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Model-based classification of regional labour markets

For purposes of labour market policy

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Auch mit seiner neuen Reihe „IAB-Discussion Paper“ will das Forschungsinstitut der Bundesagentur für Arbeit den Dialog mit der externen Wissenschaft intensivieren. Durch die rasche Verbreitung von Forschungsergebnissen über das Internet soll noch vor Drucklegung Kritik angeregt und Qualität gesichert werden.

Also with its new series "IAB Discussion Paper" the research institute of the German Federal Employment Agency wants to intensify dialogue with external science. By the rapid spreading of research results via Internet still before printing criticism shall be stimulated and quality shall be ensured.

Contents

Abstract 4

1 The basic classification problem 5

2 Background of the analysis 7

3 The method in two steps 10
3.1 Background 10
3.2 Integration rate for further vocational training measures 12
3.3 Exit rate from unemployment into non-assisted employment 15
3.4 Consequence for the classification of employment office areas 18
3.5 Procedure used in the cluster analysis 19

4 Results 21
4.1 Comparison types 22
4.2 Strategy types 28

5 Applications and further perspectives 29

Appendix 1: Type membership of the employment office areas, and regional values of the classification variables 32

Appendix 2: Definition of the indicators included 42

Appendix 3: Maps in black and white 44

References 46

Abstract

In many countries fairly large and persistent regional disparities can be observed for a variety of economic indicators. Since these disparities can not be reduced to one single dimension, a classification system is needed to give a parsimonious overview. The article presents a system which is designed to assess labour market policy in Germany.

The innovation in this article is the development of a procedure that combines the analysis of determinants of regional disparities with standard classification approaches. The procedure is designed to solve two problems of many existing classification schemes: firstly, their purely descriptive nature and secondly, their interpretation with relation to arbitrarily chosen classification variables.

The proposed method is used to identify 12 types which show the regional diversity of labour markets in Germany.

JEL-Classification: R23, R11, R50

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1 The basic classification problem

In Europe, regional labour market disparities within many countries are of about the same magnitude as differences between countries (Südekum 2005). In many respects the unemployment rate is the most crucial variable for characterising regional labour markets. However, the labour market problems of large cities are quite different from those of rural areas - even if the unemployment rate is the same. Yet the disparities in labour markets - and in other aspects of the regional economy - have more than one dimension, so they can not be reduced to one single variable. To understand the pattern of regional disparities a strategy is required to condense the multitude of dimensions. A typology of regions is informative with respect to at least three aims:

- *To assess the consequences of special policy measures*. If regional units implementing policies have some discretion concerning the blend of measures, a comparison of the outcomes could help to find the optimal mix and to assess the effectiveness of the efforts. However, only regional units which respond to a labour market situation that really is comparable should be compared. “Good” labour markets in the rural countryside require different strategies from “bad” labour markets in agglomerations. Markets with a strong seasonal component should be treated differently again. A classification or a typology of regions could help in this respect. There are many policy strategies which have a regional component and which could be improved by using a typology of regions.
- *To obtain a clear picture of the spatial structure of the economic situation:* Is the economy characterised by large-scale or small-scale disparities? Are there sharp differences between regions or can a tendency be observed which leads to the blurring of differences? How do agglomeration effects show up? All these questions are interesting since they concern basic problems of regional analysis.
- *To provide background information for research studies.* The design of evaluation studies on the effectiveness of labour market policy is often based on data about individual respondents. The success of a group of individuals who have received a certain “treatment” is compared with their “statistical twins” that have not been treated. Within this context, it is necessary to control for the labour market situation. Again, a typology could be useful. Another important research application concerns the drawing of survey participants. The survey should map regional dis-

parities. Stratification according to types might be helpful to ensure representativeness.

The regional typology developed in this paper is related to the first aim, but is useful with respect to the other two. Its primary purpose is the support of labour market policy, which has to deal with regional variation in the labour market situation. In order to develop an appropriate policy response it is helpful to condense the disparities and thus to classify regional labour markets into types.

For classifying regions we suggest a new approach which could be used for many other classification problems. Why is a new approach required? The standard approaches to classification, either regional classification or other problems concerning classification, (see textbooks e.g. Romesburg 2004 and Kaufman, Rousseeuw 2005, Bacher 1994) proceed in the following way. Some variables are chosen on the basis of theoretical or practical considerations and then a method of cluster analysis is applied, which generates a classification. This result depends strongly on the variables chosen (and on their weights, if there are any). However, this selection of the classification variables usually poses difficulties.

It can be shown that the available theory normally gives only relatively vague hints as to which variables are to be chosen. Frequently, the selection follows an arbitrary decision based on “expert knowledge” rather than on a methodological principle which could also be applied by a third person. If no expert knowledge is available, a trial and error procedure is applied that is often guided not by the problem at hand but by the desire to generate a nice, plausible solution. The classification procedure is applied repeatedly using different sets of variables until the desired result is achieved. The approach chosen in this paper can help with the selection of variables. As a consequence the reliability of the results can be improved.

In the following this is demonstrated with the classification of German labour markets. It was developed for the assessment and management of regional labour market policy. By applying the proposed method 12 types of region can be identified, which shows the diversity of labour markets in Germany in a parsimonious way. In the short time since this classification was introduced it has been widely applied for many purposes of practical labour market policy and scientific research.

The remainder of this paper proceeds as follows. In the next section we describe the specific classification problem which we use to demonstrate our approach. In the third section the analysis is carried out. In the fourth section we present results. The final section concludes by outlining applications and perspectives.

2 Background of the analysis

Strategies of labour market policy have to deal with regional variation in the labour market situation. In Germany, regional unemployment rates vary between 4% and 27% (Sept. 2004) and other variables show similar variation. Most of these variables are correlated, but not perfectly, so neither of them may be omitted. Labour markets in rural areas are quite different from those in agglomerations, even if the unemployment rate is controlled for. In addition, there are static and dynamic regions, and some are characterized by seasonal employment patterns. Since these dimensions are also important for the success of labour market policy, a classification system was needed to take the background for policy measures into account.

The types to be identified could not simply be restricted to differences in the unemployment rate because of the multidimensionality of the problem. The classification was intended to represent both the magnitude and nature of the problems that labour market policy has to deal with. It should therefore map the “regional (dis-)advantage” for the success of policy measures. It should help in the selection of specific measures and the intensity of their application.

The typology was developed by a project group (see footnote 1) of the Federal Employment Agency. This is an institution responsible for unemployment insurance and labour market policy in Germany. It is represented by 179 local employment offices, each related to a specific regional labour market.

At the start of the project work it was clear that a technique was missing which could help to identify the variables that are crucial for the specific problem. As a consequence, there is an infinity of possible solutions with respect to both the classification variables and their weights. Any one of these approaches might be as good as any other. Subsequently, many different typologies are in use – a rather unsatisfactory situation.

The problem lies deeper, as can be inferred from the observation that the development of all or at least many classification schemes is motivated by specific purposes which are related to causal processes. The purpose might be to classify regions according to varying conditions for productivity growth. Or it might be to identify regions which promise a more successful implementation of policy measures. In the first case the classification requires an analysis of the determinants of growth. In the second case, something like the "regional advantage" has to be identified, as this will influence the success of labour market policy. Only regions that show roughly the same prospects for success with respect to the policy measures should be compared. If there is no such idea about how the different performance of regions might be related to their respective type, a typology will be useless. Therefore it could be argued that behind a classification project in most cases there is a hypothesis (or at least some kind of idea) about the typology and its relevance for an outcome variable or for a multitude of outcome variables.

However, this characterization of a classification being a parsimonious description of the determinants of an outcome does not show up in the standard procedures for constructing the classification. In some cases classification schemes are regarded as purely descriptive. But even then, the question arises as to what aspects of reality the classification should aim at and why?

A new approach is required to overcome these difficulties. In what follows, we propose a solution which extends the usual procedures of cluster analysis. For the classification of regional labour markets, represented here by employment office areas, a two-step procedure was adopted. In the first step, the exogenous determinants of the success in labour market policy were derived; in the second step these determinants – suitably weighted – were used to identify the types by means of a specific variant of cluster analysis. The two-step approach was meant to ensure that the classification obtained was grounded on variables reflecting the basic conditions for labour market policy.[1]

[1] Our approach is based on experiences made in the United Kingdom with the classification of the Jobcentre Plus districts (Schütz 2003). There again a two-step procedure

The analysis of the exogenous determinants shows the extent of the "handicap" or "disadvantage" that is associated with the respective labour market situation for the individual employment agency. Different rates of unemployment, for example, are associated with different probabilities of an unemployed person moving into employment following job-creation or training measures. It is precisely this "handicap" that the second step of the classification procedure is based upon. The regression analyses are conducted on a sound theoretical basis, as will be shown.

The approach chosen here could easily be generalized and transferred to other classification problems that are not related to labour markets. Instead of using a policy-related variable in the first step, other outcome variables are possible. Therefore, our paper follows a twofold purpose. One aim is to show how the outlined methodological problem can be overcome. The main aim, however, is the classification of regional labour markets. The method is developed up to the point which serves the classification problem at hand.

The specific properties of the procedure we have chosen can be demonstrated by a comparison with Kronthaler's (2005) analysis. His article is a positive example of a cluster analysis which is based on theoretical considerations. Kronthaler's aim is to classify (German) regions according to their growth prospects (see also Aumayr 2006 for European regions). The selection of variables follows various theories of growth. However, since he relies on standard cluster analysis, he is not able to assess whether a variable really fulfils its role as far as the theoretical expectations. Cluster analysis provides no test for the underlying theoretical hypothesis. Another problem is the weighting of the variables. Kronthaler includes public capital with the same weight as private capital. There may be doubts as to whether this is the appropriate decision. There is no criterion provided by standard cluster approaches, one has to rely on assumptions.

In many other cluster analyses the selection problem and the weighting problem are quite severe. Frequently no clear theoretical advice is available. In other cases it is disregarded. Then solely "expert-knowledge" is

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was chosen. The main difference was that in the UK case only two variables were used, which simplifies the technique greatly. No cluster analysis was required.

employed to select the variables relevant for the classification task and for choosing the weights. In our case, the problem is solved by a regression analysis preceding the application of a clustering algorithm.

Though the approach chosen in this paper can offer some improvements, one cautious remark is appropriate, which concerns the limitation of any clustering of regional labour markets. The variables on the labour market regions do not form a multivariate distribution that is divided by empty "gaps". Any criteria that are used for the formation of groups would be unable to produce clusters that are completely distinct from each other in the sense that no variable shows an overlap in value ranges between groups. The labour market regions do not constitute a set of types that are separated from each other like, for instance, a biological population in separate genera. It is possible that one member of a group - located at its "frontier" - is relatively close to other regions not of its own group but to those of a different group. This is a problem that could not be avoided.

We would like to conclude this section with a remark on terminology: we avoid the term "cluster" as far as possible (but we use approaches of "cluster analysis") in order to avoid any confusion with "regional cluster" in the sense of a spatial concentration of firms (forming a network). Instead we speak of "groups" and "types" interchangeably. The complete set of types forms a typology or a classification of regions.

3 The method in two steps

3.1 Background

Two basic criteria were chosen for analysing the determinants of labour market policy success. The first one is the flow of unemployed people into employment and the second one is the rate of people integrated in the labour market after completing a labour market policy measure.

