

Urban Unemployment in the EU, tertiary sector employment growth and urban size.

by

Graham Robert Crampton

**Centre for Spatial and Real Estate Economics,
Faculty of Urban and Regional Studies,
University of Reading,
Reading, UK RG6 6AW**

email: G.R.Crampton@reading.ac.uk

Fax: (+44) (0)1189-316533

Paper prepared for the 38th Congress of the European Regional Science
Association, 28th August - 1st September 1998, Vienna.

Abstract: The paper uses REGIO data to study recent change in unemployment in major urban areas of Europe. Previous results suggested a significant role for tertiarisation in employment, and a systematic association with urban size. This work is carried forward using more recent data on urban areas at NUTS3 level. Patterns in variation of unemployment across countries and city sizes are discussed. Econometric estimates going beyond OLS are discussed using LIMDEP software.

1. Introduction

The study of unemployment continues to play a prominent role in economics, but mainly from a macroeconomic view point. The recent review in the Economic Journal's 'Controversy' series (Nickell(1998) and other papers) focused on using modern time series econometrics to aid understanding of international differences in labour market behaviour. The idea that labour markets function in a spatial context, which affects job search and commuting, hardly rates a mention. One motive for this paper is to attempt to address the question of European unemployment in a spatial context. The large literature seeking explanations for the striking excess of EU unemployment rates over those of US, Japan and the rest of the OECD has largely stressed the macroeconomic mechanisms which may have contributed to this phenomenon and tried to disentangle the relative role of the different causes. The authoritative recent survey by Bean (1994) hardly mentioned the words 'city' or 'region' at all, so that economists who work in spatial economics feel they have to contribute some locational factors to research which is usually done in terms of national cross-sections.

We also wanted to try to find explanatory factors which played an important role in changes in unemployment rate, beyond the simple impact of employment change. We seem to have found such a factor in the role of tertiarisation, that is the relative increase in the share of the service sector in total employment. This appears to suggest that a form of mismatch mechanism is playing perhaps a more substantial role in cross-sectional variation of European unemployment than had been thought.

From a more practical empirical point of view, the REGIO database has been established as a EU-wide empirical resource designed to enhance the quality and quantity of European regional research. Major research projects (such as the work discussed in Baddeley, Martin and Tyler, 1996) have focused on the problem of interregional convergence or persistence in

unemployment rates. Earlier work by Cheshire (1990) assembled a European database of Functional Urban Regions (FURs), using Census data from each member state and locally based research collaborators. We wanted to build up a set of European metropolitan areas based on REGIO data at NUTS 2 and NUTS 3 level, so that in principle each new year of REGIO data would extend the time series in a normal way.

It becomes clear quite quickly when working on EU unemployment data that there are strong patterns based on national factors. Major political-economic changes such as the adjustments in Spain following the death of Franco (discussed in Bentolila, S. and Blanchard, O.J. (1994)), or the varying application and success of special labour market measures, are combined with the complexity of the impact of urban size on economic development, and the spatial detail of how component areas such as NUTS 3 regions are built up into whole urban areas.

In Section 2, we outline some elements of the large and growing literature on European unemployment. Section 3 discusses the data and presents some results from cross-sectional estimations of unemployment rate change. Section 4 focuses a little more closely on the problem of heteroscedasticity which arises when the observations are ratios drawn from labour markets of widely varying size. The LIMDEP software is used to produce some tests of heteroscedasticity. Section 5 concludes, and adds some comments on the difficulties of data availability.

2. Literature on European unemployment

The special place which has now been given to the sharp rise in unemployment in Europe relative to the rest of the developed world was symbolised by the major Journal of Economic Literature review article by Bean (op.cit.). This is a comprehensive review of the recent macroeconomic explanations and related theoretical developments. It includes attempts to measure European wage and price inertia in the face of the demand shocks occurring after 1974, the slowdown in productivity growth, the adverse movements in terms of trade and the

‘tax wedge’, worker militancy, and the impact of unemployment benefit on the unemployment/vacancy trade-off, and possible adverse effects of European labour market regulations. Only brief attention was given by Bean to a topic which normally plays a prominent role in urban and regional analysis of unemployment, namely mismatch (Bean, *ibid.*, p.594).

