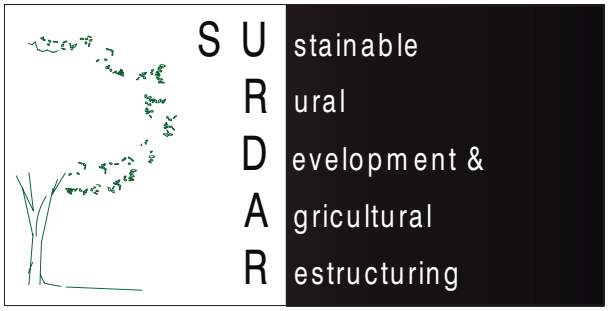

LOCAL UNEMPLOYMENT IN POLAND

Working Paper No. 7

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May 2005

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Abstract

High unemployment continues to bedevil Poland, although the national picture masks striking spatial differences that this paper seeks to explain using a panel data set for the country's NUTS 4 level powiats. Given the economy's somewhat peculiar configuration throughout its communist epoch, emphasis is placed on rural-urban differences. Finding a random effects estimator to be most appropriate for the observations in question, the results indicate that increases in foreign capital, investment and the concentration of agriculture are associated with lower unemployment while its opposite is characteristic, all else equal, of more rural areas and those placing greater reliance on domestic enterprise.

Keywords: Regional unemployment, agriculture, rurality, industrial mix, migration.

JEL Classification: J64, J69, R11, R19

1. Introduction

Some unemployment was always expected to emerge in the transition economies; indeed, it was often seen to be a sign that restructuring was underway and that labour was being freed by the public sector for use in the private sphere (Blanchard *et al.*, 1994). Nonetheless, it was also recognised that this near pre-requisite for economic modernisation must not force workers into prolonged periods of idleness if the twin risks of social upheaval and wasted human capital were not to become issues of concern. In the event, Poland's headline unemployment rate has been consistently amongst the highest of the eight transition economies from Central and Eastern Europe (CEE) that recently acceded to membership of the EU. Furthermore, it housed five of the ten NUTS 2 regions in 2003 with the highest unemployment rates in the then to be EU-25 (Mladý, 2004) and these rates exceeded those prevailing within all of equivalent territories of Bulgaria and Romania, the current leading candidate countries.[1]

The general flavour of these observations is not particularly novel, of course, and there have been quite a large number of studies of the country's national and NUTS 2 regional (voivodship) unemployment problems (e.g. Rukowski and Przybyla, 2002; Newell and Pastore, 2000; Ingham *et al*., 1998; Kwiatkowski and Kubiak, 1998; Lehmann *et al*., 1997; Gora and Lehmann, 1995; Czyz, 1993; Lehmann *et al*., 1991). However, much less has been written about the unemployment problems faced by more finely disaggregated spatial areas within Poland and detailed analysis of them has been rarer still. The purpose of this paper is to examine Poland's spatial unemployment problem at the NUTS 4 level of disaggregation; that is, at the level of the powiat. This has the additional advantage of permitting a sharper focus on what is

usually seen to be a marked rural-urban divide within the country (FDPA, 2002; Crescenzi, 2004).

The next section outlines briefly the basic administrative structure of Poland, placing the powiats in comparative, historical and statistical context. This is followed by a consideration of the nature of the powiat level unemployment rate to be analysed. Section 4 contains an overview of the more usual theoretical approaches to the explanation of within country spatial unemployment differences, while Section 5 develops the particular empirical specification investigated in this paper. As the model is applied to a panel data set of powiat unemployment observations, Section 6 is devoted to econometric issues and specifies the estimator employed. The results of the estimation and some interpretations placed upon them are presented in Section 7. A concluding section closes the paper.

2. The territorial delineation of Poland

In 1992, Poland adopted a new constitution that declared local self-rule to be the basic organizational form of public life and provided for directly elected community (gmina) councils whose members in turn elected delegates to the self-governing regional council. Although central government retained control over much local finance, these developments were in accord with the democratic thrust of the 1989 agreement that accompanied the demise of the old communist apparatus. Democracy was not, however, sufficient in the eyes of many. The Polish elite, if not always the population at large, was also determined to pursue membership of the European Union as the next step in the country's 'return to Europe'.[2] In order to achieve this goal, the country needed to comply with the EU's *acquis communautaire*, including the requirement that new members be in a position to participate in the Structural

Fund programmes and Cohesion Fund actions from the date of entry. This mandatory stipulation is obviously central for poorer applicant countries and its fulfilment dictates that a NUTS consistent classification of their territorial organization be established, which the prevailing local government structure in Poland was not. In particular, the country did not possess a NUTS 2 division of its space and it is at this level that dealings with the Commission for Structural Fund Objective 1 purposes are conducted. While other factors were also at work, this dictated the need for a thoroughgoing and domestically controversial local government reform (Gorzelak and Jałowiecki, 2000).

The ultimate result was the Local Government Reform Act that came into effect on 1 January 1999. This created sixteen NUTS 2 regions by reducing the number of voivodships from the previous 49 and re-introduced the powiat tier of government that had been abolished in 1974. The reform retained 2,489 NUTS 5 level gminas.[3] As a point of reference, the powiats, with an average population size of just over 103,000, are about three-quarters of the size of the districts in the United Kingdom that represent its NUTS 4 regions.