In the case of the outflow from unemployment into employment, a well-known theoretical basis was available, which uses a so-called matching function. An overview on this topic is provided by Petrongolo and Pissarides (2001); analyses of eastern Germany using panel data collected by the Federal Employment Agency have been conducted by Burda (1994).

The matching function is based on the idea that in order to produce an exit out of unemployment into employment, an unemployed person and a vacancy must come together. Other characteristics included describe how effectively this process runs, in other words, how rapidly the supply on the labour market balances out the demand. As the exits out of unemployment refer to a certain period of time, it is possible to make a direct connection with the business-policy objective of the German Federal Employment Agency[2] of "reducing the duration of unemployment". The more rapidly a vacancy can be filled with an unemployed person, the shorter the duration of unemployment will be, other things being equal. At the same time, as long as the supply of available vacancies is not yet exhausted, the exit rate out of unemployment into employment will also rise.

As mentioned at the beginning, the results of the analyses on the basic conditions were decisive for the selection of the classification variables: only the variables that had proved to be key determinants of the success of the employment office were included in the regional classification as classification variables. The variables were also weighted according to their importance for the success of labour market policy. The actual division of the regional units into types was done with the aid of cluster analysis methods.

In both the regression analyses and the cluster analysis, the spatial reference units were the employment office areas. In the case of Berlin, however, there was a deviation from this principle: the four Berlin regions were combined into one spatial unit, firstly because of the high level of commuting within the city, and secondly because of the frequent reorganisation of the Berlin employment offices and the associated jumps in the data series.

Even though alternative spatial reference frameworks were not under discussion – due to the objectives of the project – it must nevertheless be emphasised that the 179 employment office areas (or 176 given that Ber-

[2] In Germany the Federal Employment Agency is responsible for the unemployment insurance and for a broad range of labour market policy measures. It is organized into 179 employment offices, which are responsible for the local strategies of measures to improve the labour market situation.

lin's four employment office areas are combined into one) are only suitable to a limited extent as spatial units of analysis. In many cases they do not represent functional spatial units and it is therefore quite possible that neighbouring areas which are closely linked with each other are actually assigned to different types if they show differences in the key base dimensions of the labour market situation.

The following sections first present the analyses that were necessary for selecting and weighting the variables which were then used in a cluster analysis in the next step. The exact definition of the variables included is given in Appendix 2. The following definitions were used for the two dependent variables:

- the integration rate of people completing further vocational training measures (outflow into regular employment without subsequent support, for 2001) and
- the exit rate out of unemployment into non-assisted employment (for 2002).

3.2 Integration rate for further vocational training measures

The first of the two selected success dimensions of labour market policy is described by the regional integration rate following further vocational training measures provided by the Federal Employment Agency. An "integration" is the mobility of one person into employment. The rate is calculated in a way that excludes people who receive subsequent support. The numerator of the rate includes only those flows (integrations) into the regular labour market which are achieved without the aid of further employment or training measures.

A previous study by Hirschenauer (2003) showed in particular the dominating influence of the underemployment rate. This rate includes not only the unemployed but also all those who participate in measures of active labour market policy. In the regressions carried out here, the important role of this variable is confirmed. Other regional context variables are also included to control for regional heterogeneity. Table 1 contains a summary of the results for the "best" model determined. Once again the outstanding negative impact that the underemployment rate has on the integration rate is confirmed: the higher the regional underemployment rate,

the lower the regional integration rate (see Figure 1). In a bivariate regression with only the underemployment rate as an explanatory variable the R-square was no less than 84%. In addition to the underemployment rate, two further variables prove to be significant: the rate of hirings in employment, which has a positive impact on the integration rate, and the dummy variable of eastern Germany, which produces a negative effect. In eastern Germany the integration rate is generally almost 3% lower, even if the differences in underemployment and hirings are taken into account.

Including the underemployment rate as a logarithm leads to a slightly better model fit than when the rate is used in linear form. According to this the relationship is non-linear. The R-square is 86.0% (adjusted R-square 85.7). If only western German *Länder* (Federal States) or only eastern German *Länder* are included in the analysis, then this results in R-squares of 63% and 55% respectively. These figures are still high; a certain drop in the R-square arises naturally due to the reduction in the range of the most important independent variable, the underemployment rate. This reduction is associated with the division of the data.

Table 1: Regression analysis of the regional integration rate for further vocational training measures, without subsequent support, for 2001
(176 employment offices; Berlin offices combined; R2 = 86.0%, adj. R2 = 85.7%)

Coefficients [a]

Model		Non-standardised coefficients		Standardised coefficients	T	Significance
		B	Standard error	Beta		
1	(Constant)	74.873	2.516		29.756	0.000
	Underemployment rate 2001 (Log.)	-15.229	0.943	-0.804	-16.144	0.000
	Eastern Germany	-2.731	1.117	-0.122	-2.445	0.016
	Hirings in employment 2001	0.201	0.059	0.099	3.427	0.001

a. Dependent variable: integration rate for further training without subsequent support 2001

Figure 1: Scatterplot: Integration rate for further vocational training versus underemployment rate for 176 employment office areas

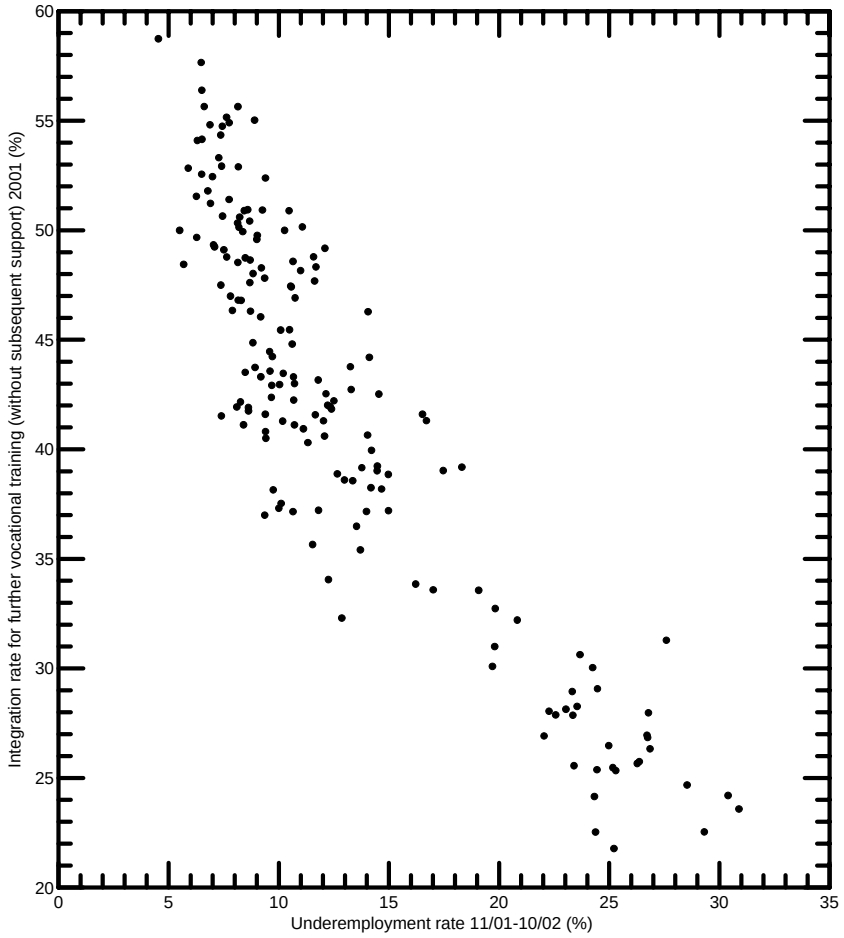


Table 1 contains only a few independent variables. A larger number of further variables was tested in the analyses for the integration rate. However, they proved to be insignificant – especially after the underemployment rate was included in the model. Some of these variables were:

- Duration and rate of vacancies
- Proportion of recipients of social assistance
- Population density
- Overall employment growth
- Employment growth by sector
- Composition of employment by qualification level
- Composition of unemployment by qualification level etc.

The analyses mentioned earlier in which eastern and western Germany were dealt with separately produced no additional findings. Only the degree of tertiarisation (i.e. the proportion of service-sector employment in total employment) proved to be relevant in some specifications.

If many variables are found to be insignificant, this does not mean that they are irrelevant for labour market policy. On the one hand their effects are only not detectable, on the other hand they are represented in the variables that have already been included. It can be assumed for example that the rate of employment growth is of key importance for the labour market. Different growth rates are reflected in different underemployment rates, however, and are then no longer significant in the regression analysis.

If one starts out from the 'explained' variation of 86%, the 'remainder' of 14% contains all other conceivable influences on the integration rate, i.e. additional variables (such as the regional structure of participants), which, however, proved not to be significant. Finally, distinctive regional features, measurement errors and differences in the efficiency of labour market policy also contribute to the 'remainder' of the variation.

The t-values are calculated by dividing the coefficients of the independent variables by their standard error as usual. Therefore they are an indicator of how closely the relevant independent variable is linked with the dependent variable. This is why they are used in the cluster analysis as weights of the variables (see below).

The regression analyses are also of interest in themselves (cf. Hirschenauer 2003 on this subject). The expected values for individual employment agencies which can be determined using these analyses show what integration rate an employment office could achieve if no local characteristics played a role.

3.3 Exit rate from unemployment into non-assisted employment

The analysis of the exogenous determinants of the exit from unemployment follows a widely-used approach with a sound theoretical basis, which uses a so-called matching function. In this approach it is assumed that for an exit out of unemployment into employment it is necessary for an unemployed individual and a vacancy to come together. This is why the different causal influences have a multiplicative effect and not an additive one as is shown in equation (1).

$$M_r = A_r U_r^{\alpha} V_r^{\beta}$$

Here M describes the matches on a regional labour market (employment office area) r, operationalised with the exits out of unemployment into employment. U is an indicator for unemployment, V for the vacancies, A is an efficiency parameter and α and β are partial elasticities. Analogous to a Cobb-Douglas production function, the labour market produces outputs, i.e. matches, dependent on inputs, in other words, vacancies and unemployed people.

A lot of work has been published about this approach. An international overview is provided in Petrongolo and Pissarides (2001) and analyses with a regional orientation are Burda (1994) and Sunde (2002) and with reference to regional evaluation of labour market policy Hujer, Blien, Caliendo, Zeiss (2006) and Hagen (2003).

The implementation of the approach in empirical analyses is simple. In order to change to a conventional regression estimate of a linear equation, the logarithm of (1) is found. The parameter Ar can be further resolved into regional variables that determine the efficiency of the matching and into the regression constant.

Table 2 shows the results. Once again a large proportion of the variation of the dependent variables can be described by the model approach. Here it amounts to 93.5% (adjusted 93.3%).

However, with these results it must be taken into account that one key independent variable, the rate of vacancies reported to the Federal Employment Agency, is only available with a market share of the employment offices which varies from region to region. Supplementary analyses using the IAB survey of the supply of jobs in the economy (Magvas, Spitznagel 2002), which are not described in detail here, show that the market share is negatively correlated with the labour market situation. The higher the level of unemployment, the larger the market share of the employment offices is.

