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PATTERNS OF FUTURE-ORIENTATION IN CENTRAL AND EASTERN EUROPE

The paper shows that Comprehensive Neo-Schumpeterian Economics (CNSE) is an adequate theoretical approach accompanying the enforcement of the aims of the Lisbon Agenda and the recent Growth Strategy 2020. The CNSE approach as well as the Growth Strategy 2020 are based on the principle of innovation as a competitive driving force, and the idea of future orientation penetrating all spheres of economics which can be summarized in three domains of economic life: industry, finance and the public sector (the 3-pillars of CNSE). The CNSE approach is applied to an empirical study of 11 Central Eastern European Economies. The country patterns of pillars are identified in a cluster analysis. This gives a fine-grained picture of institutional and structural set-ups for the countries under study.

INTRODUCTION

In the so-called 5th enlargement in 2004 and 2007 Malta, Cyprus, Estonia, Latvia, Lithuania, Poland, the Czech Republic, Slovakia, Slovenia, Hungary, Romania and Bulgaria joined the European Union. In particular, the former communist economies had to undergo severe structural transformations after the fall of the iron curtain and still when they entered the European Union showed marked differences with respect to the western part. Obviously, these differences also frame their strategies to react to the challenges of the current worldwide financial and economic crisis. After more than five years it is time to ask the question how the new member countries perform in the restructuring of their economies and in their refurbishment with the crisis. The Economist (March 20th–26th 2010, p. 29) writes "The idea of a single 'ex-communist region' called Eastern Europe does not bear scrutiny." In fact the economies of the new member countries show severe structural dissimilarities, which are to be considered in the evaluation of the performance as well as in the design of policy strategies to manage the transformation processes.

In March 2010, the EU Commission renewed the *Lisbon Agenda* with the so-called Growth Strategy 2020, in which it is outlined: "Europe is recognised the world over for its high quality of life, underpinned by a unique social model. The strategy should ensure that these benefits are sustained and even further enhanced, while employment, productivity and social cohesion are optimised." Like the Lisbon Goal, this goal is challenging and extraordinarily difficult to be accomplished in particular in the current economic crisis. From the point of view of economics, the following major issues have to be addressed:

1. The decisive economic elements and forces responsible for the achievement of the agenda must be identified.
2. An adequate economic approach should be developed which explicitly includes these elements.

3. For the application of this theoretical approach on the empirical realm the right methodological concept must be found.
4. The fourth major issue is to apply this operationalisation to Europe. A severe difficulty here stems from the fact that Europe is not a unity composed of homogenous components but a collection of heterogeneous countries. Accordingly, the method chosen should focus on detecting patterns of similarities and dissimilarities among the countries under investigation.
5. This discovery of patterns is a necessary step for a further analysis which focuses on the manifestation of success in the sense of the Lisbon Agenda and compares patterns of similarity with patterns of performance.

These five points also structure the content of our paper. In the first section we derive the economic substrate of the Lisbon agenda and Growth Strategy 2020. It can be shown that the Lisbon Agenda as well as the Growth Strategy 2020 is mainly based on innovation and the resulting future orientation. We then elaborate Comprehensive Neo-Schumpeterian Economics (CNSE) as an adequate theoretical framework suitable for the enforcement of the Lisbon agenda. In order to apply CNSE, we develop an indicator based 3-pillar model in the following section, composed of an industry, a financial and a public sector part. This 3-pillar concept is applied to 11 Central and Eastern European countries encompassing the ten new member states of the EU which are on the continent (thus excluding Cyprus and Malta) as well as Croatia as a potential new member in the near future. A study which tried to find clusters for 14 older EU-members (EU-15 excluding Luxemburg) has been conducted in 2006.

We then focus on dissimilarities and similarities of the various economies and their pillars. This analysis allows for the detection of whether there is variety in the composition of the three pillars for the different countries or whether one finds a convergent structure of groups of countries. This allows us to get a first hint on the convergence and divergence of structures in geographic areas in Europe. The study is done by a cluster analysis. Our paper ends with some conclusions and the agenda for future research.

1. THE ECONOMIC SUBSTRATE OF THE LISBON AGENDA

One of the most frequently cited statements of the famous Lisbon agenda claims that *Europe should become the most competitive and dynamic knowledge-based economic region in the world*. What does this mean in economic terms?