One important conclusion Bean makes after surveying this vast literature is that the econometric rigour of ‘most’ of the research leaves a bit to be desired:

“Most of the empirical literature is characterised by a distinctly cavalier attitude to lag structures and issues of identification, so it is perhaps not surprising that results are fragile.” (Bean, *ibid.*, p.614)

However, he is also realistic about the difficulty of gaining further insights from detailed analysis of the same data set:

“There is simply not enough information in the data to give clear signals on the relative merits of the competing hypotheses.” (ibid., p.615)

Perhaps we would suggest that although “ ... diminishing returns to the analysis of macroeconomic data set in a long time ago ... ” (ibid., p.615), there is still a role for analysis which acknowledges more explicitly the urban and regional as well as macroeconomic context in which European unemployment occurs.

A more discursive discussion of the European labour market and the mixed success of economic theory and econometrics in understanding recent developments was provided by Adnett (1996). Again, relatively little attention was given to spatial factors, other than the

recent flowering of the regional convergence debate stimulated mainly by Barro and Sala-i-Martin (1991), and developed further by Armstrong (1995), de la Dehesa and Krugman (1992), among others. A recent Leverhulme Trust project on European Labour Market Dynamics (Baddeley, Martin, Tyler, op.cit.) is generating more results on the stochastic behaviour of regional unemployment relativities including application of modern time series techniques. Martin (1997) applied, almost for the first time, modern cointegration techniques to UK regional disparities and the unusual impact of the early 1990s recession.

The recent orientation of certain strands of economic geography research towards 'globalisation' and the further development of flexible specialisation has led to some more detailed discussion of deindustrialisation, and related tertiarisation (Coriat and Petit, 1991), a process which plays a prominent role in our empirical work below. The 'regulationist' approach favoured by Coriat and Petit focuses on the promotion through policy of the most productive framework in which development of the service sector can take place.

The economic research literature has been broadly oriented towards research of unemployment on a national time series basis, or a cross-section of countries. Most of the spatial perspective on European unemployment has been geared towards the regional convergence debate. The uniqueness of Cheshire's work (1995) has stressed the fact that no European-wide (American-style) standardised definition of metropolitan area has ever been developed.

3. Data and Results

3.1 Data

Most previous work on regional unemployment and disparities in Europe has used basic regional data at NUTS 1 or NUTS 2 level, without any attention being paid to the extent to which these regions were affected by the spatial structure of the urban areas of Europe (Baddeley *et al.*, op.cit.; Barro and Sala-i-Martin, op.cit.). The major exception is the research of Cheshire and colleagues (1990, 1995, 1996) who painstakingly defined a European-wide set of FURs, based on spatial detail from each country's Census supplemented

by other data sources. This provided an interesting series of papers on perceptions of the urban problem, and European-wide decentralisation patterns. The principal disadvantage is that there is no established regular updating of such data, and no officially accepted definition of FUR on a European-wide basis.

It would seem desirable to use the regularly issued NUTS data giving spatial detail on labour market and other phenomena but to do what seems sensible to manipulate the NUTS data into a reasonable approximation of FURs. In this paper, we worked on the assumption that, at least for the largest urban areas, such a reasonable approximation could be built up from the NUTS 3 component regions, which would then be updated regularly as part of the REGIO data base.

We used the Cheshire (*op.cit.*) set of European FURS as a starting point, and included each NUTS 3 component region if all or most of it (in terms of most recent population data) was contained in the Cheshire FUR. In the large majority of cases, there is only a small number of NUTS 3 regions, with modest populations, which are included in one of 'our' metropolitan regions, which were only partly included in the Cheshire set of FURS. Alternatively, they might be just excluded by us, but were partly included by Cheshire. The restriction to cities for which urban area population exceeded 300,000 and adequate NUTS 3 detail was available gave us 116 observations for the data set analysed below.