Table 2: Regression analysis of the regional exit rate from unemployment (as a log.) into non-assisted employment 2002
(176 employment offices; Berlin combined; R2 = 93.5%, adj. R2 = 93.3%)

Coefficients [a]

Model		Non-standardised coefficients		Standard-ised coefficients	T	Significance
		B	Standard error	Beta		
1	(Constant)	1.034	0.078		13.315	0.000
	Eastern Germany	0.170	0.034	0.232	4.962	0.000
	Unemp. rate 2002 (Log.)	0.395	0.035	0.587	11.440	0.000
	Rate of vacancies 2002 (Log.)	4.130E-02	0.020	0.045	2.071	0.040
	Adjusted pop. density (Log.)	-6.75E-02	0.008	-0.209	-7.966	0.000
	Rate of recipients of social assistance (Log.)	6.848E-02	0.021	0.113	3.257	0.001
	Seasonal span of unemp. 2001	1.287E-02	0.001	0.535	20.734	0.000

a. dependent variable: exit from unemployment into non-assisted employment 2002

The IAB survey can not be utilised for analyses at the level of small area units as the sample is too small. Thus all that remains for the analyses are the vacancies reported by the Federal Employment Agency, which, however, reflect the market share of the Federal Employment Agency and the labour market situation together. For this reason the results for the matching function obtained including this variable must be used with caution. In the literature the problem has so far generally been ignored; only Sunde (2002) deals with it. At any rate the mentioned analyses using the IAB survey on the supply of jobs show that the variation in the market share is clearly smaller than the variation in the labour market situation. The results of the matching function are not of interest in themselves, but serve as an input into the classification procedure. For this reason it is advisable to include the variable of vacancies in the cluster analyses, albeit with a low weight. However, this is the case anyway, since only a relatively small t-value was established for the variable of vacancies.

It seems to be counterintuitive that a positive coefficient is determined for the unemployment rate. This corresponds with expectations, however, since the outflow from unemployment into employment can only reach

higher levels in areas where there is a sufficiently large potential of unemployed people.

3.4 Consequence for the classification of employment office areas

From the results of the regression analyses for the determinants of labour market policy it is possible to gather how close the relationship is between the dependent and the independent variables. The variables determined in the two regression analyses as being significant influences for the basic conditions of labour market policy are used in a cluster analysis for the classification. Here the t-values of the regression analyses serve as weights for the classification variables (for general information on the technique of weighting cf. Wishart 2000: 29f.). This guarantees that as much information as possible from the causal analyses is used for the classification: variables that proved in the regression analyses to have a formative influence on the basic conditions of labour market policy are given a correspondingly large weight in the classification.

The t-values from the two regression analyses are added together for each variable. In order to simplify the calculations, instead of using the unemployment rate from the matching function, the underemployment rate is used a second time. This is justified by the fact that the unemployment and the underemployment rates correlate with 0.98.

Table 3 shows the variables and the weights used. What becomes clear in particular is the outstanding significance of the regional underemployment rate. For the variable of “vacancies” on the other hand there is a low weight, which is quite correct, as the low t-value in the regression analysis is caused by the varying market share of the Federal Employment Agency. In Table 3 the following modifications were made to the weights determined directly from the regression analyses: as the analyses additionally conducted for eastern and western Germany separately had shown that the degree of tertiarisation is also of importance, this was also included in the cluster analysis. The seasonal span was given a lower weight as it constitutes more an additional characteristic than a fundamental structural dimension of regions.

Table 3: Weights determined in the analyses of the determinants for variables used in the classification of the regions

Variable	*Weight*
Underemployment rate 9/03-8/04 (%)	27.844
Eastern Germany	7.407
Hiring rate 1/03-12/03 (%)	3.427
Rate of vacancies 9/03-8/04 (%)	2.071
Adjusted population density 31.12.2003 (inhabitants/km^2)	7.966
Seasonal span 3/03-2/04 (% points)	5.367
Rate of recipients of social assistance 31.12.2003 (%)	3.257
Degree of tertiarisation 30.6.2003 (%)	2.500

The characteristic of eastern Germany proved to be unnecessary: if this variable is used with the given weight, the same result is obtained as when the variable is removed from the analysis altogether. The labour markets of eastern and western Germany still differ so greatly that the other variables included are already sufficient to make a differentiation. This is evidence of the stability of the cluster analysis result.

3.5 Procedure used in the cluster analysis

The results of the described regression analyses suggested using a larger number of classification variables for forming regional types. As the basic conditions of labour market policy are of multi-dimensional nature, it was not possible to form the types “by hand”, for example by graphing bivariate data on a scatterplot and using threshold values for classification. Instead it was necessary to use a formal procedure of cluster analysis. With this procedure groups were formed which are distinguished by a large degree of inner homogeneity (great similarity between the members of a group) and simultaneously by a large degree of external heterogeneity (great dissimilarity between the types). The procedure of cluster analysis generates clusters, i.e. groups, which are interpreted as types.

The variables named in Table 3 with the weights given there were included in the classification procedure as classification variables. It was possible to update the data for the classification procedure. The exact time to which the data refer can be seen from the table. The regressions could not be performed with the updated data because of availability problems

with the response variables. Before the weighting the variables were each standardised (z-transformed) by subtracting the mean in each case and then dividing the result by the standard deviation.

The squared Euclidean distance D was selected as the measure of similarity between the employment offices:

$$D_{rs} = \sum_{j=1} (x_{rj} - x_{sj})^2$$

Here r and s are two cases (employment office areas), j is an index for the variables used, x represents the corresponding variable values. Ward's method (Ward 1963, for applications cf. for example Bacher 1994, chapter 3) is used for the clustering. This is a hierarchical-agglomerative method in which cases are successively combined. The procedure begins with a situation in which each employment office represents its own cluster. At the end all the employment offices are fused into just one cluster. A certain intermediate stage can be understood as the appropriate partitioning. Ward's method is characterised by its combining into groups such cases which produce the smallest possible increase in a given measure of heterogeneity, the variance criterion F. For cluster p it is:

$$F_p = \sum_{i=1}^{n_p} \sum_{j=1}^{J} (x_{ij} - \bar{x}_{ij})^2$$

Here $\bar{x}_{ij}$ is the mean of the j variable in group i, in other words $\bar{x}_{ij} = \frac{1}{n_p} \sum_{i=1}^{n_p} x_{ij}$, where n_p represents the number of cases in group p. Ward's method has the advantage over other methods of clustering that it tends to lead to clusters of a similar size and that in particular singularities (clusters with only one region) are less likely than with other methods.

In a previous version of the classification the steps described were carried out and a cluster solution with 12 spatial types was selected. Diverse assessments showed that this cluster solution - based on the data included in the regression analysis presented above - was appropriate for the classification problem at hand (see Blien et al. 2004). In 2005 the classification was updated, by using newer data (see Table 3 for the time periods that the data refer to). Since the old classification has been used for some

time for purposes of labour market policy and there was an interest in continuity, in the update the old centroids were used as a starting point for the reclassification.

This reclassification is also appropriate for further optimizing a result obtained using a hierarchical cluster method. All algorithms of this class have the characteristic that units joined together in a certain stage of aggregation are no longer assigned to different clusters in the further course of the aggregation process. This can lead to units showing a greater distance to the centroid of their own cluster than to the centroid of a different one. This problem arises in particular when the cluster centroid moves in the course of the agglomeration process.

Therefore, for the purpose of updating and optimizing the results the k-means procedure was applied to the regions represented by their updated variables. This means that the partition obtained using the hierarchical procedure is taken as a starting point. Step by step, units which are closer to the centroid of a different cluster than to their own centroid are newly classified. This process is repeated until an optimum is reached. Between steps the centroids are newly calculated. The pure application of the k-means procedure leads to the reclassification of 23 (of 176) regions. In general the regions were put into a similar cluster, the overall spatial pattern of the classification did not change. In the following the results of this new classification scheme is discussed.

4 Results

The solution for the classification problem with 12 clusters was regarded as satisfactory with respect to the coherence of the combinations of variables and the range of values of the variables for individual clusters. In the following the types are characterised more closely so that the result can be assessed. The 12 clusters are called *Comparison Types*, because they were needed for purposes of benchmarking and the assessment of the success of labour market policy.

With respect to developing strategies of labour market policy a differentiation of 12 is too much, therefore a coarser classification was needed. As a consequence the Comparison Types were joined together into five *Strategy Types*. In the aggregation to the Strategy Types only two variables

were used, these were the underemployment rate and the population density. Once again extensive tests were conducted to examine whether the result was coherent and could be used to develop meaningful strategies of labour market policy. These assessments reached a positive result: the Strategy Types were suitable for deriving strategies as is shown in the description below.

4.1 Comparison types

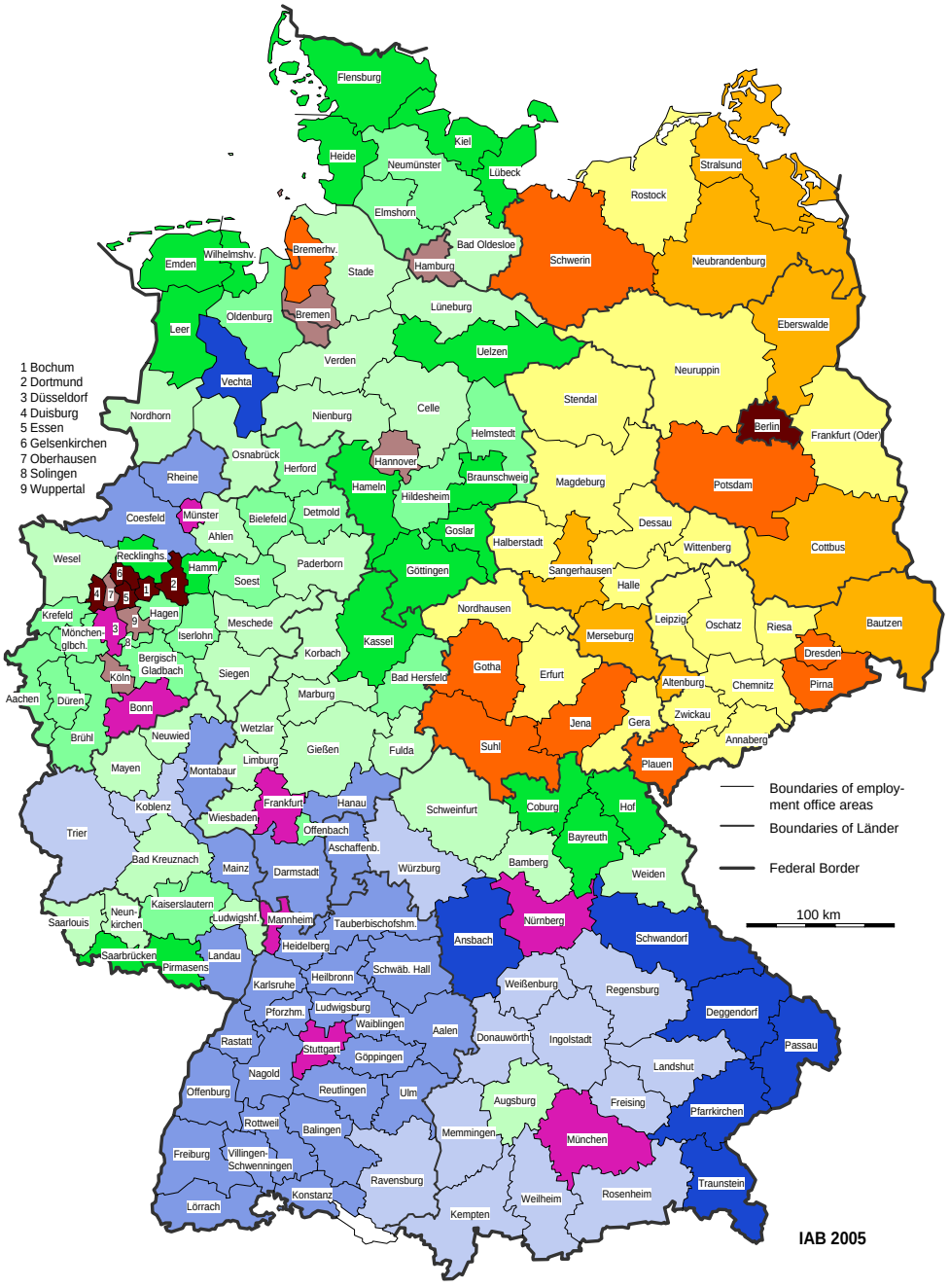
The choice of a relatively fine partitioning for the Comparison Types permits strong demands on the homogeneity of the classes. This makes comparisons of the employment offices easier, e.g. for evaluation studies and for purposes of controlling by the Federal Employment Agency.

