AICEI PROCEEDINGS

How Similar Are the CEE and SEE Countries in Terms of the Efficiency of Financial Institutions?

Suela Kristo, Raimonda Duka, Eri Gjoka

Abstract

This study sets out to discover similarities regarding the efficiency of financial institutions within the CEE countries. Similarities are also required within SEE countries that are not EU members to understand better their financial development. We apply cluster analysis techniques for the period 2003-2010 in order to see the trend of homogeneity of these countries. The results show that Bulgaria, the Czech Republic and Slovakia are more integrated countries, while Hungary and Poland have fewer similarities by comparison with the other countries. Croatia, Macedonia, Bosnia and Herzegovina have greater similarities with the other CEE countries that are EU member states than with Serbia, Albania and Montenegro, which are usually classified in a separate group. Therefore, because of their position we included Greece in the cluster analysis of the SEE countries that are not members of the EU. This inclusion clarified the position of Albania, which seemed to have many more similarities with this country. Furthermore, it seems even more obvious that Macedonia and Bosnia and Herzegovina are included in the same group, while Serbia is again at some distance from the other countries. Such differences appear to be maintained during the period under consideration, leaving scope for further integration.

Keywords: Financial institutions, efficiency, CEE & SEE countries, cluster analysis

AICEI Proceedings, 2013, Volume 8, Issue 1
DOI: 10.5281/zenodo.4543778

1. Introduction

The globalisation trend on the one hand increases the financial linkages, increasing in this way the contagion effects. On the other hand, the financial systems face competitive pressure. These issues become even more sensitive for post-communist European countries as their economies have created relatively new financial systems, which are currently relatively inexperienced since becoming part of the EU. Therefore, their very survival requires them, amongst other factors, to be as efficient as possible. In such conditions, financial institutions, managers, regulators, investors as well as governments are concerned about how efficiently these institutions can perform their functions. Therefore, in this chapter, we want to answer the following three basic questions: 1) In terms of the efficiency of financial institutions how close are the CEE or SEE countries to each other; 2) how have these similarities changed during the years of the period under consideration; 3) Whether or not the CEE countries which are EU members are closer to each other than those outside EU?

We apply cluster analysis techniques to examine the degree of financial integration of these countries, focusing in particular on the financial institutions. Cluster analysis aims to find similarities between the two countries and cluster them into groups. This analysis can not impose restrictions on relationships between countries and can not find the factors that have contributed to these relationships. Such an analysis is very important as a first step toward any deeper analysis that tries to explain the relationship between financial institutions and factors affecting on these relationships.

In our analysis, we will particularly focus on the efficiency of financial institutions, although this has not fully captured all the features of financial institutions or financial systems. The paper uses this characteristic as a basis for describing, comparing, and analyzing financial institutions between CEE and SEE countries, and their evolution over time in the period 2003-2010. At first 16 CEE countries were selected to observe similarities between their financial institutions. We also tried to capture perhaps more similarities between those who are members of the EU and those outside it. The results showed differences between the EU member countries. On the one hand, we have more

integrated countries such as Bulgaria, the Czech Republic and Slovakia, and on the other hand less integrated countries such as Hungary and Poland. With regard to the countries outside the EU, some of them (Croatia and Macedonia) are closer to other countries that have been integrated into the EU. While some other countries, such as Serbia, Albania and Montenegro are far away from all other countries. Later we continue with cluster analysis of the SEE countries that are not members of the EU except Greece. We included Greece in order to look for any similarities with Serbia or Albania, because they are often in a cluster of their own and for most of the sample period, each of them is the most distant cluster. Results showed that Albania and Greece are always in the same group, strengthening the relationship between the financial institutions of these countries, however Serbia seems to stand again far away from all other countries except Montenegro, so that sometimes they are grouped together. Macedonia and Bosnia and Herzegovina were always grouped on the same cluster throughout the sample.

The paper continues with section 2, which provides a review of the literature on the financial linkages, particularly with reference to the efficiency dimension. Section 3 describes the general methodologies for cluster analysis. Section 4 explains the data and theoretical foundation for the choice of variables. Section 5 presents the results, while section 6 concludes and outlines areas for further research.

2. Literature Review

The importance of financial institutions in the development of any economy is widely known. Financial institutions play a significant role in economic development because they determine which firms should use a society's scarce saving (Schumpeter, 1912). Levine (2005) points out that financial institutions and financial markets exert a powerful influence on economic development, the alleviation of poverty, and economic stability. Furthermore, Aghion et al. (2005), in their cross-country comparisons have shown that the development of the financial sector has a stronger impact on growth in low and middle economies than those in high income countries.

