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Applying a Comprehensive Neo-Schumpeterian Approach to Europe and its Lisbon Agenda

Horst Hanusch, Andreas Pyka

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ABSTRACT

The paper shows that Comprehensive Neo-Schumpeterian Economics (CNSE) is an adequate theoretical approach accompanying the enforcement of the aims of the Lisbon Agenda. The CNSE approach is based on the principle of innovation and the idea of future orientation penetrating all spheres of economics which can be summarized in three domains of economic life: industry, finance and public sector, the 3-pillars of CNSE.
The CNSE approach is applied to an empirical study of 18 OECD countries using a three step procedure: In a first step 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. In a second step within the pillar clusters a performance analysis is exercised in order to rank the countries. Because of the similarities of countries within a cluster this comparative analysis can be done whereas for countries belonging to different clusters this comparison would lead to wrong conclusions. In a final step as a crude representation of macro-economic performance the cluster composition is sorted by the average growth rates of the economies. This allows a first correlation of pillar composition and growth performance.

KEYWORDS

Lisbon Agenda, Comprehensive Neo-Schumpeterian Economics, European Country Patterns, future-oriented indicator-based model

JEL: O30, O40, L2, P0, G10, B52

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1. Introduction

In March 2000, the EU Heads of States and Governments agreed in the so-called *Lisbon Agenda* to make the EU "the most competitive and dynamic knowledge-driven economy by 2010". This goal has to be considered as extremely challenging and extraordinarily difficult to be accomplished. From the point of view of economics the following major issues have to be addressed:

(1) First of all the decisive economic elements and forces responsible for the achievement of the agenda have to be identified.

(2) An adequate economic approach has to be developed which explicitly includes these elements.

(3) For the application of this theoretical approach on the empirical realm the right methodological concept has to be found.

(4) The fourth major issue is to apply this operationalization 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 are also structuring the content of our paper. In the first section we deviate the economic substrate of the Lisbon agenda. It can be shown that the Lisbon Agenda is mainly based on innovation and the resulting future orientation. Then we elaborate that Comprehensive Neo-Schumpeterian Economics (CNSE) is the adequate theoretical frame suited for the

enforcement of the Lisbon agenda. In order to apply CNSE we develop in the following section an indicator based 3-pillar model composed of an industry, a financial and a public sector part. This 3-pillar concept is applied to 16 European countries, additionally Japan and US are included. The European countries include the old member states of the EU (besides Luxemburg). The new accession countries are not included.

In a next step we focus on dissimilarities and similarities of the various economies and their pillars. This analysis allows detecting whether there is a variety in the composition of the three pillars for the different countries, or whether one finds a convergent structure of groups of countries especially in Europe. This allows getting a first hint on the convergence and divergence of structures in geographic areas in Europe. This study is done by a cluster analysis.
After having discovered patterns for the pillars and having grouped the countries to clusters with similar pillars, we perform a ranking analysis within the cluster, i.e. only comparable countries are compared according to their pillar performance. This is done by a linear benchmarking program. In a final step as a crude representation of macro-economic performance the cluster composition is sorted by the average growth rates for the period 1996 to 2000 of the economies. This allows a first correlation of pillar composition and growth performance. Our paper ends with some conclusions and the agenda for future research.

2. 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 of 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 find most importantly 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. 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. Among other, these sources encompass besides

economic actors like entrepreneurs, firms and households as well as financial actors as banks, ventures capitalists and private equity firms also public actors and institutions like governments, universities, schools, research institutes, patent offices and regulatory authorities etc.

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

3. Comprehensive Neo-Schumpeterian Economics

The Lisbon agenda formulates a strategy for keeping and even improving the competitiveness of the European Union. Therefore, its overall goal has to be seen in securing the welfare for European citizens. Without doubt, economics is the science which focuses on economic welfare and the means to its increase. 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 both of these approaches.

One of the decisive differences of Neo-Schumpeterian Economics with respect to other approaches in economics can be found in the emphasis which is put on the 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, between the micro and the macro level of economic analysis the important meso-level is 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 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 behavior 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, 2006a)

To summarize, in Neo-Schumpeterian Economics the central actor 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, Neo-Schumpeterian Economics seems to be the most adequate approach in tackling the enforcement of the Lisbon Agenda. Nevertheless, to fulfill its extreme challenges, namely to hold successfully ground in a global innovation-oriented competition with the aim to enforce a development which makes *Europe to 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 (2006b). CNSE has to offer a consistent theory which encompasses all realms relevant to an improved understanding of the economic processes of 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 inevitably has to 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 even eliminated within these 3-pillars (figure 1).