The 12 types determined are shown in Map 1 (black and white versions of the maps are shown in the appendix). They can be seen in detail in Table 4, together with their descriptions and the number of employment office areas assigned to each of them. This is based essentially on comparisons of the cluster centroids and the national means of the classification variables. The regional values of the classification variables for all of the regions sorted according to type can be found in detail in the table in Appendix 1.

Details regarding the internal homogeneity and external heterogeneity of the regional groups can be found in Figure 2, which contains 12 boxplots. They show for the individual spatial types the median (horizontal line within the box), the 2nd and 3rd quartiles (lower and upper edges of the box) and the minimum and maximum regional values of the particular classification variable being examined (ends of the lines coming out of the box). Outliers are symbolised by stars, extreme outliers by circles. The information from the boxplots is used to further characterize the types, which is done in Table 4.

Map 1: Comparison Types 2005

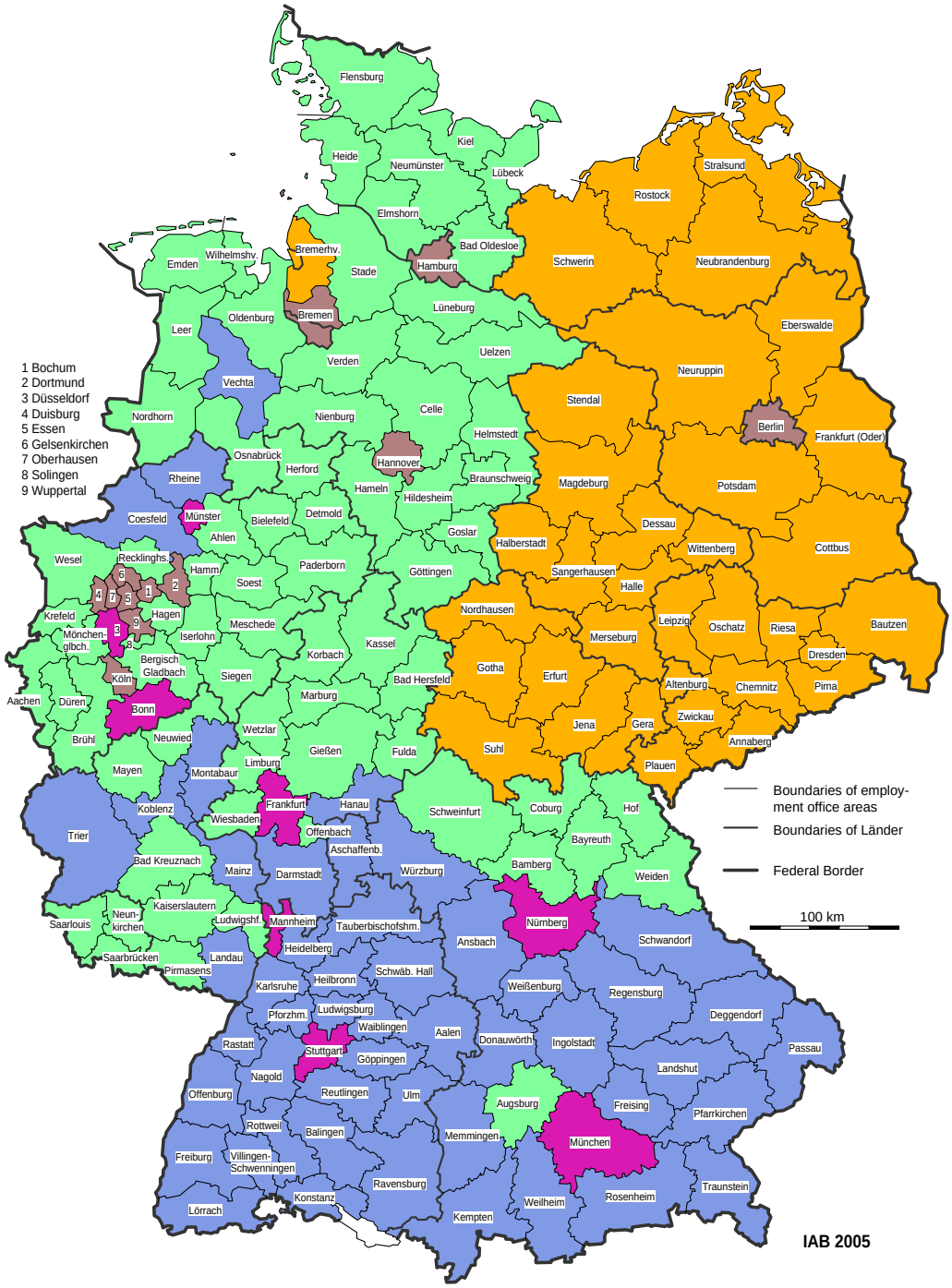
Classification of employment office areas by underemployment rate, population density, seasonal span, hiring rate, rate of social assistance recipients, degree of tertiarisation and vacancy rate



Type Ia (8):	Areas in eastern Germany with poorest labour market conditions	Type IIIb (21):	Areas with average unemployment
Type Ib (18):	Areas in eastern Germany with poor labour market conditions	Type IIIc (30):	Areas with below-average unemployment and weak dynamics
Type Ic (9):	Areas mainly in eastern Germany with high unemployment, some on border to west	Type IV (8):	Centres with a good labour market situation and strong dynamics
Type IIa (6):	Areas charcterised by big cities, with high unemployment	Type Va (7):	Rural areas with a good labour market situation and strong seasonal dynamics
Type IIb (6):	Areas mainly characterised by big cities, with moderately high unemployment	Type Vb (29):	Areas with SME structure and a good labour market situation
Type IIIa (20):	Areas with above-average unemployment but moderate dynamics	Type Vc (14):	Areas with best labour market situation and strong dynamics

Map 2: Strategy Types 2005

The Strategy Types were generated by combining the Comparison Types



Type I (35): Areas mainly in eastern Germany with a dominant job deficit

Type II (12): Areas characterised by big cities, mainly in western Germany, with high unemployment

Type III (71): Areas in western Germany with average unemployment

Type IV (8): Centres in western Germany with a good labour market situation and strong dynamics

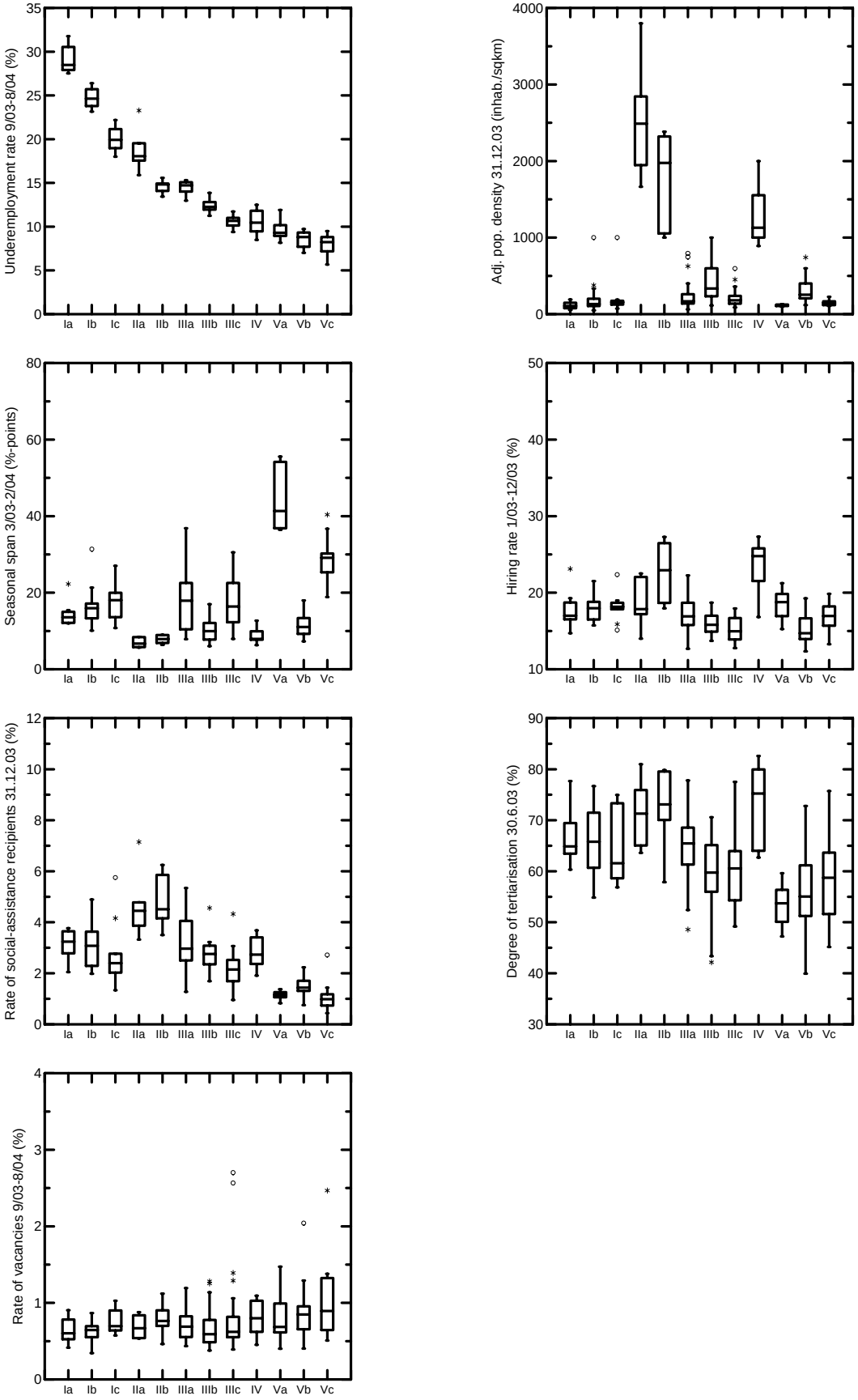
Type V (50): Areas in western Germany with a good labour market situation and strong dynamics

Table 4: Classification of employment agency areas by *Comparison Types / Strategy Types*

