

Fingleton, Bernard; Iglori, Danilo; Moore, Barry

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## Urban Employment Growth: Evidence From Great Britain 1981-2001

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Urban Employment Growth:  
Evidence from Great Britain 1981-2001

Danilo Iglori<sup>ψ</sup>, Barry Moore<sup>φ</sup> and Bernard Fingleton<sup>φ</sup>

<sup>φ</sup>Department of Land Economy, University of Cambridge

<sup>ψ</sup>Department of Land Economy, University of Cambridge and Department  
of Economics, University of Sao Paulo, Brazil (corresponding author:  
dci21@cam.ac.uk)

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# Urban Employment Growth in Great Britain

Danilo Iglori, Barry Moore and Bernard Fingleton

## 1. Introduction

Cities differ substantially in their economic performance and such differences persist over long periods of time. Thus whilst some cities such as the smaller towns and cities in the south of the Britain have increased their share in the growth of national Gross Value Added, employment and population in the post-war period, the larger conurbations and free-standing cities have typically experienced a relative decline, DETR (2000). Moreover, there is considerable stability in the rankings of cities with many of the cities towards the top and bottom of the growth league five decades ago still placed there today (Annas et al 1998, Begg et al 2002). Although differences in city performance have always been a familiar feature of the urban landscape, increasing competition between cities has prompted a growing interest in the factors that give some cities a competitive edge over others. Scrutiny of the factors favouring the growth of some cities over others has also intensified with increasing evidence of differences in the concentrations of innovative activity across cities.

Although there exists a considerable body of case study research analysing the economic strengths and weaknesses underpinning the economic performance of particular cities and the different sources of urban competitive advantage (most recently under the ESRCs Cities; Competitiveness and Cohesion Research Programme 1997 to 2002), there is relatively little research focusing on the entire urban system and the long run economic performance of Britain's cities. Under the auspices of the ESRC programme Moore and Begg (2004) and Begg, Moore and Altunbas (2002) identified persistent trends in urban Britain across over the period 1951 to 2001 but provided no systematic econometric analysis of the factors underpinning these trends. Other research on urban performance has typically concentrated on a relatively small number of cities, for example Turok and Edge. (1999), Deas and Giordano (2002); specific

sectors such as manufacturing Fothergill and Gudgin (1985); specific factors influencing city performance such as Donoghue's (1999) paper which analysed the relationship between diversification and growth in the British urban system for the period 1978 to 1991. More recently Rice and Venables (2004) analysed the spatial determinants of income and productivity growth across the NUTS3 sub-regions of Britain but did not attempt to delineate urban spatial units.

The central aim of this paper is to analyse the factors influencing employment growth across the British city system. The choice of employment as the indicator of city growth partly reflects the absence of reliable GVA data either in aggregate or at a sufficiently disaggregated industry level where cities are the unit of spatial analysis but also because employment data permits the analysis long run trends in the urban system.

A first question is 'Why do city growth rates differ?'. In contrast to Neo-Classical growth models of the Solow variety which emphasised capital investment and exogenous technological change to explain differences in growth across nations, regions and cities, and the export led cumulative causation models of Kaldor (1970) and Dixon and Thirlwall (1975), much of the more recent research on growth focuses on externalities as the 'engine of growth' and in particular on the role of local knowledge externalities as sources of increasing returns. This approach has its origins in the work by Romer (1986), and his revival of the early work by Arrow (1962) on learning by doing, extending the latter to include investment in knowledge. Lucas (1988), adopting a somewhat different approach reaches a similar conclusion.

Later work by Romer (1990) and Grossman and Helpman (1990, 1991) for example, also emphasise the role of R&D and research spillovers as sources of growth. The Marshall-Arrow Romer (MAR) externalities relate to knowledge spillovers between firms in an industry and this view applied to cities implies that urban concentrations of firms facilitates such spillovers, Glaeser et al (1992). Porter (1990) likewise emphasises the importance of intra-industry knowledge spillovers. On this view, industry specialisation favours city growth. By contrast for Jacobs (1969) it is inter-industry knowledge spillovers that matter most and it is urban industrial diversity that is important for growth. Acs and Armington (2003) examine the role of entrepreneurial activity as the mechanism linking knowledge spillovers to city growth in the US. Their

findings lend support to the Porter view that rivalry results from entrepreneurial activity creating new competitors which in turn fosters growth.

New Economic Geography Models (NEG) provide further insights into the dynamics of urban growth. Krugman (1991) for example, working within the framework of the NEG has emphasised the importance of dynamic externalities for our understanding of spatial patterns of growth but has downplayed their importance except in the case of localities dominated by high-technology industries (Martin and Sunley 1996). Krugman's (1991) Core-Periphery (CP) model focuses therefore on increasing returns, pecuniary externalities and transport costs. The mechanics of the model are driven by three effects: market access, cost of living, and market crowding. As summarised by Baldwin et al (2003), the 'market access effect' describes the tendency of monopolistic firms to locate their production in the big market and export to small markets; the 'cost of living effect' concerns the impact of firms' location on the local cost of living (goods tend to be cheaper in regions or cities with more industrial firms since consumers will import a narrower range of products and thus avoid more of the trade costs); the 'market crowding effect' reflects the fact that imperfectly competitive firms have a tendency to locate where there are relatively few competitors.

The first two effects encourage spatial concentration while the third discourages it. Combining the market-access effect and the cost-of-living effect with interregional migration creates the potential for 'circular causality' – also known as 'cumulative causation'. The natural question is therefore what determines the relative strength of these forces. Trade costs play the key role in balancing centripetal and centrifugal forces. As trade costs decline both dispersion and agglomeration forces diminish. Competition from firms outside the locality becomes approximately as important as competition from locally based firms and there will be very little spatial difference in prices between the two areas. However, the formal mechanics of the model produce a complex relation between these forces and trade costs. The features of the CP model from the perspective of city performance are firstly that agglomeration forces are self-reinforcing. A circular or cumulative causality can be generated in cycles attached to changes in demand or costs. Secondly, the CP model embeds an endogenous asymmetry and thirdly the model features locational hysteresis.