3. The spatial dimension of unemployment

Poland first officially recognised unemployment as a post-war labour market state in 1990. As the only measure that can be made available on a comprehensive and reliable basis at fine levels of spatial disaggregation, this paper seeks to model jobless rates based on individuals who register their position at the local labour office, the so-called registration count.[4] Fortunately, on this score, the published data have become progressively more detailed, and, from 2000, quarterly information on the unemployment problem by powiats has been released. As the number of powiats was

increased in 2002, the current analysis utilises an eight quarter, balanced panel covering the years 2000 and 2001 to examine the determinants of their unemployment rates.

The national average unemployment rate stood at 14.0 per cent in 2000, rising to 16.2 per cent for the following year, which meant that there were more than three million people registered as unemployed in Poland by the end of 2001 (GUS, 2005). These figures reflect a slow but steady increase from the lows achieved in 1998, although, even then, these still represented over 1.6 million people.[5]

The use of registration data at the level of the powiat demands that one issue is brought to the fore. This is that functional local labour markets, defined as nodal areas, the boundaries of which are traced with the goal of containing the inter-relations between its constituent entities (OECD, 2000), have not been defined for Poland. A typical way of constructing them is on the basis of the commuting patterns of workers. Examples of this approach are the Employment Zones for France, the Travel-To-Work Areas (TTWAs) for the UK, the Local Labour Systems for Italy and the Economic Areas for the United States. In practice, it is normally not possible to divide countries into an exhaustive set of labour markets and the UK, for example, adopts a criterion of 75 per cent self-containment for its TTWAs.[6] That is, the number of people who both work and live within the boundaries of an area should account for at least three-quarters of both the number who work in the area and of the number of workers living there. Additionally, the statistical authorities in the UK impose a minimum size restriction of 3,500 on the working population for a TTWA.

In general, the boundaries of TTWAs are not co-terminus with those of administratively defined districts. Using local authority areas that are not TTWAs can therefore render the calculation of unemployment rates problematic whenever, as

here, the data on unemployment and employment come from different sources: local labour offices in the case of the former and establishment surveys in the case of the latter.[7] Nevertheless, the correlation of recorded powiat unemployment rates with pseudo-unemployment rates, defined as the unemployed stock divided by the working age population, was 0.81 in 2000 and 0.86 in 2001. These coefficients are highly significant and, and, as such, very close to the residence based measure of local unemployment rates that are argued to be the ideal (ONS, 2002; Thomas, 2003). Furthermore, local authority areas tend to have powers of policy intervention that abstractly constructed TTWAs typically do not and the approximations and agglomerations of heterogeneous groups of workers inherent in the definition of the latter can render them quite unreliable and unhelpful constructs. As shown in Table 1, powiat unemployment rates in the current data set varied from a low of 2.7 per cent to almost thirty-eight per cent.

Table 1 about here

4. Theoretical approaches to spatial unemployment disparities

Numerous theoretical approaches to the explanation of regional unemployment differentials exist within the literature, although all mainstream approaches have common antecedents and therefore they tend not to be mutually exclusive. In particular, all view unemployment as an outcome of the interaction between labour demand, labour supply and some measure of the real wage. This underlying frame of reference underpins the choice of the empirical specification described below, although casual inspection is sufficient to dismiss the perfectly competitive paradigm under which flexible wages coupled with perfect capital and labour mobility combine to ensure that there is no unemployment other than that which is purely frictional. The

reality is that, in most European countries at least, differences across spatial units often persist over very long periods of time (e.g. Elhorst, 2003; Badinger and Url, 2002). Nevertheless, the tendencies inherent in the competitive model underpin the attempts to construct frameworks that yield more palatable outcomes, with those to which later reference is made now outlined briefly.

One approach looks to compensating differentials to explain persistent differences in unemployment rates across regions (Harris and Todaro, 1970). In such models, a zero migration equilibrium comes about as a result of some compensation (relatively high wages, social benefits, transaction costs or good regional amenities) offsetting a high risk of unemployment. In other words, utility is equalised across space and high wages (or non-wage benefits) are associated with high unemployment rates and the relationship persists over time. This approach has also been labelled the amenity model (Marston, 1985).

Search models, on the other hand, predict a negative relationship between unemployment and the real wage. The central idea is that the individual maximises expected wages net of search costs, which underpins that person's reservation wage. The optimal search strategy is then to accept the first wage offer in excess of the reservation wage. Migration and commuting expenses are transaction costs to be added to search costs, while the regional distribution of job vacancies is seen as part of the opportunity set. Unemployment benefits raise the reservation wage, thereby prolonging search and raising the level of unemployment. Within this framework, the size and dynamics of the local labour market matter, with large or growing labour markets affording higher vacancy rates and better job access, which speed up the job matching process.

Sector based models are also quite common explanations of spatial unemployment disparities, with areas in which declining industries are concentrated predicted to suffer relatively high unemployment rates. The malaise persists through the depreciation of existing human capital stocks and deficiencies in the adaptation of skill portfolios to the needs of growing sectors (Gripaios and Wiseman, 1996). A related hypothesis is that the level of unemployment within an area is likely to depend negatively on the degree of industrial diversity, insofar as the latter promotes greater opportunities for labour redeployment in the face of discriminatory demand shocks (Neumann and Topel, 1991). It is also useful to recall here that Schumpeter (1942) saw regional dynamism as being directly related to the number of new firm start-ups.