Comp-arison / Strategy Type	Name	Brief description	Number of Regions
I	Areas mainly in eastern Germany with a dominant job deficit		35
I a	Areas in eastern Germany with the poorest labour market conditions	• Highest underemployment • Below-average population density • Least movement on the labour market	8
I b	Areas in eastern Germany with poor labour market conditions (typical employment agency in eastern Germany)	• Very high underemployment • Little movement on the labour market	18
I c	Areas mainly in eastern Germany with high unem-ployment, some on border to west	• High underemployment • Moderate movement on the labour market	9
II	Areas characterised by big cities, mainly in western Germany, with high unemployment		12
II a	Areas character-ised by big cities, with high unem-ployment	• High underemployment • Highest population density • Moderate movement on the labour market • Large proportion of social-assistance recipients / problem groups • Above-average degree of tertiarisation	6
II b	Areas mainly characterised by big cities, with moderately high unemployment	• Average underemployment (above-average by western standards) • High population density • Above-average movement on the la-bour market • Large proportion of social-assistance recipients / problem groups	6
III	Areas in western Germany, with average unemployment		71
III a	Areas with above-average unem-ployment but mod-erate dynamics	• Above-average underemployment (high by western standards) • Moderate movement on the labour market • Above-average proportion of social-assistance recipients / problem groups	20
III b	Areas with aver-age unemployment	• Average underemployment (above-average by western standards) • Little movement on the labour market	21

Comp-arison / Strategy Type	Name	Brief description	Number of Regions
III c	Areas with below-average unemployment and weak dynamics	• Below-average underemployment (average by western standards) • Little movement on the labour market	30
IV	Centres in western Germany with a good labour market situation and strong dynamics		8
IV	Centres with a good labour market situation and strong dynamics	• Below-average underemployment • High population density • Greatest movement on the labour market • High degree of tertiarisation • Little seasonal employment • Above-average proportion of social-assistance recipients / problem groups	8
V	Areas in western Germany with a good labour market situation and strong dynamics		50
V a	Rural areas with a good labour market situation and strong seasonal dynamics	• Below-average underemployment • Lowest population density • Below-average proportion of social-assistance recipients / problem groups • Greatest seasonal span	7
V b	Areas with SME structure and a good labour market situation	• Low underemployment • Average population density • Below-average proportion of social-assistance recipients / problem groups • Above-average rate of reported vacancies	29
V c	Areas with best labour market situation and strong dynamics	• Lowest underemployment • Below-average population density • Great movement on the labour market • Lowest proportion of social-assistance recipients / problem groups • Large seasonal span	14

Figure 2: Boxplots of the classification variables by Comparison Types



The boxplots make it clear that the ranges of values for the classification variables of the individual spatial types more or less overlap. A better division of the types was not possible as the reality of Germany's labour market does not show any clear dividing lines; instead transitional areas can be detected. Nevertheless, due to the preliminary causal analysis, it is possible to claim that the classification reveals key dimensions of reality, which is the basis for the assessments of labour market policy. This claim is supported by the fact that clear trends in the included variables can generally be determined for the types; in particular the underemployment rate has a considerable effect on the order of the types. Some variables only show values diverging from the average for certain types. This is true, for example, of the population density.

As has already been mentioned, the results presented here have a predecessor, which was produced with the same data that was used in the regression analyses shown above (not with the updated data set). In this predecessor the final step with the application of the k-means procedure was skipped. It was possible to use this attempt to assess the stability of the classification. It could be seen that only 22 regions (12 %) were classified differently., It can therefore be concluded that the situations on the labour markets under observation show a high degree of persistence. The underemployment rate, for example, changes only slightly between years. The correlation between 2003 and 2004 was as high as 0.9938. Therefore the classification is robust in the time dimension. Nevertheless, for use in research and in practical purposes of labour market policy the classification must be checked regularly at intervals of about two years.

4.2 Strategy types

For strategic purposes of labour market policy the 12 *Comparison Types* were combined into five *Strategy Types* according to only two criteria, the unemployment rate and the population density. The types are:

- I: Areas mainly in eastern Germany with a dominant job deficit
- II: Areas characterised by big cities, mainly in western Germany, with high unemployment
- III: Areas in western Germany with average unemployment
- IV: Centres in western Germany with a good labour market situation and strong dynamics

V: Areas in western Germany with a good labour market situation and strong dynamics

The five types determined, together with the employment office areas assigned to them, are shown in Map 2 (black and white versions of the maps are shown in the appendix).

5 Applications and further perspectives

The regression analyses in the first stage and the subsequent weighting of the classification variables constitute the main differences from the standard approach to classification. The purpose of the regressions is to avoid any arbitrariness with respect to the choice of variables. The combination of regression and cluster analysis suggested in this paper offers a new approach. It permits special insights as the classification goes beyond pure description and reflects the causal processes underlying labour market outcomes.

Two variants of the classification scheme for employment office areas were developed, one with five and the other with twelve types. By means of (dis-)aggregation they could be transformed into each other. The classification with five types is intended for the development of policy strategies. The other one serves to facilitate comparisons of the employment office areas.

The classification helps with respect to the three applications described in the introduction:

- To depict the spatial structure of the labour market in a parsimonious way.
- To support (the assessment of) labour market policy.
- To support further research.

Maps 1 and 2 give a parsimonious overview of the spatial structure of the labour market. An overall divide between the labour markets of eastern and western Germany is clearly visible. Within western Germany the north and south are relatively distinct, though there are some “islands” that are associated with other types. In addition, it is clear that the agglomerations are different. In general, they show higher values of underemployment than rural areas do. We find a tendency for labour markets of neighbour-

ing regions to be similar. Relatively large groups of neighbouring regions are visible with common labour market conditions. They are not confined to the boundaries given by administrative units (Federal States).

It would not be possible to identify these spatial structures in a classification based on only one or two variables. Type Va, for example, is characterized by high variation in unemployment throughout the year as there are seasonal dynamics present. Therefore these regional units form a type of their own.

Coming to the second application, our classification could be used for the assessment and support of labour market policy. The *Comparison Types* permit a differentiated portrayal of regional labour markets: employment office areas with similar structures are grouped together in the same type. This classification enables employment offices to compare themselves with others in the appropriate peer group. The solution to current problems, the blend of labour market policy measures, the success of certain approaches – all this can now be subjected to comparative analyses within types. Although differences remain within the types as regards the basic conditions set by the labour market, the complexity of reality is nonetheless reduced. It is further possible to differentiate within types since the results for the distance matrix between all labour market areas is available.

The *Strategy Types* provide an appropriate classification for all applications that require a more abstract assessment of the situation of the individual employment offices. This concerns in particular the development of policy strategies, for which a smaller number of types is preferable. Since the labour market situation in Germany varies so much between regions, the type-specific strategies should therefore be rather different, too. In type I regions (parts of eastern Germany with a pronounced job deficit), mobility subsidies and job-creation schemes constitute an appropriate response, whereas in type V regions (prosperous parts of western Germany), the emphasis is on improved job matching.

The third application of the classification scheme is related to its usefulness for research studies. Since our classification scheme was obtained on the basis of regression analyses and grounded in theory, it is useful for

more than purely descriptive characterisations. It may provide condensed background information on regional labour markets in studies using micro-data. Recently, several labour market evaluation studies have found this classification helpful (see e.g. Hujer et al. 2005). Micro-level analyses of the effects of labour market policy employ these types as controls for different labour market situations. There is a comprehensive research programme on the effects of the German labour market reforms, which started in autumn 2004. Within this programme, which is being carried out by researchers from several German institutes, the Strategy Types are being employed.

Another intended application concerns the selection of random samples that are stratified according to the types. They ensure that the sample will be representative of the multitude of labour market constellations. It is impossible to stratify directly with respect to more than two or three variables, because of the implied combinatorical explosion. The labour market types represent more variables. Again the Comparison Types can be used for the characterization of the labour market situation.

The by far most frequent application of our typology (and its immediate predecessor) has been in the field of labour market policy, i.e. with respect to the third application. For some time now, the allocation of the budget for active labour market policy has been based at least partly (for some time parallel to the use of a “formula allocation”, cf. Blien 2004) on target agreements between the Federal Employment Agency and its regional offices. Our classification has provided guidance for these agreements. Also, reports on current issues are routinely based on this classification scheme. The Federal Employment Agency frequently employs these types for comparing the efficiency of employment offices. For instance, an assessment of their performance regarding the integration of target groups into employment is based on a comparison of employment offices of the same type.

Appendix 1: Type membership of the employment office areas, and regional values of the classification variables

The definition of the following variables is given in Appendix 2.
(1) Euclidean distance to the cluster centroid (sorted)
(2) Underemployment rate 9/03-8/04 (%)
(3) Adjusted population density 31.12.2003 (inhabitants/km^2)
(4) Rate of vacancies 9/03-8/04 (%)
(5) Hiring rate 1/03-12/03 (%)
(6) Rate of social-assistance recipients 31.12.2003 (%)
(7) Degree of tertiarisation 30.6.2003 (%)
(8) Seasonal span 3/03-2/04 (% points)

Employment office area (Land (abbr.), key number, name)			1	2	3	4	5	6	7	8
Type Ia (8) Areas in eastern Germany with the poorest labour market conditions										
ST	46	Merseburg	3.23	29.57	154.96	0.68	17.09	3.76	62.87	12.08
BB	35	Cottbus	5.55	28.05	87.97	0.89	16.89	3.20	64.97	11.98
TH	70	Altenburg	6.02	28.50	192.07	0.41	14.70	2.05	60.34	14.52
SN	72	Bautzen	6.75	27.78	141.53	0.55	16.82	2.44	64.00	13.43
BB	36	Eberswalde	7.72	27.52	69.71	0.62	16.22	3.13	67.58	15.43
MV	34	Stralsund	8.97	28.49	84.20	0.90	23.11	3.62	77.66	22.30
MV	31	Neubrandenburg	11.23	31.53	52.95	0.50	19.28	3.66	71.32	13.71
ST	47	Sangerhausen	12.11	31.78	126.93	0.59	18.17	3.29	64.75	12.16
Arith. mean				29.15	113.79	0.64	17.79	3.14	66.69	14.45
Minimum				27.52	52.95	0.41	14.70	2.05	60.34	11.98
Maximum				31.78	192.07	0.90	23.11	3.76	77.66	22.30
Std. dev.				1.66	47.74	0.17	2.53	0.61	5.50	3.40