The data set on major European urban areas does not pretend to be comprehensive, for two main reasons. Firstly, the REGIO data is available for different periods in different countries and not available at all for some, and secondly some countries have not yet begun to publish regional and sub-regional data. Either or both of these reasons mean that for countries such as Ireland, Greece, the major urban areas cannot be included at this stage. It is hoped, for full information and proper research using Eurostat data, that eventually all EU member states will publish regional data on a reasonably comparable basis.

This is at least an attempt to use REGIO data on spatial detail, acknowledging the fact that in many cases sub regional data are reflecting urban phenomena, and offering the clear advantage of a regularly updated data base.

3.2 Explanatory variables

The main target of the empirical analysis was the explanation of changes in unemployment rate at the European metropolitan area level. The use of a metropolitan area level of data means that unemployment rate changes are not simply the result of major employment moves or changes taking place within a metropolitan area. Here we try to give some insight into what role is played by the ‘naive’ factors of employment and working population change (the former on the demand side, the latter on the supply). The fact that in terms of absolute numbers, the change in total unemployment U, denoted by ΔU , over some period, is exactly given by a difference of working population (WP) and employment (E) change:

$$\Delta U \equiv \Delta WP - \Delta E$$

If such absolute numbers were used for a cross sectional sample of metropolitan areas, statistical explanations would be dominated by the scale of the metropolitan area, so it is normal that unemployment rates (U/WP) are used in empirical analysis. Even so, as we see below, there will be strong tendencies for the bigger metropolitan areas to have a lower level of random variation in the unemployment rate, so that the problem of heteroscedasticity needs some action.

To begin with however, we see what explanation can be achieved for unemployment rate changes using ‘naive’ variables, and a number of other explanatory factors. Firstly, as a result of different data availability in REGIO, the periods of change in unemployment and employment are different for the different countries. The employment growth variable was ‘annualised’ to eliminate this factor.

In addition to the annualised rate of change in employment, we introduced a less familiar variable, the ‘tertiarisation’ of the metropolitan employment structure, and annualised this also. This makes use of the fact that REGIO gives a 3-sector breakdown of the employment total for each NUTS 3 sub-region. The share of employment in the 3rd (services) sector has in almost all cases risen, and the change in this proportion per year over the relevant period gives a simple measure of annual ‘tertiarisation’. This would represent a form of required adjustment and mismatch which all metropolitan labour markets, to different extents, have had to cope with. Of course, such a tertiarisation masks a wide range of complex adjustment processes, but these have not been given the importance they deserve. There is also a full range of national dummy variables which could be used, but they have the disadvantage of burying the economic mechanisms under the names of countries, which purely by themselves of course carry no explanatory economic power.

3.3 Weighted Least Squares Regressions

To begin with we did an unweighted OLS regression of unemployment rate changes over the 116 urban areas, using annual employment change and tertiarisation. This was compared with the same equation in weighted least squares regressions, in which the square of total employment is used as a weighting variable. This is a preliminary attempt to cope with the problem of heteroscedasticity. Table 1 shows the results of OLS regressions and the weighted least squares regressions.

Table 1: Dependent variable ADURMA, 122 observations on metropolitan areas using NUTS 3 definitions

Variable	OLS	Weighting variable (EMMA) ²
Constant	-0.27	0.032
ADEMMA Annual % Change in Employment	-0.099* (0.042)	-0.185** (0.035)
ATERTMA (Tertiarisation)	0.556** (0.126)	0.321** (0.116)
% Adj R ²	28.3%	35.8%

Notes: Numbers in parentheses are standard errors.

* = coefficient significant at 5%. ** = coefficient significant at 1%.

Variable Definitions

ADURMA Annual Change in Metropolitan Area (NUTS 3)
Total unemployment rate (final year used was one year later than for employment).

