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**HOMOGENEOUS GROUPS WITHIN A
HETEROGENEOUS COMMUNITY-
EVIDENCE FROM AN INDEX
MEASURING EUROPEAN ECONOMIC
INTEGRATION**

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Homogeneous groups within a heterogeneous community - Evidence from an index measuring European economic integration

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Abstract

In the light of the current economic debt crisis within the Euro zone, the heterogeneity of EU members has becoming increasingly apparent. This heterogeneity is evident not only in some single macroeconomic variables but also in the level of economic integration with the other EU members. Despite the common use of the term “European integration”, neither a uniform definition nor a holistic economic approach to this concept exists. Thus, the different steps and processes of European integration are hard to quantify, thereby making it almost impossible to argue objectively whether an individual EU member state has fallen behind the general speed of European integration or whether the distance to a potential core group is undesirably large. In order to fill this gap, we have developed a composite indicator – the EU-Index – measuring the extent of European economic integration of the EU member states. The EU-Index exhibits large heterogeneities between the member states with respect to overall European economic integration and with respect to various sub-indices. By using cluster analysis, however, we find relatively homogeneous country groups within this heterogeneous community. The prevailing economic heterogeneities combined with the strong and even growing clustering of EU members may create fundamental difficulties for further integration of the European Union, and may even put existing integration steps (such as the creation of the European Monetary Union) into question. The EU-Index thus offers a unique statistically solid base for political discussions and empirical investigations, since now the degree of European economic integration is numerically tangible and can be determined individually for each country.

Keywords: European Union, economic integration, multivariate analysis.

JEL classifications: C 43, F 15, F 55.

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1 Introduction

The European Union (EU) is a unique community of 27 sovereign countries, which are politically connected and economically tied through the various steps of European integration. To foster economic ties between its member states is one of the main objectives of the EU's integration policy "in creating an ever closer union" (Preamble TEU). Moreover, the European Union seeks to promote economic, social and territorial cohesion by "reducing disparities between the levels of development of the various regions" (Art. 174 TFEU).

Despite this integration policy, the EU member states still demonstrate large heterogeneities with respect to their economic performance. Although they are committed to the same *acquis communautaire*, economic research has found heterogeneous outcomes for the investigated member states by analyzing trade integration (e.g. Badinger 2005, Baldwin 2006), monetary integration (e.g. de Grauwe 2006, Mongelli and Vega 2006), capital market integration (e.g. Baele et al. 2004), labor market integration (e.g. Nowotny et al. 2009) or institutional integration (e.g. Mongelli et al. 2007). While economic research is thus able to compare the economic performance of the EU members within one specific field, it is not able to give an overall comparison of the members' heterogeneity across the various fields of European economic integration.

In order to fill this gap, we have developed a composite indicator measuring the extent of European economic integration in the EU member states. This "EU-Index" will be able to determine the degree of European integration on an annual basis since the formation of the European Monetary Union (EMU) in 1999. It can be used to evaluate a country's level of integration for a certain year and to analyze whether a member state has fallen behind the general speed of integration for a given period. The index is designed to offer a solid analytical foundation for economic developments and political decisions in the European Union, which are usually justified by referring, quite unspecified, to "the need of deeper European integration". Since there is no common definition of the concept of European integration, the EU-Index will be composed of various mostly economic indicators, capturing the variety of forms of integration in different markets and with respect to different economic outcomes. In order to develop this complex index, we use the following procedure:

- 1) analyzing the structure of European integration,
- 2) identifying adequate integration indicators according to their economic legitimacy and relevance,
- 3) normalizing the data and using appropriate statistical methods to assign proper weights to the individual indicators.

Eventually we will present the EU-Index, in which the EU member states can be ranked according to their current level of European integration. This ranking order gives a first impression of the extent of heterogeneity between the member states. In order to investigate more closely whether heterogeneity differences have led to the formation of country groups pursuing their own speed of integration, a cluster analysis is performed at the end of this paper. The thereby identified country groups are exactly those groups that are counterparts in the current Euro zone debt crisis.

2 Structure and characteristics of European integration

The structure of European economic integration is characterized by two different forms of integration policy: market integration and institutional integration. Market integration aims at the removal of tariffs, quotas and non-tariff barriers to trade as a first step. Liberalizing and opening up the markets of all goods, services, and their production factors leads to the formation of a common market (Balassa 1961). Institutional integration focuses on allocating political competences to the supra-national level, e.g. in order to reduce transnational market inefficiencies. The highest stage of institutional integration is the formation of a political union, to which all important national sovereignties are transferred.

The indicators to be analyzed in the EU-Index can be derived from both market and institutional integration. Following Balassa's "stages of economic integration", the highest stage of market integration can be represented by the European Single Market. The European Single Market – with its four fundamental freedoms – ensures the free movement of goods and services within the European Union (intra-European trade), which in turn should result in positive welfare effects, according to traditional trade theories. It also attempts to ensure efficient intra-European movements of capital and labor, thereby improving factor allocation within the EU. Since the European Union as a customs union imposes a common external tariff, this discrimination against third

countries (and the possibility of retaliatory tariffs) further enhances the amount of intra-European trade, both through trade diversion and trade creation (Viner 1950).

Increasing intra-European trade and optimizing intra-European factor movements is expected to eventually equalize the prices of goods and services (“law of one price”) and the factor prices (Lerner-Samuelson theory) in the integration area. Per capita income is supposed to converge through the equalization of factor prices as well, meaning that the per capita income levels of less developed countries will tend to catch up with the per capita income levels of advanced economies.

The convergence of European economies, implying greater homogeneity among them, can also be supported by institutional integration, for instance, through a common regulatory framework, reducing transactions costs and friction losses and therewith enhancing intra EU-trade, capital flows and labor migration. Convergence of per capita income is also supported by the cohesion policy of the European Union, where European regions and countries whose per capita GDP is far below the EU average receive financial assistance for structural projects.

After all, the idea of endogeneity of the optimum currency area (Frankel and Rose 1998) proposes that the intensity of transnational capital and goods mobility will increase in a monetary union (mainly through reduced transaction costs, the loss of currency risks and enhanced price transparency). Especially the former weak-currency countries are then more likely to attract foreign capital through the decreased long-term interest rates as the currency risk runs off. If this capital is invested in an efficient and productive manner and not solely spent for consumptive purposes, the European economies are expected to converge.

However, Myrdal (1957) and Hirschman (1958) argue that deeper market integration may also have diverging effects on the regions’ per capita income. According to new growth theory, increasing economies of scale, spillover effects, and endogenous technological progress will favor especially advanced economies at the expense of less advanced economies (Lucas 1990). Additionally, new trade theory (and new economic geography) holds that spatial concentration of economic activities will lead to agglomeration effects and further increases these diverging effects (Krugman 1979, 1991).

Moreover, following the Prebisch-Singer thesis, an inter-industry trade specialization as defined by traditional trade theory may have a diverging effect on the countries’ terms of trade as world income is expected to increase. This effect in turn

implies diverging tendencies with respect to factor prices, prices of tradables, income per capita, and other main economic indicators in the integration area.

