# THE TYRANNY OF REGIONAL UNEMPLOYMENT RATES

# Conceptual, Measurement and Data Quality Problems

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## Abstract

Regional unemployment rates come in different forms. They are the input and output of models. They are the backbone of suggestions and conclusions. The paper aims to discuss some of the problems that are associated with the use of regional unemployment rates. We will focus attention on conceptual problems, problems of data quality and on some of the new problems that have arisen due to the widespread use of new information technology. The paper looks into some more details at the official rate of regional unemployment in Germany that is based on the concept of registered unemployment. Due to technical and organizational restrictions the data utilized show shortcomings in a number of important ways. One is the mismatch of the time reference of the various components of the labour force. It can argued that in view of the severe shortcomings the official regional unemployment rate is incorrect. A way is shown how some of the these problems can be circumvented at least partly. There is still much work to be done with defining rates that measure the phenomenon of regional unemployment under the constraints of data availability and data quality.

# 1    Introduction

Regional unemployment rates come in different forms. They are the input and output of models. They are the backbone of our suggestions and conclusions. We discuss conclusions from the data. If they are suspect, conclusions are suspect. If the data are accurate, conclusions are more likely to be supportable, but much rests in the quality of interpretations. Democratic societies thrive on quality data and interpretations.

In this paper we will outline some of the problems that are associated with the use of regional unemployment rates. Solutions to many of the problems are obvious, that is, more care and attention should be given to the issues involved, but many of the problems will require an extra effort for their solution. The tyranny that threatens the research community is that data exercise a power over us that can lead to misinterpretations. Conceptual, measurement and data quality problems basically cause scholars difficulty. For many researchers, frustration and disappointment attend the realisation that a key phrase on data category has changed definition**.** For example, while this was done for good reason, the change makes it difficult to compare regional labour market data taken before year 1998 with those gathered later. One solution, of course, is to ignore the change, but then how good is the research? In addition, those working with census data know that tract boundaries often changed.

The paper is organized as follows. The section that follows argues that unemployment is a complex phenomenon difficult to measure. There are a number of ways to define and to measure this phenomenon. Two major concepts may be distinguished: the one based on labour force surveys and the other based on registration. The German case serves as the context for the discussion. Section 3 considers the regional unemployment rate that is used by official institutions in Germany and points to measurement and data quality problems. In section 4 a modification of this rate is suggested to circumvent some of these problems at least partially. Evidence is provided how these rates differ in space. The paper is rounded up with a brief summary and some conclusions.

# 2    Regional Unemployment: Conceptual, Measurement and Data Quality Issues

The dynamics of labour market processes have been the subject of considerable interest in recent times due to at least three interrelated, policy-related reasons:

- *First*, most advanced economies have been confronted with high aggregate rates of unemployment partly due to a recession of world demand for goods and service, a lack of international competitiveness in the countries concerned and changes in the labour supply (see Layard, 1991).

- *Second*, the same countries have also displayed strong variations in the rate of regional unemployment either between core and peripheral regions, between urban centres and their hinterlands or both (see Pehkonen, 1998).

- *Third*, there has been a shortage of labour supply in certain IT oriented occupations. This last phenomenon which leads to structural unemployment is more colloquially referred to as the problems of mismatch.

## 2.1 Different Types of Unemployment Viewed from a Regional Labour Market Perspective

The basic assumption underlying regional labour market research is that spatial disaggregations of the labour market provide additional insight into the observed labour market behaviour, by both identifying various internal forces operating within individual regional labour markets and revealing the external forces which are transmitted between different regional labour markets via various economic, social and institutional-political linkages. Thus, the description and definition of a regional labour market is of central importance.

Even if there is no simple definition which may be universally appropriate for all types of regional labour market analysis, three criteria seem to be important for forming a more general definition of a regional labour market (see Fischer and Nijkamp 1991): travel-to-work, the markets employment opportunities and the accessibility to market information about job offers, actual and potential future wages etc. Based upon these criteria, a regional labour market may be defined to be a spatially delineated area that fulfills the following boundary requirements:

- *first,* daily travel-to-work across the boundary is insignificant,

- *second*, the pecuniary and non-pecuniary commuting and migration costs within the boundary of the region are significantly less than those between this region and any other region of the economy,

- *third,* firms are located so that they can obtain the major properties of their potential labour supply within the boundary of the region,

- *fourth,* although information about vacancies and wages is imperfect, for the regional labour force search costs within the region are significantly less than those searching in an alternative region.