The growing financial linkages in the globalisation trend make the financial system architecture more difficult to plan. Contagious

effects that are transmitted through financial linkages could also result in heightened cross-country spillovers of macroeconomic fluctuations (Claessens and Forbes, 2001). The potential harmful consequences of cross-border interconnectedness for the stability of the domestic banking sector have been illustrated rather dramatically during the recent global financial crisis, when shocks to one country's financial system were rapidly transmitted to many others (Čihák et al. 2011). Čihák et al. (2011) using model simulations and econometric estimates based on a world-wide dataset, which found an M-shaped relationship between the financial stability of a country's banking sector and its interconnectedness. According to them, it may be beneficial for policies to support greater interlinkages for less connected banking systems, but after a certain point the advantages of increased interconnectedness become less clear.

Many studies have supported the relationship between low efficiency and the failure of a financial institution. Banks and S&Ls with low efficiency failed at greater rates than institutions with higher efficiency levels (Berger and Humphrey, 1992a; Cebenoyan, et al. 1993). Management quality, as measured by regulatory agency assessments, is positively related to cost efficiency (DeYoung, 1997c) which, in turn, causes reductions in problem loans (past due and nonaccrual, Berger and DeYoung, 1996). As a result, efficiency measures have been shown to improve the predictive accuracy of failure prediction models and thus may represent a useful addition to current modelling efforts by regulatory agencies Berger (1997).

Although the evidence on the role of the financial system in shaping economic development is diversified, researchers do not have good cross-country, cross-time measures of the degree to which financial systems enhance the efficiency of resource allocation. Through our literature survey, we found that Sorensen et al. (2006) explain that, in the period 1998-2004, the banking sectors in the euro area countries seem to have become more homogeneous, although the results are unequivocal and considerable differences remain. Karreman (2009) examines the contemporary financial geographies of Central and Eastern Europe and argues how these may affect the established European financial centre network in the future. The results show a distinct spatial order of financial centres organised around three main city clusters: a 'south-east' cluster controlled by Athens, a 'central-east'

cluster controlled by Vienna and a 'Baltics' cluster controlled by both Copenhagen and Stockholm. Beck et al. (2008) use information from different databases to benchmark countries' financial systems over time. Beck et al. (2010) introduce the updated and expanded version of the Financial Development and Structure Database and presents recent trends in the structure and development of financial institutions and markets across countries. They found a general deepening of financial markets and institutions over time, which is more pronounced in the high-income countries and more pronounced for markets than for banks. Čihák et al. (2012) use the Global Financial Development Database, an extensive dataset of financial system characteristics for 205 economies from 1960 to 2010. The authors document cross-country differences and time series trends.

Otherwise, researchers have largely—though not exclusively—relied on measures of the size of the banking industry as a proxy. However, size is not a measure of quality, nor of efficiency, nor of stability. Moreover, the banking sector is only one component of financial systems. Berger (1997) surveys 130 studies that apply frontier efficiency analysis to the financial institutions of 21 countries and finds that the various efficiency methods do not necessarily yield consistent results. Bauer et al. (1998) comparing efficiency estimates on U.S. bank efficiency from variants of all four of the major approaches -- DEA, SFA, TFA, and DFA -- and find mixed results.

There are various studies within the literature that used different clustering methods for a given classification problem and compared their results (Nanda et al. 2010). Our contribution is to try clustering CEE and SEE countries related to efficiency of financial institutions based on a newly launched Global Financial Development Database. This analysis had to confront significant gaps in information on regional financial interlinkages that are necessary to inform policy decisions regarding financial institutions.

3. Methodology

The objective of cluster analysis (see Dillon and Goldstein, 1984; Everitt et al. 2001) is to determine the natural groupings (or clusters) of

observations. In our study, we have researched into the data for groups of countries, in which countries in the same group are more similar to each other than to those in other groups. We use cluster analysis as an exploratory data-analysis technique. This technique would provide a better and more accurate explanation of the observations with a minimal loss of information, because it requires no assumptions about the independence of the observations. However, this method like other methods imposes some limitations on the researcher. There are several cluster-analysis methods, where most of them allow a variety of distance measures for determining the similarity or dissimilarity between observations. Nevertheless, before applying this method, it is necessary to perform data transformations and/or variable selection. Then, it may be difficult to determine how many clusters are really in the data and how significant are the clusters that have been formed (see Korobow and Stuhr, 1991).