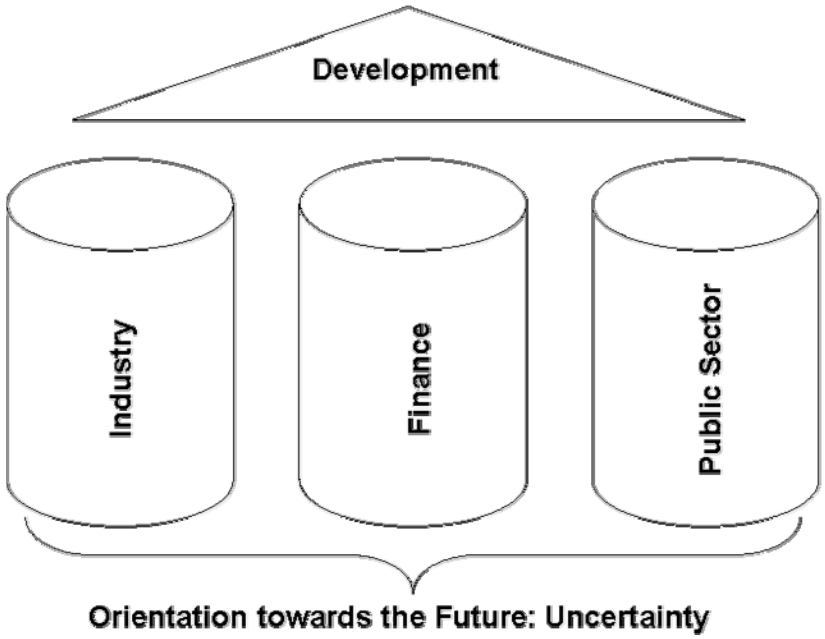

Figure 1: The three pillars of comprehensive Neo-Schumpeterian Economics

In order to understand the crucial co-evolutionary relationship, one has to consider 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 infrastructure, education etc. become the bottlenecks of system development.

A comprehensive Neo-Schumpeterian economic theory focusing on innovation driven qualitative development has to 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 this pillars and are also intrinsically interrelated. An improved understanding of the development processes can only be expected when the co-evolutionary dimensions of the three pillars are taken into account. This is illustrated with the concept of a Neo-Schumpeterian corridor shown in figure 2.

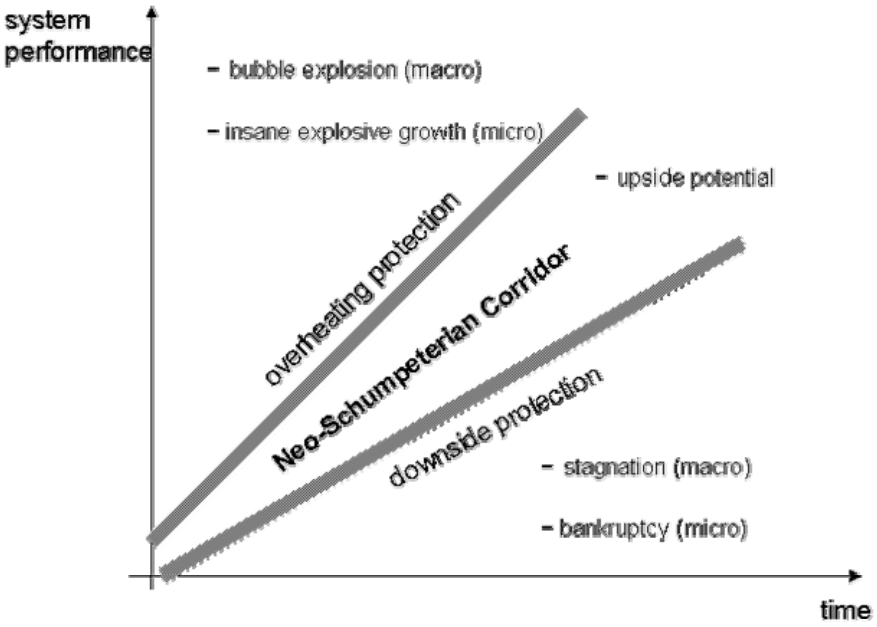

Figure 2: The Neo-Schumpeterian Corridor

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 is supposed 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, i.e. on the macro-level stagnation and on the micro-level bankruptcy.

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 restricted to industry only but also include the financial and public sphere of an economy and thereby encompass all spheres of economic and societal issues.