Baldwin et al (2003) propose two endogenous growth models: which extend the CP family of models in that the long run accumulation of knowledge capital is supported by learning effects from an innovation sector that has a public good component. In the global spillovers model, beneficial spillovers are available to all firms wherever they are located. By contrast in their Local Spillovers model beneficiaries are local. The former eliminates the importance of proximity and face-to-face interactions for the transmission of knowledge. The latter assumes that some frictional barrier reduces the diffusion of public knowledge to distant innovators and therefore re-establishes the role of proximity in knowledge diffusion and its contribution to local (city) growth. These models of growth and agglomeration provide analytical underpinning for empirical models using a variety of spatial econometric methods (Abreu et al 2004, Fingleton 2003).

The recent literature on spatial economics has emphasized the role of agglomeration and clustering of economic activities as fundamental causes of an enhanced level of local economic performance, creating externalities that cause firms to grow faster and larger than they otherwise would do.

One important consideration in spatial economics is that the positive externalities generated by agglomerations could be offset to some degree by negative externalities due to congestion effects. Congestion is most likely in the densest agglomerations, so that it is an interesting empirical question to examine whether the balance of positive and negative externalities swings in favour of congestion effects at the higher levels of agglomeration. A second fundamental idea lies on the relevance of transport costs for generating unequal patterns of distribution of economic activity. Here proximity to markets for both inputs and outputs are central to explain growth and development of cities.

The typical New Economic Geography behavioural assumptions have been recently expanded to incorporate some alternative micro-foundations for agglomeration economies. Duranton and Puga (2004) distinguish three types of micro-foundations: sharing, matching and learning mechanisms<sup>1</sup>.

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<sup>1</sup> The authors conclude that different microeconomic mechanisms may be used to justify the existence of cities. Moreover, these mechanisms generate final outcomes that are observationally equivalent in many

Micro-foundations of agglomeration economies based on sharing mechanisms might involve sharing indivisible public facilities, sharing the gains from the wider variety of input suppliers that can be sustained by a larger final-goods industry, sharing the gains from the narrower specialization that can be sustained with larger production, and sharing risks. As for matching Duranton and Puga (2004) identify two sources of agglomeration economies: 'an increase in the number of agents trying to match improves the quality of each match, and stronger competition helps to save in fixed costs by making the number of firms increase less than proportionately with the labour force' (p.19). The latter force originates from the assumption that, as the workforce grows, the number of firms increases less than proportionately due to greater labour market competition. As a result, each firm ends up hiring more workers, which in the presence of fixed production costs means higher output per worker. Also, in order to examine the potential impacts of matching on income per worker it is possible to examine the issue looking at mismatch costs.

Finally, when looking at learning Duranton and Puga (2004) discuss mechanisms based on the generation, the diffusion, and the accumulation of knowledge. In any of these mechanisms, learning it is not a solitary activity. Instead it involves interactions with others and many of these interactions have a 'face-to-face' nature (p.30). Since the original work by Jacobs (1969), numerous authors have been studying how cities contribute with the creation of new ideas. More importantly these authors have emphasized that the advantages of cities for learning involve not only cutting edge technologies, but also the acquisition of skills and 'everyday' incremental knowledge.

Knowledge accumulation has become the main aspect of learning processes due to its connections with economic growth. As mentioned by Duranton and Puga (2004) there are two main approaches dealing with knowledge accumulation. The first one looks at the dynamic effects of static externalities and the second one focuses on dynamic externalities. In the former growth is driven only by the externality in the city production function. In the latter approach, growth is driven by an externality in the

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respects. This point has an important policy implication as it suggests that it might not be easy to identify which microeconomic mechanisms has been responsible for growth or decline of a particular city and therefore create problems for targeting policy initiatives.

accumulation of human capital in the city. In both cases the externality plays a dual role as engine of growth and agglomeration force.

The next section of this paper presents the definition of a city used for purposes of empirical analysis and briefly outlines the main elements of the cities database. Section 3 presents evidence on long run employment trends in the British urban system. Section 4 describes the empirical model. Section 5 presents the results and section 6 finishes the paper with discussion and conclusions.

## 2. City Definition and Data

This paper extends the city system employment database established by Begg, Moore and Altunbas (2002). We begin by outlining their definition of a city. The definition used covers all settlements with a population in excess of 65,000 as shown in *Key Statistics for Urban Areas* from the 1991 Census of Population. These urban areas were then matched as closely as possible to the 1991 definition of Local Authority Districts (LADs). This yielded a list of 106 cities most of which correspond with recognised city boundaries although for some areas the resulting 'cities' consist of a group of contiguous urban settlements such as Brighton, Hove, Littlehampton and Worthing which form the 'Brighton urban area' or Cambridge and South Cambridgeshire which form the 'Cambridge urban area' and for London the urban area stretches beyond the conventional definition of the Greater London Council area to embrace adjacent Districts in Surrey and Hertfordshire. This approach to defining the geographical boundary of a city although involving an element of arbitrariness and judgement, has the advantage that the definition of the city is not constrained to administrative boundaries beyond which the city has, over time, expanded. The disadvantage is that in some cases the city definition includes some rural hinterland.

