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SPATIAL ANALYSIS OF CRIME EVOLUTION IN PORTUGAL BETWEEN 1995 AND 2013

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SPATIAL ANALYSIS OF CRIME EVOLUTION IN PORTUGAL BETWEEN 1995 AND 2013

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SPATIAL ANALYSIS OF CRIME EVOLUTION IN PORTUGAL BETWEEN 1995 AND 2013

ABSTRACT

The main objective of this survey was to perform descriptive analysis of crime evolution in Portugal between 1995 and 2013. The main focus of this survey was to analyse spatial crime evolution patterns in Portuguese NUTS III regions. Most important crime types have been included into analysis. The main idea was to uncover relation between local patterns and global crime evolution; to define regions which have contributed to global crime evolution of some specific crime types and to define how they have contributed. There were many statistical reports and scientific papers which have analysed some particular crime types, but one global spatial-temporal analysis has not been found. Principal Component Analysis and multidimensional descriptive data analysis technique STATIS have been the base of the analysis. The results of this survey has shown that strong spatial and temporal crime patterns exist. It was possible to describe global crime evolution patterns and to define crime evolution patterns in NUTS III regions. It was possible to define three to four groups of crimes where each group shows similar spatial crime dynamics.

KEYWORDS

Crime evolution

Spatial data analysis

Multidimensional data analysis

STATIS

Principal component analysis

ACRONYMS

PCA - Principal component analysis

PC - Principal components

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1. Introduction

Changes over time in the levels and patterns of crime have significant consequences that affect not only the criminal justice system but also other critical policy sectors. Descriptive information and explanatory research on crime trends across the nation that are not only accurate but also timely are pressing needs in the nation's crime-control efforts. Without useful and reliable information, national and local policy makers are not able to implement effective policies for crime prevention, properly evaluate the effectiveness of policy interventions, and combat crime in general (Goldberger & Rosenfeld, 2008).

For these reasons there is a strong need to conduct crime analysis. Crime analysis includes analysis of crime trends and patterns. It plays an important role in the human society, especially in crime prevention and devising solutions to crime problems. Since the birth of criminology, researchers have employed a variety of quantitative methods to describe the origins, patterning, and response to crime and criminal activity, and this line of research has generated important descriptive information that has formed the basis for many criminological/criminal justice theories and public policies (Piquero & Weisburd, 2010).

The objective of this survey is to make a spatial analysis of crime evolution in Portugal between 1995 and 2013 using various quantitative techniques. So, we will focus on both spatial and temporal aspects of the crime. Our objective it is only to make a descriptive spatial and temporal analysis of crime trends, so we will not focus on examining the factors that appear to have been influential in driving crime trends. Also we will try to focus on all main crime types. We haven't found any scientific work with an integrated spatial and temporal analysis of all main crime types and patterns in a perennial period. So, the motivation for this survey was to describe and present main spatial and temporal crime trends in Portugal since a global integrated analysis was not conducted before.

Spatial crime patterns will be analysed on the level of NUTS III regions as minimal spatial units, while temporal crime patterns will be analysed on the level of years as minimal temporal units. The crime data are represented by a set of 19 data tables, where each table contains data for each year of the 1995-2013 period. In each table NUTS III regions of Portugal are observations, and crime rates of various crime types are variables. The data are provided by Portuguese Ministry of Justice.

There are a lot of descriptive data analysis techniques which are used in crime analysis. One of widely used techniques is factor analysis and especially principal component analysis (and its extensions) (Kitchen, 2007). PCA has been widely used because of its ability to represent a multidimensional data set in lower dimension space. In our work principal component analysis will be used to analyse global crime evolution patterns in Portugal.

However, the base of this survey will be STATIS method which is based on the principals of PCA. STATIS is a descriptive data analysis technique whose objective is to summarize main characteristics of data set, and to represent the summary combining statistical analysis with visual methods. It is used to perform a joined analysis of the set of quantitative tables. STATIS will be used to analyse the set of 19 tables with spatially referenced crime data. This survey will be focused on general analysis of main crime trends, so we will not be analysing each table separately.

In the last years STATIS method has been used to perform a number of three-way analysis in various distinct fields. In the industry it is applied to monitoring of the evolution in time of batch processes (Gourvénec et al., 2006) and development of multivariate control charts for monitoring non-linear batch processes (Marcondes Filho et al., 2011). It is also applied to environmental data in order to investigate transport processes inside karst aquifer of the western Paris (Fournier et al., 2008). STATIS was also used to characterize the internal molecular motions and conformational states of flexible molecules from molecular dynamics simulations (Coquet et al., 1994). It was also used to analyse the travel modes in Brazilian cities (Coelho Barros et al, 2009).

Few extensions of STATIS method are also developed. These include *X*-STATIS or partial triadic analysis (PTA) which is used when all data tables collect the same variables measured on the same observations (e.g., at different times or locations), COVSTATIS, which handles multiple covariance matrices collected on the same observations, DISTATIS, which handles multiple distance matrices collected on the same observations and generalizes metric multidimensional scaling to three way distance matrices, Canonical-STATIS (CANOSTATIS), which generalizes discriminant analysis and combines it with DISTATIS to analyse multitable discriminant analysis problems, power-STATIS, which uses alternative criteria to find STATIS optimal weights, ANISOSTATIS, which extends STATIS to give specific weights to each variable rather than to each whole table, ($K + 1$)-STATIS (or *external*-STATIS), which extends STATIS (and PLS-methods and Tucker inter battery analysis) to the analysis of the relationships of several data sets and one external data set, and double-STATIS (or DO-ACT), which generalizes ($K + 1$)-STATIS and analyses two sets of data tables, and STATIS-4, which generalizes double-STATIS to more than two sets of data (Abdi et al., 2012).

STATIS will be the base of this spatial-temporal analysis of crime, but some other auxiliary statistical techniques will also be used to analyse the outputs of STATIS. These include trajectory classification methods, clustering and spatial statistical techniques. Trajectory analysis techniques are also used in criminology. One of prominent examples includes criminological analyses of the progression and causes of criminality over life stages or of time trends of reported crime across geographic locations (Piquero & Weisburd, 2010). Trajectories of observations are built in the last step of STATIS, so trajectory classification methods will be used in this survey. Spatial statistical techniques are unique in that they were developed specifically for use with geographic data. They differ from originally "non-spatial" techniques like STATIS which can be applied on any data set (including spatial data). There is a wide variety of spatial statistical techniques which can be used in crime analysis. One of widely used techniques is Moran's Index (Piquero & Weisburd, 2010), which will also be used in this survey.

The crime analysis will be performed using R software for the statistical analysis and ArcGIS for the spatial analysis and geospatial representation of the data.

The thesis consist of few sections. In the introduction section background to the study, motivation, methods and objectives of the study were briefly presented were presented. In the methods section techniques used in the analysis have been presented: principal component analysis, STATIS, clustering methods, trajectory classification methods and Moran's Index. In the data description the data have been presented with special focus on the variable description. In the results and discussion section the results of the data analysis have been presented and discussed. In the first part results of global crime analysis have been presented, while in the second part results of spatial crime analysis have been presented. Conclusion section provides global summary and most important conclusion. In the last section literature review was provided.

2. Methods

In this survey few statistical techniques will be used to analyse spatial crime evolution patterns in Portugal between 1995 and 2013. These include principal component analysis, STATIS technique, trajectory classification techniques, cluster analysis and spatial statistical techniques.

2.1. Principal component analysis

Principal component analysis (PCA) is a statistical procedure that uses an orthogonal transformation to convert a set of correlated variables into new variables called principal components. The number of principal components is less than or equal to the number of original variables. The objective of PCA is to extract maximal amount of information from the data table and present it in a graphical form. In our survey we have applied PCA using denomination and methodology proposed by Dazy & Le Barzic (1996).

Before explaining principals of PCA it is important to define the data set and its main features. Let's denote with Y a matrix associated with the table with n observations and p variables:

$$Y = \begin{bmatrix} y_1^1 & \cdots & y_1^j & \cdots & y_1^p \\ \vdots & \ddots & & \iddots & \vdots \\ y_i^1 & & y_i^j & & y_i^p \\ \vdots & \iddots & & \ddots & \vdots \\ y_n^1 & \cdots & y_n^j & \cdots & y_n^p \end{bmatrix}$$

Each variable from the table can be associated with a vector $y^j = \begin{bmatrix} y_1^1 \\ \vdots \\ y_n^j \end{bmatrix}$, while each observation can be associated with a vector $e_i=\begin{bmatrix} y_i^1 & \dots & y_i^p \end{bmatrix}$.

In the beginning of the analysis it is necessary to attribute a weight to each observation. These weights are represented by the weight matrix:

$$D = \begin{bmatrix} p_1 & & 0 \\ & \ddots & \\ 0 & & p_n \end{bmatrix}$$ where sum of all p_i is equal to 1.

Centre of gravity of the data matrix associated with the weights is a vector g defined by:

g = $\begin{bmatrix} \bar{y}^1 \\ \vdots \\ \bar{y}^p \end{bmatrix}$ where $\bar{x}^j = \sum_{i=1}^{n} p_i x_i^j$

Centre of gravity can be seen as a generalization of the mean.

Usually PCA is not applied on the original data matrix, but on the centred data matrix. We can define a centred table X, associated with the initial table Y, as:

$$X = \begin{bmatrix} \ddots & & \iddots \\ & x_i^j = y_i^j - \bar{y}^j & \\ \iddots & & \ddots \end{bmatrix} = \begin{bmatrix} x_1^1 & \cdots & x_1^j & \cdots & x_1^p \\ \vdots & \ddots & & \iddots & \vdots \\ x_i^1 & & x_i^j & & x_i^p \\ \vdots & \iddots & & \ddots & \vdots \\ x_n^1 & \cdots & x_n^j & \cdots & x_n^p \end{bmatrix}.$$

We can also define a matrix of variance and covariance V, and a matrix of correlation R, both associated with the initial matrix as:

$V = \begin{bmatrix} s_1^2 & \cdots & s_{1,i} & \cdots & s_{1,p} \\ \vdots & \ddots & & \cdots & \vdots \\ s_{i,1} & & s_i^2 & & s_{i,p} \\ \vdots & & & \ddots & \vdots \\ s_{p,1} & \cdots & s_{p,i} & \cdots & s_p^2 \end{bmatrix}$ where s_j^2 is covariance of a variable j defined: $s_j^2 = \sum_{i=1}^{n} p_i (x_i^j)^2$, and $s_{jj'}$ variance of variables j and j' defined: $s_{jj'} = \sum_{i=1}^{n} p_i\, x_i^j x_i^{j'}$.

$$R = \begin{bmatrix} 1 & r_{1,2} & \cdots & r_{1,p} \\ r_{2,1} & \ddots & & \vdots \\ \vdots & & \ddots & r_{p-1,p} \\ r_{p,1} & \cdots & r_{p,p-1} & 1 \end{bmatrix}.$$

Each variable can be seen as an element of a vector space called variable space. In variable space we can define a metric D which enables us to calculate distances between variables. This metric is the weight matrix D.

Each observation can be seen as an element of a vector space called observation space. In this space we can define a metric M which enables us to calculate distances between observations. Usually metric M is equal to I_p, where I_p is an identity matrix with p rows and p columns:

$$M=I_p=\begin{bmatrix} 1 & & 0 \\ & \ddots & \\ 0 & & 1 \end{bmatrix}.$$

In case when there is a need to standardize the data, we use matrix:

$$M_{1/s^2}=\begin{bmatrix} 1/s_1^2 & & 0 \\ & \ddots & \\ 0 & & 1/s_p^2 \end{bmatrix}.$$

The squared distance between two observations e_i and e_j is defined by a relation:

$d^2(e_i, e_j)=(e_i - e_j)'M(e_i - e_j)=||e_i - e_j||^2_M$

Inertia I_g of the set of points is defined as an average pondered squared distance of points from their centre of gravity:

$I_g=\sum_{i=1}^{n} p_i(e_i - g)'M(e_i - g) = ||e_i - g||^2_M$

Inertia has a property:

$I_g=Tr(MV)$, where Tr(A) is a trace of the matrix A.

Finally, one "survey" is defined as a triplet: (X,M,D) where X is a centred data matrix, M metric on the observation space and D metric on a variable space.

The main idea of PCA is to obtain a close representation of the set of initial observations in the sub-space of the lower dimension. When projecting the observations in a lower dimension space it is necessary to take into consideration the fact that the distances between observations have to suffer the least possible deformation in the projection. This means that in a subspace of the dimension k the average value of squared distances between projected observations has to be the highest possible; the inertia of the projected cluster has to be maximal. It can be proved that the subspace of the dimension k is generated with k eigenvectors of the matrix VM associated with k highest eigenvalues:

$VM\mu=\mu\pi$.

In the context of PCA these eigenvectors $\mu_1, \ldots \mu_k$ are orthogonal vectors generating so-called principal axes. Inertia explained by each principal axis is equal to the value of eigenvalues $\pi_1, \ldots \pi_k$ associated to it. Finally, principal components are the new variables $\mathbf{c^t}$ in a subspace which is generated by the eigenvectors (principal axis) and defined by:

$c=XM\mu$.

After finding principal axes, principal components, and eigenvalues, the obtained results have to be interpreted. Principal axes can be interpreted by calculating the correlation between principal components and variables from the initial table. They are usually represented with the circle of correlations.

When a principal component shows a strong correlation with a variable it means that observations with high positive component values have variable values notably superior then the average.

It is also possible to calculate the absolute contribution CTA of the observation i to the principal axis k which is defined by:

$$CTA_i^k = \frac{p_i(c_i^k)^2}{l_k}.$$

Also, it is possible to calculate relative contribution CTR of the observation i to the principal axis k:

$$CTR_i^k = \frac{(c_i^k)^2}{x_i{}'Mx_i}.$$

Relative contribution of an observation i is equal to the cosines of the angle between the principal axis and vector e_i representing an observation. Relative contribution represents the quality of the representation of an observation on that axis (or plane); if it close to 1 the representation is very good.

The basic idea of the supplementary points technique is to place additional observations and/or variables in the Euclidian image. These additional observations and variables are called supplementary observations and variables. They were not used when PCA was performed on the data table, but they may contribute to the interpretation.

2.2. STATIS

The STATIS is an exploratory data analysis technique used to analyse a data cube - to perform a joined analysis of the set of quantitative tables (where STATIS stands for Structuration des Tableux A Trois Indices de la Statistique). The technique is based on principals of linear algebra and Euclidean vector spaces. STATIS is especially useful for the analysis of evolution data, and therefore it is similar to other descriptive methods designed for evolution data (like Double principal component analysis or Multiple factorial analysis). In our survey we have applied STATIS using denomination and methodology proposed by Dazy & Le Barzic (1996) and Lavit (1988.).

STATIS technique is designed to analyse the set of T data tables (plot X). Tables 1, ... t, ... T represent a phenomena measured on the set of same observations in different circumstances (where variables may be different from one table to another). The analysis is performed on T studies where each study t is defined with a triplet $(X_t, M_t, D)_t$ (as described in 2.1.). The weight given to each observation has to be same for all the tables; the metric D is constant, while metric M may wary depending is there is a need to standardize the data.

STATIS uses scalar products to analyse the data. Scalar product can be defined for each pair of observations e_i and e_j. Scalar product is a bilinear symmetric form w_{ij} defined by $w_{ij}=<e_i,e_j> =e_iM_te_j$. A scalar product between two objects can be seen as a measure of association between them.

When applying STATIS it is necessary to represent each study $(X_t, M_t, D)_t$ with one object. This object, denoted W_t, is the matrix of scalar products between observations in a table. It is defined by $W_t=X_tMX_t'$. The matrix W_t can be seen as a table of associations between the observations in a table. However, W_t can't be considered as a table of similarities because the values in the diagonal are generally not equal.

Like other descriptive methods designed for evolution data, STATIS has an analytical structure which consists of:

-interstructure analysis

-finding a compromise

-intrastructure analysis

- plot of trajectories of observations

2.2.1. Interstructure analysis

The objective of interstructure analysis is to analyse similarities between data tables in the study on a general level without describing the elements which cause this difference. So, it is necessary to find a form which would enable to induce the distance between data tables. Since STATIS performs analyses on W_t objects (it doesn't directly operate on the set of original data tables), Hilbert-Schmidt scalar product can be used to induce the distance between tables represented by W_t. Hilbert-Schmidt scalar product between objects W_t and $W_{t'}$ is defined:

$\langle W_t \mid W_{t'} \rangle_{HS} = Tr\,(DW_tDW_{t'})$

It represents a measure of association between two tables.

It is also possible to define the norm of an object W_t, denoted $||W_t||$, where squared norm is defined by: $||W_t||^2_{HS} = \langle W_t \mid W_t \rangle_{HS}$. In case when tables have significantly different norms it is strongly recommended to represent the "surveys" as normed objects $W_t/||W_t||_{HS}$ instead of W_t. Objects with higher values strongly affect the compromise structure in the further analysis, which can be dangerous for the interpretation of results.

The Hilbert-Schmidt scalar products can be interpreted thanks to the interpretation of an expression $||W_t - W_{t'}||_{HS}$. Expression $||W_t - W_{t'}||^2_{HS}$ represents pondered sum of squares of differences between the scalar products between observations from the tables t and scalar products between observations from the tables t':

$$||W_t - W_{t'}||^2_{HS} = \sum_{i=1}^{n} \sum_{j=1}^{n} p_i p_j [< e_i^{(t)}, e_j^{(t)} >_{M_t} - < e_i^{(t')}, e_j^{(t')} >_{M_{t'}}]^2.$$

We can denote with S the matrix of Hilbert-Schmidt scalar products between "surveys" represented by W_t. Matrix S is defined by:

$$S = \begin{bmatrix} \ddots & & \iddots \\ & S_{tt'} = < W_t | W_{t'} >_{HS} & \\ \iddots & & \ddots \end{bmatrix}.$$

The matrix of Hilbert-Schmidt products can be seen as a matrix of associations between "surveys". However, it can't be considered as a table of similarities because the values in the diagonal are generally not equal.

Another measure of association between two studies t and t' is the so-called RV coefficient (Escouffier**,** 1973). RV coefficient can be seen as a multivariate generalization of the correlation coefficient. It is defined as a Hilbert-Schmidt product between two normed objects:

$$RV\,(t, t') = \langle \frac{W_t}{||W_t||_{HS}} \mid \frac{W_{t'}}{||W_{t'}||_{HS}} \rangle_{HS}.$$

Values of RV coefficients can range from 0 to 1. An RV coefficient enables us to calculate the distance between two normed objects:

$$d(\frac{W_t}{||W_t||_{HS}} \mid \frac{W_{t'}}{||W_{t'}||_{HS}}) = \sqrt{2(1 - RV(t, t')}$$

If RV(t,t') = 1 then $(W_t/||W_t||_{HS}) = (W_{t'}/||W_{t'}||_{HS})$. If RV(t,t') = 0 and $M=I_p$, then the values of covariance between variables from the table t and the variables from table t' are equal to 0.

After calculating the relations between tables, it is possible to represent them on the Euclidian image. This means that it is possible to plot the interstructure relations. In order to do this it is necessary to give a weight q_t to each study. Weights are represented with the matrix:

$$Q=\begin{bmatrix} q_1 & & 0 \\ & \ddots & \\ 0 & & q_t \end{bmatrix}.$$

One of main ideas of STATIS is to represent the table of scalar products between objects in Euclidean space of lower dimension so that the scalar products can be well restored. The Euclidean image of n individuals associated to scalar products w_{ij} is a set of points M_1, ... M_n and a point O of the affine Euclidian space which resituates scalar product in the form:

for every i,j e {1,... n} $<OM_i, OM_j> = w_{ij}$

The same property applies to the Hilbert-Schmidt product $<W_t \mid W_{t'}>_{HS}$.

Euclidean image of data tables associated with matrix of scalar products S is obtained by performing a specific version of PCA on the matrix of scalar products S where SQ matrix corresponds to VM matrix of the "standard" PCA. So, it is necessary to calculate eigenvectors and eigenvalues of matrix SQ. The eigenvectors represent axes which form the new Euclidean space. In this case principal axes are not interpretable, so in practice only first two PC are taken into consideration. If f_1, ... f_n are eigenvectors of matrix SQ and t_1, ... t_n eigenvalues associated to them, then first two PC can be calculated by:

$$\sqrt{t_i} f_i.$$

The distance between two points M_t and $M_{t'}$ in the 1st principal plane is the best possible approximation of the Hilbert-Schmidt distance between objects representing two tables t and t'.

Since obtained principal axes can't be interpreted, the Euclidean image in terms of interpretation only represents relations between tables (plot X). It can be proved that: RV (t,t') = cos $(OM_t, OM_{t'})$. This means that coefficients RV represent the cosines of the angle between vectors OM_t and $OM_{t'}$. Euclidean image can be interpreted in this context; the smaller the angles between two vectors OM_t and $OM_{t'}$ are, the studies t and t' are more correlated. The distance between O and M_t on the Euclidian image represents the norm of the object W_t.

2.2.2. Finding the compromise

The objective of finding a compromise is to find a commune and unique structure which explains and detects the most important tendencies of the studied phenomenon. Compromise can be seen as a global summary of the tables. The idea is to find this commune structure without analysing separately each table.

The compromise W is an object defined as pondered average of all objects W_t:

W =$\sum_{i=1}^{T} a_t W_t$.

It has a property that it is an object which is mostly correlated with all W_t objects. It can be proved that W will be mostly correlated with all W_t objects when:

a_t = $1/\sqrt{o_1}(\sum_{t=1}^{T} q_t \sqrt{S_{tt}}) q_1 f_1^{(t)}$ where o_1 is the first eigenvalue of the matrix W_tD.

When interpreting the compromise it is important to consider the coefficients a_t; tables associated with higher a_t will have a higher contribution to the compromise.

Compromise can also be plotted on Euclidean image of intrstructure. It is situated on the 1st principal axis, at the distance $||W||_{HS}$ from O. Interstracture plot is important when analysing if compromise W is a good "resume" of data tables. Objects W_t with more elevated norms have significantly higher associated a_t coefficients.

When analysing Euclidian image of interstructure regarding the compromise, four typical situations can be found (Figure 1).

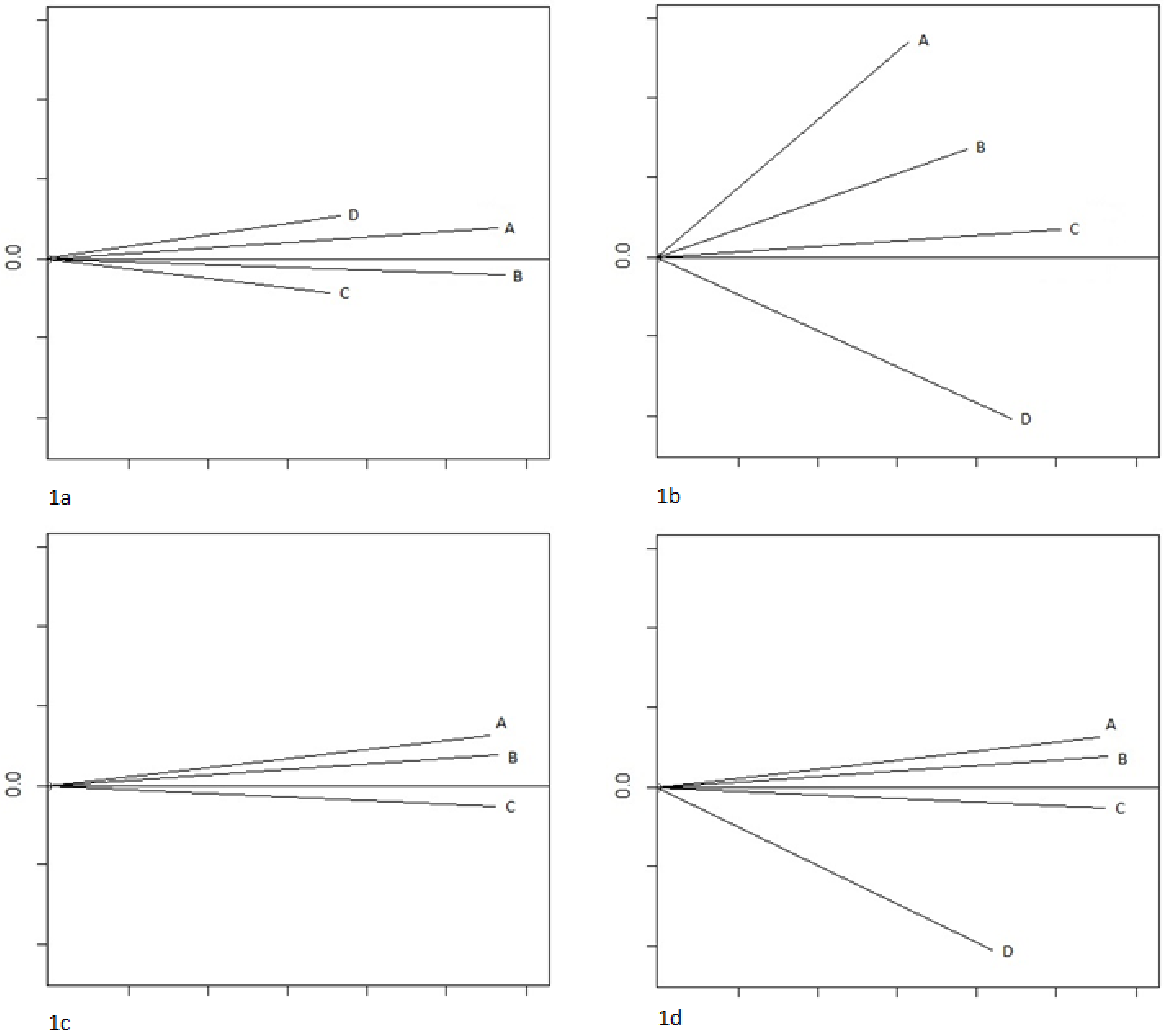

Figure 1 Four typical cases of interstructure relations

In case when W_t objects have significantly different norms (Figure 1 a) it is strongly recommended to work with normed objects. In case when studies are not correlated (Figure 1 b) (angles between vectors representing studies are large) compromise will not represent a good "resume". On the other hand, when studies are very well correlated (Figure 1 c) (angles between vectors representing studies are small) the compromise will represent a good "resume". Also if there are outliers -tables that are not correlated with majority of other tables - then these tables will not have a good representation on compromise (Figure 1 d).

2.2.3. Intrastructure analysis

The objective of intrastructure analysis is to analyse the similarities between observations in the study. Intrastructure analysis is also called the fine analysis. In the first part of intrastructure analysis the compromise positions of observations are obtained in the compromise plane and interpreted. In the second part of analysis the trajectories of observations are obtained in the compromise plane and interpreted.

In this stage of analysis it is possible to represent each observation i by one vector and point A_i - its compromise position. Compromise position of observations is obtained by performing a specific version of PCA on compromise matrix of scalar products W where WD matrix corresponds to the VM matrix of the "standard" PCA. So, it is necessary to calculate eigenvectors and eigenvalues of the matrix WD. The eigenvectors m_1, ... m_n represent principal axes which of the new Euclidean space, while eigenvalues l_1, ... l_n associated to eigenvectors represent inertia associated to each axis. Principal components representing compromise position of observations are calculated by:

$$\frac{1}{\sqrt{l_k}} WDm_k$$

Compromise position of observations describes their average position in the set of tables. The distance between two points A_i and A_j in compromise plane represents the pondered average distance d between observations i and j in the set of tables:

$$d^2_{A1A2}=\sum_{t=1}^{T} a_t ||e_i^{(t)} - e_j^{(t)}||^2.$$

Like in PCA, the interpretation of principal axis can be obtained by calculating the values of correlation between principal components and variables from each original table. In the way trajectories of variables can be plotted in the correlation plane.

2.2.4. Trajectories of observations

The finest analysis is conducted by placing each observation from each table in the compromise plane using the method of supplementary points. Each point $A_1^{(t)}$, ... $A_n^{(t)}$ represents different positions of observation n in the data tables T on the compromise plane. Coordinates of observation n in the table t on the axis k are calculated by:

$$\frac{1}{\sqrt{l_k}} W_t Dm_k.$$

Usually only first two principal axes are taken into consideration.

Compromise position of the observation i, represented by the point $A_{i,}$ is the canter of gravity of points $A_i^{(1)}$, ... $A_i^{(T)}$ (representing the position of the observation i in different tables) pondered by the corresponding coefficients a_t.

In the case of evolution data it is possible to represent observations with trajectories. In this case trajectories of observations and variables represent the evolution of phenomena as it is described by each table. In the case of non-evolution data trajectories represents only similarities between observations and variables as they are described by each table.

At the end it is important to note that, like in PCA, technique of supplementary points can be also used in STATIS.

2.3. Clustering techniques

Cluster analysis or clustering is the task of grouping a set of objects in such a way that objects in the same group (called a cluster) are more similar to each other than to those in other groups (clusters). Typically when applying clustering on a data table the observations (lines) described by the set of variables or characters are being grouped into clusters.

When applying clustering techniques it is important to optimize different types of inertia. If we partition a set of n points into k groups then we can denote:

g_1, ...g_k; centres of gravity of k groups

I_1, ... I_k; interties of k clusters

Total inertia I of the set of all n points is equal to:

$I = I_w + I_g$, where I_w is the intraclass inertia which is equal to the sum of inertias of all clusters, and I_g is the interclass inertia of the set of k centres of gravity. One of objectives of clustering is to obtain such a partition where I_w is minimal (so that all the clusters could be as much as homogenous as possible) and I_g maximal; this means that the ratio I_w/I has to be maximal (Dazy & Le Barzic, 1996).

There are various clustering techniques. We will consider two widely used techniques: hierarchical clustering and k-means.

2. 3. 1. Hierarchical clustering

Hierarchical clustering is a clustering method whose objective is to build a hierarchy of clusters. There are various versions of hierarchical clustering, but here we will consider techniques where each observation starts in its own cluster, and then the pairs of clusters are merged into new clusters based on their similarity until the complete hierarchy is established. The results of hierarchical clustering are usually presented in a dendrogram. Similarity and dissimilarity can be measured by calculating distances between sets of observations. In order to define the distance we have to define a metric. Besides Euclidian distance, there are different kinds of distances (i.e. Ward distance, Manhattan distance etc.) with their corresponding metrics. Linkage criteria defines the distance used in the clustering. In our case we will use single, complete, average and ward linkage criteria. (Lebart et al., 2002)

When applying hierarchical clustering the observations are not required; it is enough to provide a matrix of distances between observations.

2. 3. 2. K-means algorithm

K-means algorithm is a clustering method which aims to partition n observations into k clusters where each observation belongs to the cluster with the nearest mean. In the first step points c_1, ...c_k are usually randomly placed in the set which has to be parted. There are few initialization methods which define how initial seed will be placed. Each observation in the set is assigned to the cluster closets to each c_j. In the second step the initial seeds are replaced with the centres of the gravity of the corresponding clusters and process of assigning observations to clusters is repeated. The algorithm has converged to the optimum when the seeds stop changing. There is no guarantee that the global optimum (where ratio I_w/I is maximal) will be found using k-means.

2.4. Trajectory classification techniques

Since STATIS technique represents observations with trajectories (in the case of evolution data), we will classify these trajectories with a classification technique. In the case when we have a large number of trajectories their interpretation can be difficult. These techniques enable us to decrease the number of trajectories by grouping them into classes and calculating the "average" trajectory for each class. In our survey we have applied trajectory classification using denomination and methodology proposed by Dazy & Le Barzic (1996).

It is possible to represent trajectories using their factorial coordinates (table 1) where q is the number of axes. $(z_i^j)^{(t)}$ represent the coordinate of an observations i on the factorial axes j in the point t.

observations	Axis 1			.....	Axis q		
1	$(z_1^1)^{(1)}$	…	$(z_1^1)^{(T)}$	.....	$(z_1^q)^{(1)}$	…	$(z_1^q)^{(T)}$
⋮	⋮		⋮	.....	⋮		⋮
n	$(z_n^1)^{(1)}$	…	$(z_n^1)^{(T)}$	.....	$(z_n^q)^{(1)}$	…	$(z_n^q)^{(T)}$

Table 1 Factorial coordinates for trajectories

Depending on the objectives of the study it is possible to classify the trajectories based on their coordinate positions ($(z_i^j)^{(t)}$) and their evolutions ($(z_i^j)^{(t)} - (z_i^j)^{(t-1)}$). Two trajectories on the figure 2a have similar position and different evolution, while on the figure 2b two trajectories have different position, but similar evolution.

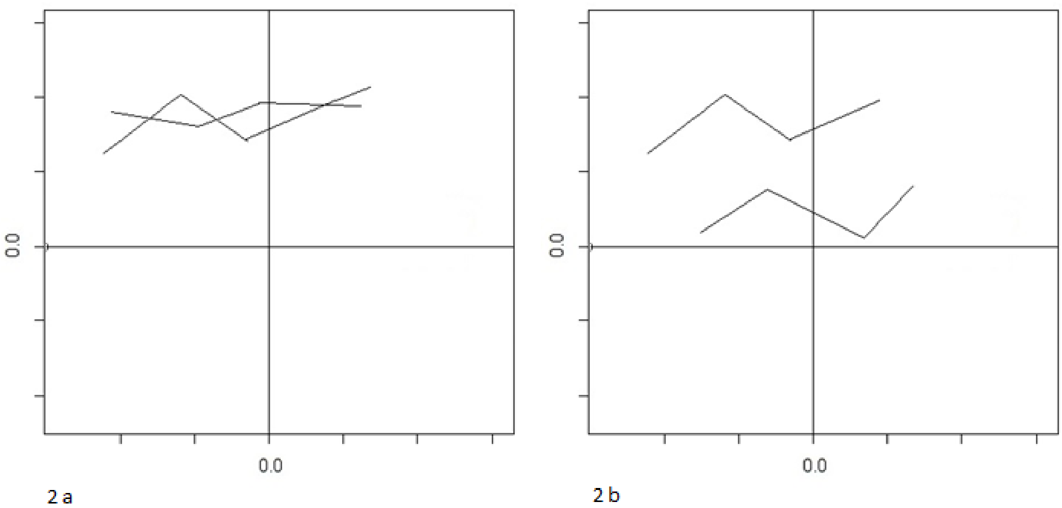

Figure 2 Trajectories with: similar position and different evolution (2 a), and similar evolution and different position (2 b)

In order to apply classification it is necessary to define the distance between trajectories. There are few possible distances designed for the temporal data. They depend on the objectives of the study.

Distance $d_1(i,i') = \sum_{t=1}^{T}\sum_{j=1}^{q}[(z_i^j)^{(t)} - (z_{i'}^j)^{(t)}]^2$ is the Euclidian distance based on the positions of the observations on the factorial planes. The classification of trajectories derived from this distance can be considered as classification based on their positions.

The distance $d_2(i,i') = \sum_{t=1}^{T}\sum_{j=1}^{q}[[(z_i^j)^{(t)} - (z_i^j)^{(t-1)}] - [(z_{i'}^j)^{(t)} - (z_{i'}^j)^{(t-1)}]]^2$ is the distance based on the evolution of trajectories, where $(z_i^j)^{(t)}$ - $(z_i^j)^{(t-1)}$ is the evolution coordinate. It is notable that the number of evolution coordinates is smaller than number of position coordinates by 1. The classification of trajectories derived from this distance can be considered as classification based on their evolutions.

The third idea is to define one distance that would take into account distance between trajectories based on both their positions and their evolutions in a way that their influences are balanced. This compromise position - evolution distance would be based on the determination of points which should conserve their position coordinates and points whose coordinates should be transformed into evolution coordinates. In order to do this we have to define a configuration. Configuration is a sequence of binary numbers $\{\alpha_1, \dots \alpha_T\}$ which corresponds to the set of coordinates in a way that $\alpha_t=1$ if we have a position coordinate $(z_i^j)^{(t)}$ at time t in a table and $\alpha_t=0$ if we have an evolution coordinate $((z_i^j)^{(t)}$ - $(z_i^j)^{(t-1)})$ at time t in a table. It is important to note that $\alpha_1=1$. The number of possible configurations is equal to 2^{T-1}. For each configuration element α_t the original factorial coordinates will be transformed into evolution coordinates or kept in the form of position coordinates depending if α_t is equal to 0 or 1.

Let's denote with I_T the inertia of the set of observations defined by the new transformed coordinates. If $I_{T1}= \sum_{i=1}^{n}\left\{\sum_{j=1}^{q}\sum_{\{t\ where\ \alpha_t=1\}} p_i[(z_i^j)^{(t)} - (\bar{z}^j)^{(t)}]^2\right\}$ is the inertia of the set of position coordinates, and $I_{T2}= \sum_{i=1}^{n}\left\{\sum_{j=1}^{q}\sum_{\{t\ where\ \alpha_t=0\}} p_i[[(z_i^j)^{(t)} - (z_i^j)^{(t-1)}] - [(\bar{z}^j)^{(t)} - (\bar{z}^j)^{(t-1)}]]^2\right\}$ is the inertia of the set of evolution coordinates, then total inertia is equal to: $I_T=I_{T1}+I_{T2}$.

The objective of compromise position - evolution method is to find a configuration $\{\alpha_1, \dots \alpha_T\}$ where difference between I_{T1} and I_{T2} is minimal. This means that that the value of I_{T1}/I_{T2} should be closest possible to 1. Finally, the distance compromise position evolution is defined:

$d_3(i,i') =$

$\sum_{j=1}^{q}\sum_{\{t\ where\ \alpha_t=1\}}^{T}[(z_i^j)^{(t)} - (z_{i'}^j)^{(t)}]^2+\sum_{j=1}^{q}\sum_{\{t\ where\ \alpha_t=0\}}^{T}[[(z_i^j)^{(t)} - (z_i^j)^{(t-1)}] -$

$[(z_{i'}^{j})^{(t)} - (z_{i'}^{j})^{(t-1)}]]^2$.

The classification of trajectories can be performed by transforming the position coordinates into evolution coordinates or position - evolution compromise coordinates, or even keeping the original coordinates and applying some of the clustering techniques on the data table as it is shown in a table 1.

2.5. Spatial statistical techniques – Moran's index

For a given set of spatial data with geospatial features and an associated variables, it is useful to evaluate whether the pattern expressed is clustered, dispersed, or random. For this reason we can calculate spatial autocorrelation.

The term spatial autocorrelation owes its origins to work in a related field, time series analysis (TSA), and in turn to the notion of correlation in univariate statistics. The autocorrelation of a random process describes the correlation between values of the process at different times, as a function of the two times or of the time lag.

Spatial autocorrelation follows these concepts. It is characterized by a correlation in a signal among nearby locations in space. Global Moran's Index is an index that measures spatial autocorrelation based on both feature locations and associated feature variable values. The Spatial Autocorrelation (Global Moran's I) tool is an inferential statistic, which means that the results of the analysis are always interpreted within the context of its null hypothesis. For the Global Moran's Index, the null hypothesis states that the attribute being analysed is randomly distributed among the features in the study area. Negative values of Moran's Index indicate negative spatial autocorrelation and the inverse for positive values. Values range from −1 (indicating perfect dispersion) to +1 (perfect correlation). A zero value indicates a random spatial pattern (De Smith et al, 2007).

3. Data description

In this section criminal data used in the analysis will be described. Since the original data was not structured there was a need to transform it.

3.1. Data structure

Set of 19 data tables with crime rates of various crime types in NUTS III regions of Portugal is shown in annex. Each table represents crime structure in each year of the period 1995-2013. In each table NUTS III regions are considered as observations, while various crime types are considered as variables.

The number of crimes in Portugal reported by police and other investigation support units in the period between 1993 and 2013 is provided by the Portuguese Ministry of Justice (Estatístiças oficiais da justiça, 2009). Reported crimes are grouped by crime type, by location, by official unit which reported it, and by year. Before performing any analysis and extracting meaningful information these data had to be cleaned and transformed.