Unemployment is by no means a homogenous phenomenon. *First,* unemployment is unevenly distributed among regions and individuals. The fact that the problems of unemployment have become serious in several regional labour markets such as in traditional industrial and peripheral areas is not a controversial point. There are also strong spatial and occupational variations in unemployment that affect some individuals more than others. Especially, young workers as labour market entrants, females and foreign workers or minority groups suffer disproportionately more than others from greatly reduced labour demand (Angrist, 1998).

*Second,* there are different types of unemployment. From a regional labour market perspective five major categories of unemployment may be distinguished (Gleave and Palmer, 1980):

- *regional frictional unemployment* which arises when a person is temporarily unemployed between two jobs and occurs because a wage bargain cannot be struck because of the lack of knowledge about jobs on offer, because of interregional transport problems or a combination of both,

- *regional demand deficient unemployment* that occurs because aggregate supply exceeds aggregate labour demand,

- *regional occupational structural unemployment* that relates to an intraregional mismatch of skills, where people find their skills not employable because they have become technologically redundant in the part of country where they live,

- *interregional structural unemployment* that occurs because of a spatial mismatch between demand and supply within a specific occupational labour market,

- *regional structural unemployment* that accounts for the remaining categories of unemployment due to both a spatial and occupational mismatch of labour supply and demand.

Regional unemployment can not be evaluated with rigour for two reasons: First, published employment data are not particularly reliable for a number of reasons, and second, vacancy data which are needed for an accurate measurement of unemployment types are definitely inaccurate. Some of these inadequacies are specific to the German case that provides the context for the discussion in this paper.

## 2.2 Unemployment - A Fuzzy Concept

What is unemployment? This question that appears to have an obvious answer becomes less obvious and fuzzy in nature when examined in detail. There are a number of ways to define unemployment and the appropriation of the definition depends in large part upon its use. Unemployment may be defined with some precision in relation to individuals searching for work and their willingness to accept the market wage for a particular type of job. But, it is usually not measured in this way.

Two types of unemployment data are available in Europe: unemployment data from labour force surveys (most prominently the Commission's Labour Force Survey) and unemployment data based on registered unemployment. These data rely on different conceptual definitions and distinct measurement concepts. The issue of precision in the measurement of unemployment is currently the subject of much controversy in Europe. None of the two types of unemployment data is able to provide accurate measurement of the phenomenon. Registered unemployment is functionally related to claiming unemployment benefits. As a consequence, those who are ineligible to claim and those who claim through a different mechanism such as persons in early retirement schemes need not to register as being unemployed. The following groups of workers who might be registered as unemployed according to our conceptual definition do not figure in registered unemployment statistics:

♦ persons participating in active labour market policy programs of various kinds including early retirement schemes,

♦ young people aged under 25 years who are on training or work experience schemes,

♦ married women involved in child care, etc.

Against the underregistration some males – with occasional employment in the black economy – do register as being unemployed when in fact they are not. In Germany, many commentators and academics suggest that the true level of unemployment is about 4 percent points above the registered official level. Clearly, there is no objective resolution to this problem than saying that the boundary between unemployment and inactivity is fuzzy in nature, defined politically and economically and becomes a major problem in regional unemployment analysis if spatial variation in registration occurs among the questionable groups.

Labour force surveys may shed some light on the boundary between unemployment and inactivity, but show other serious limitations. The discussion that follows refers to unemployment data based on the Commission's Labour Force Survey, the principal source of cross-national comparative statistical data on the labour force in Europe.

## 2.3   Unemployment Figures Based on the Communities Labour Force Survey

The Commission's Labour Force Survey (LFS) has been designed to provide consistent European-wide measurement and accounting framework for employment, unemployment and inactivity in order to provide the basic statistics against which Community policy can be formulated and evaluated. The main units of measurement are households. In Germany, for example, the survey program is based on 0.45 percent of the resident population in private households including professional militaries but excluding conscripts. The survey involves interviews performed once a year and provides statistical information on three categories of the population in employable age: Persons in employment, unemployed persons and inactive persons (Eurostat, 1999). So – called inactive persons include sick and disabled, full time students, the early retired and those looking after families.

The unemployed are defined in accordance with the ILO (International Labour Office) recommendations and as an affirmative answer to a question like: "Are you currently unemployed?" The implicit definition of unemployment consequently varies with the identity of the respondent but includes those 15 years and older persons that are, *first* without work (that is, not in paid employment or self employment) during the reference period; *second*, are available to start work within two weeks of the reference period, and *third*, had used an active method of seeking work at some time during the reference period. The reference period

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involves four weeks preceding the survey interview. The survey is usually carried out at the end of April or in May. It is important to note that already a working time of one hour a week during the reference period distinguishes employment from unemployment. The tailored questionnaire allows a more focused approach to the design of questions, permits a range of interesting questions to identify the phenomenon of unemployment.

