and a constrained land use pattern to match (See Fothergill and Gudgin, 1982). In constraint our fast growing Club I cities contain post second world war New Towns characterised by plentiful and planned land assembly, up to-date infrastructure and labour with skills more appropriate to the new age. While there is considerable scope for policy initiatives to modify and improve these local supply factors and characteristics, it is also the case that their development is primarily the outcome of a long-term cumulative and path dependent process in which industrial change plays a key role and accumulates different types of asset and institution (Storper, 2015).

In the course of the dynamic specialisation seen in city economies, the relationships between these three sets of processes are deeply recursive through time. Moreover, while beyond the scope of this paper, in order to properly understand the direction and degree of 'within and between sector' effects in a particular urban area we need to understand how city economies sit within regional ensemble of industries as well as within national and global markets and supply chain relationships (McCann, 2016).

What this suggests is that unambiguously determining the effects of consequences of structural change for urban economic performance is much more complex and difficult than might be assumed. While our dynamic shift-share analysis has allowed us to rigorously distinguish and pull out the direct effects of structural change on variations in city growth, it is not intended to identify more indirect and evolutionary path dependent effects that stem from structural change. But these indirect effects may be important and may be closely integrated with both within-sector and local supply-side development in specific ensembles. More specifically, studies of deindustrialisation in particular cities have increasingly emphasised that it is a long-term process which has lasting damaging and continuing effects on communities and economies (Martin and Gardiner, forthcoming). Indeed sociologists have described 'the half-life of deindustrialisation' to capture these lasting inhibiting influences effects on cultures and individuals (see Linkon, 2013; Strangleman, 2016).

In economic terms our evidence suggests that such effects have been particularly strong in Club III cities and it may be significant that cities in this group appear to have a stronger concentration of metals and related industries. Further investigation might find that the lasting effects of deindustrialisation may be strongest in such cities, where industrial plant and premises are hardest to convert, where land is often contaminated and where negative images of industrial decline are most often entrenched. Interestingly, Club II cities seem to have had greater concentrations in textiles which may have experienced less severe obstacles to conversion and renewal. But without further research we can at this stage only speculate about the causes of the differences between the two Clubs of cities in responding to negative structural change. It may be that varied legacies of decline have shaped withinsector effects in service industries. It could also be that the two groups are distinguished more by their policy environments and character of their collective and institutional agency. Nevertheless, the broader point is that structural change and deindustrialisation are a key source of lasting path dependent effects in some cities (Martin and Sunley, 2006).

While it is important not to paint too deterministic and bleak a picture, as deindustrialised economies undoubtedly contain many resources and assets for renewal, our interpretation is that the legacies of these economies have frequently constrained and filtered the development of growth of service sector firms, as well as the provision of a skilled and educated labour force that is well-suited to knowledge-intensive firm growth. There may well be a type of spatial differentiation and sorting in which the emergence and growth of knowledge-intensive and high-productivity firms is shaped by the degree to which path dependence allows some cities to be more valued by these firms and their employees. Our decomposition techniques are not suited to fully capturing these long-term legacies and indirect effects as they will show up only as local competitiveness effects and residuals. They require much fuller and more detailed intensive investigation than we have been able to offer in this extensive and synthetic paper. Nevertheless, we hope to have highlighted their potential importance in conjunction with measurable structural industrial change.

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Appendix: Classification of 81 sectors