The cities database initially established by Begg et al (2002) covered the period from 1951 to 2001 and derives principally from the decennial Census's of Population for the years 1951, 1971, 1981, 1991 and 2001. In this period the boundaries of the LADs changed, for example in the major Local Authority re-organisation of 1974 and other



small changes have also been made throughout the period. To overcome this problem of changing boundaries, use was made of a consistent longitudinal database assembled by Dr. Danny Dorling. This database provides consistent Census of Population data for the Local Authority Areas (LAAs) in force in 1951 for the Census years 1971, 1981 and 1991. The database was extended back to 1951 and the LAAs for 1951 were matched to the 1991 LADs for each of the 106 cities. In this way a boundary-consistent definition for each of the cities was achieved for the years 1951, 1971, 1981, 1991 and 2001. In addition a second annual employment data base was established for the period 1971 to 2003 for each of the cities (defined according to the 1991 LADS) from data provided by the former Census of Employment and the Annual Business Inquiry. This paper uses both data sets and focuses on the period 1981 to 2001.

For each city, employment was also dis-aggregated by industry. Over this period since 1951 the definitions of industrial sectors have changed with each of the four revisions to the Standard Industrial Classification (SIC). New industries of major significance have emerged and existing industries have been re-classified to reflect their changing characteristics. Reasonably consistent data allowing for SIC changes have been assembled for 32 industries for Census of Population years from 1951, and annual data for 22 industries from 1971 to 2003.

The data also includes a number of variables measuring different city attributes or characteristics influencing city employment growth was also assembled from the Census's of Population (1951, 1971, 1981 and 1991) and a variety of other Government Official Sources.

### 3. Long Run Employment Trends in the British Urban System

Britain's urban system has been in a state of continuous flux in the past fifty years. Some cities have consistently prospered and been relatively successful in terms of maintaining or increasing their share of national employment and population, whilst others have lost ground and have struggled to attract new investment and jobs. The major conurbations and large cities that grew rapidly in the 19<sup>th</sup> Century have typically experienced declines in both population and employment whilst smaller towns and new

Towns, particularly those in the South close to London, have expanded their population and employment base. This changing geography of where people live and where economic activity locates are major systematic long-term trends persisting over decades rather than years.

Total employment in Britain increased by nearly 6 million or 0.5% p.a., in the period 1951 to 2001, Table 1. Notwithstanding this very substantial expansion of national employment, both the Conurbations and the smaller Northern cities experienced a fall in employment. By 2001 the share of total employment located in the Conurbations had fallen to 34.3% from 45.3% in 1951. Employment in the Conurbations shows signs of recovering in the 1990s. Major employment increases are to be found in the southern smaller cities (+934 thousand) and the New and Expanded Towns (+879 thousand) but the really substantial gains in employment have taken place in the rural areas outside the cities and here employment increased by nearly 4 million. Moreover employment growth was much greater in the Southern rural areas than in the rural areas in the North.

Focusing on the period of relevance for this paper, 1981 to 2001, the pattern of employment change across the main city groupings is broadly similar to that of the earlier period. Employment growth in the New and Expanded Towns and the Southern cities significantly exceeded national employment growth. Employment growth in the conurbations was positive over the two decades largely owing to the turnaround of employment growth in London and West Yorkshire conurbations in the 1990s. Figure 1 illustrates the city groups employment evolution.

A more detailed picture of the growth performance of each of the 106 cities is shown in Figure 2, which shows both population and employment change. Not surprisingly employment growth and population growth are positively correlated. The median employment growth was 14.4% for the period 1981 to 2001.

Across the different cities there were major differences in the growth of employment in different sectors. Manufacturing employment declined across all city groups with by far the greatest loss of employment in the Conurbations and larger Free Standing cities.

As the manufacturing sector has released labour across the city system other sectors have expanded their employment, most notably the Financial and Business Services sector. Although the Conurbations have not experienced the most rapid % growth of employment in this sector, as Figure 3 in absolute terms employment in this sector has increased dramatically, with much of this increase concentrated in the London conurbation.

## 4. Econometric Analysis

### 4.3. Empirical Model

In this section we set out a model that seeks to explain the change in employment growth over the period 1981-2001. We firstly look at total employment and then examine Business Services and Manufacturing separately. The model is a modified version of the growth model proposed by Henderson (2000) and attempts to explain employment variation as a function of a set of social and economic initial conditions, and spatial characteristics. We also envisage a non-linear relationship between agglomeration intensity and growth and this non-linearity reflects the presence not only of positive externalities but also negative externalities, with negative externalities becoming increasingly relevant as the agglomeration intensifies, due to the effects of congestion<sup>2</sup>. Hence, in the initial stages of increasing agglomeration intensity, it is likely that employment growth will increase as the externalities associated with agglomeration become more powerful. However, it is likely that some point negative externalities associated with congestion will also start having an effect that will increasingly counteract the positive externalities as agglomeration intensity increases, to the point that employment growth will fall to zero and then become negative. The specification is completed by introducing a control variable to capture the impact of national trends allowing by differences in industrial structure. This variable is denominated ‘expected growth’. Hence, our basic empirical equation is

$$G_{91-01} = aP_{91}^2 + bP_{91} + X_{85}c + dEG_{91-01} + D + u \quad [1]$$

where

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<sup>2</sup> For a similar empirical application in the context of computing services see Fingleton et al (2005).

The model should have significant regression coefficients for both agglomeration intensity and the square of agglomeration intensity, with a positive coefficient on the former and a negative coefficient on the latter. The hypothesis of increasing congestion effects is rejected if the coefficient on  $P^2$  is either insignificantly different from zero or is positive.

In order to check for spatial autocorrelation and test the robustness of coefficients we extend equation 1 and estimate the following standard spatial econometric models (Anselin 1988, 2003). A general homoskedastic spatial autoregressive model can be written as

$$y = \rho W y + X\beta + e, \text{ where } e = \lambda W e + u \quad [2]$$

In this paper we consider the two usual particular cases. First the spatial lag model with  $\lambda = 0$  and second the spatial error model with  $\rho = 0$ . These two models control for global spatial autocorrelation where neighbours at closer proximity carry more weight (Anselin 2003).

