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Alternative Composite Lisbon Development Strategy Indices: A Comparison of EU, USA, Japan and Korea

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Abstract

This study addresses the measurement of two composite Lisbon strategy indices that quantifies the level and patterns of development for ranking countries. The first index is nonparametric labelled as Lisbon strategy index (LSI). It is composed of six components: general economics, employment, innovation research, economic reform, social cohesion and environment, each generated from a number of Lisbon indicators. LSI by reducing the complexity of the set of indicators, it makes the ranking procedures quite simple. The second and parametric index is based on principal component analysis. Despite the difference in the ranking by the two indices, it is shown that the United States outperformed most EU-member states. Our investigations also show evidence of significant dynamic changes taking place, as the countries of the Union struggle to achieve the Lisbon goals. The necessity of a real reform agenda in several old and new members and candidate countries emerges from our analysis. We briefly refer to two important European phenomena emerging from our data analysis and discuss the possible lessons learned from the Korean development strategy

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1. Introduction

Development of performance and efficiency indicators related to national economic environment are very important process and tools to measure and to verify the international economic competitiveness of countries and to evaluate their policy. For this purpose the EU launched a comprehensive set of targets which is called "Lisbon strategy". At the European Council of March 2000 in Lisbon, the member countries announced the targets for the EU to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion.

There are 15 main structural Lisbon agenda indicators.[2] These indicators play an important role in European policy making and in monitoring EU economic and social policy and its development. The lists of indicators are perhaps the most important checklists for individual countries success or failure in Europe today. Despite their

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[2] List of Lisbon indicators include: GDP per capita; Labour productivity; Employment rate; Employment rate of older workers; Female participation rate; Educational attainment; Research and Development expenditure; Business investment; Comparative price levels; At risk-of-poverty rate; Long-term unemployment rate; Dispersion of regional employment rates; Greenhouse gas emissions; Energy intensity; and Volume of freight transport. Originally there are 14 indicators, but following a referees suggestion to consider gender specification, we have added female labour market participation rate to the list. A high level of the first 8 indicators are considered as positive, while a high value of the remaining 7 indicators negative to development.

limitations, but because of its relatively good coverage, they are frequently present in the public political as well as in scientific debate.

In general it is assumed that a good performance on one indicator is causally linked to a good performance on the other indicators. But recent studies by the European Commission (2005a, 2005b and 2005c) warns that it is very difficult to quantify the impact of the reforms because of the heterogeneity of individual reform measures, time lags in reform implementation and complementarities and trade-offs between reforms across member countries. Here the Commission classifies the Lisbon reforms into five distinct reform categories.[3]

The study by the European Commission underlines that product and labour market reforms alone in the second half of the 1990s resulted in an increase in annual GDP growth of almost 0.5%. When also taking into account the potential contribution of increased investment in knowledge, the increase in EU potential annual growth could reach 0.75%. Over a ten-year period, this would imply an increase in the GDP level of up to 7 or 8%. In addition it is emphasized that costs of not achieving a better environment may be felt in a reduced quality of life, negative health impacts, lost economic opportunities, and economic costs as a result of a poor environment. The report points to the need for further research to establish what policies are needed to maximize the benefits of Lisbon strategy while minimizing the adjustment and negative costs of achieving the targets.

In this study we present results from the computation of two composite indices corresponding to the Lisbon structural development strategy. We see computation of composite indices as a proper methodology to analyze the statistical observations provided by Eurostat on the Lisbon process. The index will help to establish the state of performance of member countries in the Lisbon process. There is lack of cross-national and quantitative social science research on the results of the Lisbon process and the Lisbon indicators provided by Eurostat. The usual simple analyses are not acceptable from a methodological viewpoint because they simply aggregate the Lisbon indicators on a 1:1 basis for a ranking of the EU-member countries.

The purpose of this study is to improve the existing methods to measure the impact of reforms by two composite indices that quantify the level and patterns of development for ranking countries. We use cross-national development indicators and apply methodological advances mainly achieved in the framework of the United Nations development programmes to the problems raised by the Lisbon process. Two index approaches are used. Our first non-parametric approach is based on the methodology of the human development index (HDI) also used for measurement of globalization index.[4] The second parametric index is obtained from principal component analysis, widely known in the literature on social indicators of development. We compare the result from European countries with United State, Japan and also the newly industrialized South Korea. Despite limited theoretical and empirical support we also refer to two important European phenomena emerging from our data analysis and discuss the trajectory of the Korean development strategy.

[3] The five reform categories are related to: product and capital market; investments in the knowledge-based economy; labour market, social policy; and environmental policy.

[4] It should be noted that this HDI type index differs from the simple aggregation of the Lisbon indicators on a 1:1 basis. In the HDI type index the individual indicators are normalized prior to the aggregation, and in some cases certain factors are given different weights. Thus, in addition to the ranks the distance to the best in the HDI type index is quantitatively measured as well.

The composite index reduces the complexity of the 15 main Lisbon indicators and the ranking procedures. The LSI index is composed of six components: general economics, employment, innovation research, economic reform, social cohesion and environment, each generated from a number of indicators. Each of the index components develop differently over time and across countries. Such composite indices inform us about the individual countries' level of development and patterns of changes over time in their efforts to achieve the Lisbon goals. Thus, a breakdown of the composite index into major components provides possibilities to identify the sources of development at the country level and associate it with economic policy measures.

The empirical results show that by accounting for non-technology development factors US and Japan are not superior to several European nations. From the result we can observe that most countries improve their efficiency in achieving the Lisbon goals. These are reflected in the governments attempt to improve their economic efficiency by necessary changes in their economic system and incentive scheme for the future.

Rest of the study is organized as follows. In the next section we introduce the Lisbon development strategy and its theoretical basis followed by a review of findings from previous studies in Section 3. In Section 4 we outline the composite strategy indices. The data and variables are presented in Section 5 and distribution and development of the indicators are discussed in Section 6. Variations in the composite indices across countries and over time are discussed in Section 7 and 8. The superiority of the development strategy in Scandinavia and Korea in some respects is discussed in Sections 9 to 11. Guideline for construction of a better index is presented in Section 12. The final Section 13 summarizes this study.