The limitations of unemployment figures based on the Community Labour Force Surveys are evident:

♦ *first*, the data refer to the reference period and, thus, do not allow to study seasonal effects;

♦ *second*, the concept of measurement relies on self-declaration of unemployment and, thus, may lead to non-sampling errors and reduce the value of the information collected;

♦ *third,* the measurements are not only affected by a wide variety of non-sampling errors, but also subject to sampling errors. Even though there are techniques available to access these errors they are generally not applied due to cost reasons.

♦ Data collection is carried out at the spatial level of NUTS II regions. This may be appropriate to measure unemployment at the national level, but less appropriate for gathering the complex picture of unemployment at a finer spatial resolution such as NUTS III regions.

## 2.4  Unemployment Figures Based on Registration

Unemployment figures based on registration are derived from administrative records of unemployed people registered as job seekers at employment offices, a conditio sine qua non to claim unemployment benefits. In Germany, the registered unemployed are those without employment, who are registered at a public employment office and are directly available for a job (insured employment) of at least 15 hours per week. "Without employment" means no employment at all, less than 15 hours per week as employed, self-employed or employment in a status of family working, or continuation of self-employment /family working to the extent of 15 to 18 hours per week (Bundesanstalt für Arbeit, 2001). This specification has serious implications for the calculation of unemployment rates as will be seen later in section 3. On

the one hand a person can be registered to be unemployed and simultaneously employed at the other as low paid part time or marginal worker (geringfügig Beschäftigter).
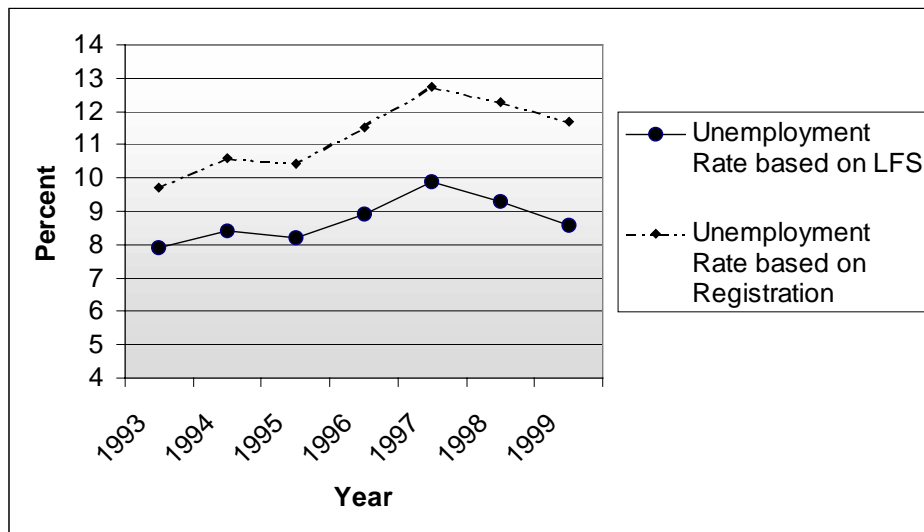


Source: Eurostat and Federal Employment Service

**Figure 1:** The Two Unemployment Rates Differ

Rates based upon registration do not tell the whole story, because some countries like Germany shift people out of unemployment statistics into categories of inactivity, notable disability and early retirement. Also students and school-leavers seeking for an apprenticeship or conscripts are not registered as unemployed. Because eligibility criteria widely differ across countries cross-national comparisons are fraught with major difficulties. Those working with registered unemployment data know that ineligibility criteria are often changed so that analysing unemployment trends even within one country may be difficult in nature. The last policy change in this respect happened in Germany in 1998.

Despite the above limitations the concept of registered unemployment tends to be superior to the concept between Community Labour Force Survey, due to at least two reasons:

♦ *First*, the concept provides continuous observations, and not only one discrete observation per year.

♦ *Second,* the data are presented at the level of administrative districts, a finer spatial resolution than the NUTS II regions.

Figure 1 provides evidence that unemployment rates based on registration and unemployment rates based on the Communities Labour Force Survey widely differ. They indeed measure different phenomena.