Today, economists widely agree that technological progress is the central determinant of growth and dynamics in modern economies. These dynamics are propelled by innovative activities in all parts and spheres of the economy and the society as the main driving force of change and development. Behind innovation understood as a process of unpredictable and discontinuous crowding out of established and appearance of new products, production technologies and organizational solutions, we most importantly find knowledge generation and diffusion processes. As a consequence, looking at the competitiveness of firms, regions, countries or even a union of countries, it is no longer price-competition which plays the central role,

but the competition for innovation which really counts (Saviotti and Pyka 2008). Under this angle, the dynamics which are relevant and have to be observed include not only quantitative features of economic growth but also qualitative features of economic development and structural change. Obviously, dynamic processes understood and analyzed in this vein are fed by multiple sources which also mutually influence each other in a co-evolutionary way. These sources encompass actors like entrepreneurs, firms and households as well as financial actors as banks, venture capitalists and private equity firms. Public actors and institutions like governments, universities, schools, research institutes, patent offices and regulatory authorities also play a role.

Keeping in mind this comprehensive innovation-oriented view of the Lisbon Agenda, which economic approach might be suited for its enforcement?

2. COMPREHENSIVE NEO-SCHUMPETERIAN ECONOMICS

The Lisbon agenda and its successor, the Growth Strategy 2020 formulates a strategy for keeping and even improving the competitiveness of the European Union. Therefore, its overall goal must be seen in securing the welfare for European citizens. Without doubt, economics is the science which focuses on economic welfare and the ability to increase it. This can be stated as a goal for all schools in economics, among the most important being the Neoclassical school, the Neo-Keynesian approach and Neo-Schumpeterian economics. But the angle of analysis differs sharply among these various approaches. Boiling down the Neoclassical approach to its essentials, it can be characterized by rational individuals acting on markets where the price mechanism is responsible for an efficient allocation of resources within a set of given constraints. Neo-Keynesian Economics, briefly characterized, turns out to be a demand-oriented macro approach based primarily on short term processes occurring in non-perfect markets. Accordingly, the knowledge-driven and the ensuing innovation-driven processes characterizing long run development are by far not central to either of these approaches.

One of the decisive differences of Neo-Schumpeterian Economics with respect to other approaches in economics can be found in its emphasis on different levels of economic analysis and their particular interrelatedness. Due to the dominance of the Neoclassical School in the 20th century, the approach of a micro foundation of macroeconomics has wide appeal. The aggregation from micro to macro becomes possible because of the idea of representative households and firms. Although this approach may seem convincing due to its analytical stringency, its mechanistic design may lead to difficulties when it comes to the analysis of dynamic phenomena endogenously caused by the economic system.

Neo-Schumpeterian economics, by contrast, seeks to get a grip on these dynamic phenomena of economic reality. In order to do this, important meso-level aspects between the micro and the macro level of economic analysis are considered (e.g. Dopfer, Foster and Potts 2004). It is the meso-level of an economic system in which the decisive structural and qualitative changes take place and can be observed.

To understand the processes driving the development at the meso-level, Neo-Schumpeterian economics puts a strong emphasis on knowledge, innovation and entrepreneurship at the micro-level. Innovation is identified as the major force propelling economic dynamics. In this emphasis on innovation, the major difference in the Neo-Schumpeterian approach with respect to alternative economic approaches can be identified. Generally, one may say that novelty (i.e., innovation) is the core principle underlying the Neo-Schumpeterian approach. Innovation competition takes the place of price competition as the coordination mechanism of interest. Of course, prices are also of significance, but concerning the driving forces of economic development, they are by far not central. Whereas prices are basic concerning the adjustment to limiting conditions, innovations are responsible for overcoming previous limiting conditions and – as in economic reality, everything except human creativity has an end – setting new ones.

The focus on novelties is thus the most important distinctive mark of Neo-Schumpeterian economics. By its very nature, innovation, and in particular technological innovation, is the most visible form of novelty. Therefore, it is not very surprising that Neo-Schumpeterian economics today is most appealing in studies of innovation and learning behaviour at the micro-level of an economy, in studies of innovation-driven industry dynamics at the meso-level, and in studies of innovation-determined growth and international competitiveness at the macro-level of the economy (e.g. Hanusch and Pyka 2007c).

To summarize, in Neo-Schumpeterian Economics the central actors under investigation are entrepreneurs and entrepreneurial firms, the most important process under investigation is innovation and the underlying knowledge creation and diffusion processes. Here, in sharp contrast to Neoclassical Economics, the notion of innovation focuses on the removal and overcoming of limiting constraints and the setting of new ones.

However, Neo-Schumpeterian Economics, in its present shape, restricts itself to the dynamics of the industry side only. Even with this shortcoming, it seems to be the most adequate approach in tackling the enforcement of the Lisbon Agenda. Nevertheless, to fulfil its extreme challenges, namely to successfully hold ground in global innovation-oriented competition with the aim to enforce a development which makes *Europe the most dynamic knowledge-based economic region in the world,* the Neo-Schumpeterian approach has to be put on a broader conceptual basis.