2. Lisbon Development Strategy

2.1 The Lisbon Development Targets

At the European Council of March 2000 in Lisbon, the EU launched a comprehensive set of targets, to be achieved by implementing a series of integrated structural reforms over the next decade. Growth performance has been the important subject for the European countries which face difficulty in re-orienting their economy towards the higher productivity growth sectors such as Information and Telecommunication Technology (ICT). EU has the objective to develop a strategy which involves a broad set of structural reforms to encourage employment and productivity growth. The structural reforms are geared towards the general objective of becoming "the most competitive and dynamic knowledge-based economy in the world by 2010 and capable of sustainable economic growth with more and better jobs and greater social cohesion." This became known as the "Lisbon strategy" or the "Lisbon agenda" (EC, 2005a).

In the year after, the Gothenburg European Council of June 2001 added an environmental pillar. As far as policy tools are concerned, the Lisbon conclusions make reference to the need to apply an appropriate macroeconomic policy mix, to modernise the European social model, to invest in people and combat social exclusion; to improve research and development (R&D) and ICT policies, to stimulate competitiveness and innovation, and to compete at the internal and external markets.

The wide scope of the Lisbon strategy has made it necessary to identify a set of operational targets or policy measures necessary to achieve the objectives. However, this

is far from straightforward given the difficulty of distinguishing clear policy objectives from the policy reforms necessary to achieve these objectives.[5] Therefore the breadth of its scope makes the Lisbon strategy very different from earlier Community initiatives such as the internal market and economic and monetary union, which had more precisely defined programs.

For the better implementation of policies and achievement of targets, the member states need information about the state of their performance relative to others and to the goals. Since the structural reforms touch upon sensitive areas of national competence, the EU member, USA, Japan, Korea and several East European non-members are selected for the comparison of development. The EU members need incentives to act on the reforms and to coordinate their policies. Therefore well defined indicators are needed to measure policy, achievement of the objectives and to monitor progress on the targets. The use of relevant indicators with good coverage can help the member states to evaluate their progress, agreement on the targets and benchmarks.

2.2 Theoretical Basis for the Lisbon Development Strategy

Over the last 50 years advances in technology have been the most important factor in creating growth in many economies. Therefore technology innovation policy is important for both developed and developing countries. As countries achieve economic progress, they modify their technology policy from an initial focus on infrastructure, to comprehensive education and research agendas for knowledge creation and diffusion of new technology. Conceicao et al. (2001) find it crucial to understand the feature of knowledge induced growth in rich countries, as well as the challenges and opportunity for late-industrialized and less-developed countries. Mitchell (1999) discusses the patterns of Technology policy evolution. In Michell's research the technology policy emerges in which developing nations pass through several phases and the final phase involves the development of indigenous R&D and commercialization capability, strongly linked to leading-edge technical advances. The process includes substantial government and private sector investment in R&D, a significant focus on higher education and workforce development, and the creation of a business climate to promote technological innovation. Comprehensive analysis of theories and empirics of human capital is found in Becker (1993).

The new technology policy such as described above is needed for economic growth in the future. The purpose of Lisbon strategy is to make Europe the most competitive, knowledge based economy in the world by 2010. The current era of competition between firms, industries and nations has been called an era of "hypercompetition" (Porter, 1996). Because innovation is the most important factor for surviving such fierce competition where countries seek to enhance their capacity for innovation by enlarging the capacity of individual actors, strengthening the linkages between actors, and building up the overall knowledge infrastructure. The innovative capacity of a country is thus the basic driving force behind its economic performance (Hu and Mathews, 2005). The performance of an innovation system is, however, increasingly depending on the intensity and effectiveness of the interactions between the main actors involved in the generation and diffusion of knowledge.

A number of factors then those mentioned above which affect the innovation system are: a country's national innovation system which is significantly influenced by

[5] Council of the European Union, Brussels, 17 March 2005 (EC, 2005c).

the quality of basic research, workforce skills, systems of corporate governance, the degree of competitive rivalry and local inducement mechanisms, such as abundant raw materials, the price of labour and energy, and persistent patterns of private investment of public procurement (Pavitt and Patel, 1999). The element of nationality follows not only from the domain of technology policy but also from elements of shared language and culture which bind the system such as the EU together, and from the national focus of other policies, laws and regulations which condition the innovative environment (Metcalfe, 1997).

It takes a long time for a country to reach the technological frontier where innovation becomes a principal driver of their development. In the case of the outstanding latecomer economies of the 19th century, Germany and the US, it took 50 to 100 years to catch-up with and overtake the leader, the UK. In the 20th century, it was Japan who first caught up with the leaders. In the post war period, the outstanding cases have been the East Asian "Tiger" economies, Korea, Taiwan, Hong Kong and Singapore, described by the World Bank as the "East Asian Miracle" (World Bank, 1993). Several European countries are still technology leaders in segments of the market. Despite their small sizes, to catch up with US and Japan in segments of the market, it should not be an impossible task for the Tiger economies.

In the National innovation perspective, country differences with respect to innovation and growth might reflect not just different endowments in terms of labour, capital and the stock of knowledge, but also the varying degrees of the knowledge distribution or the efficiency of their innovation system. Overall, this perspective warns against looking at statistical indicators individually to assess the performance of a National Innovation Capacity. Rather, a systemic approach should be taken to understand the relationships between socio-economic development indicators. The problem with this approach, however, is to approximate empirically the institutional framework and the knowledge distribution of nations (Furman, 2002). For better performance, nations need to innovate their infrastructure. Without skilled R&D and management labour to facilitate absorptive capacity, growth and assimilation of external knowledge is unlikely to be effective in these latecomer countries (Hu and Mathews, 2005). The national innovative infrastructure incorporates a wide set of both the economic and policy influences of national boundaries in explaining cross-country differences. We therefore integrate prior research that focuses on the impact of geography on knowledge spillover and differential access to human capital (Porter, 1990; Krugman, 1991), as well as the work that emphasizes how regional differences may be driven by differential public policy and institutions (Nelson, 1993; Ziegler, 1997).

In this paper we compare the Europe countries, US, Japan and one of East Asian economies - Korea's national innovation competitiveness based on the Lisbon strategy indicators. We also suggest the development strategy which involves a broad set of structural reforms to encourage employment and productivity growth to enhance competitiveness. We include the main factors which are correlated with the strength of nations' innovation infrastructure like population, higher education, total R&D expenditure and GDP per capita. The goal is to implement index components including general economics, employment, innovation research, economic reform, social cohesion and environment as tools in evaluation of the Lisbon strategy. Given discussion above, we find the composite Lisbon strategy index to have potential to serve as a useful tool to critical evaluation of the strategy and its revision.