Most empirical treatments see the different theoretical approaches as complementary and include variables designed to capture a number of them. This tendency will be followed here, although, as is usual, it is recognised that some of the empirical analogues introduced into the model that follows could be capturing more than one theoretical influence and hence may not attract *a priori* unambiguous expectations.

5. An empirical model of powiat unemployment

As noted in the introduction, numerous analyses of the spatial distribution of Polish unemployment are now available, although invariably these have been conducted at the level of the voivodship. With the number of regions reduced from 49 to 16, such exercises are now much less informative and the current focus on powiats is warranted. However, the availability of data with which to test hypotheses regarding the determinants of unemployment is less rich at this more disaggregated level and underlies the relative simplicity of the model to be examined below. One might note,

for example, that no wage data is available. Notwithstanding the limitations, the measurable influences to be described do have theoretical underpinnings and help to throw a good deal more light on local unemployment disparities than is currently available.

In the ideal case, a model of the local unemployment rate (*UN*) would recognise that it is but one element in a more complex system of inter-related phenomena. In an accounting framework, unemployment is the difference between total labour supply and labour demand. The former, however, is determined by flows into and out of the labour market, both to and from inactivity and as a result of commuting and migration decisions. Both of these flows are normally conjectured to depend on *inter alia* the prevailing tightness of the labour market. Labour demand will also depend on the unemployment rate to the extent that the labour market is imperfect and the wage setting process depends upon it. What is more, the level of investment within a region could be hypothesised to depend upon the rate of unemployment, if this is taken as an indicator of the size of the pool of labour from which firms may choose. Such considerations lead naturally to a simultaneous multi-equation model approach, with Blanchard and Katz (1992) representing a well-known example. However, the data requirements for the examination of such system models can be formidable, which represents the reason why most regional unemployment studies employ a single equation methodology and this practice will be adopted here, although simultaneity tests are conducted and, in the event, rejected.[8].

Rurality

A central question in the case of Poland, a country in which almost thirty per cent of the labour force is still engaged in agriculture (GUS, 2004), much of which is

subsistence, and where rural development is seen as a priority issue (Ingham and Ingham, 2004), is the extent to which such areas also suffer labour market disadvantage as manifested by their unemployment rates. This issue is best explored at a reasonably fine level of spatial disaggregation in the context of multivariate analysis such as that undertaken here. Unfortunately, however, there is no one unambiguous definition of rurality. The simplest approach is that of the OECD, which defines NUTS 5 level communities as rural if they possess population densities of less than 150 people per square kilometre. At higher levels of spatial aggregation, the Organization defines predominantly rural regions as those with over 50 per cent of their population living in rural communities, significantly rural regions as those with 15 to 50 per cent of their population in rural communities and predominantly urban regions as those having less than 15 per cent of their population in rural communities (European Commission, 1997).

The approach to area classification adopted by Eurostat is somewhat more complex. It is based on a three-tier hierarchy of the degree of urbanisation. Densely populated zones comprise groups of contiguous municipalities, each with a population density greater than 500 inhabitants per square kilometre and a minimum zonal population of 50,000. Intermediate zones comprise groups of municipalities, each with a population density in excess of 100 inhabitants per square kilometre and not belonging to a densely populated zone. The zone's total population must number at least 50,000 or it must be adjacent to a densely populated zone. Sparsely populated zones are those groups of municipalities not classified as either densely populated or intermediate. Provided that the area concerned is less than 100 square kilometres, a municipality or continuous group of municipalities not reaching the required density threshold, but wholly contained in either a densely populated or intermediate zone, is

considered to be part of that zone. If it is located between a densely populated and an intermediate zone, it is considered to be intermediate (*ibid.*).[9]

In Poland, rural areas are actually defined as 'territory situated outside town administrative boundaries' (MARD, 2002). Using this definition, the Polish Ministry of Agriculture calculated that 38.1 per cent of the country's population and 93.4 per cent of its land would be classified as rural whereas, under the OECD definition, the corresponding figures are 35 per cent and 91.7 per cent, respectively (*ibid*.). The basic unit of enumeration for such calculations is the gmina, although in the Polish case the division is not simply into urban and rural communities. Thus, while such are defined, there is an additional category of mixed urban and rural gminas. The practice in official Polish publications is to classify these sub-populations separately in computing urban and rural population totals. One possible objection to this procedure is that these mixed gminas often have relatively densely populated urban cores and their rural elements may therefore in reality be suburban in character. Such reasoning brings the focus back to whether peripherality should be a component element of definitions of rurality. However, consistency would require that the issue be addressed in the case of all gminas, irrespective of their urban or rural designation. This line of enquiry is not pursued at this juncture.