Simple manipulation of spatial lag and spatial error models yields the respective following reduced forms

$$y = (I - \rho W)^{-1} X\beta + (I - \rho W)^{-1} u \quad [3]$$

$$y = X\beta + (I - \lambda W)^{-1} u \quad [4]$$

In equation 3 we see that both explanatory variables and the disturbance are impacted by the same spatial multiplier  $(I - \rho W)^{-1}$  in the spatial lag model. However, equation 4 shows that in the spatial error model the spatial multiplier  $(I - \lambda W)^{-1}$  only operates in the autocorrelated disturbances. Models depicted by equations 3 and 4 are estimated using the method of maximum likelihood originally proposed by Anselin (1988).

## 4.2. Variables

The set of explanatory variables used in the econometric analysis is composed by

- ❖ Initial total population,
- ❖ Initial employment level in the city-industry,
- ❖ Human capital in base year, measured by share of population in employment with education post 18 years of age (HNC, Degree,etc)\*
- ❖ University located in the city, RAE ranking weighted by size of faculty
- ❖ Designated for regionally differentiated policy support e.g. Assisted Area status, Enterprise Zone, Urban Development Corporation, Objective 1 or 2 EC support. (Dummy variables if designated at any time between  $t$  and  $t+1$ ).
- ❖ Proximity to international airport dummy variable
- ❖ New/expanded Town status dummy variable
- ❖ Entrepreneurial activity measured by the registration rate of new firms in 1991
- ❖ Proximity to London dummy variable
- ❖ Area of the city
- ❖ North region dummy variable
- ❖ Expected growth (national growth rate, allowing for differences in industrial composition).

## 4.3. Spatial Weight Matrix

To spatially associate the cities we construct a so-called Spatial Weight Matrix ( $W$  matrix henceforth), which is a square matrix of dimension 106. The values in  $W$  reflect an *ad-hoc* hypothesis of spatial interaction between the cities. The diagonal contains zeros, and the off-diagonal elements reflect the spatial proximity between the cities.

We test two forms of spatial proximity and estimate regressions using different  $W$  matrices,  $W_t$  and  $W_d$ .  $W_t$  uses the Euclidian distance and  $W_d$  uses travelling time to capture the spatial interaction between cities. The assumed spatial interaction is therefore a diminishing function of distance (or time).

A further step in the construction of the  $W$  matrix is to standardise it so that each row sums to 1. Hence

$$W_{ij}^* = \frac{1}{d_{ij}}$$

$$W_{ij} = \frac{W_{ij}^*}{\sum_j W_{ij}^*}$$

Standardising helps with interpretation, since the value for area  $j$  of the spatial lag, defined as the  $j$ 'th cell of  $Wx$ , is then the weighted average of the values of the variable  $x$  in the areas that are 'neighbours' to  $J$ , and so its estimated coefficient can be compared directly to the coefficient for  $x$ . Also, using the standardised  $W$  matrix usefully identifies a parameter value below 1 as being consistent with a 'non-exploding' process while 1 and above leads to complex and little understood consequences for inference and estimation (the mathematical background to this and implications of spatial unit roots consistent with a parameter equal to 1 are discussed in Fingleton, 1999).

## 5. Results

The estimated models provide some evidence of the determinants of urban employment growth allowing us to confront the theoretical literature discussed above. The estimated coefficients in the different models are robust as they are generally similar in value and significance. However, the spatial econometric specifications do impact the value of coefficients. Moreover the spatial lags for the error term are significant in some specifications, indicating that controlling for spatial autocorrelation is important in this empirical methodology. Table 2,3 and 4 present the estimates for OLS and spatial models of total employment growth and Table 5 presents the estimates for the models of employment growth in business services and manufacturing.

As suggested by the literature on spatial economics the estimates for population, controlled for area size, are significant in most equations for both the linear and quadratic terms, with positive coefficient for the linear variable and negative for the quadratic one in the models for cleared land and output. These results provide evidence

that agglomeration intensity is relevant for total employment change. Moreover the effects of agglomeration work in a similar way. For low levels of agglomeration the increase in population size contributes to both economic growth and land conversion. However, at higher levels of agglomeration congestion effects start to ‘quick in’ producing negative externalities that reduce growth and result in less land conversion as well. The results do not allow us to identify what kinds of agglomerations effects are more relevant in the case of the British urban system and distinguish the potential impacts of market size, public facilities sharing, better matching between firms and workers or knowledge spillovers. Possibly we would find most of these factors in a greater or lesser extent depending on the local conditions.

A second important result relates to the role of entrepreneurship and local knowledge spillovers. The coefficient for SMEs VAT registration is positive and significant in all specifications providing evidence in favour of Audretsch’s (2003) arguments.

Thirdly, our results indicate that New Towns had performed better in terms of employment generation, when controlled for other characteristics. This results might be interpreted as a consequence of the provision of public infrastructure. However, the role of proximity to markets are not captured by our estimation, as the coefficients of London and airports are not significant in any regression.

The results for human capital and local science base are somehow disappointing as the coefficients in the total employment regressions are not significant. However, both educational level and the university impact variable resulted significant with positive coefficients in the estimation for employment change in the business services.

## 7. Discussions and Conclusion

In this paper we have estimated spatial models for employment growth in British cities. We extend the previous empirical literature in three ways. Firstly we motivate the study by connecting the spatial processes of economic growth with the modern literature on spatial economics and agglomeration. Secondly, we adopt spatial econometric methods

that take into account a wider range of spatial effects and control better for spatial autocorrelation. Thirdly we are making use of a recently assembled database.