Crimes were reported by various services. As the years passed the data from more and more institutions were included into statistics. For our case we decided to take into account crime data provided by Justice Police, Public Security police, National Republican Guard, Game's Inspection, General Inspection of Economic Activities, Costumes, and Local Management of Finances. Since in 1993 and 1994 crime data from General Inspection of Economic Activities, Costumes, and Local Management of Finances were not included into the crime statistics, we decided not to include these years in the analysis. We also did not take into account data provided by some other institutions like Maritime Police or Military Police, because these data were included into statistics only after 2005. Crimes reported by Justice Police, Public Security police, National Republican Guard, Game's Inspection, General Inspection of Economic Activities, Costumes, and Local Management of Finances count for more than 99% of all crimes in all the years after 2005, so we were able to conclude that our data set is a good representative of crime structure in Portugal. This way we were also able to ensure consistency and comparability of the data during the whole period 1995-2013.

It is important to note that we are working with crimes reported by public authorities; we are not dealing with crimes which were processed by courts. This has to be taken into account when interpreting the results. There are obviously crimes that were committed and not reported, but there are also crimes which were reported, but discarded by the courts.

Crime data are available at the level of 308 municipalities, 20 districts of continental Portugal and 2 autonomous regions. Since we decided to work with NUTS III regions, we had to aggregate crimes which were registered at the level of municipalities and represent them on the level of NUTS III regions. It is important to note that some registered crimes did not have spatial reference at the level of municipality, so these crimes could not be include into spatial analysis. We included into spatial analysis only crimes which have spatial reference at the level of municipality. Percentage of reported crimes with the spatial reference at the level of municipality is also shown in the annex. However, all reported crimes (with and without spatial reference) are included in a data table representing yearly crime structure at the level of whole Portugal. NUTS III regions are considered as observations in spatial analysis, while years are considered as observations in global crime structure analysis.

3.2. Variable description

Reported crimes are originally grouped by crime types in 3 levels. On the 1st level crimes are grouped into 6 large groups. On the 2nd level these 6 crime groups are subdivided into subgroups and finally on the 3rd level these groups are again subdivided into many subgroups. Since the number of available crime types is very large we grouped crimes into groups of most significant crimes. We followed Portuguese Penal Code (Procuradoria-Geral Distrital de Lisboa, 2001) and official statistics to define variables which were considered as variables in the analysis. Number of crimes was transformed into crime rates using the formula: (number of crimes / residential population) * 1000. The variables are: Theft (without violence), Robbery (with violence), Fraud, Property damage, Drug trafficking, Drunk driving, Homicides and offences to physical integrity due to traffic accidents, Crimes against public authority, Falsification crimes, Forest fire crimes, Defamation, Issuing cheques without provision, Homicide, Corruption. All of these crimes are defined by Penal Code. Current Penal Code was established in 1995, but it has changed 35 times, so we had to be careful to ensure that all crimes were defined the same way in the whole period. All variables included in the analysis are described below.

Theft (without violence) is defined the taking of another person's property without that person's permission or consent with the intent to deprive the rightful owner of it, but without violence or assault. It is different from *robbery (with violence)* which is also defined as taking of another person's property without that person's permission, but with the difference that robbery includes assault, violence, or some kind of force against a person. Statistics of Ministry of Justice differentiates various types of robberies and thefts in different time periods, but we decided to group all of these subgroups of crimes into two variables: *Theft (without violence)* and *Robbery (with violence).* Definition of these crimes hasn't changed significantly during the study period.

Fraud is defined as crime where someone obtains or intents to obtain for himself or some other person illegitimate enrichment and which is caused by the error or deception he provoked. Here we included all types of frauds except fraud related with work and employment because it has been defined as a crime only after 2005.

Property damage is defined as destruction, damaging, or making unusable of alien thing. Definition of this crime hasn't changed significantly during the study period.

Drug trafficking includes distribution and sale of illegal drugs. We were not able to take into consideration crimes related with drug cultivation and consumptions because of changes in drugs policy in Portugal in 2001.

Drunk driving is defined as driving a vehicle with more than 1.2 g/L of alcohol in the blood. Definition of this crime hasn't changed during the study period. We were not able to consider other road crimes because of changes in the legislation.

Crimes against public authority include tirade, escape and riot of the prisoners, resistance of the coercion, disobedience, violation of public measures, and usurpation of functions. These crimes were registered by crime statistics as crimes against public authority during the whole study period. Other crimes against public authority were not registered as crimes at the beginning of the period, so they were not included in the analysis. However crimes included into analysis are significant majority of crimes in the domain of crimes against public authority.

Falsification crimes include falsification of identification or travel documents, technical reports, documentation and money. Definition of this crime hasn't significantly changed during the study period.

Forest fire crimes is defined as provocation of fire on the terrain covered by forest, including grasslands, bush, spontaneous vegetation or agricultural land. Definition of this crime hasn't changed during the study period.

Defamation includes imputation to another person, in the form of suspicion, a fact, or judgment about it, which is offensive to their honour. This crime also includes calumny and injury of a person due to defamation or calumny. Definition of these crimes hasn't changed during the study period.

Homicide is defined in our case as consummated voluntary homicide. Homicides due to traffic accidents crime and homicides due negligence are not included in this variable.

Issuing cheques without provision is a crime whose definition hasn't changed during the study period.

Under the name *corruption* we consider crimes of corruption, but also peculation and abuse of authority. Definition of these crimes has not changed significantly during the study period.

Because of changes in the legislation in 2007 we were not able to include offence to physical integrity, crimes against personal liberty, crimes of sexual nature, and domestic violence into the analysis. Domestic violence was established as a separate crime in 2007. Some of the crimes which were considered before 2007 as an offences to physical integrity, crimes against personal liberty and crimes of sexual nature have started being considered as crimes of domestic violence after 2007. This disabled the analysis of crime evolution of these crimes for the period 1995-2013.

Since variables Issuing cheques without provision, Homicide, Corruption, and Homicides and offences to physical integrity due to traffic accidents have significant number of crimes without spatial reference, then these crimes were not included into spatial analysis. All of the mentioned crimes were included into data table which shows reported crimes in whole Portugal and which was used to perform a global analysis of crime trends.

4. Exploratory data analysis

In this section basic descriptive statistics were calculated for each table. Mean, median, standard deviation, sample variance, kurtosis, skewness, range, maximal and minimal values, were calculated for each variable in each data table. The results are provided in the annex. Summary statistics for the set of 19 tables is shown in the table 2. The results show that crime rate of crimes related to Theft was significantly highest during the whole period. Both mean and median values of variable Theft were significantly highest during the whole period. Observing the range of mean and median values, it is possible conclude that after variable Theft, the highest crime rates were related with variables Property damage and Drunk Driving during the study period. Other crimes types have generally significantly lower crime rates. It is notable that maximal and minimal mean values are higher than maximal and minimal median values for all variables.

	Theft	Robbery	Fraud	Prop. Damage	Drug traffic.	Drunk driv.	A.pub. author.	Falsification	Forest fire	Defamation
Minimum	2.22	0	0	0.79	0	0.06	0	0	0	0.25
Maximum	41.08	4.81	1.66	3.91	1.75	5.95	1.38	3.12	6.46	2.32
Min. Mean	9.76	0.27	0.31	1.73	0.17	1.00	0.10	0.27	0.40	0.61
Max. Mean	13.27	0.90	0.85	2.18	0.32	2.59	0.48	0.97	1.39	1.08
Min. Median	7.62	0.11	0.26	1.51	0.15	0.94	0.10	0.23	0.25	0.57
Max. Median	12.61	0.60	0.84	2.11	0.27	2.54	0.48	0.87	1.38	1.04

Table 3 Summary statistics for the set of 19 data tables

5. Results and discussion

The spatial analysis of crime evolution in Portugal will be done in two steps. In the first step global analysis will be done in order to extract information about general trends in crime evolution in Portugal between 1995 and 2013. In the second step spatial analysis of crime evolution between 1995 and 2013 will be done. The first analysis will enable us compare local trend with global trends and to have a clearer picture how crimes evolved in Portugal.

5.1. Global analysis

5.1.1. Crime evolution in Portugal

Crime evolution in Portugal between 1995 and 2013 will be analysed using principal component analysis. Years of period 1995-2013 are considered as observations, while different crime types are considered as variables. Crimes are measured in crime rates. Principal component analysis enables us to represent crime evolution in a lower dimension space.

Since variable Theft (without violence) has significantly higher crime rates than any other variable (especially compared to Homicide and Corruption) we decided to work with metric on the observation space M_{1/s^2}.

Results of PCA show that 1st PC has explains 57.45% of inertia, 2nd PC explains 22.43% of inertia, while other dimensions have very similar and small values (Figure 3). First principal plane explains 79.89% of inertia, so our decision was to consider only first two principal components in the analysis. Tables with percentage of inertia explained by each component and first two eigenvectors are shown in the annex.

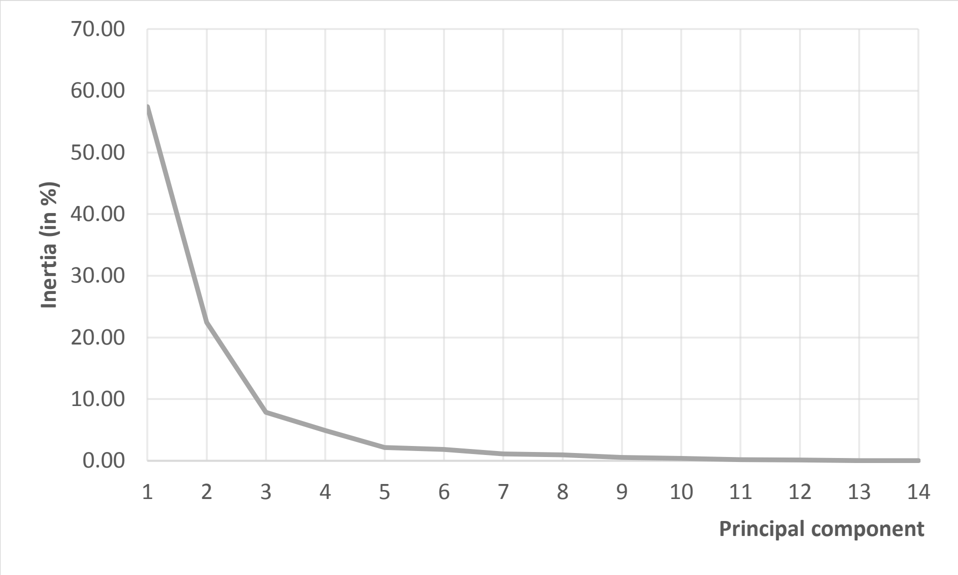

Figure 3 Percentage of inertia explained by each component

The interpretation of two components can be obtained by calculating their correlation with variables under study. Correlation of variables with components is shown in the Table 3. Since we decided to use standardized data, the image representing correlation of the variables with principal components is the exact projection of standardized variables on the plane generated by first two principal components. Correlation of variables with components and their position on the plane generated by 1st two principal components is shown on the Figure 4.

	Prin. Comp. 1	Abs. Cont. 1	Rel. Cont. 1	Prin. Comp. 2	Abs. Cont. 2	Rel. Cont. 2	Rel.Ct. Pl. 1
Theft	0.23	0.007	0.053	**0.82**	0.213	0.670	0.723
Robbery	**0.95**	0.112	0.897	0.03	0.000	0.001	0.898
Fraud	**0.82**	0.084	0.672	0.51	0.083	0.260	0.932
Prop. Damage	0.03	0.000	0.001	**0.97**	0.297	0.933	0.934
Drug traffic.	0.23	0.007	0.053	**0.66**	0.140	0.439	0.492
Drunk driv.	**0.95**	0.112	0.899	0.19	0.012	0.036	0.936
Accidents	**0.95**	0.112	0.904	0.06	0.001	0.003	0.907
A.pub. author.	**0.95**	0.113	0.909	0.06	0.001	0.004	0.913
Falsification	0.42	0.022	0.173	0.44	0.063	0.198	0.371
Forest fire	**0.83**	0.085	0.685	0.24	0.018	0.057	0.743
Defamation	**0.85**	0.089	0.717	0.46	0.066	0.208	0.925
Cheques	**0.75**	0.071	0.567	**0.56**	0.099	0.311	0.879
Homic.	**0.96**	0.115	0.925	0.14	0.007	0.021	0.946
Corruption	**0.77**	0.073	0.588	0.02	0.000	0.001	0.588

Table 3 Absolute and relative contributions of variables on the 1st plane

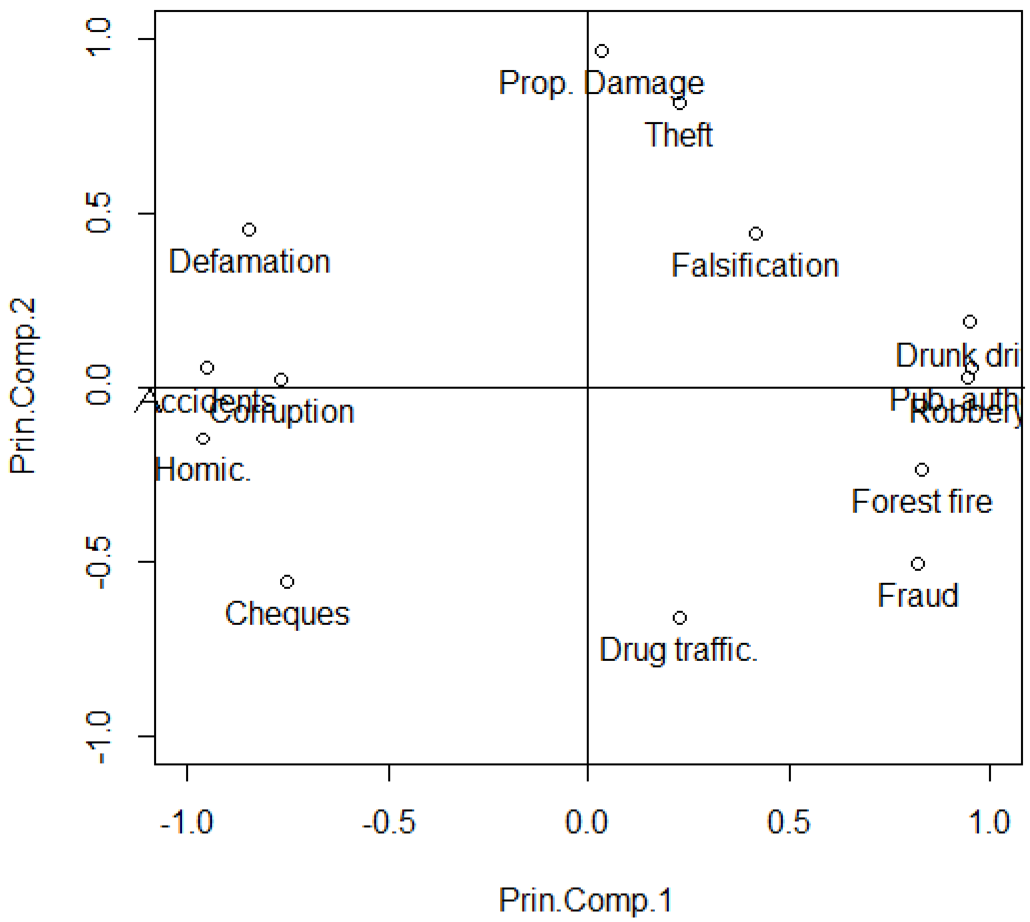

Figure 4 Correlation of the variables with principal components

Absolute and relative contributions of variables are shown in Table 3. It is notable that variable Falsification crimes doesn't have a good representation on the 1st plane. Variables Drug trafficking and Corruption also don't have a good representation on the 1st plane like other variable. However, it is still possible to interpret their general evolution. Other variables have good or even excellent representation on the 1st plane. Absolute contribution shows that 1st axis explains variables Robbery, Fraud, Crimes against public authority, Drunk driving, Forest fire crimes, Issuing cheques without provision, Corruption, Homicide, Homicides and offences to physical integrity due to traffic accidents, and Defamation. 2nd axis explains variables Theft, Property damage, Drug trafficking, but also Fraud and Issuing cheques without provision which have lower contribution.

Values of the first two principal components, together with their absolute and relative contributions, are shown in the Table 4. Since we are working with evolution data, it was possible not only to represent years in 1st principal plane, but also to draw a trajectory of observations (Figure 5). It is notable that the years 1999, 2002, 2006 and especially years 2005 and 2007 don't have a good a representation on the 1st principal plane. Relative contributions also show that years of the first and third period have especially good representation on the 1st principal plane. It is also notable that the years 1999-2009 have a lower contribution to 1st axis. Years at the beginning (1995-1998) and at the end (2008-2013) of the period have a high absolute contribution to the 1st axis. Years 1995 and 2013 have the significantly highest absolute contribution to 2nd axis. However years 1996, 1999-2004, and 2012 also have a high absolute contribution to 2nd axis.

	Prin. Com.1	Abs.Ct. Cp.1	Rel.Ct. Cp.1	Prin. Comp.2	Abs.Ct. Cp.2	Rel.Ct. Cp.2	Rel.Ct. Plane 1
1995	-4.35	13.05	53.62	-3.77	25.1	40.26	93.88
1996	-4.27	12.59	77.00	-2.17	8.3	19.83	96.83
1997	-4.34	13.00	85.57	-0.82	1.19	3.07	88.64
1998	-3.79	9.93	68.06	0.64	0.73	1.95	70.01
1999	-2.63	4.79	44.42	1.17	2.42	8.76	53.18
2000	-1.64	1.86	33.29	1.61	4.57	32.03	65.32
2001	-0.98	0.67	28.44	1.13	2.24	37.22	65.66
2002	-0.57	0.23	6.05	1.51	4.01	41.69	47.74
2003	0.03	0.00	0.01	2.33	9.63	69.37	69.38
2004	0.9	0.56	11.97	2.15	8.2	68.9	80.87
2005	0.93	0.6	20.31	0.71	0.88	11.69	32.00
2006	1.1	0.83	33.53	0.60	0.63	9.97	43.50
2007	1.27	1.11	27.24	0.69	0.85	8.19	35.43
2008	1.85	2.36	51.11	1.26	2.80	23.66	74.77
2009	2.63	4.78	65.15	-0.04	0.00	0.01	65.16
2010	3.15	6.84	72.41	-0.83	1.23	5.07	77.48
2011	3.08	6.54	78.4	-0.85	1.29	6.05	84.45
2012	3.93	10.69	74.77	-2.13	8.06	22.01	96.78
2013	3.72	9.58	54.7	-3.18	17.86	39.82	94.52

Table 4 Principal components and their absolute and relative contributions

In the context of our analysis this trajectory on the Figure 5 represents crime evolution in Portugal. In order to interpret crime evolution it is important to interpret the axes first.

1st PC opposes the years with the higher crime rates of crimes like Robbery (with violence), Fraud, Crimes against public authority, Drunk driving, Forest fire crimes and lower crime rates of crimes like Issuing cheques without provision, Corruption, Homicide, Homicides and offences to physical integrity due to traffic accidents, Defamation on one side, and years with the lower crime rates of crimes like Robbery (with violence), Fraud, Crimes against public authority, Drunk driving, Forest fire crimes and higher crime rates of crimes like Issuing cheques without provision, Corruption, Homicide, Homicides and offences to physical integrity due to traffic accidents, Defamation.

2nd PC opposes the years with the higher crime rates of crimes like Property damage and Theft (without violence) and lower crime rates of crimes like Drug trafficking, Fraud and Issuing cheques without provision on one side, and years with the lower crime rates of crimes like Property damage and Theft (without violence) and higher crime rates of crimes like Drug trafficking, Fraud and Issuing cheques without provision on the other side. It is notable that variables like Property damage and Theft (without violence) have much higher absolute correlation value then the variables Drug trafficking, Fraud and Issuing cheques without provision.

Falsification crimes have a positive correlation with both components, but they don't have a good representation on the 1st principal plane; these crimes are not interpretable on the 1st principal plane.

Just looking at the trajectory it is notable that crime patterns have changed after the years 1998 and 2008. So, it is possible to divide the period 1995-2013 into three sub-periods with specific crime dynamics.

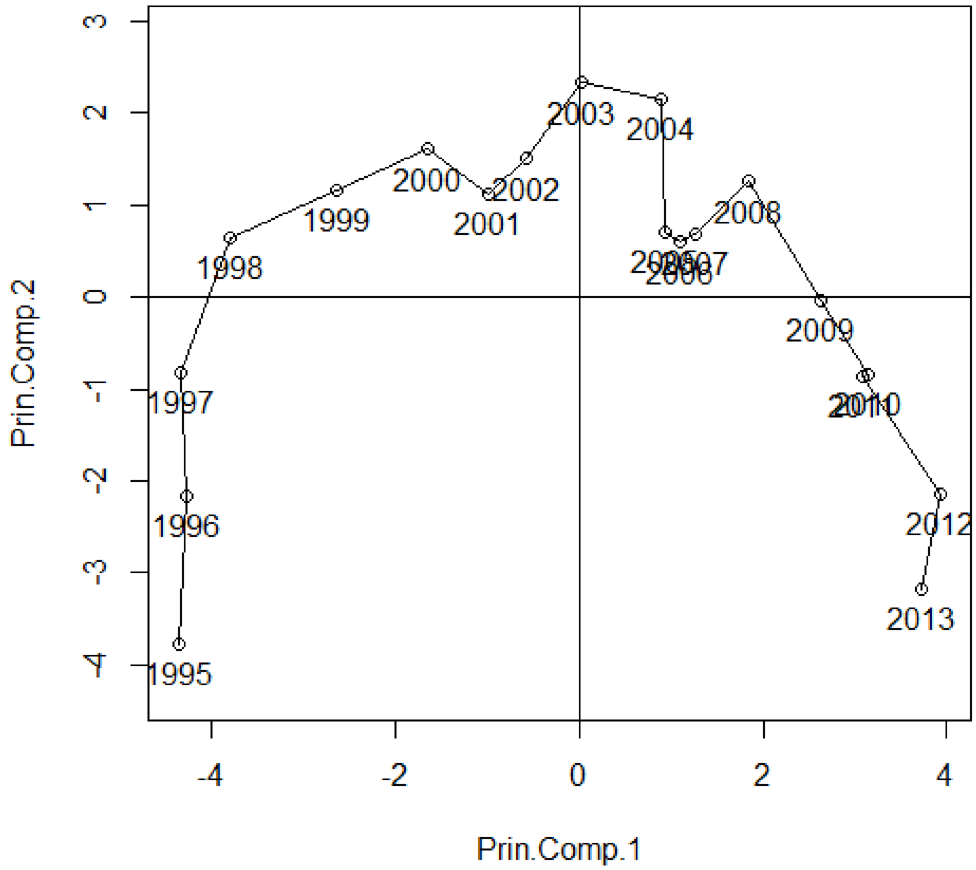

Figure 5 Crime evolution represented on the 1st principal plane

Years between 1995 and 1998 form the first period. These years are characterized by relatively high crime rates of Issuing cheques without provision, Corruption, Homicide, Homicides and offences to physical integrity due to traffic accidents, Defamation and relatively low crime rates of crimes like Robbery (with violence), Fraud, Crimes against public authority, Drunk driving, Forest fire crimes. While the values of these crimes were relatively constant, this period was characterized by a very rapid increase of crime rates of Property damage and Theft (without violence) and general decrease of Drug trafficking crimes. It is also interesting to note that crime rates of Issuing cheques without provision were also decreasing, but they still remained relatively high during the whole period. Crime rates of crime Defamation were slightly increasing towards the end of the period.

Years between 1998 and 2008 form the second period. These years are characterized by relatively high crime rates of Property damage and Theft (without violence) crimes and generally low crime rates of Drug trafficking crimes. Crime rates of Property damage and Theft were slowly increasing until 2003, when they reached their maximum. After 2003 they were decreasing slowly. However, this period was characterized by constant and rapid diminution of crime rates of Issuing cheques without provision, Corruption, Homicide, Homicides and offences to physical integrity due to traffic accidents, and Defamation and a constant and rapid increase of crime rates of crimes like Robbery (with violence), Fraud, Crimes against public authority, Drunk driving, and Forest fire crimes. Inside this period years 2005, 2006, and 2007 show specific crime dynamics, but we have to take into account that quality of their representation on the 1st principal plane is not good.

The last period is formed by years between 2008 and 2013. It is characterized by low crime rates of Issuing cheques without provision, Corruption, Homicide, Homicides and offences to physical integrity due to traffic accidents, and Defamation. Crime rates of these crimes generally have continued to decrease generally, but in this period very slowly. This period is also characterized by high crime rates of Robbery (with violence), Fraud, Crimes against public authority, Drunk driving, Forest fire crimes. Crime rates of these crimes have continued to increase generally, but in this period very slowly with the exception of Forest fire crimes and Fraud. Crime rates of Forest fire crimes and especially Fraud have continued to increase significantly in the last years. This period is especially characterized by a significant and constant diminution of crime rates of Property damage and Theft (without violence) and increase of crime rates of Drug trafficking.

Finally, it is possible to conclude that changes in crime rates off various crimes were gradual and they have followed few general patterns. Only crime rates of Falsification crimes don't show gradual changes; they even don't seem to follow any rule.

Generally crime rates of crimes like Issuing cheques without provision, Corruption, Homicide, Homicides and offences to physical integrity due to traffic accidents, and Defamation have significantly decreased in the period 1995-2013. Decrease of crime rates of these crimes has started after 1998, with the exception of crime Issuing cheques without provision, which crime rates show constant decrease during the whole period 1995-2013. Defamation has shown an increase of crime rates in the period 1995-1998. It is important to note that crime evolution of Corruption crimes is not explained so well on the 1st principal plane.

On the other hand crime rates of Robbery (with violence), Fraud, Crimes against public authority, Drunk driving, and Forest fire crimes have increased in the period 1995-2013. The most significant period of increase was between 1998 and 2008, with the exception of

Forest fire crimes and especially Fraud whose crime rates have continued to increase rapidly in the years after 2008.

Crimes like Drug trafficking, Theft and Property damage have shown circular evolution. Crime rates of Theft and Property damage were increasing until 2003 (with the fast increase in the period 1995-1998). After 2003 their crime rates have been decreasing. In 2013 their crime rates were in the similar level like in 1995. Crime rates of Drug trafficking crimes were high at the beginning of the period, they were relatively low in the middle of the period, and finally they were high at the end of the period.

Proximity of the variables on the 1st principal plane enables us to identify few groups of crimes with similar crime evolution patterns. First group includes Homicide, Homicides and offences to physical integrity due to traffic accidents, and Corruption. Second group includes Theft and Property damage. Third group includes Robbery, Crimes against public authority, and Drunk driving.

It is possible to observe an interesting phenomena; crimes with similar evolutions generally don't belong to same crime types. It seems that different socio-economic factors and public policies have resulted in similar crime evolution patterns. Also sometimes crime evolution patterns are unexpected. For example, while the number of Drunk driving crimes has significantly increased, the number of Homicides and offences to physical integrity due to traffic accidents has decreased. Also Theft and Robbery don't follow the same evolution pattern; Theft is correlated with Property damage, while Robbery is correlated with Drunk driving.

In the further studies it may be interesting to analyse socio-economic factors and public policies which affected crime evolution. It may be interesting to analyse why changes have occurred in years 1998 and 2008, especially having in mind the beginning of the recession in Portugal in 2008.

5.1.2. Interstructure analysis of data tables

The second part of the global crime analysis is going to be to detect similarity and to observe is there a commune structure in 19 data tables with 10 variables and 30 observations where each table represents one year of the 1995-2013 period. This will be done using STATIS technique - finding the interstructure. This procedure will indicate if it is going to be possible to obtain a good compromise.

Since Theft (without violence) crime rate has significantly higher values than any other crimes, we decided to work with matrices on observation space $M_d = (M_{1/s^2})_d$.

First part of interstructure analysis find RV coefficients for different years. RV coefficients represent the correlation between spatial crime structures in different years and are shown in the annex. They have the same order of size and they are always greater than 0.67. It can be concluded that crime structures in all the years of the studied period are correlated.

Norms of data tables are shown in the table annex. It is notable that norms have relatively similar values, which indicates that it may be possible to obtain a good compromise without normalizing the objects W_t.

Non-centred Euclidian image of interstructure is obtained by performing a PCA on the matrix of Hilbert-Schmind scalar products S (annex) and is shown on the Figure 6. Eigenvalues of a matrix S, together with the percentage of inertia associated to each of them is shown in the table X- annex. Inertia related with the 1st axis is about 81.23%, while inertia related with 2nd axis is about 6.57%. Since first principal plane captures about 87.8% of inertia, interstructure is well represented. Each year is represented in the form of OM line segment where O is the centre of the coordinate system and M a point on the plane.

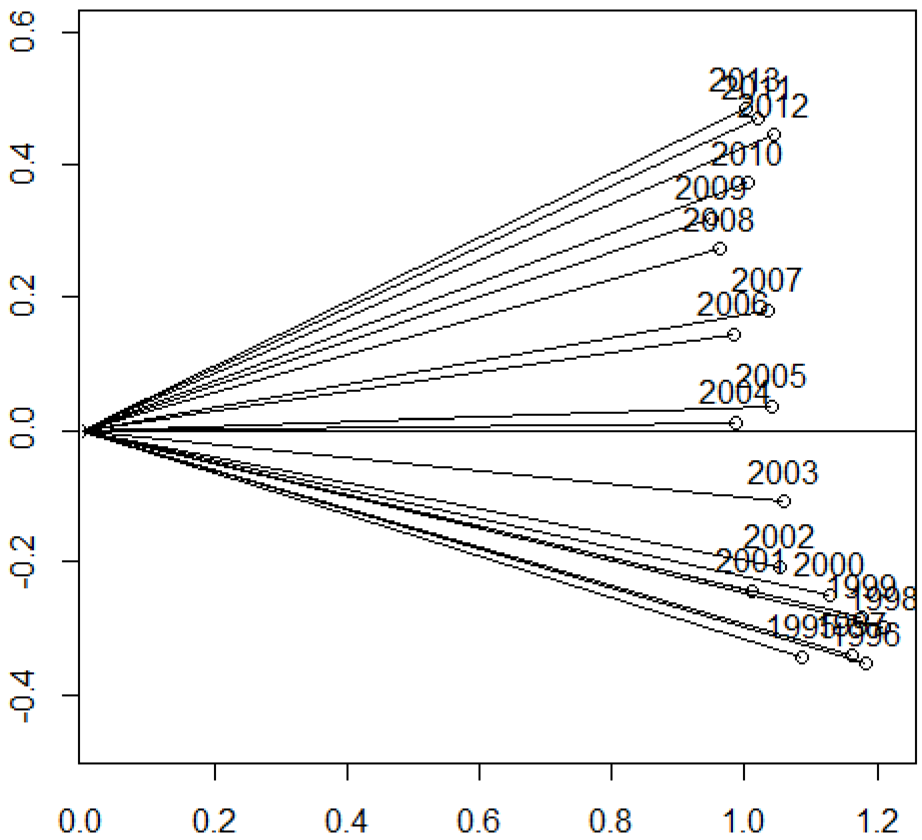

Figure 6 Interstructure

It is notable that in general the pairs of years which have lower values of RV coefficients (the ones that have bigger angles between their line segments on the Figure 6) are the ones that are more far away in the time period, while the ones with higher RV coefficients (the ones that have smaller angles between their line segments on the image) are the ones that are more far away in the time period. Since RV coefficients represent correlations between crime structures in different years, it can concluded that crime structures in neighbouring years were very correlated and as the years passed the correlation was lower and lower. There wasn't any dramatic change in the crime evolution between years; the change in the crime patterns was graduate.

Since RV coefficients and norms have the same order of size, the compromise will represents a good overview of the data structure.

5.2. Spatial analysis of crime evolution in Portugal

5.2.1. Definition of the compromise

Compromise matrix was calculated as the linear combination of intrastructurte matrices. Eigenvectors of the compromise matrix are shown in the table X-annex. Eigenvalues of a matrix W, together with the percentage of inertia associated to each of them is shown in the annex.

Coefficients a_k associated with W_k matrices are shown in the Table 5. Years like 1999 and 2000 are favoured by comprise structure, while the years like 1995, 2004, and 2009 do not have such a good representation on a compromise. Overall, all years have a relatively significant contribution to the compromise.

	Coefficient a_k
1995	0.044634
1996	0.049923
1997	0.049102
1998	0.047867
1999	0.055343
2000	0.056816
2001	0.051186
2002	0.052565
2003	0.046334
2004	0.043106
2005	0.047648
2006	0.051727
2007	0.046487
2008	0.048973
2009	0.044585
2010	0.045507
2011	0.048489
2012	0.051378
2013	0.049471

Table 5 Coefficients a_k associated with W_k matrices represented by years

Diagonalization of matrix WD showed that 1st principal component explains about 43.93% of inertia, while 2nd principal component explains about 14.15 % of inertia. The decision was to represent compromise with two principal components; 1st principal plane explains about 58.07 % of inertia.

5.2.2. Interpretation of compromise

Interpretation of compromise PC regarding crime types and their evolution is obtained by calculating correlation of principal components with all the variables in all the tables. This way we can obtain a trajectory of a crime type and plot it, which enables efficient interpretation of PC.

Correlation of variables with the 1st and 2nd principal component is shown in the annex. Trajectories of correlations of the variables with principal components are also shown in annex**.**

Variables Theft (without violence), Robbery (with violence), Fraud, Drug trafficking, Falsification crimes show a strong correlation with 1st PC during the whole period, while the variable Forest fire crimes shows a strong to moderate negative correlation with 1st PC during the whole period. Very strong positive correlation is especially notable for the variable Theft (without violence), which is a crime type with the significantly highest crime rate in Portugal. These variables do not show a significant correlation with 2nd PC. However it is notable that variable Robbery (with violence) has a low but stable positive correlation with 2nd PC, while variable Drug trafficking has a low but constant negative correlation with 2nd PC.

Variable Drunk driving has a medium positive correlation with the 2nd PC at the beginning of the study period and high positive correlation with the 2nd PC in rest of the period. It has a very low positive correlation with 1st PC.

Variable Property damage has a medium to low positive correlation with the 2nd PC at the beginning of the period, while at the end of the period the correlation becomes higher. It is notable that the correlation with the 1st PC is high and positive only in the period 1996-2002.

Variable Crimes against public authority are strong positive correlation with the 1st PC at the beginning (1995-2000) and at the end (2007-2013) of the study period. It is interesting to note that the correlation with the 2nd PC was medium positive in the period 2001-2008 when the correlation with 1st PC is low.

Variable Defamation has a stable medium positive correlation with the 2nd PC, while the correlation with the 1st PC evolves gradually from being medium positive at the beginning of the study period, then it becomes almost insignificant in the middle of the period, and finally it becomes moderate negative at the end of the period.

In general 1st PC opposes regions with higher crime rates related with crimes like Theft (without violence), Robbery (with violence), Fraud, Drug trafficking, Falsification and lower crime rates related with Forest fire crimes on one side, and regions with lower crime rates related with crimes like Theft (without violence), Robbery (with violence), Fraud, Drug trafficking, Falsification and higher crime rates related with Forest fire crimes on the other side during the whole period 1995-2013.

It is notable that crimes related with Theft (without violence) are especially well represented on the 1st PC during the whole study period. Also it is notable that crimes like Drunk driving, Property damage, Crimes against public authority have a positive correlation with 1st PC during the whole period, but the correlation wasn't so strong.

Taking into account these facts, it can be concluded that 1st PC opposes regions with more crime ("crime hot spots"), especially with more severe crimes like crimes like Theft (without violence), Robbery (with violence), Fraud, Drug trafficking, Falsification and Crimes against public authority (except a period 2001-2006), with areas with lower crime rates, especially with less severe crimes. Only exception of this rule are the crimes related with forest fires; there are more forest fire crimes in the regions with less "severe" crimes and vice versa.

In general 2nd PC opposes regions with a the higher crime rates of crimes like Drunk driving, Property damage (especially after 2003) and Defamation and regions with lower crime rates related with same crime types during the whole period 1995-2013. Drunk driving crimes have the best representation on this axis, but Property damage is also very well represented, especially in the period after 2003.

In general 2nd PC is less correlated with crimes like Drunk driving, Property damage and Defamation in comparison with 1st PC which is more strongly correlated with crimes like Theft (without violence), Robbery (with violence), Fraud, Drug trafficking, Falsification. Still, it is possible to have a good explaination of 2nd PC.

2nd PC axis opposes regions with higher crime rates of specific groups of crimes (Drunk driving, Property damage and Defamation) which can be seen as less severe crimes and regions with lower crime rates related with these specific crimes.

Finally correlation of variables with PC are shown in the annex.

5.2.3. Interpretation of compromise position of NUTS III regions

Compromise position of NUTS III regions on the Euclidian image represents their average position during the study period regarding different crime types. Their compromise position on the first principal plane is shown on a Figure 7. First two principal components are shown in table 6.

	comp 1	comp 2
Alentejo Central	-0.05121	0.111364
Alentejo Litoral	0.030194	0.117521
Algarve	1.032776	0.310736
Alto Alentejo	-0.13801	0.266878
Alto Trás-os-Montes	-0.24802	0.127337
Ave	-0.18389	-0.33715
Baixo Alentejo	-0.14811	0.20993
Baixo Mondego	0.068845	-0.16164
Baixo Vouga	0.156396	0.071706
Beira Interior Norte	-0.27849	-0.02786
Beira Interior Sul	-0.07397	0.236158
Cávado	0.016848	-0.23218
Cova da Beira	-0.26359	0.041347
Dão-Lafões	-0.19363	-0.09821
Douro	-0.29315	0.158515
Entre Douro e Vouga	-0.12531	-0.12552
Grande Lisboa	1.022254	-0.30229
Grande Porto	0.430023	-0.36303
Lezíria do Tejo	0.044129	0.038442
Médio Tejo	-0.17459	-0.17968
Minho-Lima	-0.12725	0.185742
Oeste	0.023207	-0.13243
Península de Setúbal	0.547266	-0.10457
Pinhal Interior Norte	-0.43207	-0.02668
Pinhal Interior Sul	-0.53371	-0.17984
Pinhal Litoral	0.096394	-0.1954
Região Autónoma da Madeira	0.179671	0.120312
Região Autónoma dos Açores	0.308131	0.503496
Serra da Estrela	-0.36402	0.144655
Tâmega	-0.32712	-0.17767

Table 6 First two compromise principal components

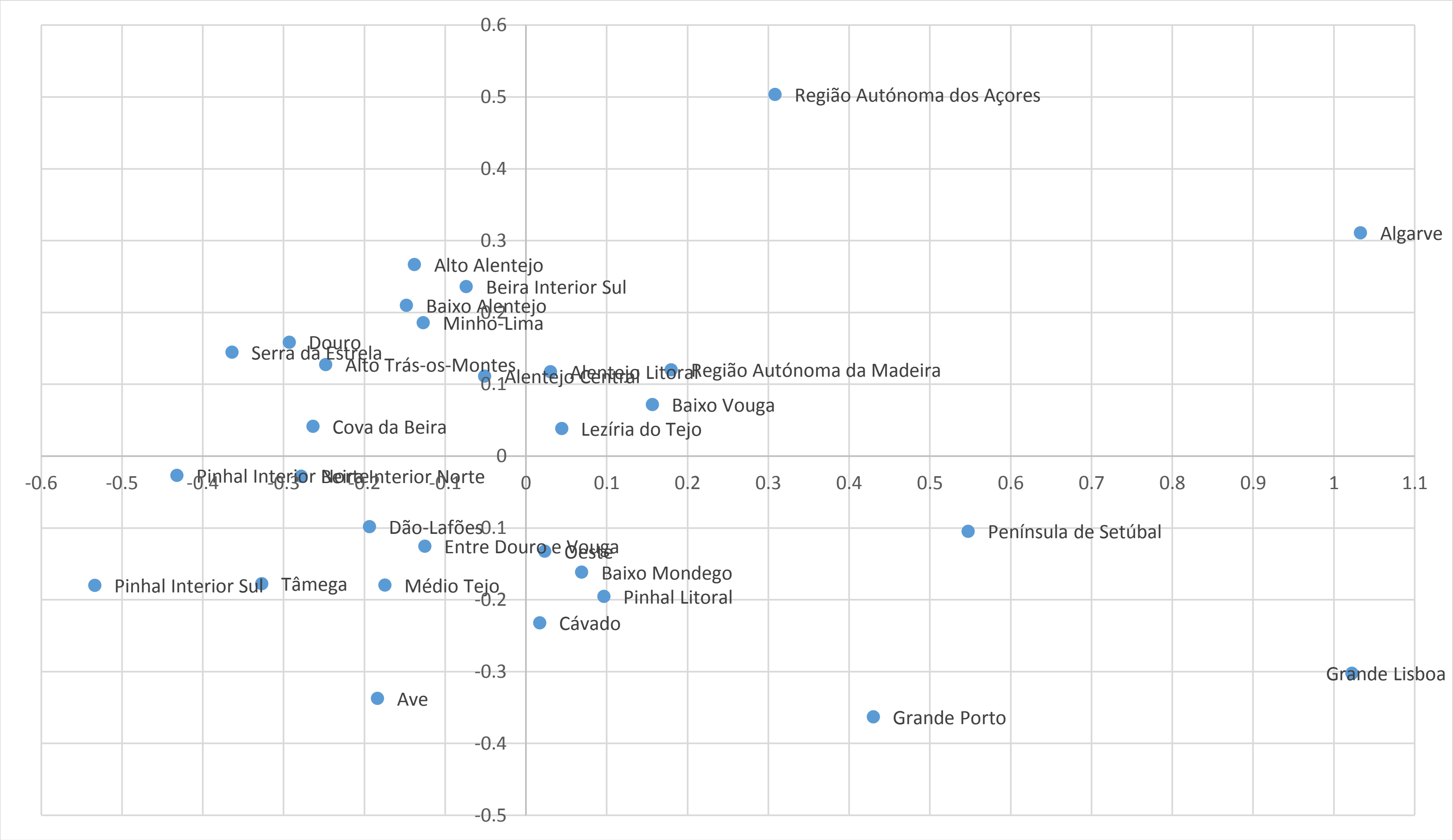

Figure 7 Compromise position of NUTS III regions on the 1st principal plane

It is notable that there are 5 probable multivariate outliers: Algarve, Grande Lisboa, Peninsula de Setubal, Grande Porto and Açores. Grande Lisboa, Peninsula de Setubal, and Grande Porto regions form two biggest metropolitan areas in Portugal - Lisbon metropolitan area and Porto metropolitan area. Algarve is the region in the south of Portugal whose economy is heavily oriented toward tourism, and Açores are group of islands far away from the continental Portugal.