For current purposes, four alternative measures of rural are defined in order that the purely administrative Polish definition of rural can be compared with the outcome from defining the same concept in a seemingly more objective, but in fact equally arbitrary, manner. The first is simply the population density of the powiat (*POPDENS*). However, the inclusion of population density in unemployment regression models has also been justified on grounds other than its role as an inverse measure of rurality and, as such, it will be discussed further below. The second is

defined as the percentage of the powiat's population resident in wholly rural gminas or in the rural part of mixed gminas (*RURPOL*). This, in effect, is the Polish administrative definition. The third is the percentage of the powiat's population living in whole or part gminas with population densities below 150 persons per square kilometre (*RUROECD*). This is a continuous variant of the OECD classification for aggregations of NUTS 5 units.[10] The final measure examined here is a dummy variable taking the value one if more than half of a powiat's total population live in whole or part gminas that are classified by the Polish authorities as being rural (*RURDUM)*. If this threshold is not exceeded, the variable takes the value zero.

There are certain reasons for expecting that Polish rural areas might have higher levels of unemployment than their urban counterparts. Thus, it is widely acknowledged that the rural population is poorly educated (*ibid.*; Ingham *et al*., 1998a; Ciechocińska, 1989) and low levels of human capital are inimical to the conduct of modern economic activity. With no measure of the stock, as opposed to flow, of educational attainment available, it is certainly the case that any measure of rurality will, at least partly, pick up this influence. Also, many of Poland's rural areas are connected but poorly to the more dynamic centres of the country's economy as a result of inferior physical communications networks (MARD, *op cit*). While noting that economic distance rather than simple physical distance is the core concern when examining the impact of isolation and peripherality, it is clear that measures of rurality will also, in the absence of more direct indicators, be capturing at least part of this effect. Both low educational attainment and remoteness would be expected to raise observed levels of unemployment. However, there is one important reason to expect that this relationship may not prevail, to which attention now turns.

Industry mix

Empirical models of unemployment measure the industry mix of an area in a large number of ways, with the choice often dictated by the availability of data. The usual approach is to argue that areas with heavy concentrations of employment in declining sectors should experience high unemployment, while those housing expanding sectors are likely to witness the opposite. Polish agriculture is certainly declining insofar as its share of GDP fell from 12.9 per cent in 1989 to just 2.6 per cent in 2003 (GUS, 1994, 2004a); however, its employment total has not adjusted accordingly and it still accounts for almost 29 per cent of all in work (GUS, 2004). In short, the evidence suggests that the sector's more than four million workers includes many that are disguised unemployed; indeed, it has frequently been regarded as a 'buffer-zone' in which some of those displaced by the economic upheavals of recent years have sought refuge. Furthermore, given that prevailing regulations prevent individuals connected to family farms receiving unemployment benefit, there may be little incentive for them to register themselves as out of work. As such, it is natural to hypothesise that the more agricultural is an area, the lower would be its unemployment rate. Deflating agricultural employment by the working age population of the powiat yields the industrial structure variable to be used in the ensuing analysis (*PCAGEMP*).[11]

A potential complication arises in the context of the current model insofar as it could be argued that the notion of rurality is more appropriately measured by the types of activity undertaken within an area than by simple population density counts or administrative conventions. Certainly in more advanced economies, with their evident suburbanisation, this might be a potent consideration. However, while this points to the need for quite subtle area classifications, in the case of Poland it is necessary to recognise that there is a strong correlation between measures of rurality

and the importance of agriculture, whether using either OECD or Polish administrative conventions, as demonstrated in Table 2. This suggests the need for caution in a regression framework and alternative specifications of the model will both exclude and include the rural variables.

Table 2 about here

Economic activity

Ideally, a measure of local economic activity such as gross regional product (GRP) would be used as a proxy for local labour demand. Unfortunately, no tolerably accurate measure of this is available at the level of the powiat and other indicators must be employed.[12] The first is the level of investment per capita (*INVPC*), which is itself an important component of GRP. Furthermore, it might also be argued to be one measure of the extent of modernisation being undertaken within a local economy. In the case of the former consideration, the natural expectation would be for there to exist a negative relationship between investment and unemployment, although matters are more ambiguous when the second possibility is taken into account. Thus, while modernisation could take the form of more progressive and more competitive enterprises that create new work opportunities, it could also take place through the rationalisation of existing operations and, at least in the first instance, the destruction of jobs. The net outcome of investment on unemployment is therefore taken to be an empirical matter.

A second possible measure of local economic activity is the number of enterprises per head of population. In Poland, an approximation to this can be achieved using official REGON enterprise registration data. It might be hypothesised that the larger is the number of enterprises within an area, the greater would be the

prevailing demand for labour and thus the lower would be the unemployment rate. At the very least, it might argued that the larger the number of enterprises, the more diversified the employment base should be and therefore the higher the chance that the local labour market will not be subject to only uni-directional shocks. On the other hand, a proliferation of businesses may simply be an indication of local economic distress.

For current purposes it can be noted that it is possible to sub-divide the number of REGON units registered in a powiat in various ways and here they are apportioned into three categories, each of which is defined *per capita*: purely domestic commercial companies (*DCPC*), commercial companies with foreign participation (*FCPC*) and other units on the REGON register (*OTPC*).[13] This sub-division will be employed in the model examined below. In the face of the conflicting mechanisms that might be at work, no particular hypothesis is advanced, although further discussion of the second category of enterprise follows in the next subsection.