Employment office area (Land (abbr.), key number, name)			1	2	3	4	5	6	7	8
Type Ib (18) Areas in eastern Germany with poor labour market conditions										
SN	79	Riesa	2.92	24.50	165.72	0.55	16.74	2.89	59.01	15.70
BB	38	Neuruppin	3.16	25.08	67.73	0.55	16.51	3.03	64.23	15.25
BB	37	Frankfurt (Oder)	3.63	24.76	100.00	0.54	15.72	3.19	70.11	13.32
SN	76	Oschatz	4.79	24.44	123.54	0.34	16.43	2.25	60.76	20.73
SN	71	Annaberg-Buchholz	5.28	24.92	199.18	0.65	16.32	2.29	54.81	21.34
TH	97	Nordhausen	5.80	25.63	110.89	0.75	16.76	2.00	60.68	18.28
ST	48	Stendal	5.86	25.92	49.61	0.65	17.79	3.12	64.69	16.71
ST	45	Magdeburg	5.89	23.68	135.99	0.64	19.12	3.63	71.49	12.55
ST	42	Dessau	6.31	25.92	127.22	0.87	18.41	4.03	69.11	15.77
TH	93	Erfurt	6.78	23.79	201.70	0.70	21.33	3.04	72.92	11.24
ST	49	Wittenberg	7.45	26.20	83.49	0.48	16.53	3.53	60.29	17.02
TH	94	Gera	7.51	23.25	158.99	0.60	18.39	1.98	64.99	17.14
SN	92	Zwickau	7.60	23.34	377.60	0.70	18.15	2.06	59.60	17.15
SN	73	Chemnitz	7.63	23.15	277.15	0.69	18.80	2.41	67.98	15.34
ST	44	Halle	7.65	25.72	334.26	0.51	18.51	4.45	76.70	10.11
MV	32	Rostock	8.87	26.39	106.70	0.86	19.77	3.93	76.56	16.11
ST	43	Halberstadt	9.33	24.11	123.26	0.59	16.13	3.28	66.57	31.35
SN	75	Leipzig	13.25	24.37	1000.00	0.68	21.51	4.89	76.58	10.67
Arith. mean				24.73	207.95	0.63	17.94	3.11	66.51	16.43
Minimum				23.15	49.61	0.34	15.72	1.98	54.81	10.11
Maximum				26.39	1000.00	0.87	21.51	4.89	76.70	31.35
Std. dev.				1.06	216.75	0.13	1.72	0.86	6.65	4.84

Employment office area (Land (abbr.), key number, name)			1	2	3	4	5	6	7	8
Type Ic (9) Areas mainly in eastern Germany with high unemployment, some on border to west										
TH	95	Gotha	3.48	19.92	136.31	0.64	17.95	2.03	56.83	18.05
MV	33	Schwerin	4.98	20.06	71.49	0.90	18.32	4.16	68.03	21.11
TH	98	Suhl	6.09	19.49	125.81	0.57	15.88	1.33	57.11	19.98
TH	96	Jena	6.53	21.15	155.05	1.03	17.85	1.68	61.55	18.04
SN	77	Pirna	7.26	21.28	160.91	0.61	15.10	2.40	61.40	17.72
BB	39	Potsdam	7.55	18.57	117.87	0.97	18.99	2.74	74.54	13.60
SN	78	Plauen	11.94	22.20	188.36	0.70	18.70	2.10	58.62	27.05
HB	217	Bremerhaven	12.89	18.00	174.01	0.65	18.16	5.75	73.33	10.76
SN	74	Dresden	13.10	18.98	1000.00	0.85	22.34	2.77	74.96	10.83
Arith. mean				19.96	236.65	0.77	18.14	2.77	65.15	17.46
Minimum				18.00	71.49	0.57	15.10	1.33	56.83	10.76
Maximum				22.20	1000.00	1.03	22.34	5.75	74.96	27.05
Std. dev.				1.38	288.33	0.17	2.04	1.38	7.61	5.20
Type IIa (6) Areas characterised by big cities, with high unemployment										
NW	341	Duisburg	6.87	17.86	2175.58	0.53	17.19	4.78	65.05	5.64
NW	321	Bochum	7.97	17.56	2845.29	0.71	17.20	3.32	66.91	5.78
NW	345	Gelsenkirchen	10.58	19.54	1946.87	0.63	14.00	4.15	63.60	6.29
NW	333	Dortmund	12.27	18.28	1664.43	0.84	18.51	3.86	75.92	7.14
NW	343	Essen	14.18	15.89	2802.07	0.88	22.05	4.74	75.71	8.45
BL	900	Berlin	28.18	23.28	3799.81	0.54	22.52	7.15	80.98	8.39
Arith. mean				18.73	2539.01	0.69	18.58	4.67	71.36	6.95
Minimum				15.89	1664.43	0.53	14.00	3.32	63.60	5.64
Maximum				23.28	3799.81	0.88	22.52	7.15	80.98	8.45
Std. dev.				2.52	774.62	0.15	3.24	1.33	7.10	1.26

Employment office area (Land (abbr.), key number, name)			1	2	3	4	5	6	7	8
Type IIb (6) Areas mainly characterised by big cities, with moderately high unemployment										
NW	391	Wuppertal	7.76	14.09	1654.11	0.46	17.97	4.35	57.85	6.84
NW	371	Oberhausen	9.36	14.77	2321.50	0.70	18.66	3.50	70.04	8.95
NI	237	Hannover	10.05	14.89	1053.70	0.71	23.24	4.67	75.99	8.99
HH	123	Hamburg	10.60	13.43	2296.31	1.12	26.48	5.85	79.82	7.12
NW	357	Köln	10.96	15.58	2384.19	0.82	27.29	4.16	79.55	6.34
HB	214	Bremen	11.42	14.93	1000.00	0.90	22.64	6.25	70.20	8.68
Arith. mean				14.61	1784.97	0.79	22.71	4.80	72.24	7.82
Minimum				13.43	1000.00	0.46	17.97	3.50	57.85	6.34
Maximum				15.58	2384.19	1.12	27.29	6.25	79.82	8.99
Std. dev.				0.75	644.43	0.22	3.86	1.05	8.26	1.18
Type IIIa (20) Areas with above-average unemployment but moderate dynamics										
NI	231	Göttingen	3.02	14.78	166.08	0.61	17.02	2.85	64.51	14.30
NI	227	Goslar	4.39	14.81	156.37	1.00	15.50	4.18	65.53	16.85
NI	271	Uelzen	4.45	15.02	61.53	0.73	17.89	2.56	67.96	21.33
NI	247	Leer	4.57	14.44	118.36	0.56	17.60	2.44	57.89	23.19
NI	281	Wilhelmshaven	4.97	15.22	261.97	0.70	16.54	4.18	73.33	19.00
NI	234	Hameln	5.21	15.04	189.01	0.52	14.14	3.20	62.62	14.08
RP	551	Pirmasens	5.72	14.43	169.67	0.60	15.45	1.71	59.11	13.11
NI	211	Braunschweig	5.72	13.99	401.21	0.59	17.21	3.74	63.76	10.27
BY	731	Hof	6.11	15.11	145.96	0.76	16.77	1.80	52.40	19.68
SH	135	Lübeck	7.00	15.30	258.34	0.99	20.83	3.92	74.82	21.91
SH	131	Kiel	7.41	14.31	260.65	0.83	16.42	4.49	77.81	9.08
SH	119	Flensburg	7.47	13.47	114.15	0.82	19.55	3.24	74.65	24.92
HE	435	Kassel	8.14	13.65	219.66	0.55	16.04	5.16	65.97	10.64
SH	127	Heide	8.36	14.80	87.96	0.68	19.20	2.76	67.80	31.21
BY	727	Coburg	8.63	13.50	154.45	0.46	16.32	1.28	48.57	19.46
NW	351	Hamm	9.54	15.21	746.36	0.50	14.58	2.86	65.39	9.24

Employment office area (Land (abbr.), key number, name)			1	2	3	4	5	6	7	8
NW	375	Recklinghausen	10.60	14.68	792.63	0.44	12.66	3.08	69.16	8.86
BY	723	Bayreuth	11.45	12.97	131.15	0.79	18.18	1.39	60.02	30.88
SL	555	Saarbrücken	11.51	14.03	626.31	0.88	22.27	5.34	67.66	7.83
NI	224	Emden	12.85	15.33	145.80	1.19	21.60	2.85	64.28	36.86
Arith. mean				14.50	260.38	0.71	17.29	3.15	65.16	18.14
Minimum				12.97	61.53	0.44	12.66	1.28	48.57	7.83
Maximum				15.33	792.63	1.19	22.27	5.34	77.81	36.86
Std. dev.				0.70	214.34	0.20	2.46	1.16	7.30	8.32

Type IIIb (21) Areas with average unemployment

SH	115	Elmshorn	3.25	12.15	285.70	0.38	15.82	2.69	63.72	10.69
NW	335	Düren	3.62	12.03	290.18	0.97	15.67	2.87	61.18	7.17
NW	353	Herford	3.86	12.06	361.16	0.48	16.45	1.69	55.98	9.96
NI	244	Hildesheim	5.09	11.82	241.29	0.69	14.12	3.23	59.73	14.57
NW	383	Soest	5.42	11.71	232.66	0.55	13.71	2.13	55.20	10.37
NW	315	Bergisch Gladbach	5.49	11.41	509.15	0.44	15.95	2.13	55.21	7.77
SH	139	Neumünster	5.59	12.26	144.90	0.45	15.43	3.08	70.58	12.94
NW	331	Detmold	5.65	12.99	291.83	0.49	14.63	2.35	56.33	16.99
NW	355	Iserlohn	5.71	11.95	428.52	0.47	14.92	2.76	42.17	8.76
RP	515	Kaiserslautern	5.72	11.68	183.13	0.77	14.34	2.18	65.67	12.07
NW	361	Krefeld	5.81	12.82	773.95	1.14	17.00	2.61	60.75	8.46
NW	325	Brühl	5.84	11.25	334.99	0.64	15.19	2.47	64.87	8.63
HE	411	Bad Hersfeld	5.97	12.52	112.91	0.75	17.39	3.05	59.08	16.52
NI	261	Oldenburg	6.00	12.88	204.31	0.85	18.25	3.06	68.71	14.62
HE	451	Offenbach	6.21	12.12	600.00	0.78	14.91	4.56	66.44	6.98
NW	311	Aachen	6.39	13.50	615.37	0.56	17.00	3.14	68.99	10.23
NW	317	Bielefeld	7.60	13.86	554.26	0.54	17.41	3.11	58.92	6.04

Employment office area (Land (abbr.), key number, name)			1	2	3	4	5	6	7	8
NI	241	Helmstedt	7.73	12.36	162.29	1.28	18.71	2.17	43.35	10.89
NW	365	Mönchengladbach	7.99	12.45	948.87	1.25	15.90	2.62	65.12	7.18
NW	385	Solingen	8.34	12.80	1000.00	0.58	17.36	3.00	51.60	9.18
NW	347	Hagen	9.54	13.70	960.40	0.59	14.85	3.14	59.13	7.11
Arith. mean				12.40	439.80	0.70	15.95	2.76	59.66	10.34
Minimum				11.25	112.91	0.38	13.71	1.69	42.17	6.04
Maximum				13.86	1000.00	1.28	18.71	4.56	70.58	16.99
Std. dev.				0.72	281.95	0.27	1.39	0.60	7.58	3.21