European integration, however, is characterized by growing intra-industry trade rather than inter-industry trade. Similar demand structures across advanced economies imply the production and trade of similar types of goods and services. By exporting and importing similar products, the income elasticity of the trading partners' export demand will be similar too. Thus, intra-industry trade is less likely to cause divergence effects (Dluhosch 2001, Giannetti 2002).

Assuming the above-mentioned intra-industry trade structure with similar demand patterns and the dependence on similar intermediate goods used in the manufacturing process, prevailing transnational co-movements of business cycles are usually expected. Market integration through increased intra-European trade, as well as institutional integration through a common refinancing basis interest rate within the European monetary union, should lower the risk of asymmetric shocks, implying an enhanced symmetry of business cycles between the member states (Furceri and Karrass 2008). However, a common monetary policy does not necessarily imply symmetry of the members' business cycles (Dorrucci et al. 2004). Since national inflation rates still differ between the member states, their real interest rates and real exchange rates are diverging. Different real interest rates imply different investment opportunities; diverging real exchange rates indicate differences in international competitiveness. Both will exert diverging impacts on macroeconomic performance.

Hence, both market integration and institutional integration can be captured by direct and indirect indicators. Cross-border market interrelations and contractual agreements at the EU-level can be treated as direct measurements of economic integration. Indicators measuring economic convergence (resp. homogeneity) and the symmetry of business cycles reflect indirect effects of economic integration.

With respect to these considerations we have chosen 25 indicators that need to be accounted for in the EU-Index and grouped them into four dimensions of European economic integration:

- 1) **EU Single market** (for goods, services, capital and labor)
- 2) **EU homogeneity** (level of convergence)
- 3) **EU symmetry** (of business cycles)
- 4) **EU conformity** (to EU law and institutional participation)

1) The degree of market relations in the EU Single market will be analyzed in two different ways: the sum of a country's intra-European imports and exports as a percentage of its GDP (so-called EU openness) and as a percentage of its total sum of imports and exports (so-called EU importance).¹ Trade in goods and services are investigated independently from each other. Capital movements are reflected by a country's stocks (intra-EU, inward and outward) of foreign direct investment (FDI).² Labor mobility is measured by foreign European workers as a percentage of all domestic workers (EU openness) and as a percentage of all foreign workers within that country (EU importance).³

2) EU homogeneity (or convergence) as a result of economic integration is not always expected by economic theory but primarily desired by politicians and the European Union itself. The indicators analyzing EU homogeneity are the countries' real GDP per capita, purchasing power standards, labor costs per hour, harmonized long-term interest rates (government bonds with maturities of close to ten years), public debt ratios (as a percentage of GDP), and implicit tax rates on capital and consumption. Each indicator is measured in relation to the arithmetic mean of the remaining EU member states. The population size of each country is accounted for in calculating the arithmetic mean.

3) EU symmetry is measured by using the most common indicators when analyzing the co-movement of business cycles: GDP growth rate, inflation rate, change in unemployment, and government net borrowing. Pairwise correlations between the country's value and the (moving) average value of the remaining EU member states are considered over a period of 20 quartiles, since this is widely regarded as an appropriate

¹ The two mentioned alternatives may lead to different results in certain situations: A country may be defined as "closed" because of showing a very low export ratio, but from the few exports most of it goes to the EU. This country would have a low level of integration according to the first alternative, but a relatively high level of integration according to the second alternative. For this reason, it may be reasonable to include both versions in the EU-Index. This approach is also found in Dorrucchi et. al. (2004).

² Limited data availability unfortunately does not allow us to consider more interesting indicators such as intra-EU portfolio investments or outgoing workers.

³ The analyzed indicators do not evaluate the main reasons why EU movements have increased or decreased between countries. There are certainly other driving factors apart from European integration such as geographic or cultural proximity. If we were to incorporate these factors we would have to weigh the data according to their bilateral regional distances. The developed EU-Index, however, is primarily interested in detecting the level of European integration, no matter what the driving factors are.

length for detecting business cycles.⁴ The average value of the remaining EU members is again weighted by the respective population size. Data in the time series is seasonally and trend adjusted (using Hodrick-Prescott filter with $\lambda=1600$).

4) EU conformity is captured through the member states' participation in economically relevant steps of European institutional integration and through their compliance with economically relevant EU law. Since most institutional steps were ratified uniformly across the EU member states, the major remaining disagreement relates to participation in the Schengen area and to membership of the European Monetary Union. Participation in the European Exchange Rate Mechanism (ERM II) is treated as "half-integration" towards EMU. Moreover, de jure agreement on the regulatory framework provided by the EU does not necessarily mean de facto compliance. In these cases, the European Commission (EC) is able to start infringement proceedings against countries violating EU law. The proceedings begin with the pre-litigation phase, where countries are urged through a so-called "reminder" to correct their violating behavior. The amount of new reminders per year is incorporated into our index. If member states do not act on the reminder and the following proceedings, the European Court of Justice (ECJ) finally decides on the case by verdict. All verdicts enter the ECJ's statistical database "InfoCuria". For the EU-Index, the convictions were gathered and assigned according to the following groups: "single market", "environment and consumer protection", and "other sectors".⁵

The EU-Index covers those member states that entered the European Union no later than 1995 (so-called EU-15), due to data restrictions. Indicators referring to "intra-EU" thus consider transnational movements between the EU-15. Since Luxembourg contains many extreme values, it is not considered in the index.⁶ Table A1 in the appendix gives a short description of the indicators and their source used for the EU-Index.

⁴ See Buch et al. (2005). Kitchin (1923) found evidence for a short business cycle of about 3 to 4 years, whereas investment cycles detected by Juglar (1862) cover at least 6 to 7 years.

⁵ See Busch (2009) for the assignment of groups.

⁶ An alternative approach for treating outliers is the application of percentiles in the normalization process, as done, for instance, by Dreher et al. (2008). However, then the index values will be distributed too smoothly within the designed scale, which leads to another distortion of the original data structure.

3 Measurement strategies in detail

The data incorporated into the index needs to be normalized in order to ensure data comparability. The normalization procedure will convert the data to a scale ranging from 0 to 100, where 100 denotes the maximum level of European integration ($I_{i,t}$) for country i in year t . This leads to the following normalization with respect to the individual sub indices:

The data belonging to “EU Openness” will be normalized to:

$$I_{i,t} = \frac{V_{i,t}}{V_{\max(j,T)}} \times 100 \quad (1)$$

The value of variable V of country i in year t is put in relation to the maximum value V_{\max} measured in all EU member states j in period T from 1999 to 2010. The maximum value is identified only once in this period and not for every single year in order to increase the quality of comparability over time. The closer a value comes to this maximum value, the greater its level of European integration.

The data measuring “EU Importance” is normalized as follows:

$$I_{i,t} = \frac{V_{i,t}}{V_{i,t}^{\text{world}}} \times 100 \quad (2)$$

Intra-European trade and factor movements are measured as a percentage of the country’s total (global) trade and factor movements. The more interlacing takes place with the European partners, the greater the level of European integration.