4. 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 of economies in highly developed countries from a Neo-Schumpeterian angle.

a) Data

To meet this target our analysis is grounded on a comprehensive set of indicators. In total, more than sixty variables have been collected, reflecting many different activities in the various economies which are related to innovation. Above all, the set of variables reflects structural specifics. But the data also comprise several indicators of the functioning of the economies, including outputs of the innovation process such as patents or the commercialization of technology- and knowledge-intensive goods and services on international markets. To summarize, the data we draw upon are supposed to reflect all sort 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 the OECD, especially its *Main Science and Technology Statistics*, its *Educational Database* and its *Patents Database*. From these three OECD 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. Further main data sources are the World Economic Forum and the UN.

b) 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 the indicators we use for the industrial pillar encompass various patent information with a particular focus on knowledge intensive industries in order to cover the sectoral composition of the pillar (Biotech, ICT, knowledge-intensive services) as well as cooperation (co-patenting). Furthermore, the international orientation is depicted by a couple of indicators such as FDI and foreign trade.

Also for the *financial pillar* we emphasize its future orientation which accordingly has to be expressed in the selection of indicators. A first set of indicators reflects the financing of innovative activities in particular venture capital involvement in the various stages (founding and expansion phase, VC availability) of the entrepreneurial innovation process. A second set of indicators covers the organizational dimension of financial markets (soundness of banks etc.) and their degree of sophistication. Finally we include the difference between short- and long-term

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

macro-economic interest rates to consider the transformation process between the monetary and real sphere of an economy.

The future orientation of the *public pillar* is divided into five groups of indicators covering public revenues and expenditures, the knowledge and information infrastructure, education and science as well as the institutional framework governing development. Besides public expenditures on R&D, the expenditures for programmes of technology policy are covered by indicators (GOVERD etc.). Infrastructural information is contained in indicators describing the quality of internet access etc. Indicators describing the education sector encompass quantitative information (e.g. HERD) as well qualitative information (e.g. class room size), stemming mainly from the OECD PISA study. The science sector is included by indicators like number of publications etc. Indicators concerning the framework conditions of development include an index of regulatory quality and political stability etc.

5. 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 the respect to the future orientation and innovativeness of the economies.[2]

a) The method: Cluster analysis

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 sample for the degree of structural commonalities between the units of analysis. Its outcome is a categorisation of the analyzed units so that the coherence of each group (or cluster) as well as the heterogeneity across different clusters is to be 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. That is because this 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:

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

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

Here, a_{ik} represents the parameter value of characteristic $k=1,\ldots,m$ for country $i=1,\ldots,n$. Thus, the entire quantitative data matrix is $\mathrm{A} = (a_{ik})_{m \times n}$.

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. eighteen countries in total) and at the same time by a relatively large number of variables (more than sixty variables in total) and 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:

$v(K,L) = \frac{1}{|K| \cdot |L|} \sum_{\substack{i \in K \\ j \in L}} d(i,j)$, 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 $\bigcup_{K \in \mathrm{K}} K = N$, with N being the total amount of analyzed objects. A disjunctive partition meets the condition that $K, L \in \mathrm{K}, K \neq L$, so that $K \cap L = \phi$. The clustering method is applied to each pillar of the countries under study.

To introduce the results from the cluster analysis, it is first shown how the optimal number of different classes for the different pillars has been derived from the employed data. For this purpose, the so-called elbow criterion is applied. This is a commonly employed measure in cluster analysis that will be briefly described below. In a second step, the found composition of the various country clusters is introduced and interpreted.

b) Cluster determination

The following three figures (Figures 3, 4 and 5) display for the various cluster analyses that have conducted a measure of quality of the different stages of the clustering process. For all different steps in the hierarchical clustering analysis, this measure indicates the degree of similarity between those two clusters that are consolidated at different stages of the clustering process on the basis of distance values between the entities. Low coefficient values indicate strong coherence of two clusters that are to be consolidated, a high coefficient value points to little similarity across the objects belonging to the two clusters that are merged in a certain clustering step. The results of this inter-group distance coefficient can be directly used in order to determine an appropriate number of clusters. It arises when a further merging step would result in sharp rise of the coefficient, i.e. a strong loss in the coherence of the different clusters and thus in a strong quality reduction of the entire classification.[3]

The figures 3, 4 and 5 show the application of the elbow-criteria for our case of the 3- pillars. The appropriate number of clusters which can be identified for the industrial and public pillar is six, for the financial pillars we find four different clusters with intra-cluster homogeneity and inter-cluster heterogeneity.