3. The existing development and competitiveness indices

In recent years in a number of studies, several indices are introduced focusing on different forms of national competitiveness. The index of economic freedom (IEF), environmental sustainability index (ESI), the Arco technology index (ATI), technology assessment index (TAI), human development index (HDI) and globalization index (GI) are among such indices.[6]

The Global Competitiveness Report of the World Economic Forum (WEF) and International institute for Management Development (IMD) in The World Competitiveness Report are examples of the national competitive indices. However, these reports do not analyze specific development areas in details. The definitions are too broad. Lall (2001) developed the competitiveness indices for developing countries and the analyses are from a development economics perspective.

Archibugi and Coco (2004) present an index (ArCo) of technological capabilities that aims at accounting for developed and developing countries. The index takes into account a number of variables associated with technological change. Three main components are considered including: creation of technology, technological infrastructures, and development of human skills. These are based on 8 indicators. For the policy makers national competitiveness is a serious concern, but many qualitative measures are vague. These weak theoretical and empirical foundation reduce the value of the indices for analytical or policy purposes.

The Council of the European Union (2005) in the review of the Lisbon Strategy "Working together for growth and jobs: A new start for the Lisbon Strategy" therefore favours an increased focus around two principal tasks – delivering stronger, lasting growth and creating more and better jobs. The purpose of this report is to analyze the impact of Lisbon-type structural reforms. While these reforms do not correspond exactly to the present Lisbon package, they are designed to achieve the same goals as those set out in the strategy. However, it is extremely difficult to quantify the impact of the reforms due to the heterogeneity of individual reform measures, the time lags in their implementation, the complementarities and trade-offs between reforms in different domains. The influence of short-term to medium-term developments make it also difficult to separate the effects of reforms undertaken from other determinants of performance.

The Lisbon reforms are classified into five categories: product and capital market reforms; investments in the knowledge-based economy; labour market reforms; social policy reforms; and environmental reforms. Some argue that one of the reasons why the Lisbon strategy has been relatively ineffective thus far is a lack of focus and clarity about its contents. This view is reflected in the report prepared by the High Level Group chaired by Kok (2004). Kok concludes that Europe needs to focus on growth and employment first without neglecting environmental and social concerns in the process. In line with the above findings in this paper we aim to improve on the limitation of the previous evaluation studies and to find policy implications of our new index measures to be used in ranking of countries and in their policy decisions to achieve the Lisbon goals.

[6] For examples of these indices see: UNDP (2001), Noorbakhsh (1998), Esty et al. (2005), Archibugi and Coco (2004), Heshmati (2006) and Dreher (2005).

4. A composite Development Strategy index

Several attempts have been made to construct databases based on which human development type composite indices are computed. Kearney (2002, 2003) is one of such used to annually compute a composite globalization index. The index is composed of four major components: economic integration, personal contact, technology, and political engagement, each generated from a number of determinant variables, 13 in total (see also Heshmati, 2006). This index can serve as a model for computation of a Lisbon strategy index (LSI). The LSI is then estimated parametrically or computed non-parametrically based on the normalization of the 15 individual indicators and the subsequent aggregation using an ad hoc weighting system as follows:

$$(1) \qquad LSI_{it} = \sum_{j=1}^{J}\sum_{m=1}^{M} \omega_{jm}\{(X_{jmit} - X_{jmt}^{\min})/(X_{jmt}^{\max} - X_{jmt}^{\min})\}$$

where i and t indicate country and time periods, m and j are within and between component subscripts, ω_{jm} are the weights attached to each indicator (X), min and max are minimum and maximum values of respective indicator across countries in a given year to allow for year specific reference points.

The index in (1) is suitable for indicators with an expected positive effect on development. In cases where the indicators are expected to have a negative impact on development the corresponding index is written as:

$$(2) \qquad LSI_{it} = \sum_{j=1}^{J}\sum_{m=1}^{M} \omega_{jm}\{(X_{jmt}^{\max} - X_{jmit})/(X_{jmt}^{\max} - X_{jmt}^{\min})\}$$

where the two indices differ only by the nominator of the ratio. Alternatively, prior to the normalization in (1) the negative indicators are transformed to inverses, (1/X) reversing their expected impact from negative to positive.

The component's weights in equations (1) and (2) are chosen on an ad hoc basis and are constant across countries and over time. This LSI index can be used as a benchmark index. Lockwood (2001), in computation of the globalization index, finds the ranking of countries to be sensitive to the way the indicators are measured, normalized and weighted. The weighting approach here is similar to the commonly used human development index (HDI), which is based on educational attainment, life expectancy and real GDP per capita (see Noorbakhsh, 1998), where all indicator are given equal weight.

There are at least two other alternative parametric approaches to the non-parametric index above for computing a Lisbon strategy index; using the principal component or factor analysis (see e.g. Heshmati, 2003; Andersen and Herbertsson, 2003).[7] In this study initially we adopt both approaches hereafter, labelled as principal component index (PC) and factor analysis index (FA), respectively. However, since the two methods in normalized form give principal component scores with unit variance, we use only the PC results in the analysis.

Principal component analysis is a multivariate technique for examining relationships within a set of quantitative variables. Given a dataset with p numeric

[7] For recent surveys on the literature on the use of composite indices in different development research context see also Archibugi and Coco (2004) and Grupp and Mogee (2004).

indicators, at most *p* principal components can be computed; each is a linear combination of the original indicators with coefficients equal to the eigenvectors of the correlation of the covariance matrix. The principal components are sorted according to the descending order of the eigenvalues, which are equal to the variance of the components. So for the readers, not familiar with technical notations, it might suffice to say that: PC analysis can be viewed as a way to uncover approximate linear dependencies among variables. This method gives a least square solution to the following model:

$$Y = XB + E \quad (3)$$

where Y is a $n \times p$ matrix of the centred observed variables, X is the $n \times j$ matrix of scores of the first *j* principal components, *B* is a $j \times p$ matrix of eigenvectors, *E* is a $n \times p$ matrix of residuals, *n* is the number of observations, *p* the number of partial variables, and *j* the number of variables or indicators of strategy. Here we minimize the sum of the squared residuals measured as distances from the point to the principal axis. In a traditional least squares estimation case, the vertical distance to the fitted line is minimized.

5. Data and variable definitions

The database created by Eurostat [8] is used for the computation of the Lisbon strategy index. The part of the database used here constitutes a small balanced panel covering 34 countries [9] observed for the period 1995-2003. There were several missing units and missing observations. These are imputed, when available, using lag or trended values for the same country, and when not available the missing units were imputed using average EU-25. The imputation was undertaken to avoid the use of unbalanced data and subsequent distortions in the reference points for the normalizations. Imputation with mean values has a minimum of effects on the average index results, but the temporal patterns of the index components will be less variable. The data contain 15 structural indicators that are expected to proxy the countries development towards the Lisbon agenda goals. The 15 indicators are grouped into 6 groups including: general economics, employment, innovation research, economic reform, social cohesion and environment, each generated from a number of indicators.