For this purpose, we suggest Comprehensive Neo-Schumpeterian Economics (CNSE) as elaborated in Hanusch and Pyka (2007a). CNSE has to offer a consistent theory which encompasses all realms relevant to an improved understanding of economic processes involving change and development. This becomes even more pressing in cases in which the different realms are in close relation, mutually influencing each other, which is very likely the case for economic development. In other words, a comprehensive understanding of economic development must inevitably consider the *co-evolutionary* processes between the different economic domains.

Consequently, we argue that it is high time for Neo-Schumpeterian economics to devote considerable attention to the role of the financial and public sector with respect to economic development. In particular, we introduce the Comprehensive

Neo-Schumpeterian approach as a theory composed of 3-pillars: one for the real side of an economy, one for the monetary side of an economy, and one for the public sector. Economic development then takes place in a co-evolutionary manner, pushed, hindered and also even eliminated within these 3-pillars *(figure 1)*.

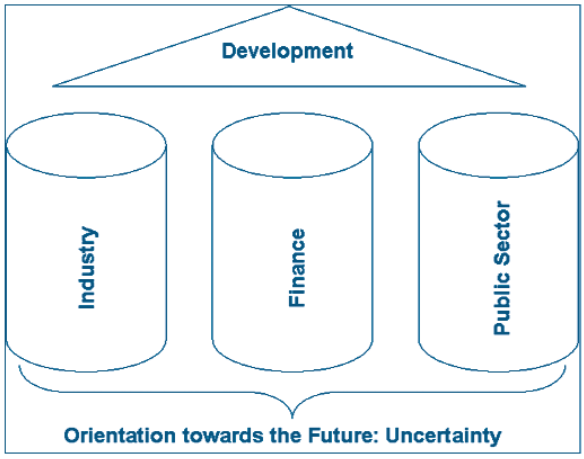

Figure 1. The three pillars of Comprehensive Neo-Schumpeterian Economics

In order to understand the crucial co-evolutionary relationship, one must explore the bracket encompassing all 3-pillars, namely their orientation towards the future which introduces uncertainty into the analysis. The relationships between the 3-pillars drive or hinder the development of the whole economic system in a non-deterministic way. Consider, for example, the case of the financial sector, exaggerating the developments taking place in the real sector and leading to dangerous bubble effects which might cause a breakdown of the whole economy. Or think of the case in which the public sector cannot cope with the overall economic development, and areas such as infrastructure and education become the bottlenecks of system development.

A comprehensive Neo-Schumpeterian economic theory focusing on innovation driven qualitative development should offer theoretical concepts to analyze the various issues of all 3-pillars: industry dynamics, financial markets, and the public sector. Innovation and, as a consequence thereof, uncertainty, are ubiquitous phenomena characteristic of each of these pillars and are also intrinsically interrelated. An improved understanding of the development processes can only be expected if the co-evolutionary dimensions of the three pillars are taken into account. This is illustrated within the concept of a Neo-Schumpeterian corridor shown in *figure 2*.

In a CNSE-perspective, there exists only a narrow corridor for a prolific development of socio-economic systems. Profound Neo-Schumpeterian development takes place in a narrow corridor between the extremes of uncontrolled growth and exploding bubbles, on the one hand, and stationarity (i.e., zero growth and stagnancy) on the other hand. Economic policy in the sense of CNSE strives to keep the system in an upside potential including both overheating-protection (i.e., on the macro-level bubble explosions and on the micro-level insane explosive growth) and downside-protection, that is on the macro-level stagnation and on the micro-level bankruptcy.

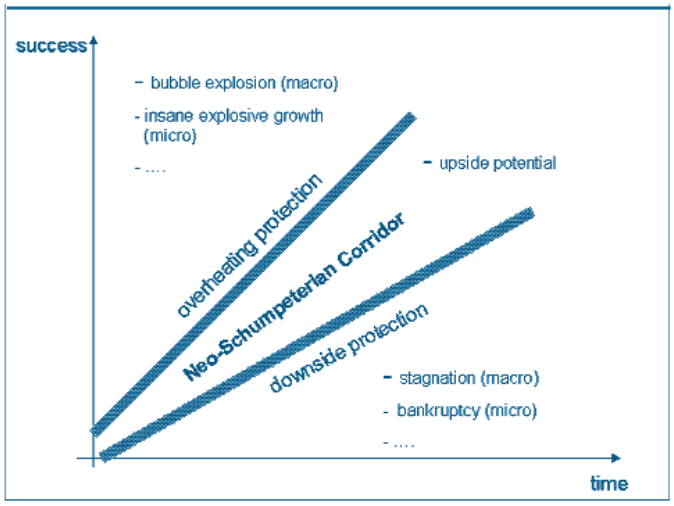

Figure 2. The Neo-Schumpeterian Corridor

To summarize, the essence of CNSE is captured by the following definition: CNSE deals with dynamic processes causing qualitative transformation of economies driven by the introduction of novelties in their various and multifaceted forms and the related co-evolutionary processes. These processes are not merely restricted to industry but also include the financial and public sphere of an economy and thereby encompass all spheres of economic and societal issues.