It is notable that Algarve is the crime hot-spot of Portugal; it has very high values on both 1st and 2nd PC, which implicates that Algarve had high crime rates of both "severe" crimes and specific crimes associated with 2nd PC.

Peninsula de Setubal and Grande Lisboa regions have high and positive values on the 1st PC, which implicates that in Lisbon metropolitan area crime rates of "severe" crimes were high during the 1995-2013 period.

Negative values on 2nd PC implicate low crime rates of specific crimes like Drunk driving, Property damage or Defamation during the 1995-2013 period in the Lisbon metropolitan area. It is notable that Grande Lisboa has higher values on 1st PC than Peninsula de Setubal, which implicates higher crime rates of "severe" crimes.

Grande Lisboa also has lower values on 2nd PC than Peninsula de Setubal, which implicates lower crime rates of crimes like Drunk driving, Property damage or Defamation during the 1995-2013 period.

Other NUTS III regions are situated on the middle of the principal plane. They form one cluster. Distances between these 25 regions on the first principal plane are generally smaller than the distances between these regions and the outliers.

Values of first two principal components are also shown on a map are shown on figures 8a and 8b. Image 8a indicates that distribution of values of 1st PC shows a spatial pattern. Value of Global Moran's Index is equal to 0.188, values of z-score is 2.067, and value of p-score is 0.039. These values indicate that we can reject null-hypothesis; spatial pattern is not the result of random processes. Slightly positive values of Moran's I indicates that values of 1st PC tend to be clustered.

It is notable that areas with highest values of 1st PC (which implies generally more severe crimes like Theft, Robbery, Fraud, Drug trafficking, Falsification crimes and less forest fires during the period 1995-2013) in general are Algarve and Lisbon and Porto metropolitan areas. The values of the 1st component are also elevated in littoral regions of Portugal including

Azores and Madeira. Generally less severe crimes and more forest fires are found in the regions in the inland Portugal. Safest areas during the study period in terms of severe crimes were regions Pinhal Interior Norte and Pinhal Interior Sul. The results of the analysis show that these severe crimes are mostly concentrated in major urban areas and other areas with higher population density since littoral Portugal is more populated and urbanised then the inland. On the other hand forest fire crimes follow the opposite pattern. Rural areas with lower population density and less severe crimes have more forest fire crimes. This is not surprising since these areas are more forested.

Image 8a indicates that distribution of values of 2nd PC shows a spatial pattern. Value of Global Moran's Index is equal to 0.221, values of z-score is 2.208, and value of p-score is 0.027. These values indicate that we can reject null-hypothesis; spatial pattern is not the result of random processes. Slightly positive values of Moran's I indicates that values of 2nd PC tend to be clustered.

The value of the 2nd PC is significantly highest on the Azores. On the continental Portugal the value of 2nd PC is elevated in the southern and south-eastern regions like Algarve, Alentejo and Beira Interior Sul. The values are also elevated in some northern and north-eastern regions and on Madeira. These are the areas with generally more crimes like Drunk driving, Property damage (especially after 2003) and partly Defamation during the period 1995-2013. It is interesting to note that Lisbon and Porto metropolitan areas had lower crime rates of these types of crimes. It is obvious that these crimes are more related with rural areas, but their pattern is a bit different than the pattern of forest fire crimes. Forest fire crimes follow clearly opposite spatial patterns then severe crimes and thus show contrast between dominantly rural and urban regions. However, spatial patterns of Drunk driving, Property damage and partly Defamation (which are generally related with dominantly rural regions) are more complex. This is notable in the case of Algarve which has high crime rates of both crime groups (except Forest fire crimes).This is probably due to heavily urbanised littoral and less urbanized interior. Pinhal Interior Sul, rural region without any city, is a rural area with low crime rates of both crime groups (except Forest fire crimes).

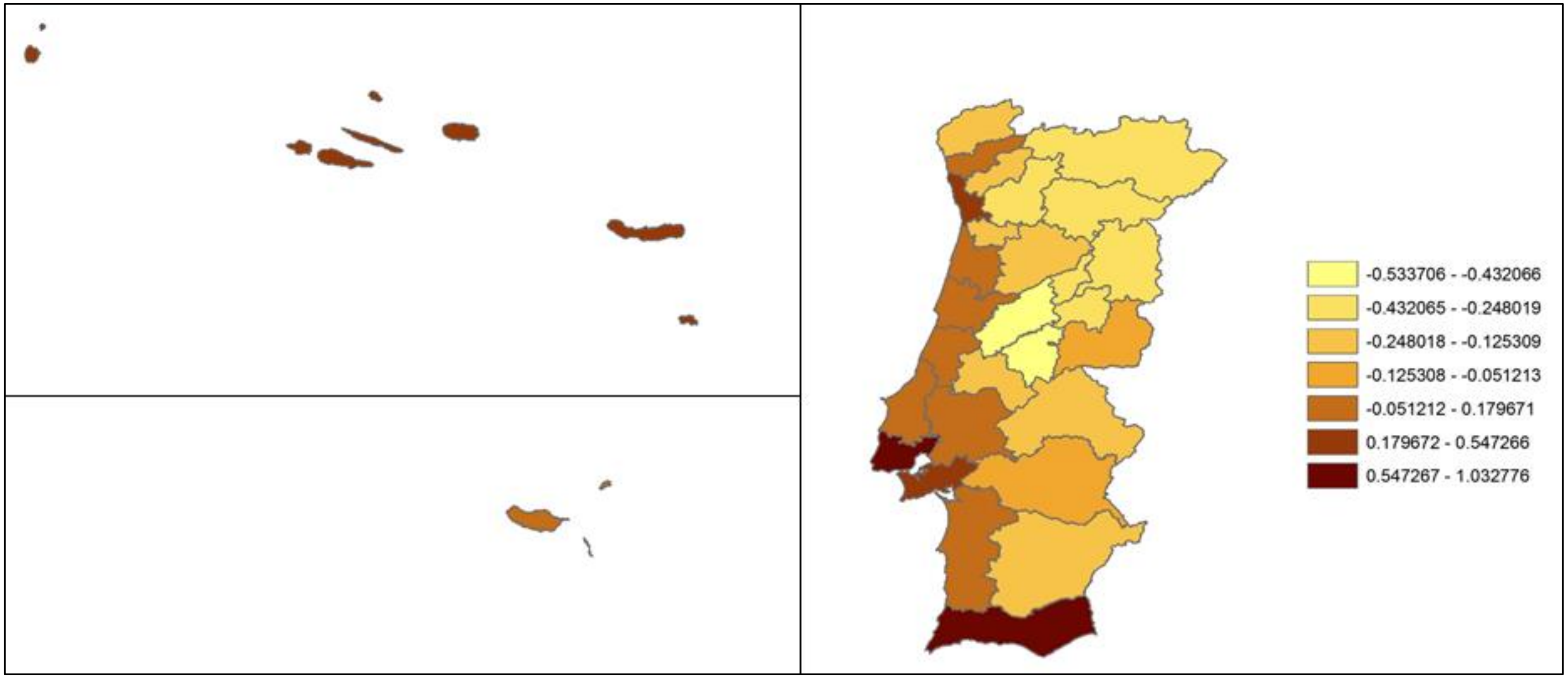

Figure 8a Values of 1st PC

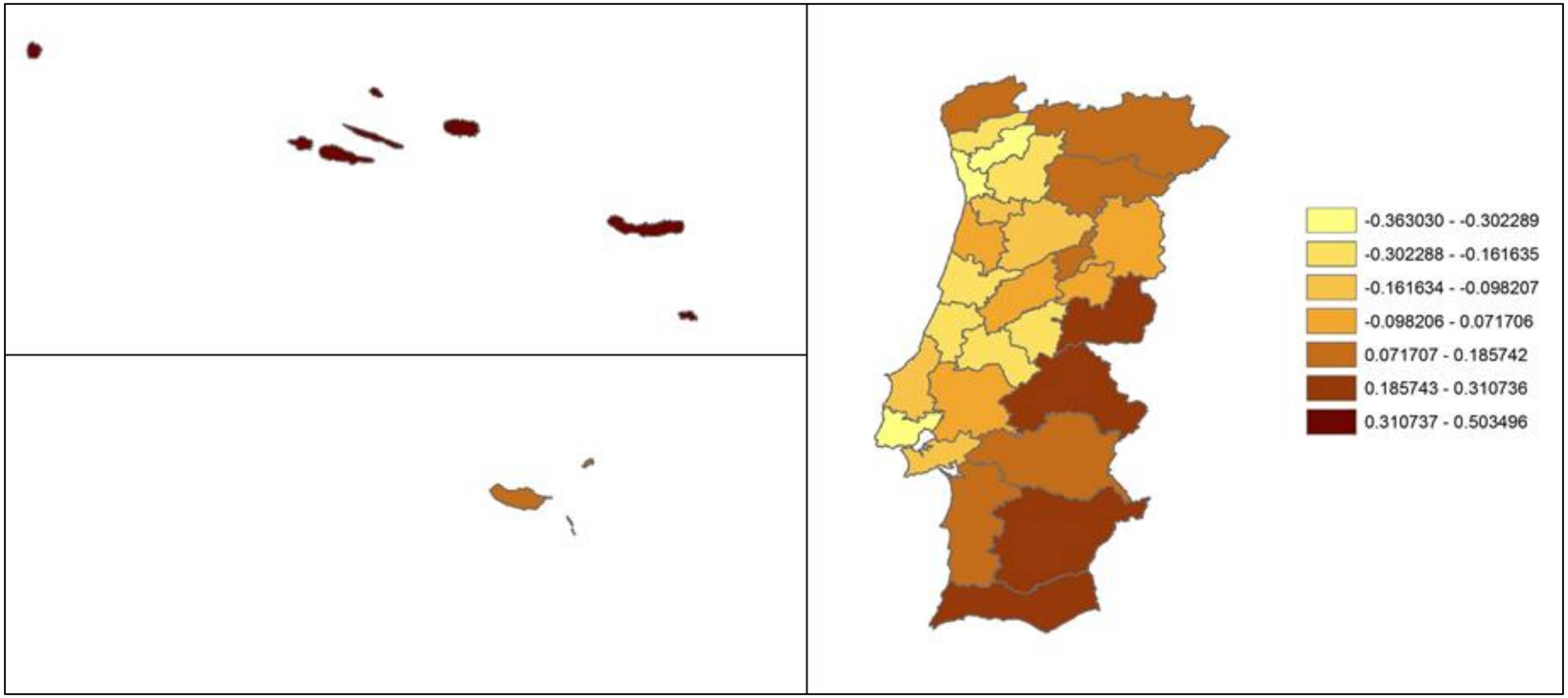

Figure 8b Values of 2nd PC

Clustering methods were used to have a better understanding of similarities and differences in crime structure between NUTS III regions. Coordinates of NUTS III regions on the first principal plane were used for clustering.

In the first phase hierarchical clustering was used to get a basic idea about the similarities between NUTS III regions and potential number of clusters. In the second phase k-means algorithm was used to find the optimal partition. Outliers were not included into clustering algorithms because each outlier is very distant from other region, so it can represent its own class.

Percentage of intraclass inertia for 1-15 clusters and for four hierarchical clustering methods is shown in annex. It is notable that ward's method has the best value in all cases except in the case 3 clusters when it is outperformed by complete method. Our decision is to take into consideration results of the hierarchical clustering with ward's method since we want to obtain more than 3 clusters. Dendogram of the hierarchical clustering using ward's method is shown on the Figure 9. From the dendogram it is possible to conclude that a good solution may be to partition the set of observations into 6 clusters.

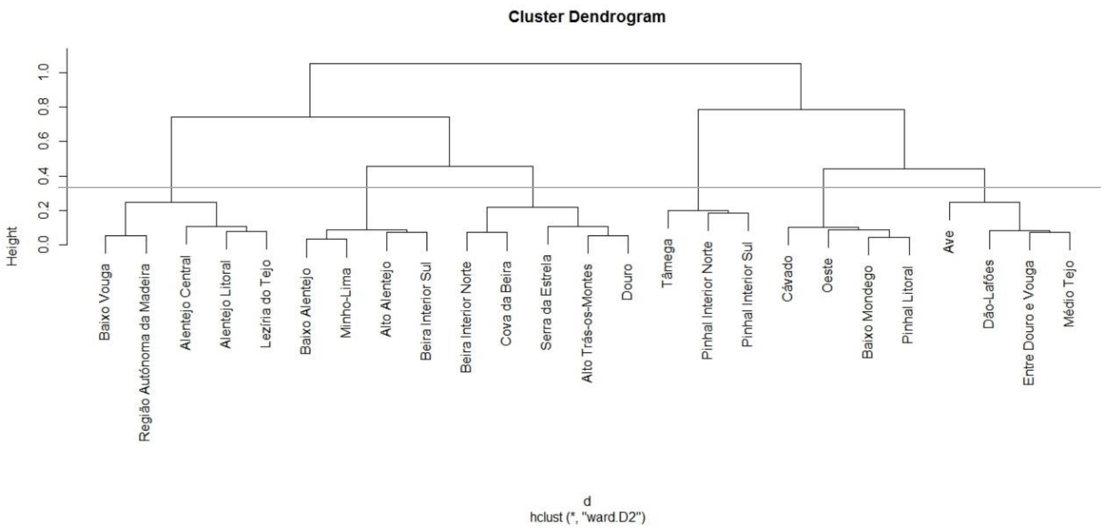

Figure 9 Dendogram for ward’s method

In the second phase we've decided to partition the set of observations into 6 clusters and run k-means algorithm. In the first attempt we've used the centres of gravity of 6 clusters obtained by ward's hierarchical clustering method as initial seeds. Later we applied k-means algorithm several times with random initialization.

The best solution was obtained using centres of gravity of clusters obtained by hierarchical clustering as initial seeds with the percentage of intraclass inertia ---. It is interesting to note that these clusters are not identical as clusters obtained by hierarchical clustering. This way NUTS III regions were assigned to 11 classes, where 6 classes correspond to 6 clusters and other 5 classes to 5 outliers (annex).

Average values of principal components for 6 clusters are shown on the Figure 10, while average values of principal components for 5 outliers are shown on the Figure 11.

Regions of class 1 have highest values of the 1st component, and relatively high values of the 2nd component.

Regions of class 2 have moderate values of the 1st component, and highest of the 2nd component.

Regions of class 3 have low values of the 1st component, and relatively high values of the 2nd component.

Regions of class 4 have moderate values of the 1st component, and very low values of the 2nd component.

Regions of class 5 have high values of the 1st component, and very low values of the 2nd component.

Regions of class 6 have lowest values of the 1st component, and low values of the 2nd component.

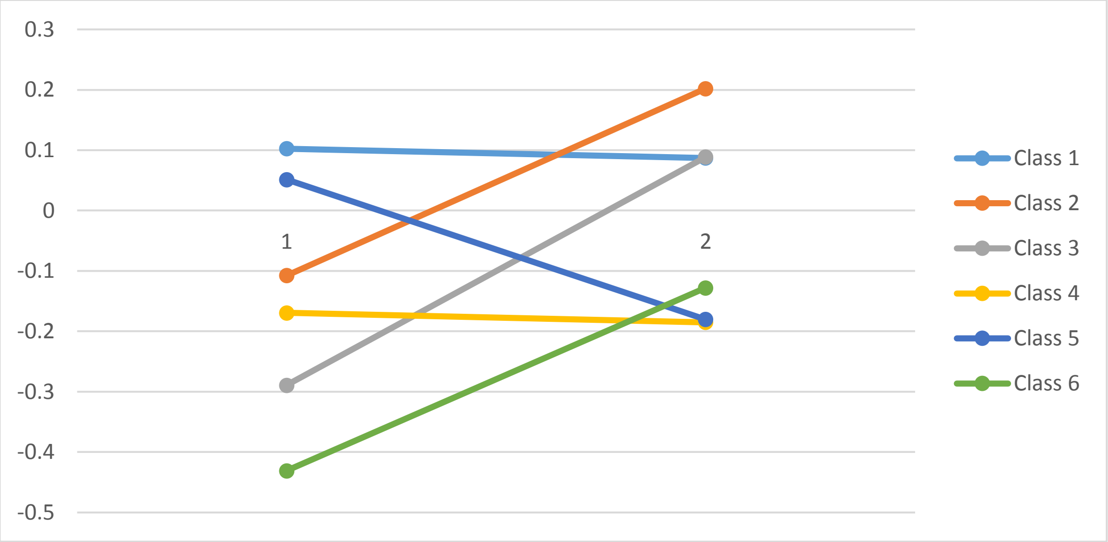

Figure 10 Average values of principal components for classes 1-6

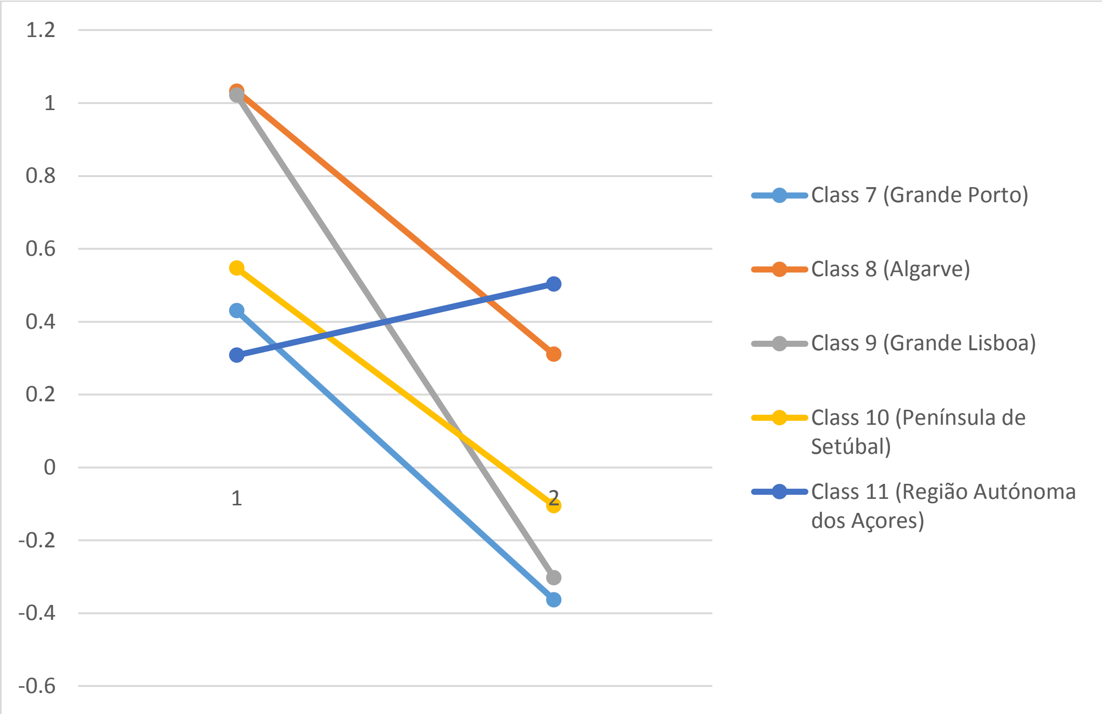

Figure 11 Average values of principal components for classes 7-11

Map of NUTS III regions classified by their compromise position on the 1st principal plane is shown on the Figure 12. We can note that classes are generally spatially clustered (except in the case of class 1 where the regions are completely scattered) and that a spatial pattern exists.

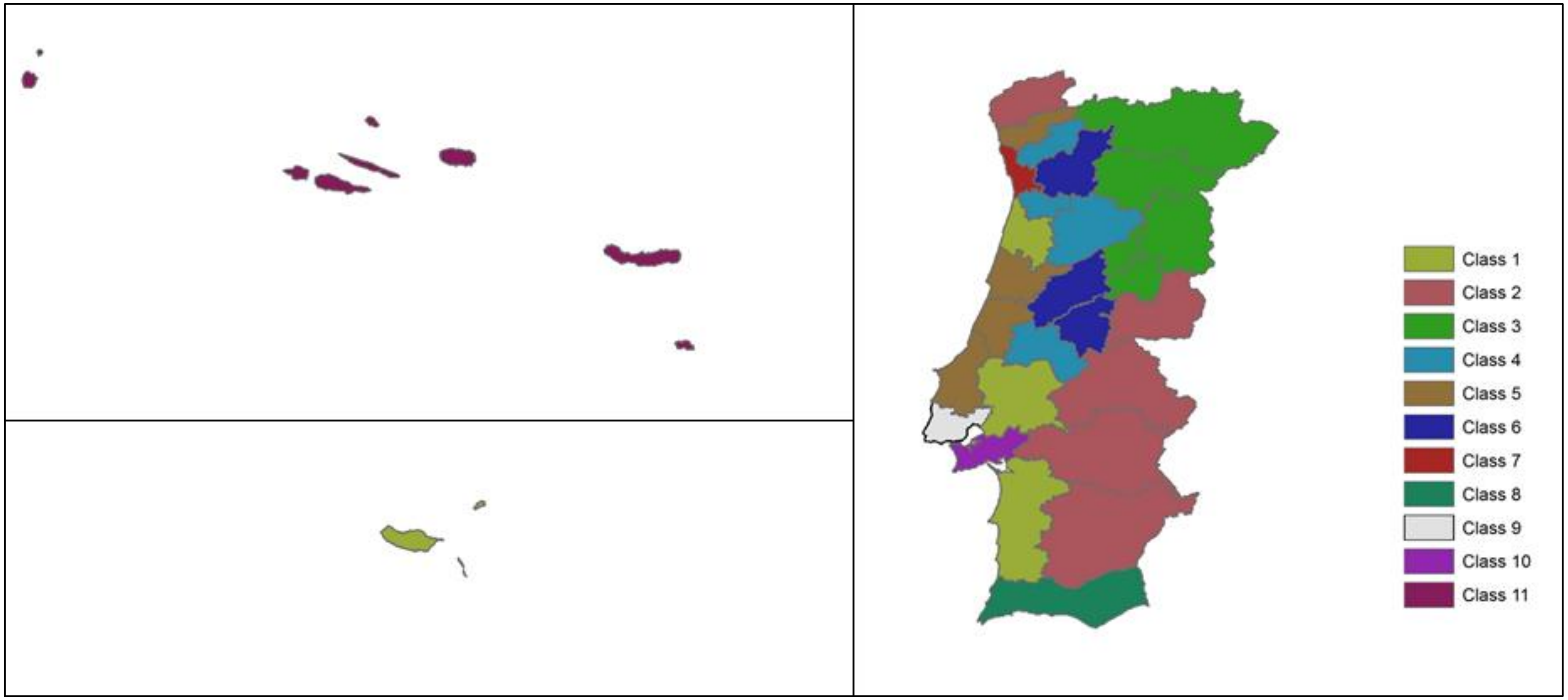

Figure 12 Map of NUTS III regions classified by their compromise position

5.2.4. Trajectories of NUTS III regions

In the last part of the STATIS analysis trajectories of observations in the first principal compromise plane were obtained. All 30 trajectories for all 30 regions of Portugal are shown in annex. It was very important to analyse crime evolution in Grande Lisboa and Grande Porto, since these two areas have the highest contribution to overall crime evolution in Portugal.

Trajectories obtained by STATIS are interpreted in context of average evolution of the whole data set. This means that change of the position of the observation on the axis does not reflect the absolute change of value of variable of the observation explained by that axis. Change in the position of observation reflects change in the value of the variable in comparison to its mean values. Observations with small amplitude on an axis show similar evolution as the whole data set.

Grande Lisboa shows a large amplitude on the 1st axis. The value of the 1st component significantly decreased from 1998 until 2007, which represents the decrease in contribution of Grande Lisboa to severe crimes in Portugal. After 2007 value of the 1st component increased a bit, but its values were still lower in 2013 than in 1995. This means that Grande Lisboa had a higher contribution to severe crimes at the beginning of the period than at the end. There was lot of variation in the values of 2nd component in the period 1995-2013, but finally the value of the component was higher in 2013 than in 1995; this mean that Grande Lisboa had lower contribution to Drunk driving, Property damage and Defamation at the beginning of the period than at the end.

The positions of Grande Porto in compromise plane in 1995 and 2013 are almost the same, which reflects similar contribution to all crimes at the beginning and at the end of the study period. Contribution of Grande Porto to crimes explained by 2nd axis was lowest in the 1st half of 2000s. Its contribution to severe crimes was increasing until it reached it maximum in 1999. Later the contribution to severe crimes decreased from 1999 until 2009, when it reached its minimum. After 2009 it increased a bit.

Península de Setúbal shows a large amplitude on both axes, but especially on the 1st. It is notable that contribution of Península de Setúbal to severe crimes has been increasing in the period 1997-2000. In this period its contribution to crimes explained by 2nd axis was also very high. Then the contribution of all crimes was generally decreasing in the period 2000-2006. In the period after 2006 there was no any significant pattern. The values of both components are very similar in 1995 and 2013 which is explained by similar contribution of Península de Setúbal to all crimes at the beginning and at the end of the study period.

Algarve shows a large amplitude on both axis. We can note that contribution of Algarve to crimes explained by the 2nd axis has increased significantly from the beginning of the period when it was lowest. The contribution to crimes explained by 2nd axis was maximal in 2007. Algarve's contribution to severe crimes was similar in 1995 and 2013, but with a lot of variation during the study period especially on the 1st axis.

Região Autónoma dos Açores shows a large amplitude on both axis without significant pattern. Contribution of this region to all crimes was higher in 2013 than in 1995.

Região Autónoma da Madeira shows an interesting evolution. The contribution Madeira to crimes explained by 2nd axis was high at the beginning of the period and it was rapidly decreasing until 2013. The contribution of Madeira to severe crimes was also decreasing until 2005. We can conclude that overall contribution of Madeira to all crimes in Portugal has significantly decreased.

The evolution of Alentejo Litoral shows a large amplitude from the beginning until the end of the period, especially on the 1st axis. It shows that there was a significant increase of contribution of this region to severe crimes. In the period 1995-2006 contribution to crimes explained by 2nd axis had increased, but it became lower again towards the end of the period.

Alto Alentejo doesn't show such a large amplitude because the positions of points representing the beginning and at the end of the period are similar. It shows crime evolution similar to crime evolution in Portugal. However, in the period 2002-2008 there was a significant growth of crimes like Drunk driving, Property damage and Defamation (similar like in Alto Alentejo) in comparison to evolution of these crimes in Portugal.

Alentejo Central showed crime evolution patterns which were very similar to average crime evolution in Portugal until 2003. After 2003 contribution of Alentejo Central to crimes explained by 2nd axis started to change with general decrement trend. Contribution of this region to crimes explained by 2nd axis is lower in 2013 than in 1995, while the contribution to crimes explained by 1st axis was similar in the whole period.

Contribution of Baixo Alentejo to crimes explained by 2nd axis was changing during the whole period, while de evolution of severe crimes was very similar to average crime evolution of severe crimes in Portugal (except in 2010). Contribution of this region to crimes explained by 2nd axis was increasing until 2003 and 2004 when it reached maximum. After 2004 the contribution was decreasing until 2013. Contribution of this region to crimes explained by 2nd axis is lower in 2013 than in 1995.

Baixo Vouga showed crime evolution patterns which were very similar to average crime evolution in Portugal until 2002. After 2003 contribution of Baixo Vouga to crimes explained by 2nd axis was increasing until 2008, when it started to decrease. Contribution of this region to all crimes was similar in 2013 and in 1995.

Contribution of Lezíria do Tejo to severe crimes has increased significantly in the period 1995-2013 with some small variation. Contribution of this region to crimes explained by 2nd axis similar in 2013 and 1995, but with the period of decrease 1995-2004 and the period of increase 2004-2013.

Beira Interior Sul showed crime evolution patterns which were very similar to average crime evolution in Portugal until 2000. After 2000 contribution of Beira Interior Sul to crimes explained by 2nd axis was increasing until 2004/2005, when it started to decrease. Contribution of this region to all crimes was similar in 2013 and in 1995, while the contribution to crimes explained by 1st axis was generally similar in the whole period (with few outliers).

Cova da Beira shows a very big amplitude on both axis without a strong pattern, especially on the 2nd. Contribution of this region to all crimes was similar in 2013 and in 1995.

Minho-Lima showed crime evolution patterns which were similar to average crime evolution in Portugal until 2007. In the period after 2007 contribution of this region to crimes explained by 2nd axis has increased.

Alto Trás-os-Montes trajectory has a very high amplitude which represents an evolution different to average evolution in Portugal. Generally contribution of this region to crimes explained by 1st axis has decreased in the period 1995-2013, while contribution of this region to crimes explained by 2nd axis has increased in the period 1995-2013. Evolution trend were not constant during the whole period.

Beira Interior Norte shows moderate amplitude on both axes without a strong pattern. Contribution of this region to all crimes was similar in 2013 and in 1995.

Douro trajectory has a high amplitude which represents an evolution different to average evolution in Portugal. Contribution of this region to crimes explained by 1st axis has slightly decreased in the period 1995-2013, while contribution of this region to crimes explained by 2nd axis has slightly increased in the period 1995-2013. Contribution of Douro to crimes explained by 2nd axis was particularly high in years 2005 and 2006.

Serra da Estrela shows a very different evolution of crimes explained by the 2nd axis in comparison to average crime evolution in Portugal. In general significant increase of contribution of this region to crimes explained by the 2nd axis is notable when comparing 1995 and 2013. The changes in contribution of this region to crimes explained by the 1st axis were significant, but they don't show a significant pattern.

Contribution of Ave to crimes explained by 2nd axis was generally decreasing until 2003, when it started to increase. The contribution was generally increasing until 2013, so finally the contribution of this region to all crimes was similar in 2013 and in 1995. Contribution to crimes explained by 1st axis has not changed significantly during the whole period.

Contribution of Dão-Lafões to crimes explained by 1st axis was increasing during the period 1996-2004, while the contribution to crimes explained by 2nd axis was decreasing during the period 2004-2012. Finally, contribution of this region to crimes explained by 1st axis was slightly higher in 2013 than in 1995, while the contribution to crimes explained by 2nd axis was similar in 2013 and 1995.

Entre Douro e Vouga shows moderate amplitude on both axes with many short periods with specific crime evolution patterns. Contribution of this region to all crimes was slightly lower in 2013 than in 1995.

Médio Tejo shows moderate amplitude on both axes with many short periods with specific crime evolution patterns. Contribution of this region to crimes explained by 1st axis was slightly higher in 2013 than in 1995, while the contribution to crimes explained by 2nd axis was slightly lower in 2013 and 1995.

Baixo Mondego showed crime evolution patterns of severe crimes which were similar to average crime evolution of severe crimes in Portugal. This region also shows constant and significant decrease of crimes explained by 2nd axis during the whole period.

Contribution of Cávado to crimes explained by 1st axis was increasing during the period 1997-2002, while the contribution to crimes explained by 2nd axis was decreasing during the period 1997-2003. Later, contribution of this region to crimes explained by 1st axis was decreasing until 2013, while the contribution to crimes explained by 2nd axis was increasing during the period 2007. Finally, contribution of Cávado to all crimes slightly lower in 2013 than in 1995.

Oeste shows moderate to small amplitude on both axes. Evolution of crimes in Oeste was particularly similar to average crime evolution in Portugal in the period after 1997. Contribution of this region to crimes explained by 1st axis was slightly higher in 2013 than in

1995, while the contribution to crimes explained by 2nd axis was slightly lower in 2013 and 1995.

Contribution of Pinhal Litoral to crimes explained by 2nd axis was generally decreasing until 2008 when it reached minimum. After 2008 there was a period of slight increase, but contribution of this region to crimes explained by 2nd axis was similar in 2013 and 2008. It was much significantly lower than in 1995. Contribution to crimes explained by 1st axis has not changed significantly during the whole period.

Contribution of Pinhal Interior Norte to crimes explained by 1st axis has increased during the study period, with the period 1995-2008 with most significant increase. Contribution of this region to crimes explained by 2nd axis was similar in 2013 and 1995, but there were periods with notable variation.

Pinhal Interior Sul shows high amplitude on both axes. However, contribution of this region to crimes explained by 2nd axis was similar in 2013 and 1995, while the contribution to crimes explained by 1st axis was slightly higher in 2013 than in 1995.

Tâmega shows moderate to small amplitude on both axes. Finally, contribution of this region to all crimes was similar in 2013 and in 1995.

5.2.5. Classification of trajectories of NUTS III regions

It is hard to interpret each trajectory because of large number of points on and large number of trajectories. There was a need to apply trajectory classification methods which enable us to reduce the number of trajectories and make the interpretation easier. Classification was applied regarding compromise position - evolution.

To apply classification algorithm we had to find the optimal configuration where the relation between inertia of the set of position coordinates and inertia of the set of evolution coordinates is closest possible to 1. Results have shown that optimal configuration is { 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0 }, which means that only 1st and 14th coordinates keep their position coordinates, while other position coordinates are transformed into evolution coordinates. Ration between two types of inertia is 1.047118. Classification was applied on this table.

In the first phase of the analysis hierarchical clustering was used to get a basic idea about the similarities between NUTS III regions regarding the trajectory compromise position - evolution and potential number of clusters. In the second phase k-means algorithm was used to find the optimal partition.

Percentage of intraclass inertia for 1-15 clusters and for four hierarchical clustering methods is shown in the annex. It is notable that ward's method has the best value in all cases except in the case 3 clusters when it is outperformed by complete method. In some cases percentage of inertia is the same for ward's method and some other methods, but in general ward's method is the most appropriate. So, we decided to use ward's method in the analysis. Dendogram of the hierarchical clustering using ward's method is shown on the Figure 13. From the dendogram it is possible to conclude that a good solution may be to partition the set of observations into 10 clusters**.** This number may seem a bit too high, but we can notice that there are some regions whose evolution and position was very different from all other regions since they are the only objects in the cluster. Objective of the analysis is also to identify this kind of regions.

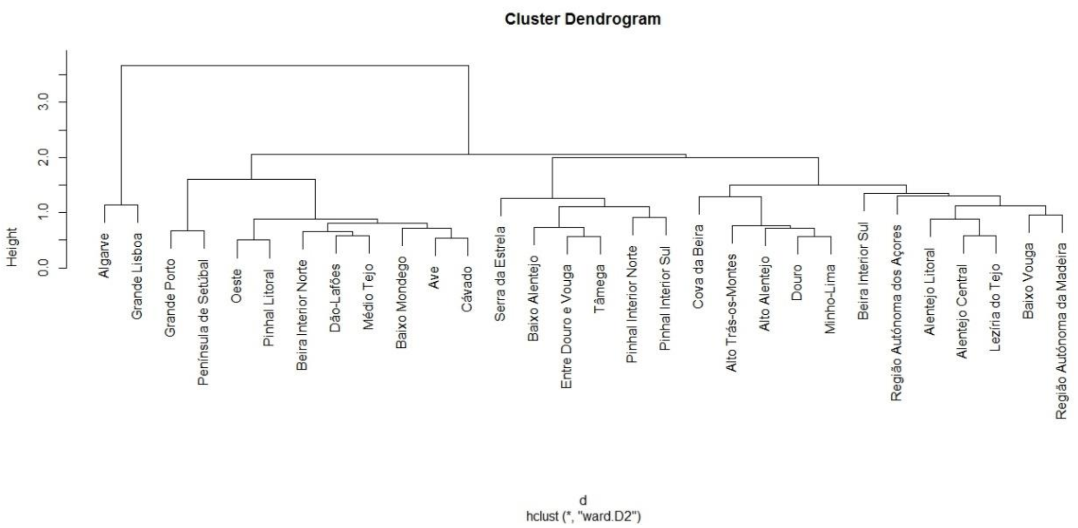

Figure 13 Dendogram for ward’s method

In the second phase we've decided to partition the set of observations into 10 clusters and run k-means algorithm. In the first attempt we've used the centres of gravity of 10 clusters obtained by ward's hierarchical clustering method as initial seeds. Later we applied k-means algorithm several times with random initialization.

The best solution was obtained using centres of gravity of clusters obtained by hierarchical clustering as initial seeds with the percentage of intraclass inertia ---. It is interesting to note that these clusters aren't identical as clusters obtained by hierarchical clustering. This way NUTS III regions were assigned to 10 classes which are shown in annex. Average trajectories for all classes are also shown in annex.

Regions in the class 1 show small amplitude on both axis. The crime evolution of regions in this class is similar to average crime evolution in Portugal. The values on both axes are generally slightly positive which represent moderate crime rates for all crimes.

Regions in the class 2 have moderate to low crime rates of crimes explained by 2nd axis and very crime rates of crimes explained by 1st axis. There was a significant decrease of contribution of these regions to severe crimes in the period 1998-2001, when the crime rate started to follow the average crime evolution in Portugal. There were also significant changes in contribution of these regions to crimes explained by 2nd axis, but these crime rates also have started to follow in general average crime evolution in Portugal after 2002.

Regions in the class 3 have higher crime rates of crimes explained by 2nd axis and low crime rates of crimes explained by 1st axis. There was increase of contribution of these regions to crimes related with 2nd axis until the year 2005, but later the contribution has slightly decreased. Overall the contribution of regions to crimes related to 1st axis has also slightly decreased.

Regions in the class 4 have relatively low crime rates of crimes explained by 2nd axis and relatively low crime rates of crimes explained by 1st axis. There is almost in contribution of these regions to crimes related with 1st axis. Contribution of regions to crimes related with the 2nd axis first started to decrease until 2006, and after that there was a slight increase. Since amplitude is very small, regions from this class are following the average evolution of crime in Portugal.