The general economics component consists of two indicators: GDP and labour productivity. The two indicators are defined as GDP per capita and GDP per person employed measured in purchasing power standards (PPS) and normalized at EU25=100.

The second group, employment, is obtained from three indicators: total employment rate, employment rate of older people and female participation rate.[10] The

[8] The Lisbon database can be viewed at Eurostat website: http://epp.eurostat.cec.eu.int/

[9] The Lisbon database contains information on 25 EU members, 5 East European and Turkey as non-members, USA and Japan, in total 33 countries. After adding South Korea, the sample is increased to 34 countries.

[10] The female employment rate is another alternative variable to female participation rate. The two variables are positively correlated, but a high participation and unemployment rates will result in a low employment rate. The main differences between the two definitions are due to motherhood leave and females job market training program participation, which are salaried activities with pension

first two indicators are obtained by dividing the number of persons aged 15 to 64 and 55 to 64 in employment by the total population of the same age group, respectively. The last indicator accounts for the gender specification of the labour market among the sample countries.

The third group, innovation and research, is based on the R&D expenditure and youth education attainment levels. R&D expenditure is gross domestic expenditure on R&D as share of GDP. The education variable is defined as the percentage of young people aged 20-24 years having attained at least upper secondary education level as share of the total population of the same age group.

The Economic reform component builds on two indicators. The comparative price level which is based on the price levels of final consumption by private households including indirect taxes normalized at EU25=100, and business investment. Business investment is measured as gross fixed capital formation invested by the private sector as a percentage of GDP.

Social cohesion is obtained from three indicators: the risk of poverty after social transfers, the unemployment rate and the regional dispersion in employment. The poverty indicator is defined as the share of persons with an equivalent disposable income below the risk-of-poverty threshold, which is set at 60% of the national median equivalent disposable income after social transfers. The long-term unemployment defined as unemployment lasting 12 months and more is measured as percentage of the total active population. Finally regional dispersion in employment is defined as the coefficient of variation of employment rates of the age group 15-64 across regions within countries.

The last component, the environment, is based on three variables: the green house gas, energy intensity of the economy and volume of freight transport. The emission variable is defined as percentage change since base year and targets according to Kyoto Protocol/EU Council Decision for 2008-2012 (in CO2 equivalents), indexed on actual base year=100. The energy variable is measured as gross inland consumption of energy in kilogram of oil equivalent per 1000 Euro relative to GDP (at constant prices, 1995=100). Finally, the freight indicator is an index of inland freight transport volume relative to GDP. It is measured in tone-km/GDP in constant 1995 prices, normalized at 1995=100.

6. Distribution of the development indicators

Summary statistics of the 15 indicators are reported in Table 1. In Table 1 we can observe large variations in the indicators underlying the calculation of the LSI index and its six index components. The GDP per capita, R&D expenditure, unemployment rate, regional dispersion in employment and energy intensity indicators show the largest dispersion measured by the coefficient of variation (standard deviation/mean). Labour productivity and energy intensity indicators show a large discrepancy between the mean and the median values suggesting a skewed distribution. The mean and median values of employment, business investment and regional dispersion in employment are overlapping.

Correlation coefficients among the various indicators are presented in Table 2. There is no statistically significant trend in the indicators. We find no systematic

contributions. The recent years of lowering fertility rate and growing importance of giving birth and motherhood leave justify our preference for using female participation rate in this study.

patterns in the sign and significance of correlation coefficients between and within the groups of indicators with the expected positive and negative effects on development. Business investment and educational attainment are unexpectedly negatively correlated with GDP per capita and labour productivity. Reasons for unexpected negative correlations might be the low return to human capital, difficulties in measuring labour productivity in the expanded service sector and low saving rate as a result of highly taxation and development of the welfare system. The factors of risk at poverty, unemployment and energy intensity are found to be negatively correlated with the increases in GDP and labour productivity. However, the relationship with energy intensity and poverty risk and unemployment is positive. All employment variables are contributors to GDP per capita.

The correlation coefficients among the 15 indicators corresponding to those reported in Table 2, but based on normalized indicators (using equations 1 and 2), are reported in Table 3. In normalized form there is a statistically significant trend in development of most of the indicators over time. Business investment, prices, emission and freight are negatively correlated with several other indicators.

The results from the computation of principal component analysis are reported in Table 4. Here two indices are computed (PC1 and PC2). The two indices differ because in the first index the expected sign of the indicators is not accounted for, while in the second index it is accounted for.[11] In each approach four principal components are found with eigenvalues exceeding one. In order to utilize all power in explaining variations in the data, the final two indices are computed as averages of the four components. In the aggregation the share of variance explained by each component is used as weights. The share of total variance explained by the first four principal components of the two indices is 71.35% and 69.21%, respectively.

The eigenvectors of each principal component are shown in Table 4, where a value larger than 0.3 indicates that an indicator has a significant contribution to the component, while the sign indicates the direction of the contribution. The indicators with eigenvectors greater than 0.3, will jointly make up a principal component. Each indicator usually plays such role only to one principal component. The components structure depends on the composition of the contributing indicators. The first component which explains the highest share of the variations in the data is considered as the primary component and is often used in analysis of data.

The use of parametric PC analysis has a number of disadvantages compared to the non-parametric Lisbon strategy index. One disadvantage is that PC methods do not allow decomposition of the overall index into the underlying six index components as in the case of LSI. Such decomposition would require, first, the application of PC analysis on each of the six components separately, and then the aggregation of the components into a single index by assigning some weights to each index component. A second disadvantage is that PC approach does not distinguish between bad indicators (like negative expected effects of high levels of emission or high levels of energy use) and good indicators (like positive expected effects of high GDP per capita and high labour

[11] The difference between PC1 and PC2 results is that, in computation of PC2 we account of the fact that the comparative price level in the economic reform and factors of social exclusion environment are to be seen in a negative light from the social policy and the general Lisbon policy perspective. In PC1 the original positive and negative factors (X) are used, while in PC2 the inverses (1/X) of the negative factors are used. The difference between the two indices is thus attributed to possible bias due to the mixture of both positive and negative indicators.

productivity) for the strategy index. Such separation is possible only if the variables with expected negative effects are transformed prior to the computation by using the inverse as is done here or by reversing the ranks of the variables as in equation (2).