3. THE INDICATOR BASED 3-PILLAR APPROACH

It is a central aim of this empirical study to gain new findings as regards the structural characteristics and the functioning as well as the competitiveness of economies in 11 countries which have just recently joined the EU (or will join in the near future, as in the case of Croatia) from a Neo-Schumpeterian angle.

3.1. DATA

To achieve this objective, our analysis is grounded on a comprehensive set of indicators (Hanusch and Pyka 2007b). In total, more than seventy variables have been collected, reflecting many different activities in the various EU economies which are related to innovation. In dependence of data availability, the indicator sets comprise different years, namely from 2001 to 2006.

Above all, the set of variables reflects structural specifics, yet the data are also comprised of several indicators for the functioning of the economies, including inputs in the innovation process such as R&D related indicators as well as variables on the knowledge base and the institutional structure. To summarize, the data we draw upon must reflect all types of activities for the three pillars introduced above, immediately entailing the future-oriented characteristics.

The utilized indicators originate from various sources, the most important one being Eurostat, the statistical office of the European Union. The central additional data sources are the World Bank, the UNESCO and the European Private Equity and Venture Capital Association (EVCA). From these databases, patent statistics, R&D expenditure data as well as several indicators of national education systems and of qualification structures of national workforces have been extracted.

3.2. THE INDICATORS FOR THE 3-PILLARS[1]

The crucial feature of the *industrial pillar* in a CNSE conception is its orientation towards the future. In order to comprise this dimension structurally as well as from a process perspective, we divided the pillar in three independent dimensions. In a first step, we considered the knowledge base in the country in order to associate them in educationally comparable groups. Secondly, we considered the openness of the economy through an analysis of the export of high technology. The third step encompasses the integration of the innovativeness and the efforts undertaken in R&D. Altogether, the three categories can enable us to draw a picture of the structural relatedness between the different countries with respect to their real sector.

Concerning the *financial pillar,* we focus once again on the future orientation, which therefore must be expressed in the selection of indicators. We concentrated on the availability of venture capital as a variable which can both reflect the willingness and the ability to finance innovation in a country. Furthermore, it includes the perspectives which the financial markets attribute to the development in the respective economy.

The future orientation of the *public pillar* is centred around the institutions and the economic structure in the different countries. The indicators are linked to the public life in general and range from the use of e-government services to the public budget deficit. It also includes aspects relating to the workforce as well as the energy intensity in each country. Taken together, these indicators can offer a comprehensive picture of the structure and the institutional setup of the public role in each of the economies.

4. PATTERN DETECTION: SIMILARITIES AND DISSIMILARITIES

By using the conceptual framework of our Comprehensive Neo-Schumpeterian Approach, the specific targets of the study are to detect and then to analyze cross-national (dis-)similarities in the structure and composition with respect to the future orientation and innovativeness of the economies.[2]

To meet these objectives, cluster analysis techniques are applied to the data (see, e.g. Jobson, 1992). The general rationale behind this analytical tool is to test a sam-

1 A complete listing of all utilized data sources can be found in Appendix 1.

2 A similar approach has been applied in Balzat and Pyka (2006) in an analysis of national innovation systems.

ple for the degree of structural commonalities between the units of analysis. Its outcome is a categorization of the analyzed units so that the coherence of each group (or cluster) as well as the heterogeneity across different clusters is maximized. To determine the coherence of a certain cluster and to calculate the existing diversity of different clusters, distance values between the units of analysis need to be determined on the basis of the characteristics of each entity. From the various methods to calculate distances between the entities, the squared Euclidean distance measure is applied, because it is a frequently applied distance measure of metric data. Furthermore, it more strongly accounts for differences between entities than the linear Euclidean distance does. Hence, the distance between two countries *i* and *j* can be calculated as follows:

$$d(i,j) = \sum_{k=1}^{m} (a_{ik} - a_{jk})^2 \qquad (1)$$

Here, a_{ik} represents the parameter value of characteristic $k=1,...,m$ for country $i=1,...,n$.

Thus, the entire quantitative data matrix is

$$\mathbf{A} = (a_{ik})_{m \times n} \qquad (2)$$

The determination of distances between entities is a crucial but at the same time preliminary step in the entire cluster analysis. It needs to be completed by the application of a classification algorithm. Depending on the quality of the underlying data and on the research target, various classification procedures exist.

The data are characterized by a relatively small number of units of analysis (i.e., eleven countries in total) and at the same time by a relatively large number of variables (more than seventy variables in total) as well as by a cardinal data level.

Given these specifics of the underlying data and the country sample, a hierarchical, two-step cluster method (which rests upon the average-linkage principle of cluster membership) is applied to the sample.

