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An Empirical Investigation of the Relationship Between Regional Economic Growth and Structural Change

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ABSTRACT

It is well recognized that changes in the economic performance of regions would normally be associated with a degree of structural change. In any region it is extremely improbably that all industrial sectors are growing or declining at the same rate. This paper seeks to examine the nature of the interrelationship between economic growth and the extent of structural change that takes place in a region. Using data for Great Britain the paper seeks to establish whether there is any identifiable association in the short-run between regional growth rates and the extent of structural change in the region, whether that relationship is symmetric with respect to growth and decline and finally whether the relationship is linear or non-linear. There appears to be a reasonable association between regional economic growth and structural change in the region. However the relationship varies across regions; in some regions less structural change is observed at any level of growth than in other regions. Further the relationship between growth and structural change appears to be non-linear suggesting that increasingly faster growth rates are associated with more than proportional increases in structural change, at least in the short-run.

Keywords: Structural Change, Regional Growth Rates

JEL Classification: O18, R11

An Empirical Investigation of the Relationship Between Regional Economic Growth and Structural Change

1. Introduction

Regions grow at different rates. Some regions prosper whilst others decline. Over time an individual region may experience times of prosperity and times of relative decline. As the economy of a region develops some industries in that region grow relatively quickly whereas some grow less quickly, of which some may decline in absolute terms. As a consequence the industrial structure of the region changes and evolves over time. The secular trend for first the manufacturing sector and then the service sector to become more important, at the expense of agriculture and latterly manufacturing, as economies grow is well recognized and documented. Long-term shifts in employment structure of this nature are seen as a probably consequence of long-term growth in an economy.

It is also apparent that in the short and medium term also changes in the economic structure of regions are determined, at least in part, by the relative growth performance of the regional economy. Regions that have suitable conditions to allow sectors with a high degree of technical progress to flourish will exhibit both faster growth and a faster degree of structural change. The ability of an economy to respond most positively to the forces that lead to some industries grow faster than others will depend, to some extent, on the flexibility of the employment in the region. More flexible labour markets will be able to respond to the need to switch employment sectors more easily than rigid markets. However such job switching is not costless. In addition to the costs incurred by the labour force moving from one employment circumstance to another there are costs bourn by firms as they expand and contract. The greater the growth, the greater the degree of structural change that may be required and the greater costs that have to be met.

There has been renewed interest in recent years in the link between economic growth and structural change. The theory linking the two economic concepts has been developed in order to replicate observed, mainly long run, stylized facts (see, for example, Echevarria, 1997, Kongsamut, Rebelo and Xie, 2001, and Foellmi and Zweimüller, 2002). There is relatively less short-run empirical work carried out at the regional level, an exception being Köppen (2001).

This paper has a modest aim. Using data for Great Britain the paper seeks to establish whether there is any identifiable association in the short-run between regional growth rates and the extent of structural change in the region, whether that relationship is symmetric with respect to growth and decline and finally whether the relationship is linear or non-linear. The data and the model used are given in Section 2 and an analysis of the findings is given in Section 3. The final section raises a number of technical issues that arise because of the peculiar nature of the data set used in the empirical analysis.

2. The Data and the Regression Model.

The data is used in this exercise is regional employment data for the 11 standard regions of Great Britain taken from the NOMIS (National On-line Manpower Information Service) database. Data from the Annual Employment Survey is available for the years 1991, 1993, 1995, 1996, 1997 and 1998. The industrial disaggregation of the data is at the two-digit level that provides a disaggregation into fifty-eight sectors.

Any measure of structural change relies on comparing two vectors (in this case of 58 elements) of employment in a region at different points in time and there are numerous ways of reducing such information to a single value. The measure of structural change used in the empirical work below is

$$SC_{r,t} = \sum_{k=1}^{58} \left| S_{r,t,k} - S_{r,t-1,k} \right| \text{ where}$$

$S_{r,t,k}$ is the share of employment in industry k in region r at time t.

Regional growth is measured as the percentage increase in total employment in a region between t-1 and t. As data exists for six years and eleven regions there are 55 observations of structural change and regional growth rates. It is recognized that a measure of output growth might well be superior to total employment growth as a measure of regional growth, but as constant price output figures are not available for GB regions over the period employment growth has to be used as a proxy.

Given that the time period is relatively short, the empirical exercise has to focus on the short-term association between structural change and regional growth. The basic regression model used in the analysis is

$$SC = \alpha + \beta_{1-}\ NGR + \beta_{1+}\ PGR + \beta_{2-}\ NGR^2 + \beta_{2+}\ PGR^2 + \sum_{i=1}^{4} \gamma_i\ TD_i + \sum_{r=1}^{10} \lambda_r\ RD_r$$

where the TD_i are a set of time dummies and the RD_r are a set of regional dummies which allow for fixed effects for each time period and each region.

PGR and NGR are positive and negative growth rates, separately identified in order to capture any non-symmetric behaviour of structural change with respect to regional growth. It should be noted that the quadratic type of specification of the equation performs better in the empirical exercise than relatively simple spline functions that can also be fitted to the data.

3. Empirical Results

In all estimated variants of the basic equation given above a problem with non-linearity is observed. This may be overcome by taken the natural logarithm of the structural change measure. In the estimations the set of time dummies proved insignificant and were therefore eliminated from the regression. This suggests that in the short-run at least the relationship between structural change and regional growth is unaffected by the state of the national economy as proxied by the time dummies. Introduction of a variable measuring the national growth rate is not supported by the data, as it is insignificant at traditional levels.