The summary of the six components of the composite LSI index and the two composite PC indices are reported in Table 5. The indices differ in distribution and by the levels of mean and medians. The level differences among the three indices are due to different weighting systems used in their computations and are not a matter of concern.

Economic reform is negatively correlated with the remaining five components (see Table 6). However, the correlation coefficient with environment is statistically not significant. Economic growth and social cohesion are positively correlated. Employment and innovation research are also positively correlated with GDP per capita. Economic reform is negatively correlated to both of the LSI indices. The two LSI indices are positively correlated (0.92). Social cohesion and the general economic component are positively correlated (0.35). Social cohesion is in turn positively correlated with the levels of GDP and labour productivity, measured in both normalized and original forms, but negatively correlated with changes in these two variables (see Table 7). The finding of a positive association between social cohesion and general economic condition (level of GDP and labour productivity) is in favour of European model of welfare policy suggesting that investment in welfare enhances productivity of labour.

7. Variation in the Lisbon strategy index across countries

The normalized indicators ranging in the interval 0 and 1, used in the computation of the non-parametric LSI index in the form of country mean values are reported in Table 8. The countries are ranked in ascending order of the composite LSI index (see Table 9). Sweden, Norway, the USA and Denmark are ranked as the highest. Despite the high ranks, Sweden has quite low scores in the price level and business investment components, Norway in prices and freights, and USA in the regional distribution of employment and emissions. Japan is ranked very low as number 13, partially a consequence of its high price levels. South Korea is ranked as number 10. Its high rank is a reflection of the relative low price levels, low energy intensity and very high old age workforce participation. Bulgaria, Turkey and Malta, despite their low prices and their low levels of energy intensity and frights, are amongst the lowest ranked countries.

A breakdown of the LSI index into the underlying six components provides the possibility to identify the sources of development and to quantify their impacts on the development of individual countries. The results are reported in Table 9 where the countries again are ranked in ascending order of the LSI index, with Sweden, Norway, USA, Denmark and Netherlands ranked highest (see also Figure 1). The economic reform component is quite low for Norway and Sweden, as the price levels are very high in these countries and low business investment is a result of a combination of the high tax rate and low saving rate. Ireland is surprisingly ranked as a medium performer. The low scores in employment, social cohesion and innovation research negatively affects its rank. Italy is ranked as 31st and with the exception of general economics and environment components it achieves low scores in the remaining four components, in particular in employment and social cohesion.

There is a positive trend in emission and employment indicators suggesting a reduction in emission and unemployment rates over time. In comparison between the

individual and groups of countries, the EU3 is ranked higher than the EU10 and EU12, although the USA is ranked highest in total. Korea and Japan are ranked higher than EU10 and EU12. The countries and groups of countries differ by the individual indicators (see Table 8). The high rank of Korea in the non-parametric index as number 10th is changing to much lower ranks, 13th and 17th respectively in the parametric indices (see Table 9).[12] The difference might be attributed to low comparability in data.

Over time there are positive trends in employment, social cohesion, environment and the overall composite LSI index, but a declining tendency in the general economics component. The dispersion in development among the EU countries is very large as shown in Table 9. When countries are grouped and the average EU is considered, USA, Korea Japan rank higher than the average EU countries. The East European countries, including Turkey, rank lowest.

If we, instead of the non-parametric LSI index rank countries by the parametric principal component PC1 and PC2 indices where each of the indices are based on weighted averages of their first 4 principal components, the rank of some countries is changed significantly (see Figure 2). The highest transition in position of countries is observed when comparing LSI and PC1. The difference is a consequence of the failure in PC1 to distinguish between good and bad indicators. The losers in ranks are Sweden, Czech Republic, Korea, Luxembourg and Germany, while the winners are Portugal, Japan, Iceland and Spain. Inequality in the levels of different components of the strategy index across countries is shown in Figure 3.

In comparison of LSI and PC2 which both are based on a case where one accounts for the bad and good aspects of the indicators, but the two indices differ by parametric and non-parametric natures of the indices, the ranks of countries changes less. Norway is the highest ranked followed by Sweden, Denmark and Austria all of which outperform USA and Japan (see Table 9). In going from LSI to PC2, the winners are Japan and Ireland the losers are Korea, Romania and Germany. The correlation between the two LSI and PC2 in Table 6 is very high (0.95) and it allows us to say that the results could claim validity in favour of these two indices requiring correction for the expected signs prior to their computation.

8. The dynamics of the Strategy Indices

In the previous section we discussed that in normalized form there is a statistically significant trend in development of several indicators over time. We have shown that business investment, prices, emission and freight are negatively correlated with several other indicators. We also found that there is a positive trend in environment and employment indictors suggesting a reduction in emission and unemployment rates over time for many countries. Further, we found that all three indices are increasing over time.

Our investigations also allow us to show the dynamics of changes taking place, as the countries of the Union struggle to achieve the Lisbon goals. The 1995-2003 period average percentage changes in the three composite indices labelled as ΔI are computed as:

[12] It was rather difficult to add Korea to the Lisbon database. Possible inconsistency in the data and its normalization of indicators might be the cause of shifts in the rank of Korea and sensitivity of the computation methods.

$$(4) \qquad \Delta I = \sum_{t=1}^{9} \left[((I_{it} - I_{it-1}) / I_{it-1}) \times 100 \right] / T - 1$$

for each country, presented in the Table 10. T is the number of time periods. The results show that Spain, Bulgaria, Hungary and Ireland had the most rapid positive changes to be reported, while the new member Poland and candidate countries Romania experience negative average period changes in LSI and PC2 indices. By the PC2 index, Bulgaria, Latvia and Spain experienced the highest positive changes, while Poland and Turkey the highest negative changes. The average positive changes in the three indices in the case of Korea and Japan are relatively low compared to the EU country group averages (see Figure 4 and 5). Both countries experience small negative changes measured as PC1. This might be due to the strong impacts of the Asian economic crisis on these countries development compared to the growth of best performing countries.

Table 10 shows that the year to year variations is highest in relation to economic reform and environment components. However, these changes are not associated with EU countries, rather than to other countries foremost Japan, Korea and USA. Innovation research and social cohesion show stability over time with small year to year changes. Although, EU has been active in its social reforms, while the situation in Korea deteriorated as a result of the financial crisis of 1997.[13] Despite a low economic reform the economic growth in the East European non-members is quite high and they show lower performance in environmental concerns as well. The mean and changes in the indices and their components across difference groups and single countries for 1996 and 2003 is reported in Table 11. Only EU10 and Korea show positive trend in the general economic component. In terms of employment, EU countries and USA show positive trends. Positive trend in innovation research is associated with EU12 and EU3, while USA and Korea experienced negative trend in social reforms. Japan, USA and Korea show higher level of environmental component than Europeans. Concerning the composite indices, the EU12 show the highest positive trend and Korea and Japan the lowest.