The normalization of the data measuring “EU Homogeneity” is carried out by:

$$I_{i,t} = \left(1 - \frac{|V_{i,t} - \bar{V}_{j,t}|}{|\max(V_{j,T} - \bar{V}_{j,T})|} \right) \times 100 \quad (3)$$

The difference between a country’s value and the average value of the remaining EU countries $\bar{V}_{j,t}$ reflects the degree of heterogeneity between this country and the rest of the EU sample countries.⁷ If this difference matches the maximum difference measured over the whole sample period, the maximum degree of heterogeneity is achieved. Absolute values are considered in this equation since for the observation of homogeneity (or convergence) it is irrelevant whether a value deviates positively or negatively from the EU average. Subtracting the (relative) degree of heterogeneity from 1 leads to the

⁷ Average values are weighted by the respective population size of each country.

respective level of EU homogeneity. The smaller the difference between a country's value and the average value of the remaining EU countries, the greater the level of EU integration.

The “EU Symmetry” of the members’ business cycles is measured as follows:

$$I_{i,t} = \text{corr} (V_{i,\tau}, \bar{V}_{j,\tau}) \times 100 \quad (4)$$

A pairwise correlation is carried out for a country's values and the average values of the remaining EU sample countries. The correlation takes into account period τ , covering the preceding 5 years (20 quartiles) for each value.⁸ A positive correlation of 1 represents the highest possible level of European integration in this field.⁹

Gauging the member states’ institutional conformity, “EU Participation” is treated as follows:

$$I_{i,t} = \begin{cases} 0, & \text{if "having flexible exchange rates"} \\ 50, & \text{if "participating in the European Exchange Rate Mechanism II"} \\ 100, & \text{if "being a member of the European Monetary Union"} \end{cases} \quad (5)$$

and

$$I_{i,t} = \begin{cases} 0, & \text{if "staying out of the Schengen Agreement"} \\ 100, & \text{if "participating in the Schengen Agreement"} \end{cases} \quad (6)$$

The member states’ “compliance with EU law” as part of their institutional conformity is normalized by:

$$I_{i,t} = \left(1 - \frac{V_{i,t}}{V_{\max(j,T)}}\right) \times 100 \quad (7)$$

Value $V_{i,t}$ represents here the amount of newly introduced infringement proceedings by the European Commission and the number of convictions by the European Court of Justice per year and country. The denominator contains the maximum amount of EU infringements measured in any of the countries over the whole sample period and therefore reflects the least possible level of European integration. Subtracting the

⁸ The index values of 1999, for instance, are derived from the 20 quartiles between 1995 and 1999, the 2000 index values from the 20 quartiles of 1996 to 2000, and so on.

⁹ Negative correlation values are also tolerated here. A value of 0 denotes non-correlation between the two analyzed figures and thus represents no influence on European integration. A value of less than 0, however, stands for an anti-cyclical behavior of a country's figures and should therefore be treated as disintegration.

(relative) number of EU infringements from 1 leads to the respective level of EU compliance. Committing no infringements would thus yield the highest possible level of EU integration in this field.

Before the 25 normalized indicators are entered into the EU-index, they will be weighted according to their statistical relevance with respect to European integration. The selection of an appropriate weighting and aggregation procedure is crucial to the development process of an index, since it has a direct effect on the outcome of the overall index-values and country rankings. The weights are to be derived from statistical models that respect both the underlying theoretical framework and the data properties. The weights then reflect their relative importance to European integration and the dimensions of the overall composite (OECD and JRC 2008).

Multivariate analysis using principal components is an appropriate weighting and aggregation technique that has gained increasing popularity with academics in recent years. In academic literature, principal component analysis (PCA) is used in different ways in order to develop a composite indicator. Some studies such as Lockwood (2001), Gwartney and Lawson (2001) and Dreher (2006) use PCA to derive the weights from the first component, irrespective of the overall suitability of the data set performing PCA and independent from the size of the eigenvalues and factor loadings of the remaining components. Our study, in contrast, uses PCA in a way similar to Noorbakhsh (1998) and Nicoletti et al. (2000), where the information received from the data before and after performing PCA is gathered and employed as much as possible. Building on this approach, the correlation structure of the data set will be considered in order to assess the suitability of the indicators that will perform a PCA. The computed components will then be analyzed to derive the optimum size of components to be retained. Rotation of the factor loadings will reassess the intended structure of the index and will finally assign adequate weights to the individual indicators. Our final weighting procedure differs from that of Noorbakhsh (1998) and Nicoletti et al. (2000) as we use oblique rotation instead of orthogonal rotation, thereby allowing for correlations between the factors, which takes into account the nature of the index variables in a more realistic manner.¹⁰

The matrix shown in Table A2 mostly reveals statistically significant correlations between the individual indicators. Especially within the designed groups of indicators, the correlation values are high and statistically significant. This gives a first statistical

¹⁰ Simple PCA is used rather than polychoric PCA since only eight percent of the data is discrete in nature.

reassurance that the underlying theoretical framework is well chosen and the indicators belong to the correct group.¹¹ The coefficient alpha, developed by Cronbach (1951) to estimate the reliability of measurement instruments by analyzing the internal consistency for composite scores, of 0.82 underpins the quality of the data. Bartlett’s test of sphericity (chi²: 3525.038, p-value: 0.000) and Kaiser-Meyer-Olkin’s measure of sampling adequacy (KMO: 0.62) also support the overall suitability of the data set.

It should be noted that the indicators measuring EU homogeneity enter PCA in terms of $V_{i,t}/\bar{V}_{j,t}$, as their previously presented normalization method for measuring the index-values heavily changes their original characteristics by restricting the maximum value attainable to the average value of the remaining member states. Only for performing PCA, a country’s value is therefore relativized by the average value of the remaining member states, which in turn allows the quotient to be greater than 1.¹²

The performed PCA suggests an extraction of three components. The scree test, first proposed by Cattell (1966), illustrates in Figure A3 a smooth decrease of eigenvalues after the fourth component, meaning that the eigenvalues could have the status of random correlations and should therefore be neglected. Besides, considering only those components that explain more than ten percentage points of total variance would also suggest an extraction of three components, as Table A4 demonstrates.¹³

Following Noorbakhsh (1998) and Nicoletti et al. (2000), the three extracted components will be rotated in order to reveal a simple structure in the pattern of factor loadings. In Table A5 the rotated factors with the highest loadings are highlighted. Considering the squared factor loadings multiplied by the share of variance explained by the corresponding component underlines again the well suited structure of the indicators. Indicators representing EU single market, EU symmetry and institutional conformity hold their highest value in the same respective component. Only the indicators reflecting EU homogeneity cannot simply be put into one component, but this is due to the limitation of three components.

¹¹ On the one hand, statistically significant correlations are a necessary precondition for performing a PCA. On the other hand, correlation values between two variables must not be too high (collinear) in order to avoid the inclusion of double counting into the index, which is not the case here.