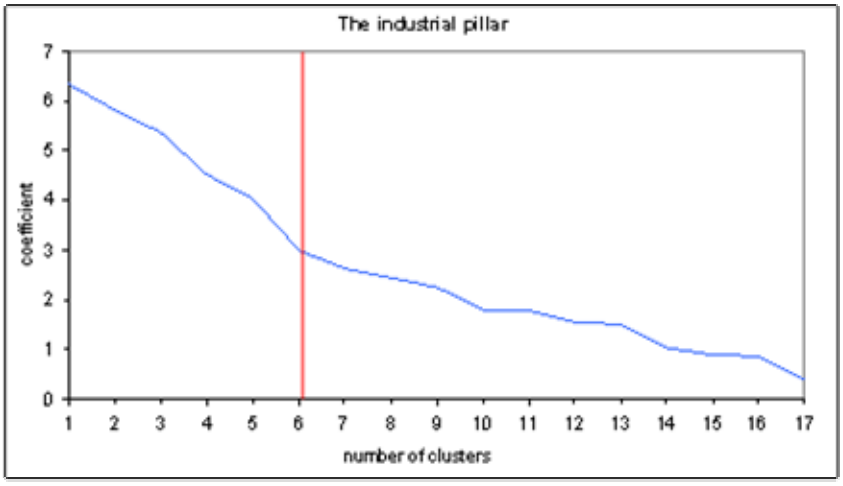

Figure 3: Appropriate number of clusters of industrial pillars

[3] According to its graphical representation, this decision criterion is called *elbow criterion*. The top left chart in Figure 2 shows the inter-cluster coefficient values for the industry pillar, and it exemplifies very clearly that according to the elbow criterion the appropriate number of clusters for this pillar is six.

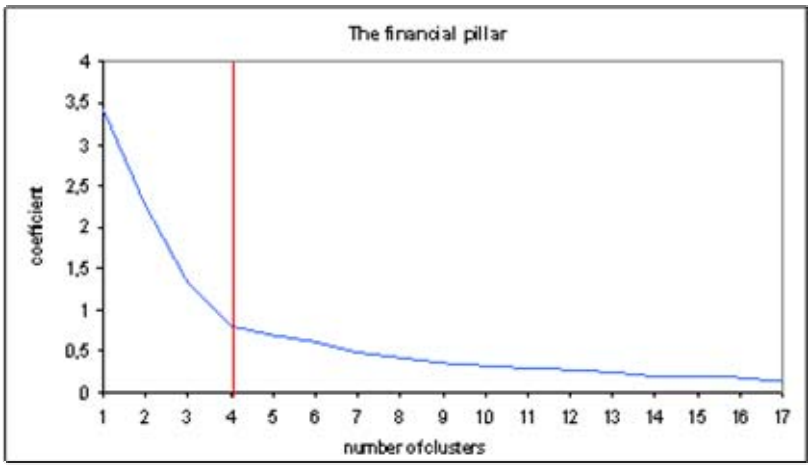

Figure 4: Appropriate number of clusters of financial pillars

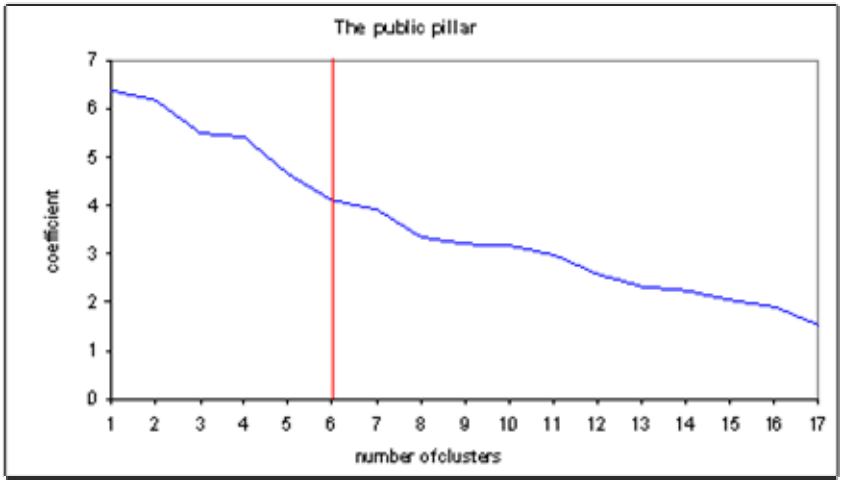

Figure 5: Appropriate number of clusters of public pillars

6. Empirical Results

The following sections deal with the description of detected clusters, a ranking of countries within a single cluster as well as a correlation of cluster composition with economic performance approximated by average growth rates.

6.1 Country Pillar groups

In order to represent the country clusters graphically the figures 6 a, b, c are organized as follows: The upper line includes the country codes (the meaning of the abbreviations for the different countries is explained in the appendix). The lower line includes the mapping of the countries to the various clusters which is expressed by numbers and colours.