Type IIIc (30) Areas with below-average unemployment and weak dynamics

NW	363	Meschede	3.28	10.71	142.61	0.55	14.92	2.24	50.83	18.30
NI	221	Celle	3.60	10.93	131.99	0.61	14.87	2.66	68.72	16.66
SL	559	Saarlouis	3.77	10.21	313.66	0.90	16.82	2.14	52.65	15.75
BY	811	Augsburg	3.99	10.63	313.67	0.76	17.27	1.45	60.79	13.80
RP	547	Neuwied	4.19	11.11	254.59	0.71	13.90	1.77	54.31	13.07
NI	257	Nordhorn	4.39	10.31	125.02	0.51	15.53	1.73	57.23	22.84
NW	381	Siegen	4.40	10.01	236.94	0.61	14.99	1.57	50.85	16.13
BY	747	Schweinfurt	4.56	10.74	114.05	0.56	17.00	1.67	54.31	22.06
SH	111	Bad Oldesloe	4.72	10.54	200.48	1.06	14.13	2.39	61.63	9.87
NI	267	Stade	4.74	11.03	114.85	0.51	16.68	2.99	62.67	21.36
RP	531	Mayen	4.88	10.06	172.23	0.59	14.28	1.46	63.96	22.56
SL	539	Neunkirchen	4.98	11.02	361.72	0.54	13.09	2.72	57.78	12.85
NW	313	Ahlen	5.01	10.83	215.15	0.82	13.19	1.39	50.95	12.29
HE	443	Limburg	5.19	9.78	238.11	0.70	13.65	2.81	67.69	15.93
RP	511	Bad Kreuznach	5.22	11.72	136.34	0.82	15.00	1.96	62.19	17.96
NW	373	Paderborn	5.27	11.67	184.24	0.53	15.79	2.14	60.61	19.18
HE	455	Wetzlar	5.41	10.88	227.47	0.64	12.76	2.37	49.17	11.94
HE	439	Korbach	5.53	11.28	91.76	0.58	15.27	2.26	56.47	24.24
NI	251	Lüneburg	5.56	11.16	160.28	0.39	13.38	2.15	70.69	13.65
NI	264	Osnabrück	5.60	10.54	233.59	0.85	17.95	2.32	61.57	9.43

Employment office area (Land (abbr.), key number, name)			1	2	3	4	5	6	7	8
NW	387	Wesel	5.98	10.85	344.29	1.39	14.04	2.12	62.11	9.83
HE	427	Gießen	6.06	11.00	185.22	0.79	13.54	3.07	68.63	9.86
HE	423	Fulda	6.21	9.67	159.07	0.63	16.81	2.52	60.50	23.68
NI	277	Verden	6.37	9.40	136.77	0.56	14.15	1.79	66.32	17.89
BY	719	Bamberg	7.86	9.82	175.57	0.55	13.69	0.95	56.07	26.93
HE	447	Marburg	7.97	10.09	173.85	1.29	16.09	1.69	65.37	28.98
BY	751	Weiden	9.83	11.53	86.91	0.54	17.62	1.45	52.64	30.55
HE	459	Wiesbaden	10.43	10.59	450.56	0.58	17.84	4.32	77.52	7.94
NI	254	Nienburg	12.05	10.13	96.84	2.70	14.15	2.76	60.22	23.08
RP	523	Ludwigshafen	12.33	10.46	594.26	2.57	16.17	2.48	52.58	11.10
Arith. mean				10.62	212.40	0.83	15.15	2.18	59.90	17.32
Minimum				9.40	86.91	0.39	12.76	0.95	49.17	7.94
Maximum				11.72	594.26	2.70	17.95	4.32	77.52	30.55
Std. dev.				0.59	113.18	0.54	1.56	0.66	6.88	6.18

Type IV (8) Centres with a good labour market situation and strong dynamics

NW	367	Münster	6.29	10.51	890.02	0.45	24.30	2.81	81.56	10.19
HE	419	Frankfurt	6.32	10.39	1093.71	0.86	27.33	3.63	82.60	6.29
BW	677	Stuttgart	6.85	9.36	1164.40	1.02	25.29	2.63	62.69	8.02
BW	644	Mannheim	7.06	11.70	1184.29	1.09	20.67	3.19	64.41	7.61
NW	323	Bonn	10.10	9.58	1000.00	0.51	16.81	2.10	76.20	7.84
BY	735	Nürnberg	10.47	12.51	1000.00	1.03	22.37	2.65	63.61	12.70
NW	337	Düsseldorf	11.31	11.94	1921.70	0.73	25.68	3.68	78.36	7.86
BY	843	München	14.03	8.50	2000.00	0.74	25.92	1.91	74.26	9.59
Arith. mean				10.56	1281.77	0.81	23.55	2.83	72.96	8.76
Minimum				8.50	890.02	0.45	16.81	1.91	62.69	6.29
Maximum				12.51	2000.00	1.09	27.33	3.68	82.60	12.70
Std. dev.				1.40	430.33	0.24	3.44	0.65	8.23	2.00

Employment office area (Land (abbr.), key number, name)			1	2	3	4	5	6	7	8
Type Va (7) Rural areas with a good labour market situation and strong seasonal dynamics										
BY	743	Schwandorf	5.90	10.78	100.16	0.66	16.99	1.14	50.56	41.35
BY	815	Deggendorf	6.28	9.57	109.81	1.47	18.78	0.98	54.74	53.60
BY	851	Pfarrkirchen	6.60	9.30	128.07	0.57	15.24	1.19	49.61	36.44
NI	274	Vechta	6.69	9.10	127.21	1.17	21.25	1.16	47.21	37.17
BY	711	Ansbach	7.05	8.80	97.25	0.40	16.90	0.83	53.72	36.50
BY	859	Traunstein	9.22	8.16	114.58	0.81	20.07	1.33	59.62	54.75
BY	847	Passau	12.14	11.92	124.45	0.69	19.60	1.38	57.96	55.58
Arith. mean				9.66	114.50	0.83	18.40	1.14	53.35	45.05
Minimum				8.16	97.25	0.40	15.24	0.83	47.21	36.44
Maximum				11.92	128.07	1.47	21.25	1.38	59.62	55.58
Std. dev.				1.28	12.71	0.37	2.11	0.19	4.51	9.14
Type Vb (29) Areas with SME structure and a good labour market situation										
BW	651	Offenburg	2.92	8.30	222.65	0.74	16.64	1.23	55.03	12.89
BW	627	Heilbronn	3.14	8.81	373.59	1.29	15.62	1.53	52.51	9.95
NW	377	Rheine	3.44	9.13	246.58	0.68	13.35	1.34	58.72	11.28
RP	543	Landau	3.69	9.10	246.42	0.97	14.34	1.34	62.46	14.75
BW	617	Freiburg	4.31	8.42	277.96	0.85	17.36	1.71	67.50	11.03
BW	634	Konstanz	4.32	8.89	297.50	0.66	16.74	1.94	58.77	17.11
BW	687	Villingen-Schwenningen	4.51	9.23	206.59	1.20	17.05	1.39	52.30	13.44
BW	674	Schwäbisch Hall	4.57	7.91	131.95	0.93	14.18	1.31	50.97	11.18
BY	715	Aschaffenburg	4.77	9.59	254.09	0.92	15.82	1.48	53.12	13.90
BW	681	Tauberbischofs-heim	4.88	8.76	118.65	0.96	12.32	1.23	50.49	14.50
HE	431	Hanau	4.94	9.58	293.08	0.73	15.02	2.16	61.15	11.42
NW	327	Coesfeld	4.96	9.63	231.96	0.90	14.05	1.15	55.71	10.08
BW	637	Lörrach	5.11	7.71	200.29	0.61	13.98	1.79	53.13	10.68

Employment office area (Land (abbr.), key number, name)			1	2	3	4	5	6	7	8
BW	624	Heidelberg	5.13	8.75	510.73	0.78	16.50	1.27	68.57	8.30
BW	684	Ulm	5.20	8.60	209.28	0.85	19.25	1.37	61.15	13.00
RP	535	Montabaur	5.46	8.98	188.09	0.75	12.34	1.43	55.25	17.97
BW	664	Reutlingen	5.50	7.60	307.47	0.51	14.29	1.47	58.20	9.25
BW	657	Rastatt	5.85	7.69	319.24	1.28	17.11	1.71	49.37	12.37
BW	654	Pforzheim	5.96	9.64	468.07	0.87	13.94	1.37	49.09	7.68
BW	614	Balingen	6.47	9.50	154.22	0.43	12.53	1.28	48.19	13.39
BW	621	Göppingen	6.53	7.63	600.00	0.77	14.71	1.32	51.23	8.13
BW	671	Waiblingen	6.62	7.51	485.52	0.48	13.53	1.46	52.45	8.81
BW	631	Karlsruhe	6.63	9.00	564.00	0.99	18.66	1.75	67.63	9.28
HE	415	Darmstadt	6.65	9.71	400.71	1.26	15.36	2.24	62.35	7.28
BW	647	Nagold	6.99	7.55	170.18	0.58	14.06	0.75	55.43	17.49
BW	611	Aalen	7.05	9.73	211.88	0.40	13.73	1.45	45.06	8.09
BW	667	Rottweil	8.04	7.35	184.16	0.60	13.41	1.43	39.91	10.84
BW	641	Ludwigsburg	9.64	7.00	742.07	0.89	15.19	0.97	54.25	9.85
RP	527	Mainz	10.19	9.34	422.78	2.04	18.37	2.19	72.80	8.54
Arith. mean				8.64	311.71	0.86	15.15	1.48	55.96	11.46
Minimum				7.00	118.65	0.40	12.32	0.75	39.91	7.28
Maximum				9.73	742.07	2.04	19.25	2.24	72.80	17.97
Std. dev.				0.84	154.47	0.33	1.90	0.34	7.40	2.97

Employment office area (Land (abbr.), key number, name)			1	2	3	4	5	6	7	8
Type Vc (14) Areas with best labour market situation and strong dynamics										
BY	827	Ingolstadt	3.84	7.73	157.34	0.90	15.44	0.95	48.37	26.08
BY	739	Regensburg	4.11	8.81	143.63	0.92	18.21	1.18	58.65	30.26
BY	855	Rosenheim	4.20	8.20	149.56	0.80	19.85	0.88	63.94	30.30
BY	839	Memmingen	4.45	8.49	179.64	0.65	15.69	0.61	52.50	24.92
RP	563	Trier	4.81	8.85	105.81	1.38	16.99	1.44	63.36	29.68
BY	831	Kempten	5.15	8.79	139.12	0.61	19.26	0.98	58.81	26.75
BY	759	Würzburg	5.40	8.28	167.91	1.13	16.56	1.00	63.66	19.70
BY	863	Weilheim	6.49	7.18	117.86	0.71	16.94	0.73	61.16	36.72
BW	661	Ravensburg	7.59	7.07	174.08	1.38	16.26	1.19	51.60	18.84
BY	819	Donauwörth	7.59	6.91	109.65	0.51	13.86	1.06	46.74	28.59
BY	755	Weißenburg	8.66	9.50	109.33	0.52	13.26	0.99	53.39	29.70
RP	519	Koblenz	9.53	9.22	226.74	1.33	19.51	2.72	75.71	25.35
BY	823	Freising	11.61	5.68	166.86	0.89	17.15	0.44	72.78	30.05
BY	835	Landshut	11.97	7.49	128.58	2.47	17.90	0.71	45.16	40.40
Arith. mean				8.01	148.29	1.01	16.92	1.06	58.27	28.38
Minimum				5.68	105.81	0.51	13.26	0.44	45.16	18.84
Maximum				9.50	226.74	2.47	19.85	2.72	75.71	40.40
Std. dev.				1.06	33.80	0.52	1.97	0.54	9.26	5.70
Total Arith. mean				13.88	430.19	0.78	17.07	2.49	62.09	16.32
Minimum				5.68	49.61	0.34	12.32	0.44	39.91	5.64
Maximum				31.78	3799.81	2.70	27.33	7.15	82.60	55.58
Std. dev.				6.09	590.95	0.35	2.99	1.21	8.87	9.36

Appendix 2: Definition of the indicators included

(1) *Underemployment rate:* The denominator of the underemployment rate is composed of the dependent labour force (including 4,021,163 unemployed in the Federal Republic of Germany for 2002) and participants in the following measures (2002):

Job-creation measures	127,811
Structural adjustment measures without SAM-OfW (SAMs for business enterprises in eastern Germany)	54,415
Full-time further vocational training measures	299,029
Rehabilitation measures aimed at occupational reintegration	38,319
German language courses	23,956
Short-time work in the full-time equivalent	85,488
Partial retirement	59,050
Benefit recipients in accordance with § 428 Social Code III	274,451

The sum of the measures together with the unemployed form the numerator of the rate

(2) *Adjusted population density:* For this the population figures of the employment office areas was related to their surface areas. In order to balance out large differences in the territory covered by the employment offices (in the case of Nürnberg the surrounding area belongs to the employment office area, in the case of Hannover it does not), the value for some city employment offices was adjusted.