Foreign investment

Attitudes towards foreign inward investment are divided. On the one hand, it can support transition by transferring technologies, managerial and labour skills, marketing channels and a market-based business culture, while at the same time supplementing domestic savings in the process of catching up with western living standards (Lankes and Venables, 1997). Such developments might be expected to reduce unemployment. On the other hand, it is seen as a threat to democratic workplace organisation and as a force acting to marginalize local economic strengths through its focus on low wage cost advantages and large scale worker flexibility (Smith and Pavlinek, 2000), although it is not immediately apparent that such

negative developments would impact deleteriously on the prevailing level of unemployment. The latter could come about if worker flexibility is reflected in greater employee turnover. Likewise, joblessness might increase if the inward investment for some reason crowded out domestic activity or if it was associated with the rationalisation of newly privatised enterprises. Also, it is possible that foreign enterprises employ more capital-intensive technologies and hence *ceteris paribus* less labour than domestic undertakings, thereby leading to higher unemployment rates.

Once again, however, measurement of the relevant concept is potentially an issue. Probably the most obvious variable to capture the impact of foreign investment would be its monetary volume, but this is not available, whether as a stock or a flow, at the level of the powiat. Nevertheless, what can be measured, as noted above, is the number of commercial companies with foreign capital participation per head. Even absent a monetary dimension, this could be useful as an indicator of the spread of foreign capital influence throughout a local economy and it will serve as at least one test of its role in the labour market. Its impact on the local unemployment rate must, however, be taken to be an empirical matter.

Labour supply and migration

Unemployment is a residual: that part of the prevailing labour supply that is not matched by an equivalent demand. Important influences on the demand for labour were discussed above, so attention here focuses on supply. Empirically, labour supply is approximated by the population of working age multiplied by the participation rate (*PCWKAGE*).[14] The participation rate is not available at the level of the powiat, although data for the population of working age are released. The basic supply pressure measure that was proposed in this instance was therefore the proportion of

the local population that is of working age. However, this was found to be highly negatively correlated with *PCAGEMP* (r=-0.88) and had to be discarded. The measure of agriculture's importance is therefore capturing both industry mix and age of workforce effects.

The labour supply of working age is of course the outcome of a number of flows, of which migration, as noted above, often receives emphasis in the literature on local unemployment. Some, such as Marston (1985), see it as a powerful and rapid equilibrating mechanism when unemployment rates diverge across space. If his theoretical perspective is the correct one, there arises an endogeneity problem when migration is introduced into an unemployment equation. However, the evidence for countries other than the U.S. does not support the causal link from unemployment through to migration so strongly (Elhorst, 2003). Also, the ongoing housing shortage in Poland (Ingham and Węcławowicz, 2001) is a notorious constraint on mobility. In the present instance therefore the migration rate (*MIG*) enters the model and the question of endogeneity is left as an empirical issue.

Population density

Population density enters models of local and regional unemployment for a number of reasons. Krugman (1991) and Fagerberg *et al*. (1997) consider the possibility that more densely populated areas generate greater agglomeration and scale economies and thereby exhibit stronger growth and create more jobs than other localities. In a similar vein, higher population densities have also been associated in the literature with lower job search costs and a quicker matching process between workers and job vacancies (e.g. Badinger and Url, 2002). On a rather different note, population density has sometimes been introduced as a variable attempting to capture the

amenities/disamenities workers associate with different areas (Partridge and Rickman, 1997). However, there is little agreement about the underlying causal mechanism. On the one hand, there are those such as Barro and Sala-i-Martin (1991) who see densely populated areas as a repellent on account of their congestion problems while, on the other hand, the cultural assets of densely populated areas might be regarded as an attraction. The overall impact of population density (*POPDENS*) on local unemployment rates must therefore be treated as an empirical matter.

Finally, some account needs to be taken of the fact that a good deal of economic activity is seasonal in nature, with agricultural work representing an obvious case in point. In order to account for this concern, seasonal dummy variables were added to the model, with quarter four taken as base.

The model

In the light of this preceding discussion, the model to be estimated is of the form:

$$UN = f(RURALITY, PCAGEMP, INVPC, DCPC, FCPC, OTPC, MIG)$$

where *RURALITY* will be represented in alternative specifications by *POPDENS*, *RURPOL*, *RUROECD* and *RURDUM*. However, in view of the correlations with *PCAGEMP* noted above, the model will also be estimated with none of these terms. Full definitions and sources of the included variables can be found in the Appendix. Prior to the assessment of the performance of the model, however, the question of the choice of appropriate estimator must be considered. This issue is addressed in the next section.

6. Econometric specification

Data sets containing information for a group of observational units over a number of time periods immediately raise questions about the choice of modelling strategy. The most straightforward option would be to ignore heterogeneity within the sample and to simply pool the data. However, if heterogeneity across groups – powiats in this application – is present, this results in biased and inconsistent estimators. Two major means are available by which to model explicitly such group-specific effects.[15] The first is the so-called Least Squares Dummy Variable (LSDV) model, commonly known as the fixed effects estimator, which accommodates heterogeneity through the inclusion of individual effects z_i, which may, or may not, be observable. This approach is tantamount to having constant terms that are specific to each unit of observation. The alternative is to incorporate the specific effects into the error term. This involves replacing the standard error ε_{it} with the composite term $\varepsilon_{it} + \mu_i$, where the random individual component μ_i differs across groups, but is constant over time. This is the random effects, or error components, model.