9. The factor analytical results [14]

From the viewpoint of international social welfare policy, the multivariate calculations presented above, based on principal components analysis of all the 15 structural Eurostat indicators show the following. In the description of the results below, much emphasis is devoted to the outcomes of the correlations among determinants of development performance. The results should, however, be interpreted with caution. A more careful interpretation of causal determinants of development performance is possible if models from economic literature with more complex set of determinants are used.

The results show that a development strategy, based on research and development, will be most successful in reducing poverty. The non-normalized correlation matrix (Table 2) documents that the highest negative correlation of the Eurostat poverty rate is with R&D followed by general and old age employment rate, GDP and labour productivity, but not with female labour participation rate. Investment

[13] For details about the economic development strategy in Korea, the effects of financial crisis and the country's state of technology and competitiveness see Branscomb and Kim (1996), Lee (1997), Cooper (1999) and Chung and Richard (2002).

[14] Sections 9 and 10 have benefited from the discussion in Tausch and Heshmati (2006).

in R&D is probably the most important measure to enhance the European competitiveness and technology leadership, as well as in creation of new jobs outside the old line industries. In general R&D expenditure has positive effect on positive factors such as GDP, labour productivity and employment and it has a negative effect on the negative factors such as energy use, emission and poverty.

If we want to reduce the complexity of the 15 indicators, the usual ranking procedures, based on average rank with equal weights, employed by EU employees are insufficient. The principal components analysis is a better and less restrictive composite index and results in Table 4 shows that there are 4 underlying factor (principal component) that explain 70 to 71% of the total variance of all 15 Lisbon indicators combined, and that these 4 Lisbon dimensions have the following loadings with the original variables.

The most important factor explains 38% of the variance, and achieves the highest loadings with the comparative price level, the GDP per capita, labour productivity, high employment, high level of research and development expenditure and the reduction of the energy intensity of the economy (Table 4). The reversed sign of the negative factors in the two PC models is due to the inverse transformation of the negative variables. This most important factor (prin1) can simply be called development of productive forces. Norway, Sweden and Denmark lead the field here; while the worst performance is found in Bulgaria, Turkey and Malta (see Table 9). With it, a significant part of the reduction of the Eurostat poverty rate and the unemployment rate can be explained. In other words, by concentrating on the growth factor alone, Europe would be able to influence its poverty and unemployment rates. Again, research and development plays an important role here. In the EU, Sweden and Finland are the research and development record holders, with Iceland and Germany behind Japan, US and Korea. It is to be noted that R&D, unemployment and labour productivity are among the Lisbon factors, where the US have a real advantage over most European states. For more details see Table 8.

There is a second factor which we call social exclusion, not very much related with the other dimensions of policy, and rather reflecting historical and long-term trends of social exclusion in societies. The factor 2 achieves the highest loadings with different general, old age and female employment rates and education (Table 4). The best performance in avoiding social exclusion is to be found in Netherlands, Sweden, Austria, and Norway while Italy, Slovakia, Croatia and Latvia have the worst performance (Table 8). It explains 15-16% of the total variance of the Lisbon indicators over the last decade, and achieves its highest loadings with the lack of educational attainment. Typically, we encounter such high rates of social exclusion in the European South with its long-standing patterns of internal polarization between a relatively richer regional centre and poor South. The Central European and the Scandinavian countries are homogeneous and do not suffer from these often long-standing and historical exclusion patterns that evolved in the process of nation-building in modern times. The factor explains less than 1/3 of the variance of poverty rates.

The 15 main structural Lisbon indicators, as they are constituted at present, also measure the power of the freight lobby in Europe, a third important factor (Table 4). Estonia, Ireland, Spain, Latvia, Greece, Lithuania, Austria and Portugal all experienced freight transport increase over the last years. The freight lobby factor explains 9-11% of total variance on its own, and is responsible for ¼ of the poverty rate in the nations analyzed by Eurostat. The overall best performance in avoiding the freight lobby index

is to be found in Slovakia, Bulgaria, Luxemburg and Poland, while the worst performances are found in Estonia, Greece, Latvia, Norway and Portugal (Table 8).

Only the 4th factor, business investment and neo-liberal investment climate, is more strongly related to the growth-scenarios of neo-classical economics (prin4 in Table 4). The overall weights of this factor are strongest in Slovakia, Czech Republic, Slovenia Portugal, and Estonia. The weakest performance is to be found in Bulgaria, Sweden, Cyprus and UK (Table 8). The product market reforms, capital market reforms, and labour market reforms are elements of a neo-liberal strategy. Our approach however stresses the importance of the factors knowledge-based economy, avoiding social exclusion, and overcoming the power of the freight lobby as an important step in the direction of a better environment as the three most important central pillars of a successful Lisbon strategy. The new liberal factor contribution to explain variance in the total model is only 7.2%, while the knowledge-based economy factor 1 explains 38% of the variance of the 15 structural indicators, social exclusion 16%, and the freight lobby 9-11% (see Table 8).

A real Lisbon strategy would be to go for factor 1, i.e. to learn from the really advanced countries like Sweden, Norway or the United States, ideally combining high labour productivity, high research and development, high employment rate and a tendency towards lower energy intensity. A concentration on these factors very likely would solve the problems of European employment, but at the price of high green house gas emissions. The model would considerably reduce poverty and would also reduce energy intensity. Seven indicators, employment of older workers; female participation rate, at risk of poverty; dispersion of regional employment; business investment, educational attainment, and freight transport are not very well explained by Factor 1. More than half the variance is unaccounted for by Factor 1, which combines strategies aiming at the development of productive forces.

10. Two European development models

In the following we briefly refer to two important European phenomena emerging from our data analysis and discuss the trajectory of the Korean development strategy. However, the theoretical base for such development models must be better posed and empirical results only partially support discussion of the models. The results on causal determinants of development performance here should be interpreted with caution. The set of determinants despite their good coverage cover simple aspects of development. We are currently considering such theoretical and empirical issues to facilitate a better modelling and to use a more complex set of determinants and account for the deep country-to-country differences in evaluation of the determinants of economic development in EU and competitor countries.[15]

We would not like to conclude this paper without referring to two important phenomena, which emerge from our data analysis. First, there is a relatively small correlation between the 4 different factors identified above. However, the strong linear relationship between development level and social exclusion emerges from our analysis. The strength of the relationship suggests any application of the "growth is good for the poor" strategy on the European level. Growth will most probably polarize in the poorer countries, before it really starts to re-distribute. It is also shown that the powerful

[15] We thank an anonymous referee for pointing out the importance of several aspects of the development models discussed here.