A first result which shows up in all three pillars is a strong geographical determination of cluster affiliation. Japan and the U.S., the two non-European countries in our sample, always go separately and form independent clusters. For the European countries also membership in the

European Union seems to play a certain role as can be seen in the case of Switzerland which forms its own cluster in the industrial and public pillar. Only with respect to the financial pillar, Switzerland is allocated to a larger group of countries belonging to the European Union. Norway, also not a member country, nevertheless, seems to have commonalities with other member countries, in particular from Scandinavia. These communalities are responsible for Norway to join the European clusters.

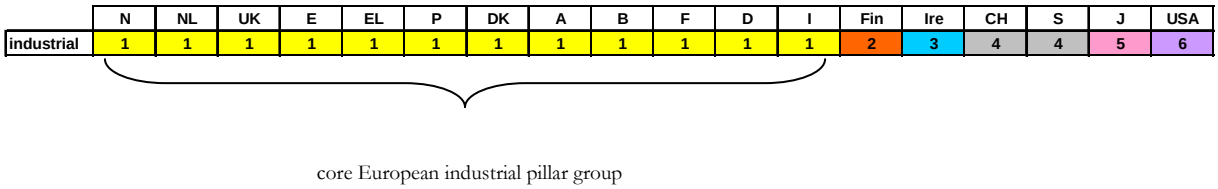

Figure 6a: Country clusters of industrial pillars

A central result concerning the industrial pillar is a large cluster including 12 countries, which may be labelled as *core European industrial pillar group*. This might be interpreted as a hint on strong structural similarities within European countries concerning the innovativeness and future orientation prevailing in the industrial sphere. This result does not mean that the different countries are characterized by the same quantitative values, only the structural composition is similar. Not surprisingly, the tremendous catch-up process of the Finish industry in the 1990s leads to a single cluster solution which justifies to stress the particular role of the country often coined as the "Nokia-effect". The large engagement of foreign firms in production activities together with framework conditions supporting entrepreneurial activities in Ireland also leads to a single country cluster. This obviously corresponds to a widely used description of this country as the "Celtic Tiger". Finally, the industrial pillars of Sweden and Switzerland are with respect to the core European cluster as well as the other single country clusters different enough to form an own pillar group. For this result, one might make responsible a similar strong orientation towards knowledge-intensive industries (Biotech, ICT) of the two economies.

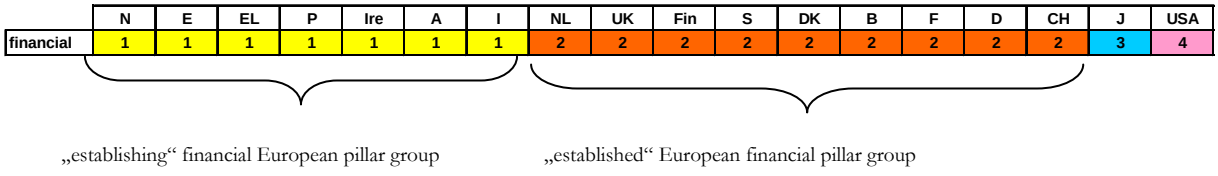

Figure 6b: Country clusters of financial pillars

Concerning the financial pillars we find two clusters in Europe which surprisingly do not coincide with the Euro-zone. Due to the strong emphasis of the future orientation in our indicator-based model instead a pattern emerges which might correspond to different development stages of national financial industries. Whereas one cluster, which we labelled the "established European financial pillar group" includes the countries of the so-called "blue banana" in northern and central Europe, the other cluster, labelled as the "establishing financial European pillar group", encompasses mainly Mediterranean countries as well as Norway, Ireland and Austria. This might reflect a different orientation of the financial industries with stronger emphasis towards traditional business and less knowledge intensive industries (agriculture, natural resources etc.).

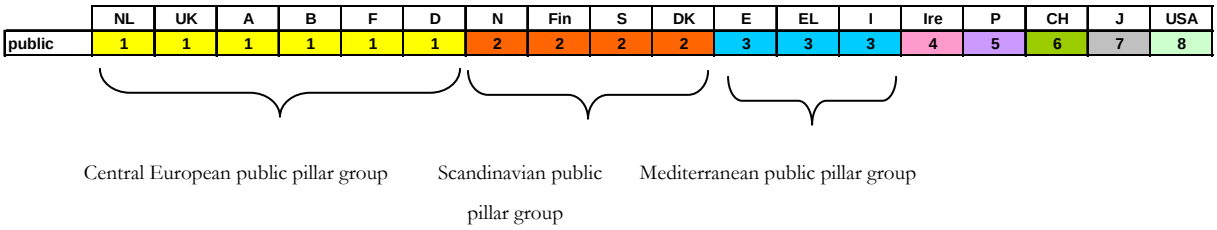

Figure 6c: Country clusters of public pillars

The pattern of clusters of public pillars shows to be determined geographically: We find three larger clusters, a central European, a Scandinavian and a Mediterranean public pillar group. For the group of Scandinavian countries the alignment to one cluster clearly follows the idea of the Scandinavian welfare state which shapes the design of the public sector even visible with regard to the future orientation. This holds in particular for the education and science sector and the importance which is attached to a highly developed public infrastructure.