The determination of the inter-cluster diversity between two classes *K* and *L, v(K,L)*,can thus be described formally as follows:

$$v(K,L) = \frac{1}{|K| \cdot |L|} \sum_{\substack{i \in K \\ j \in L}} d(i,j) \qquad (3)$$

with both distinctive classes *K* and *L* (i.e. $K \neq L$) belonging to the entire classification **K**.

Since it is not intended to impose a given, pre-determined classification of countries ex ante, an agglomerative classification method is utilized. This method starts with single-country clusters and entails a step-wise concentration of countries according to their degree of structural similarities. Given that it is intended to attach all countries in the sample to a certain cluster and that cases in which a certain country belongs to several clusters shall be ruled out, the selected clustering

method yields an exhaustive as well as a disjunctive classification. A classification is exhaustive if
$\bigcup_{K \in \mathbf{K}} K = N$, with N being the total amount of analyzed objects. A disjunctive partition meets the condition that $K, L \in \mathbf{K}, K \neq L$, so that $K \cap L = \phi$.

The clustering method is applied to each pillar of the countries under study.

In order to determine the optimal number of clusters, the so-called elbow criterion (see Hanusch and Pyka 2006b) is applied. The elbow-criterion is a commonly employed measure in cluster analysis that guarantees intra-cluster homogeneity and at the same time inter-cluster heterogeneity is maximized. Countries grouped within one cluster show strong similarities concerning the future orientation of the different pillars, whereas countries allocated to different clusters are structurally heterogeneous in this respect.

5. EMPIRICAL RESULTS

The following sections deal with the description of detected clusters and the analysis of their composition. We will discuss each pillar and the overall implications on the comparability and similarity between the analyzed countries.

5.1. CLUSTERS IN FUTURE-ORIENTATION OF CENTRAL AND EASTERN EUROPEAN COUNTRIES

Before we look at the individual pillars and their respective cluster separation, it is worth looking at the global analysis where all variables and indicators are taken into account. This will give us an idea of the overall distribution of the countries in the different clusters and will help in the interpretation of the pillar-related clusters.

In order to represent the country clusters graphically, *figure 3* is organized as follows: The upper line includes the country codes (the meaning of the abbreviations for the different countries is explained in Appendix 2). The lower line includes the mapping of the countries to the various clusters which is expressed by numbers and colours.

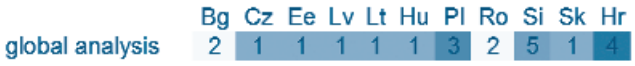

Figure 3. Country clusters of the global analysis

The most striking result of this global analysis is that there is one large cluster comprised of the Baltic countries Estonia, Latvia and Lithuania as well as the medium-sized central European countries Czech Republic, Hungary and Slovakia. This hints towards a structural similarity in the future-orientation in these countries during the analyzed time period. The table can also be read in such a way that the countries in cluster 1 are similar enough to be grouped into one cluster and too dissimilar to be compared with the other economies in our sample. This result does, however, not mean that the different countries are characterized by the same quantita-

tive values, rather only the structural composition is similar. Furthermore, we find that the two newest accession states, Bulgaria and Romania, make up their own cluster. Consequently, they are considerably different from all the other countries under observation and they share some similarities. The three countries which are left all form individual clusters implying that they are too different from the other economies to be compared with them. This applies to the largest country in terms of population, Poland, to the only one which has not yet joined the European Union, Croatia, as well as to Slovenia, which became the first of the new member states to adopt the Euro as their currency in 2007.

In the first cluster, we find countries which experienced a growth rate between 1% and 10% in 2007. Consequently, the global analysis does not yet tell us where the most promising starting point or termed negatively the most pressing bottlenecks are to be expected. Therefore, it is important to break the dimensions even further up and look at the different components in order to be able to better differentiate the distinct influences which may help explaining the different developments.

5.1. RESULTS IN THE INDIVIDUAL PILLARS

As explained above, we have analyzed the real sector by looking at the three different dimensions "knowledge base", "openness" and "innovative efforts". The first thing we notice is that there is considerable variation in the clusters which were formed according to those three domains. Only Estonia and Croatia, as well as Latvia and Slovakia form pairs of countries which belong to the same cluster (1–1–1 in the first case and 1–2–1 in the second) in each of the three dimensions. This means that those pairs can be considered to have a fairly similar industrial structure. All other countries are comparatively individual in the setup of their real sector. Nevertheless, in each dimension, we have a largest cluster which is made up of seven countries which are relatively close in their structure *(see figure 4)*.

Figure 4. Country clusters of the industrial pillar

When looking at the knowledge base in Central and Eastern Europe, we find that the main cluster has grown compared to the global analysis because Poland and Croatia have joined it and only Lithuania has left this cluster. It now contains seven countries, Bulgaria and Romania form a cluster on their own again. In this analysis, we only find two single-country clusters which are made up of Lithuania on the one hand and Slovenia on the other.