There are two general types of clustering methods, which are known as: partition and hierarchical. Partition methods break down the observations into a certain number of final clusters in advance. Two partition methods are kmeans and kmedians. Otherwise, hierarchical clustering is the most useful method and it consists of creating hierarchically related sets of clusters. Hierarchical cluster analysis begins by separating each object into a cluster by itself. At each stage of the analysis, the criterion by which objects are separated is relaxed in order to link the two most similar clusters until all of the objects are joined in a complete classification tree.

Hierarchical clustering methods are generally of two types: agglomerative or divisive. Agglomerative hierarchical clustering starts with single elements and aggregates them into clusters, while divisive hierarchical clustering starts with the complete data set and divides it into partitions. In this study, we chose to apply hierarchical techniques, since the number of final clusters was unknown. Furthermore, the agglomerative methods were preferred to the divisive ones because they are widely implemented in software.

The hierarchical cluster method consists of an ordered paired list $\{t, W_t; t=1... T\}$, where t represents the different year and W_t represents n row-matrices of the observed variables for the n individuals in each year. In the case of CEE, n represents 16 countries, hence in the other

case n represents six countries. A description of variables in W_t is given in Section 3. From each W_t matrix, applied in each year, we obtain a D_t squared n×n distance matrix. For a particular t year, the initial D_t matrix is represented as:

$$D_t = \begin{pmatrix} 0 & \cdots & d_{1i} & \cdots & d_{1n} \\ \vdots & \ddots & & & \vdots \\ d_{j1} & & 0 & & d_{jn} \\ \vdots & & & \ddots & \vdots \\ d_{n1} & \cdots & d_{ni} & \cdots & 0 \end{pmatrix}$$

where d_{ij} represents the distance between the individuals i and j. In order to obtain the final dendrogram, we should do the specification of the following parameters:

Type of distance, which defines the formula for calculating distance, which is used to approximate the similarity of two financial institutions. The most typical and well-known distances that might be used are the Euclidean and squared Euclidean distance, the Manhattan or city block distance, the Mahalanobis distance or the Chebychev distance, among others. We decided to use the squared Euclidean measurement in this study, since it places greater emphasis on outliers to generate distance patterns (for more various levels of warnings about using different type of measures and for importance of using squared Euclidean distance, see Kaufman and Rousseeuw, 1990; Gordon, 1999; Everitt et al. 2001).

Linkage method defines the rules for cluster formation. The best-known linkage methods are single, complete, average, Ward's method, centroid, median, and weighted average. However, since the first three methods are more common and broadly known in most of the statistical packages, we used them to obtain the final dendrograms (for examples of these methods, see Dillon et al. 1984). Overall, the complete and average linkage method led to the most consistent and stable results. We have therefore based our discussion on these methods, and the dendrograms for each time period showing the cluster-relation between the different countries are presented in a condensed form in the appendix. Stata 11 package was applied to carry out the calculations.

4. Data and Variables Description

The paper uses the data to characterize and compare financial institutions across countries and over time. As already mentioned, this will be through cluster analysis to assign the countries into groups (clusters). Therefore, countries in the same cluster are more similar to each other than to those in other clusters. Cluster analysis implies that no restrictions or stipulated structures are imposed upon the data *ex ante*. So, it is the data itself that structures the results, therefore the selection of variables is very important.

For intermediaries, efficiency is primarily constructed to measure the cost of intermediating credit. Determinations of efficiency require different methodologies to measure it. Traditional methods of measuring efficiency are related with the analysis of various financial ratios, such as ROA, ROE, net interest margin etc. Several other studies have attempted to identify the characteristics that explain financial institution efficiency differences by means of financial institution size, form of organization, market characteristics (such as concentration), age of financial institution, loans to total assets ratio, etc. The variables described above are relatively crude measures of efficiency. For a sub-set of countries, it is possible to calculate efficiency indices based on data envelopment analysis, stochastic frontier analyses or other more sophisticated measures (see Bauer et al. 1998 for a detailed comparison of frontier efficiency methods in financial institution). However, the data required for this type of analysis are available only for a sub-set of countries. Therefore, we measure efficiency for financial institutions via traditional indicators based on the categorization of variables proposed by Beck et al. (2000, 2010). In our study, the efficiency measures will include indicators such as overhead costs to total assets, net interest margin, lending-deposits spread, non-interest income to total income, cost to income ratio, and closest related variables include return on assets and return on equity.