Regions in the class 5 have low crime rates of all crime types, but especially of severe crimes. The amplitude is also moderate on both axes, so these regions follow average evolution in Portugal in general. There were period of significant increase and decrease of contribution of these regions to crimes related with 2nd axis in the period 2002-2008. Changes on the 1st axis were more graduate, but in general contribution of these regions to crimes explained by 1st axis has increased slightly in comparison to average crime evolution in Portugal.

The only region in this class 6 is Beira Interior Sul, whose evolution was described above.

The only region in this class 7 is Cova da Beira, whose evolution was described above.

Regions in the class 8 show moderate amplitude on both axes, has had similar contribution to all crimes in Portugal. These regions have lower crime rates related with crimes explained by 2nd axis, and high crime rates of crimes explained by 1st axis.

The only region in this class 9 is Azores, whose evolution was described above.

The only region in this class 10 is Serra da Estrela, whose evolution was described above.

Map of NUTS III regions classified using trajectory compromise position - evolution distance is shown on the Figure 14. However, it is important to emphasize that some region have not been well represented by the average trajectories.

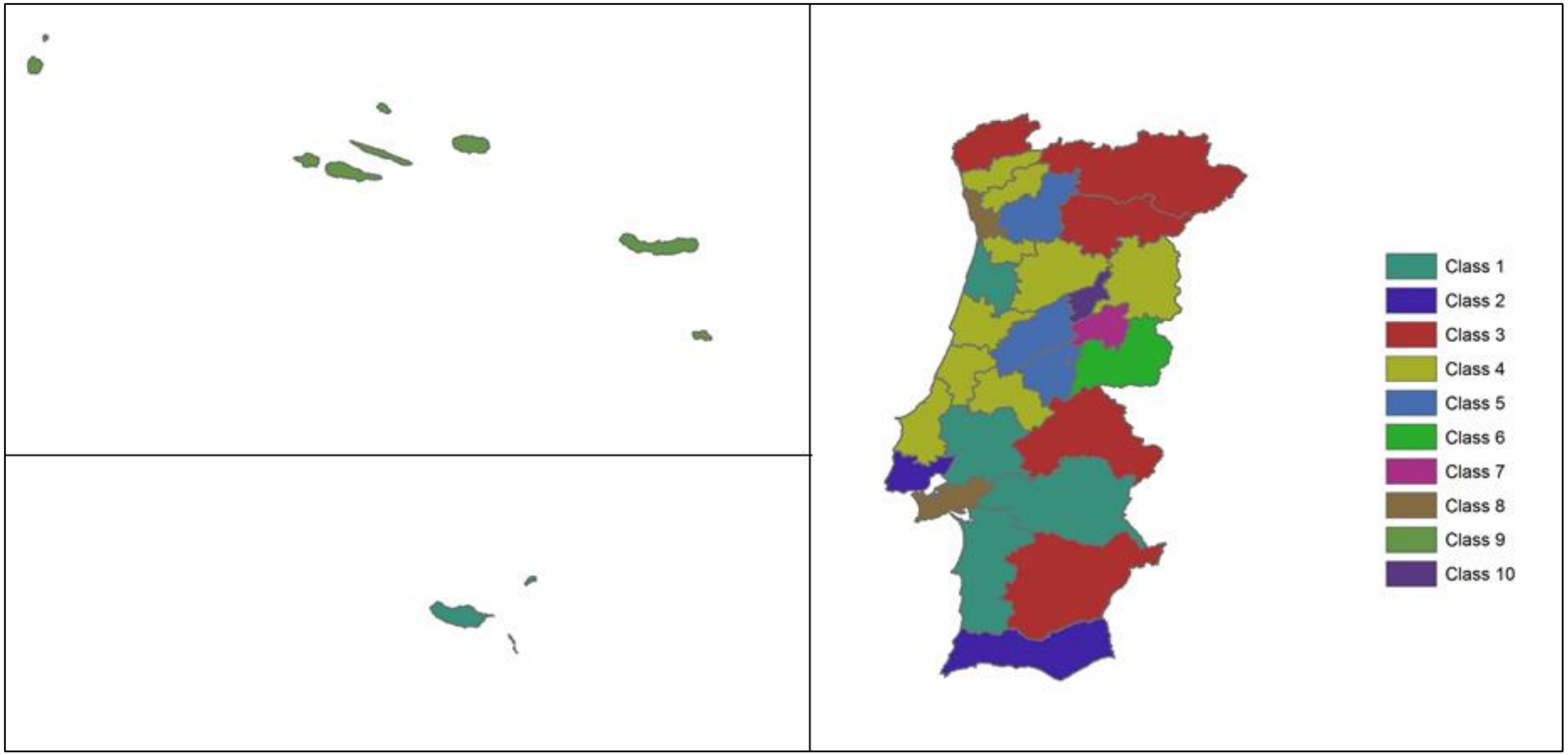

Figure 14 Map of NUTS III regions classified using trajectory compromise position - evolution distance

6. Conclusion

In our work we have analysed patterns in crime evolution in Portugal 1995-2013 using STATIS and other statistical methods. This was a clearly descriptive data analysis where we have successfully analysed most significant crime types and their evolution in NUTS III region of Portugal. Since crimes related with theft had significantly highest crime rates, standardization of data (working with matrices M) has shown good results; we were able to describe all most important crimes included into analysis.

Two types of analysis which were conduct – global and spatial analysis – gave us a clear picture of crime evolution in Portugal. Global analysis has shown general trends and patterns in crime evolution regarding different crime types. On the other hand spatial analysis has shown evolution of the same crime types in different regions which enables us to identify regions which have contributed to these global changes.

Global analysis proved that there were three significant periods in crime evolution: 1995-1998, 1998-2008, and 2008-2013. It has also shown that there are few significant groups of crimes whose evolution was closely related. 1^{st} group includes Issuing cheques without provision, Corruption, Homicide, Homicides and offences to physical integrity due to traffic accidents, Defamation, 2^{nd} group includes Robbery (with violence), Fraud, Crimes against public authority, Drunk driving, Forest fire crimes, and 3^{rd} group includes Property damage and Theft (without violence). Drug trafficking and Falsification crimes show specific and different crime evolution patterns. First period was characterized by relatively high crime rates of crimes from the 1^{st} group, relatively low crime rates of crimes from the 3^{rd} group, and persistent elevation of crime rates of crimes from the 2^{nd} group. Second period was characterized by relatively high crime rates of crimes from the 2^{nd} group, constant decrease of crimes from the 1^{st} group, and constant decrease of crimes from the 3^{rd} group. Third period was characterized by relatively constant and low crime rates of crimes from the 1^{st} group, relatively high crime rates of crimes from the 3^{rd} group, and decrease of crimes from the 2^{nd} group. Since crimes with similar evolutions are not generally related, it is possible to conclude that different factors have contributed to similar evolution.

STATIS enabled us to have a general picture of average crime structure and crime evolution in Portuguese regions in the period 1995-2013. Spatial analysis has shown that there are two large groups of crimes which are showing similar spatial patterns. First group includes Theft (without violence), Robbery (with violence), Fraud, Drug trafficking, Falsification which can be seen as severe crimes. Second group includes crimes like Drunk driving, Property damage and Defamation. Forest fire crimes and Crimes against public authority show a separate spatial pattern. It is interesting to note that Theft and Property damage show different spatial patterns on a local level, while on a global level they show the similar evolution. The same phenomena can be observed for Drunk driving on one side and Robbery and Fraud on the other side, and Forest fire crimes on one side and Robbery and Fraud on the other side. We can conclude that crime evolution of these crimes may be closely related on global level, but different regions contribute to their evolution. It is also notable that regions with higher crime rates of Forest fire crimes have lower crime rates of severe crimes. This is quite expected; regions with higher population density belong to the urban areas and have more severe crimes, while forest fire crimes are usually related with rural areas.

The spatial analysis shows that the highest number of severe crimes is concentrated in two major urban areas which correspond to regions Grande Porto, Grande Lisboa, and Península de Setúbal. High crime rates of these crimes are also notable in Algarve. Generally crime rates related to severe crimes are more concentrated in more populated littoral regions of Portugal and on Azores and Madeira, while Forest fire crimes are more concentrated in rural and timbered inland regions. Algarve is a crime black-spot of Portugal because of very high crime rates of other groups of crimes like Drunk driving, Property damage and Defamation. Drunk driving, Property damage and partly Defamation crimes are more related with dominantly rural regions, but with some exceptions and more complex spatial pattern. Generally in the southern and south-eastern regions like Algarve, Alentejo and Beira Interior Sul, on Madeira, and in some northern and north-eastern regions, the values of crime rates related with Drunk driving, Property damage and Defamation are elevated. Azores have in general highest crime rates of these group of crimes.

In the final part of the analysis we have built the trajectories of NUTS III regions which describe their evolution in comparison to average evolution in Portugal. In general regions show an evolution similar to average evolution in Portugal with variations in some periods. However, we have locally found specific and diverse crime evolutions in Portuguese NUTS III regions, which were clustered for the purpose of the interpretation.

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ANNEX 1 - GLOBAL CRIME EVOLUTION IN PORTUGAL DATA AND SUMMARY STATISTICS

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Homic./ Offen. accidents	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation	Issuing cheques w. provision	Homicide	Corruption
1995	14.560	0.750	0.560	1.740	0.450	0.820	1.040	0.170	0.520	0.500	0.950	3.660	0.041	0.030
1996	14.500	0.730	0.570	1.840	0.380	1.000	0.920	0.150	0.710	0.310	1.020	2.910	0.039	0.028
1997	14.520	0.750	0.480	1.960	0.330	0.990	0.940	0.170	0.730	0.240	1.080	2.220	0.038	0.025
1998	15.300	0.770	0.480	2.010	0.350	1.230	1.160	0.190	1.270	0.420	1.170	0.660	0.033	0.050
1999	16.370	1.010	0.470	2.110	0.400	1.520	1.120	0.220	1.370	0.370	1.040	0.410	0.029	0.046
2000	16.420	1.130	0.510	2.190	0.310	1.540	1.020	0.240	0.860	0.510	1.010	0.280	0.024	0.018
2001	16.240	1.270	0.530	2.220	0.370	1.590	0.620	0.280	0.940	0.480	0.990	0.280	0.027	0.019
2002	17.300	1.320	0.450	2.220	0.390	1.730	0.550	0.340	0.860	0.460	0.980	0.190	0.025	0.018
2003	17.790	1.280	0.550	2.260	0.360	2.170	0.510	0.430	0.990	0.500	1.090	0.170	0.026	0.018
2004	17.530	1.410	0.570	2.160	0.350	2.060	0.430	0.460	1.270	0.520	1.010	0.160	0.018	0.013
2005	15.940	1.400	0.570	2.100	0.340	1.880	0.380	0.450	0.920	0.810	0.940	0.120	0.016	0.018
2006	15.430	1.470	0.710	2.150	0.340	1.910	0.330	0.490	0.950	0.580	0.870	0.070	0.018	0.015
2007	15.340	1.230	0.740	2.120	0.310	1.950	0.320	0.500	1.040	0.630	0.800	0.070	0.013	0.017
2008	17.550	1.460	0.800	2.110	0.350	2.020	0.250	0.430	1.210	0.560	0.710	0.060	0.014	0.016
2009	16.530	1.460	0.810	2.030	0.400	1.930	0.210	0.410	1.420	0.900	0.650	0.060	0.014	0.012
2010	15.640	1.930	0.880	1.960	0.430	2.090	0.170	0.490	1.380	0.640	0.610	0.040	0.013	0.012
2011	16.060	1.930	0.930	1.980	0.400	2.210	0.160	0.490	0.930	0.600	0.540	0.030	0.011	0.014
2012	15.380	1.760	1.080	1.880	0.440	2.420	0.130	0.540	1.030	0.890	0.530	0.020	0.014	0.011
2013	14.140	1.590	1.160	1.750	0.420	2.360	0.130	0.540	0.900	0.890	0.520	0.020	0.011	0.012

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Homic./Offen. accidents
Mean	15.923	1.297	0.676	2.042	0.375	1.759	0.547
Standard Error	0.253	0.086	0.049	0.036	0.010	0.108	0.085
Median	15.940	1.320	0.570	2.100	0.370	1.910	0.430
Standard Deviation	1.104	0.374	0.214	0.156	0.042	0.472	0.369
Sample Variance	1.218	0.140	0.046	0.024	0.002	0.223	0.136
Kurtosis	-0.873	-0.631	0.022	-0.553	-0.927	-0.497	-1.353
Skewness	0.159	-0.047	1.000	-0.598	0.209	-0.669	0.505
Range	3.650	1.200	0.710	0.520	0.140	1.600	1.030
Minimum	14.140	0.730	0.450	1.740	0.310	0.820	0.130
Maximum	17.790	1.930	1.160	2.260	0.450	2.420	1.160

	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation	Issuing cheques w. provision	Homicide	Corruption
Mean	0.368	1.016	0.569	0.869	0.602	0.022	0.021
Standard Error	0.032	0.057	0.044	0.048	0.247	0.002	0.003
Median	0.430	0.950	0.520	0.950	0.160	0.018	0.018
Standard Deviation	0.140	0.247	0.191	0.211	1.075	0.010	0.011
Sample Variance	0.019	0.061	0.036	0.045	1.156	0.000	0.000
Kurtosis	-1.523	-0.512	-0.347	-1.149	3.615	-0.910	2.770
Skewness	-0.404	0.057	0.446	-0.550	2.167	0.629	1.814
Range	0.390	0.900	0.660	0.650	3.640	0.030	0.039
Minimum	0.150	0.520	0.240	0.520	0.020	0.011	0.011
Maximum	0.540	1.420	0.900	1.170	3.660	0.041	0.050

ANNEX 2 - CRIME EVOLUTION IN PORTUGESE NUTS III REGIONS DATA FOR THE 1995-2013 PARIOD AND SUMMARY STATISTICS

1995	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	7.02	0.24	0.40	2.87	0.23	1.08	0.07	0.06	0.59	0.96
Alentejo Litoral	7.17	0.11	0.15	0.89	0.55	1.22	0.20	0.46	1.36	0.60
Algarve	32.37	0.55	0.80	2.68	1.75	1.26	0.20	0.80	0.35	1.24
Alto Alentejo	6.20	0.06	0.21	1.68	0.31	1.86	0.14	0.09	0.92	0.99
Alto Trás-os-Montes	7.68	0.05	0.22	2.67	0.42	0.35	0.12	0.46	1.16	0.94
Ave	7.55	0.18	0.29	1.43	0.35	0.27	0.06	0.30	0.27	0.51
Baixo Alentejo	5.00	0.09	0.15	1.21	0.39	2.20	0.17	0.10	1.15	0.84
Baixo Mondego	12.68	0.31	0.53	1.97	0.19	0.90	0.22	0.26	0.89	0.96
Baixo Vouga	10.77	0.20	0.50	1.71	0.36	1.09	0.22	0.31	0.37	0.85
Beira Interior Norte	5.22	0.11	0.21	1.31	0.05	1.61	0.15	0.38	0.76	0.94
Beira Interior Sul	6.58	0.11	0.24	1.97	0.33	2.83	0.19	0.24	0.42	0.66
Cávado	11.45	0.21	0.38	1.56	0.17	1.02	0.13	0.54	0.45	0.54
Cova da Beira	4.98	0.03	0.05	1.49	0.14	0.78	0.10	0.24	0.98	0.89
Dão-Lafões	4.96	0.01	0.32	1.32	0.09	0.50	0.09	0.20	1.07	0.65
Douro	5.37	0.00	0.17	1.50	0.16	0.95	0.13	0.25	0.64	0.87
Entre Douro e Vouga	6.76	0.16	0.16	1.37	0.19	0.44	0.13	0.23	0.30	0.81
Grande Lisboa	27.55	2.23	1.19	2.02	0.63	0.55	0.27	1.32	0.07	1.10
Grande Porto	18.37	1.14	0.56	1.05	0.53	0.36	0.17	0.40	0.04	1.06
Lezíria do Tejo	9.01	0.10	0.44	1.31	0.39	2.39	0.06	0.14	1.18	0.88
Médio Tejo	8.53	0.18	0.32	1.46	0.27	0.53	0.08	0.29	1.76	0.79
Minho-Lima	8.51	0.11	0.22	1.71	0.21	1.36	0.15	0.30	1.02	0.71
Oeste	10.02	0.16	0.32	1.17	0.41	1.21	0.06	0.14	0.47	0.67
Península de Setúbal	17.37	1.23	0.74	2.09	0.73	0.94	0.18	0.55	0.18	1.21
Pinhal Interior Norte	4.97	0.02	0.05	1.60	0.02	0.47	0.07	0.21	3.91	0.71
Pinhal Interior Sul	3.32	0.00	0.06	1.24	0.00	0.32	0.11	0.17	2.52	0.25
Pinhal Litoral	14.31	0.12	0.49	1.66	0.35	1.51	0.12	0.27	0.74	0.76
Região Autónoma da Madeira	8.75	0.29	0.46	3.61	0.12	1.17	0.13	0.29	0.32	1.65
Região Autónoma dos Açores	13.09	0.11	0.30	3.21	0.08	0.72	0.10	0.07	0.16	2.09
Serra da Estrela	3.04	0.00	0.12	1.22	0.00	0.06	0.00	0.06	1.04	1.04
Tâmega	4.05	0.03	0.16	0.94	0.21	0.09	0.05	0.10	0.48	0.47

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	9.76	0.27	0.34	1.73	0.32	1.00	0.13	0.31	0.85	0.89
Standard Error	1.23	0.09	0.05	0.12	0.06	0.12	0.01	0.05	0.14	0.06
Median	7.62	0.11	0.29	1.53	0.25	0.94	0.13	0.26	0.69	0.86
Standard Deviation	6.73	0.47	0.25	0.67	0.33	0.68	0.06	0.25	0.79	0.35
Sample Variance	45.32	0.22	0.06	0.45	0.11	0.46	0.00	0.06	0.62	0.12
Kurtosis	4.50	10.72	3.56	1.34	12.46	0.74	-0.14	8.33	7.39	4.25
Skewness	2.05	3.16	1.64	1.33	3.04	0.95	0.26	2.50	2.38	1.52
Range	29.33	2.23	1.14	2.72	1.75	2.78	0.27	1.27	3.87	1.83
Minimum	3.04	0.00	0.05	0.89	0.00	0.06	0.00	0.06	0.04	0.25
Maximum	32.37	2.23	1.19	3.61	1.75	2.83	0.27	1.32	3.91	2.09

1996	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	6.93	0.28	0.43	2.50	0.21	1.93	0.08	0.14	0.19	1.11
Alentejo Litoral	7.20	0.07	0.21	0.91	0.39	1.21	0.14	0.59	0.51	0.41
Algarve	33.55	0.72	0.89	3.23	1.35	1.86	0.19	0.97	0.13	1.41
Alto Alentejo	6.81	0.04	0.30	1.69	0.25	2.02	0.08	0.14	0.91	1.06
Alto Trás-os-Montes	7.67	0.03	0.31	2.47	0.41	0.51	0.10	0.71	1.01	0.88
Ave	8.35	0.16	0.23	1.45	0.25	0.31	0.09	0.46	0.19	0.63
Baixo Alentejo	4.26	0.13	0.13	1.29	0.27	2.14	0.12	0.31	1.01	0.95
Baixo Mondego	12.31	0.34	0.58	1.88	0.24	0.91	0.11	0.53	0.46	1.02
Baixo Vouga	10.25	0.22	0.58	1.79	0.39	1.42	0.12	0.65	0.30	0.96
Beira Interior Norte	4.54	0.06	0.15	1.27	0.21	1.55	0.08	0.69	1.02	0.79
Beira Interior Sul	6.29	0.04	0.38	1.85	0.37	2.00	0.00	0.47	0.29	0.59
Cávado	10.57	0.34	0.35	1.43	0.24	1.01	0.07	0.59	0.22	0.78
Cova da Beira	4.70	0.00	0.35	1.51	0.15	1.04	0.11	0.17	0.42	1.02
Dão-Lafões	5.51	0.08	0.24	1.47	0.01	0.82	0.09	0.30	0.83	0.71
Douro	5.66	0.00	0.14	1.77	0.21	1.00	0.09	0.47	0.55	1.06
Entre Douro e Vouga	7.74	0.10	0.23	1.36	0.20	0.67	0.12	0.50	0.15	0.91
Grande Lisboa	26.33	2.03	1.25	2.28	0.43	0.74	0.26	1.46	0.03	1.14
Grande Porto	19.23	1.29	0.50	1.12	0.39	0.44	0.12	0.88	0.05	1.13
Lezíria do Tejo	8.94	0.22	0.47	1.45	0.36	3.56	0.11	0.22	0.34	0.80
Médio Tejo	8.64	0.14	0.36	1.47	0.30	0.77	0.06	0.30	0.70	0.78
Minho-Lima	8.04	0.07	0.24	1.56	0.24	1.32	0.13	0.44	0.70	0.93
Oeste	10.36	0.16	0.32	1.41	0.21	1.26	0.07	0.32	0.17	0.83
Península de Setúbal	15.51	1.14	0.59	2.10	0.70	1.23	0.15	0.68	0.08	1.31
Pinhal Interior Norte	4.66	0.00	0.29	1.51	0.12	0.59	0.02	0.24	2.11	0.85
Pinhal Interior Sul	2.22	0.00	0.15	0.83	0.06	0.68	0.06	0.17	1.11	0.40
Pinhal Litoral	13.03	0.11	0.43	1.82	0.32	1.58	0.10	0.40	0.36	1.02
Região Autónoma da Madeira	11.82	0.31	0.54	3.42	0.31	1.35	0.08	0.25	0.21	1.51
Região Autónoma dos Açores	15.75	0.09	0.52	3.91	0.46	1.03	0.16	0.11	0.12	2.25
Serra da Estrela	2.38	0.06	0.06	0.92	0.08	0.25	0.00	0.23	0.58	0.35
Tâmega	4.69	0.02	0.13	1.05	0.24	0.21	0.06	0.28	0.53	0.52

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	9.797903	0.274975	0.378676	1.756479	0.313116	1.180661	0.098657	0.455867	0.509498	0.937018
Standard Error	1.247219	0.082929	0.044842	0.134064	0.043571	0.128906	0.00934	0.05368	0.081051	0.068146
Median	7.892169	0.10548	0.33454	1.512023	0.249241	1.033204	0.095212	0.422613	0.388315	0.919755
Standard Deviation	6.831301	0.45422	0.245611	0.734299	0.23865	0.706047	0.051156	0.294015	0.443935	0.373252
Sample Variance	46.66668	0.206316	0.060325	0.539195	0.056954	0.498503	0.002617	0.086445	0.197078	0.139317
Kurtosis	4.732667	7.85181	4.75239	2.068318	12.39937	3.017394	2.380671	3.405702	4.5016	4.378286
Skewness	2.011681	2.754926	1.804604	1.464641	3.014146	1.313831	0.676639	1.54778	1.768005	1.417328
Range	31.32912	2.031954	1.195834	3.082482	1.340872	3.342035	0.255512	1.346633	2.077315	1.903791
Minimum	2.216208	0	0.058498	0.831078	0.010642	0.213536	0	0.11253	0.033259	0.350987
Maximum	33.54532	2.031954	1.254332	3.91356	1.351513	3.555571	0.255512	1.459163	2.110574	2.254777

1997	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	6.63	0.16	0.26	2.75	0.20	1.27	0.16	0.13	0.03	0.99
Alentejo Litoral	6.06	0.12	0.26	1.33	0.60	1.16	0.06	0.41	0.22	0.79
Algarve	32.30	0.58	0.79	3.53	1.02	1.98	0.26	0.98	0.09	1.48
Alto Alentejo	7.00	0.12	0.26	1.93	0.16	1.46	0.15	0.11	0.80	1.15
Alto Trás-os-Montes	8.02	0.07	0.18	2.49	0.36	0.61	0.06	0.59	0.96	1.02
Ave	8.98	0.15	0.21	1.42	0.29	0.30	0.05	0.55	0.13	0.54
Baixo Alentejo	3.77	0.07	0.23	1.26	0.26	2.15	0.11	0.43	0.71	1.04
Baixo Mondego	11.76	0.30	0.46	1.82	0.22	0.78	0.15	0.60	0.43	1.02
Baixo Vouga	10.29	0.34	0.57	1.72	0.32	1.33	0.17	0.47	0.25	0.95
Beira Interior Norte	5.85	0.03	0.20	1.54	0.07	1.79	0.10	0.41	0.60	1.05
Beira Interior Sul	7.65	0.19	0.39	1.89	0.27	2.02	0.22	0.43	0.05	0.81
Cávado	9.39	0.27	0.23	1.59	0.25	1.14	0.07	0.49	0.09	0.75
Cova da Beira	5.15	0.06	0.33	1.44	0.04	0.86	0.17	0.45	0.25	0.97
Dão-Lafões	5.64	0.03	0.27	1.71	0.09	0.84	0.12	0.32	0.96	0.78
Douro	6.15	0.00	0.10	1.91	0.10	0.91	0.11	0.57	0.41	1.17
Entre Douro e Vouga	8.37	0.15	0.25	1.33	0.29	0.39	0.15	0.34	0.12	0.85
Grande Lisboa	24.86	2.27	0.95	2.66	0.35	0.93	0.32	1.62	0.03	1.21
Grande Porto	20.60	1.13	0.44	1.18	0.32	0.39	0.14	0.77	0.03	1.22
Lezíria do Tejo	9.45	0.30	0.38	1.67	0.28	2.58	0.10	0.23	0.24	0.97
Médio Tejo	9.59	0.14	0.22	1.76	0.31	0.58	0.09	0.34	0.61	0.96
Minho-Lima	7.32	0.08	0.18	1.84	0.27	1.79	0.12	0.45	0.53	0.98
Oeste	10.44	0.23	0.26	1.43	0.22	1.40	0.05	0.33	0.15	0.80
Península de Setúbal	15.87	1.02	0.38	2.22	0.58	1.08	0.17	0.70	0.05	1.29
Pinhal Interior Norte	4.95	0.02	0.20	1.39	0.00	0.49	0.00	0.35	1.64	1.07
Pinhal Interior Sul	3.02	0.00	0.00	1.16	0.00	0.84	0.00	0.15	1.38	0.37
Pinhal Litoral	12.88	0.07	0.56	1.56	0.33	1.39	0.14	0.57	0.33	0.88
Região Autónoma da Madeira	11.98	0.42	0.42	3.50	0.32	1.33	0.07	0.35	0.10	1.75
Região Autónoma dos Açores	16.31	0.13	0.90	3.15	0.39	1.18	0.15	0.16	0.04	2.01
Serra da Estrela	2.42	0.00	0.00	0.79	0.00	0.31	0.06	0.12	0.47	0.85
Tâmega	6.13	0.03	0.16	1.19	0.23	0.23	0.07	0.25	0.29	0.78

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	9.96	0.28	0.33	1.84	0.27	1.12	0.12	0.46	0.40	1.02
Standard Error	1.19	0.08	0.04	0.13	0.04	0.11	0.01	0.05	0.08	0.06
Median	8.20	0.14	0.26	1.69	0.27	1.11	0.11	0.42	0.25	0.98
Standard Deviation	6.53	0.46	0.23	0.69	0.20	0.60	0.07	0.30	0.41	0.32
Sample Variance	42.67	0.21	0.05	0.47	0.04	0.36	0.00	0.09	0.17	0.10
Kurtosis	4.21	11.90	1.68	0.92	5.41	-0.22	1.23	7.39	2.14	2.85
Skewness	1.92	3.24	1.30	1.20	1.71	0.53	0.76	2.21	1.53	1.15
Range	29.88	2.27	0.95	2.74	1.02	2.34	0.32	1.51	1.61	1.64
Minimum	2.42	0.00	0.00	0.79	0.00	0.23	0.00	0.11	0.03	0.37
Maximum	32.30	2.27	0.95	3.53	1.02	2.58	0.32	1.62	1.64	2.01

1998	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	6.09	0.14	0.17	2.22	0.30	1.67	0.15	0.14	0.24	1.06
Alentejo Litoral	5.84	0.08	0.11	1.06	0.48	1.68	0.13	0.56	0.64	0.76
Algarve	25.97	0.48	0.78	3.11	0.79	2.33	0.38	1.49	0.17	1.65
Alto Alentejo	6.46	0.05	0.07	1.70	0.16	1.75	0.09	0.36	1.01	0.98
Alto Trás-os-Montes	8.01	0.08	0.15	2.49	0.32	0.74	0.04	0.56	1.45	1.32
Ave	9.57	0.25	0.28	1.45	0.25	0.38	0.10	0.62	0.47	0.66
Baixo Alentejo	4.42	0.04	0.09	1.37	0.23	2.87	0.11	0.58	1.04	1.01
Baixo Mondego	10.69	0.25	0.33	1.87	0.22	1.11	0.15	1.07	0.38	1.20
Baixo Vouga	11.43	0.27	0.54	1.67	0.25	1.65	0.21	1.09	0.19	1.02
Beira Interior Norte	5.10	0.03	0.22	1.54	0.26	1.63	0.05	0.61	1.43	0.69
Beira Interior Sul	5.52	0.23	0.18	1.77	0.17	2.45	0.13	0.51	0.61	1.10
Cávado	10.74	0.22	0.24	1.61	0.20	1.30	0.13	1.16	0.22	0.81
Cova da Beira	5.31	0.14	0.27	1.83	0.50	0.85	0.13	0.38	0.47	1.06
Dão-Lafões	6.79	0.08	0.24	1.76	0.14	0.82	0.08	0.43	1.09	0.85
Douro	5.76	0.06	0.06	1.76	0.17	0.98	0.11	0.62	1.05	0.98
Entre Douro e Vouga	8.56	0.13	0.23	1.57	0.21	0.55	0.12	0.28	0.01	1.08
Grande Lisboa	26.02	2.24	1.02	2.68	0.54	1.13	0.34	3.12	0.08	1.38
Grande Porto	26.71	1.22	0.41	1.68	0.33	0.45	0.15	1.36	0.10	1.29
Lezíria do Tejo	9.09	0.26	0.37	1.62	0.24	2.33	0.11	0.36	0.50	1.09
Médio Tejo	10.77	0.21	0.29	1.82	0.15	1.01	0.10	1.02	0.83	1.00
Minho-Lima	8.08	0.10	0.30	1.64	0.12	2.25	0.11	0.58	1.11	0.88
Oeste	9.80	0.21	0.29	1.31	0.19	1.72	0.17	1.07	0.16	0.83
Península de Setúbal	16.75	1.11	0.53	2.48	0.52	1.55	0.20	0.86	0.23	1.38
Pinhal Interior Norte	5.82	0.02	0.18	1.96	0.00	0.74	0.08	0.48	2.47	1.31
Pinhal Interior Sul	3.23	0.00	0.22	1.27	0.00	0.65	0.09	0.55	2.10	0.26
Pinhal Litoral	12.14	0.25	0.64	1.55	0.42	1.69	0.09	1.42	0.40	0.89
Região Autónoma da Madeira	9.81	0.32	0.33	3.31	0.28	1.64	0.25	0.43	0.28	1.78
Região Autónoma dos Açores	13.43	0.18	0.46	2.81	0.35	1.70	0.18	0.30	0.12	1.76
Serra da Estrela	3.57	0.00	0.06	1.05	0.08	0.34	0.18	0.30	1.43	1.35
Tâmega	6.33	0.06	0.11	1.25	0.20	0.23	0.07	0.37	0.65	1.00

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	9.92	0.28	0.31	1.84	0.27	1.34	0.14	0.76	0.70	1.08
Standard Error	1.15	0.08	0.04	0.10	0.03	0.13	0.01	0.10	0.11	0.06
Median	8.32	0.16	0.26	1.69	0.23	1.43	0.12	0.57	0.49	1.04
Standard Deviation	6.31	0.46	0.22	0.57	0.17	0.70	0.07	0.58	0.61	0.33
Sample Variance	39.85	0.21	0.05	0.32	0.03	0.48	0.01	0.33	0.38	0.11
Kurtosis	2.60	11.32	3.08	0.73	1.92	-0.68	3.27	8.91	1.35	0.80
Skewness	1.76	3.22	1.61	1.10	1.12	0.27	1.67	2.55	1.26	0.18
Range	23.48	2.24	0.96	2.26	0.79	2.64	0.34	2.98	2.46	1.52
Minimum	3.23	0.00	0.06	1.05	0.00	0.23	0.03	0.14	0.01	0.26
Maximum	26.71	2.24	1.02	3.31	0.79	2.87	0.37	3.12	2.47	1.78

1999	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	8.99	0.28	0.43	1.92	0.17	2.32	0.21	0.38	0.24	1.17
Alentejo Litoral	6.02	0.07	0.27	1.33	0.50	2.29	0.15	0.51	0.71	0.88
Algarve	30.12	0.54	0.80	3.31	0.91	2.38	0.32	1.58	0.25	1.17
Alto Alentejo	7.58	0.07	0.27	2.15	0.17	1.67	0.23	0.42	1.47	1.18
Alto Trás-os-Montes	7.72	0.04	0.16	2.60	0.24	1.21	0.08	0.86	0.76	1.08
Ave	8.94	0.40	0.28	1.18	0.31	0.44	0.12	1.04	0.12	0.67
Baixo Alentejo	4.94	0.10	0.14	1.57	0.40	3.12	0.23	0.48	0.71	1.03
Baixo Mondego	10.29	0.35	0.35	1.59	0.42	1.80	0.21	1.15	0.48	1.06
Baixo Vouga	12.74	0.47	0.48	1.83	0.27	2.18	0.22	1.31	0.27	1.00
Beira Interior Norte	5.36	0.04	0.20	1.41	0.08	2.52	0.10	0.80	0.92	0.61
Beira Interior Sul	7.49	0.18	0.27	2.63	0.04	3.50	0.17	0.69	0.61	0.78
Cávado	11.04	0.53	0.28	1.46	0.26	1.52	0.18	1.54	0.24	0.72
Cova da Beira	4.49	0.03	0.09	1.67	0.10	0.89	0.09	0.35	0.98	1.02
Dão-Lafões	6.27	0.08	0.17	1.98	0.20	1.18	0.06	0.67	1.05	0.94
Douro	5.84	0.07	0.12	2.00	0.10	2.05	0.07	0.81	0.80	0.96
Entre Douro e Vouga	8.98	0.30	0.23	1.75	0.21	0.67	0.13	0.47	0.05	1.27
Grande Lisboa	25.82	2.67	0.83	2.82	0.64	1.28	0.35	2.43	0.06	1.07
Grande Porto	31.49	1.81	0.47	1.79	0.35	0.68	0.17	1.69	0.09	1.26
Lezíria do Tejo	10.07	0.23	0.39	2.10	0.31	2.70	0.23	0.55	0.58	0.87
Médio Tejo	9.49	0.16	0.49	1.78	0.32	1.16	0.10	1.10	1.23	0.75
Minho-Lima	8.92	0.14	0.33	2.01	0.18	3.22	0.16	0.80	0.96	0.83
Oeste	10.61	0.23	0.37	1.46	0.31	1.87	0.14	1.22	0.28	0.65
Península de Setúbal	17.97	1.37	0.66	3.04	0.55	1.98	0.29	1.37	0.16	1.28
Pinhal Interior Norte	6.61	0.06	0.12	1.64	0.00	0.82	0.00	0.45	2.18	1.02
Pinhal Interior Sul	4.00	0.00	0.24	1.17	0.00	0.97	0.00	0.49	2.19	0.40
Pinhal Litoral	12.07	0.27	0.45	1.37	0.30	2.27	0.14	1.52	0.52	0.66
Região Autónoma da Madeira	8.59	0.30	0.31	2.91	0.32	2.26	0.48	0.47	0.10	1.28
Região Autónoma dos Açores	12.50	0.19	0.39	2.68	0.49	2.33	0.27	0.49	0.05	2.08
Serra da Estrela	3.55	0.08	0.00	1.28	0.16	0.78	0.26	0.48	0.82	0.68
Tâmega	6.63	0.06	0.14	1.32	0.17	0.32	0.09	0.53	0.34	0.78

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	10.50	0.37	0.32	1.92	0.28	1.75	0.17	0.89	0.64	0.97
Standard Error	1.29	0.11	0.04	0.11	0.04	0.16	0.02	0.09	0.10	0.06
Median	8.93	0.18	0.28	1.78	0.26	1.84	0.16	0.74	0.55	0.98
Standard Deviation	7.05	0.58	0.20	0.60	0.20	0.86	0.11	0.51	0.57	0.31
Sample Variance	49.70	0.34	0.04	0.35	0.04	0.74	0.01	0.26	0.32	0.10
Kurtosis	3.69	8.94	1.06	-0.32	2.29	-0.81	1.27	1.29	1.90	4.36
Skewness	2.03	2.94	0.98	0.81	1.19	0.16	0.80	1.21	1.38	1.33
Range	27.93	2.67	0.83	2.14	0.91	3.18	0.48	2.07	2.14	1.68
Minimum	3.55	0.00	0.00	1.17	0.00	0.32	0.00	0.35	0.05	0.40
Maximum	31.49	2.67	0.83	3.31	0.91	3.50	0.48	2.43	2.19	2.08

2000	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	7.67	0.50	0.29	1.83	0.07	2.61	0.24	0.51	0.57	1.16
Alentejo Litoral	6.86	0.29	0.33	1.48	0.30	2.72	0.37	0.32	0.65	0.56
Algarve	30.65	0.62	0.64	3.07	0.60	2.91	0.43	0.95	0.28	1.06
Alto Alentejo	7.20	0.18	0.22	2.05	0.11	2.02	0.32	0.46	1.77	1.10
Alto Trás-os-Montes	8.65	0.09	0.22	2.98	0.20	1.32	0.11	0.84	1.45	1.13
Ave	8.81	0.26	0.23	1.13	0.15	0.32	0.09	0.40	0.23	0.69
Baixo Alentejo	5.98	0.13	0.21	1.59	0.24	2.59	0.28	0.31	1.64	0.81
Baixo Mondego	11.90	0.41	0.31	1.70	0.27	1.89	0.21	0.58	0.48	1.07
Baixo Vouga	11.92	0.29	0.35	1.62	0.16	2.02	0.19	0.57	0.34	1.00
Beira Interior Norte	5.15	0.07	0.11	1.84	0.04	1.98	0.10	0.41	1.48	0.80
Beira Interior Sul	7.58	0.22	0.33	2.15	0.00	3.60	0.15	0.58	0.69	0.74
Cávado	13.03	0.37	0.29	1.38	0.18	1.39	0.20	0.84	0.29	0.64
Cova da Beira	5.09	0.06	0.13	1.86	0.12	0.78	0.06	0.39	1.24	0.76
Dão-Lafões	6.70	0.07	0.23	1.96	0.15	0.99	0.13	0.37	0.79	0.90
Douro	5.93	0.05	0.12	1.93	0.12	1.88	0.08	0.34	1.41	0.98
Entre Douro e Vouga	10.38	0.33	0.38	2.00	0.19	0.73	0.14	0.26	0.25	1.08
Grande Lisboa	27.77	3.29	0.69	2.99	0.44	1.42	0.34	0.90	0.16	0.96
Grande Porto	26.10	1.75	0.46	1.97	0.33	0.65	0.17	0.59	0.09	1.29
Lezíria do Tejo	10.59	0.37	0.42	1.70	0.15	2.69	0.25	0.33	0.90	1.06
Médio Tejo	8.19	0.23	0.28	1.70	0.20	1.21	0.12	0.77	1.67	0.70
Minho-Lima	10.03	0.18	0.27	2.10	0.11	3.01	0.20	0.56	0.75	0.68
Oeste	12.09	0.33	0.43	1.64	0.26	1.98	0.14	0.88	0.41	0.71
Península de Setúbal	17.69	1.63	0.92	3.11	0.40	1.72	0.37	0.51	0.30	1.19
Pinhal Interior Norte	5.96	0.04	0.13	1.76	0.02	0.83	0.02	0.13	2.61	1.03
Pinhal Interior Sul	3.10	0.22	0.16	1.47	0.00	0.89	0.09	0.13	2.34	0.51
Pinhal Litoral	14.81	0.35	0.42	1.55	0.27	1.90	0.13	0.76	0.58	0.81
Região Autónoma da Madeira	9.69	0.42	0.09	3.02	0.28	2.92	0.43	0.28	0.14	1.15
Região Autónoma dos Açores	13.64	0.19	0.33	2.80	0.39	2.59	0.31	0.34	0.05	2.01
Serra da Estrela	3.49	0.00	0.06	1.12	0.00	0.56	0.20	0.26	1.68	1.04
Tâmega	7.66	0.10	0.15	1.41	0.15	0.42	0.07	0.23	0.66	0.81