With respect to the openness of the countries, the picture changes considerably. We are only left with three clusters and there is no imminent geographical or historical link between the countries within a cluster. The first cluster has shrunk to three economies and is only comprised of the Czech Republic, Estonia, and Croatia. The

second cluster now counts seven countries. Bulgaria and Romania are now joined by Poland, Slovenia and Slovakia, as well as by the two Baltic States Latvia and Lithuania. It is interesting to note that while Estonia and Latvia shared the same cluster when looking at the knowledge base, it is Latvia and Lithuania in the case of openness. Apparently, similarities and dissimilarities in the Baltic States are not as clear cut as one might expect. Hungary makes up a cluster of its own, which shows that it is different from all the other countries in the sample in this category. This difference can be traced back to Hungary's historically determined close connection with the Austrian economy.

Our third category in the industrial pillar leads to a separation into five groups again where we find four single-country clusters and have one large cluster made up of seven countries. For the first time, Bulgaria and Romania do not show a similar setup in their innovative efforts, where Bulgaria belongs to the large cluster together with the – once again reunited – three Baltic states, Hungary, Slovakia and Croatia. Romania is too different from all other countries and, consequently, forms its own cluster. The same is true for the Czech Republic, Poland and Slovenia. While Poland and Slovenia already belonged to single-country clusters in the above analyses, it is the first time for Romania and the Czech Republic to be significantly different from all other countries.

Figure 5. Country clusters of the financial pillar

Even though we once again find a large cluster made up of six countries, the future-orientation in the financial market differs most strongly from the result of the global analysis *(figure 5).* For the first time, Bulgaria constitutes a cluster on its own and Romania finds itself in a cluster only together with the Czech Republic. Hungary which has been struck so hard by the current economic crisis is forming a cluster on its own, just like Poland. The six-country cluster is made up of the three Baltic states Estonia, Latvia and Lithuania – even though we found Latvia in considerably larger distress during the financial crisis than the other two countries –, the two countries which by now have introduced the Euro, Slovenia and Slovakia, as well as Croatia as the only country which is not yet a member of the EU.

Figure 6. Country clusters of the public pillar

The pattern of clusters in public pillars *(figure 6)* shows to be strongly politically determined. We find a large cluster made up of those eight countries in our study which joined the European Union in 2004: the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Slovenia and Slovakia. This implies that their institutional setup is somewhat harmonized and comparable.

Obviously different enough to this first group, the clustering algorithm identifies Bulgaria and Romania in one public pillar group. Not surprisingly, these two countries joined the EU together in 2007. Finally, the only candidate country, Croatia, is put in a single-country cluster. There is no causality check in our data, so we cannot imply if the perspective of membership to the European Union has led to a harmonization in the public structure or if the similarity has allowed those countries to fulfil the accession criteria at similar moments. Nevertheless, the correspondence of the clusters to the different accession dates is striking.

6. CONCLUSIONS

Innovativeness and orientation towards the future are central elements of the Lisbon Agenda and the Growth Strategy 2020. CNSE offers an appropriate theoretical approach for the enforcement of the Lisbon Agenda. Our cluster analysis demonstrates that from an empirical point of view, CNSE can be operationalized without major difficulties. It is central to maintain future orientation as a common feature of both the Lisbon Agenda and our 3-pillar approach. This target can be achieved by relying on a comprehensive set of indicators reflecting different activities related to innovation.

Of course, due to its composition of very heterogeneous member countries, Europe will not come up with a simple pattern of pillar compositions. Does this mean that each country needs a specific policy design to achieve the Lisbon strategy? From the results of this analysis, we suggest that this is not the case. Countries can be attributed to clusters according to their similarities and differences. These groups of countries with similar pillar compositions can then be analyzed according to their performances in such areas as patenting, growth, and employment in order to identify bottlenecks as well as catalysers of economic development. This procedure has the advantage that only comparable countries are used for comparisons in the sense of benchmarks concerning their future orientation and innovativeness. This avoids a major problem of all international comparisons, namely neglecting the complex interdependencies and complementarities stemming from two sources: First, countries composed of very different pillars (e.g., the Slovenian vs. the Croatian public pillar) are not used for comparisons and for deviating policy conclusions. Second, within groups of countries with similar structures of pillars, one can analyze the joint functioning of the industrial, the public and the financial pillars. Besides the design of the 3-pillars, one can thus demonstrate that an important dimension of economic development is constituted by the co-evolutionary relations between the 3-pillars.