Obviously different enough to the Scandinavian strong welfare-orientation, the clustering algorithm identifies a Central European public pillar group. Here the social responsibility of the public sector is also pronounced, but the particular public areas with a high future orientation like the education system and the knowledge infrastructure seem to play a minor role.

Concerning the Mediterranean public pillar group encompassing Spain, Greece and Italy, the public sector has a different influence on economic life compared to the Scandinavian and Central European cluster. Behind this, one can assume a less dominant role in the social domain as well as in the domains of futurity. Especially, the education and knowledge system as well as the future-oriented public infrastructure seems to be less important.

Ireland, Switzerland and, surprisingly, also Portugal form their own country clusters and are therefore identified as structurally different to the other three European clusters.

6.2 Similarity Patterns and Performance

The cluster analysis has generated pillar groups of countries which show strong structural similarities and which are compared to other pillar groups sufficiently heterogeneous. In the following section we begin with an intra-cluster comparison by applying a ranking analysis of cluster performance. In the next section we compare the particular cluster composition of the various countries under study with their respective macro-economic performance referring to average growth rates of the years 1996 to 2000.

a) Pillar Performance Ranking

The ranking analysis is done by drawing on the indicators of the different pillars. In a first step, the empirical information of the single indicators is normalized between 0 and 1 in order to be linearly aggregated in a second step. The figures 7 a, b and c show the results of the rankings of the countries for the different clusters and pillars.

	N	NL	UK	E	EL	P	DK	A	B	F	D	I	Fin	Ire	CH	S	J	USA
industrial	1	1	1	1	1	1	1	1	1	1	1	1	2	3	4	4	5	6
ranking	8	4	5	10	12	9	3	7	1	6	2	11	1	1	2	1	1	1

Figure 7a) Country rankings of performance for the industrial pillars

	N	E	EL	P	Ire	A	I	NL	UK	Fin	S	DK	B	F	D	CH	J	USA
financial	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3	4
ranking	1	4	7	3	2	6	5	1	2	4	6	9	7	8	5	3	1	1

Figure 7b) Country rankings of performance for the financial pillars

	NL	UK	A	B	F	D	N	Fin	S	DK	E	EL	I	Ire	P	CH	J	USA
public	1	1	1	1	1	1	2	2	2	2	3	3	3	4	5	6	7	8
ranking	1	3	5	4	6	2	4	1	2	3	2	1	3	1	1	1	1	1

Figure 7c) Country rankings of performance for the public pillars

The comparison of the country rankings in the various clusters and the 3-pillars leads to some revealing insights. For instance, Germany is ranked on second place in the large European industrial cluster, and also holds the second place in its public pillar cluster, the Central European public pillar group. However, the results concerning the financial pillar of the "established" European financial pillar group are comparatively bad; Germany is ranked only on place 5, which means that the future orientation here is only less pronounced compared to countries like the Netherlands and the United Kingdom ranked on place 1 and 2 respectively. From this, one can conclude, that major bottlenecks for the development of the German economy with respect to other European economies in its clusters are rooted to a high degree in the composition of its financial pillar.

A similar case is Denmark which is placed on rank 3 in its industrial and public pillar group, but only holds rank 9 in its financial pillar group. Also here, the financial pillar shows only an underdeveloped orientation towards the future restricting its developmental potentials.

An interesting example is also given by the UK which holds rank 3 in its public pillar group and rank 2 in its financial pillar group. However, the strong trend towards de-industrialization since the 1980s is only partly compensated by the creation of a strong knowledge-intensive service industry. So this has left its mark in the British industrial pillar, where the UK holds only the 5th rank in its group. Accordingly, our method suggests a relative weak future orientation of the British industry pillar compared to other European countries in its cluster.

In the large Central European clusters the Netherlands are an impressing case: The Netherlands hold the first ranks in their public and financial pillar clusters and are also in the first third of its industrial pillar cluster. Accordingly, the Netherlands seem to be well prepared concerning their future orientation of its economy in the sense of CNSE.

The Italian economy gives an example in the other direction: Italy holds in all its pillar clusters nearly the last ranks. It is ranked on 5 in its financial pillar cluster, ranked as next to last in its industrial pillar cluster and last in its public pillar cluster. The clearly indicates that the Italian economy has serious deficiencies in its future orientation.