## 3 The Official Unemployment Rate in Germany

### 3.1 Definition

The official regional unemployment rate in Germany is based on the concept of registered unemployment and defined as follows:

$$UR_{r,t} = \frac{U_{r,t}}{LF_{r,t-n}} \qquad (1)$$

where $U_{r,t}$ denotes the number of registered unemployed in region $r$ at time $t$, while $LF_{r,t-n}$ refers to the labour force in $r$ at time $t-n$ ($n \geq 1$). $LF_{r,t-n}$ is given by the sum of the following six different labour force components:

$$LF_{r,\,t-n} = (DE_{r,t-n1} + U_{r,t-n1} + CS_{r,t-n2}) + (MW_{r,t-n3} + SE_{r,t-n3} + FW_{r,t-n3}) \qquad (2)$$

with

$DE_{r,t-n1}$     employees in dependent employment in region r at time t-n1; dependent employers are persons working under a contract of employment in exchange for a wage or salary (including persons participating in job creation programs),

$U_{r,t-n1}$     registered unemployed in region r at time t-n1,

$CS_{r,t-n2}$     civil servants in region r at time t-n2,

$MW_{r,t-n3}$     marginal part time workers in region r at time t-n3 (that is, persons working regularly below a certain number of hours per week and/or below a certain monthly wage),

$SE_{r,t-n3}$     self-employed in region r at time t-n3,

$FW_{r,t-n3}$     family workers in region r at time t-n3 (that is, persons assisting in the operation of a family business without receiving a wage or salary).

Different information sources are necessary to measure the various labour force components. The micro census is the source of data for the family workers (FW), the self-employed (SE), the marginal part time workers (MW; until 1998) and the civil servants (CS). The German micro census is an annual one percent household sample survey with the reference week at the end of April and focussing at the regional level of provinces. The micro census shows the same shortcomings as the Community Labour Force Survey and requests to convert the data from the provincial level to the district level. Finally it is important to note that there has been a policy change with respect to marginal part time workers. Since 1999 this component is being registered in the same way as dependent employees (DE) and became a part of the employment statistics of the Federal Employment Services. A registered unemployed may take up a job less than 15 hours a week and will remain in the data file of the unemployed. That is, he/she is counted as unemployed and as marginal worker at the same time.

### 3.2 Updating Procedure

The unemployment rate $UR_{r,t}$ defined by Equations $(1) - (2)$ is updated each quarter. $U_{r,t}$ is a continuous variable while the various components of the labour force in the denominator are discrete in nature, measured once a year. This is the reason why the denominator remains fixed for four quarters in the updating process starting with the June rate. In order to clarify the way of calculating the rate let us consider the regional unemployment rate for spring quarter (March 1999, for example) in comparison to the summer quarter of the same year. The spring quarter regional unemployment rate is defined as

$$UR_{r,t} = \frac{U_{r,t}}{\left(DE_{r,t-21} + U_{r,t-21} + CS_{r,t-33}\right)_{full-survey} + \left(MW_{r,t-23} + SE_{r,t-23} + FW_{r,t-23}\right)_{sample-survey}} \tag{3}$$

where t refers to March 1999. The first three components of the denominator come from data sources of full surveys and are provided by the labour market statistics of the Federal Employment Services. They include all employment relationships which are subject to social security and all registered unemployed. The reference date is June 1997 for the variables DE and U, and June 1996 for CS. The remaining three components are micro census information that had been conducted in April 1997.

The summer quarter regional unemployment rate is defined as

$$UR_{r,t} = \frac{U_{r,t}}{\left(DE_{r,t-12} + U_{r,t-12} + CS_{ri,t-24}\right)_{full-survey} + \left(MW_{r,t-14} + SE_{r,t-14} + FW_{r,t-14}\right)_{sample-survey}} \qquad (4)$$

where t refers to June 1999. Note that the lag of time between the numerator and the denominator of the rate varies between 12 and 24 months in the case of the summer rate, while between 21 and 33 months in the case of the spring rate. The reason for this is the change of the time reference of the updating procedure that happens to occur between the first and second quarter of the year.

Even with the use of modern information technologies the updating process takes much time because the components of the labour force are stored in different formats and data-standards. They have to pass through many institutional processes of the data collecting organizations, such as the local employment offices responsible for collecting the unemployed data, social insurance agencies doing the data processing of employees or the Federal Statistical Office carrying out the micro census. Data are stored in disparate legacy systems running different operating systems and they must be transferred from one system to another for integration. Changing the applications always requires converting data. These conversions are generally very complex and require much effort and time especially if the spatial resolution is not the same. Even within an organization this problem is characterized by inconsistent data models, disparate data structures, and poor quality of data. Problems arise if several organizations are involved in data processing activities such as the Federal Employment Service and Federal Statistical Office. It is not uncommon to find a situation in which there are different data structures for data-dimensions of gender, age, period of reference or region for participants of the labour force. These problems are difficult to solve in the short and medium run. Thus, we propose a modification of the above rate that circumvents, at least partly, some of the appeared methodological problems involved.