The net interest margin (see Cihák et al., 2012; Beck et al., 2010) equals the accounting value of an institution's net interest revenue as a share of its total earning assets, while *overhead cost* equals the accounting value of an institution's overhead costs as a share of its total assets. Higher levels of net interest margins and overhead costs indicate

lower levels of financial institution efficiency, as they incur higher costs and there is a higher wedge between lending and deposit interest rates. *Lending-deposits spread* is lending rate minus deposit rate. *Cost-income ratio* that measures the overhead costs relative to gross revenues, with higher ratios thus indicating lower levels of cost efficiency. *Return on Assets and Return on Equity* are computed as unweighted averages across all institutions in a given year. They are regarded as the basic indicators of financial institution profitability.

By selecting these indicators, we aim to capture one of the dimensions of financial system development. These variables are a considerable part of the factors determining the behaviour and development of efficiency in the financial institutions without imposing any causality links or structures restriction. The data for all these variables offers from a newly launched Global Financial Development Database, an extensive worldwide database combining and updating several financial data sets. The data have been selected for 16 European countries for the period 2003 to 2010 (last year offered by World Bank). We selected these from the World Bank database for the period 2003 to 2010, so as to avoid missing any variables for the countries selected.

5. Results

We have applied the two methods: average and complete linkage. Both of them give almost identical results, with very small differences. Results obtained from the complete methods provide a clearer idea of the similarities and differences between the banking sectors in these countries, so we decided to illustrate the dendrograms of this method. Figure 1 in the appendix illustrates the results of cluster analysis and the table below gives a summary table of the CEE countries classification.

Summary table of CEE countries classification

Country	Group 1 *(years)*	Group 2 *(years)*	Group 3 *(years)*
Bulgaria (BGR)	8		
Czech Republic (CZE)	8		
Croatia (HRV)	7	1	
Macedonia (MKD)	7		
Slovak Republic (SVK)	7	1	
Estonia (EST)	6	2	
Latvia (LVA)	6	2	
Lithuania (LTU)	6	2	
Romania (ROM)	6	2	
Slovenia (SVN)	6	2	
Bosnia and Herzegovina (BIH)	5	3	
Hungary (HUN)	4	3	1
Poland (POL)	4	3	1
Montenegro (MNE)	2	6	
Albania (ALB)	3	1	4
Serbia (SRB)	1	3	4

Source: Authors, based on the Global Financial Development Database

Generally, these countries are classified in three groups. The first and the bigger group include 9-12 countries. In this group, Bulgaria and the Czech Republic are always included. Croatia, Macedonia and Slovakia are included in the second group only for one year, whereas Estonia, Latvia, Lithuania, Romania and Slovenia are included in the second group for only two years and Bosnia is classified as being in the second group for three years. The second group includes fewer countries compared to the first one (2-5 countries). The countries that are more often included in this group are Hungary, Montenegro and Poland. The last group, in general, includes only one country. In this group, Serbia and Albania have been included. In 2003, Poland was included in this group, whereas in 2008 Hungary had been included. We can observe that throughout the observation period the distance of the groups has changed. At the beginning of this period (2003), the differences were relatively small compared to the years 2004–2006. There is generally an increase in homogeneity between groups during 2007-2008, but in 2009, the differences between the groups become larger whilst last year these differences seemed to be more relaxed. If we make a detailed observation of the CEE countries to understand better the similarities and the differences between them, we would have these results:

● Serbia is the country that has the biggest differences; forming a group on its own for many years (2003, 2004, 2009 and 2010), whilst in the other years it belongs to the second, smaller group. The only year that the Serbian financial institution appeared to be more similar to other countries was in 2008, when all countries seem to have had more similarities than in other years. The reason of this homogeneity between the countries might have been the financial crises that appeared strongly in this year. Serbia has a few more similarities with Montenegro and Hungary in 2006 and 2007, when they were included in the same group.

● Albania is the second country, after Serbia that appears to have the biggest differences in comparison with the other countries. For four years (2004-2007), Albania is included in the third group, due to huge differences with the other countries. It seems that during 2008 and 2009, the integration of this country increased, nevertheless, in the last year of the observation it would appear that the gap is beginning to grow again.

● Montenegro could be the third country that appears to be less integrated. Usually this country has more similarities with Bosnia, Serbia and Macedonia. This country rarely appears to have any similarities with the CEE countries that belong to the EU.

● Bosnia and Macedonia seem to be very similar to each other and to Slovenia. During the last few years, these countries seem to become more similar to Croatia. Moreover we can say that countries that are not members of the EU, (excluding Macedonia and Croatia), are less integrated than the member countries of the EU.