Which of these two models is appropriate depends upon whether the individual effects are or are not correlated with the exogenous variables. If they are, then the fixed effects model is the correct specification to use whereas, if they are not, the random effects model should be employed. As such, Mundlak (1978), a staunch advocate of the fixed effects model, contended that although the LSDV model assumes endogeneity of all the regressors, the random effects model requires that they are all exogenous. In support of the error components approach, Nerlove (2002) pointed out that fixed effects are equivalent to considering only the deviations from individual means, thereby ignoring any cross-sectional variation in them. Under this view, this means that fixed effects models 'throw away important and useful

information about the relation between the explanatory and the explained variables in a panel' (*ibid*.: 20).

Whether the random effects and the regressors are orthogonal can be ascertained using the Hausman test, which is based on the product of the difference between the parameter vector from the LSDV model (b**)** and the GLS results from the random effects model ($\hat{\beta}$) and the covariance of this difference vector. The test statistic is:

$(b - \hat{\beta})' \mathbf{\Psi}^{*-1} (b - \hat{\beta})$

where $\mathbf{\Psi}^{*-1}$ is the difference between the estimated covariance matrices from the LSDV and random effects models. Under the null hypothesis, the orthogonality assumption is upheld by the data, the value of this statistic will be small and the random effects model is the correct specification.[16] However, it is important to note that rejection of the null does not mean that the fixed effects model is correct (Nerlove, *op. cit.*). Furthermore, there is nothing to guarantee that the matrix difference $\mathbf{\Psi}^*$ will be positive definite and, although it is possible to compute a generalised inverse for the matrix difference, the test statistic is no longer valid (Greene, 2002). In such cases, a value of 0 should be recorded for the Hausman statistic and the difference between the two estimators taken as random variation, in which case the error components model is the most appropriate specification. This was the outcome in the current application, the Hausman test therefore upheld the null hypothesis of the exogeneity of the regressors and the error components approach was adopted.

The random effects model

Given the preceding diagnostics, the current random effects model introduced differences across the units of observation via the inclusion of a powiat-specific component μ_i, whereby:

$$y_{it} = x'_{it}\beta + (\alpha + \mu_i) + \varepsilon_{it}$$

and

$E[\varepsilon_{it} | \mathbf{X}] = E[\mu_{it} | \mathbf{X}] = 0$

$E[\varepsilon_{it}^2 | \mathbf{X}] = 0$

$E[\mu_{it}^2 | \mathbf{X}] = 0$

$E[\varepsilon_{it} \mu_j | \mathbf{X}] = 0$ for all i, t and j

$E[\varepsilon_{it} \varepsilon_{js} | \mathbf{X}] = 0$ if $t \neq s$ or $i \neq j$

$E[\mu_i \mu_j | \mathbf{X}] = 0$ if $i \neq j$.

In addition, regional heterogeneity was introduced into the model via voivodship specific disturbances. This can be achieved using a natural extension of the specification presented above by allowing the powiat-specific component μ_i to be heteroscedastic and then proceeding by use of one of the feasible generalized least squares (FGLS) estimators discussed in Baltagi (2001: 77-8). However, two problems arise with this approach. The first is that consistency of the variance component of such estimators requires that $T \rightarrow \infty$ whilst N remains finite. Here, as is frequently the case in panels, T is only short (eight quarters) and it is therefore unsuitable for asymptotic deductions. Second, as noted by Greene (2003: 316), any estimator of σ_{ui}^2 .would be derived from a set of residuals from the distribution of μ_i., which the error components model assumes is single valued and is repeated for all observations; as such, only one residual for each unit of observation is used to estimate σ_{ui}^2 . The

resulting estimates cannot be assumed to be efficient and, furthermore, do not converge to a population figure, even as T increases.

Regional heterogeneity is therefore introduced into the unique component of the error (ε_{it}), which captures difference by assuming that:

$Var[\varepsilon_{it}] = \sigma_j^2$, $j = 1,\ldots,G$ and $G < N$

where N represents the number of powiats contained in the G voivodships. In order to compute the required FGLS estimator, it is necessary to derive consistent estimates of the variance components. Given that OLS results on the pooled data are consistent, utilising the estimates gives:

$$\hat{\sigma}_{\varepsilon j}^2 + \sigma_\mu^2 = \mathrm{e}'^{ols}_i \, \mathrm{e}^{ols}_i / T.$$

As the residuals from a LSDV model are not contaminated by the individual specific effects, μ_i, $\sigma_{\varepsilon j}^2$ may be estimated consistently as:

$$\hat{\sigma}_{\varepsilon j}^2 = \mathrm{e}'^{lsdv}_i \mathrm{e}^{lsdv}_i / T.$$

Combining terms:

$$\hat{\sigma}_\mu^2 = \frac{1}{N}\sum_{i=1}^{N} \left[(\mathrm{e}'^{ols}_i \, \mathrm{e}^{ols}_i / T) - (\mathrm{e}'^{lsdv}_i \mathrm{e}^{lsdv}_i / T)\right] = \frac{1}{N}\sum_{i=1}^{N} (\hat{\mu}_i^2)$$

and these estimates of the variance components are used to generate the FGLS estimates reported below.