¹² Comparability between the indicators is still assured since PCA uses standardized z-scores for all indicators, where the expected value is zero and the standard deviation and variance is one.

¹³ Parallel analysis and the Kaiser-Guttman criterion reveal unpractical and statistically non-efficient results of six and seven components.

The horizontal sum of the squared factor loadings multiplied by the share of variance explained by the corresponding component eventually assigns the weight to each indicator. In contrast to Noorbakhsh (1998) and Nicoletti et al. (2000), where only the highest factor loadings are used to calculate the individual weights, we incorporate the sum of all three factor loadings into our calculation. By disregarding the remaining factor loadings for each indicator, one has to accept a certain loss of information with regard to the total variance explained. Since both studies use orthogonal rotation each component explains one independent (uncorrelated) dimension of the total variance. Combining factor loadings would therefore harm this independent structure.

The analysis of European integration, however, does not exhibit dimensions that are considered to be independent from each other. The dimensions derived in this study (EU single market, EU homogeneity, EU symmetry and institutional conformity) do have an effect on each other's performance. They also have a mutual underlying motivation in disclosing the nature of European integration. An uncorrelated and thus isolated consideration of these dimensions would not reflect the intended pattern of European integration. Therefore, this study allows for correlation between the components by using oblique rotation of the factor loadings.

The correspondingly calculated weights for each indicator and dimension (sub index) are illustrated in Table A6. Sensitivity analysis was performed to assess the robustness of the calculated weights. Including and excluding single indicators, years and countries from the sample shows no significant effect on the composite values and their weighting scheme.

4 Results of the EU-Index

The EU-Index presented in Table 1 reveals country rankings and index points for the EU-15 (without Luxembourg) for the years 1999 and 2010. Belgium with 77.33 index points has the highest level of European integration in 2010, whereas Greece with only 43.65 index points is at the very bottom of the ranking. These figures demonstrate a large discrepancy between the most and least integrated countries in the European Union. This discrepancy was already present in 1999, but with lower index points. Apart from Spain, whose level of integration remained nearly the same, all the investigated EU member states were able to increase their level of European integration.

Table 1: Results of the EU-Index for 1999 and 2010

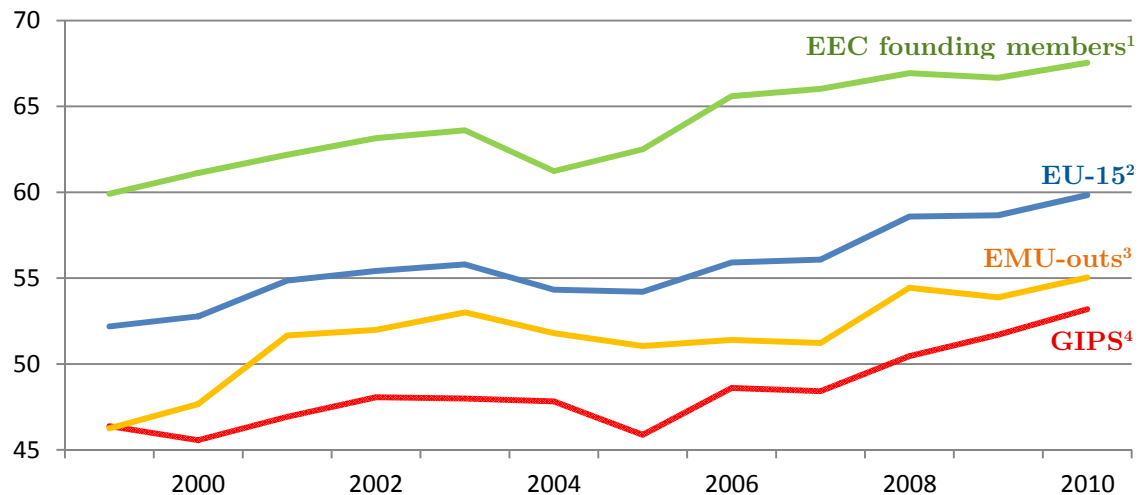
EU-Index 1999			EU-Index 2010		
Rank	Country	Index points	Rank	Country	Index points
1	Belgium	68.42	1	Belgium	77.33
2	Ireland	60.93	2	Austria	65.74
3	France	59.36	3	Netherlands	64.54
4	Netherlands	59.03	4	France	64.24
5	Spain	57.23	5	Germany	64.08
6	Austria	56.97	6	Ireland	62.38
7	Germany	52.86	7	Finland	61.54
8	Sweden	49.96	8	Sweden	57.22
9	Portugal	49.13	9	Spain	57.16
10	Finland	48.82	10	Italy	56.08
11	Italy	46.09	11	Portugal	55.86
12	United Kingdom	44.62	12	Denmark	55.72
13	Denmark	44.17	13	United Kingdom	52.17
14	Greece	33.09	14	Greece	43.65

Most of the founding members of the European Economic Community (EEC) are placed among the five most integrated countries in 2010, and only Italy demonstrates a low integration level. With respect to the euro zone, the EU-Index identifies four of the five "GIPSI" (Greece, Italy, Portugal, Spain, and Ireland) to be in the lower part of the ranking. The three non-members of EMU (Sweden, Denmark, and UK) also appear in the lower part. These differences in the level of European integration hold for the entire period since 1999, as Figure 1 shows.

In order to interpret these developments more closely, the sub indices representing the four dimensions of European integration need to be analyzed. The relevant tables are presented in the appendix. The sub index representing the Single Market accounts for nearly 40 percent of the EU-Index. The discrepancy between the most and least

integrated countries is therein even higher than in the total index. Comparing the values for 2010 with those of 1999 illustrates that some countries are actually less integrated today. These are the five GIPSI and the United Kingdom.

Figure 1: EU-Integration for certain country groups



Notes: ¹ without Italy; ² without Luxembourg; ³ Sweden, Denmark, UK; ⁴ Greece, Italy, Portugal, Spain.

The sub index measuring economic homogeneity in the EU shows that the member states are on average less homogeneous today. Important economic factors including per capita GDP, price levels, labor costs and public debts have diverged fundamentally across the EU members. The expected economic effects of Single Market integration and Monetary Union thus seem to cause heterogeneity in the EU rather than homogeneity.

The symmetry of business cycles, however, has improved considerably in the last decade. Whereas many countries have shown almost no co-movement effects in their economic activities in 1999, the members' business cycles seem to be strongly correlated today. In spite of the overall improved symmetry, Greece and Ireland are the members that are dragging behind the other EU members. Endogeneity of optimum currency areas implies that a common monetary union increases the amount of trade within that union, which ultimately adjusts the economic cycles of its member states (de Grauwe and Mongelli 2005). The overall improved symmetry detected by the EU-Index, though, only partly underscores this reasoning. In fact, the three non-members of the EMU (Sweden, Denmark, and the UK) were also able to increase their cyclical correlations to a great extent and are now better off than many EMU member states.