● Hungary is a country that is part of the EU with fewer similarities to the other countries. Greater similarity has been noticed in the early years with the Czech Republic and Latvia. However, with the passage of time the differences have become larger, even in 2008 Hungary was completely separated from other groups of countries.

● Although it seems that Poland has greater similarity with Romania, it does not seem to have that consistency that Romania has. During the study period, Poland passes from one group to another.

● The strongest relationship between groups is among Bulgaria, Croatia, Slovakia and a little less with Estonia. These countries, together with the Czech Republic and Romania stand out as the most integrated countries, regarding this dimension of the financial institutions development.

Analysis continues with the SEE countries that are not EU member states. Through this analysis, we have tried to clarify the results found above. In this classification, we have made two exceptions. The first relates to the exclusion of Croatia; a country not completely included in the SEE and that will soon be part of the EU. The second concerns the inclusion of Greece, a country that is part of the EU and has an impact on the financial systems of the SEE countries. We do so, in a bid to find a relationship between Albania and Serbia with this country, since in the above analysis they looked very separate. Figure 2 in the appendix gives dendrograms of this analysis according to the complete linkage method. Generally speaking, over the years we have classified these countries into the three following groups.

● Macedonia and Bosnia are always in the same group. It is obvious how much similarity there is between the financial institutions of these two countries in terms of the efficiency dimension. In some

years, this group also includes Montenegro, which has more similarities with these two countries than the others.

● The other group includes Albania and Greece, which as was assumed, bear much more similarity with each other (except for 2003). Greece is closer to Albania than to Serbia, except in 2008 when it was closer to Serbia. Just as resulted from our analysis of the CEE countries, with the exception of 2008, in all the other years, Albania and Serbia were significantly apart from each other.

● Serbia is the only country included in the third group again for the years 2003, 2004, 2009 and 2010. In the other years, it seems to have a little more resemblance to Montenegro. However, Montenegro is actually closer to Macedonia and Bosnia than to Serbia. Although it seems that the SEE countries have become more similar in 2008; in recent years the differences between them grew even more. Serbia is the country that has the greatest differences, which at times seems to pull behind Montenegro.

6. Conclusion

In this study we have used the Global Financial Development Database in order to analyze the financial institutions of different countries, under the efficiency dimension. This was done through cluster analysis for the years 2003-2010. The purpose was to observe the homogeneity of the CEE countries, but not only that. We also worked towards finding the similarities between the SEE countries, as well as between countries integrated within the EU and those outside the EU.

The results showed that there are differences between members and non-EU members. Thus, with regard to the non-member countries of the EU, Macedonia and Croatia are the more integrated SEE countries. Then come Bosnia and Herzegovina, and Montenegro. Less integrated are Albania and Serbia. The last two are not only far away from the other countries, but they are far away from each other with the year 2008 being the only exception (they seem to be closer in this year). Among the CEE countries Bulgaria, the Czech Republic and Slovakia appear to be more integrated. Less integrated among these countries are Hungary and Poland, which tended to be at a long distance from the main clusters

(2008 and 2003 respectively). The tendency of homogeneity in the period under the study generally shows an increase until the year 2008, and a decrease in the last two years. Such behaviour might be due to the financial crisis that may have increased the differences between these countries. However, this requires further and more detailed analysis.

The study recognizes that financial efficiency does not capture all the features of financial systems. Rather, the paper uses this characteristic as a basis for comparing, and clustering financial systems in these countries and their evolution over the period taken into consideration. Certainly, in other subsequent studies other features of financial systems should be included in order to achieve a more comprehensive analysis. The paper also emphasizes a need for further research, including indicators measured by the most advanced methods.