## 4    Modification of the Rate of Regional Unemployment

### 4.1   Why?

There are good reasons to argue that the rate of regional unemployment as defined by Equations (1) − (2) along with its updating procedure is incorrect:

♦ *first,* the numerator and denominator refer to distinct points in time (t versus t-n1, t-n2, t-n3),

♦ *second,* in particular the number of unemployed in the numerator and the denominator do not match (t versus t-n1)

♦ *third*, the six components of the labour force refer to distinct points in time (t-n1, t-n2, t-n3),

The problem is aggravated by the fact that the time lag n (n = n1, n2, n3) amounts to 24 months in updating the summer rate and to 33 months in updating the spring rate. Certainly, it makes not much sense to assume no change in the spatial flexibility of labour supply, shifts of demand, migration etc. in a period of 24/33 months. During this period the labour force has been changed by one percent per year on average over all districts.

### 4.2   Proposal for a Modified Rate of Regional Unemployment

In order to circumvent some of the problems mentioned above we suggest to replace the official by the following rate

$$UR_{r,t}^{\mathrm{mod}} = \frac{U_{r,t}}{\left(DE_{r,t-n} + U_{r,t-n}\right)} \tag{5}$$

where *U* and *DE* are defined as above. The unemployment data are based on registration, the dependent employment data come from the employment statistics of the Federal Employment Services. This rate does not solve the problem completely (the number of unemployed in the numerator and denominator do not match), but evidently leads to some improvements: *First,* the labour force components refer to the same point in time (t-n). *Second,* the time lag is n = 12 for the summer rate so that seasonal effects are avoided. This advantage is being achieved at the loss of four minor components of the labour force (*CS, MW, SE, FW*). This requires some evaluation. Even though the issue is still very unsettled, some remarkable evidence can be seen from Table 1.

**Table 1:** The Official Rate *UR* and the Modified Rate $UR^{\text{mod}}$ of Regional Unemployment in Comparison: Some Basic Statistics for Selected Points in Time at the NUTS III Level

| | June 1995 | | June 1996 | | June 1997 | | June 1998 | | June 1999 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *UR* | $UR^{mod}$ | *UR* | $UR^{mod}$ | *UR* | $UR^{mod}$ | *UR* | $UR^{mod}$ | *UR* | $UR^{mod}$ |
| **Minimum** | 3.4 | 3.8 | 4.0 | 4.5 | 4.4 | 4.9 | 4.2 | 4.8 | 3.5 | 4.0 |
| **Maximum** | 19.1 | 21.8 | 20.5 | 22.5 | 20.6 | 22.7 | 20.7 | 23.0 | 19.3 | 21.7 |
| **Range** | 15.7 | 18.0 | 16.5 | 18.0 | 16.2 | 17.8 | 16.5 | 18.3 | 15.8 | 17.7 |
| **Sample Mean** | 8.3 | 9.4 | 9.2 | 10.2 | 10.1 | 11.3 | 9.4 | 10.7 | 8.9 | 10.2 |
| **Standard Deviation** | 2.8 | 3.2 | 2.9 | 3.3 | 3.0 | 3.4 | 3.1 | 3.5 | 3.0 | 3.4 |
| **Coefficient of Variation** | **34.0** | **33.9** | **32.3** | **31.9** | **30.2** | **30.0** | **32.6** | **32.3** | **33.5** | **33.2** |

Source: Labour Market Statistics; Regional Information System of the Institute for Employment Research ABIS.REG

Table 1 provides some basic statistics comparing the modified rate of regional unemployment, $UR^{mod}$, with the official rate of regional unemployment, *UR*, utilizing the 327 administrative districts (NUTS III level) in summer (= second quarter) in West-Germany (1995-1999). According to the expectations, the sample mean slightly increases as does the range, the standard deviation, and the coefficient of variation. No doubt, the differences may be larger in individual cases, but are relatively low on average. The difference between $(UR_{r,t}^{\text{mod}} - UR_{r,t}) = 1.33$ percent points or measured in terms of $(UR_{r,t}^{\text{mod}} / UR_{r,t})$ x 100 equal to 15.04 percent. This latter measure ranges from 8.43 percent (district Segeberg with $UR_{6,99} = 7.9\%$; $UR_{6,99}^{\text{mod}} = 8.6\%$) to 34.86 percent (district Waldshut with $UR_{6,99} = 8.3\%$; $UR_{6,99}^{\text{mod}} = 11.2\%$).