The sub index on institutional conformity shows no great changes in index values between 1999 and 2010. Although not a member of EMU, Denmark raised its level of institutional integration due to its low amount of infringement proceedings and ECJ verdicts and its participation in ERM II. Spain and Portugal, on the other hand, decreased their level of integration due to relatively high non-compliance with EU law. The United Kingdom is far behind the remaining EU member states when it comes to overall institutional conformity.

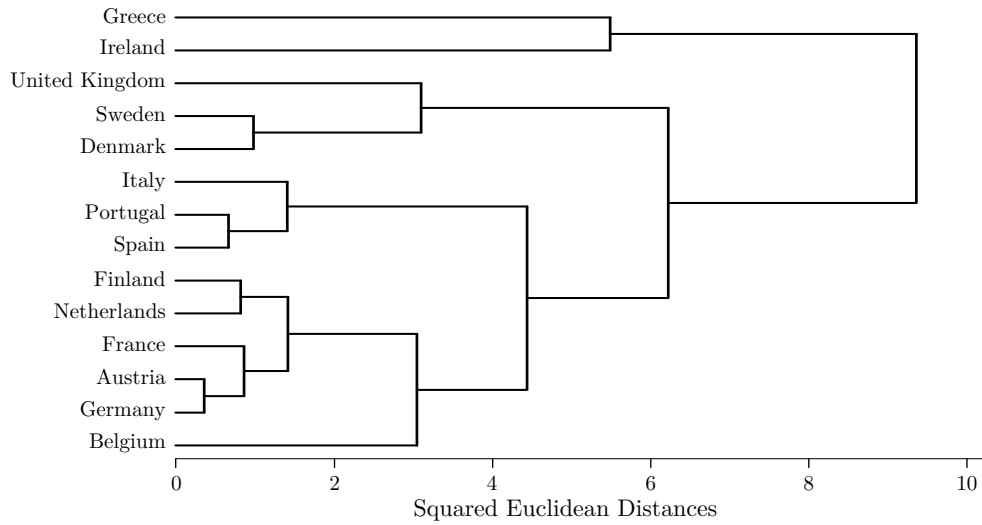
5 Heterogeneity in the light of cluster analysis

The EU-Index captures the member states' different levels of European integration. As shown above, the same countries often appear to be in either the upper or lower part of the various sub index rankings. The EEC founding members usually show high levels of European integration, whereas the GIPSI and the non-members of the EMU generally show integration levels below the EU average. Thus, the European Union seems to be a heterogeneous community, but with several homogeneous country groups. In principle, homogeneous countries are more likely to take similar integration steps based on common preferences. The identification of homogeneous country groups may therefore enhance the opportunity for these countries to undertake further (flexible) integration into the EU. The EU has laid down general arrangements for the principle of "enhanced cooperation" for this purpose, because growing economic heterogeneity among the member states is seen as one key problem to European integration in the future.¹⁴

To identify homogeneous country groups, a hierarchical cluster analysis (using Ward's clustering) is performed with the 25 indicators of the EU-Index representing European economic integration. The cluster analysis allows us to clearly uncover those countries that are most closely linked to each other. Squared Euclidean distances are used to cluster the member states. The dendrograms shown in Figures 2 and 3 reveal the country groups identified within the EU for 2010 and 1999, respectively.

¹⁴ For an analysis of enhanced cooperation in the EU using cluster analysis see Ahrens et al. (2007).

Figure 2: Dendrogram for 2010 (using Ward's clustering)

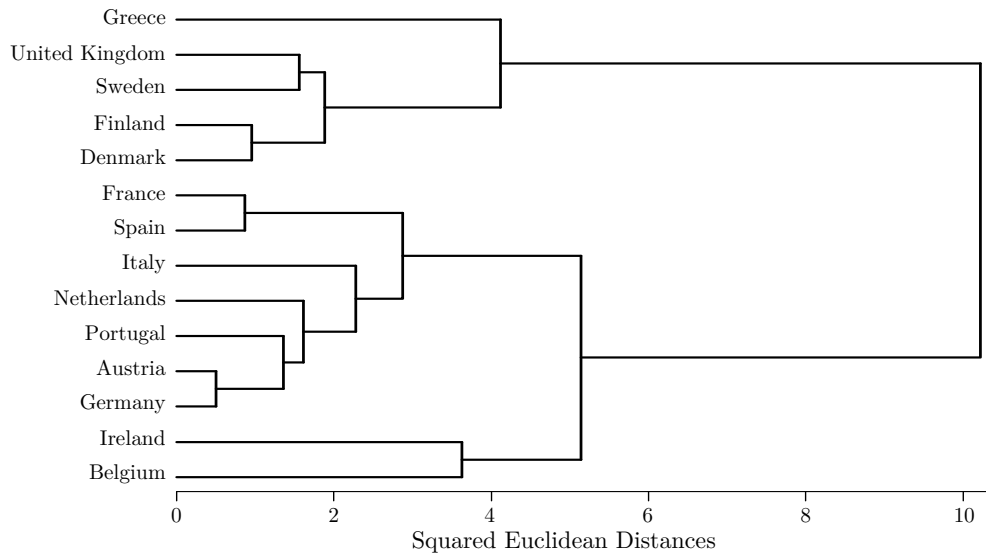


Germany and Austria are identified as the two countries with the lowest heterogeneity between each other. Together with France, Netherlands and Finland they form a group of countries that shows large distances to the other clusters. These countries shall be regarded as the “core group” of European integration in 2010. Belgium is the first country among the remaining member states to approach this core group.

Three of the GIPSI form the next cluster, namely Italy, Portugal, and Spain. They already display a large distance to the core group. The three non-members of the EMU form another cluster and are even further away from the core group. The largest distance is shown by Ireland and Greece. They are also part of the GIPSI and incidentally the two countries that have had to take part in lending operations by the European Financial Stability Facility (EFSF) at first. Portugal and – in the meantime – Spain are the other two countries financed by the EFSF.

In 1999 Greece was already the country with the largest differences to the other EU member states. By then, the United Kingdom formed a group together with the Nordic countries (Sweden, Finland and Denmark). Finland was at that time not part of a core group of European integration. The core group of 1999 was again led by Germany and Austria as those countries with the lowest heterogeneity. Together with France, Spain, Italy, Netherlands and Portugal, this former core group was much larger than today’s core group. According to the distance measure shown on the axis, however, those core countries were much further away from each other than today’s core countries. The same holds when Ireland and Belgium approach to this core group with great distance.

Figure 3: Dendrogram for 1999 (using Ward's clustering)



Thus, today's core group seems to be much more homogeneous than that of 1999. Whereas European integration was characterized mainly by two different country clusters in 1999, today's integration level reveals the formation of at least three clusters: a core group around Germany, Austria and France; a group of GIPSI; and a group of non-EMU states.

6 Conclusion

The EU-Index measures the individual level of economic integration for the member states of the European Union. It verifies that the member states indeed hold different levels of economic integration. Within the past decade, however, the EU countries were able to increase their individual integration level, except Spain.