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	10.81	0.44	0.31	1.96	0.20	1.75	0.20	0.49	0.86	0.95
Standard Error	1.24	0.12	0.03	0.11	0.03	0.16	0.02	0.04	0.13	0.05
Median	8.73	0.25	0.29	1.83	0.17	1.88	0.18	0.43	0.66	0.97
Standard Deviation	6.79	0.67	0.19	0.58	0.14	0.90	0.11	0.24	0.70	0.29
Sample Variance	46.10	0.45	0.04	0.34	0.02	0.80	0.01	0.06	0.49	0.08
Kurtosis	2.77	11.81	2.88	-0.21	0.95	-1.00	-0.56	-0.80	-0.03	5.38
Skewness	1.75	3.29	1.49	0.88	0.84	0.13	0.63	0.49	0.91	1.61
Range	27.55	3.29	0.86	1.99	0.60	3.28	0.41	0.82	2.56	1.49
Minimum	3.10	0.00	0.06	1.12	0.00	0.32	0.02	0.13	0.05	0.51
Maximum	30.65	3.29	0.92	3.11	0.60	3.60	0.43	0.95	2.61	2.01

2001	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	7.54	0.30	0.28	1.89	0.09	2.23	0.37	0.33	0.29	1.28
Alentejo Litoral	8.03	0.20	0.44	1.97	0.13	2.55	0.39	0.37	1.12	0.53
Algarve	29.54	0.73	0.59	2.77	0.69	3.06	0.53	0.76	0.34	0.98
Alto Alentejo	6.73	0.22	0.18	2.09	0.16	2.39	0.49	0.28	2.09	1.06
Alto Trás-os-Montes	7.60	0.05	0.28	2.06	0.15	1.01	0.16	0.38	1.38	1.09
Ave	9.57	0.45	0.20	1.19	0.19	0.45	0.10	0.54	0.30	0.58
Baixo Alentejo	6.67	0.16	0.28	1.88	0.27	4.18	0.37	0.36	2.37	0.88
Baixo Mondego	13.54	0.43	0.39	1.85	0.30	1.77	0.21	0.51	0.28	1.12
Baixo Vouga	13.37	0.40	0.36	1.79	0.23	2.19	0.24	0.60	0.30	1.06
Beira Interior Norte	5.43	0.03	0.13	1.50	0.17	1.77	0.21	0.71	1.25	0.83
Beira Interior Sul	8.11	0.22	0.35	2.29	0.24	3.44	0.35	0.19	0.78	0.88
Cávado	13.55	0.67	0.35	1.50	0.29	1.42	0.19	0.79	0.32	0.70
Cova da Beira	4.86	0.10	0.18	1.46	0.15	1.06	0.10	0.61	0.80	0.93
Dão-Lafões	6.63	0.04	0.22	1.91	0.13	0.99	0.13	0.50	0.68	0.77
Douro	5.97	0.03	0.09	2.11	0.09	1.90	0.18	0.39	1.28	1.23
Entre Douro e Vouga	11.27	0.15	0.45	2.19	0.35	0.89	0.21	0.29	0.47	1.15
Grande Lisboa	25.55	3.27	0.65	3.03	0.56	1.40	0.37	1.18	0.10	0.94
Grande Porto	25.95	2.73	0.51	1.95	0.35	0.78	0.20	0.60	0.09	1.20
Lezíria do Tejo	10.79	0.43	0.48	1.81	0.16	2.37	0.38	0.55	0.81	0.88
Médio Tejo	8.34	0.26	0.23	2.27	0.23	1.23	0.13	0.46	1.69	0.73
Minho-Lima	10.33	0.18	0.25	2.69	0.10	2.95	0.30	0.67	0.95	0.81
Oeste	11.72	0.40	0.41	1.74	0.19	1.79	0.19	0.76	0.34	0.70
Península de Setúbal	18.41	1.70	1.11	2.79	0.38	1.76	0.35	0.60	0.20	1.07
Pinhal Interior Norte	5.74	0.07	0.24	1.77	0.03	0.72	0.12	0.25	2.28	0.92
Pinhal Interior Sul	4.06	0.49	0.09	1.68	0.09	0.94	0.22	0.16	2.38	0.45
Pinhal Litoral	14.45	0.40	0.51	1.34	0.35	1.99	0.18	0.76	0.57	0.81
Região Autónoma da Madeira	11.60	0.33	0.22	3.09	0.35	3.89	0.36	0.29	0.10	1.20
Região Autónoma dos Açores	14.78	0.19	0.26	3.07	0.43	2.52	0.26	0.25	0.03	2.03
Serra da Estrela	4.04	0.00	0.63	1.72	0.00	0.57	0.32	0.65	1.25	1.05
Tâmega	8.23	0.10	0.20	1.71	0.08	0.34	0.21	0.24	0.52	0.88

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	11.08	0.49	0.35	2.04	0.23	1.82	0.26	0.50	0.85	0.96
Standard Error	1.18	0.14	0.04	0.09	0.03	0.18	0.02	0.04	0.13	0.05
Median	8.95	0.24	0.28	1.90	0.19	1.77	0.22	0.51	0.63	0.93
Standard Deviation	6.46	0.76	0.21	0.52	0.16	1.01	0.11	0.23	0.72	0.29
Sample Variance	41.77	0.57	0.04	0.27	0.02	1.02	0.01	0.05	0.52	0.09
Kurtosis	2.07	7.93	4.56	-0.18	1.58	-0.15	-0.38	0.94	-0.11	5.32
Skewness	1.54	2.86	1.72	0.75	1.12	0.63	0.57	0.75	0.97	1.48
Range	25.49	3.27	1.02	1.90	0.69	3.84	0.44	1.02	2.35	1.58
Minimum	4.04	0.00	0.09	1.19	0.00	0.34	0.10	0.16	0.03	0.45
Maximum	29.54	3.27	1.11	3.09	0.69	4.18	0.53	1.18	2.38	2.03

2002	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	8.82	0.39	0.36	1.87	0.22	2.36	0.39	0.23	0.44	1.15
Alentejo Litoral	10.02	0.17	0.72	2.19	0.22	2.93	0.81	0.17	0.72	0.68
Algarve	32.88	0.84	0.65	2.68	0.71	3.58	0.67	0.85	0.29	0.85
Alto Alentejo	8.00	0.28	0.13	2.29	0.23	2.07	0.36	0.15	1.67	1.14
Alto Trás-os-Montes	8.00	0.10	0.24	2.36	0.08	1.16	0.23	0.47	1.12	0.85
Ave	11.88	0.75	0.29	1.22	0.14	0.49	0.14	0.35	0.32	0.67
Baixo Alentejo	6.30	0.20	0.28	2.14	0.17	4.15	0.43	0.26	1.59	1.00
Baixo Mondego	16.40	0.67	0.32	1.78	0.25	1.76	0.29	0.52	0.32	1.03
Baixo Vouga	18.74	0.78	0.48	2.01	0.25	2.64	0.31	0.45	0.37	1.15
Beira Interior Norte	7.16	0.08	0.11	1.90	0.13	1.74	0.22	0.50	1.11	0.61
Beira Interior Sul	9.54	0.21	0.49	2.41	0.27	3.67	0.49	0.35	0.85	1.13
Cávado	17.57	0.75	0.56	1.77	0.31	1.37	0.23	0.91	0.31	0.91
Cova da Beira	6.63	0.00	0.11	1.56	0.12	1.47	0.17	0.47	0.61	0.89
Dão-Lafões	7.57	0.10	0.24	2.18	0.08	1.63	0.15	0.42	0.61	0.94
Douro	6.33	0.11	0.14	2.16	0.06	2.40	0.25	0.36	1.40	1.13
Entre Douro e Vouga	12.34	0.31	0.43	2.09	0.12	0.87	0.18	0.37	0.34	1.29
Grande Lisboa	25.95	3.32	0.63	3.12	0.63	1.55	0.45	1.06	0.10	0.85
Grande Porto	22.77	2.71	0.53	1.81	0.32	0.79	0.28	0.81	0.09	1.21
Lezíria do Tejo	11.87	0.38	0.38	1.77	0.21	2.34	0.39	0.46	1.18	0.89
Médio Tejo	8.97	0.34	0.25	2.10	0.14	1.28	0.24	0.39	1.36	0.74
Minho-Lima	9.33	0.16	0.21	2.49	0.16	2.61	0.35	0.63	0.92	0.91
Oeste	13.27	0.39	0.34	1.79	0.12	3.07	0.31	0.52	0.36	0.72
Península de Setúbal	22.93	1.50	0.45	2.66	0.46	1.48	0.40	0.55	0.32	1.02
Pinhal Interior Norte	6.70	0.04	0.09	1.51	0.06	1.20	0.20	0.28	1.79	0.85
Pinhal Interior Sul	5.36	0.07	0.14	2.19	0.00	2.03	0.38	0.34	2.08	0.68
Pinhal Litoral	15.05	0.47	0.76	1.46	0.28	2.16	0.24	0.49	0.61	0.92
Região Autónoma da Madeira	14.88	0.25	0.22	2.90	0.51	3.26	0.32	0.18	0.07	1.13
Região Autónoma dos Açores	12.81	0.31	0.32	2.63	0.39	2.66	0.39	0.21	0.04	1.86
Serra da Estrela	4.49	0.00	0.14	1.51	0.00	1.84	0.18	0.33	1.10	1.00
Tâmega	9.41	0.13	0.13	1.58	0.09	0.45	0.15	0.24	0.65	0.86

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	12.40	0.53	0.34	2.07	0.22	2.03	0.32	0.44	0.76	0.97
Standard Error	1.23	0.14	0.04	0.08	0.03	0.17	0.03	0.04	0.10	0.04
Median	9.78	0.29	0.30	2.09	0.19	1.94	0.30	0.40	0.61	0.92
Standard Deviation	6.74	0.75	0.19	0.46	0.17	0.94	0.15	0.22	0.56	0.24
Sample Variance	45.42	0.57	0.04	0.21	0.03	0.89	0.02	0.05	0.32	0.06
Kurtosis	1.81	7.82	-0.55	-0.27	1.45	-0.37	3.10	1.13	-0.45	4.96
Skewness	1.40	2.77	0.64	0.35	1.26	0.37	1.51	1.15	0.71	1.59
Range	28.39	3.32	0.66	1.90	0.71	3.71	0.67	0.91	2.04	1.24
Minimum	4.49	0.00	0.09	1.22	0.00	0.45	0.14	0.15	0.04	0.61
Maximum	32.88	3.32	0.76	3.12	0.71	4.15	0.81	1.06	2.08	1.86

2003	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	9.04	0.37	0.30	2.21	0.09	3.51	0.49	0.39	0.37	1.23
Alentejo Litoral	10.45	0.22	0.38	2.08	0.27	3.05	0.66	0.39	1.25	0.84
Algarve	38.22	1.08	0.91	3.07	0.53	4.67	0.87	1.90	0.25	1.10
Alto Alentejo	8.29	0.22	0.22	2.49	0.38	3.01	0.65	0.47	1.81	1.08
Alto Trás-os-Montes	7.71	0.06	0.21	2.31	0.12	1.55	0.45	0.78	1.33	1.05
Ave	13.94	0.62	0.33	1.30	0.12	0.52	0.10	0.56	0.28	0.67
Baixo Alentejo	6.46	0.20	0.35	1.91	0.21	5.95	0.68	0.59	1.80	1.26
Baixo Mondego	14.90	0.48	0.43	2.02	0.18	1.62	0.26	0.52	0.44	1.29
Baixo Vouga	16.68	0.57	0.52	1.90	0.16	3.44	0.61	0.61	0.42	1.40
Beira Interior Norte	6.80	0.06	0.05	1.67	0.13	2.29	0.29	0.64	1.56	0.58
Beira Interior Sul	10.64	0.30	0.46	2.54	0.18	4.89	0.52	0.45	0.98	0.94
Cávado	17.32	0.75	0.61	1.55	0.26	1.41	0.26	0.88	0.23	0.90
Cova da Beira	7.30	0.12	0.31	2.48	0.14	1.45	0.35	0.39	1.13	1.12
Dão-Lafões	7.67	0.09	0.51	2.04	0.14	3.29	0.30	0.51	0.87	0.99
Douro	7.52	0.03	0.13	1.95	0.19	3.75	0.55	0.63	1.51	1.02
Entre Douro e Vouga	13.58	0.53	0.64	2.18	0.14	1.19	0.30	0.38	0.41	1.48
Grande Lisboa	26.93	3.31	0.76	3.16	0.57	1.87	0.58	1.26	0.10	0.99
Grande Porto	22.93	2.44	0.70	1.60	0.30	0.96	0.26	0.86	0.09	1.27
Lezíria do Tejo	12.83	0.44	0.44	1.94	0.13	2.45	0.48	0.46	1.12	0.99
Médio Tejo	8.47	0.35	0.36	1.88	0.19	1.38	0.28	0.50	1.65	0.83
Minho-Lima	11.35	0.16	0.27	2.61	0.12	3.25	0.48	0.53	0.59	1.21
Oeste	14.81	0.37	0.37	1.89	0.14	3.27	0.39	0.67	0.54	0.87
Península de Setúbal	20.36	1.42	0.62	2.34	0.47	1.70	0.50	0.67	0.28	1.01
Pinhal Interior Norte	7.32	0.09	0.15	1.98	0.05	1.54	0.28	0.31	1.47	1.05
Pinhal Interior Sul	5.94	0.32	0.14	2.24	0.00	1.80	0.32	0.34	2.24	0.59
Pinhal Litoral	12.82	0.38	0.60	1.60	0.29	2.63	0.31	0.76	0.68	0.71
Região Autónoma da Madeira	12.77	0.26	0.38	2.97	0.58	3.46	0.31	0.49	0.12	0.99
Região Autónoma dos Açores	15.91	0.29	0.30	3.48	0.40	3.53	0.44	0.24	0.02	2.32
Serra da Estrela	5.93	0.06	0.41	2.22	0.21	3.75	0.39	0.27	2.30	1.16
Tâmega	11.01	0.14	0.22	1.91	0.05	0.65	0.25	0.34	0.61	1.19

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	12.86	0.52	0.40	2.18	0.23	2.59	0.42	0.59	0.88	1.07
Standard Error	1.29	0.13	0.04	0.09	0.03	0.24	0.03	0.06	0.12	0.06
Median	11.18	0.31	0.38	2.06	0.18	2.54	0.39	0.52	0.64	1.04
Standard Deviation	7.05	0.72	0.20	0.50	0.15	1.32	0.17	0.33	0.67	0.32
Sample Variance	49.67	0.51	0.04	0.25	0.02	1.74	0.03	0.11	0.45	0.10
Kurtosis	4.91	8.66	0.05	0.60	0.44	-0.07	0.31	8.56	-0.80	7.12
Skewness	1.96	2.87	0.54	0.82	1.09	0.52	0.64	2.56	0.58	1.89
Range	32.29	3.28	0.85	2.18	0.58	5.43	0.77	1.65	2.28	1.74
Minimum	5.93	0.03	0.05	1.30	0.00	0.52	0.10	0.24	0.02	0.58
Maximum	38.22	3.31	0.91	3.48	0.58	5.95	0.87	1.90	2.30	2.32

2004	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	6.98	0.36	0.51	1.77	0.15	3.26	0.58	0.81	0.13	0.93
Alentejo Litoral	13.16	0.33	0.61	2.39	0.28	2.47	0.65	0.58	1.28	0.81
Algarve	41.08	1.04	0.88	3.31	0.62	4.59	0.88	2.81	0.43	1.17
Alto Alentejo	8.84	0.22	0.23	2.65	0.14	4.00	0.61	0.51	1.83	1.38
Alto Trás-os-Montes	7.44	0.09	0.16	2.56	0.09	1.68	0.41	1.07	1.45	1.15
Ave	12.48	0.55	0.27	1.29	0.13	0.48	0.18	0.74	0.29	0.73
Baixo Alentejo	6.69	0.30	0.23	2.11	0.27	4.93	0.92	0.84	1.56	1.07
Baixo Mondego	15.33	0.51	0.66	2.31	0.37	1.89	0.25	1.07	0.59	0.98
Baixo Vouga	15.12	0.51	0.58	2.09	0.17	3.32	0.67	1.02	0.60	1.13
Beira Interior Norte	5.88	0.11	0.20	1.58	0.20	2.25	0.42	0.86	1.26	0.72
Beira Interior Sul	8.92	0.18	0.63	2.77	0.25	5.64	0.70	0.54	1.91	1.15
Cávado	15.14	0.89	0.57	1.63	0.21	1.62	0.24	1.21	0.33	0.91
Cova da Beira	5.78	0.07	0.34	2.28	0.15	1.49	0.35	0.76	1.06	1.20
Dão-Lafões	6.77	0.09	0.56	2.06	0.30	2.73	0.36	0.68	0.74	0.97
Douro	5.76	0.04	0.10	1.84	0.17	3.11	0.53	0.50	1.76	0.96
Entre Douro e Vouga	13.08	0.55	0.46	2.08	0.18	1.47	0.30	0.59	0.46	1.57
Grande Lisboa	27.56	3.78	0.73	2.76	0.55	1.74	0.59	1.55	0.11	0.78
Grande Porto	19.79	2.54	0.77	1.48	0.24	1.11	0.32	1.47	0.10	1.22
Lezíria do Tejo	13.50	0.34	0.45	1.97	0.12	2.03	0.34	0.93	0.96	0.78
Médio Tejo	11.23	0.30	0.36	2.18	0.12	1.22	0.19	0.70	1.80	0.75
Minho-Lima	12.36	0.14	0.30	2.52	0.12	2.37	0.40	1.08	0.98	1.06
Oeste	15.88	0.46	0.45	1.79	0.16	3.05	0.45	1.33	0.55	0.81
Península de Setúbal	22.15	1.87	0.66	2.41	0.31	1.39	0.58	1.09	0.26	1.01
Pinhal Interior Norte	7.06	0.00	0.15	1.81	0.08	1.47	0.21	0.36	1.47	0.80
Pinhal Interior Sul	6.70	0.00	0.44	2.00	0.00	1.73	0.23	0.23	1.04	0.51
Pinhal Litoral	12.39	0.24	0.63	1.56	0.24	2.63	0.29	0.94	0.55	0.67
Região Autónoma da Madeira	11.60	0.41	0.57	2.99	0.61	3.02	0.33	0.42	0.14	0.66
Região Autónoma dos Açores	16.06	0.26	0.43	2.26	0.42	2.78	0.63	0.43	0.04	2.29
Serra da Estrela	5.62	0.00	0.29	1.72	0.08	4.19	1.20	0.50	0.75	1.32
Tâmega	10.18	0.15	0.19	1.63	0.04	0.65	0.25	0.71	0.72	1.15

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	12.68	0.54	0.45	2.13	0.23	2.48	0.47	0.88	0.84	1.02
Standard Error	1.37	0.15	0.04	0.09	0.03	0.23	0.04	0.09	0.11	0.06
Median	11.98	0.30	0.45	2.09	0.18	2.31	0.41	0.79	0.73	0.98
Standard Deviation	7.52	0.82	0.21	0.48	0.16	1.26	0.24	0.49	0.58	0.34
Sample Variance	56.49	0.67	0.04	0.23	0.02	1.60	0.06	0.24	0.34	0.12
Kurtosis	6.32	8.74	-0.89	-0.09	1.29	0.16	1.38	7.47	-1.04	5.85
Skewness	2.17	2.87	0.08	0.50	1.28	0.75	1.16	2.20	0.41	1.86
Range	35.46	3.78	0.78	2.02	0.62	5.16	1.01	2.58	1.87	1.79
Minimum	5.62	0.00	0.10	1.29	0.00	0.48	0.18	0.23	0.04	0.51
Maximum	41.08	3.78	0.88	3.31	0.62	5.64	1.20	2.81	1.91	2.29

2005	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	7.53	0.29	0.43	2.00	0.06	2.99	0.55	0.32	0.06	0.81
Alentejo Litoral	12.89	0.33	0.38	2.77	0.15	2.38	0.51	0.47	1.13	0.72
Algarve	34.72	1.17	0.85	3.06	0.64	3.90	0.78	1.79	0.30	0.97
Alto Alentejo	9.18	0.30	0.27	2.34	0.16	4.26	0.84	0.32	1.09	1.07
Alto Trás-os-Montes	7.43	0.12	0.23	2.96	0.08	1.42	0.45	0.62	3.19	1.15
Ave	11.54	0.56	0.30	1.46	0.13	0.73	0.23	0.55	0.75	0.75
Baixo Alentejo	6.59	0.22	0.27	1.89	0.16	4.78	0.69	0.40	0.78	0.91
Baixo Mondego	16.56	0.90	0.52	2.07	0.09	2.22	0.33	0.59	1.17	0.95
Baixo Vouga	14.67	0.54	0.55	1.98	0.23	3.08	0.56	0.73	0.94	1.07
Beira Interior Norte	5.26	0.07	0.23	1.59	0.21	1.95	0.41	0.71	1.34	0.53
Beira Interior Sul	8.66	0.12	0.35	2.34	0.25	4.69	0.69	0.45	3.51	0.97
Cávado	16.30	0.82	0.51	1.58	0.21	1.81	0.29	0.67	0.42	0.87
Cova da Beira	5.72	0.16	0.39	2.09	0.16	2.12	0.42	0.42	0.83	0.92
Dão-Lafões	7.29	0.22	0.59	1.94	0.29	2.04	0.33	0.44	1.41	0.82
Douro	5.14	0.08	0.15	2.41	0.29	2.99	0.61	0.43	2.77	1.03
Entre Douro e Vouga	12.52	0.36	0.38	1.79	0.12	1.11	0.24	0.45	1.18	1.29
Grande Lisboa	22.93	3.84	0.71	2.48	0.61	1.58	0.57	1.29	0.13	0.68
Grande Porto	16.99	2.12	0.75	1.49	0.31	0.88	0.33	0.87	0.33	1.29
Lezíria do Tejo	13.71	0.45	0.51	1.91	0.05	2.05	0.39	0.55	1.12	0.82
Médio Tejo	9.54	0.24	0.29	1.93	0.02	1.28	0.19	0.62	2.13	0.62
Minho-Lima	11.29	0.15	0.29	2.71	0.06	2.80	0.40	0.69	1.40	1.09
Oeste	15.50	0.38	0.44	1.90	0.16	2.46	0.39	0.93	0.75	0.68
Península de Setúbal	21.35	1.89	0.63	2.50	0.23	1.15	0.51	0.86	0.20	0.93
Pinhal Interior Norte	8.53	0.05	0.25	1.88	0.07	1.56	0.38	0.32	3.68	1.08
Pinhal Interior Sul	6.87	0.00	0.30	1.49	0.00	1.42	0.16	0.21	2.51	0.61
Pinhal Litoral	12.11	0.36	0.54	1.43	0.19	2.31	0.26	1.04	1.17	0.66
Região Autónoma da Madeira	11.43	0.48	0.86	2.71	0.41	2.49	0.29	1.07	0.08	0.51
Região Autónoma dos Açores	16.69	0.31	0.43	2.62	0.40	2.74	0.62	0.28	0.03	2.02
Serra da Estrela	6.20	0.00	0.30	1.78	0.00	3.14	0.49	0.45	3.17	1.36
Tâmega	9.29	0.19	0.21	1.58	0.05	0.76	0.19	0.56	1.52	1.20

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	12.15	0.56	0.43	2.09	0.19	2.30	0.44	0.64	1.30	0.95
Standard Error	1.16	0.15	0.03	0.09	0.03	0.20	0.03	0.06	0.20	0.06
Median	11.36	0.30	0.39	1.96	0.16	2.17	0.41	0.56	1.12	0.92
Standard Deviation	6.33	0.80	0.19	0.47	0.16	1.10	0.18	0.34	1.07	0.31
Sample Variance	40.06	0.63	0.04	0.22	0.02	1.20	0.03	0.11	1.15	0.09
Kurtosis	4.42	9.87	-0.10	-0.85	1.92	0.05	-0.43	3.83	-0.08	4.12
Skewness	1.75	2.96	0.79	0.44	1.36	0.71	0.48	1.70	0.93	1.46
Range	29.58	3.84	0.71	1.62	0.64	4.04	0.68	1.58	3.65	1.51
Minimum	5.14	0.00	0.15	1.43	0.00	0.73	0.16	0.21	0.03	0.51
Maximum	34.72	3.84	0.86	3.06	0.64	4.78	0.84	1.79	3.68	2.02

2006	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	8.24	0.41	0.48	1.96	0.15	3.65	0.74	0.54	0.17	0.94
Alentejo Litoral	11.85	0.12	0.31	2.48	0.47	2.90	0.73	0.49	0.71	0.96
Algarve	33.64	1.54	0.83	2.95	0.43	3.51	0.83	1.90	0.22	0.87
Alto Alentejo	7.50	0.30	0.25	2.08	0.25	3.30	0.92	0.51	0.91	1.03
Alto Trás-os-Montes	7.53	0.05	0.25	3.14	0.12	1.37	0.51	0.36	2.29	1.24
Ave	11.16	0.51	0.41	1.56	0.16	0.79	0.26	0.49	0.71	0.69
Baixo Alentejo	5.76	0.16	0.59	1.92	0.15	3.65	0.70	0.60	0.65	0.93
Baixo Mondego	17.08	0.71	0.56	2.06	0.13	1.66	0.29	0.63	0.96	0.71
Baixo Vouga	14.46	0.51	0.60	2.01	0.16	2.88	0.58	0.73	0.76	0.97
Beira Interior Norte	5.38	0.23	0.25	1.88	0.12	1.88	0.39	0.56	1.47	0.66
Beira Interior Sul	9.06	0.34	0.39	2.35	0.09	3.99	0.69	1.38	2.54	0.60
Cávado	13.27	0.74	0.74	1.69	0.22	1.95	0.31	0.75	0.65	0.84
Cova da Beira	6.81	0.12	0.26	2.41	0.11	2.81	0.61	0.85	1.14	0.97
Dão-Lafões	7.23	0.16	0.68	1.94	0.18	1.93	0.36	0.47	0.69	0.77
Douro	6.58	0.09	0.23	2.19	0.21	3.26	0.71	0.48	1.54	1.01
Entre Douro e Vouga	10.74	0.27	0.55	1.59	0.06	1.20	0.27	0.45	0.42	1.22
Grande Lisboa	22.17	4.23	0.83	2.62	0.64	1.72	0.58	1.20	0.06	0.67
Grande Porto	15.92	2.02	1.25	1.77	0.34	1.31	0.38	1.05	0.16	1.03
Lezíria do Tejo	14.56	0.55	0.90	2.30	0.09	1.96	0.49	0.91	0.76	0.98
Médio Tejo	11.45	0.29	0.35	1.83	0.03	1.07	0.25	0.67	1.40	0.58
Minho-Lima	8.53	0.09	0.51	2.87	0.09	2.78	0.51	0.66	2.00	0.87
Oeste	14.45	0.50	0.66	1.71	0.12	2.16	0.47	1.10	0.33	0.94
Península de Setúbal	21.25	1.78	0.80	2.41	0.24	1.25	0.56	0.80	0.27	0.80
Pinhal Interior Norte	8.37	0.09	0.27	1.85	0.00	1.19	0.18	0.32	1.84	0.96
Pinhal Interior Sul	5.47	0.00	0.26	1.71	0.00	0.75	0.14	0.28	2.18	0.63
Pinhal Litoral	13.38	0.47	0.74	1.41	0.19	2.47	0.37	0.78	0.63	0.60
Região Autónoma da Madeira	10.79	0.56	0.25	2.34	0.44	2.70	0.18	1.30	0.14	0.65
Região Autónoma dos Açores	15.64	0.42	0.44	2.70	0.70	3.14	0.72	0.33	0.02	1.61
Serra da Estrela	5.70	0.09	0.24	2.28	0.00	1.66	0.39	0.34	1.94	1.46
Tâmega	9.39	0.22	0.24	1.58	0.03	0.72	0.24	0.44	1.11	0.96

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	11.78	0.59	0.50	2.12	0.20	2.19	0.48	0.71	0.95	0.91
Standard Error	1.11	0.15	0.05	0.08	0.03	0.18	0.04	0.07	0.13	0.04
Median	10.77	0.32	0.46	2.04	0.15	1.95	0.48	0.62	0.73	0.93
Standard Deviation	6.09	0.85	0.26	0.44	0.18	0.97	0.21	0.37	0.73	0.25
Sample Variance	37.09	0.72	0.07	0.20	0.03	0.95	0.05	0.14	0.53	0.06
Kurtosis	4.63	11.85	0.67	-0.34	1.67	-1.17	-0.94	2.34	-0.58	1.46
Skewness	1.82	3.19	0.93	0.57	1.43	0.18	0.24	1.45	0.68	1.05
Range	28.25	4.23	1.02	1.73	0.70	3.28	0.78	1.62	2.52	1.03
Minimum	5.38	0.00	0.23	1.41	0.00	0.72	0.14	0.28	0.02	0.58
Maximum	33.64	4.23	1.25	3.14	0.70	3.99	0.92	1.90	2.54	1.61

2007	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	8.08	0.31	0.35	2.06	0.04	3.42	0.73	0.59	0.06	0.94
Alentejo Litoral	13.72	0.23	0.44	2.51	0.18	2.01	0.77	0.63	0.29	0.91
Algarve	32.53	1.23	0.98	3.24	0.45	3.96	1.38	1.49	0.12	0.79
Alto Alentejo	7.05	0.14	0.22	1.86	0.15	3.78	0.80	0.44	0.25	0.94
Alto Trás-os-Montes	8.10	0.12	0.24	2.94	0.03	1.17	0.33	0.45	3.19	0.95
Ave	11.45	0.47	0.32	1.49	0.15	0.99	0.24	0.53	1.38	0.69
Baixo Alentejo	6.49	0.24	0.36	1.84	0.22	3.81	0.41	0.34	0.32	0.79
Baixo Mondego	15.91	0.63	0.73	1.77	0.17	1.55	0.27	0.62	0.43	0.64
Baixo Vouga	13.42	0.57	0.66	1.97	0.13	3.28	0.63	0.86	0.63	0.94
Beira Interior Norte	6.18	0.11	0.18	2.08	0.13	2.25	0.33	0.50	1.87	0.58
Beira Interior Sul	8.43	0.45	0.68	2.23	0.21	3.58	0.55	0.37	1.99	0.59
Cávado	14.03	0.82	0.58	1.66	0.20	1.86	0.36	0.75	0.73	0.93
Cova da Beira	7.40	0.06	0.22	2.38	0.14	1.79	0.42	0.49	1.16	0.88
Dão-Lafões	6.63	0.08	0.46	2.05	0.18	1.83	0.34	0.45	0.84	0.75
Douro	6.25	0.08	0.21	2.15	0.11	2.21	0.52	0.26	1.96	0.96
Entre Douro e Vouga	9.93	0.33	0.48	1.36	0.09	1.15	0.30	0.68	0.49	0.84
Grande Lisboa	22.64	3.18	0.91	2.43	0.47	1.77	0.56	0.86	0.05	0.65
Grande Porto	15.14	1.67	1.03	1.54	0.31	1.67	0.42	1.26	0.15	0.82
Lezíria do Tejo	15.57	0.44	0.80	2.17	0.10	1.55	0.53	0.45	0.98	0.70
Médio Tejo	11.33	0.31	0.51	2.14	0.03	1.33	0.22	0.60	1.70	0.61
Minho-Lima	7.83	0.14	0.43	2.53	0.08	2.26	0.37	0.58	1.72	1.05
Oeste	14.16	0.41	0.48	1.98	0.10	2.12	0.41	0.66	0.92	0.72
Península de Setúbal	21.52	2.02	0.98	2.99	0.24	1.43	0.57	0.61	0.24	0.77
Pinhal Interior Norte	8.95	0.13	0.27	1.99	0.00	1.21	0.22	0.34	1.00	0.78
Pinhal Interior Sul	7.01	0.07	0.36	2.18	0.00	0.92	0.09	0.14	1.99	0.92
Pinhal Litoral	11.15	0.40	0.71	1.27	0.18	2.23	0.32	0.72	0.50	0.50
Região Autónoma da Madeira	10.47	0.53	0.44	2.41	0.27	2.74	0.31	1.67	0.30	0.47
Região Autónoma dos Açores	16.48	0.52	0.64	2.83	0.80	2.65	0.73	0.33	0.04	1.48
Serra da Estrela	5.93	0.00	0.33	2.18	0.00	1.59	0.39	0.46	1.31	0.85
Tâmega	8.89	0.24	0.31	1.48	0.04	1.02	0.29	0.46	1.30	0.94

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	11.76	0.53	0.51	2.12	0.17	2.10	0.46	0.62	0.93	0.81
Standard Error	1.08	0.12	0.05	0.09	0.03	0.17	0.05	0.06	0.14	0.04
Median	10.20	0.32	0.45	2.11	0.15	1.84	0.40	0.55	0.78	0.80
Standard Deviation	5.92	0.68	0.25	0.48	0.17	0.91	0.25	0.34	0.78	0.20
Sample Variance	35.06	0.47	0.06	0.23	0.03	0.83	0.06	0.11	0.60	0.04
Kurtosis	4.16	7.75	-0.54	-0.02	6.38	-0.51	5.47	3.44	0.74	3.62
Skewness	1.80	2.65	0.68	0.38	2.18	0.75	1.89	1.77	0.97	1.07
Range	26.60	3.18	0.84	1.96	0.80	3.03	1.28	1.53	3.15	1.01
Minimum	5.93	0.00	0.18	1.27	0.00	0.92	0.09	0.14	0.04	0.47
Maximum	32.53	3.18	1.03	3.24	0.80	3.96	1.38	1.67	3.19	1.48

2008	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	9.21	0.25	0.52	1.95	0.09	3.02	0.48	0.44	0.11	0.66
Alentejo Litoral	11.06	0.45	0.28	2.86	0.76	1.55	0.35	0.20	0.40	0.56
Algarve	35.57	1.37	0.88	3.43	0.56	4.08	0.91	0.45	0.09	0.80
Alto Alentejo	7.23	0.22	0.34	1.44	0.20	3.78	0.60	0.32	0.18	0.77
Alto Trás-os-Montes	9.82	0.24	0.32	3.01	0.10	1.71	0.17	0.09	2.71	0.86
Ave	14.09	0.80	0.57	1.31	0.15	0.90	0.20	0.20	0.77	0.59
Baixo Alentejo	7.79	0.23	0.19	1.83	0.32	3.07	0.44	0.13	0.27	0.55
Baixo Mondego	18.72	0.79	0.61	1.80	0.13	1.41	0.25	0.27	0.49	0.68
Baixo Vouga	16.82	0.61	0.68	2.20	0.18	4.24	0.68	0.30	0.57	0.86
Beira Interior Norte	7.87	0.14	0.21	2.41	0.15	2.55	0.33	0.21	1.27	0.34
Beira Interior Sul	11.85	0.43	0.57	2.52	0.16	3.28	0.30	0.24	3.35	0.58
Cávado	13.54	0.87	0.74	1.75	0.18	1.94	0.29	0.23	0.55	0.82
Cova da Beira	8.92	0.07	0.38	2.48	0.10	2.13	0.39	0.21	2.34	1.01
Dão-Lafões	8.16	0.18	0.80	1.85	0.23	2.26	0.30	0.21	0.64	0.55
Douro	6.97	0.07	0.19	1.94	0.24	2.87	0.47	0.27	1.70	1.00
Entre Douro e Vouga	11.96	0.35	0.50	1.55	0.14	1.48	0.27	0.22	0.33	0.77
Grande Lisboa	26.74	3.60	0.79	2.45	0.45	1.77	0.53	0.86	0.06	0.53
Grande Porto	17.88	1.73	0.89	1.37	0.31	1.26	0.33	0.52	0.14	0.68
Lezíria do Tejo	15.65	0.52	0.67	2.32	0.11	1.61	0.34	0.36	0.99	0.68
Médio Tejo	11.80	0.42	0.44	1.75	0.05	1.57	0.17	0.13	1.62	0.48
Minho-Lima	9.08	0.13	0.51	2.74	0.11	2.48	0.30	0.27	1.17	1.01
Oeste	18.08	0.63	0.62	1.78	0.11	1.70	0.38	0.33	0.74	0.56
Península de Setúbal	22.71	3.10	1.06	3.04	0.35	1.32	0.51	0.33	0.26	0.69
Pinhal Interior Norte	11.33	0.13	0.34	2.16	0.02	1.91	0.42	0.20	1.43	0.77
Pinhal Interior Sul	6.66	0.10	0.26	1.80	0.00	0.93	0.07	0.00	2.61	0.69
Pinhal Litoral	12.95	0.56	1.07	1.16	0.22	2.10	0.35	0.22	0.35	0.44
Região Autónoma da Madeira	8.35	0.48	0.47	1.85	0.28	2.95	0.23	0.30	0.53	0.39
Região Autónoma dos Açores	16.20	0.58	0.66	2.47	0.85	2.68	0.64	0.21	0.04	1.52
Serra da Estrela	8.57	0.09	0.38	2.57	0.00	1.66	0.27	0.13	2.32	1.08
Tâmega	10.90	0.38	0.34	1.81	0.09	1.38	0.29	0.21	1.09	0.91

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	13.22	0.65	0.54	2.12	0.22	2.19	0.38	0.27	0.97	0.73
Standard Error	1.18	0.15	0.04	0.10	0.04	0.16	0.03	0.03	0.17	0.04
Median	11.56	0.43	0.51	1.94	0.15	1.93	0.34	0.23	0.61	0.68
Standard Deviation	6.45	0.83	0.25	0.56	0.20	0.90	0.17	0.15	0.91	0.24
Sample Variance	41.59	0.68	0.06	0.31	0.04	0.80	0.03	0.02	0.83	0.06
Kurtosis	4.08	7.00	-0.46	-0.35	3.30	-0.16	1.98	6.59	0.40	2.66
Skewness	1.83	2.63	0.50	0.43	1.82	0.77	1.13	1.96	1.14	1.18
Range	28.91	3.54	0.88	2.27	0.85	3.34	0.84	0.86	3.31	1.18
Minimum	6.66	0.07	0.19	1.16	0.00	0.90	0.07	0.00	0.04	0.34
Maximum	35.57	3.60	1.07	3.43	0.85	4.24	0.91	0.86	3.35	1.52