So far, our results are restricted to the performance of the 3-pillars of countries in their different clusters. Although the advantage is that in this case only structurally similar and not heterogeneous countries are compared, the particular rankings tell nothing about coherent pillar compositions with respect to macro-economic performance. This will be done in the next section.

b) Pillar Constellations and Growth Performance

In figure 8 the countries are ordered according to their average growth performance of the years 1996 to 2000. To establish a relation to our concept of the *Neo-Schumpeterian Corridor* we introduce four different growth classifications. They range from "very high" (vh) which means an average growth rate higher than 4 percent, to "high" (h) with an average growth rate between 3 and 4 percent, "medium" (m) with an average growth rate between 2 and 3 percent and "low" (l) with an average growth rate below 2 percent.

	Ire	Fin	USA	P	E	NL	N	EL	S	UK	F	A	B	DK	I	CH	D	J
industrial	3	2	6	1	1	1	1	1	5	1	1	1	1	1	1	5	1	4
financial	1	2	4	1	1	2	1	1	2	2	2	1	2	2	1	2	2	3
public	4	2	8	6	3	1	2	3	2	1	1	1	1	2	3	7	1	5
growth	vh	vh	vh	h	h	h	h	h	h	h	m	m	m	m	l	l	l	l

Countries with hyper dynamics?

Countries within the Neo-Schumpeterian Corridor?

Countries dropped out the Neo-Schumpeterian Corridor ?

Figure 8) Growth performance and pillar composition

In the group of countries with "very high" average growth rates we find Ireland, Finland and the United States. In this group one might ask the question whether the countries have left in the years observed the Neo-Schumpeterian Corridor in the upper direction and run the risk of potential hyper dynamics. Interestingly, the pillar compositions of these three, with respect to their growth performance most successful, countries are completely different. A similar result also shows up for the other growth clusters with lower performance.

At the other end of the growth performance scale we find four countries, namely Italy, Switzerland, Germany and Japan. For these countries accordingly, one might ask the question whether they have left the Neo-Schumpeterian Corridor in downwards direction and find themselves in an area of stagnation. Again, a look at the pillar composition of these four countries shows that it is completely different.

The country groups with "medium" and "high" performance we integrated and suggest placing them within our Neo-Schumpeterian Corridor. Again, no specific pattern of pillar composition responsible for a specific growth performance can be detected.

This observation becomes even more puzzling, when countries with similar pillar compositions are compared according to their average growth rates as it is shown in figure 9.

	NL	UK	F	B	D
public	1	1	1	1	1
financial	2	2	2	2	2
industrial	1	1	1	1	1
growth	h	h	m	m	l

Figure 9) Similar pillar compositions and varying growth rates

Figure 9 displays 5 countries which in all 3-pillars are allocated in the same clusters. This means that there are pronounced structural similarities concerning their future orientation. In this case one would expect also comparable growth performances. However, a look at figure 8 shows this is not the case, but that almost every growth performance becomes possible.

A potential explanation for this surprising case might be found when the results of the intra-pillar-cluster-rankings are additionally considered. If countries with lower performances are ranked behind those with higher average growth rates, the reason behind our observation would be obvious. In order to see, whether this is true, figure 10 displays the rankings of the five countries under consideration together with their average growth performances.

NL	UK	F	B	D
1	3	6	4	2
1	2	8	7	5
4	5	6	1	2
h	h	m	m	l

Figure 10) growth performance and pillar rankings

Figure 10) indicates that the relationship between the intra-cluster-ranking and growth performance is less trivial. This is strongly illustrated in the special case of France and Germany: Germany's growth performance is worst in this group of five countries with similar pillar composition. However, within all pillars France is ranked behind Germany. Nevertheless, the

growth rates of France are almost 1 percent above those of Germany within the observed time span. What might be an explanation for this strange finding?

To give a first answer to this question, we refer again to our CNSE approach. Besides the design of the 3-pillars, an important dimension of economic development is constituted by the co-evolutionary relations between the 3-pillars. Accordingly, complementarities and harmonised relations between the different pillars are also an essential prerequisite for prosperous economic development. In the case of France and Germany, we can conclude that a further deficiency of the German economy has to be seen in an imbalanced relationship between the industrial, financial and the public sector. Instead, France seems to be a case where the disadvantages shown in the ranking analysis are compensated by a relatively higher degree of balance, harmony and integration between the 3-pillars. The higher consistency among the French pillars might lead to hidden co-evolutionary forces which are supportive and benevolent with respect to the macro-economic performance.

7. Conclusions

Innovativeness and orientation towards the future are central elements of the Lisbon Agenda.

CSNE offers an appropriate theoretical approach to the enforcement of the Lisbon Agenda.