(3) *Rate of vacancies:* The vacancies reported to the Federal Employment Agency were related to the dependent labour force.

(4) *Hiring rate:* The recruitments in employment subject to social security contributions in one year were related to the dependent labour force.

(5) *Rate of social-assistance recipients:* The recipients of social assistance aged between 18 and 65 (1999) were related to the reference quantity of the underemployment rate (2002).

(6) *Degree of tertiarisation:* Here the people in employment subject to social security contributions in the economic activities 62-94 (WZ73) are counted as a proportion of employment as a whole.

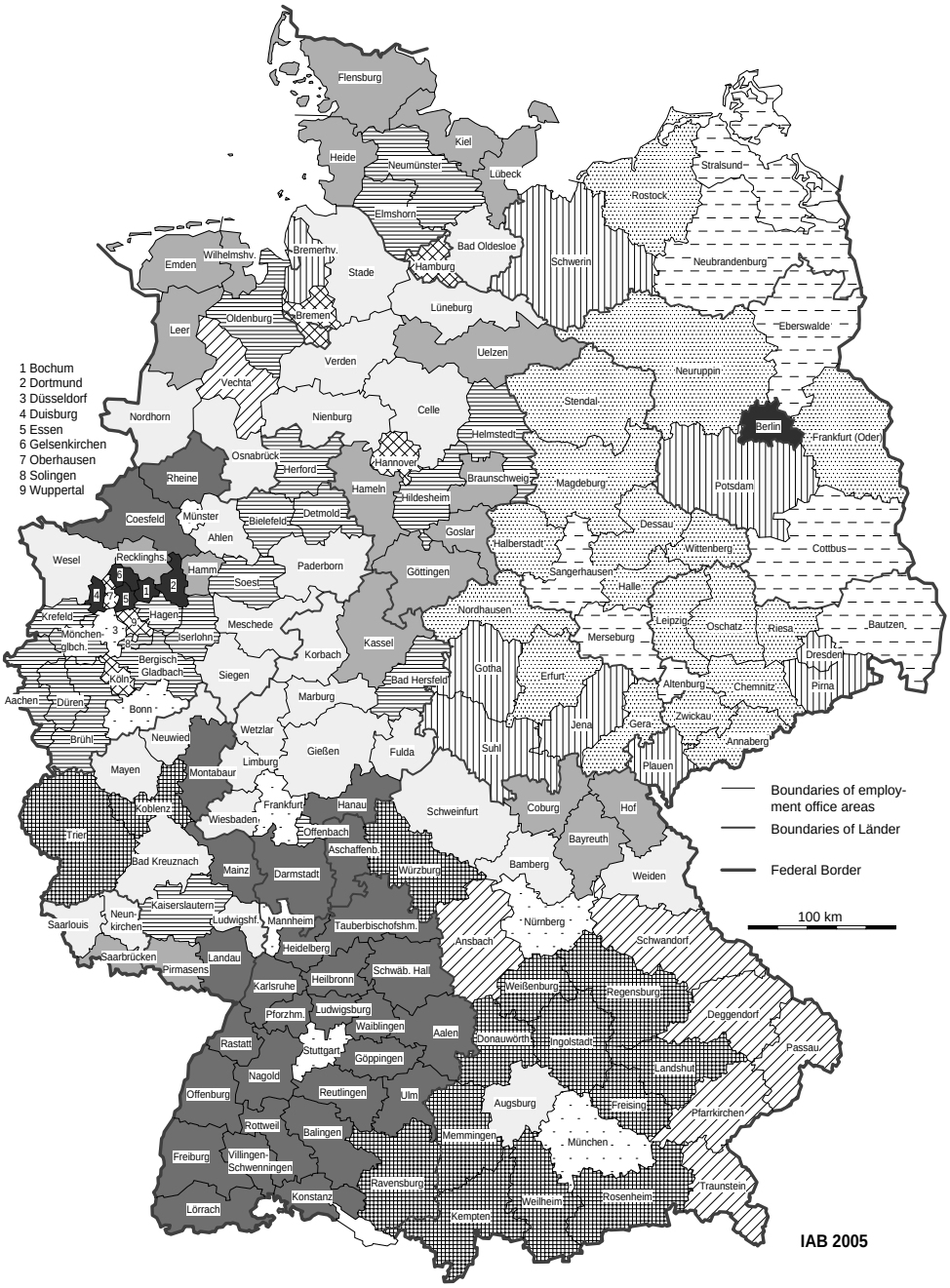
(7) *Seasonal span:* For this, moving annual averages are applied to the monthly values of the time series and in this way the “level”, the “trend” of the series is calculated. For the reference year (here 2001), the relative seasonal deflection is calculated for each month. Then the maximum and minimum of the seasonal deflections during the reference year are ascertained. The seasonal span then results as the difference between the maximum and the minimum. When determining the moving annual averages the calculation generally used in the Federal Employment Agency moving over 13 months is taken, i.e. the starting and finishing months each count as half.

Unless stated otherwise, annual averages were always used. In the case of 2002, the figures referred to the first ten months of that year and the last two months of 2001.

Appendix 3: Maps in black and white

Map 1: Comparison Types 2005

Classification of employment office areas by underemployment rate, population density, seasonal span, hiring rate, rate of social assistance recipients, degree of tertiarisation and vacancy rate



Type Ia (8): Areas in eastern Germany with poorest labour market conditions

Type Ib (18): Areas in eastern Germany with poor labour market conditions

Type Ic (9): Areas mainly in eastern Germany with high unemployment, some on border to west

Type IIa (6): Areas charcterised by big cities, with high unemployment

Type IIb (6): Areas mainly characterised by big cities, with moderately high unemployment

Type IIIa (20): Areas with above-average unemployment but moderate dynamics

Type IIIb (21): Areas with average unemployment

Type IIIc (30): Areas with below-average unemployment and weak dynamics

Type IV (8): Centres with a good labour market situation and strong dynamics

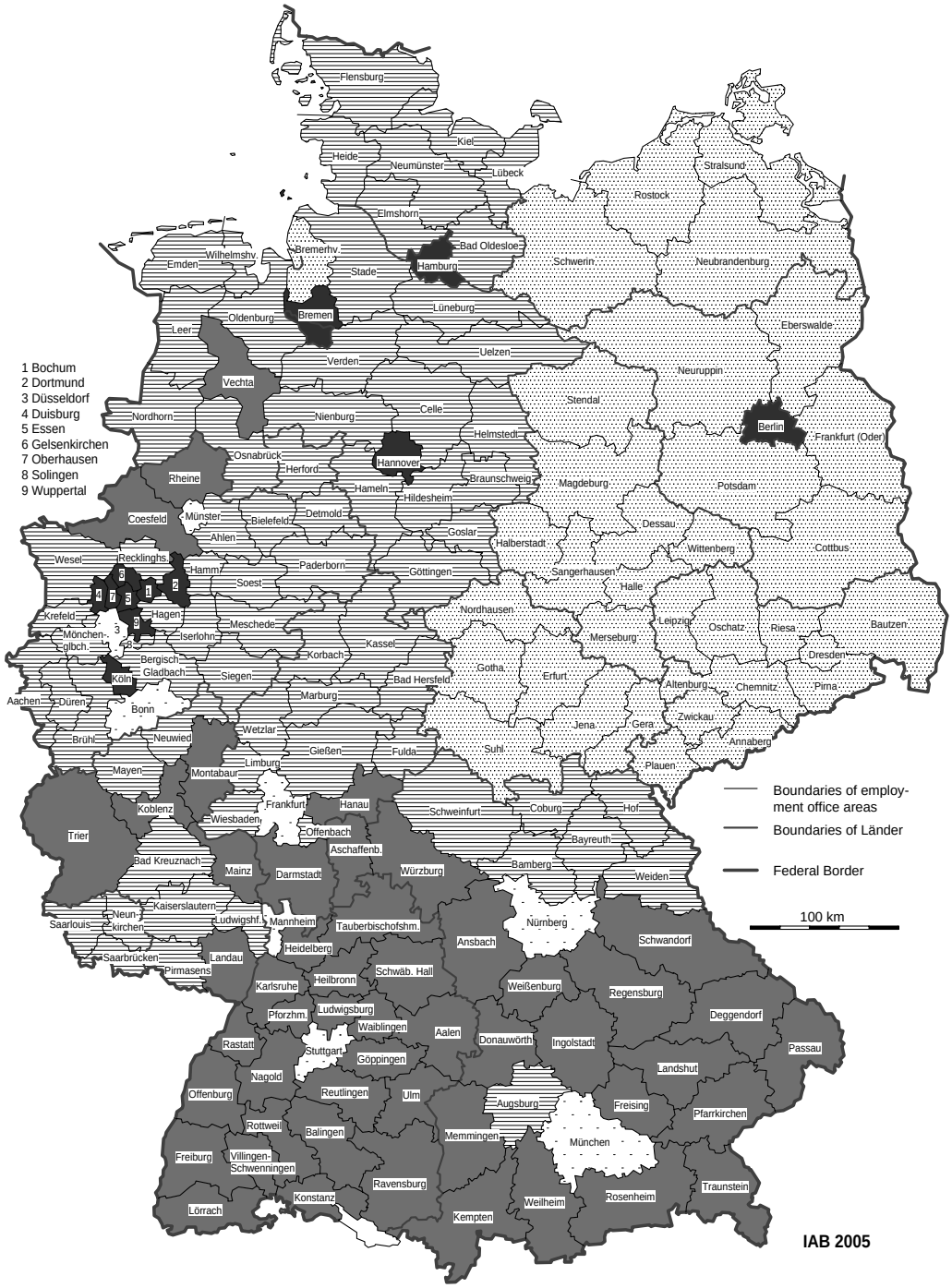
Type Va (7): Rural areas with a good labour market situation and strong seasonal dynamics

Type Vb (29): Areas with SME structure and a good labour market situation

Type Vc (14): Areas with best labour market situation and strong dynamics

Map 2: Strategy Types 2005

The Strategy Types were generated by combining the Comparison Types



Type I (35): Areas mainly in eastern Germany with a dominant job deficit

Type II (12): Areas characterised by big cities, mainly in western Germany, with high unemployment

Type III (71): Areas in western Germany with average unemployment

Type IV (8): Centres in western Germany with a good labour market situation and strong dynamics

Type V (50): Areas in western Germany with a good labour market situation and strong dynamics

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