2009	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	7.89	0.32	0.68	1.95	0.16	2.24	0.40	0.61	0.07	0.58
Alentejo Litoral	11.91	0.27	0.41	2.24	0.65	1.72	0.27	0.39	0.27	0.57
Algarve	34.02	1.70	1.55	3.24	0.64	2.45	0.61	1.91	0.11	0.69
Alto Alentejo	5.98	0.34	0.44	1.85	0.19	2.90	0.40	0.63	0.03	0.84
Alto Trás-os-Montes	8.84	0.14	0.37	2.58	0.15	1.34	0.17	0.78	5.85	0.97
Ave	13.34	0.82	0.46	1.36	0.22	1.19	0.21	0.89	2.08	0.63
Baixo Alentejo	7.04	0.16	0.41	1.79	0.34	1.82	0.22	0.39	0.18	0.63
Baixo Mondego	20.93	0.73	0.75	1.78	0.30	0.90	0.14	0.57	0.48	0.72
Baixo Vouga	16.81	0.69	0.87	2.11	0.20	2.61	0.55	0.87	0.64	0.74
Beira Interior Norte	8.35	0.08	0.35	2.00	0.16	1.65	0.30	0.89	1.02	0.54
Beira Interior Sul	11.14	1.00	0.86	2.25	0.17	2.17	0.26	0.67	2.59	0.82
Cávado	13.09	0.89	0.69	1.64	0.19	1.04	0.16	0.88	1.39	0.84
Cova da Beira	8.68	0.10	0.59	2.34	0.15	2.53	0.51	0.91	2.80	1.27
Dão-Lafões	10.39	0.22	0.90	1.91	0.28	1.31	0.20	0.56	0.98	0.66
Douro	6.43	0.12	0.38	2.18	0.21	1.76	0.39	0.67	2.45	1.04
Entre Douro e Vouga	9.98	0.41	0.57	1.30	0.15	1.22	0.26	0.63	0.89	0.74
Grande Lisboa	22.77	3.56	0.87	2.35	0.71	1.92	0.58	2.40	0.06	0.44
Grande Porto	18.86	1.88	0.69	1.42	0.47	1.55	0.36	1.35	0.28	0.61
Lezíria do Tejo	15.54	0.75	0.75	2.62	0.27	1.12	0.33	0.94	0.62	0.61
Médio Tejo	12.99	0.48	0.73	2.16	0.09	1.28	0.20	1.03	1.44	0.53
Minho-Lima	9.56	0.31	0.73	2.64	0.17	1.38	0.29	1.04	3.14	1.06
Oeste	17.39	0.65	0.76	1.91	0.21	1.23	0.25	1.53	0.51	0.63
Península de Setúbal	18.48	2.58	0.74	2.53	0.33	1.30	0.43	0.92	0.28	0.52
Pinhal Interior Norte	9.80	0.03	0.29	1.93	0.06	2.32	0.31	0.29	2.02	0.76
Pinhal Interior Sul	9.17	0.00	0.12	1.89	0.07	1.23	0.15	0.17	1.55	0.51
Pinhal Litoral	15.52	0.48	1.11	1.60	0.19	1.34	0.27	1.05	0.51	0.40
Região Autónoma da Madeira	8.81	0.54	0.27	1.67	0.43	3.04	0.27	1.03	0.16	0.34
Região Autónoma dos Açores	15.77	0.55	0.79	2.33	1.05	1.97	0.54	0.21	0.00	1.08
Serra da Estrela	9.08	0.00	0.49	2.34	0.07	1.57	0.45	0.45	1.42	1.10
Tâmega	10.08	0.28	0.50	1.60	0.14	1.48	0.26	0.61	3.32	0.84

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	12.95	0.67	0.64	2.05	0.28	1.72	0.32	0.84	1.24	0.72
Standard Error	1.09	0.15	0.05	0.08	0.04	0.11	0.02	0.09	0.24	0.04
Median	10.77	0.45	0.69	1.97	0.19	1.56	0.28	0.83	0.77	0.68
Standard Deviation	5.96	0.80	0.28	0.43	0.22	0.58	0.13	0.48	1.33	0.23
Sample Variance	35.50	0.64	0.08	0.19	0.05	0.33	0.02	0.23	1.76	0.05
Kurtosis	4.12	5.69	2.46	0.54	3.99	-0.35	-0.52	3.23	3.64	-0.10
Skewness	1.72	2.30	0.97	0.49	1.94	0.78	0.66	1.49	1.70	0.62
Range	28.04	3.56	1.43	1.95	0.99	2.14	0.47	2.23	5.85	0.93
Minimum	5.98	0.00	0.12	1.30	0.06	0.90	0.14	0.17	0.00	0.34
Maximum	34.02	3.56	1.55	3.24	1.05	3.04	0.61	2.40	5.85	1.27

2010	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	8.43	0.67	0.71	2.03	0.06	1.81	0.22	0.95	0.23	0.58
Alentejo Litoral	11.04	0.42	0.95	2.17	0.82	1.45	0.35	0.63	0.37	0.61
Algarve	29.74	2.45	1.55	3.10	0.82	2.92	0.75	2.23	0.12	0.66
Alto Alentejo	7.46	0.40	0.51	1.60	0.28	2.66	0.48	0.65	0.04	0.71
Alto Trás-os-Montes	9.11	0.21	0.41	2.99	0.11	1.56	0.24	0.86	3.10	0.85
Ave	12.43	1.11	0.46	1.40	0.24	1.84	0.38	0.78	1.52	0.53
Baixo Alentejo	8.53	0.35	0.89	1.99	0.26	2.02	0.41	1.22	0.13	0.49
Baixo Mondego	18.77	0.95	0.94	1.60	0.38	1.11	0.23	0.84	0.44	0.62
Baixo Vouga	17.06	0.80	1.03	2.00	0.23	2.81	0.58	1.22	0.53	0.63
Beira Interior Norte	8.18	0.15	0.24	2.07	0.33	1.75	0.11	0.87	0.49	0.48
Beira Interior Sul	12.24	0.53	0.49	2.60	0.23	1.65	0.28	0.73	2.15	0.76
Cávado	15.20	1.17	0.87	1.87	0.12	1.08	0.24	1.03	1.21	0.71
Cova da Beira	7.73	0.31	0.47	1.77	0.08	1.70	0.26	0.87	1.79	0.83
Dão-Lafões	11.52	0.33	0.63	1.86	0.24	1.20	0.24	0.89	0.75	0.65
Douro	7.46	0.13	0.23	2.22	0.22	1.88	0.34	0.52	1.48	0.95
Entre Douro e Vouga	11.50	0.47	0.52	1.51	0.12	2.05	0.41	0.81	0.63	0.70
Grande Lisboa	19.23	4.81	1.16	2.08	0.68	1.91	0.65	2.35	0.03	0.43
Grande Porto	17.46	2.17	0.68	1.28	0.70	1.61	0.38	1.33	0.18	0.57
Lezíria do Tejo	17.18	1.06	0.79	2.59	0.17	1.91	0.34	1.21	0.62	0.67
Médio Tejo	13.19	0.62	0.61	1.93	0.08	1.65	0.19	0.82	0.62	0.51
Minho-Lima	10.95	0.49	1.02	3.03	0.13	1.54	0.37	0.99	3.92	1.11
Oeste	16.23	0.66	0.67	1.78	0.21	1.77	0.37	1.36	0.31	0.63
Península de Setúbal	18.20	3.42	0.76	2.34	0.42	1.15	0.47	1.36	0.34	0.51
Pinhal Interior Norte	10.23	0.05	0.27	1.80	0.14	2.31	0.21	0.30	1.73	0.85
Pinhal Interior Sul	8.42	0.00	0.07	1.74	0.00	0.95	0.22	0.15	1.81	0.69
Pinhal Litoral	15.59	0.79	1.17	1.85	0.31	1.67	0.38	0.87	0.30	0.41
Região Autónoma da Madeira	8.29	0.93	0.40	1.74	0.36	2.43	0.33	1.82	0.30	0.27
Região Autónoma dos Açores	14.70	0.58	0.75	2.20	0.60	2.41	0.73	0.29	0.00	1.03
Serra da Estrela	7.94	0.07	0.48	2.49	0.27	1.92	0.55	0.64	1.00	1.23
Tâmega	10.76	0.42	0.33	1.54	0.15	1.60	0.38	0.62	1.47	0.77

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	12.83	0.88	0.67	2.04	0.29	1.81	0.37	0.97	0.92	0.68
Standard Error	0.91	0.19	0.06	0.09	0.04	0.09	0.03	0.09	0.17	0.04
Median	11.51	0.55	0.65	1.96	0.23	1.76	0.36	0.87	0.57	0.65
Standard Deviation	4.98	1.05	0.33	0.47	0.22	0.49	0.16	0.50	0.94	0.21
Sample Variance	24.85	1.11	0.11	0.22	0.05	0.24	0.02	0.25	0.89	0.04
Kurtosis	3.00	6.72	0.36	0.20	0.72	0.07	0.48	1.82	2.60	0.83
Skewness	1.41	2.50	0.55	0.80	1.23	0.49	0.88	1.15	1.59	0.74
Range	22.28	4.81	1.48	1.83	0.82	1.97	0.64	2.20	3.92	0.96
Minimum	7.46	0.00	0.07	1.28	0.00	0.95	0.11	0.15	0.00	0.27
Maximum	29.74	4.81	1.55	3.10	0.82	2.92	0.75	2.35	3.92	1.23

2011	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	9.36	0.69	0.85	1.97	0.05	1.71	0.35	0.47	0.13	0.50
Alentejo Litoral	14.51	0.43	1.07	2.44	0.64	1.68	0.45	0.62	0.17	0.54
Algarve	28.69	2.35	1.46	3.14	0.77	3.10	0.82	1.40	0.09	0.57
Alto Alentejo	10.07	0.61	0.51	2.23	0.46	2.93	0.48	0.35	0.07	0.63
Alto Trás-os-Montes	11.17	0.33	0.46	3.07	0.21	1.98	0.22	0.47	4.19	0.77
Ave	10.88	0.81	0.45	1.33	0.16	1.54	0.33	0.64	1.10	0.55
Baixo Alentejo	9.16	0.43	0.64	1.95	0.30	1.76	0.36	0.57	0.13	0.70
Baixo Mondego	17.91	1.02	0.82	1.83	0.28	1.18	0.23	0.62	0.53	0.54
Baixo Vouga	15.74	1.00	1.00	1.83	0.20	2.83	0.73	0.80	0.67	0.57
Beira Interior Norte	8.62	0.14	0.31	2.12	0.23	2.27	0.38	0.47	0.89	0.50
Beira Interior Sul	11.74	0.36	0.63	2.46	0.07	2.41	0.16	0.35	1.71	0.55
Cávado	14.81	0.97	0.74	1.83	0.13	1.26	0.28	0.94	1.20	0.64
Cova da Beira	8.03	0.30	0.31	2.25	0.12	1.87	0.28	0.63	2.23	0.78
Dão-Lafões	11.94	0.29	0.81	1.80	0.17	1.30	0.22	0.60	0.61	0.61
Douro	8.31	0.21	0.31	2.57	0.17	1.70	0.32	0.42	2.25	0.79
Entre Douro e Vouga	11.48	0.34	0.46	1.63	0.08	1.95	0.32	0.48	0.80	0.62
Grande Lisboa	20.29	4.75	1.25	1.98	0.63	2.07	0.66	1.36	0.05	0.33
Grande Porto	17.58	2.12	0.85	1.21	0.68	1.87	0.34	0.81	0.19	0.51
Lezíria do Tejo	18.90	1.35	0.80	2.67	0.22	1.83	0.47	0.88	0.45	0.57
Médio Tejo	13.09	0.67	0.67	1.84	0.03	1.51	0.20	0.45	0.63	0.55
Minho-Lima	11.34	0.38	0.75	2.86	0.12	2.34	0.38	0.74	3.29	0.99
Oeste	18.46	0.89	0.80	2.15	0.15	1.58	0.32	0.99	0.49	0.48
Península de Setúbal	19.57	3.59	0.92	2.61	0.41	1.02	0.44	0.99	0.20	0.44
Pinhal Interior Norte	10.60	0.24	0.40	1.93	0.15	2.80	0.24	0.21	1.20	0.72
Pinhal Interior Sul	8.37	0.00	0.10	1.56	0.00	1.49	0.00	0.20	1.26	0.67
Pinhal Litoral	15.99	0.77	1.09	1.77	0.38	1.93	0.46	0.77	0.34	0.35
Região Autónoma da Madeira	7.93	0.96	0.45	1.61	0.31	2.32	0.28	1.40	0.27	0.31
Região Autónoma dos Açores	13.82	0.46	0.74	2.46	0.53	2.33	0.72	0.35	0.02	1.02
Serra da Estrela	8.17	0.09	0.32	2.49	0.25	2.89	0.48	0.35	0.85	0.83
Tâmega	11.56	0.46	0.35	1.51	0.14	1.85	0.33	0.52	0.83	0.64

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	13.27	0.90	0.68	2.10	0.27	1.98	0.38	0.66	0.90	0.61
Standard Error	0.88	0.19	0.06	0.09	0.04	0.10	0.03	0.06	0.18	0.03
Median	11.65	0.54	0.70	1.98	0.20	1.87	0.34	0.61	0.62	0.57
Standard Deviation	4.80	1.05	0.31	0.49	0.21	0.55	0.18	0.33	0.99	0.17
Sample Variance	23.07	1.10	0.10	0.24	0.04	0.30	0.03	0.11	0.97	0.03
Kurtosis	2.07	6.57	0.02	-0.47	0.20	-0.50	0.96	0.45	3.96	0.63
Skewness	1.27	2.50	0.45	0.34	1.05	0.43	0.78	0.95	1.94	0.57
Range	20.76	4.75	1.36	1.93	0.77	2.08	0.82	1.21	4.17	0.70
Minimum	7.93	0.00	0.10	1.21	0.00	1.02	0.00	0.20	0.02	0.31
Maximum	28.69	4.75	1.46	3.14	0.77	3.10	0.82	1.40	4.19	1.02

2012	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	9.47	0.57	0.85	1.82	0.16	2.44	0.38	0.88	0.62	0.73
Alentejo Litoral	15.21	0.72	1.40	2.38	0.78	2.14	0.35	0.68	1.18	0.74
Algarve	25.56	2.36	1.51	2.99	0.83	3.95	0.86	1.63	0.51	0.55
Alto Alentejo	10.75	0.71	0.61	2.35	0.10	2.54	0.40	0.66	1.67	0.65
Alto Trás-os-Montes	12.25	0.28	0.56	2.88	0.15	1.88	0.24	0.52	6.46	0.83
Ave	9.88	0.76	0.56	1.11	0.18	1.26	0.31	0.56	1.36	0.59
Baixo Alentejo	11.64	0.38	0.66	2.45	0.27	1.74	0.43	0.75	1.41	0.65
Baixo Mondego	18.33	1.23	0.89	1.81	0.25	0.85	0.16	0.55	0.38	0.54
Baixo Vouga	15.48	0.82	0.93	1.69	0.25	2.68	0.53	0.62	0.85	0.54
Beira Interior Norte	7.96	0.35	0.58	2.26	0.31	2.49	0.24	0.48	1.99	0.45
Beira Interior Sul	12.97	0.59	0.75	2.83	0.79	2.73	0.34	0.46	1.78	0.82
Cávado	13.88	0.86	0.78	1.73	0.21	1.23	0.31	0.63	1.02	0.71
Cova da Beira	8.88	0.35	0.47	2.19	0.17	1.95	0.29	0.40	2.83	0.77
Dão-Lafões	13.70	0.36	0.77	1.89	0.11	1.01	0.19	0.60	0.86	0.60
Douro	8.45	0.22	0.34	2.24	0.21	1.40	0.29	0.41	3.11	0.75
Entre Douro e Vouga	11.46	0.42	0.58	1.67	0.11	1.85	0.32	0.48	0.73	0.68
Grande Lisboa	19.43	4.09	1.36	1.83	0.67	2.47	0.77	1.94	0.14	0.30
Grande Porto	16.73	2.10	1.01	1.09	0.65	2.53	0.43	0.78	0.20	0.44
Lezíria do Tejo	17.06	1.06	1.05	2.87	0.38	2.04	0.56	0.89	1.49	0.51
Médio Tejo	13.24	1.02	0.78	1.79	0.09	1.72	0.19	0.96	1.48	0.47
Minho-Lima	10.57	0.37	0.77	2.82	0.17	2.44	0.43	0.61	1.91	0.93
Oeste	16.92	1.23	0.97	1.95	0.22	1.72	0.32	0.90	1.49	0.53
Península de Setúbal	17.94	2.93	1.24	2.39	0.56	1.77	0.63	1.01	0.32	0.42
Pinhal Interior Norte	11.73	0.22	0.46	2.15	0.12	2.66	0.30	0.33	1.77	0.64
Pinhal Interior Sul	8.92	0.08	0.55	1.53	0.15	1.81	0.18	0.23	1.78	0.55
Pinhal Litoral	15.06	0.79	1.01	1.65	0.35	1.94	0.40	0.76	0.44	0.31
Região Autónoma da Madeira	5.91	0.61	0.57	1.39	0.27	2.41	0.39	1.19	0.84	0.32
Região Autónoma dos Açores	13.60	0.50	1.14	2.22	0.69	3.39	1.07	0.40	0.00	0.84
Serra da Estrela	8.83	0.23	0.66	2.51	0.26	4.10	0.59	0.33	1.50	1.50
Tâmega	10.80	0.58	0.48	1.51	0.15	1.64	0.34	0.43	1.49	0.64

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	13.09	0.89	0.81	2.07	0.32	2.16	0.41	0.70	1.39	0.63
Standard Error	0.76	0.16	0.05	0.10	0.04	0.14	0.04	0.07	0.22	0.04
Median	12.61	0.60	0.77	2.05	0.23	2.00	0.35	0.62	1.38	0.62
Standard Deviation	4.18	0.89	0.30	0.52	0.23	0.76	0.21	0.37	1.21	0.23
Sample Variance	17.45	0.79	0.09	0.27	0.05	0.58	0.04	0.14	1.47	0.05
Kurtosis	1.26	5.50	-0.17	-0.70	-0.10	0.97	2.72	3.91	10.07	6.00
Skewness	0.86	2.28	0.73	0.07	1.15	0.78	1.58	1.80	2.64	1.75
Range	19.64	4.01	1.17	1.90	0.74	3.25	0.90	1.71	6.46	1.19
Minimum	5.91	0.08	0.34	1.09	0.09	0.85	0.16	0.23	0.00	0.30
Maximum	25.56	4.09	1.51	2.99	0.83	4.10	1.07	1.94	6.46	1.50
Sum	392.63	26.81	24.28	62.02	9.64	64.78	12.25	21.07	41.60	18.99

2013	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Alentejo Central	9.11	0.59	0.89	1.73	0.14	2.36	0.41	0.60	0.47	0.58
Alentejo Litoral	14.69	0.53	1.16	2.24	0.65	2.28	0.59	1.13	0.81	0.60
Algarve	23.17	1.99	1.66	2.59	0.71	3.76	0.82	1.43	0.63	0.64
Alto Alentejo	10.44	0.54	0.56	1.99	0.75	2.15	0.39	0.35	1.42	0.62
Alto Trás-os-Montes	11.16	0.38	0.49	2.92	0.20	1.82	0.31	0.56	4.17	0.98
Ave	9.05	0.63	0.68	1.14	0.20	1.64	0.43	0.47	1.47	0.56
Baixo Alentejo	10.90	0.29	0.71	2.01	0.27	1.54	0.32	0.80	2.00	0.69
Baixo Mondego	13.71	1.23	0.86	1.41	0.32	1.29	0.27	0.59	0.41	0.57
Baixo Vouga	13.79	0.62	0.86	1.77	0.25	2.73	0.58	0.56	0.82	0.58
Beira Interior Norte	7.54	0.20	0.48	2.23	0.39	2.47	0.29	0.72	2.07	0.54
Beira Interior Sul	12.05	0.57	1.09	2.26	0.17	2.05	0.29	0.46	1.45	0.75
Cávado	13.62	0.86	0.93	1.49	0.18	1.17	0.31	0.56	1.27	0.77
Cova da Beira	7.49	0.41	0.66	2.14	0.09	1.89	0.31	0.58	2.49	0.66
Dão-Lafões	10.61	0.35	0.85	1.59	0.20	1.51	0.29	0.74	0.63	0.70
Douro	8.17	0.13	0.47	2.44	0.26	1.43	0.32	0.60	2.16	0.88
Entre Douro e Vouga	11.19	0.43	0.57	1.54	0.10	1.76	0.25	0.41	1.04	0.56
Grande Lisboa	17.29	3.82	1.50	1.72	0.63	2.40	0.72	1.54	0.13	0.27
Grande Porto	17.12	1.79	1.16	1.10	0.56	2.32	0.38	0.76	0.24	0.43
Lezíria do Tejo	16.10	0.74	1.13	2.09	0.48	1.78	0.50	0.78	1.53	0.61
Médio Tejo	12.43	0.80	0.80	1.70	0.09	1.93	0.32	0.81	1.33	0.40
Minho-Lima	10.65	0.40	0.84	2.64	0.23	2.27	0.34	0.75	4.23	0.82
Oeste	14.09	0.92	1.01	1.80	0.19	1.68	0.31	0.63	0.80	0.46
Península de Setúbal	16.74	2.73	1.34	2.26	0.52	1.96	0.64	0.78	0.50	0.34
Pinhal Interior Norte	10.92	0.22	0.51	1.61	0.09	2.32	0.47	0.41	1.27	0.56
Pinhal Interior Sul	8.00	0.13	0.41	1.68	0.18	2.45	0.08	0.59	2.17	0.33
Pinhal Litoral	13.28	0.71	1.19	1.46	0.24	1.77	0.44	0.61	0.28	0.29
Região Autónoma da Madeira	5.80	0.67	0.49	1.40	0.31	2.23	0.27	1.13	0.23	0.28
Região Autónoma dos Açores	13.41	0.32	1.08	2.12	0.72	3.38	1.24	0.52	0.02	0.86
Serra da Estrela	9.52	0.12	0.76	2.63	0.24	2.92	0.36	0.55	1.64	1.09
Tâmega	9.37	0.38	0.39	1.49	0.15	1.43	0.31	0.47	2.01	0.75

	Theft	Robbery	Fraud	Property damage	Drug trafficking	Drunk driving	Crimes against public authority	Falsification crimes	Forest fire crimes	Defamation
Mean	12.05	0.78	0.85	1.91	0.32	2.09	0.42	0.70	1.32	0.61
Standard Error	0.67	0.15	0.06	0.09	0.04	0.11	0.04	0.05	0.19	0.04
Median	11.18	0.55	0.84	1.78	0.24	2.00	0.33	0.60	1.27	0.59
Standard Deviation	3.68	0.82	0.33	0.47	0.21	0.59	0.22	0.28	1.04	0.20
Sample Variance	13.51	0.67	0.11	0.22	0.04	0.34	0.05	0.08	1.09	0.04
Kurtosis	1.48	6.58	-0.19	-0.59	-0.44	1.32	6.39	2.83	2.06	-0.07
Skewness	0.90	2.48	0.59	0.32	0.95	0.97	2.16	1.69	1.32	0.28
Range	17.38	3.70	1.26	1.82	0.66	2.59	1.17	1.19	4.21	0.82
Minimum	5.80	0.12	0.39	1.10	0.09	1.17	0.08	0.35	0.02	0.27
Maximum	23.17	3.82	1.66	2.92	0.75	3.76	1.24	1.54	4.23	1.09

ANNEX 3 - EIGENVALUES ASSOCIATED WITH PERCENTAGE OF INERTIA (PCA)

PC	eigenvalues	inertia (in %)
1	8.044	57.46
2	3.141	22.44
3	1.101	7.86
4	0.687	4.91
5	0.304	2.17
6	0.254	1.81
7	0.157	1.12
8	0.133	0.95
9	0.077	0.55
10	0.053	0.38
11	0.024	0.17
12	0.017	0.12
13	0.005	0.04
14	0.002	0.01

ANNEX 4 - RV COEFFICENTS (STATIS)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1995	1	0.93	0.91	0.90	0.90	0.87	0.84	0.84	0.82	0.78	0.79	0.76	0.75	0.72	0.71	0.72	0.69	0.69	0.67
1996	0.93	1	0.95	0.93	0.90	0.89	0.84	0.82	0.82	0.76	0.80	0.77	0.79	0.75	0.74	0.73	0.69	0.70	0.69
1997	0.91	0.95	1	0.93	0.90	0.88	0.84	0.82	0.82	0.75	0.80	0.78	0.79	0.74	0.75	0.73	0.69	0.71	0.68
1998	0.90	0.93	0.93	1	0.92	0.87	0.86	0.83	0.84	0.78	0.82	0.78	0.79	0.74	0.77	0.76	0.72	0.73	0.70
1999	0.90	0.90	0.90	0.92	1	0.94	0.91	0.87	0.86	0.80	0.82	0.80	0.81	0.77	0.75	0.76	0.74	0.74	0.71
2000	0.87	0.89	0.88	0.87	0.94	1	0.90	0.88	0.84	0.79	0.81	0.80	0.80	0.76	0.73	0.74	0.74	0.74	0.72
2001	0.84	0.84	0.84	0.86	0.91	0.90	1	0.90	0.87	0.83	0.81	0.77	0.79	0.74	0.72	0.72	0.69	0.71	0.68
2002	0.84	0.82	0.82	0.83	0.87	0.88	0.90	1	0.89	0.85	0.82	0.79	0.80	0.74	0.72	0.72	0.70	0.72	0.70
2003	0.82	0.82	0.82	0.84	0.86	0.84	0.87	0.89	1	0.91	0.90	0.84	0.84	0.79	0.76	0.77	0.73	0.73	0.71
2004	0.78	0.76	0.75	0.78	0.80	0.79	0.83	0.85	0.91	1	0.91	0.83	0.83	0.75	0.75	0.77	0.74	0.76	0.73
2005	0.79	0.80	0.80	0.82	0.82	0.81	0.81	0.82	0.90	0.91	1	0.90	0.87	0.82	0.79	0.80	0.79	0.75	0.74
2006	0.76	0.77	0.78	0.78	0.80	0.80	0.77	0.79	0.84	0.83	0.90	1	0.89	0.85	0.82	0.80	0.80	0.79	0.79
2007	0.75	0.79	0.79	0.79	0.81	0.80	0.79	0.80	0.84	0.83	0.87	0.89	1	0.88	0.84	0.82	0.82	0.81	0.83
2008	0.72	0.75	0.74	0.74	0.77	0.76	0.74	0.74	0.79	0.75	0.82	0.85	0.88	1	0.87	0.84	0.84	0.81	0.82
2009	0.71	0.74	0.75	0.77	0.75	0.73	0.72	0.72	0.76	0.75	0.79	0.82	0.84	0.87	1	0.87	0.86	0.85	0.85
2010	0.72	0.73	0.73	0.76	0.76	0.74	0.72	0.72	0.77	0.77	0.80	0.80	0.82	0.84	0.87	1	0.94	0.86	0.85
2011	0.69	0.69	0.69	0.72	0.74	0.74	0.69	0.70	0.73	0.74	0.79	0.80	0.82	0.84	0.86	0.94	1	0.89	0.88
2012	0.69	0.70	0.71	0.73	0.74	0.74	0.71	0.72	0.73	0.76	0.75	0.79	0.81	0.81	0.85	0.86	0.89	1	0.93
2013	0.67	0.69	0.68	0.70	0.71	0.72	0.68	0.70	0.71	0.73	0.74	0.79	0.83	0.82	0.85	0.85	0.88	0.93	1

ANNEX 5 - NORMS (STATIS)

	norms
1995	5.240702
1996	5.632212
1997	5.534635
1998	5.707014
1999	5.473821
2000	5.321502
2001	4.865418
2002	5.075689
2003	5.028024
2004	4.819294
2005	4.955276
2006	4.74136
2007	4.932418
2008	4.748782
2009	4.719389
2010	4.969391
2011	5.129786
2012	5.258151
2013	5.133985

ANNEX 6 - MATRIX S (STATIS)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1995	27.46	27.45	26.45	27.04	25.78	24.36	21.45	22.38	21.5	19.59	20.58	18.8	19.35	17.89	17.65	18.79	18.61	19.11	18.03
1996	27.45	31.72	29.67	29.73	27.85	26.56	22.91	23.45	23.28	20.54	22.22	20.54	21.93	20.12	19.71	20.36	20.07	20.7	19.91
1997	26.45	29.67	30.63	29.32	27.21	25.93	22.57	23.17	22.91	20.09	21.84	20.54	21.7	19.52	19.68	20.04	19.51	20.54	19.4
1998	27.04	29.73	29.32	32.57	28.62	26.52	23.77	24.09	23.99	21.57	23.21	21.15	22.17	20.12	20.79	21.42	21.13	21.94	20.58
1999	25.78	27.85	27.21	28.62	29.96	27.5	24.26	24.3	23.58	21.12	22.16	20.84	21.92	19.94	19.43	20.75	20.66	21.27	19.91
2000	24.36	26.56	25.93	26.52	27.5	28.32	23.39	23.67	22.52	20.36	21.36	20.13	21.08	19.31	18.44	19.56	20.1	20.73	19.67
2001	21.45	22.91	22.57	23.77	24.26	23.39	23.67	22.25	21.36	19.35	19.53	17.79	18.92	17.12	16.5	17.34	17.26	18.23	16.98
2002	22.38	23.45	23.17	24.09	24.3	23.67	22.25	25.76	22.81	20.8	20.72	19.13	20.07	17.78	17.15	18.11	18.18	19.25	18.2
2003	21.5	23.28	22.91	23.99	23.58	22.52	21.36	22.81	25.28	22.1	22.33	20.01	20.89	18.82	18.1	19.12	18.83	19.29	18.32
2004	19.59	20.54	20.09	21.57	21.12	20.36	19.35	20.8	22.1	23.23	21.76	18.91	19.64	17.28	17.15	18.37	18.29	19.32	17.94
2005	20.58	22.22	21.84	23.21	22.16	21.36	19.53	20.72	22.33	21.76	24.55	21.14	21.34	19.28	18.4	19.66	20.15	19.49	18.72
2006	18.8	20.54	20.54	21.15	20.84	20.13	17.79	19.13	20.01	18.91	21.14	22.48	20.8	19.25	18.42	18.77	19.44	19.59	19.23
2007	19.35	21.93	21.7	22.17	21.92	21.08	18.92	20.07	20.89	19.64	21.34	20.8	24.33	20.63	19.51	20.11	20.63	21.04	20.99
2008	17.89	20.12	19.52	20.12	19.94	19.31	17.12	17.78	18.82	17.28	19.28	19.25	20.63	22.55	19.42	19.71	20.5	20.15	19.95
2009	17.65	19.71	19.68	20.79	19.43	18.44	16.5	17.15	18.1	17.15	18.4	18.42	19.51	19.42	22.27	20.33	20.8	21.06	20.62
2010	18.79	20.36	20.04	21.42	20.75	19.56	17.34	18.11	19.12	18.37	19.66	18.77	20.11	19.71	20.33	24.69	23.87	22.48	21.61
2011	18.61	20.07	19.51	21.13	20.66	20.1	17.26	18.18	18.83	18.29	20.15	19.44	20.63	20.5	20.8	23.87	26.31	23.89	23.25
2012	19.11	20.7	20.54	21.94	21.27	20.73	18.23	19.25	19.29	19.32	19.49	19.59	21.04	20.15	21.06	22.48	23.89	27.65	25.19
2013	18.03	19.91	19.4	20.58	19.91	19.67	16.98	18.2	18.32	17.94	18.72	19.23	20.99	19.95	20.62	21.61	23.25	25.19	26.36

ANNEX 7 - FIRST TWO INTERSTRUCTURE COMPONENTS (STATIS – INTERSTRUCTURE)

	Comp. 1	Comp. 1
1995	1.085454	-0.34251
1996	1.181973	-0.35413
1997	1.160709	-0.34035
1998	1.210057	-0.30003
1999	1.175722	-0.28325
2000	1.128914	-0.24935
2001	1.009808	-0.24429
2002	1.052485	-0.20848
2003	1.06066	-0.11013
2004	0.986137	0.011376
2005	1.041445	0.037071
2006	0.983855	0.144266
2007	1.03644	0.180683
2008	0.962378	0.273076
2009	0.95222	0.318618
2010	1.003594	0.372237
2011	1.019071	0.469288
2012	1.044399	0.444843
2013	1.001662	0.483452

ANNEX 8 - COMPROMISE AND EIGENVALUES WITH ASSOCIATED WITH PERCENTAGE OF INERTIA (STATIS – COMPROMISE)

3.70	-0.12	-2.10	1.79	-1.40	-0.59	1.41	-0.50	0.74	0.16	0.86	-0.67	0.39	0.28	0.51	0.33	-3.28	-1.81	0.30	-0.79	-0.21	-0.02	-1.29	-0.48	-0.66	-0.15	1.83	1.67	0.28	-0.19
-0.12	6.31	2.53	0.80	-0.98	-1.27	2.09	-0.55	-0.26	0.09	0.89	-0.87	-1.13	-0.40	-0.35	-1.50	-0.59	-1.67	0.83	-0.84	0.17	-0.09	0.36	-1.48	-0.07	-0.15	-0.68	0.47	-0.20	-1.34
-2.10	2.53	39.94	-2.57	-5.23	-8.69	-3.12	0.32	5.82	-8.41	0.18	-1.32	-7.81	-7.10	-8.03	-6.21	27.27	8.59	2.20	-5.97	-1.46	0.54	14.88	-12.80	-17.33	1.92	4.71	10.73	-9.67	-11.82
1.79	0.80	-2.57	6.07	0.18	-2.23	3.73	-2.04	0.33	1.35	1.71	-2.62	0.96	-0.19	2.60	-0.56	-5.73	-4.09	-0.10	-0.83	0.59	-1.49	-3.41	2.17	0.98	-1.94	0.55	2.08	2.22	-0.30
-1.40	-0.98	-5.23	0.18	9.42	-0.20	-0.58	-1.47	-2.52	1.82	1.34	-1.09	3.26	0.48	4.12	-0.19	-7.08	-5.13	-0.99	1.43	3.98	-1.70	-3.20	3.88	3.49	-3.51	-2.25	-1.21	3.39	1.94
-0.59	-1.27	-8.69	-2.23	-0.20	6.09	-1.89	1.15	-1.29	1.63	-2.89	2.59	1.34	1.85	0.02	2.59	-3.48	1.38	-1.13	2.29	-1.70	1.33	-2.44	1.98	3.92	1.59	-1.83	-5.30	0.57	4.64
1.41	2.09	-3.12	3.73	-0.58	-1.89	6.08	-1.27	-0.04	1.90	2.51	-1.44	0.20	0.41	2.22	-0.96	-6.29	-4.57	0.78	-0.49	1.12	-0.22	-3.56	0.86	1.45	-0.57	0.20	-0.48	1.36	-0.82
-0.50	-0.55	0.32	-2.04	-1.47	1.15	-1.27	2.90	-0.14	-1.09	-1.26	1.62	-1.11	0.60	-1.71	0.87	2.35	2.54	0.01	0.59	-1.45	0.82	1.67	-1.04	-0.65	1.53	0.14	-0.72	-2.30	0.18
0.74	-0.26	5.82	0.33	-2.52	-1.29	-0.04	-0.14	3.36	-1.49	0.28	-0.10	-1.12	-1.24	-1.27	-0.39	3.45	1.46	0.17	-1.73	-0.47	0.33	1.16	-2.21	-3.63	1.04	0.25	2.37	-1.12	-1.70
0.16	0.09	-8.41	1.35	1.82	1.63	1.90	-1.09	-1.49	5.00	0.92	-0.39	2.02	1.38	2.57	-0.28	-7.46	-4.08	-0.11	1.84	0.92	0.04	-4.98	3.58	4.95	-0.15	-0.75	-5.03	2.06	1.99
0.86	0.89	0.18	1.71	1.34	-2.89	2.51	-1.26	0.28	0.92	6.96	-1.36	0.46	-0.44	1.87	-1.75	-4.07	-4.31	0.90	-0.66	2.50	-0.43	-1.98	-0.36	0.31	-0.76	0.13	-0.73	1.03	-1.83
-0.67	-0.87	-1.32	-2.62	-1.09	2.59	-1.44	1.62	-0.10	-0.39	-1.36	3.60	-0.34	0.79	-1.22	0.98	1.44	2.64	-0.08	0.63	-0.56	1.64	0.44	-1.35	0.08	1.99	-1.48	-3.26	-1.34	1.09
0.39	-1.13	-7.81	0.96	3.26	1.34	0.20	-1.11	-1.12	2.02	0.46	-0.34	4.63	1.30	3.15	1.02	-7.66	-3.81	-0.99	0.80	1.69	-0.67	-4.57	3.19	3.30	-1.80	-1.52	-1.39	3.36	2.84
0.28	-0.40	-7.10	-0.19	0.48	1.85	0.41	0.60	-1.24	1.38	-0.44	0.79	1.30	3.05	1.04	1.27	-5.58	-1.63	-0.52	1.51	-0.16	0.36	-3.01	2.36	3.46	0.49	-0.86	-2.73	1.09	2.13
0.51	-0.35	-8.03	2.60	4.12	0.02	2.22	-1.71	-1.27	2.57	1.87	-1.22	3.15	1.04	5.22	0.21	-9.03	-5.23	-1.05	0.44	2.36	-1.17	-5.34	3.51	3.49	-2.61	-1.65	-0.44	3.68	2.11
0.33	-1.50	-6.21	-0.56	-0.19	2.59	-0.96	0.87	-0.39	-0.28	-1.75	0.98	1.02	1.27	0.21	3.88	-3.93	1.04	-1.05	0.63	-1.12	-0.01	-1.55	1.21	1.46	0.05	-0.56	0.03	1.24	3.24
-3.28	-0.59	27.27	-5.73	-7.08	-3.48	-6.29	2.35	3.45	-7.46	-4.07	1.44	-7.66	-5.58	-9.03	-3.93	38.85	16.08	-0.07	-3.72	-4.63	0.48	17.99	-11.90	-13.60	2.68	4.19	3.89	-11.52	-9.02
-1.81	-1.67	8.59	-4.09	-5.13	1.38	-4.57	2.54	1.46	-4.08	-4.31	2.64	-3.81	-1.63	-5.23	1.04	16.08	13.00	-0.67	-1.42	-4.51	0.90	7.76	-4.73	-5.60	2.68	0.30	1.46	-5.02	-1.52
0.30	0.83	2.20	-0.10	-0.99	-1.13	0.78	0.01	0.17	-0.11	0.90	-0.08	-0.99	-0.52	-1.05	-1.05	-0.07	-0.67	3.44	-0.23	0.61	0.92	1.30	-1.04	-0.84	0.78	-0.85	-0.58	-0.72	-1.25
-0.79	-0.84	-5.97	-0.83	1.43	2.29	-0.49	0.59	-1.73	1.84	-0.66	0.63	0.80	1.51	0.44	0.63	-3.72	-1.42	-0.23	3.72	-0.24	0.73	-2.11	3.05	4.59	0.78	-1.14	-5.42	0.37	2.15
-0.21	0.17	-1.46	0.59	3.98	-1.70	1.12	-1.45	-0.47	0.92	2.50	-0.56	1.69	-0.16	2.36	-1.12	-4.63	-4.51	0.61	-0.24	5.29	-0.64	-2.45	0.95	1.37	-2.09	-1.66	-0.23	2.15	-0.12
-0.02	-0.09	0.54	-1.49	-1.70	1.33	-0.22	0.82	0.33	0.04	-0.43	1.64	-0.67	0.36	-1.17	-0.01	0.48	0.90	0.92	0.73	-0.64	2.71	0.20	-1.37	-0.26	1.98	-0.80	-3.20	-1.10	0.18
-1.29	0.36	14.88	-3.41	-3.20	-2.44	-3.56	1.67	1.16	-4.98	-1.98	0.44	-4.57	-3.01	-5.34	-1.55	17.99	7.76	1.30	-2.11	-2.45	0.20	12.58	-6.83	-7.65	1.05	2.01	3.87	-6.11	-4.81
-0.48	-1.48	-12.80	2.17	3.88	1.98	0.86	-1.04	-2.21	3.58	-0.36	-1.35	3.19	2.36	3.51	1.21	-11.90	-4.73	-1.04	3.05	0.95	-1.37	-6.83	9.64	8.25	-1.82	-2.91	-3.74	5.14	4.30
-0.66	-0.07	-17.33	0.98	3.49	3.92	1.45	-0.65	-3.63	4.95	0.31	0.08	3.30	3.46	3.49	1.46	-13.60	-5.60	-0.84	4.59	1.37	-0.26	-7.65	8.25	12.67	-1.12	-3.62	-8.75	4.64	5.35
-0.15	-0.15	1.92	-1.94	-3.51	1.59	-0.57	1.53	1.04	-0.15	-0.76	1.99	-1.80	0.49	-2.61	0.05	2.68	2.68	0.78	0.78	-2.09	1.98	1.05	-1.82	-1.12	4.72	-0.09	-2.79	-3.02	-0.71
1.83	-0.68	4.71	0.55	-2.25	-1.83	0.20	0.14	0.25	-0.75	0.13	-1.48	-1.52	-0.86	-1.65	-0.56	4.19	0.30	-0.85	-1.14	-1.66	-0.80	2.01	-2.91	-3.62	-0.09	11.11	3.70	-3.75	-2.71
1.67	0.47	10.73	2.08	-1.21	-5.30	-0.48	-0.72	2.37	-5.03	-0.73	-3.26	-1.39	-2.73	-0.44	0.03	3.89	1.46	-0.58	-5.42	-0.23	-3.20	3.87	-3.74	-8.75	-2.79	3.70	19.83	-0.51	-3.57
0.28	-0.20	-9.67	2.22	3.39	0.57	1.36	-2.30	-1.12	2.06	1.03	-1.34	3.36	1.09	3.68	1.24	-11.52	-5.02	-0.72	0.37	2.15	-1.10	-6.11	5.14	4.64	-3.02	-3.75	-0.51	10.24	3.55
-0.19	-1.34	-11.82	-0.30	1.94	4.64	-0.82	0.18	-1.70	1.99	-1.83	1.09	2.84	2.13	2.11	3.24	-9.02	-1.52	-1.25	2.15	-0.12	0.18	-4.81	4.30	5.35	-0.71	-2.71	-3.57	3.55	6.01