7. Results

The results of estimating five variants of the model by means of FGLS on the available 2,984 observations are presented in Table 3. Notwithstanding the evident stability, one issue of concern remains, which relates to the degree of collinearity between the rurality and agriculture intensity measure. This renders the standard

errors unreliable, although removing them entirely would incur omitted variable bias. As the collinearity problem is much less severe when population density is adopted as the rurality variable, specification (2) is *a priori* preferred.

Table 3 about here

Equation (2) explains almost 35 per cent of the variance in powiat unemployment rates, which is respectable in a panel data context, and all of the regressors are significant at the five per cent level or better. The results indicate that higher population densities – less rural areas – are associated with lower unemployment rates, with the result being highly significant. While this is the preferred specification, the results are not sensitive to changes in the precise rurality measure included.

Columns (3) to (5) report the findings when the three alternatives to population density are added to the model in turn, these being the proportion of the powiat's population located in rural gminas or the rural part of mixed gminas, the proportion of the population living in whole or part gminas with population densities in excess of 150 persons per square kilometre and, finally, a dummy variable taking the value unity for those powiats in which more than half of the population live in whole or part gminas designated by the Polish authorities as rural. With the exception of *RURDUM*, these alternatives are statistically significant, with the evidence thereby pointing to the *ceteris paribus* conclusion that the more rural the powiat, the higher is the rate of unemployment. What is more, while omitting any measure of rurality from the specification – as in column (1) – leaves the qualitative findings unchanged, it does reduce the apparent dampening impact of agriculture on local unemployment rates and also lowers the coefficient of determination.

As hypothesised, the more important is agriculture in the local labour market, the lower is the registered unemployment rate. This undoubtedly reflects the hidden unemployment in Polish farming that has attracted so much attention in both academic and policy circles. It is, however, noteworthy that this result is the opposite of that found by Faberberg *et al.* (1997) for regions within the EU, where the social role of farming is much less significant.

The parameter estimates for the three REGON variables, while suggestive, clearly indicate the need for further research regarding the underlying mechanisms at work. In the first place, higher concentrations of domestic non-commercial companies serve to reduce unemployment. In contrast, the parameter estimate for the importance of commercial domestic entities is positive. To the extent that such firms are concentrated in declining industries, they are presumably unattractive to external capital, which accords with the finding that wider foreign capital injections do, in fact, serve to lower unemployment. At the same time, it could be that a proliferation of commercial firms is one result of the privatization of state enterprises, which were, and can remain, very significant employers in their local labour markets. Nonetheless, it must be noted that the coefficient values on the REGON variables are small and any realistic changes in the latter would have negligible impacts on unemployment rates. Somewhat more straightforwardly, more favourable outcomes are observed in areas with higher *per capita* investment.

The coefficient on net migration is negative, indicating that population inflows are not associated with higher unemployment. This finding for the labour supply proxy is in line with the contention that 'people cause jobs' (Layard, 1997) and is consistent with the results for other countries reported in OECD (2000). The three seasonal dummies are all negative and significant, reflecting the fact that

unemployment is highest in the winter months and lowest in the summer. Given the relatively large size of Poland's agricultural workforce and the seasonal nature of such activity, this is an expected finding.

8. Conclusion

Unemployment is nowhere distributed evenly across space and this paper has examined the phenomenon in the case of Polish NUTS 4 level powiats. While the country overall compares badly with other members of the EU, the aggregate measure conceals local areas with both very favourable and remarkably high jobless rates. The attempt here was to explain, by means of the regression analysis of an empirical model, the patterns to be observed in the data. The resulting equations were well determined, particularly in the context of a panel data set, with the key findings summarised below.

The more significant is agriculture in the local labour market, the lower tends to be the unemployment rate. This is undoubtedly a reflection of the fact that the sector is home to a significant stock of hidden unemployment. Unfortunately, given that the reform and restructuring of farming cannot be delayed indefinitely, this finding has ominous connotations for a country with already excessive unemployment and dependency rates. Lower jobless rates are associated, as expected, with higher investment and also with greater concentrations of non-commercial domestic REGON companies. Likewise more widespread foreign capital participation appears to lower the unemployment rate. It must however be noted that the location of foreign investment in Poland is highly skewed. In contrast, increases in the number of domestic commercial companies are associated with higher unemployment rates, while net inward migration appears to serve to reduce the jobless rate.

The results also point to the conclusion that, after controlling for other factors, rural areas suffer higher levels of unemployment than others. This finding would appear to reflect the fact that such areas typically have poor infrastructure, low levels of human capital and ageing populations, all of which contribute to poor labour market performance. Finally, unemployment was not unexpectedly found to exhibit a seasonal dimension, it being a more serious problem in the winter months than during the summer.