Our methodology of pattern detection allows for a fine-grained analysis of the composition of the main institutional and structural components of an economy (the 3-pillars: industry, finance and public sector) in the various countries with a particular orientation towards the future. This cluster analysis has provided strong evidence for a pronounced heterogeneity in the structural composition of the eleven observed countries. Only Slovakia and Latvia are found to be in the same cluster for the global analysis as well as all subsectors which we analyzed. Interestingly,

both countries have experienced rather successful economic growth rates before the crisis and their future orientation might serve as a benchmark for other economies in their clusters. Furthermore, we cannot detect a clear geographic pattern in the overall analysis. The Baltic States do show some homogeneity in certain subgroups as do the Black Sea abutters Bulgaria and Romania. Nevertheless, there is no clear and persistent geographical structure visible comparable to the situation for Western European countries.

Future research should concern within-the-cluster analyses in order to show rankings in the specific groups and point to bottlenecks or benchmark situations. With the help of linear programming tools such a ranking can be performed which will allow to evaluate the relative strength of single economies in their clusters concerning their future orientation. A dynamic analysis could further help to detect the changes in these patterns in time. In particular, the current financial and economic crisis very likely will change the current pattern due to different defense strategies. Looking at the shifts produced and the country structures which have proven to be better suited to cope with the crisis might be an insightful goal for future research.

The empirical analysis of the capabilities of the EU countries in achieving the goals of the Lisbon Agenda presented here allows for the design of a sound, well balanced and differentiated policy. This policy design, on the one hand, avoids being too general in the sense of neglecting the heterogeneity of countries in the European Union. On the other hand, it considerably reduces the complexity which stems from this heterogeneity by grouping countries with similar pillar compositions. This allows for a well-adapted design of policy measures according to the specificities of the various country groups identified in Europe and differing according to their innovativeness and future-orientation (i.e., their capabilities to achieve the goal of the Lisbon Agenda). The development of policy designs following CNSE is certainly on the agenda for future research.

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APPENDIX 1: INDICATORS USED IN THE ANALYSIS

Knowledge Base:

- Students' enrolment at the ISCED-levels 5–6 in science, mathematics, and computing, engineering, manufacturing, and construction in per cent of all students, 2003–2004
- Female students' enrolment at the ISCED-levels 5–6 in science, mathematics, and computing, engineering, manufacturing, and construction in per cent of all female students, 2003–2004
- Male students' enrolment at the ISCED-levels 5–6 in science, mathematics, and computing engineering, manufacturing, and construction in per cent of all male students, 2003–2004
- Graduates (ISCED 5–6) in science and technology in per cent of all fields, 2003–2004
- Female graduates (ISCED 5–6) in mathematics, science and technology in per cent of female graduates in all fields, 2003–2004
- Male graduates (ISCED 5–6) in mathematics, science and technology in per cent of male graduates in all fields, 2003–2004
- Graduates (ISCED 5–6) in science and technology in 1000s, 2003–2004
- Graduates (ISCED 5–6) in mathematics, science and technology per 1000 of population aged 20–29, 2003–2004
- Female graduates (ISCED 5–6) in mathematics, science and technology per 1000 of female population aged 20–29, 2003–2004
- Life-long learning (adult participation in education and training) – Percentage of the population aged 25–64 participating in education and training over the four weeks prior to the survey, 2002–2005
- Life-long learning (adult participation in education and training) – females – Percentage of the female population aged 25–64 participating in education and training over the four weeks prior to the survey, 2002–2005
- Life-long learning (adult participation in education and training) – males – Percentage of the male population aged 25–64 participating in education and training over the four weeks prior to the survey, 2002–2005
- Youth education attainment level – Percentage of the population aged 20 to 24 having completed at least upper secondary education, 2002–2005
- Youth education attainment level – females – Percentage of the female population aged 20 to 24 having completed at least upper secondary education, 2003–2005
- Youth education attainment level – males – Percentage of the male population aged 20 to 24 having completed at least upper secondary education, 2003–2005

Openness:

- High-tech exports: Exports of high technology products as a share of total exports, 2002–2004

Innovative Efforts:

- Gross domestic expenditure on R&D (GERD) – Percentage of GDP, 2002–2004
- Gross domestic expenditure on R&D (GERD) by source of funds – industry – Percentage of GERD financed by industry, 2002–2004
- Gross domestic expenditure on R&D (GERD) by source of funds – government – Percentage of GERD financed by government, 2002–2004
- Gross domestic expenditure on R&D (GERD) by source of funds – abroad – Percentage of GERD financed by abroad, 2002–2004
- Patent applications to the European Patent Office (EPO) – Number of applications per million inhabitants, 2002–2003
- Patents granted by the United States Patent and Trademark Office (USPTO) – Number of patents per million inhabitants, 2000–2003
- Percentage of GERD financed by industry in % of GERD, 2002
- Percentage of GERD performed by the Government Sector in % of GERD, 2002
- Percentage of GERD performed by the Higher Education Sector in % of GERD, 2002
- Personnel in R&D in Full-Time Equivalents (FTE), 2003
- Personnel in R&D in head count (HC), 2003
- Personnel in R&D in the Business Enterprise Sector in FTE, 2003
- Personnel in R&D in the Government and private Non-Profit Sector in FTE, 2003
- Personnel in R&D in the Higher Education Sector in FTE, 2003
- Number of researchers in FTE, 2003
- Number of researchers per million inhabitants in FTE, 2003
- Number of researchers in HC, 2003
- Number of researchers per million inhabitants in HC, 2003
- Number of researchers in the Business Enterprise Sector in FTE, 2003
- Number of researchers in the Government and private Non-Profit Sector in FTE, 2003
- Number of researchers in the Higher Education Sector in FTE, 2003
- Technical personnel in FTE, 2003
- Technical personnel per million inhabitants in FTE, 2003
- Technical personnel in HC, 2003
- Technical personnel per million inhabitants in HC, 2003
- Other R&D personnel in FTE, 2003
- Other R&D personnel in HC, 2003

Financial Sector:

- Total amount of Venture Capital invested in 1000 €, 2004–2005
- Venture Capital as a percentage of GDP, 2004–2005

Public Sector:

- Inequality of income distribution – Ratio of total income received by the 20% of the population with the highest income to that received by the 20% of the population with the lowest income, 2003
- At-risk-of-poverty rate before social transfers – total – Share of persons with an equivalised disposable income, before social transfers, below the risk-of-poverty threshold, 2003
- Early school-leavers – Percentage of the population aged 18–24 with at most lower secondary education and not in further education or training, 2003–2005
- Early school-leavers – females – Percentage of the female population aged 18–24 with at most lower secondary education and not in further education or training, 2002–2004
- Early school-leavers – males – Percentage of the male population aged 18–24 with at most lower secondary education and not in further education or training, 2003–2006
- Comparative price levels – Comparative price levels of final consumption by private households including indirect taxes (EU-25=100), 2002–2005
- Market integration – Trade integration of goods – Average value of imports and exports of goods divided by GDP, multiplied by 100, 2005
- Market integration – Trade integration of services – Average value of imports and exports of services divided by GDP, multiplied by 100, 2005
- Employment rate – total – Employed persons aged 15–64 as a share of the total population of the same age group, 2002–2005
- Employment rate – females – Employed women aged 15–64 as a share of the total female population of the same age group, 2002–2005
- Level of Internet access – households – Percentage of households who have Internet access at home, 2004–2005
- ICT expenditure – IT – Expenditure on Information Technology as a percentage of GDP, 2003–2004
- ICT expenditure – Telecommunications – Expenditure on Telecommunications Technology as a percentage of GDP, 2003–2005
- E-government usage by individuals – total – Percentage of individuals aged 16 to 74 using the Internet for interaction with public authorities, 2004–2006
- E-government usage by individuals – females – Percentage of individuals aged 16 to 74 using the Internet for interaction with public authorities, 2004–2006
- E-government usage by individuals – males – Percentage of individuals aged 16 to 74 using the Internet for interaction with public authorities, 2004–2006
- E-government usage by enterprises – Percentage of enterprises which use the Internet for interaction with public authorities, 2004–2006
- Broadband penetration rate – Number of broadband lines subscribed in percentage of the population, 2004–2006
- Total greenhouse gas emissions – Index of greenhouse gas emissions and targets in CO2 equivalents (Actual base year = 100), 2001–2004
- Energy intensity of the economy – Gross inland consumption of energy divided by GDP (index, 1995=100) Kgoe (kilogram of oil equivalent) per 1 000 Euro, 2001–2004

- Share of electricity from renewables to gross electricity generation: Ratio between the electricity produced from renewable energy and the gross national electricity consumption, 2001–2004
- GDP per capita in PPS – GDP per capita in Purchasing Power Standards (PPS), (EU-25=100), 2003–2006
- Real GDP growth rate – Growth rate of GDP volume – Percentage change on previous year, 2003–2006
- Labour productivity per person employed – GDP in PPS per person employed relative to EU-25 (EU-25=100) , 2004–2006
- Employment growth – total – Annual percentage change in total employed population, 2002–2005
- Employment growth – females – Annual percentage change in female employed population, 2003–2005
- Employment growth – males – Annual percentage change in male employed population, 2003–2005
- Public balance – Net borrowing/lending of consolidated general government sector as a percentage of GDP, 2002–2005
- General government debt – General government consolidated gross debt as a percentage of GDP, 2002–2005

APPENDIX 2: COUNTRY ABBREVIATIONS

Bg Bulgaria
Cz Czech Republic
Ee Estonia
Lv Latvia
Lt Lithuania
Hu Hungary
Pl Poland
Ro Romania
Si Slovenia
Sk Slovakia
Hr Croatia