Our methodology allows for a fine-grained pattern 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.

There is no single and unique solution with respect to sound macro-economic growth and development, i.e. the same compositions of the 3 pillars allow for high as well as low growth rates.

It seems that the pillar performance within a cluster seems to influence also the macro-economic performance, at least bottlenecks or weak points for growth can be identified.

Furthermore, our methodology also highlights the importance of the interrelatedness between the 3 pillars. That concerns not only the composition but also the qualitative amalgamation of the 3 pillars at the organizational, institutional and political levels of an economy.

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Appendix 1: The indicator-based pillar model

Industrial Pillar:
BERD (Business Expenditure on R&D) in percent of value added of industry, 2000
BERD, average 1991 to 2000
Indirect labour costs in Euros (reciprocal values), 2000
Number of researchers per 1,000 labour force, 2000
USPTO patents per million population, 1999
EPO patents per million population, 1999
R&D personnel per 1,000 labour force, 1999
Triadic patent families per million population, 1999
Percentage of patents with foreign co-inventors, 1995-1997
Students going abroad in percent of all students, 2001
FDI in percent of gross domestic capital formation, average 1997-1999
FDI inward stock in percent of GDP, 1999
FDI inflows in percent of global total FDI inflows, average share between 1996 and 2000
Share in total OECD high- and medium-high-technology exports, 2001
Growth of high- and medium-high-technology exports (based on the corresponding OECD classification), 1992-2001, average growth rate per annum
Number of patents in biotechnology per million population, 2001
Number of co-patents in biotechnology per million population, 2001
Number of firms in biotechnology-based industries, 2003
Number of ICT patents per million population, 2001.
Exports of services in percent of GDP, 2001
Imports of services percent of GDP, 2001
Employment in ICT sectors, in percent of total national employment, 2001
Balance of trade in communications equipment, 2001

Financial Pillar:
Soundness of banks, 2001
Sophistication of the national financial market, 2001
Average level of short-term interest rates 1997-2001
Average level of long-term interest rates 1997-2001
Local equity market access, 2001
VC investment (founding phase) in percent of GDP, 1995-1999
VC investment expansion phase in percent of GDP, 1995-1999
Perceived VC availability, 2001

Locals' access to foreign capital markets, 2001
Access of foreigners to the local capital market, 2001

Public Pillar:
GOVERD (Government Expenditure on R&D) in percent of GDP, 2000
GOVERD, average 1991 to 2000
GERD (Gross Domestic Expenditure on R&D) in percent of GDP, 2000
GERD, average 1991 to 2000
Tax burden for companies (corporate income tax, highest level, on non-distributed gains, reciprocal values), 2001
Tax burden for households (highest level of income tax, reciprocal values), 2001
Index of political stability, 2002
Index of regulatory quality (higher values indicating lower regulatory burden), 2002
Average annual real GDP growth, 1996-2000
Quality of internet access, broadband penetration rate, 2001
Number of personal computers per 100 inhabitants, 2001
Internet users per 100 inhabitants, 2001
Business internet penetration, number of internet hosts per 10,000 inhabitants, 2001
Number of secure internet servers per million inhabitants, July 2001
Employment rate of university graduates, 2001
Employment rate of the population that has attained tertiary education and is aged 25-64, 1999
Perceived R&D subsidies, 2001
Perceived R&D tax credits, 2001
Tax treatment of R&D for large manufacturing firms, 1999-2000
Tax treatment of R&D for small manufacturing firms, 1999-2000
Number of scientific publications per million population, 1999
Percentage of scientific publications with a foreign co-author, 1995−1997
Percentage of the population of 25- to 34- year-olds that has attained tertiary education, average 1993-2000
Total expenditure on non-tertiary education in % of GDP as of 2000
Total expenditure on tertiary education in % of GDP, 2000
HERD in % of GDP, 2000
Teaching staff per 1,000 students in primary and secondary educational establishments, 2001
Graduation rates at PhD level, 2001
Total public expenditure on education, all educational levels combined, 2000
Change in expenditure on educational institutions (1995, 2002)
Public Expenditure on tertiary educational institutions as a percentage of GDP 2002
Mathematical abilities, two upper quarters 2003
Teacher salaries in upper secondary education, 2003
Wage differential (tertiary-upper secondary), 2003
Classroom size, 2003

Appendix 2: Country abbreviations

A	Austria	FIN	Finland
B	Belgium	I	Italy
CH	Switzerland	IRE	Ireland
D	Germany	J	Japan
DK	Denmark	N	Norway
E	Spain	NL	the Netherlands
EL	Greece	P	Portugal
F	France	S	Sweden

UK United Kingdom
USA United States of America