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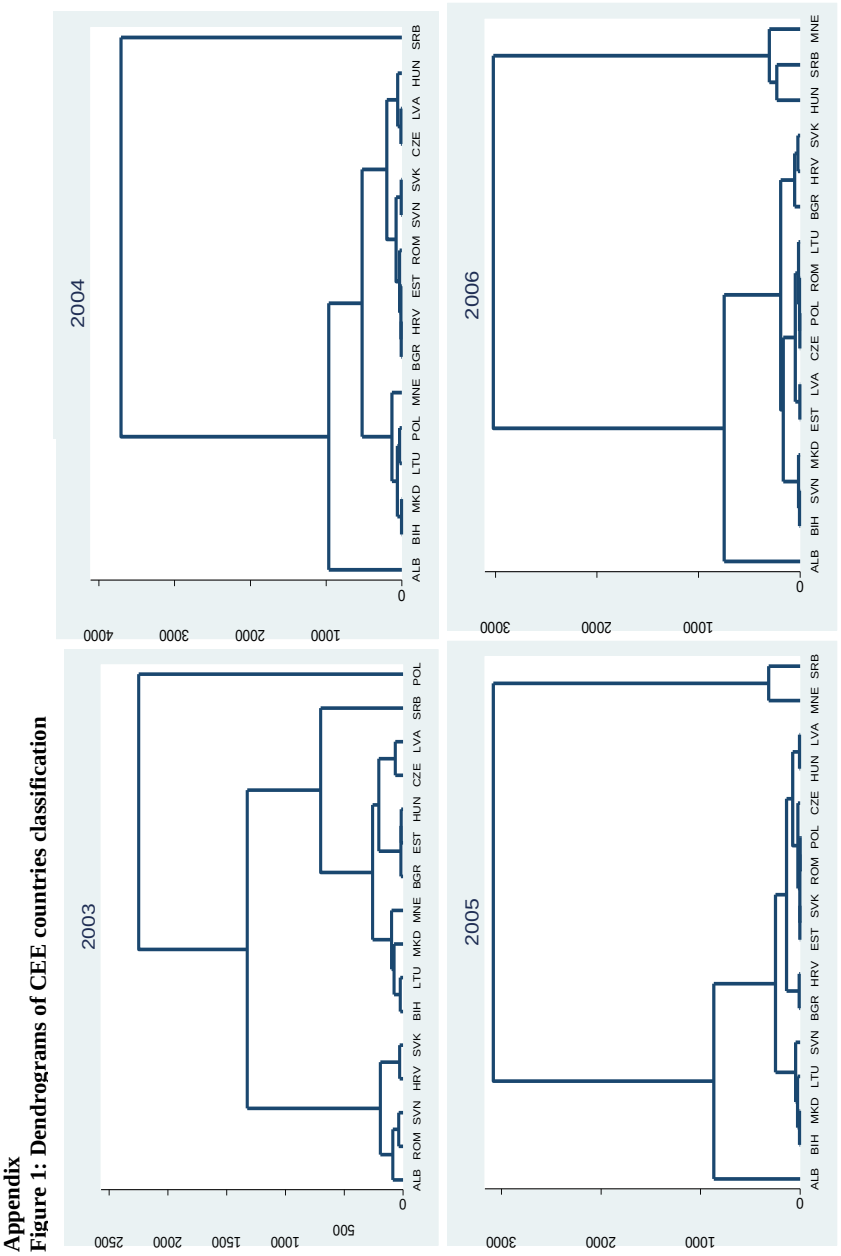
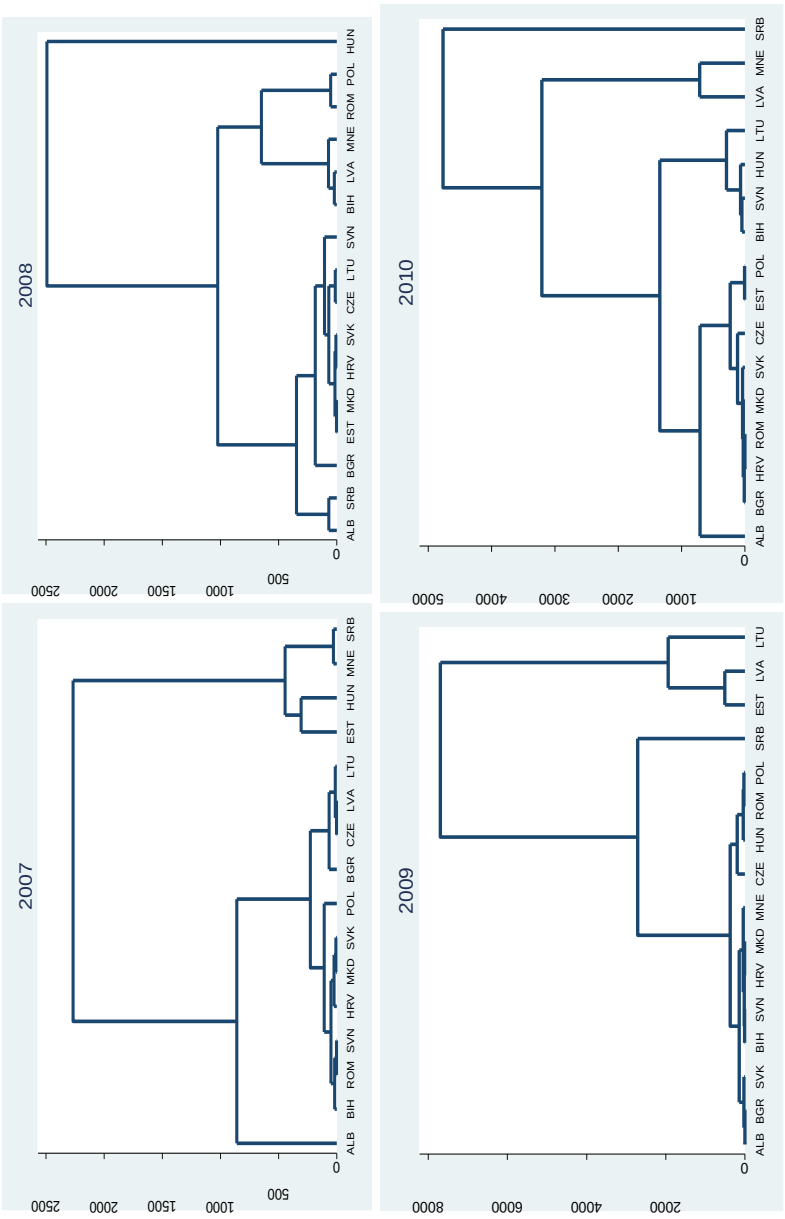
Appendix
Figure 1: Dendrograms of CEE countries classification