EMMA Total employment for metropolitan area

ADEMMA Annual % Change in Metropolitan Area Employment

ATERTMA Annual Tertiarisation for Metropolitan Areas
(Annual Increase of % Employment categorised as Services)

Periods used for unemployment and employment change for the 10 countries whose NUTS3 regions were used were as follows: Belgium 1983/92, Germany 1987/93, France 1983/92, Spain, 1986/92, Italy 1983/89, Netherlands 1988/91, U.K. 1985/91, Sweden 1990/96, Finland 1988/94, Portugal 1989/96.

Next, we tried to identify some ‘big city’ effects on unemployment rate changes. The population of the biggest city in the urban area was used (in log form), with its square, were used to see if metropolitan areas with big cities were better at absorbing the labour force changes represented by total employment and tertiarisation, and if these effects might be non-linear.

Table 2: Dependent Variable ADURMA, effects of city size variables

Variable	Weighted LS regressions (weighting variable (EMMA) ²)	
Constant	-1.13	3.81
ADEMMA	-0.128** (0.034)	-0.109** (0.03)
ATERTMA	0.571** (0.12)	0.608** (0.11)
LNBIGC	0.125** (0.025)	-1.26** (0.34)
SQLNBIGC		0.093** (0.023)
% Adj R ²	46.5%	52.8%

Note: * = coefficient significant at 5%. ** = coefficient significant at 1%.

Table 2 (using the same weighted least squares equation as in most of Table 1) shows that there is indeed a ‘big city’ effect on unemployment rate change, and it does seem to be non-linear. The simple log (big city population) variable is significantly positive suggesting that big city labour markets (once employment change and tertiarisation had been allowed for) had worse unemployment rate changes. But when the square of log (big city population) is included, it is the coefficient of the squared variable which becomes strongly positive, and the coefficient on the linear variable changes to negative. This suggests that the impact of the log

(big city population) is U-shaped, with an ‘efficient’ labour market size, for which the unemployment rate change is best (or least bad). Using the coefficients from Table 2, we might recall that any function of x of the form

$$f(x) = a - bx + cx^2$$

has a minimum at $x = b/2c$

Hence, from Table 2, if

$$b = 1.26$$

$$c = 0.093$$

So the minimum comes where

$$\ln(\text{big city '000 population}) = 6.77 \text{ and}$$

$$\text{big city population} = 875,000.$$

This result must of course be interpreted with caution. The size distribution of urban areas is truncated at around 300,000 population, so smaller cities are under-represented, although a substantial share of our observations lie in the 300-800,000 range. The coefficients may be volatile (the value of the coefficient playing the role of b above does after all change from positive to negative with the inclusion of the square variable). It is however intriguing that there is some evidence that cities around 800,000 population may in some sense have efficient labour markets. We are here really raising the question rather than answering it, but the ‘efficient’ size we find is one which many readers might find sensible, particularly given the growing importance of financial and business services in bigger cities.

4. Heteroscedastic Regression Modelling

Given the role of the weighting of observations by urban area size (employment), we also decided to use LIMDEPs multiplicative heteroscedastic regression model, so as to use modern maximum likelihood methods to compute an optimal heteroscedasticity-corrected model. It is necessary to specify a variable according to which the variance varies, and we used the metropolitan area employment size. The iterative algorithm then uses OLS as an initial point, calculates the relationship of the residual variance to the specified size variable, then

recalculates an ML estimation which gives a new set of residuals and a new residual variance/size relationship, which enters a new ML estimation. This continues until the procedure converges.

Table 3 shows that there is some evidence that the variation of residual variance according to the square of urban area employment size performs well. Under these assumptions, the annual employment change variable has the expected negative sign. The city size variable has a strong positive effect on annual unemployment change in the heteroscedastic regression model, and the Log-L function is also highest (least negative) for it. However the iterative programme did not converge to give estimates for the ‘big city’ variable and its square, so only the simple ‘lnbigc’ is shown for which there was convergence.