**Registered Unemployed - Germany-West**
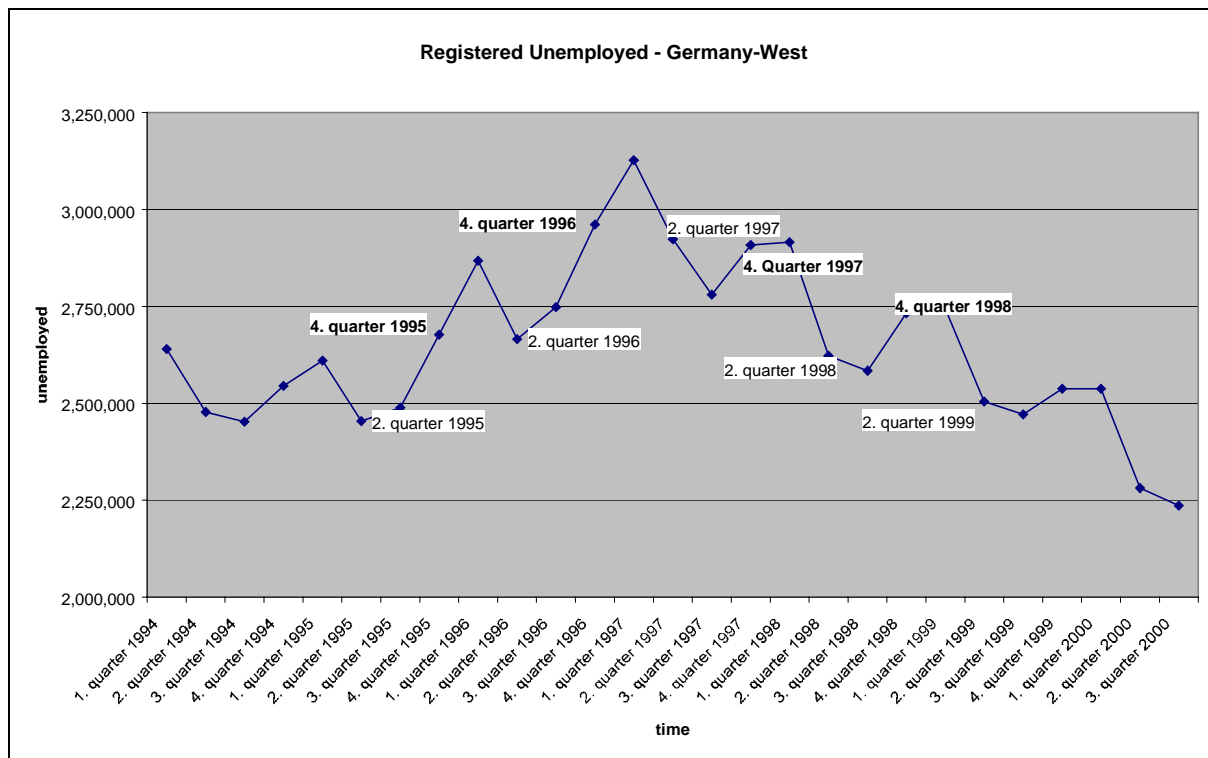
Figure 2: Number of Unemployed Persons in Germany-West (1994 - 2000)