By considering the overall index as well as the sub indices representing the four dimensions of European integration, one may assume that the EU countries form a heterogeneous community rather than a homogeneous group of countries with similar integration levels. Using cluster analysis confirms this assumption. Today's European integration is driven by a core group. To this core group belong Germany, Austria, France, Netherlands, Finland and – at some distance – Belgium. The GIPSI are far away from this core group, with Portugal, Italy and Spain forming one group and Greece and Ireland forming another group with the greatest distance to the other EU members. The

three non-EMU member states (Sweden, Denmark and the United Kingdom) are clustered together and also show great distances from the EU core group of countries.

The large economic heterogeneities and the strong and growing clustering of the EU members may create fundamental difficulties for negotiating further integration steps in the European Union and it may even put existing integration steps (such as the European Monetary Union) into question. Missing economic homogeneity is usually caused or accompanied by heterogeneous economic preferences and interests and unsuitable common policies. Moreover, it can increase the trade-off between integration and enlargement of the European Union, since future members of the EU and the EMU might be even more heterogeneous to this core group.

Thus, the EU-Index sheds light on the complexity of European integration, captures the content of the integration process, and offers a solid and statistical base for both political discussions and empirical investigations, since now the degree of European economic integration is numerically tangible and can be determined individually for each country.

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8 Appendix

A1: Description and sources of indicators measuring a country's European integration

Indicator	Description	Source
<i>EU Single Market</i>		
<i>EU openness</i>		
Trade in goods	Intra-European imports and exports of goods in percent of GDP.	Eurostat
Trade in services	Intra-European imports and exports of services in percent of GDP.	Eurostat
Capital movement	Intra-European stocks (inward and outward) of foreign direct investments in percent of GDP.	Eurostat, (UNCTAD)
Labor migration	Amount of European employees (ILO definition) in percent of the total number of employees (foreign and national).	Eurostat
<i>EU importance</i>		
Trade in goods	Intra-European imports and exports of goods in percent of total trade in goods.	Eurostat
Trade in services	Intra-European imports and exports of services in percent of total trade in services.	Eurostat
Capital movement	Intra-European stocks of foreign direct investments in percent of total FDI.	Eurostat, (UNCTAD, OECD)
Labor migration	Amount of European employees (ILO definition) in percent of the total number of foreign employees.	Eurostat
<i>EU Homogeneity</i>		
Per capita income	Real GDP per capita at current prices (2005=100, in PPP) in relation to the respective EU average.	Eurostat
Purchasing power standards	Purchasing power standards (EU-15=1) in relation to the respective EU average.	Eurostat
Labor cost	Labor costs (wage costs and payroll costs) per hour (in PPP, for the manufacturing sector and for companies with 10 or more employees) in relation to the respective EU average.	Eurostat
Long-term interest rate	Long-term interest rates according to the Maastricht criteria (10-year government bonds) in relation to the respective EU average.	Eurostat
Public debt ratio	Gross government debt in percentage of GDP in relation to the respective EU average.	Eurostat
Consumer tax rate	Implicit tax rate on consumption (consumption tax revenues in relation to private consumption spending) in relation to the respective EU average.	Eurostat
Capital tax rate	Implicit tax rate on capital (taxes on property and corporate profits for private households and companies in relation to the global profit and investment income of the private households and companies) in relation to the respective EU average.	Eurostat

EU Symmetry

Economic growth	Real GDP at current prices (2005=100, percentage change to the previous period, seasonally and trend adjusted) in pairwise correlation to the respective EU quarterly average.	Eurostat
Inflation	Harmonized Index of Consumer Prices (percentage change to the previous period, seasonally and trend adjusted) in pairwise correlation to the respective EU quarterly average.	Eurostat, (national statistical offices)
Change in unemployment	Unemployment rate (ILO definition, percentage change to the previous period, seasonally and trend adjusted) in pairwise correlation to the respective EU quarterly average.	Eurostat, (OECD)
Government net borrowing	Government net borrowing as a percentage of GDP (percentage change to the previous period seasonally and trend adjusted) in pairwise correlation to the respective EU-14 quarterly average.	Eurostat, (national statistical offices)

EU conformity*EU participation*

EMU membership	Countries of the euro zone receive a value of 100; countries of the Exchange Rate Mechanism II receive a value of 50; and countries with flexible exchange rates towards the EU countries receive a value of 0.	ECFIN
Schengen participation	Countries of the Schengen area receive a value of 100; countries outside the Schengen Area receive a value of 0.	Ministry of Foreign Affairs

EU compliance

Infringement proceedings	Infringement proceedings (pre-litigation) of the European Commission to the EU member states.	European Commission (different volumes)
ECJ verdict: Single market	Completed EU infringement proceedings via ECJ conviction in the field of the single market: free movement of services, free movement of goods, free movement of capital, free movement of people and freedom of establishment, state aid, state trade monopolies, market competition, regulations for cartels, mergers, and Union citizenship.	InfoCuria
ECJ verdict: Environment and consumer protection	Completed EU infringement proceedings via ECJ conviction in the field of environment and consumer protection.	InfoCuria
ECJ verdict: Other sectors	Completed EU infringement proceedings via ECJ conviction in the remaining sectors (e.g. social policy, fiscal law, company law, harmonization of legislation, transport, industrial policy, agriculture, fishing, energy, etc.).	InfoCuria

A2: Correlation matrix of the 25 indicators measuring European integration

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
(1)	1																								
(2)	.53*	1																							
(3)	.84*	.62*	1																						
(4)	.73*	.53*	.74*	1																					
(5)	.53*	.30*	.32*	.26*	1																				
(6)	.46*	.20*	.23*	.19*	.75*	1																			
(7)	.26*	.12	.34*	.10	.19*	.27*	1																		
(8)	.74*	.37*	.74*	.78*	.32*	.05	.18*	1																	
(9)	.42*	.53*	.44*	.50*	-.07	-.22*	-.11	.57*	1																
(10)	.16*	.26*	.30*	.30*	-.12	-.44*	-.02	.48*	.61*	1															
(11)	.43*	-.01	.40*	.59*	-.09	-.16*	-.06	.61*	.51*	.56*	1														
(12)	-.15*	.10	-.09	-.14	-.14	-.06	-.19*	-.24*	-.25*	-.18*	-.27*	1													
(13)	.04	-.23*	-.14	-.03	-.15*	.12	.05	-.23*	-.35*	-.48*	.02	.26*	1												
(14)	.31*	.35*	.34*	.12	.17*	-.20*	.10	.43*	.55*	.80*	.35*	-.23*	-.51*	1											
(15)	-.21*	-.36*	-.10	-.06	.15	-.03	-.06	.01	-.13	.28*	.11	-.10	-.17*	.08	1										
(16)	.08	-.13	.23*	.12	-.30*	-.11	.11	.09	.21*	.17*	.42*	-.15	.01	.01	.09	1									
(17)	-.01	.02	.18*	.27*	-.31*	-.23*	.04	.01	-.02	.16*	.33*	.06	.13	-.05	.10	.43*	1								
(18)	.04	.08	.18*	.11	-.11	-.05	.20*	.15	.18*	.14	.20*	-.06	-.19*	.11	-.07	.52*	.20*	1							
(19)	-.19*	.01	.15	.08	-.39*	-.43*	.05	.04	.15	.31*	.14	-.01	-.36*	.12	.13	.44*	.53*	.32*	1						
(20)	.24*	.14	.04	.02	.22*	.43*	.36*	-.16*	-.19*	-.40*	-.09	-.01	.33*	-.28*	-.46*	.12	.04	.17*	-.18*	1					
(21)	.06	-.38*	-.12	-.16*	.12	.31*	.11	-.17*	-.37*	-.26*	.22*	-.15	.34*	-.08	-.08	.21*	.24*	.13	-.07	.42*	1				
(22)	.18*	.29*	.34*	.18*	-.03	-.20*	-.11	.23*	.39*	.50*	.27*	-.11	-.51*	.57*	.03	.26*	.22*	.17*	.38*	-.25*	-.11	1			
(23)	.10	.17*	.03	-.05	.12	-.13	-.11	.17*	.25*	.29*	-.07	-.09	-.37*	.42*	-.02	-.29*	-.40*	-.12	-.21*	-.31*	-.30*	.19*	1		
(24)	.14	.13	.11	.02	.11	-.10	-.08	.22*	.20*	.29*	.11	-.06	-.33*	.46*	-.10	-.08	-.15	.02	-.07	-.19*	-.05	.40*	.47*	1	
(25)	.11	.20*	.11	.01	.21*	.09	-.03	.14	.19*	.25*	-.04	-.05	-.41*	.40*	-.01	-.05	-.25*	.01	-.05	-.21*	-.16*	.30*	.47*	.37*	1