European freight lobby, which dominates a great deal of the European political economy, will also increase in power along development, and only can be successfully disciplined at very high stages of development. The same non-linear effect might hold for business investments as well. This shows that there are rather two approaches to the Lisbon process in place – one, a research and development oriented Scandinavian model and a second approach, based on the neo-liberal Central European transformation model.

We are rather sceptical about the short-term and medium term prospects of the "old centre" of Europe, the larger EU countries including France, Germany and Italy, which perform poorly on most of our indicators used. The picture confirms the laggard nature of societal processes especially in Germany. With Germany, a former "growth locomotive", affected by such a deep crisis, Europe would be well advised to follow one of the two policy options, i.e. either the Scandinavian model, based on high R&D and a position in the world system as a centre, or the Central European growth model. In terms of the social implications of the model, our personal preference is given to the Scandinavian alternative. The freight lobby strategy is no alternative and does not stimulate long-term economic growth. Strong correlation is achieved by the R&D in factor 1 which was called as the development of productive forces.

11. The Korean development strategy

It is risky and rather difficult to evaluate the nations' different development models as the absolute standard, but it is important to examine their previous policies and find out the strength and weaknesses of such policies by comparing countries. This process of development in Korea and its evaluation is important to improvement of national competitiveness for the knowledge based economy – a growth strategy for many developing countries in the world. In this respect, we use the Lisbon strategy indices to evaluate the Korean policy which has achieved a dramatic economic development in short period.

Korea is ranked as number 10 by the LSI Index (Table 9). This position is better than Japan's, and Korea has a higher score in innovation and research than EU but lower than USA and Japan. Also Korea's economic reform is quite high as a result of lower price level than EU and a higher business investment rate (see Table 8). The reason to emphasize Korea's development model is that Korea's rapid growth has been a source of admiration. It also stabilized the economy very short after the 1997 economic crisis and the rate of rapid recovery after the crisis makes the country very interesting from the perspectives of growth, knowledge-based economy and development strategy. Thus many aspects of its policy can serve not only as a model for economic development, but also an experiment field for development of new industries, and for its achievement of high innovativeness and competitiveness.

There are several key factors deriving the Korea's rapid economic development. World Bank reports that, the high investment ratio in Korea is to be found in the structure of demand. Investment ratio is defined as the ratio of gross domestic investment to gross domestic product. From 1965 to 1990 Korea's investment ratio rose from well below to well above the group average with 23-24 percent. This was supported by high saving rate and low borrowing cost. Korean government's planning and industrial policy reduced future uncertainty, while the rapid growth has compensated or offset investors' error.

Korea's investment in human resources and technology as infrastructure for its economic development started from the mid 1960. From 1962-72 the Korean economic development was based on an export-led growth strategy, in 1973-1981 it was focusing on the heavy and chemical industry, while 1982-1992 is the period of stabilization and liberalization to promote competition and efficiency of firms and industries (see Branscomb and Kim, 1996)

Korea focused on technology development from the early 1980. Since the 1980, Korea has rapidly modernized its industrial structure by promoting capital investment and technology development a policy to adjust toward high value-added and technology intensive production. From this time the R&D investment increased dramatically. A concept of National Innovation System was introduced by Freeman (1987), Lundvall (1988), and Nelson (1987). They emphasized the differences in innovation ability among nations and underline the role of government. Korea is committed to technology based innovation as the primary source of economic transformation to realize the goal of reaching the level of the G7 group members' development in early 21 century. Korea's fiscal commitment to annually increase R&D investment by 25-30% is one measure to achieve this goal. As the result of such policy GDP per capita grow from $300 in 1955 to more than $10.000 in 1995, and despite the economic crisis of 1997, $14.000 in 2006.

Kuznets (1994) argues in his study on Korea's economic development that the key characteristics of South Korea's economic development since the mid 1960s are: high investment rates, labour market competition, export orientation and a strong interventionist government. Indices of human resource development based on post-primary school enrolment ratios for 112 countries in 1960 and 1965 show that Korea's educational attainment was the same as that of semi-advanced countries like Italy and Spain and much higher than that of other countries with equally low per capita GNP (Harbison, 1970). McGinn (1980) also found that what is unique about Korean development from 1945 is that a high level of human resources was developed early and despite low per capita income. The high level of investment in education was an important driving force of the Korean economic development. Education influences development by increasing skills and expanding learning capacity, which in turn result in a higher productivity, investment and welfare.

The results in Table 8 showed that Korea obtained a high score in education, R&D expenditure and business investment. The ranking by education is better than that of EU despite a much lower level of GDP per capita. This indicates that although the role of state and the industrial policy have been changed markedly after the crisis, the key deriving factors of Korea economic development remain the same but strengthened by their advances with information and communication technology factor.

It is to be noted that the rank of Korea by the principal component analysis is 13 and 17. The latter is preferred as in the similarity with the LSI index it accounts for the expected signs of the development indicators prior to their use in the multivariate analysis. The result of PC1 and PC2 indices shows that Korea is lower ranked that average EU, Japan and USA (see Table 9). The higher LSI rank (10) might be biased and a result of difficulties in data comparisons as Korea is not originally included in the Lisbon strategy indicator database. The results show despite its great progress in recent decades, Korea has a high poverty rate and a higher regional dispersion in employment than EU, Japan and USA, as well as a lower labour productivity measured as GDP per employed person but much faster economic growth (see Table 8).

In sum the results suggests that Korea has advanced to become a technologically advanced country with great improvement in development capability, competitiveness, and it competes with the highly developed nations like EU countries, Japan and USA. However, Korea lags behind in social reforms compared to the developed countries and in particular the European. The result shows that (see Table 10) Korea's percentage changes in social cohesion in the aftermath of the economic crisis negative. However, the percent positive change in environment is very high compared to other countries suggesting effectiveness of investment in environmentally friendly technologies both for domestic consumption and as well as for competitive export market.