The empirical results allow us to confront the factors impacting employment growth suggested by the literature. The main results provide evidence of the relevance of spatial economics for understanding the differences in economic performance across the British cities. Firstly, we find that agglomeration intensity has a non-linear relationship with employment growth suggesting that at initial levels of agglomeration positive externalities dominate and positively impact subsequent growth. However, negative externalities start to mount at higher levels of agglomeration imposing constraints to growth of output and land clearing due to congestion effects. Moreover, spatial theory is supported by our results with respect to local knowledge spillovers as our proxy for entrepreneurship seems to be an important factor for growth. However, proximity to markets is not evidenced by our estimations and the role of human capital is only evidenced in the business services regression. We therefore join the authors who claim that the issue deserve much more careful analysis as the causal relationships seem to be complex. Moreover, the nature of the spatial autocorrelation in the problem in hand is not clear, indicating that misspecification problems might be present.

Finally, we recognise that the approach put forward in this paper could be extended in at least three different ways. Firstly, it is necessary to examine further the theoretical underpinnings of urban employment growth. A formal model supporting the analysis would also help us to elicit the economic relations in a more precise way. Secondly, it would be desirable to expand the data set used in the empirical analysis, by improving the quality of some of the key variables and including other periods of time. Thirdly, more must be done regarding the empirical specifications and the testing of the econometric results. We are aware that in the absence of the above mentioned refinements our results are subject to important limitations and must be qualified accordingly. Pursuing the referred extensions is the subject of on going research.



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## Tables

Table. 1. The growth of employment (employees in employment +self employed) by city type, 1951-2001 (% p.a.; % share)

	Empl. 1951 (000)	% p.a. 1951- 2001	% p.a. 1951- 1971	% p.a. 1971- 1981	% p.a. 1981- 1991	% p.a. 1991- 2001	% share 1951	% share 2001	Empl. 1951- 2001 (000s )
Conurbations	9,721	-0.07	-0.11	-1.13	-0.06	1.07	45.3	34.3	-325
Free standing cities	3,652	0.24	0.29	-0.45	0.61	0.48	17.0	15.1	+475
Northern cities	1,238	-0.05	-0.1	-0.91	0.34	0.52	5.8	4.4	-32
Southern cities	1,580	0.93	1.09	0.09	1.52	0.89	7.4	9.2	+934
Expanded cities	576	0.8	0.51	0.47	1.15	1.43	2.7	3.2	+287
New Towns	352	1.99	2.2	0.85	2.59	2.12	1.6	3.4	+592
Coastal Towns	387	0.29	0.37	-0.5	1.6	-0.35	1.8	1.6	+61
									+390
Rural	3,961	1.38	1.48	1.66	0.88	1.39	18.5	28.7	0
	21,46								+589
Great Britain	7	0.49	0.45	-0.11	0.6	1.05	100.0	100.0	3

Source: Census of Population, Labour Force Survey, Local Authority District 1991 definition  
Moore and Begg (2004)

Table 2 Total Employment Growth – OLS Estimates

Variables	Coefficient	t-probability
Constant	-4.670353	0.087175 *
Expgr	0.564241	0.000503 ***
POP	0.817416	0.077765 *
POP2	-0.034772	0.076350 *
AREA	0.000001	0.008459 ***
VatReg	0.000260	0.055579 *
Educ	-0.000554	0.933750
Univimp	0.000011	0.807082
NT	0.125745	0.005847 ***
London	-0.000702	0.986289
North	-0.031007	0.455369
Airport	0.014230	0.702568
Policy 1	-0.239583	0.000075 ***
Policy 2	-0.104096	0.064607 *
Policy 3	-0.151340	0.045564 **
Policy 4	-0.041464	0.454101
R bar	0.5516	

Table 3 Total Employment Growth Spatial Models (W distance)

	Spatial Lag	Spatial Error
	Coefficient	Coefficient
Constant	-4.199811 (0.098707)*	-5.431758 (0.026595)**
Expgr	0.524558 (0.000510)***	0.588955 (0.000020)***
POP	0.742850 (0.084074)*	0.946046 (0.022979)**
POP2	-0.031584 (0.082930)*	-0.040256 (0.022374)**
AREA	0.000001 (0.003204)***	0.000001 (0.002333)***
VatReg	0.000261 (0.032811)**	0.000322 (0.007325)***
Educ	-0.000618 (0.919005)	-0.003179 (0.593267)
Univimp	0.000010 (0.391999)	0.000014 (0.244452)
NT	0.128220 (0.001633)***	0.133998 (0.001055)***
London	0.003564 (0.924297)	0.003110 (0.924568)
North	-0.020501 (0.608839)	-0.037083 (0.249736)
Airport	0.024724 (0.489390)	0.024782 (0.393040)
Policy 1	-0.249781 (0.000004)***	-0.223807 (0.000009)***
Policy 2	-0.108929 (0.034489)**	-0.076226 (0.116210)
Policy 3	-0.151820 (0.026126)**	-0.115744 (0.080263)*
Policy 4	-0.037097 (0.461676)	-0.009553 (0.847136)
$\rho$	-0.229266 (0.411426)	
$\lambda$		-1.513275 (0.029434)**
R bar	0.5502	0.5790

Table 4 Total Employment Growth Spatial Models (Wd)

	Spatial Lag	Spatial Error
	Coefficient	Coefficient
Constant	-4.400965 (0.082972)*	-5.418700 (0.026811) **
Expgr	0.542392 (0.000291)***	0.584658 (0.000022) ***
POP	0.774765 (0.071122)*	0.943838 (0.023194) **
POP2	-0.032935 (0.070182)*	-0.040152 (0.022632) **
AREA	0.000001 (0.003107)***	0.000001 (0.002541) ***
VatReg	0.000261 (0.033540)**	0.000330 (0.005959) ***
Educ	-0.000606 (0.920638)	-0.003515 (0.552135)
Univimp	0.000010 (0.396326)	0.000013 (0.260874)
NT	0.127132 (0.001837)***	0.133730 (0.001142) ***
London	0.002207 (0.953318)	0.002982 (0.926031)
North	-0.024122 (0.551223)	-0.040035 (0.202329)
Airport	0.020127 (0.570918)	0.031580 (0.263637)
Policy 1	-0.245979 (0.000006)***	-0.223524 (0.000008)***
Policy 2	-0.107374 (0.037500)**	-0.074806 (0.124427)
Policy 3	-0.152294 (0.026100)**	-0.110799 (0.093764)*
Policy 4	-0.039434 (0.434775)	-0.003290 (0.947405)
$\rho$	-0.173704 (0.617015)	
$\lambda$		-2.659713 (0.016235)**
R bar	0.5502	0.5879