Note that the number of unemployed in Equation (5) do not yet match, but at least they refer to the same month, in concurrent years (time lag n = 12 months). This is certainly not satisfactory even at national level (see Figure 2 for empirical evidence), but a first step towards a more useful rate of regional unemployment.
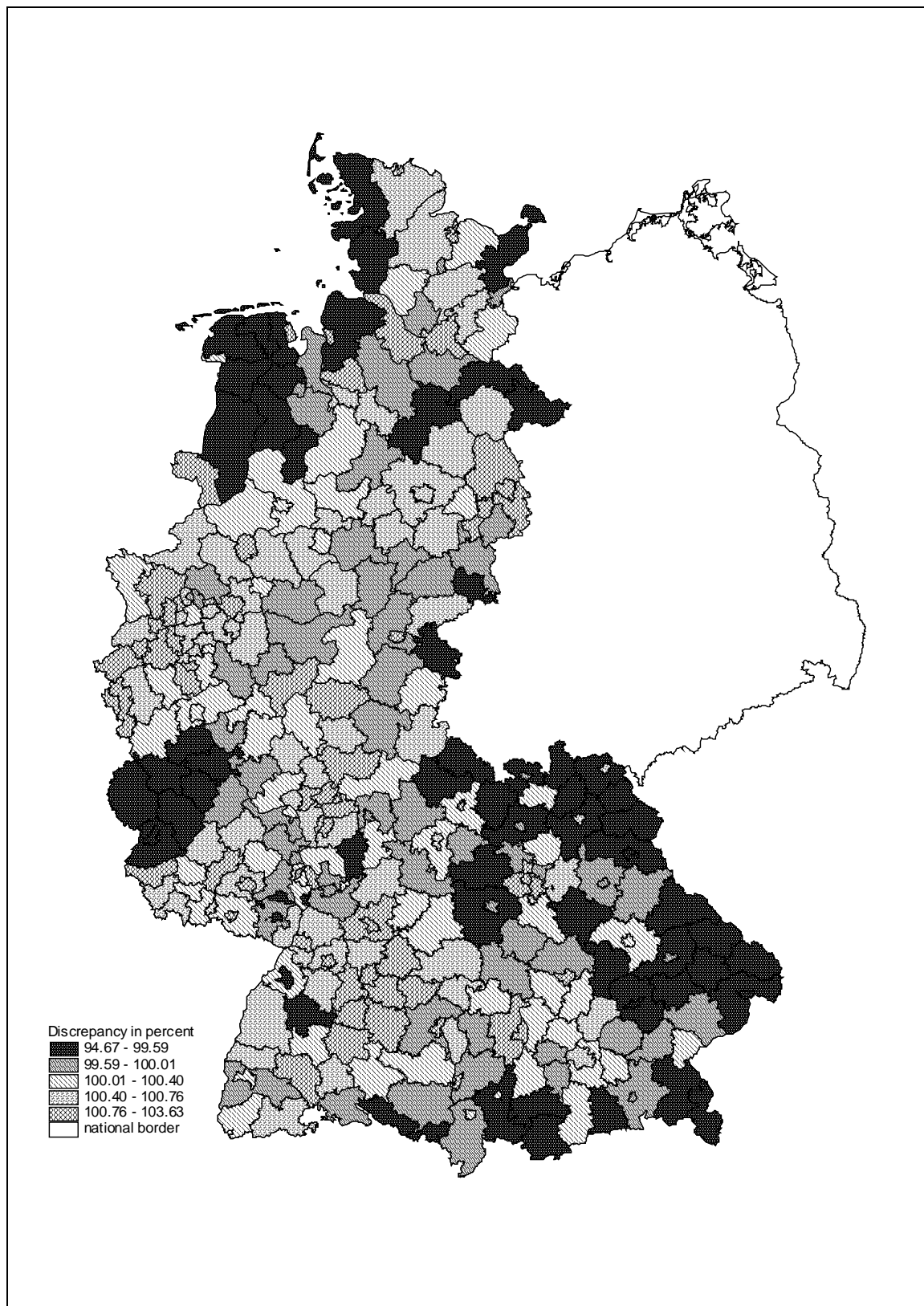
**Figure 3:** Where Do the Official Rate of Unemployment *UR* and the Modified Rate *UR^{mod}*
Differ? (December 1999, NUTS III level)

Another evident step would be to modify $UR_{r,t}^{\mathrm{mod}}$ as follows

$$UR_{r,t}^{\mathrm{mod}-1} = \frac{U_{r,\mathrm{t}}}{\left(DE_{r,t-n} + U_{r,\mathrm{t}}\right)} \tag{6}$$

where $U$ in the numerator and denominator refers to the same point in time. Figure 3 provides empirical evidence in which regions the official and the modified rate of regional unemployment differ. Differences are measured in terms of the ratio ($UR_{r,t}^{\mathrm{mod}-1} / UR_{r,t}$) at the spatial level of NUTS III regions, with t denoting the fourth quarter of 1999. Districts with a value below 100 indicates those regions where the official rate is higher than the modified rate. This occurs especially in rural regions characterised by high seasonal fluctuations of unemployed. On the other hand the official unemployment rate seems to underestimate unemployment in core cities of agglomeration. Note, that the deficiency of the official rate of regional unemployment is essentially caused by the different numbers of unemployed in the numerator and denominator which refer to different points in time. From all this evidence we conclude that there is little reason to use the official regional unemployment rate. For this reason we recommend a modified regional unemployment rate reduced to two main components: unemployed and dependent employed persons.