Table 3: Multiplicative Heteroscedastic Regression Model, Dependent ADURMA

	Initial OLS	Het. Variable (EMMA)²
Constant	-0.419	-1.05
ADEMMA	-0.0984* (0.039)	-0.082* (0.038)
ATERTMA	0.558** (0.117)	0.600** (0.12)
LNBIGC	0.0246 (0.052)	0.121** (0.018)
(Log L)	-102.8	-78.5
Iterations to Converge		31

The ML estimations of the significant negative variation of residual variance against (urban area employment)² are produced by the software, but are not given here. It does however leave us with a strong feeling that OLS regressions can often give misleading results when the basic relationship has a heteroscedastic form.

5. The Role of Unemployment Benefit

Part of the recent debate over the reasons behind the sharp rise in unemployment rates across Europe has been the suggestion that overgenerous unemployment benefit (UB) has made unemployment more acceptable, and has strengthened the incentive to ‘play the black economy’ by registering as unemployed while working. As a preliminary attempt to see if UB plays an identifiable role on our European metropolitan area unemployment rate changes, we used data on ‘replacement rates’ from Nickell (1998). Earlier detailed discussion can be found in Layard, Nickell and Jackman (1991). That is, the variable UBREPLPC denotes the weekly UB as a percentage of average weekly earnings. This changes relatively little for each country but ranges widely from 20% in Italy (where other mechanisms come into play) to 80% in Sweden and 70% in Spain. It is of course a very crude representation of the relative generosity of UB payments, since it does not embrace the duration limits of benefit payments, or other rules and controls on access to benefit. The UB replacement rate is also modelled here as affecting the increase in unemployment rate, rather than the level. However, it is often suggested that high UB replacement rates are an ingredient of ‘Eurosclerosis’, the lack of labour market flexibility in the face of adverse terms of trade or demand fluctuations.

Results in Table 4 suggest that there may be some positive contribution from UB replacement to unemployment rate increases in urban areas, but the effect seems to overlap somewhat with the ‘big city’ effect. When the ‘big city’ variables are present, the UB replacement variable is smaller though still significant, and when they are absent, it is highly significant. However, a correlation matrix between the variables (not given here) shows no strong collinearity between the variables.

Table 4: Dep Var ADURMA, including unemployment benefit and city size effects, Weighted LS regressions (weighting variable (EMMA)²)

Variable		
Constant	2.90	-0.22
ADEMMA	-0.150** (0.036)	-0.241** (0.037)
ATERTMA	0.496** (0.12)	0.172** (0.12)
UBREPLPC	0.00487* (0.0020)	0.00763** (0.0022)
LNBIGC	-1.04** (0.344)	
SQLNBIGC	0.0780** (0.023)	
% Adj R ²	54.7%	41.3%

Given the complexity of individual behaviour under varying unemployment regimes, these results should be taken to be preliminary and indicative. However, they do not contradict the suggestion that relatively generous UB payments may have contributed to adverse urban unemployment rate changes, although structural change such as tertiarisation is more powerful.

In terms of the scale of impact, the results of Table 4 suggest that an extra 1% urban employment growth per year will only bring the urban unemployment rate differential down by about 0.15% per year. An extra 1% of annual tertiarisation (the average gross tertiarisation

was nearly 5%) would raise the urban unemployment rate differential by nearly half a percent per year, whereas an extra 10% on the UB replacement rate would raise it by only about 0.05% per year. These results have to be interpreted with considerable caution, given that many of the complexities and simultaneities of the urban labour market have been neglected.

6. Conclusions

In this paper we have developed some ideas on empirical modelling of urban labour markets in Europe using NUTS data available through the REGIO data base. Although urban areas defined using NUTS3 component regions are imperfect, they have the advantage that the data could be updated as frequently as REGIO itself (which judging by current experience is not very frequently at all). Particularly for the biggest European urban areas, made up of a number of NUTS3 components, these may be a reasonable approximation, allowing useful cross-sectional empirical work.

We carried out examples of such econometric modelling, and focused on the causative influences on urban area unemployment rates. We found an especially strong role was played by the tertiarisation process, which was much more powerful than more naïve influences such as the rate of total employment change. We also did some indicative work suggesting that the size of the leading city in an urban area may have a systematic, but non-linear, effect on urban unemployment rate. We also experimented with the influence of unemployment benefit as an influence on the rate itself or increases in it, at urban area level. The special severity of unemployment in particular countries like Spain needs some comment as an extreme example of what has been widely analysed recently as 'Eurosclerosis'.