**Table 5 Employment Growth in Business Services and Manufacturing**  
**Spatial Lag Estimates (Wt)**

	Business Services	Manufacturing
	Coefficients	Coefficients
Constant	0.528637 (0.007221)***	0.198855 (0.411530)
Expgr	0.162757 (0.202444)	0.456271 (0.116101)
Emp	-0.054773** (0.021255)	0.018426 (0.088100)*
Emp Sq	0.002008 (0.135712)	-0.000394 (0.081957)*
Pop	0.000000 (0.520834)	-0.000001 (0.000867)***
AREA	-0.000000 (0.849107)	0.000003 (0.002927)***
VatReg	0.000597 (0.022812)**	0.000012 (0.966411)
Educ	0.041336 (0.001273)***	-0.043461 (0.003182)***
Univimp	0.000059 (0.028933)**	0.000013 (0.665865)
NT	0.180924 (0.037699)**	0.160962 (0.096815)*
London	-0.062848 (0.445686)	-0.160010 (0.081692)*
Airport	-0.011364 (0.877166)	-0.024617 (0.765645)
North	-0.024321 (0.756152)	-0.025633 (0.771685)
Policy 1	-0.337871 (0.002672)***	-0.091058 (0.470054)
Policy 2	-0.127157 (0.243581)	-0.024526 (0.841709)
Policy 3	-0.287038 (0.042934)**	-0.090621 (0.576975)
Policy 4	-0.145520 (0.180199)	0.085558 (0.484264)
$\rho$	-0.207736 (0.254410)	0.116249 (0.712464)
R bar	0.4124	0.1935

## List and Classification of Cities

### A1.1 Coastal Towns

Eastbourne  
Hastings/Bexhill  
Thanet  
Great Yarmouth  
Waveney  
Torbay  
Blackpool UA  
Lancaster

### A1.2 Conurbation

London UA (UALAD based)  
West Midlands UA  
West Yorkshire UA  
Manchester UA  
Liverpool UA  
Tyneside UA  
Glasgow UA (UALAD based)

### A1.3 Expanded cities

Reading/Woking  
Gatwick UA  
Halton  
Preston UA  
Sunderland UA  
Torfaen  
West Lothian

### A1.4 Free-standing

Brighton/worthing (UA base)  
Portsmouth UA  
Southampton UA  
Bristol UA (UALAD based)  
Plymouth  
Bournemouth UA  
Potteries  
Coventry /Bedworth  
Derby UA  
Leicester UA  
Nottingham UA  
Kingston upon Hull  
Doncaster  
Sheffield UA  
Wigan UA  
Teeside UA  
Cardiff UA (UALAD based)  
Swansea UA (UALAD based)  
Aberdeen City  
Edinburgh UA  
Dundee City (UALAD)

### A1.5 New Towns

Milton Keynes  
Peterborough  
Basildon  
Harlow  
Stevenage  
Welwyn Hatfield  
Redditch  
Telford and Wrekin (The Wrekin)  
Lichfield/Tamworth UA  
Northampton  
Warrington

### A1.6 Northern cities

North East Lincolnshire (UALAD)  
North Lincolnshire (UALAD)  
Harrogate (UALAD)  
York (UALAD)  
Barnsley  
Calderdale  
Chester  
Crewe and Nantwich  
Blackburn with Darwen  
Burnley /Nelson  
Hyndburn  
Carlisle  
Hartlepool  
Darlington  
Caerphilly (UALAD)  
Newport  
Rhondda, Cynon, Taff (UALAD)  
Falkirk  
Fife (UALAD)  
South Lanarkshire (UALAD)  
North Lanarkshire (UALAD)  
Inverclyde

### A1.7 Southern cities

Slough/Windsor (UALAD)  
Wycombe  
Gosport /Fareham  
North Hampshire UA  
Medway Towns (UALAD)  
Gravesend/Greys  
Maidstone  
Oxford  
Guildford  
Luton/Dunstable  
North Bedfordshire (Bedford)  
Cambridge UA  
Brentwood  
Chelmsford  
Colchester  
Southend UA  
St Albans  
Norwich  
Ipswich UA  
Exeter  
Cheltenham/Tewkesbury UA  
Gloucester  
Swindon (Thamesdown)  
Worcester UA (UALAD based)  
Shrewsbury and Atcham  
Cannock Chase  
Warwick  
Chesterfield / Bolsover  
Lincoln  
Mansfield