Sector	Broad sector group	Performance type
Crop & animal production	Agriculture and fishing	GVA below average, Prod above average
Forestry & logging	Agriculture and fishing	GVA above average, Prod above average
Fishing	Agriculture and fishing	GVA below average, Prod above average
Coal mining	Coal and Other mining	GVA below average, Prod above average
Ores & other mining	Coal and Other mining	GVA below average. Prod above average
Oil and gas extraction	Oil, Gas and Mining support	GVA above average, Prod above average
Mining support services	Oil. Gas and Mining support	GVA above average. Prod above average
Coke & petroleum	Metals and related	GVA below average, Prod below average
Basic metals	Metals and related	GVA below average, Prod above average
Metal products	Metals and related	GVA below average. Prod above average
Textiles	Textiles and related	GVA below average, Prod above average
Wearing apparel	Textiles and related	GVA below average, Prod above average
Leather. etc	Textiles and related	GVA below average. Prod above average
Food products	Light manufacturing	GVA below average, Prod above average
Beverages	Light manufacturing	GVA below average. Prod above average
Торассо	Light manufacturing	GVA below average. Prod above average
Wood products, etc	Light manufacturing	GVA below average, Prod above average
Paper, etc	Light manufacturing	GVA below average. Prod above average
Printing & recording	Light manufacturing	GVA below average. Prod above average
Rubber & plastic	Light manufacturing	GVA below average. Prod above average
Other non-metallic	Light manufacturing	GVA below average. Prod above average
Furniture	Light manufacturing	GVA below average. Prod above average
Other manuf. & repair	Light manufacturing	GVA below average. Prod above average
Chemicals, etc	High tech manufacturing	GVA below average. Prod above average
Pharmaceuticals	High tech manufacturing	GVA below average. Prod above average
Computers, etc	High tech manufacturing	GVA below average. Prod above average
Electrical equipment	High tech manufacturing	GVA below average. Prod above average
Machinery, etc	High tech manufacturing	GVA below average. Prod above average
Motor vehicles, etc	High tech manufacturing	GVA below average. Prod above average
Other transport equip.	High tech manufacturing	GVA below average. Prod above average
Electricity, gas, etc	Utilities	GVA below average. Prod above average
Water	Utilities	GVA below average. Prod below average
Sewerage	Utilities	GVA above average. Prod below average
Waste disposal	Utilities	GVA above average. Prod below average
Waste management	Utilities	GVA above average. Prod below average
Construction & civil eng.	Construction	GVA below average. Prod below average
Motor vehicles trade	Transport and logistics	GVA above average. Prod above average
Wholesale trade	Transport and logistics	GVA below average. Prod below average
Land transport	Transport and logistics	GVA above average. Prod above average
Water transport	Transport and logistics	GVA below average. Prod above average
Air transport	Transport and logistics	GVA above average, Prod above average
Warehousing, etc	Transport and logistics	GVA below average, Prod below average
Postal & courier	Transport and logistics	GVA below average, Prod below average
Retail trade	Retail and personal services	GVA above average, Prod above average
Accommodation	Retail and personal services	GVA below average, Prod below average
Food & beverage services	Retail and personal services	GVA below average, Prod below average
Veterinary	Retail and personal services	GVA above average. Prod below average
Rental & leasing	Retail and personal services	GVA above average, Prod below average
Employment activities	Retail and personal services	GVA above average, Prod below average
Travel agencies, etc	Retail and personal services	GVA above average. Prod below average
Gambling	Retail and personal services	GVA below average, Prod below average
Sport & recreation	Retail and personal services	GVA above average. Prod below average
Membership organisations	Retail and personal services	GVA above average, Prod below average
Repair of goods	Retail and personal services	GVA above average, Prod below average
Other personal services	Retail and personal services	GVA above average, Prod below average
Publishing	Knowledge Intensive Business Services	GVA above average. Prod above average
Film. TV & music	Knowledge Intensive Business Services	GVA above average. Prod above average

Sector	Broad sector group	Performance type
Broadcasting	Knowledge Intensive Business Services	GVA above average, Prod above average
Telecommunications	Knowledge Intensive Business Services	GVA above average, Prod above average
Computer programming	Knowledge Intensive Business Services	GVA above average, Prod above average
Information services	Knowledge Intensive Business Services	GVA above average, Prod above average
Financial services	Knowledge Intensive Business Services	GVA above average, Prod above average
Insurance & pensions	Knowledge Intensive Business Services	GVA below average, Prod above average
Aux. financial services	Knowledge Intensive Business Services	GVA above average, Prod above average
Real estate activities	Knowledge Intensive Business Services	GVA above average, Prod below average
Legal & accounting	Knowledge Intensive Business Services	GVA above average, Prod below average
Head offices, etc	Knowledge Intensive Business Services	GVA above average, Prod below average
Architecture & related	Knowledge Intensive Business Services	GVA above average, Prod above average
Scientific research	Knowledge Intensive Business Services	GVA above average, Prod above average
Advertising, etc	Knowledge Intensive Business Services	GVA above average, Prod below average
Other professional	Knowledge Intensive Business Services	GVA above average, Prod below average
Security, etc	Knowledge Intensive Business Services	GVA above average, Prod below average
Services to buildings	Knowledge Intensive Business Services	GVA above average, Prod below average
Office admin.	Knowledge Intensive Business Services	GVA above average, Prod below average
Arts & entertainment	Knowledge Intensive Business Services	GVA above average, Prod below average
Libraries, etc	Knowledge Intensive Business Services	GVA above average, Prod below average
Public admin. & defence	Public services	GVA below average, Prod below average
Education	Public services	GVA below average, Prod below average
Health care	Public services	GVA above average, Prod below average
Residential care	Public services	GVA above average, Prod below average
Social work	Public services	GVA above average, Prod below average