At a technical level, we were keen to experiment with rather more modern econometric techniques than simple ordinary least squares. We used our software to carry out some heteroscedasticity tests and generate some maximum likelihood estimates of heteroscedasticity-corrected regressions. These experiments made it pretty clear that, where estimates of labour market phenomena over urban areas of widely differing size are

concerned, simple unweighted OLS regressions may be biased and misleading. There does seem to be a clear tendency for the residual variance to vary inversely with urban size so that the OLS assumptions are invalid, as indeed one would expect them to be.

One data access problem has emerged in the course of this research. Most academic libraries will only buy a full copy of REGIO, if at all, at fairly rare intervals, so that the researcher's problem becomes how he can smoothly update his empirical work to take account of the latest data. I am grateful to colleagues at the 'r-cade' Centre at the University of Durham for help in obtaining updated data at academic prices.

One hopes that we can look forward to developing EU-wide urban area analysis, which should in time include a wider set of member states than those covered here. Swedish, Finnish, and Portuguese urban areas have been included in this research, and the cities of countries such as Greece, Austria or Denmark, whose spatial data is not yet widely available in a suitable form, clearly should be. Extending the time-series for the whole data set over longer periods would also make the research more insightful.

The urban labour markets of newly applying States (such as Poland, Hungary, or the Czech Republic) as well as those of the mature member economies can only be properly understood on the basis of widely available high quality data, coupled with modern statistical techniques and computational power.

References

Adnett, N. (1996) *European Labour Markets*. London and New York: Longman.

Armstrong, H.W. (1995) Convergence among regions of the European Union, 1950-1990, *Papers in Regional Science*, **74**, 143-152.

- Baddeley, M., Martin, R. and Tyler, P. (1996) European Regional Unemployment Disparities, Discussion Paper 73, Department of Land Economy, Cambridge.
- Barro, R. and Sala-i-Martin, X. (1991) Convergence across states and regions, *Brookings Papers on Economic Activity*, **1**, 107-82.
- Bean, C. (1994) European unemployment: a survey, *Journal of Economic Literature*, **32**, 573-619.
- Bentolila, S. and Blanchard, O.J. (1990) Spanish unemployment, *Economic Policy*, **10**, 234-281.
- Bentolila, S. and Blanchard, O.J. (1994) Labour flexibility and wages: lessons from Spain, *Economic Policy*, **14**, 53-99.
- Cheshire, P.C. (1990) Explaining the recent performance of the European Community's major urban regions, *Urban Studies*, **27(3)**, 311-333.
- Cheshire, P.C. (1991)
- Cheshire, P.C. (1995) A new phase of urban development in Western Europe? The evidence for the 1980s, *Urban Studies*, **32(7)**, 1045-1063.
- Cheshire, P.C. and Carbonaro, G. (1996) Urban economic growth in Europe: testing theory and policy prescriptions, *Urban Studies*, **33(7)**, 1111-1128.
- Cheshire, P.C. and D.G.Hay (1989) *Urban Problems in Western Europe*, Unwin Hyman.
- Coriat, B. and Petit, P. (1991) Deindustrialization and Tertiarization: Towards a New Economic Regime, in: A. Amin and M. Dietrich, eds, *Towards a New Europe*. Aldershot: Elgar, pp.18-45.

De la Dehesa, G. and Krugman, P. (1992) EMU and the regions, Group of Thirty, Occasional Paper No. 39, Washington, DC.

Layard, R., Nickell, S. and Jackman, R. (1991) *Unemployment: Macroeconomic Performance and the Labour Market*. Oxford: Oxford University Press.

Martin, R. (1997) Regional unemployment disparities and their dynamics, *Regional Studies*, **31(3)**, 237-252.

Nickell, S. (1998) Unemployment: Questions and Some Answers, *Economic Journal*, **108**, 802-816.