## Figures

Figure 1 Total employment growth by city type,(106 cities) 1981 - 2001

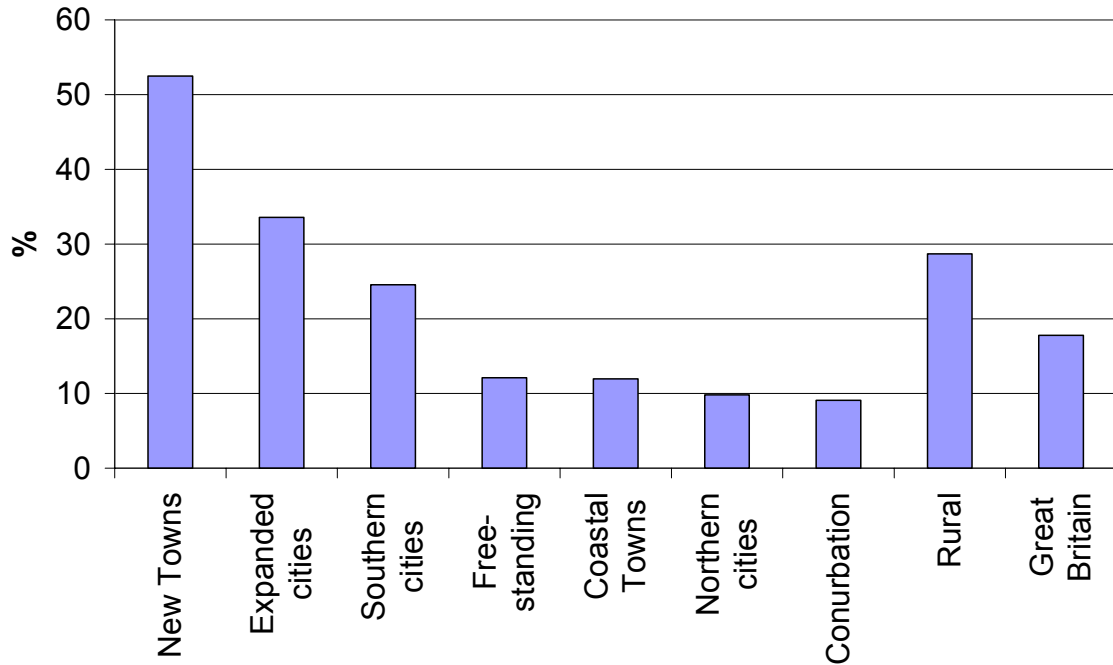


Figure 2 106 cities: Employment growth by population growth 1981 - 2001

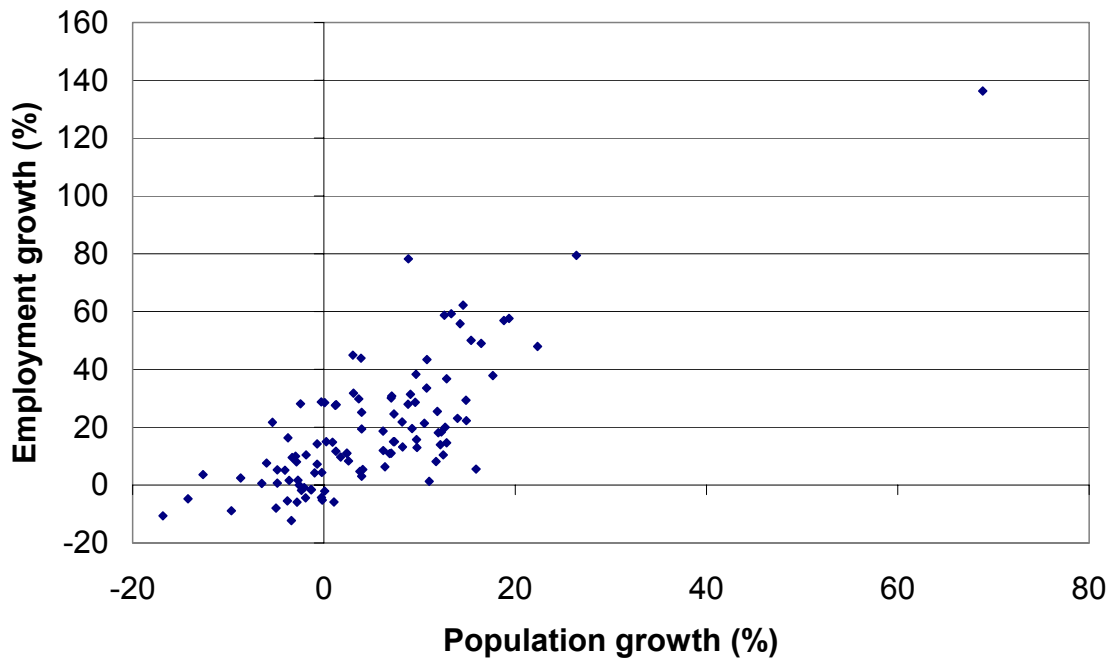


Figure 3 Manufacturing employment growth by city type (106 cities) 1981 -2001

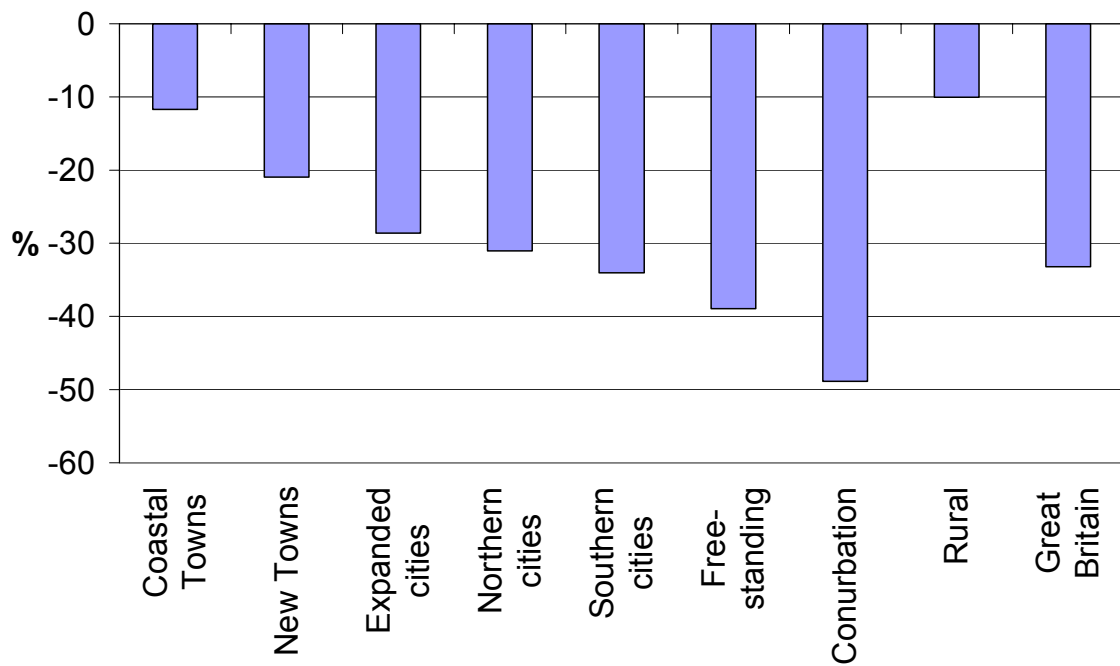


Figure 4 Finance and business services employment growth by city type 1981 - 2001