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Table 1

Dimensions of Powiat Unemployment: Descriptive Statistics

Year	National	Minimum	Maximum	Mean	St. Deviation	n
2000	14.01	2.7	32.8	16.30	6.31	373
2001	16.22	3.2	37.7	18.77	6.68	373

Source: GUS (2002)

Table 2

Correlation Matrix for Rurality Variables

	RURDUM	RURPOL	ROECD	POPDEN	PCAGEMP
RURDUM	1	0.8104	0.7635	-0.4861	0.7108
RURPOL		1	0.9361	-0.7525	0.8111
ROECD			1	-0.7311	0.8033
POPDEN				1	-0.5222
PCAGEMP					1

Table 3

Random Effects FGLS results with Groupwise Heteroscedasticity

	(1)	(2)	(3)	(4)	(5)
Constant	22.1450 (42.22)	24.5409 (47.70)	19.1971 (29.34)	18.7314 (30.56)	22.4002 (43.45)
POPDEN		-0.0050 (11.17)			
RURPOL			0.0851 (6.86)		
RUROECD				0.1066 (8.98)	
RURDUM					-0.7720 (1.59)
PCAGEMP	-0.0926 (7.86)	-0.1410 (11.56)	-0.1519 (10.73)	-0.1670 (12.16)	-0.0844 (6.57)
RINVPC	-31.1486 (7.06)	-30.2680 (6.94)	-29.8366 (6.97)	-30.0353 (6.84)	-31.2817 (7.12)
FCPC	-0.0178 (11.10)	-0.0183 (11.67)	-0.0176 (11.26)	-0.0172 (11.12)	-0.0178 (11.13)
DCPC	0.0064 (11.03)	0.0065 (11.27)	0.0063 (10.98)	0.0061 (10.69)	0.0064 (11.10)
OTHREGPC	-0.0013 (5.20)	-0.0006 (2.29)	-0.0010 (4.29)	-0.0009 (3.92)	-0.0013 (5.33)
MIG	-0.2200 (6.34)	-0.2416 (7.06)	-0.2396 (6.97)	-0.2312 (6.77)	-0.2201 (6.37)
SDQ1	-1.2782 (18.21)	-1.2782 (18.37)	-1.2782 (18.23)	-1.2782 (18.21)	-1.2782 (18.29)
SDQ2	-1.6767 (23.89)	-1.6767 (24.10)	-1.6767 (23.92)	-1.6767 (23.89)	-1.6767 (23.99)
SDQ3	-1.2268 (17.48)	-1.2268 (17.63)	-1.2268 (17.50)	-1.2268 (17.48)	-1.2268 (17.56)
NT	2,984	2,984	2,984	2,984	2,984
$\overline{R}^2$	0.2738	0.3415	0.3591	0.3993	0.2767

DATA APPENDIX

Variable Definitions and Sources

Variable	Definition	Source
UN	Rate of registered unemployment.	GUS (2002)
PCAGEMP	Agricultural employment at divided by working age population.	GUS (2001, 2002a)
INVPC	Investment per capita.	GUS (2001, 2002b)
FCPC	REGON registered commercial law companies with foreign participation divided by population.	Data extracted from GUS maintained Small Area Database (SADB). Details at www.stat.gov.pl
DCPC	REGON registered commercial law companies without foreign participation divided by population.	SADB
OTPC	Other entities on the REGON register divided by population.	SADB
MIG	Net internal and international migration (inflows minus outflows) for permanent stay per 1000 population.	GUS (2001, 2002b)
POPDENS	Population density.	SADB
RURPOL	Per cent powiat population living in rural gminas or the rural part of mixed gminas.	SADB
RUROECD	Per cent powiat population living in whole gminas or part of mixed gminas with population density below 150 people per square kilometre.	SADB
RURDUM	A dummy variable taking the value 1 if more than 50% of a powiats resided in rural gminas or the rural part of mixed gminas and zero otherwise	SADB
PCWKAGE	Per cent population of working age.	GUS (2001, 2002b)

Notes

[1] Three of the remaining regions in this 'bottom ten' are the French overseas territories of Guyana, Guadeloupe and Réunion and so cannot realistically be compared to regions in mainland Europe.
[2] The extent to which Poland was historically 'European' in the sense that Hungary and the old Czechoslovakia once were is a moot question.
[3] Amalgamations of powiats known as sub-regions represent the NUTS 3 tier, but these are largely a statistical artefact.
[4] ILO consistent self-certification data is available from the quarterly Labour Force Survey, but it cannot be used at the local level.
[5] Subsequent increases were more dramatic, with the registration roll increasing by almost one hundred per cent between mid-1998 and the end of 2004.
[6] In areas where the working population exceeds 20,000 a level of containment of 70 per cent is deemed acceptable.
[7] The only definition of a local labour market used in Poland is in fact based on powiat boundaries.
[8] Elhorst (2003) offers a review of many of the best known regional unemployment studies.
[9] The definition therefore approaches, but does not face head-on, the important issue of peripherality.
[10] It might be noted that under the basic OECD definition some 1.4 million fewer people would be classified as rural than under the standard Polish criterion, a difference that has been considered to be 'insignificant' (MARD, 2002).
[11] Numerous other studies (e.g. Partridge and Rickman, 1997; Taylor and Bradley, 1997; Elhorst, 1995) also utilise some measure of the importance of agriculture as a measure of industry mix.
[12] Even if an accurate measure of GRP were available, the relationship between it and unemployment has been found to be complex (Elhorst, 2003: 732).
[13] Natural persons, agencies and foundations are excluded.
[14] The measure can only yield an approximation because some people participate even though they are outside the accepted working age limits. Commuting across local area boundaries represents a further distortion. However, other possible measures of labour supply, such as total population multiplied by the overall participation rate, lead to even more serious problems.
[15] The random coefficients model is not discussed as it requires a time series than is longer than the one used here.
[16] Under the null hypothesis, the statistic has a limiting chi-squared distribution with $(K - 1)$ degrees of freedom.