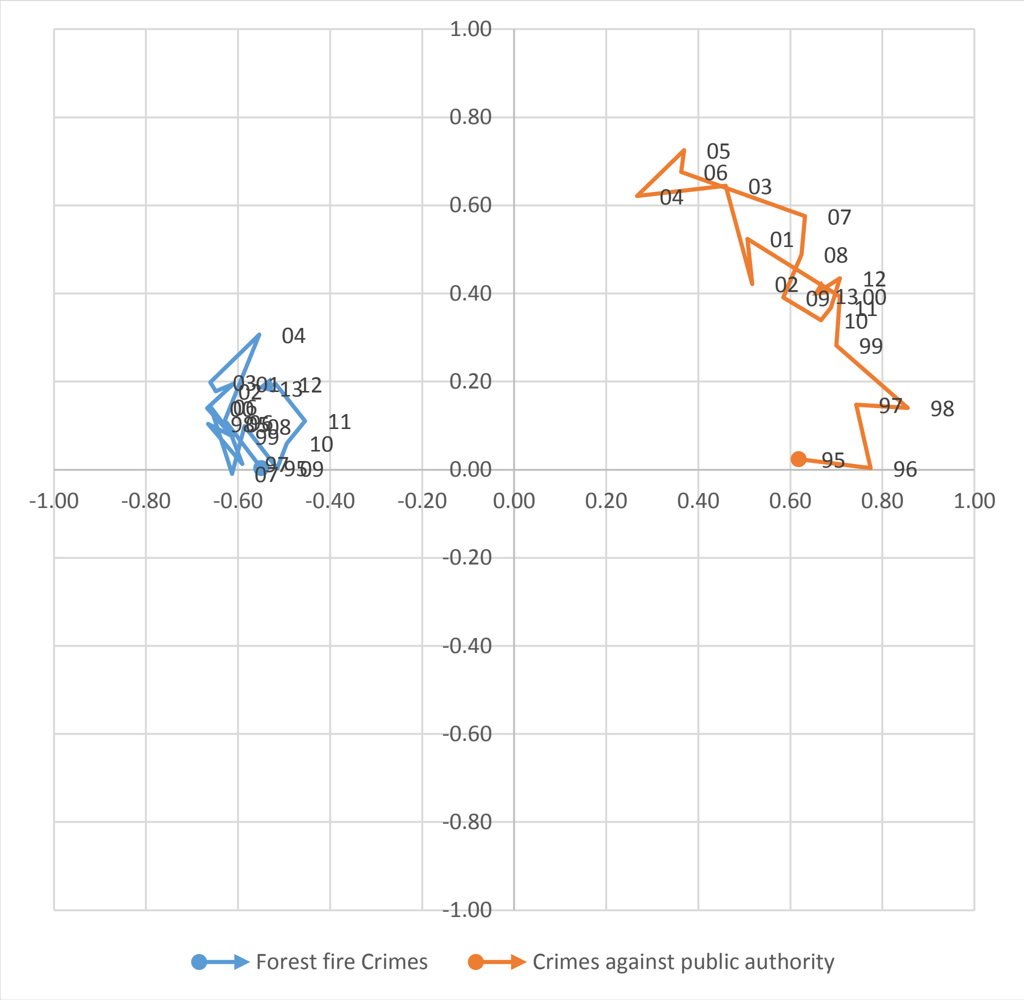
	eigenvalues	inertia (in %)
1	3.95	43.93
2	1.27	14.15
3	0.66	7.36
4	0.55	6.14
5	0.40	4.47
6	0.31	3.50
7	0.25	2.74
8	0.23	2.59
9	0.17	1.94
10	0.16	1.80
11	0.13	1.42
12	0.11	1.20
13	0.10	1.06
14	0.09	0.98
15	0.08	0.90
16	0.06	0.71
17	0.06	0.66
18	0.06	0.62
19	0.05	0.52
20	0.04	0.50
21	0.04	0.46
22	0.04	0.41
23	0.04	0.40
24	0.03	0.36
25	0.03	0.32
26	0.02	0.26
27	0.02	0.25
28	0.02	0.22
29	0.01	0.13
30	0.00	0.00

ANNEX 9 - CORRELATION BETWEEN VARIABLES AND COMPROMISE PRINCIPAL COMPONENTS – VALUES

Theft	Comp. 1	Comp. 2	Robbery	Comp. 1	Comp. 2	Fraud	Comp. 1	Comp. 2	Property damage	Comp. 1	Comp. 2	Drug trafficking	Comp. 1	Comp. 2
1995	0.95	-0.10	1995	0.79	-0.37	1995	0.91	-0.25	1995	0.41	0.47	1995	0.76	0.11
1996	0.96	-0.04	1996	0.82	-0.38	1996	0.90	-0.08	1996	0.55	0.50	1996	0.79	0.27
1997	0.94	-0.06	1997	0.81	-0.35	1997	0.85	0.14	1997	0.61	0.45	1997	0.76	0.20
1998	0.91	-0.25	1998	0.78	-0.39	1998	0.86	-0.21	1998	0.62	0.31	1998	0.79	0.11
1999	0.89	-0.21	1999	0.76	-0.45	1999	0.89	-0.14	1999	0.67	0.44	1999	0.87	0.06
2000	0.93	-0.19	2000	0.76	-0.41	2000	0.82	-0.18	2000	0.64	0.34	2000	0.88	0.01
2001	0.94	-0.18	2001	0.72	-0.48	2001	0.65	-0.16	2001	0.61	0.41	2001	0.89	-0.01
2002	0.93	-0.20	2002	0.75	-0.47	2002	0.70	-0.16	2002	0.57	0.39	2002	0.94	0.12
2003	0.92	-0.11	2003	0.77	-0.45	2003	0.80	-0.23	2003	0.47	0.60	2003	0.82	0.18
2004	0.92	-0.07	2004	0.79	-0.43	2004	0.77	-0.18	2004	0.49	0.52	2004	0.80	0.19
2005	0.90	-0.05	2005	0.81	-0.41	2005	0.81	-0.15	2005	0.43	0.65	2005	0.81	0.15
2006	0.91	-0.06	2006	0.84	-0.36	2006	0.68	-0.35	2006	0.39	0.62	2006	0.75	0.24
2007	0.90	-0.05	2007	0.85	-0.35	2007	0.83	-0.20	2007	0.39	0.57	2007	0.72	0.30
2008	0.88	-0.12	2008	0.82	-0.37	2008	0.70	-0.30	2008	0.33	0.52	2008	0.63	0.37
2009	0.84	-0.15	2009	0.86	-0.32	2009	0.69	0.07	2009	0.36	0.55	2009	0.72	0.30
2010	0.82	-0.15	2010	0.88	-0.32	2010	0.75	0.09	2010	0.22	0.59	2010	0.76	0.13
2011	0.82	-0.14	2011	0.87	-0.31	2011	0.83	0.01	2011	0.19	0.68	2011	0.76	0.15
2012	0.77	-0.11	2012	0.88	-0.33	2012	0.83	0.05	2012	0.06	0.70	2012	0.72	0.23
2013	0.80	-0.05	2013	0.86	-0.35	2013	0.85	0.01	2013	-0.01	0.69	2013	0.67	0.31

Drunk driving	Comp. 1	Comp. 2	Crimes against public authority	Comp. 1	Comp. 2	Falsific. crimes	Comp. 1	Comp. 2	Forest fire crimes	Comp. 1	Comp. 2	Defama.	Comp. 1	Comp. 2
1995	0.11	0.43	1995	0.62	0.02	1995	0.73	-0.28	1995	-0.55	0.00	1995	0.52	0.50
1996	0.19	0.43	1996	0.77	0.00	1996	0.70	-0.31	1996	-0.63	0.11	1996	0.57	0.40
1997	0.25	0.50	1997	0.74	0.15	1997	0.74	-0.32	1997	-0.59	0.01	1997	0.55	0.52
1998	0.33	0.56	1998	0.86	0.14	1998	0.71	-0.44	1998	-0.66	0.10	1998	0.57	0.40
1999	0.22	0.59	1999	0.70	0.28	1999	0.72	-0.50	1999	-0.61	0.08	1999	0.46	0.46
2000	0.32	0.65	2000	0.71	0.39	2000	0.58	-0.15	2000	-0.67	0.14	2000	0.37	0.41
2001	0.30	0.64	2001	0.51	0.52	2001	0.56	-0.37	2001	-0.61	0.20	2001	0.28	0.50
2002	0.22	0.67	2002	0.52	0.42	2002	0.62	-0.42	2002	-0.65	0.18	2002	0.21	0.47
2003	0.13	0.73	2003	0.46	0.64	2003	0.75	-0.09	2003	-0.66	0.20	2003	0.22	0.49
2004	0.11	0.70	2004	0.27	0.62	2004	0.75	-0.09	2004	-0.55	0.31	2004	0.14	0.53
2005	0.07	0.75	2005	0.37	0.73	2005	0.79	-0.15	2005	-0.63	0.10	2005	0.03	0.43
2006	0.21	0.75	2006	0.36	0.68	2006	0.72	0.04	2006	-0.66	0.14	2006	-0.08	0.48
2007	0.31	0.66	2007	0.63	0.58	2007	0.66	-0.10	2007	-0.61	-0.01	2007	-0.09	0.47
2008	0.22	0.69	2008	0.62	0.49	2008	0.78	-0.18	2008	-0.59	0.10	2008	-0.07	0.48
2009	0.18	0.55	2009	0.58	0.39	2009	0.74	-0.30	2009	-0.51	0.00	2009	-0.32	0.46
2010	0.29	0.53	2010	0.67	0.34	2010	0.81	-0.11	2010	-0.49	0.06	2010	-0.36	0.45
2011	0.11	0.56	2011	0.69	0.37	2011	0.79	-0.17	2011	-0.45	0.11	2011	-0.41	0.52
2012	0.32	0.56	2012	0.71	0.43	2012	0.85	-0.11	2012	-0.52	0.19	2012	-0.42	0.48
2013	0.41	0.50	2013	0.65	0.39	2013	0.73	0.00	2013	-0.56	0.18	2013	-0.36	0.54

ANNEX 10 - CORRELATION BETWEEN VARIABLES AND COMPROMISE PRINCIPAL COMPONENTS – TRAJECTORIES



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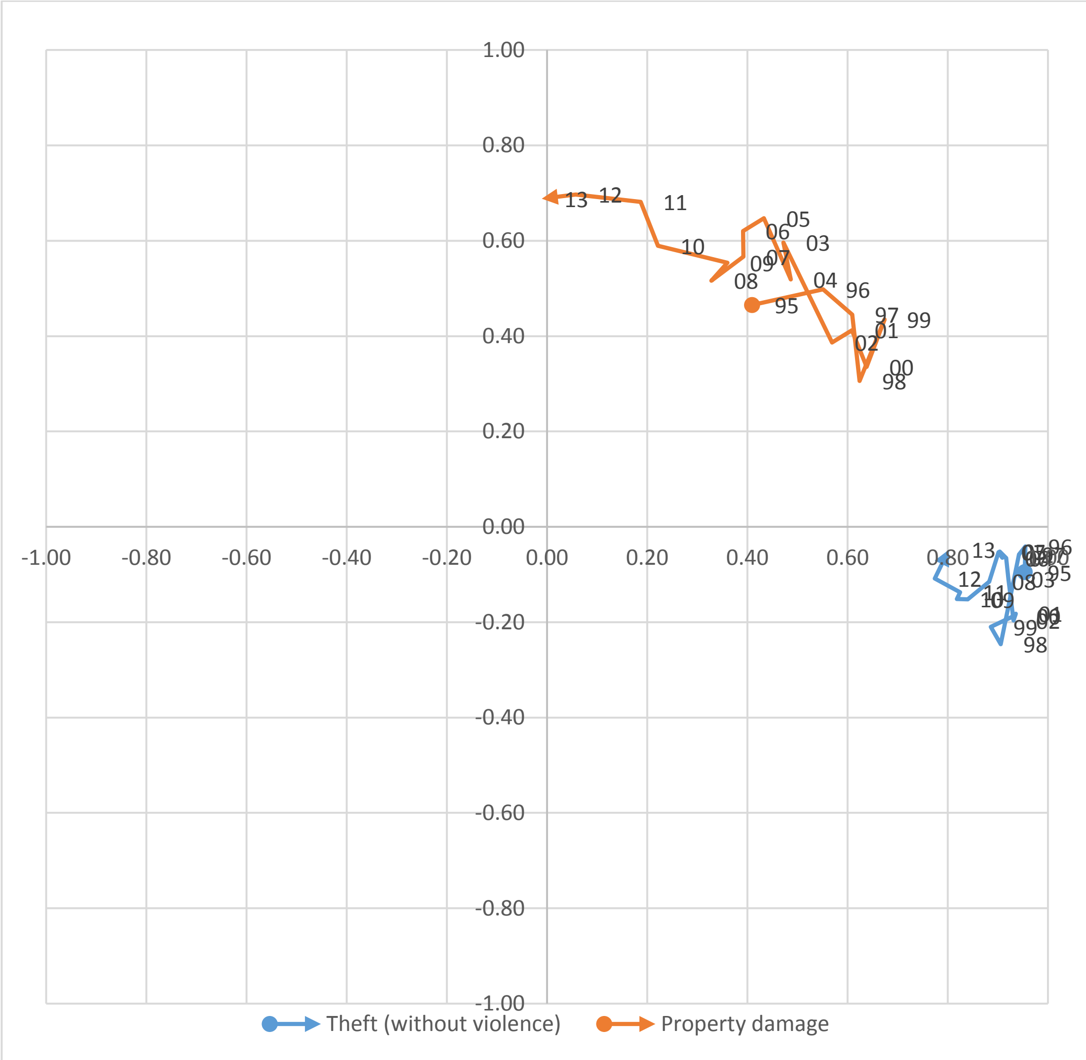
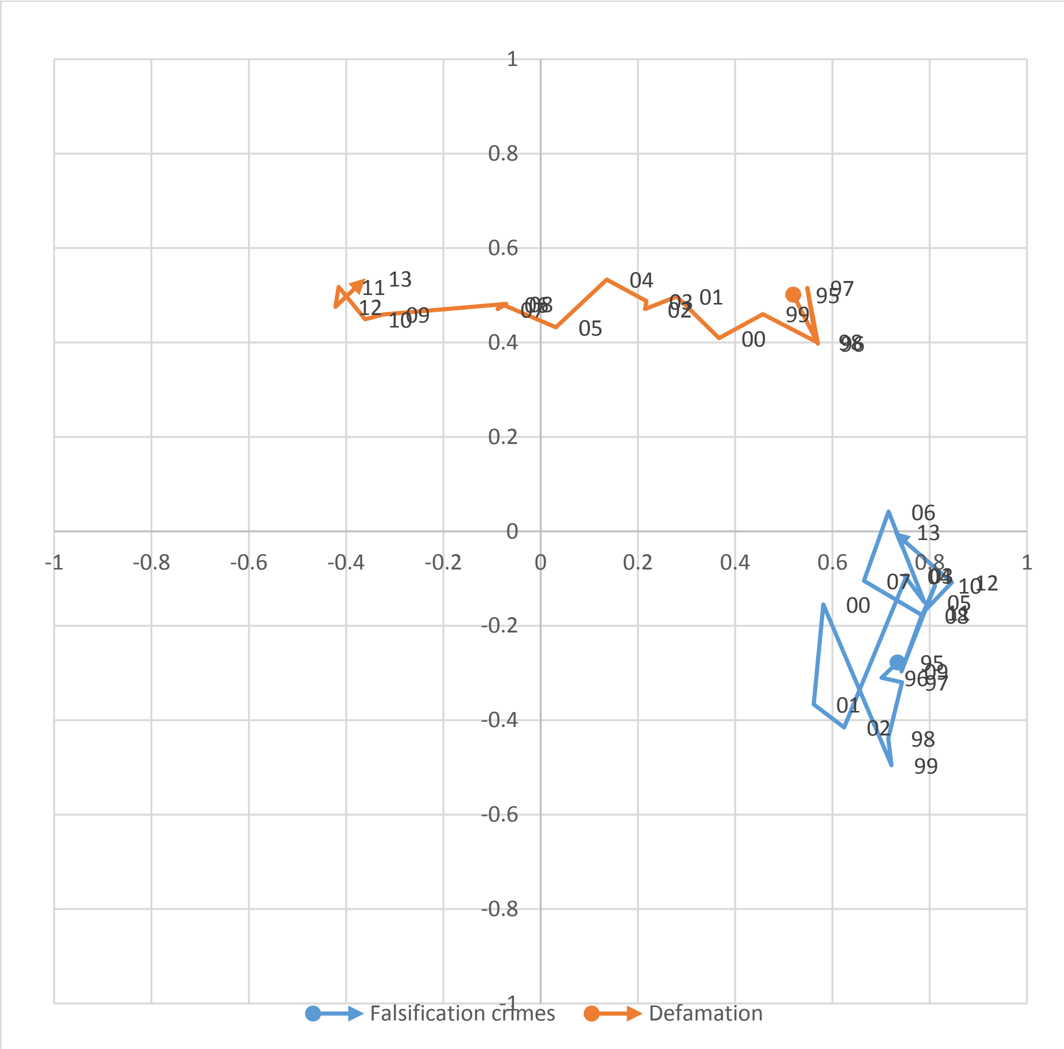
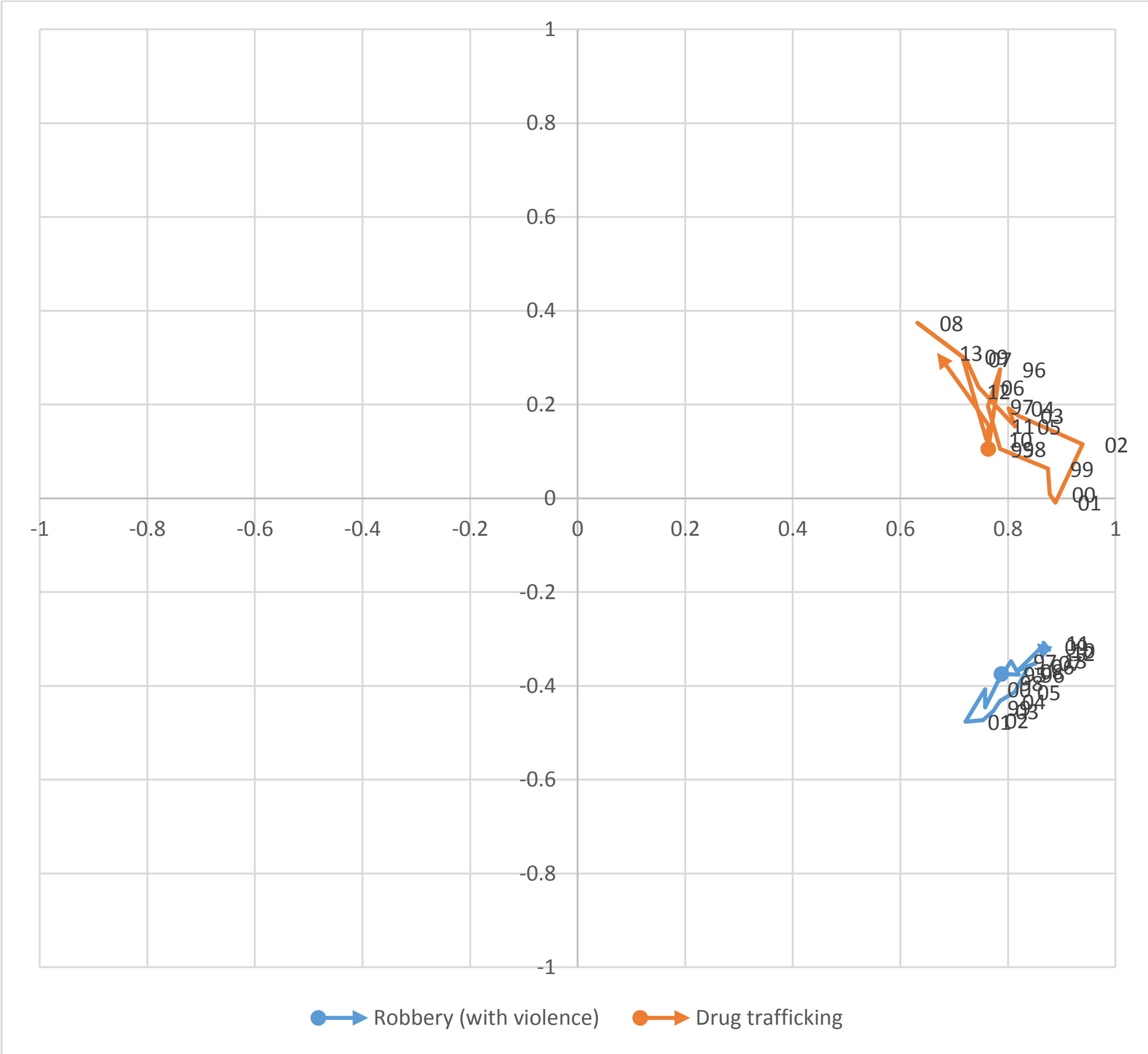
Forest fire Crimes
Crimes against public authority

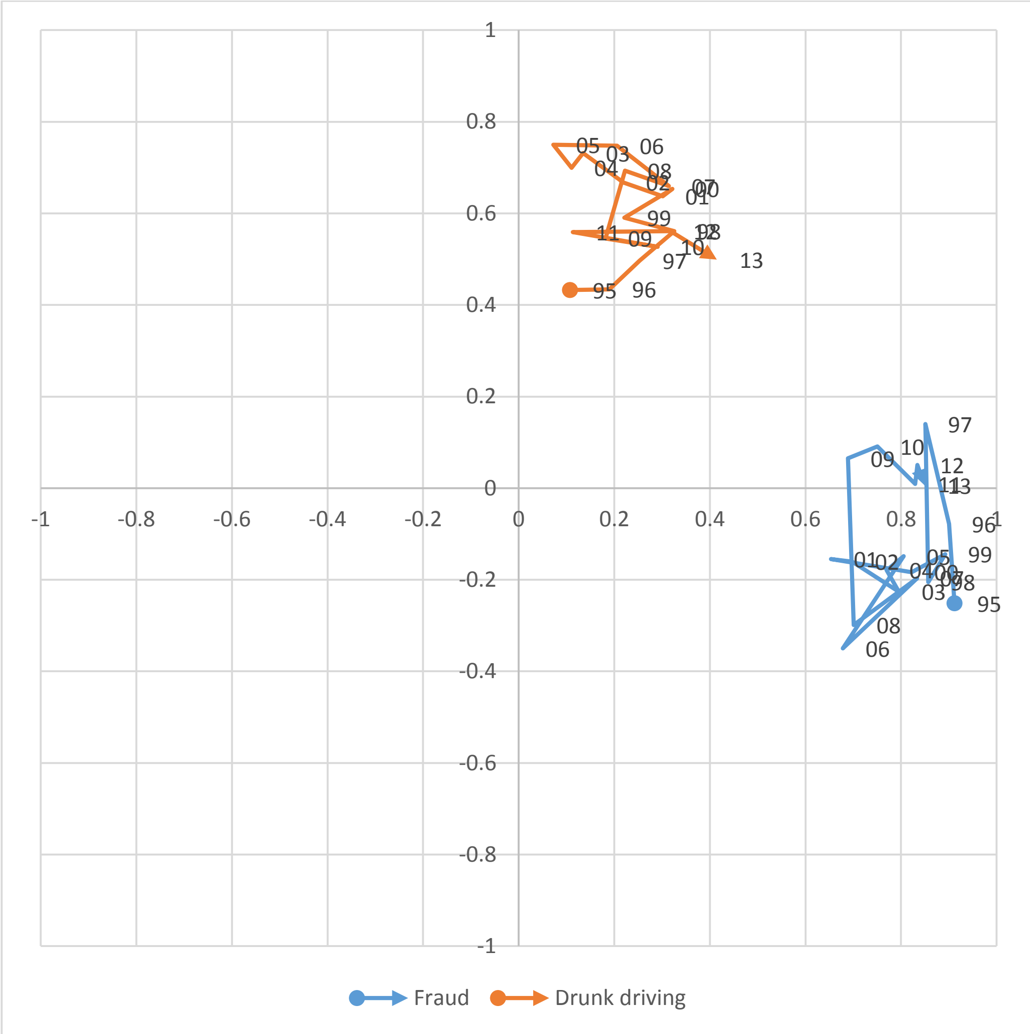


Theft (without violence)
Property damage



Falsification crimes
Defamation


Robbery (with violence)
Drug trafficking



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-0.6
-0.4
-0.2
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0.4
0.6
0.8
1
Fraud
Drunk driving

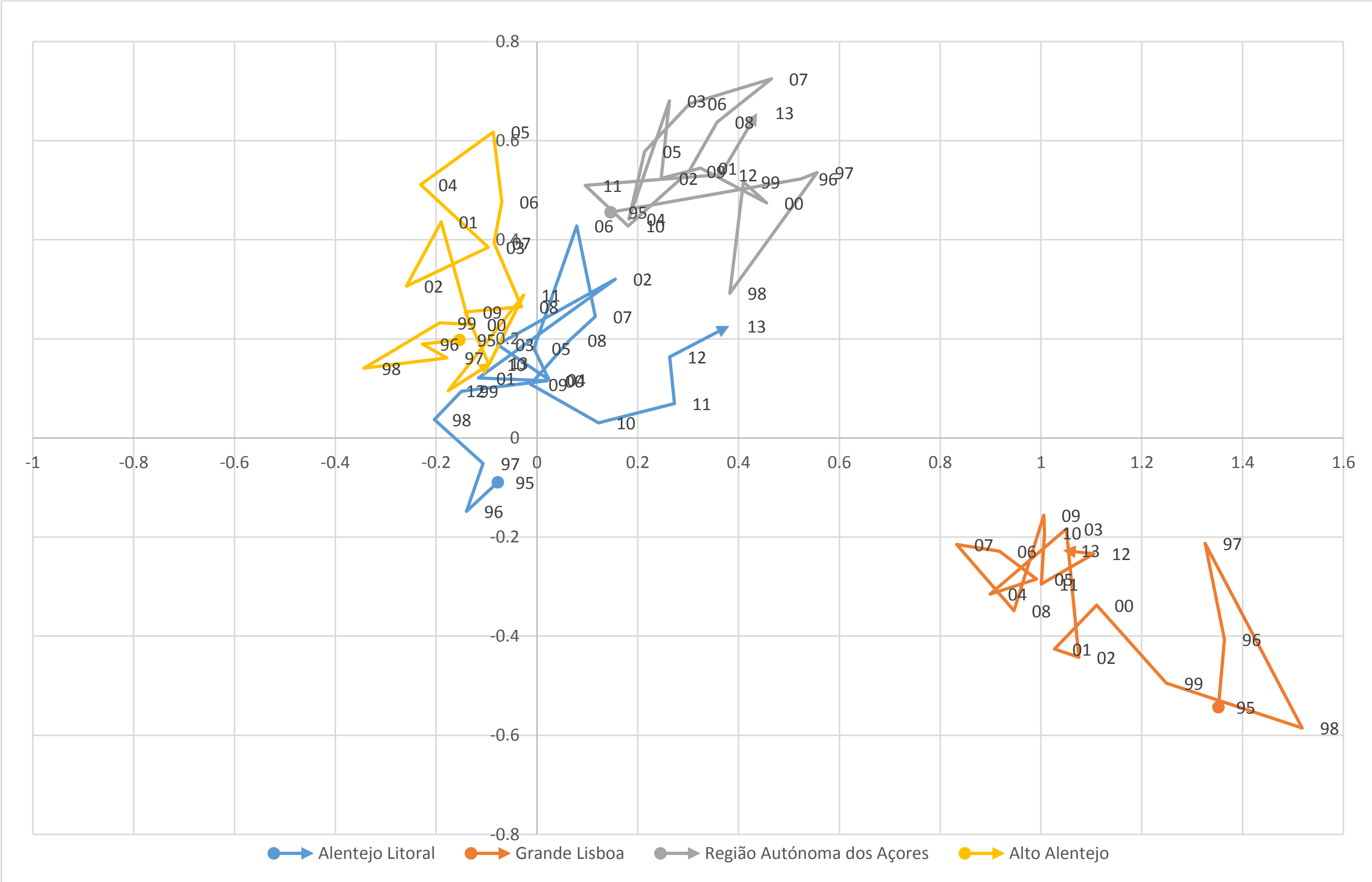
ANNEX 11 - PERCENTAGE OF INTRACLASS INERTIA FOR HIERARHICAL CLUSTERING METHODS (CLUSTERING BASED ON COMPROMISE POSITION)

No of clusters	ward	single	complete	mean
1	0	0	0	0
2	0.37	0.13	0.34	0.19
3	0.57	0.22	0.66	0.54
4	0.76	0.29	0.74	0.73
5	0.83	0.35	0.82	0.82
6	0.89	0.57	0.88	0.89
7	0.91	0.77	0.90	0.91
8	0.93	0.83	0.92	0.92
9	0.95	0.92	0.95	0.94
10	0.96	0.96	0.96	0.96
11	0.97	0.96	0.97	0.97
12	0.98	0.97	0.98	0.98
13	0.98	0.98	0.98	0.98
14	0.98	0.98	0.98	0.98
15	0.99	0.98	0.99	0.98

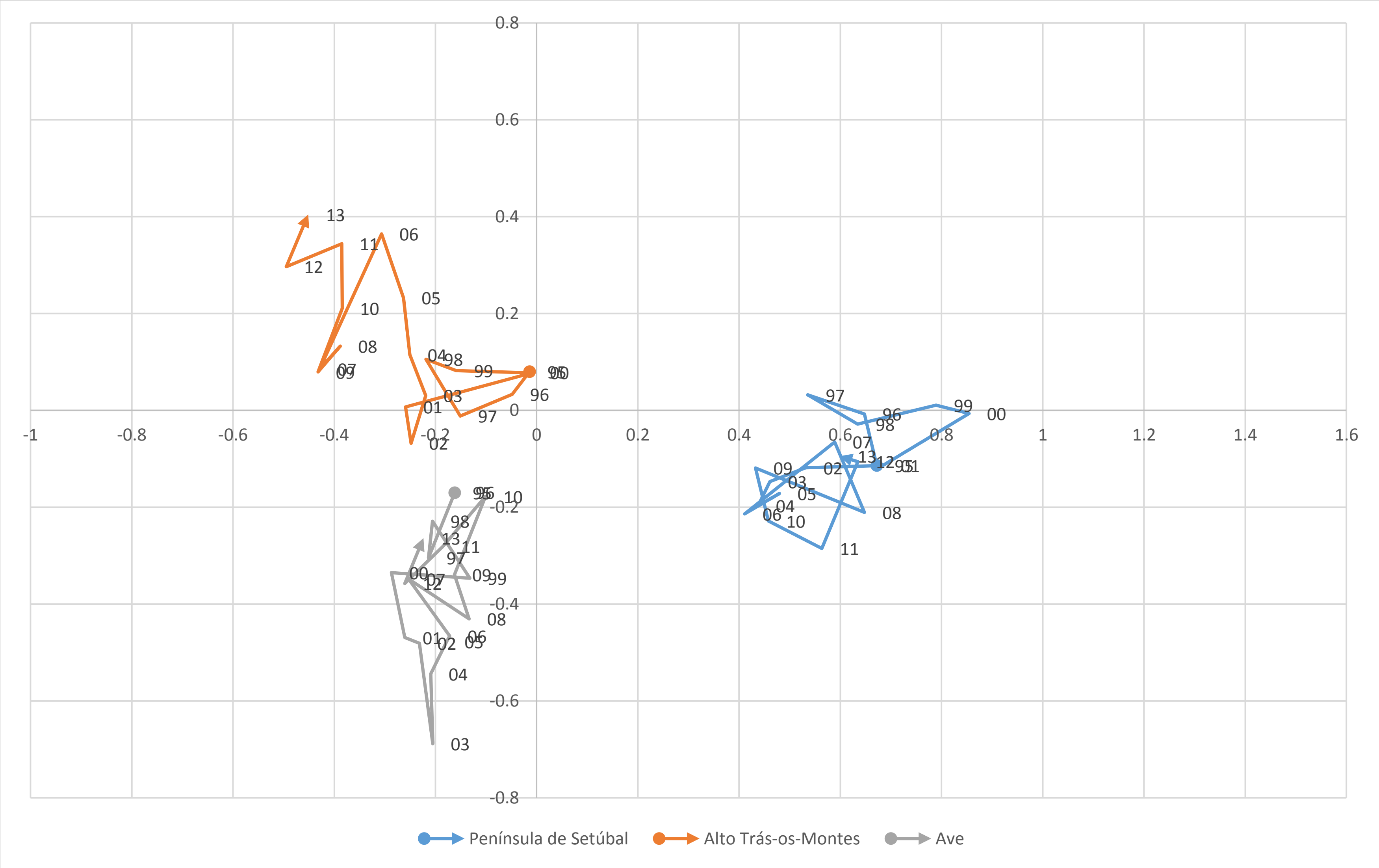
ANNEX 12 - CLASSES OF NUTS III REGIONS (CLUSTERING BASED ON COMPROMISE POSITION)

Region	Class	Region	Class
Alentejo Litoral	1	Dão-Lafões	4
Baixo Vouga	1	Entre Douro e Vouga	4
Lezíria do Tejo	1	Médio Tejo	4
Região Autónoma da Madeira	1	Baixo Mondego	5
Alentejo Central	2	Cávado	5
Alto Alentejo	2	Oeste	5
Baixo Alentejo	2	Pinhal Litoral	5
Beira Interior Sul	2	Pinhal Interior Norte	6
Minho-Lima	2	Pinhal Interior Sul	6
Alto Trás-os-Montes	3	Tâmega	6
Beira Interior Norte	3	Grande Porto	7
Cova da Beira	3	Algarve	8
Douro	3	Grande Lisboa	9
Serra da Estrela	3	Península de Setúbal	10
Ave	4	Região Autónoma dos Açores	11

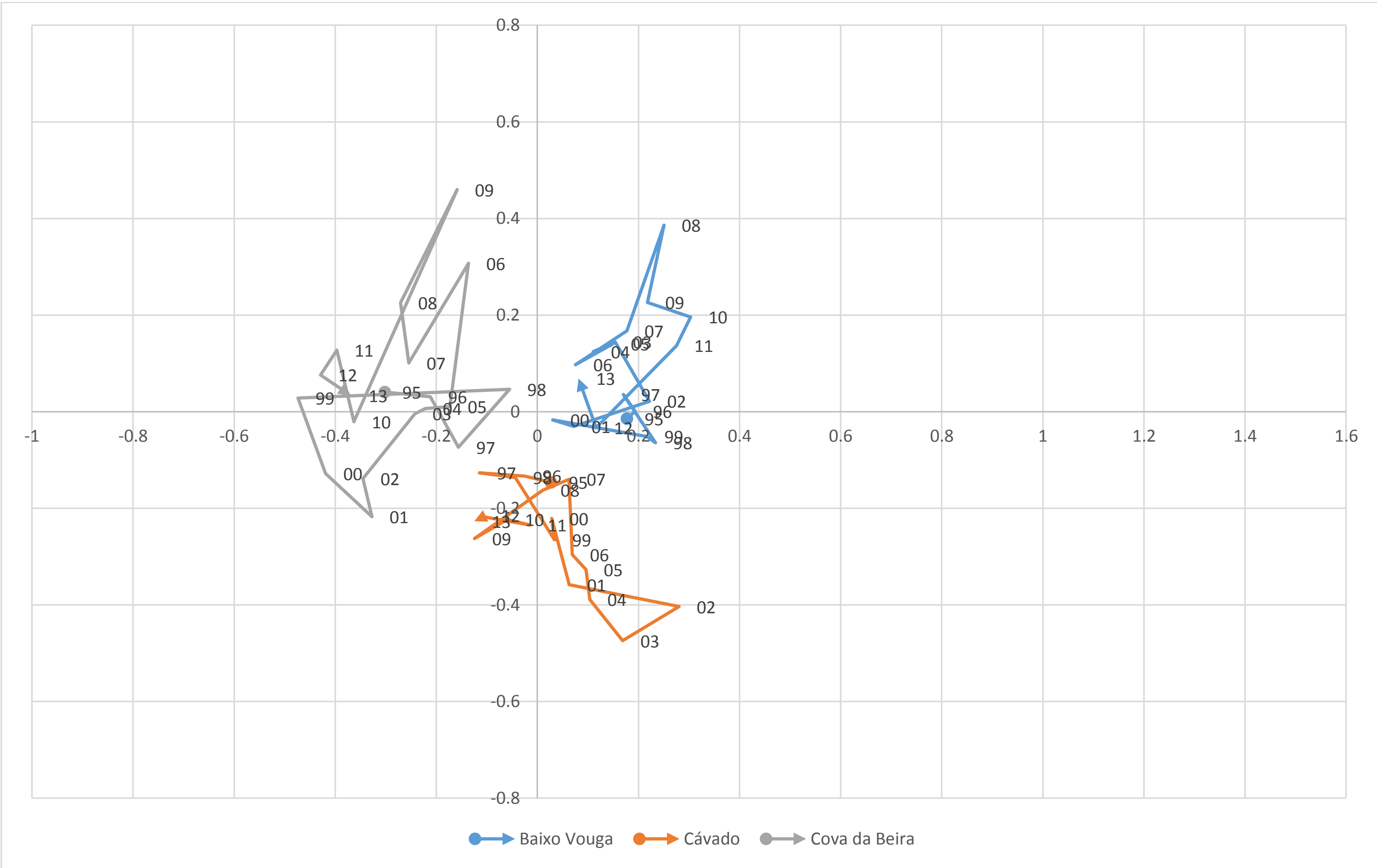
ANNEX 13 - TRAJECTORIES OF NUTS III REGIONS