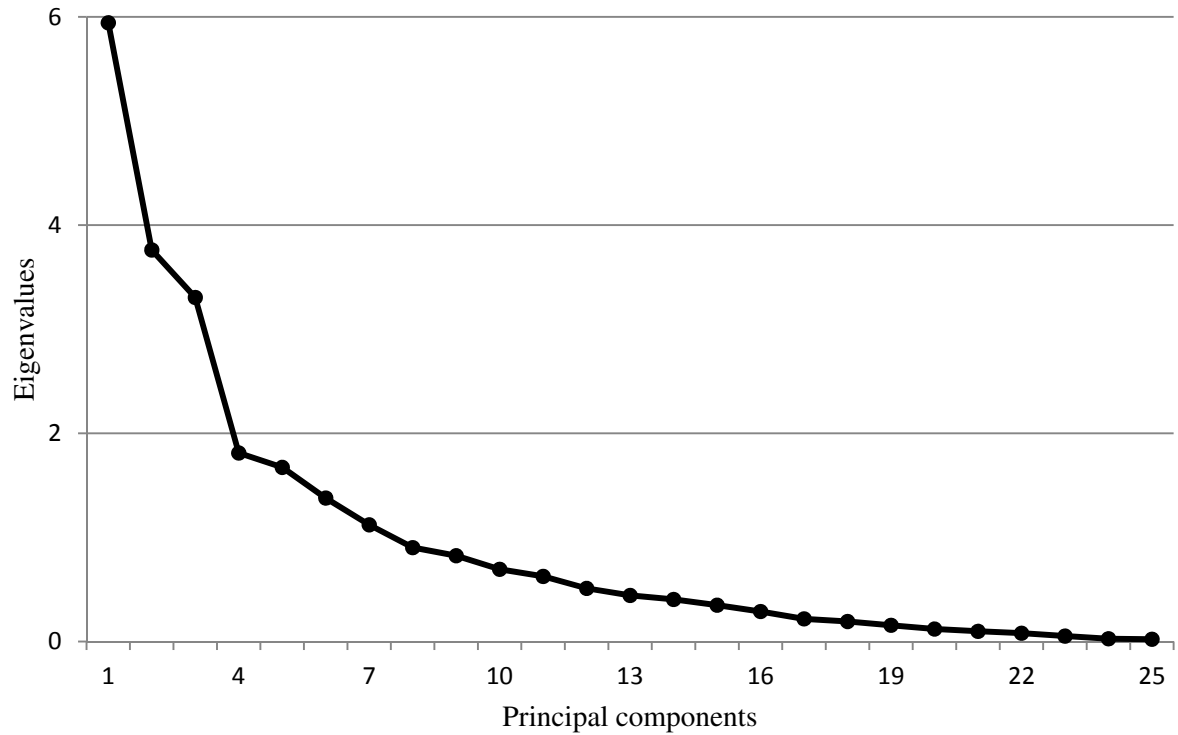
Notes:

(1) Openness to EU-goods, (2) Openness to EU-services, (3) Openness to EU-capital, (4) Openness to EU-labor, (5) Importance of EU-goods, (6) Importance of EU-services, (7) Importance of EU-capital, (8) Importance of EU-labor, (9) Per capita income, (10) Purchasing power standards, (11) Labor cost, (12) Long-term interest rate, (13) Public debt ratio, (14) Consumer tax rate, (15) Capital tax rate, (16) Economic growth, (17) Inflation rate, (18) Change in unemployment, (19) Government net borrowing, (20) EMU membership, (21) Schengen participation, (22) Infringement proceedings, (23) ECJ: Single Market, (24) ECJ: Environment and consumer protection, (25) ECJ: Other sectors.

The shaded values refer to those correlation pairs that form a joint integration group (EU movements, EU homogeneity, EU symmetry and institutional conformity);

* = significance at the 5 percent level.

A3: Scree-Test



A4: Eigenvalues and variances of the principle component analysis

Component	Eigenvalue	Difference	Explained variance (%)	Accumulated variance (%)
1	5.94	2.18	23.77	23.77
2	3.76	0.45	15.04	38.82
3	3.31	1.50	13.22	52.04
4	1.81	0.14	7.24	59.28
5	1.67	0.29	6.69	65.97
6	1.38	0.26	5.51	71.49
7	1.12	0.22	4.48	75.97
8	0.90	0.08	3.61	79.58
9	0.82	0.13	3.30	82.88
⋮	⋮	⋮	⋮	⋮
25	0.02	-	0.001	100.00