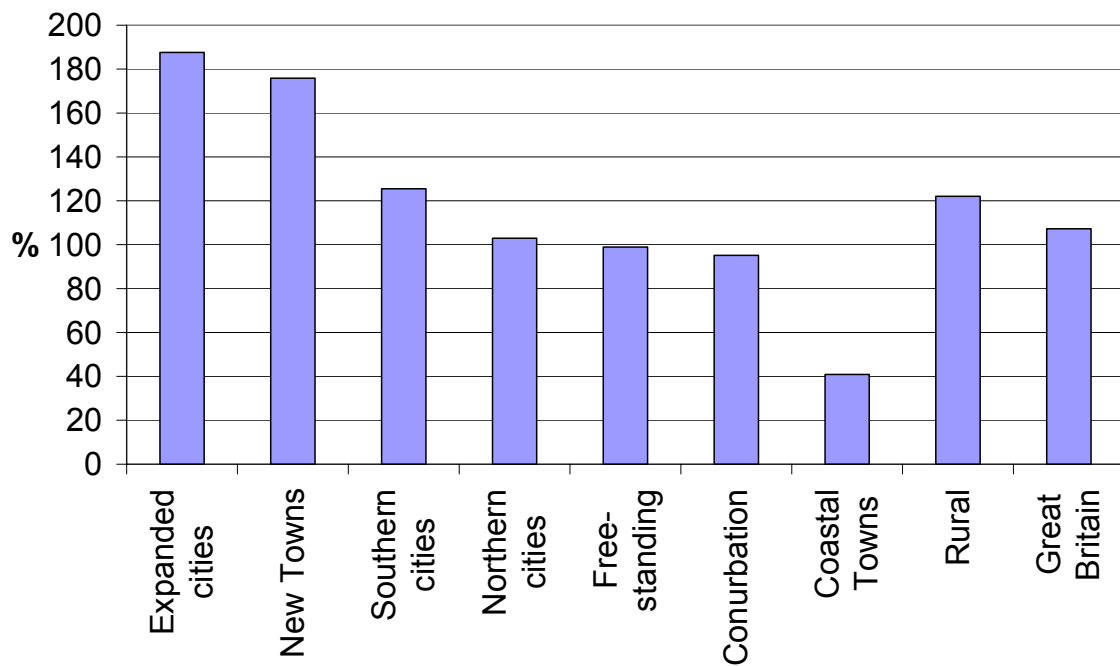


Figure 5 Absolute change in total and 6-sector employment 1981-2001 (000s)

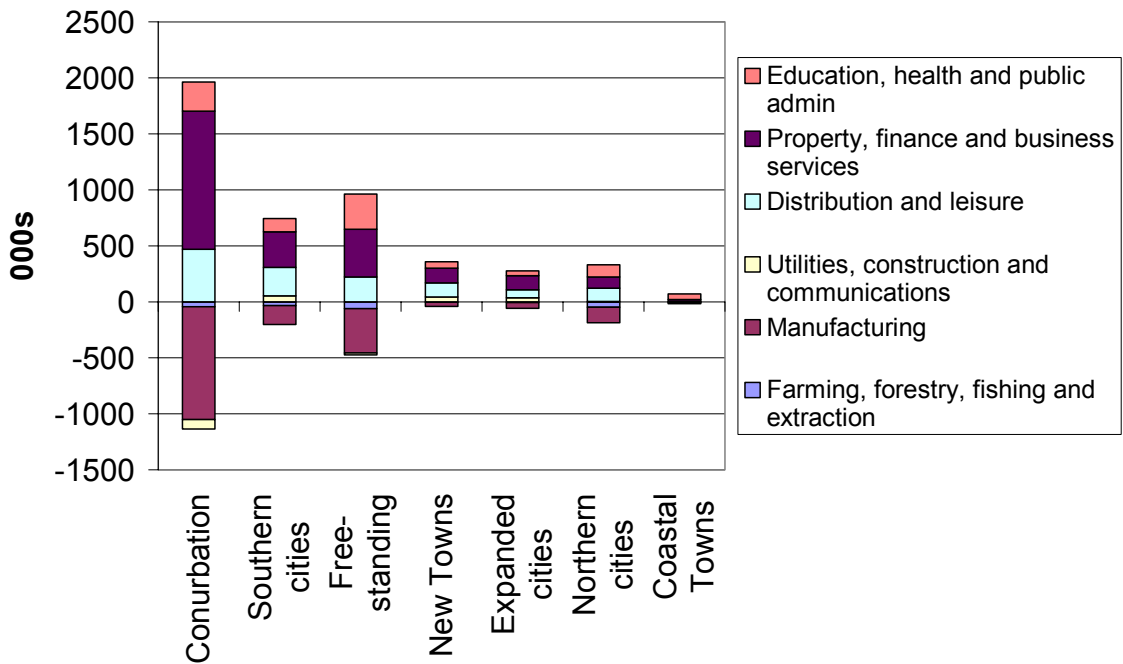


Figure 6 City Groups: Employment Change in 6 sectors as % of Change in Total Employment 1981-2001 (000s)