2008
ALB SRB BGR EST MKD HRV SVK CZE LTU SVN BIH LVA MNE ROM POL HUN
0
500
1000
1500
2000
2500
2010
ALB BGR HRV ROM MKD SVK CZE EST POL BIH SVN HUN LTU LVA MNE SRB
0
1000
2000
3000
4000
5000
2007
ALB BIH ROM SVN HRV MKD SVK POL BGR CZE LVA LTU EST HUN MNE SRB
0
500
1000
1500
2000
2500
2009
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0
2000
4000
6000
8000

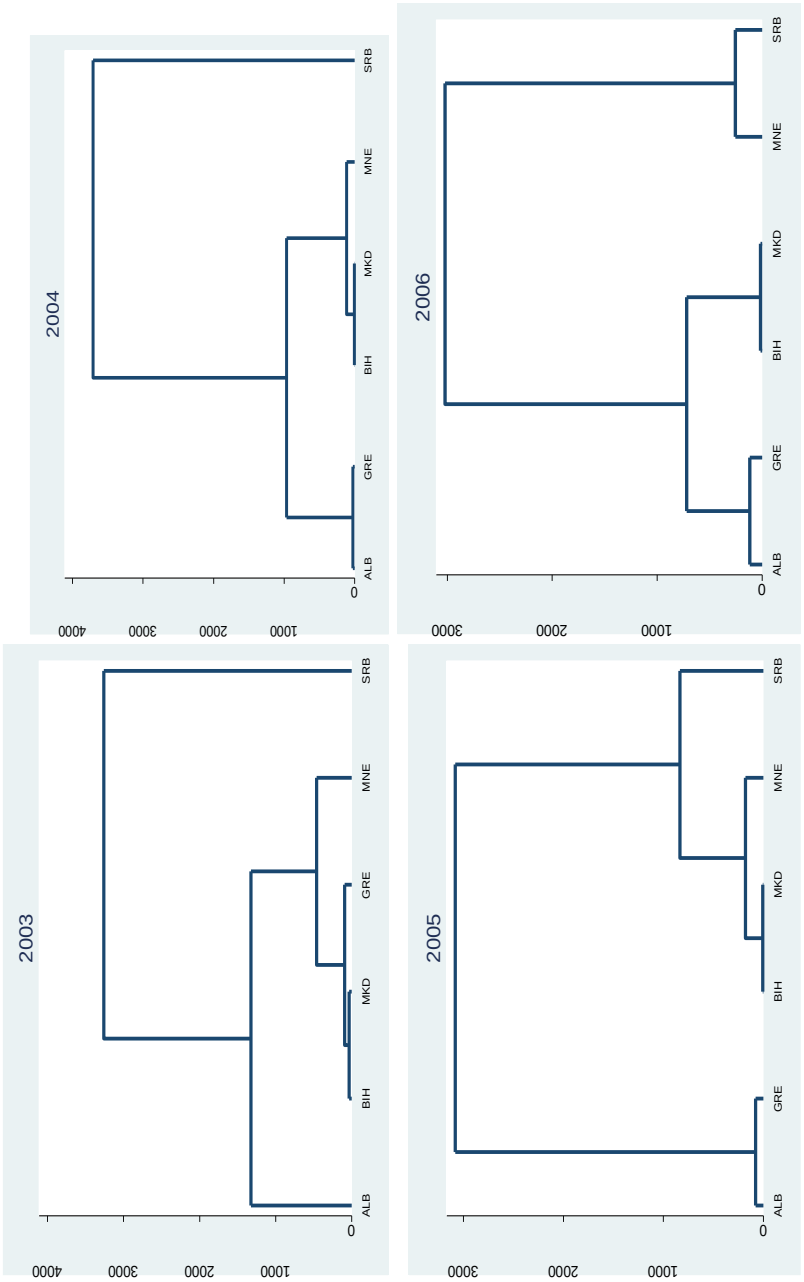
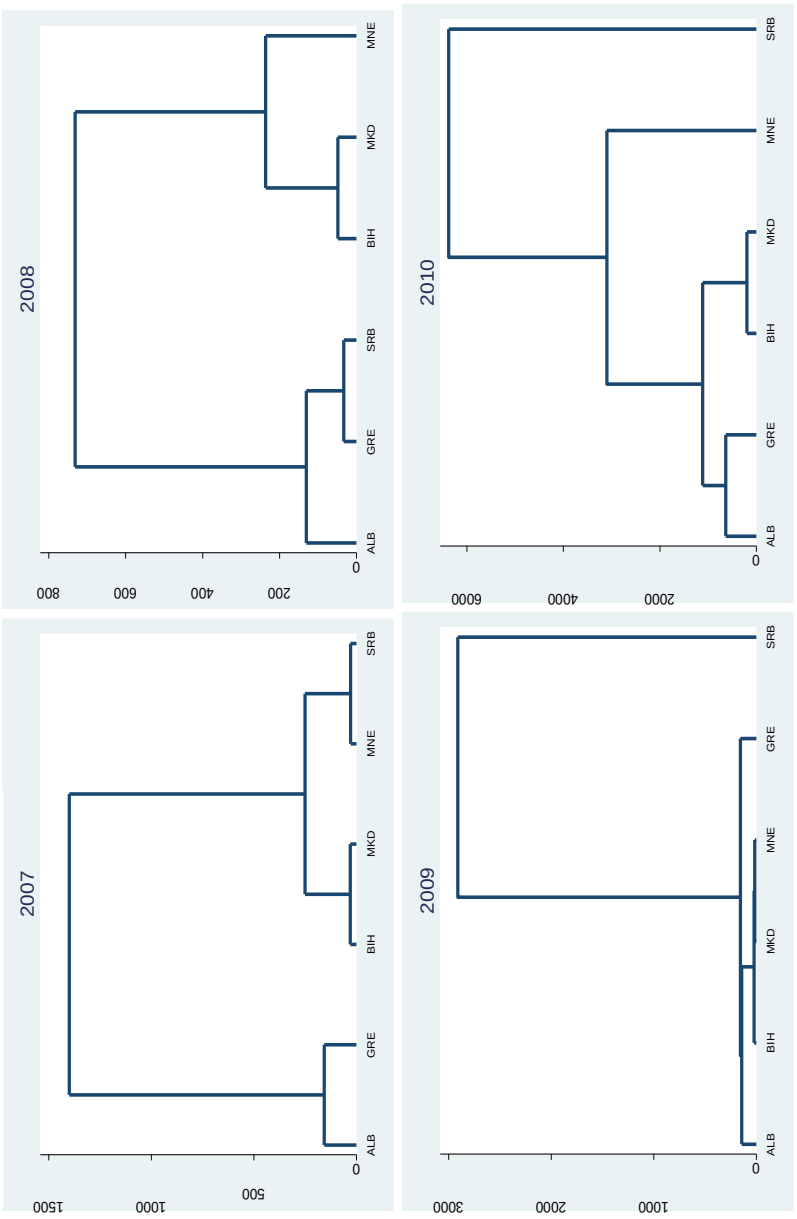


Figure 2: Dendrograms of SEE countries classification


2008
MNE
MKD
BIH
SRB
GRE
ALB
0
200
400
600
800
2010
SRB
MNE
MKD
BIH
GRE
ALB
0
2000
4000
6000
2007
SRB
MNE
MKD
BIH
GRE
ALB
0
500
1000
1500
2009
SRB
GRE
MNE
MKD
BIH
ALB
0
1000
2000
3000