A5: Rotated factor loadings and weights

<i>Indicators</i>	<i>Rotated factor loadings^a</i>			<i>Weighting of the indicators (%)^b</i>		
	<i>Component 1</i>	<i>Component 2</i>	<i>Component 3</i>	<i>Component 1</i>	<i>Component 2</i>	<i>Component 3</i>
Openness to EU-goods	0.434	-0.039	-0.049	7.1	0.1	0.1
Openness to EU-services	0.281	0.100	-0.093	3.0	0.4	0.2
Openness to EU-capital	0.390	0.020	0.081	5.7	0.0	0.2
Openness to EU-labor	0.366	-0.012	0.116	5.1	0.0	0.4
Importance of EU-goods	0.262	-0.035	-0.310	2.6	0.0	2.5
Importance of EU-services	0.244	-0.219	-0.246	2.2	1.7	1.6
Importance of EU-capital	0.182	-0.138	0.019	1.2	0.7	0.0
Importance of EU-labor	0.341	0.121	0.053	4.4	0.5	0.1
Per capita income	0.195	0.241	0.103	1.4	2.1	0.3
Purchasing power standards	0.072	0.332	0.165	0.2	3.9	0.7
Labor costs	0.206	0.041	0.294	1.6	0.1	2.3
Long-term interest rates	-0.098	-0.052	-0.042	0.4	0.1	0.1
Debt ratios	-0.000	-0.336	0.040	0.0	4.0	0.0
Consumer tax rate	0.124	0.335	-0.008	0.6	3.9	0.0
Capital tax rate	-0.102	0.097	0.063	0.4	0.3	0.1
Economic growth	0.062	-0.083	0.398	0.2	0.2	4.2
Inflation	0.029	-0.119	0.411	0.0	0.5	4.5
Unemployment	0.083	-0.036	0.252	0.3	0.1	1.7
Government net borrowing	-0.064	0.074	0.374	0.2	0.2	3.7
EMU membership	0.163	-0.323	-0.007	1.0	3.7	0.0
Schengen participation	0.045	-0.255	0.109	0.1	2.3	0.3
Infringement proceedings	0.071	0.259	0.131	0.2	2.4	0.5
ECJ: Single Market	-0.015	0.326	-0.269	0.0	3.7	1.9
ECJ: Environment & consumer	0.035	0.262	-0.128	0.1	2.4	0.4
ECJ: Other sectors	0.037	0.260	-0.196	0.1	2.4	1.0
<i>Explained variance</i>	4.963	4.652	3.492			
<i>Share of total variance (%)</i>	37.860	35.495	26.645			

Notes:

^a Rotation method: (oblique) Promax-rotation with Kaiser-normalization.

^b Squared factor loading multiplied by the share of variance of the corresponding component.

A6: Weights of indicators and sub indices in the EU-Index

Indices	Indicators	Weights in the indices (%)	Weights in the total index (%)
EU Single Market		(40)	(40)
	<i>EU openness</i>	<i>(56)</i>	
	Goods	(33)	7.2
	Services	(16)	3.6
	Capital	(27)	5.9
	Labor	(25)	5.4
	<i>EU importance</i>	<i>(44)</i>	
	Goods	(29)	5.2
	Services	(31)	5.5
	Capital	(11)	1.9
	Labor	(28)	5.0
EU Homogeneity		(22)	(22)
	Per capita income	(17)	3.8
	Purchasing power standards	(21)	4.8
	Labor costs	(18)	3.9
	Long-term interest rates	(2)	0.5
	Public debt ratios	(18)	4.0
	Consumer tax rate	(20)	4.5
	Capital tax rate	(4)	0.8
EU Symmetry		(16)	(16)
	Economic growth	(29)	4.6
	Inflation	(32)	5.0
	Change of unemployment	(13)	2.0
	Net borrowing	(26)	4.0
EU Conformity		(22)	(22)
	<i>EU participation</i>	<i>(33)</i>	
	EMU membership	(64)	4.7
	Schengen participation	(36)	2.7
	<i>EU compliance</i>	<i>(67)</i>	
	Infringement proceedings	(20)	3.0
	ECJ verdict: Single Market	(38)	5.7
	ECJ verdict: Environment and consumer	(19)	2.9
	ECJ verdict: Other sectors	(23)	3.4

A7: Results of the EU Single Market for 1999 and 2010

EU Single Market 1999			EU Single Market 2010		
Rank	Country	Index points	Rank	Country	Index points
1	Belgium	68.18	1	Belgium	74.62
2	Ireland	60.06	2	Ireland	55.19
3	Netherlands	46.85	3	Netherlands	47.70
4	Sweden	38.94	4	Sweden	42.22
5	Portugal	36.40	5	Austria	39.36
6	France	35.56	6	Denmark	37.24
7	Austria	35.13	7	France	36.12
8	Denmark	34.45	8	Portugal	36.05
9	Germany	34.09	9	Germany	34.75
10	Spain	33.83	10	Spain	33.73
11	United Kingdom	30.78	11	Finland	30.90
12	Finland	30.48	12	United Kingdom	29.39
13	Italy	25.58	13	Italy	23.78
14	Greece	23.56	14	Greece	18.75

A8: Results of EU Homogeneity for 1999 and 2010

EU Homogeneity 1999			EU Homogeneity 2010		
Rank	Country	Index points	Rank	Country	Index points
1	Austria	86.08	1	Germany	84.85
2	France	83.67	2	Austria	80.39
3	Germany	82.58	3	France	78.98
4	Netherlands	79.09	4	Italy	75.36
5	United Kingdom	78.57	5	Belgium	73.12
6	Sweden	77.61	6	United Kingdom	67.57
7	Spain	70.77	7	Ireland	67.44
8	Belgium	69.93	8	Finland	67.02
9	Italy	69.75	9	Spain	62.05
10	Finland	69.01	10	Netherlands	59.66
11	Ireland	60.94	11	Sweden	50.71
12	Denmark	53.98	12	Portugal	49.52
13	Portugal	51.09	13	Denmark	42.37
14	Greece	45.12	14	Greece	38.67

A9: Results of EU Symmetry for 1999 and 2010

EU Symmetry 1999			EU Symmetry 2010		
Rank	Country	Index points	Rank	Country	Index points
1	France	54.16	1	France	92.01
2	Belgium	47.72	2	Finland	83.97
3	Spain	47.10	3	Spain	83.96
4	Ireland	40.83	4	Sweden	79.95
5	Austria	23.20	5	United Kingdom	79.77
6	Sweden	21.09	6	Belgium	79.67
7	Portugal	18.28	7	Portugal	79.55
8	Finland	15.96	8	Austria	78.15
9	Denmark	12.85	9	Germany	78.03
10	Netherlands	11.13	10	Denmark	75.91
11	Germany	10.07	11	Netherlands	75.58
12	Italy	9.47	12	Italy	74.69
13	United Kingdom	8.11	13	Greece	60.29
14	Greece	-0.76	14	Ireland	53.25

A10: Results of EU Conformity for 1999 and 2010

EU Conformity 1999			EU Conformity 2010		
Rank	Country	Index points	Rank	Country	Index points
1	Netherlands	93.98	1	Finland	94.86
2	Spain	92.34	2	Netherlands	91.64
3	Portugal	91.30	3	Austria	89.32
4	Austria	90.17	4	Denmark	87.85
5	Germany	86.29	5	Germany	85.67
6	Italy	84.36	6	Belgium	84.70
7	Finland	84.10	7	Greece	81.29
8	Belgium	81.75	8	Italy	81.23
9	France	80.96	9	Portugal	80.92
10	Ireland	76.47	10	France	80.08
11	Denmark	73.45	11	Ireland	76.45
12	Sweden	62.01	12	Spain	75.22
13	Greece	61.60	13	Sweden	74.57
14	United Kingdom	60.66	14	United Kingdom	57.99

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