## 5   Summary and Conclusions

What is unemployment? This question that appears to have an obvious answer, becomes less obvious when examined in detail. There are a number of ways to define and two major concepts to measure unemployment. The appropriateness of both, the definition and the measurement concept, depends in large part upon the use. In most surveys, unemployment is defined as an affirmative answer to a question like: "Are you currently employed?" The implicit definition of unemployment consequently varies with the identity of the respondent on the one side but sheds some light on the boundary between unemployment and inactivity on the other. Registered unemployment functionally related to claiming unemployment benefits avoids the problems inherent to the surveying technique, but neglects those who claim through different mechanism such as persons in early retirement schemes. Consequently, the results may substantially differ, because they are derived from different

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notions of unemployment and, thus, populations from the one side and different measurement concepts from the other.

The paper looks in some more details at the official rate of regional unemployment in Germany that is based on the concept of registered unemployment. Data for updating this regional unemployment rate come in many different formats. The recorded observations are stored in different information systems with different architectures. The problem of sharing data among a number of organizations is complex and hard to solve. Due to technical and organizational restrictions the data utilized in the official rate of regional unemployment show various shortcomings in a number of important ways. One is the mismatch of the time reference of the numerator and denominator of the rate on one side and the distinct components of the labour force on the other. It can argued that in view of the severe shortcomings the official regional unemployment rate does not measure what it is intended to measure. The rate may be senseless in the case of regions characterised by high fluctuations of the labour force. A way is shown how some of these problems can be circumvented partly. There is still much work to be done with defining rates that measure the phenomenon of regional unemployment under the constraints of data availability and data quality. In any case much rests on the quality of interpretation.

## References

Angrist, J.D. and Krueger, A.B. (1999): Empirical Strategies in Labor Economics. In: Ashenfelter, O.C. (eds.): *Handbook of Labor Economics*, pp. 1277-1367. Elsevier, Amsterdam.

Armstrong, H. and Taylor, J. (1993): *Regional Economics & Policy*. Harvester Wheatsheaf, New York.

Boyce, D. E., Nijkamp, P. and Shefer, D. (eds.) (1991): *Regional Science. Retrospect and Prospect*. Springer, Berlin Heidelberg and New York.

Bundesanstalt für Arbeit (2001): Amtliche Nachrichten der Bundesanstalt für Arbeit. 49(4). Nürnberg.

Eichler, U. (2000): Probleme der Verknüpfung personenbezogener Einzeldaten aus verschiedenen Registern, *Allgemeines Statistisches Archiv* 84, 83-93.

Fischer, M. M. and Nijkamp, P. (1991): Major Issues in Regional Labour Market Analysis. In: Boyce, D. E., Nijkamp, P. and Shefer, D. (eds.): *Regional Science. Retrospect and Prospect*, pp. 43-78. Springer, Berlin, Heidelberg and New York.

Fischer, M.M. and Nijkamp, P. (eds.)(1987): *Regional Labour Markets*. North-Holland, Amsterdam, New York and Tokyo (Contributions to Economic Analysis 1968).

Gleave, D. and Palmer, D. (1980): Spatial Variations in Unemployment: A Typology, *Papers of the Regional Science Association* 44, 57-71

Huang, K-T., Yang, W.L. and Wang, R.Y. (1999): *Quality Information and Knowledge*. Prentice Hall, New Jersey.

Kerr, C. and Staudohar, P. D. (1994): *Labor Economics and Industrial Relations. Markets and Institutions*. Harvard University Press, Cambridge.

Killingsworth, M. R. (1983): *Labour Supply*. Cambridge University Press, New York.

Klös, H.-P. (1999): Die deutsche Arbeitsmarktstatistik, Aussagekraft und ihre Grenzen. *iw-trends* 1/99, 53-76.

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

Pehkonen, J. and Tervo, H. (1998): Persistence and Turnover in Regional Unemployment Disparities. *Regional Studies* 32(5), 445-458.

Solow, R. M. (1990): *The Labor Market as a Social Institution*. Basil Blackwell, Cambridge.

Sorrentino, C. (2000): International Unemployment Rates: How Comparable are They? *Monthly Labour Review* 123(6), 3-20.

Statistical Office of the European Communities (1999): The European Union Labour Force Survey. Luxembourg.

Wood, J. (2000): A Practical Example of Data Conversion. In: Purba, S. (ed.) (2000*): Data Managment Handbook*, pp. 341-349. 3rd Edition. Auerbach, New York