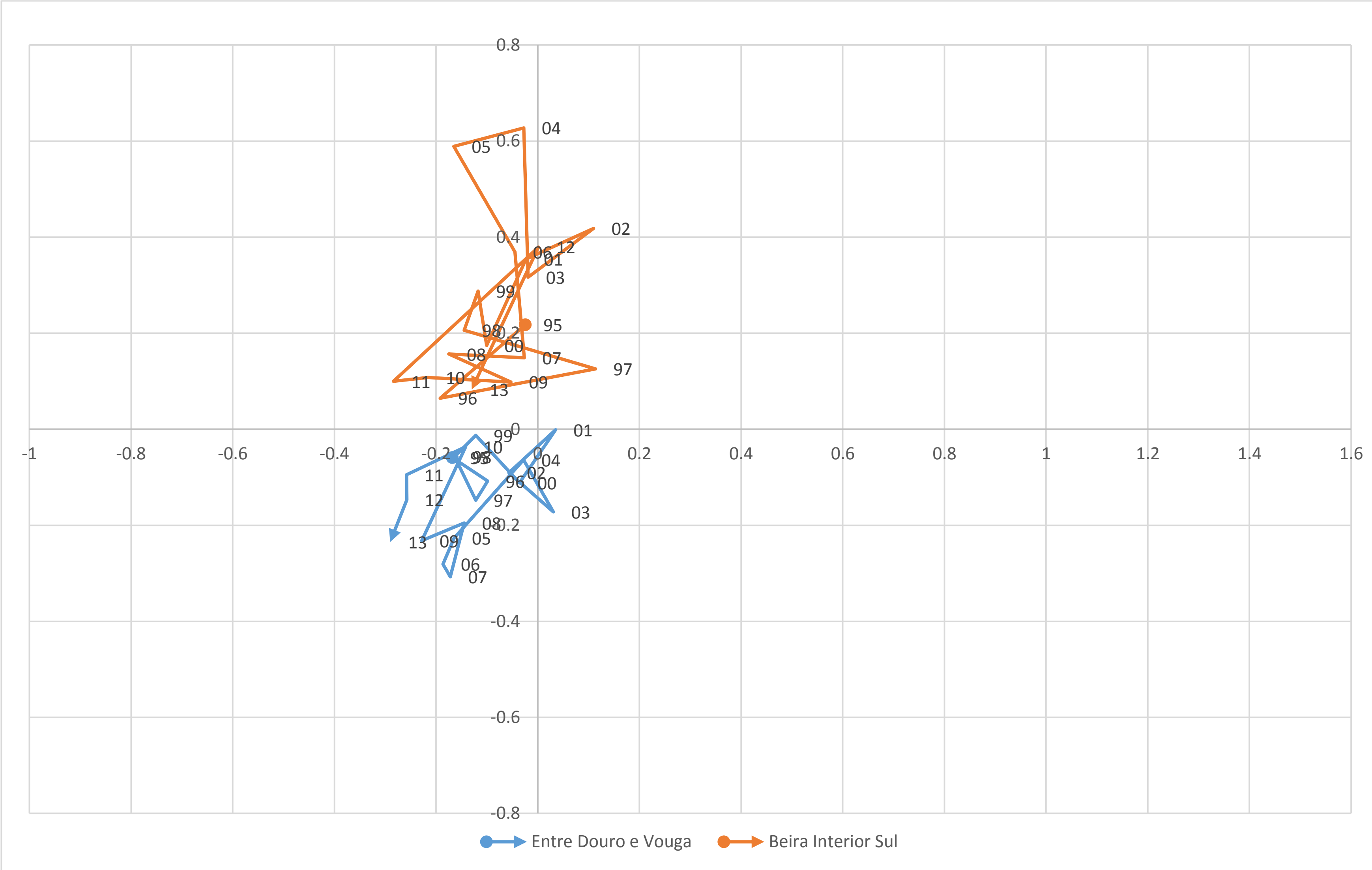


Alentejo Litoral
Grande Lisboa
Região Autónoma dos Açores
Alto Alentejo



Península de Setúbal
Alto Trás-os-Montes
Ave


Baixo Vouga
Cávado
Cova da Beira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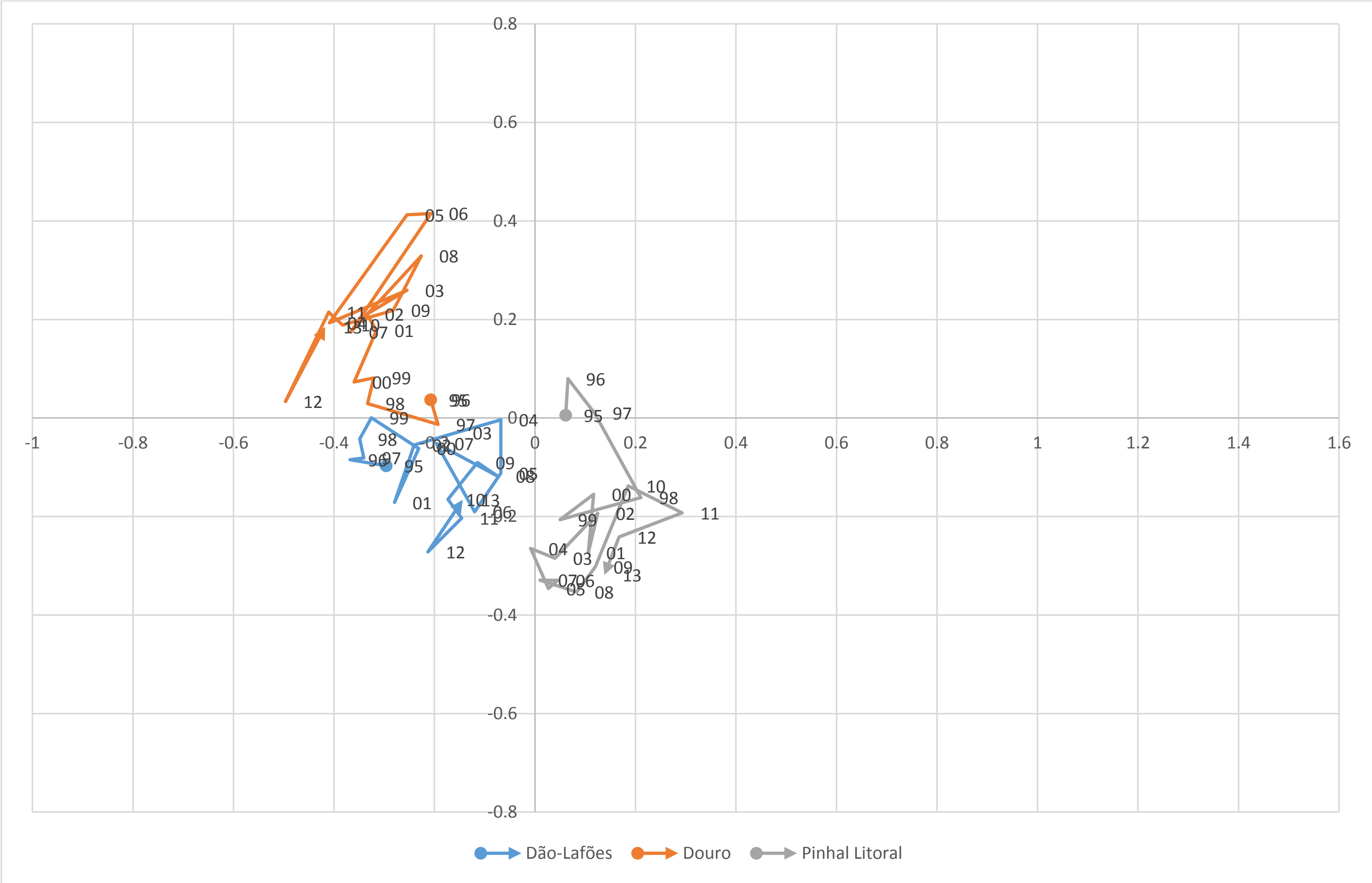
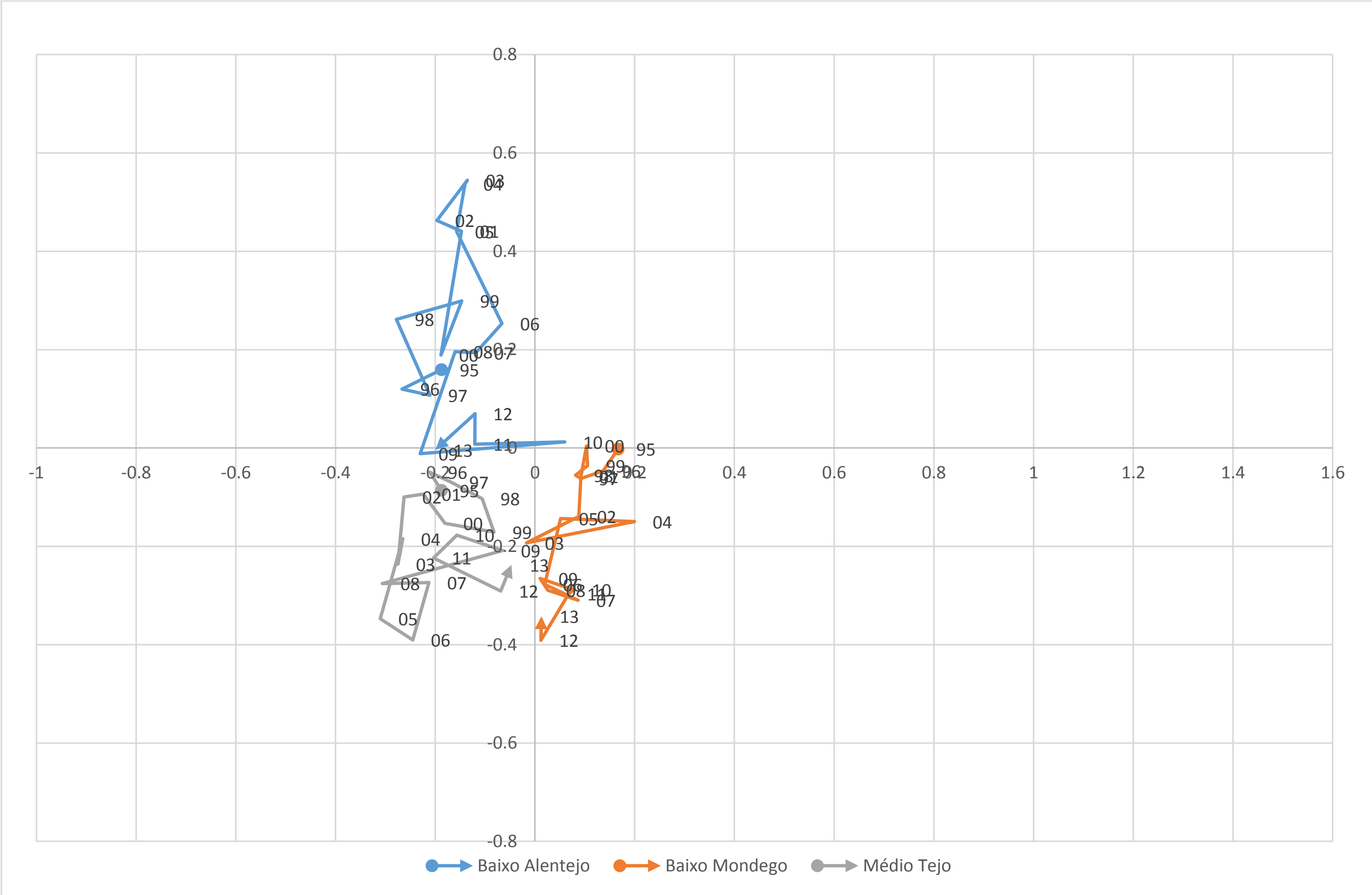
1.6
Entre Douro e Vouga
Beira Interior Sul



Dão-Lafões
Douro
Pinhal Litoral

Alentejo Central
Algarve
Beira Interior Norte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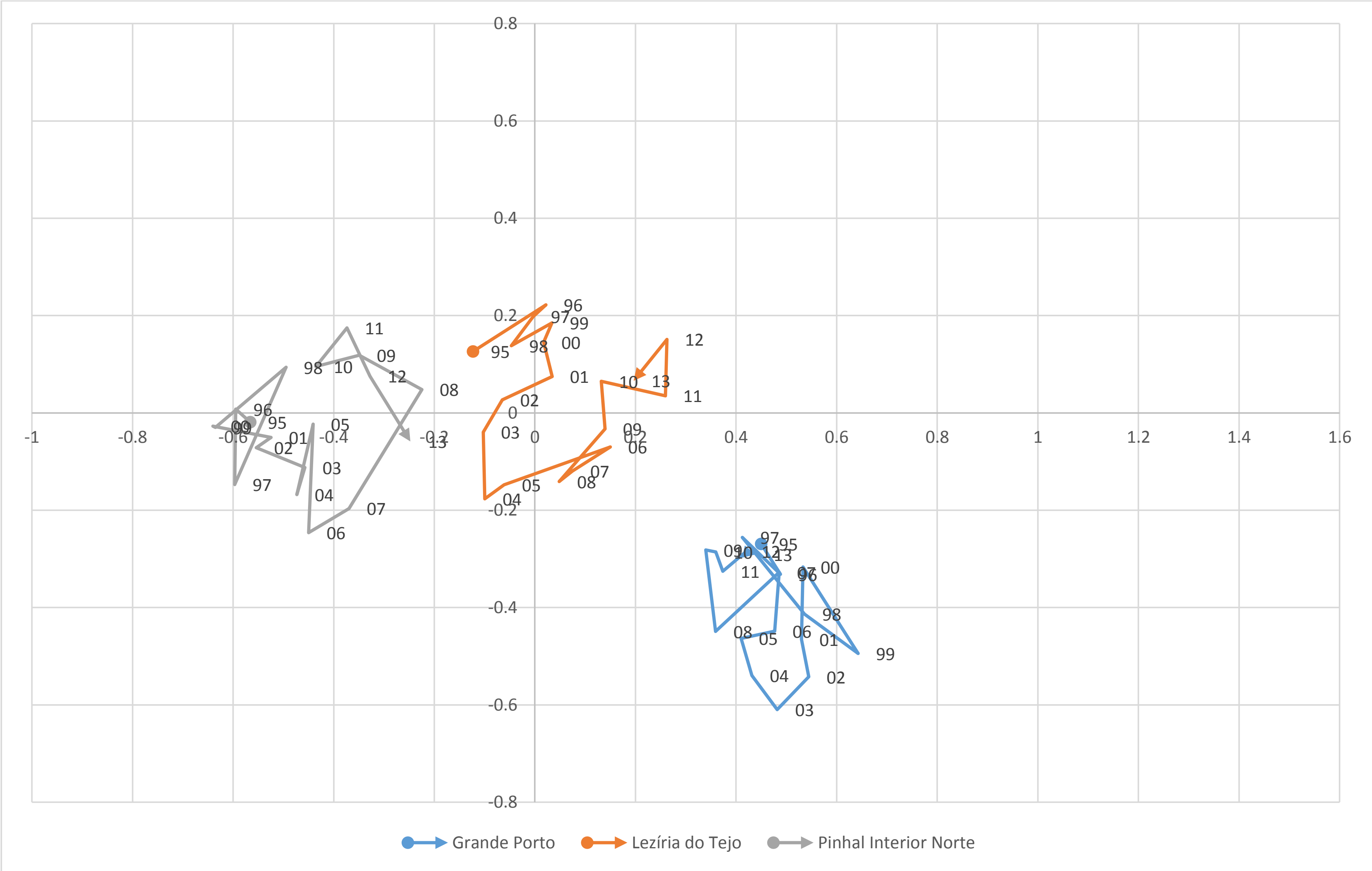
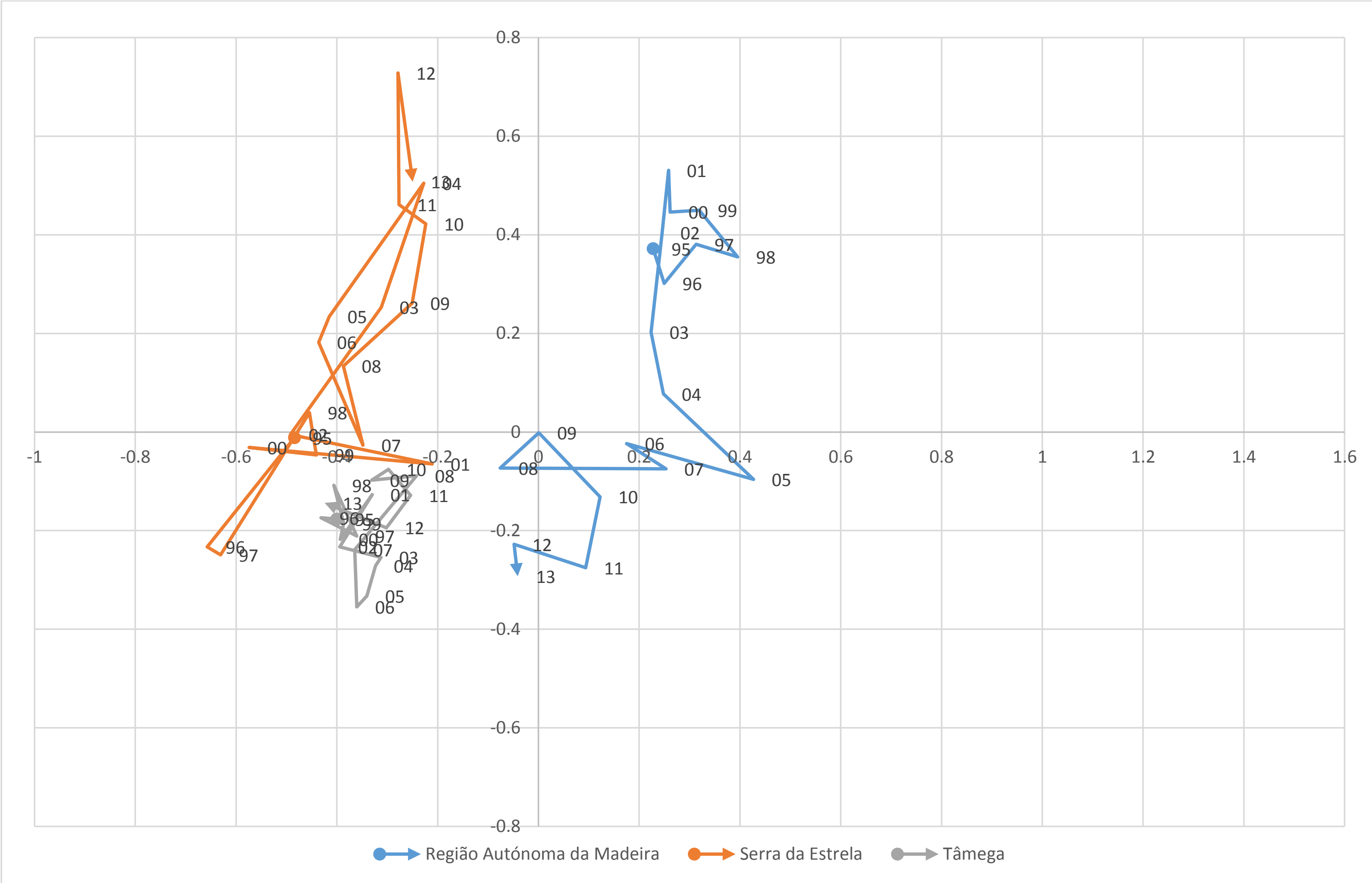
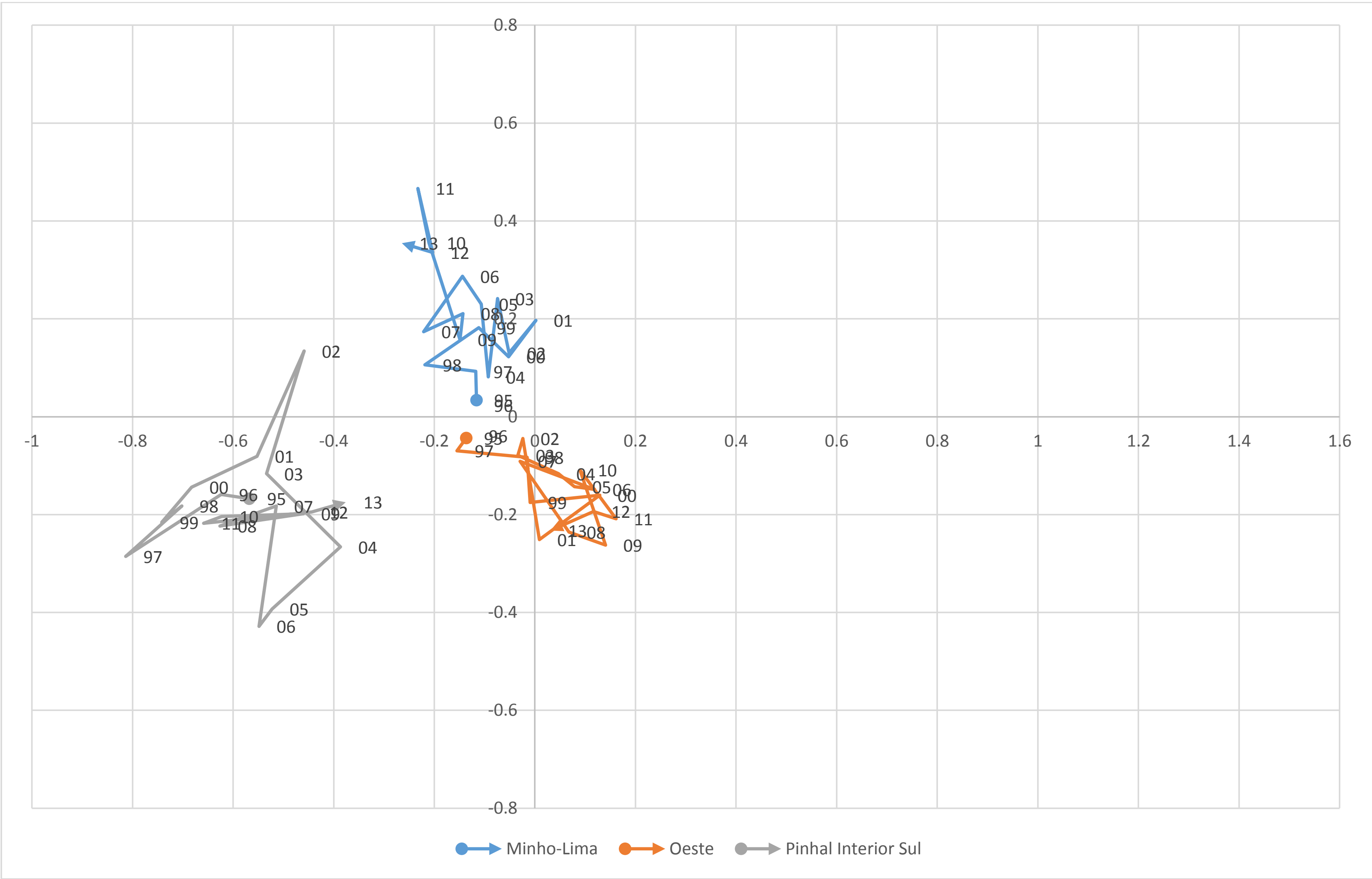
1.6
Baixo Alentejo
Baixo Mondego
Médio Tejo


Grande Porto
Lezíria do Tejo
Pinhal Interior Norte



Região Autónoma da Madeira
Serra da Estrela
Tâmega


Minho-Lima
Oeste
Pinhal Interior Sul

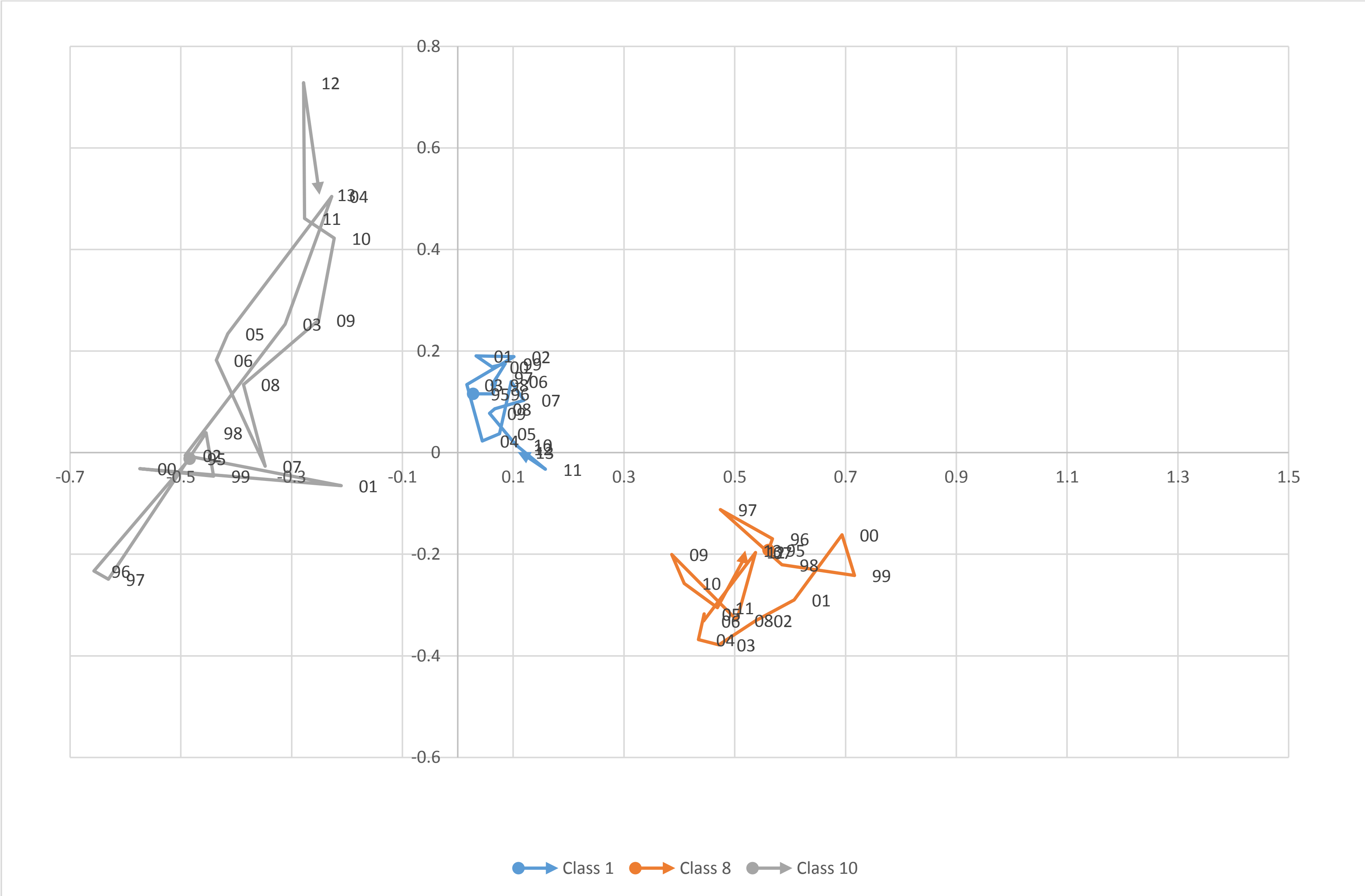
ANNEX 14 - PERCENTAGE OF INTRACLASS INERTIA FOR HIERARHICAL CLUSTERING METHODS (CLUSTERING BASED ON TRAJECTORIES)

No of clusters	ward	single	complete	mean
1	0	0	0	0
2	0.293735	0.293735	0.293735	0.293735
3	0.385536	0.322205	0.386396	0.354542
4	0.472822	0.375792	0.451841	0.407044
5	0.528802	0.435514	0.509367	0.456177
6	0.578228	0.484646	0.554921	0.537369
7	0.617605	0.527233	0.595757	0.579545
8	0.654233	0.559466	0.630087	0.608015
9	0.690121	0.599003	0.665087	0.657622
10	0.724367	0.620753	0.693557	0.689727
11	0.752837	0.643945	0.742299	0.713482
12	0.780631	0.726777	0.777342	0.731436
13	0.807591	0.775863	0.807591	0.783553
14	0.827516	0.785788	0.827516	0.818996
15	0.84547	0.815841	0.84547	0.836931

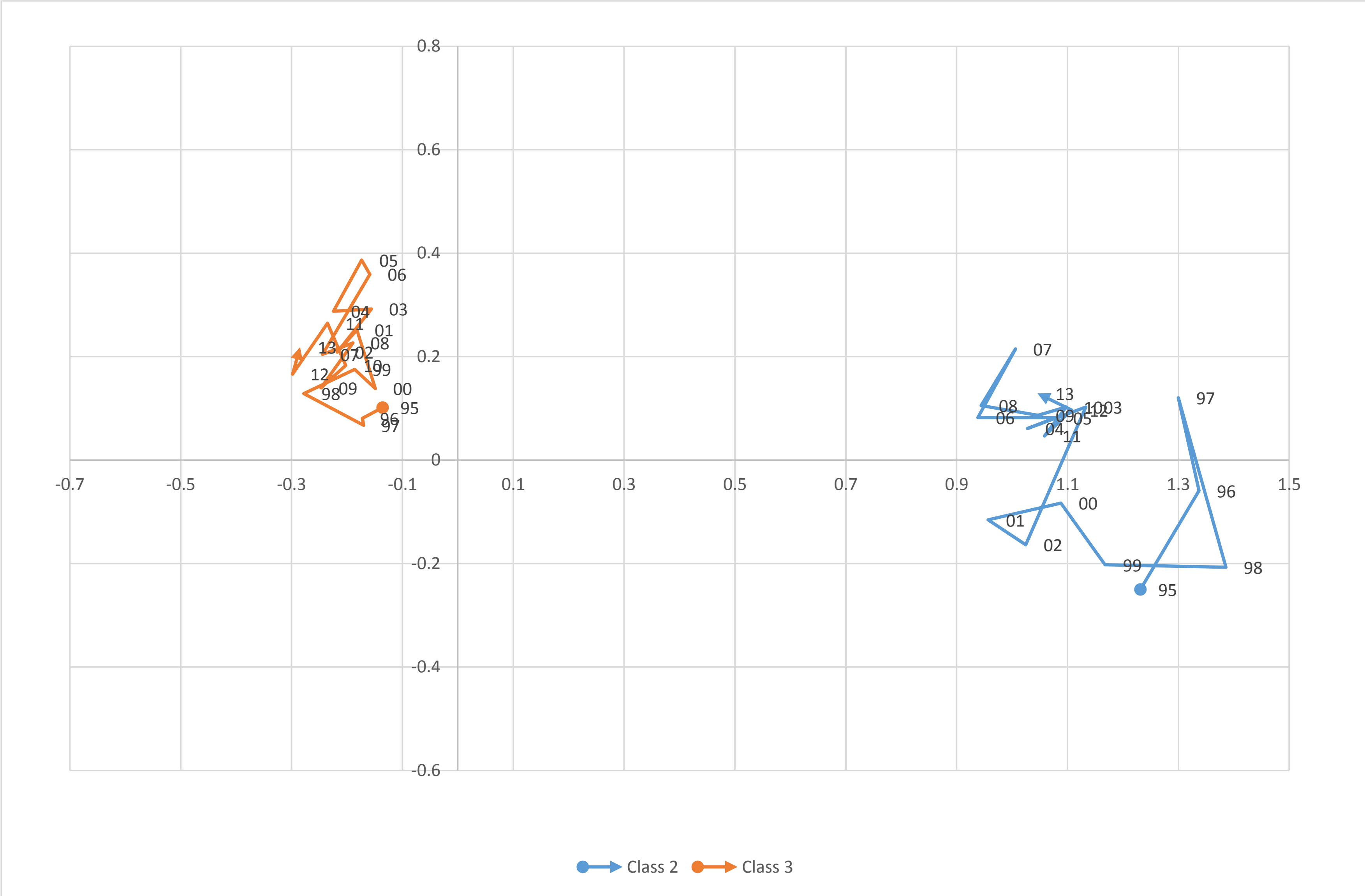
ANNEX 15 - CLASSES OF NUTS III REGIONS (CLUSTERING BASED ON TRAJECTORIES)

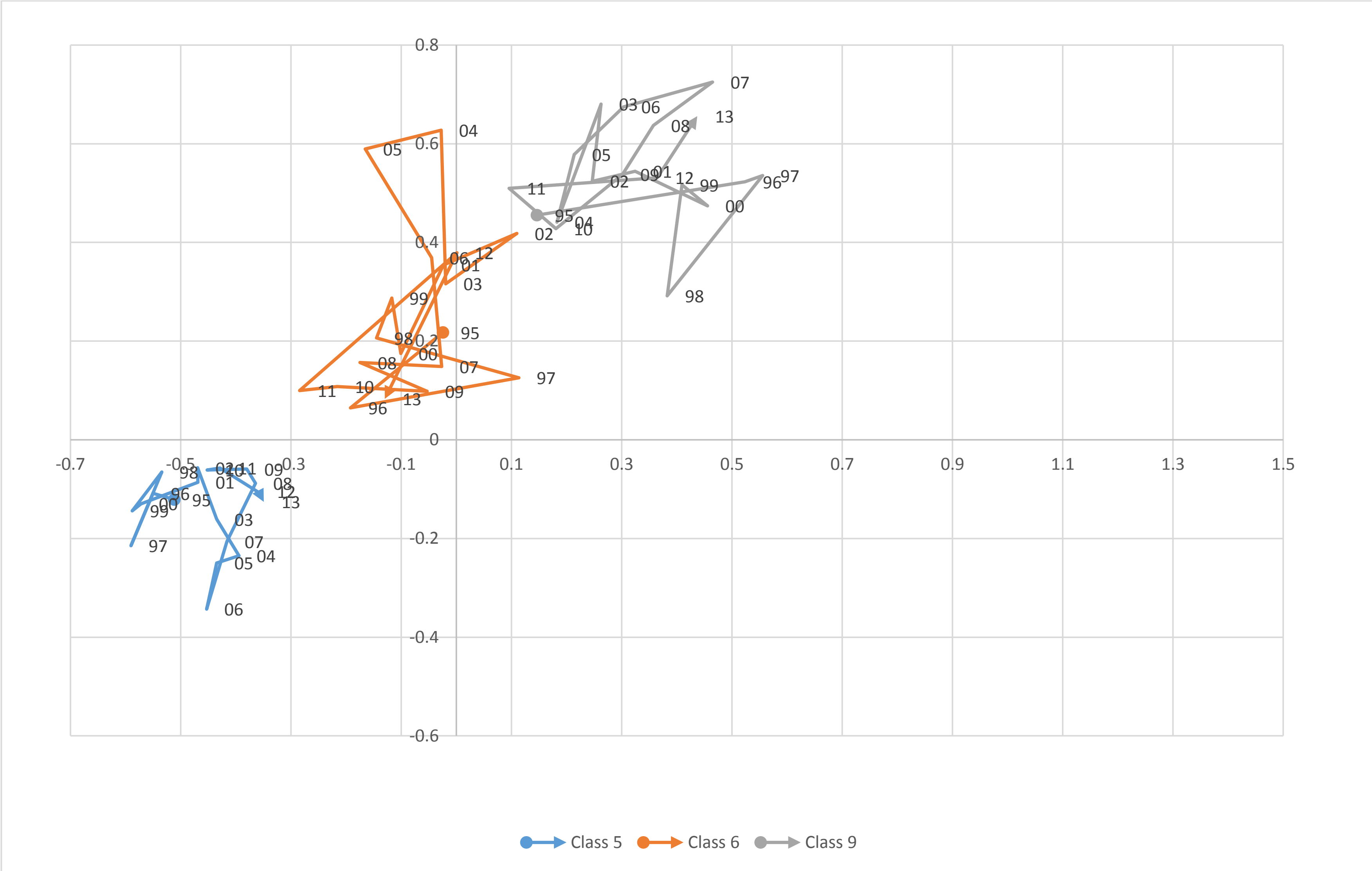
Region	Class	Region	Class
Alentejo Central	1	Cávado	4
Alentejo Litoral	1	Dão-Lafões	4
Baixo Vouga	1	Entre Douro e Vouga	4
Lezíria do Tejo	1	Médio Tejo	4
Região Autónoma da Madeira	1	Oeste	4
Algarve	2	Pinhal Litoral	4
Grande Lisboa	2	Pinhal Interior Norte	5
Alto Alentejo	3	Pinhal Interior Sul	5
Alto Trás-os-Montes	3	Tâmega	5
Baixo Alentejo	3	Beira Interior Sul	6
Douro	3	Cova da Beira	7
Minho-Lima	3	Grande Porto	8
Ave	4	Península de Setúbal	8
Baixo Mondego	4	Região Autónoma dos Açores	9
Beira Interior Norte	4	Serra da Estrela	10

ANNEX 16 - AVERAGE TRAJECTORIES FOR CLASSES

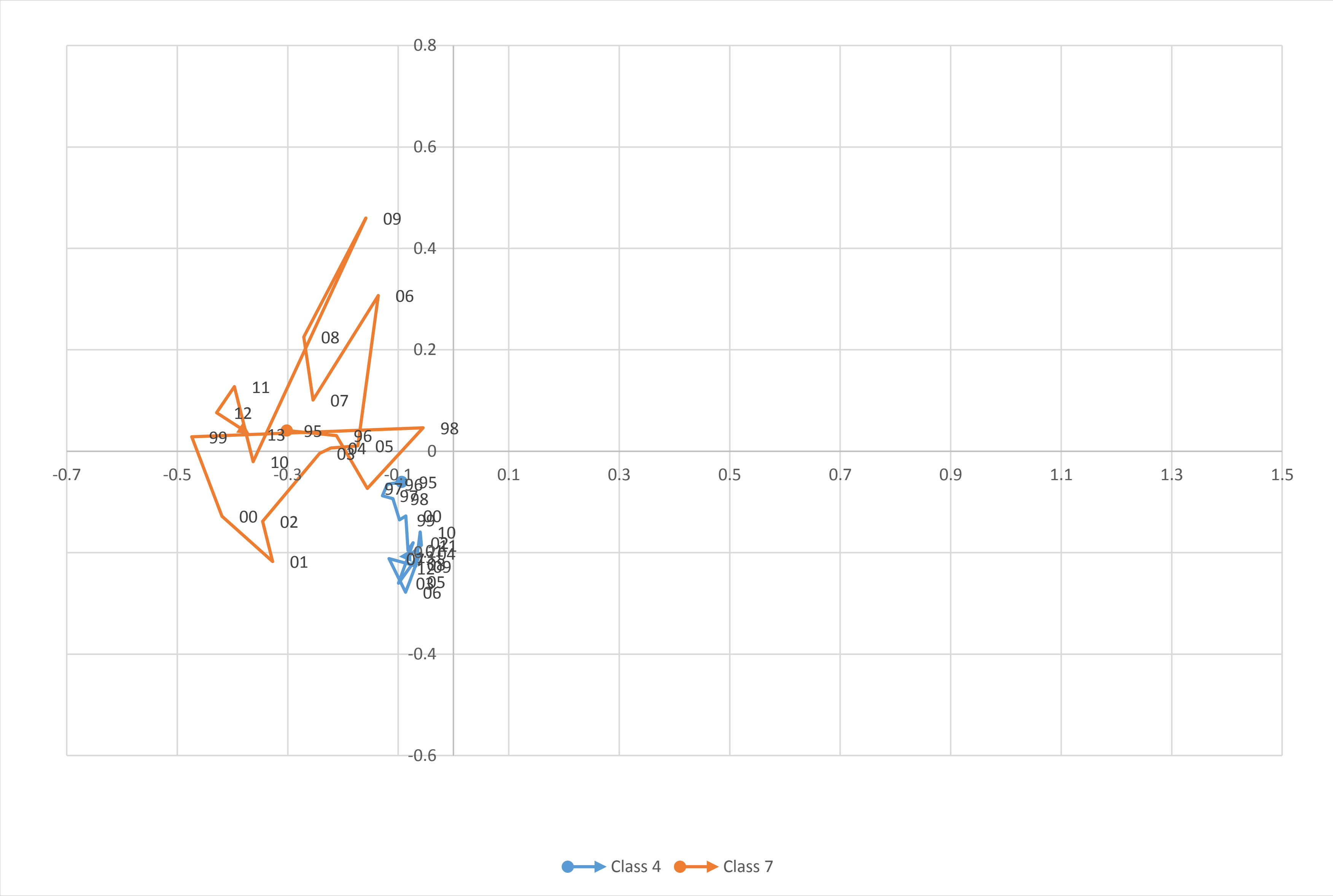


Class 1
Class 8
Class 10


0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.7
-0.5
-0.3
-0.1
0.1
0.3
0.5
0.7
0.9
1.1
1.3
1.5
Class 2
Class 3



Class 5
Class 6
Class 9



0.8
0.6
0.4
0.2
0
-0.4
-0.6
-0.7
-0.5
-0.3
-0.1
0.1
0.3
0.5
0.7
0.9
1.1
1.3
1.5
Class 4
Class 7