Further, there is no evidence that positive and negative growth rates affect structural change non-symmetrically. Declining regions appear to undergo, at least in the short-run, similar structural change effects as regions that are growing by the same amount. It should be noted that this result appears to apply both in the case considered here, where the actual regional growth rates are used, and in the case where relative growth rates are used (not reported here).

Finally, there is sufficient evidence to support the retention of the set of regional dummies. The final equation results are given in Table 1 and the ranking of the regions according to their fixed effects is given in Table 2. The higher the fixed effect for a region the more structural change there is in that region for any particular regional growth rate. There appears to be no obvious explanation for the ranking of the regions according to their fixed effects. Eastern, a relatively prosperous region is low in the list whereas Wales, a relatively less prosperous region, high on the list. The inclusion of a variable reflecting the size of the region in the estimated equation does not appear to explain this, as its coefficient is always insignificant and the regional dummies retain their significance.

It is also evident that even zero growth is associated with some structural change. The minimum structural change occurs when growth is around 1.34%. This value is significantly different from zero ($p<0.001$). This implies that the extent of structural change declines as regions increase their growth from 0 to 1.34%.

The relationship between regional growth and structural change obtained from the fitted equation can be plotted for each region. Figure 1 shows the relationship for the two most extreme regions (in terms of their fixed effects), the curve for the North East (the region with the highest fixed effect lying above that for the West Midlands, the region with the lowest fixed effect. The curves for other regions will lie between these two extremes. A plausible inference from Figure 1 is that for the North East to match the growth rate of the West Midlands requires a greater degree of structural change in the North East economy than would be necessary in the West Midlands.

This difference can be expressed in the number of net job shifts that occur in each region at any given growth rate. As the employment shares for any region at any time must sum to zero, multiplying the structural change variable by the average total employment in the region and dividing by two gives an estimate of the number of job shifts between industries consistent with a particular growth rate. For particular growth rates these estimates are given in Table 3. It is clear from the table that, for moderate levels of growth, the number of job shifts is of the same order of magnitude as the number of jobs created by growth (or lost by decline). Proportionately, the North East requires more job shifts than the West Midlands, a fact which is consistent with the theory that the differing industrial structures in the two regions has affected the growth potential of the two regions.

Finally it should be noted that the curves shown in Figure 1 are u-shaped. An increase in growth from 3% to 4% leads to a greater increase in structural change than one from 2% to 3%. As there is likely to be costs associated with structural change the u-shaped nature of the relationship suggests that, to some extent at least these costs impede growth.

4. Conclusion

The results of this paper can be easily summarized. There appears to be a reasonable association between regional economic growth and structural change in the region. However the relationship varies across regions; in some regions less structural change is observed at any level of growth than in other regions. Further the relationship

between growth and structural change appears to be non-linear suggesting that increasingly faster growth rates are associated with more than proportional increases in structural change, at least in the short-run.

Although the results are, at face value, interesting, there are a number of short-comings in the empirical exercise that suggest they should be interpreted with a great deal of caution. First, the combination of two-year and one-year changes is not particularly attractive. Although this increases the number of observations, it introduces the question of whether it is legitimate to treat the two types of change as applying equally to the short-run. Whether the errors introduced here would be less if data from other sources were used to interpolate regional employment figures for the missing years is a moot point. Second, it could reasonably be argued that causation does not simply run in the direction of growth to structural change but that both growth and structural change are simultaneously determined. Given the complications introduced because two and one period changes are used, there is no straightforward way to test this. Ideally one would like a much longer set of annual time series data for each region to examine causality issues. However an application of a type of Wu-Hausman test in this case suggests that simultaneity may be a problem. Finally, although the focus of the paper is the short-term relationship between growth and structural change, the limited extent of the data means that any treatment of the dynamics of the relationship has to be neglected. In future work it is hoped to address these not insignificant caveats in order to test the robustness or otherwise of the results reported above.

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TABLE 1: REGRESSION RESULTS

Model: $\ln SC = \alpha + \beta_1 GR + \beta_2 GR^2 + \sum_{r=1}^{10} \lambda_r RD_r$

PARAMETER	ESTIMATE	STANDARD ERROR	P-VALUE
α	-3.0324	0.1009	0.000
β_1	-0.0722	0.0205	0.001
β_2	0.0269	0.0053	0.000

R^2 =0.5728

F-stat = 4.692 ($p < 0.001$)

Functional form test = 1.599 ($p = 0.206$)

Test for heteroskedastic errors = 2.295 ($p = 0.130$)

The functional form test is Ramsey's RESET test based on the squares of the fitted values. The test for heteroskedastic errors is based on a regression of squared residuals on squared fitted values. Lagrange multiplier {i.e $\chi^2(1)$} versions of these tests are reported as there are some reservations about the normality of the residuals.

TABLE 2: REGIONAL FIXED EFFECTS

REGION	FIXED EFFECT
West Midlands	0.000
London	0.076
Wales	0.080
South East	0.110
North West	0.136
Yorkshire & The Humber	0.255
South West	0.285
East Midlands	0.304
Scotland	0.352
Eastern	0.425
North East	0.511

TABLE 3: NET JOB SHIFTS

	NORTH EAST		WEST MIDLANDS	
	Av. Emp. = 900,467		Ave. Emp. = 2,080,950	
Growth rate	New Jobs	Job Shifts	New Jobs	Job Shifts
-2%	-18,009	46,542	-41,619	64,527
0%	0	36,173	0	50,150
+2%	18,009	34,862	41,619	48,333
+4%	36,019	41,664	83,238	57,763

FIGURE 1: Structural Change and Growth