Korean rapid economic growth, investment in infrastructure for economic and technology development can serve a model for the pace of development in many other especially newly industrialized countries. The rapid economic growth was due to state planning mechanism which prioritised development of productive rather than social infrastructure. Since the economic crisis, to a large extent, stemmed from the state's planning mechanisms and intervention policy, the Korean government must analyse the causes and effects of the weak but critical factors mentioned here. These should be accounted in the future national competitiveness strategy. As the goals of education and technological capability are well achieved, more attention should be paid to construction of a globally competitive social environment.

12. Guidelines to construct a better development strategy index

The development strategy index in this study is easily distinguished from previous ones. Unlike previous studies, which are often based on analysis of individual indicators to proxy development, the Lisbon strategy index covers simultaneously most of measurable and important aspects of the development, i.e. the 15 main structural Lisbon indicators. These aspects of development vary greatly across countries and over time. However, the time period here is very short and covers only post 1995 period. The reason for choosing the post 1995 period is that construction of a composite index for consistency in comparison and reference points requires a balanced panel data limiting the length of the time period.

Despite the data limitations and the short time coverage, our results provide a better picture of the technology and development potential gap between EU, USA, Japan and Korea. With the help of the new index we can better quantify the heterogeneity in the process of development, identify possible factors causing the gap, and to identify factors with strong impacts on the catching up of countries lagging behind in their development.

The new composite index was shown to be much better than the traditional single factors in ranking of countries. However, it can be improved significantly in a number of dimensions. First, the theoretical base for such alternative development models must be posed and to generate empirical results sufficient to support discussion of the models. The theoretical and empirical issues should be given serious consideration to facilitate a better modelling and use of a more complex set of determinants and account for the deep country-to-country differences in evaluation of the determinants of economic development in EU and competitor countries. Second, a better index is needed to be developed. The index should take an axiomatic approach that sets out its desirable properties and provides a family with indexes that fulfil such properties. Third, such an index should fully quantify development by including several other relevant components. The results on causal determinants of development

performance here indicate possible ways to overcome several limitations. The set of determinants despite their good coverage cover simple aspects of development.

An extended set should include some other (and also non-monetary) measures of welfare, health, income inequality, happiness, gender equality, redistributions, other environmental aspects, wage inequality, democracy and conflict, inflow of foreign direct investment,[16] etc. Identification of the major determinants of development and quantification of their effects on the ranking of countries are key issues forming the basis on which policy options can be provided. Analysis will help to identify different ways to promote development and to reduce the negative effects of development on the poor, such that policy measures with such negative effects are accompanied by redistribution policies and an improvement in social protection of the vulnerable groups.

Finally, industrialized countries and EU in particular dominate the current sample. The over-weighing of the advanced industrial countries in the sample results in smaller and slow changes in mean development over time. Furthermore, it also biases the composition of the effects from a reform/accession country perspective. At the end of the day, the sample of countries, covered by Eurostat, should politically correspond to the Wider Europe perspective of the Commission and should include both TACIS project and MEDA project countries in East Europe and the Mediterranean area. The sample in addition to USA, Korea and Japan should further include developing and potential competitor countries such as China, India, Russia, Brazil and some other newly industrialized countries in South East Asia and Latin America.

13. Summary and conclusions

This paper provides analysis of the result of development strategy employed by most industrialized and several developing and transition countries by measuring two composite Lisbon strategy indices that quantify the level and temporal patterns of development for ranking countries. The database used here constitutes a small balanced panel covering 34 countries from the European Union and some East European countries, as well as Turkey, USA, Japan and Korea observed for the period 1995-2003.

Lisbon strategy index is composed of 15 indicators grouped into six components including general economics, employment, innovation research, economic reform, social cohesion and environment. The result shows that computation of a composite strategy index is indeed very informative and decisive in ranking the sample countries. We identify the main contributing components to economic development and thereby compare the development of individual countries. The results are useful to decision makers of development policy. In general we can say that certain factors enhance development more than others. However, the developments of countries rely on different and specific drivers of their development. One should take country-to-country differences more into account. Identification of positive and negative factors to development of individual countries will help in the design of policies that best promote their growth strategies.

We identify the most important factor called development of productive forces. The highest loadings is achieved with the comparative price level, the GDP per capita, labour productivity, high employment, research and development rate and the reduction of the energy intensity of the economy. This factor alone would be able to influence

[16] For a recent review of the new global determinants of flow of FDI see Addison and Heshmati (2004).

strongly both poverty and unemployment rates. The results suggest that a development strategy, based on research and development, will be successful in reducing poverty. A second factor of social exclusion is reflecting historical and trend of social exclusion in society achieves its highest loadings with the general employment and female participation rates and inequality in education. The power of the freight lobby in recent years as a third factor should not be ignored. The product market reforms, capital market reforms, and labour market reforms are elements of the fourth factor of neo-liberal strategy. Our approach however stresses the importance of the factors knowledge-based economy, to avoid social exclusion, and to overcome the power of the freight lobby as an important step in the direction of a better environment as the three most important central pillars of a Lisbon strategy.

Korea has become a technologically advanced economy with great potential for further improvement in development capability, and competitiveness. However, Korea lags behind in social reforms compared to the developed countries and in particular the European. As the Korean economy has recovered from the deep economic crisis, it should embark on introduction of social reforms to share a larger part of the positive returns from growth and to invest it in improvement of the quality of the life of its citizens. Tendencies for the direction of such policy are evident from the positive changes in environmental component of the development strategy index and also indications of introduction of child allowance and support for the elderly citizens and families with children. Thus Korean rapid economic growth, investment in infrastructure for economic and technology development can serve as a model for economic development in many other developing and transition countries. The Korean government must analyse the causes and effects of the weak but critical factors to its future economic, social and technology policies.

The economic development of Korea in our view is attributed more to the technologists, skilled and disciplined workforce and economic policy planners and very little to the economists. The economists have had a marginal contribution and they are to a high degree absent in playing a role for instance in evaluation of the effects of economic crisis, venture business crisis, the corporate and financial market restructuring, and in proposing necessary economic reforms and to introduction of welfare programs and redistribution of growth measures.

The current index is certainly an improvement over the previous simple indicator indices. However, it has a number of limitations. We suggest improvements to the index along several dimensions. The theoretical base for proposed development models and strategies need to be considered. A new index should have desirable properties of an index number and fully quantify development by including several other relevant components including other measures of welfare, health, inequality, happiness, gender equality, redistribution, other environmental aspects, wage inequality, democracy and conflict, etc.

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Appendix

Table 1. Summary statistics of structural development indicators, 34 countries, 1995-2003, 306 observations.

Variable	Definition	Mean	Median	Std Dev	Minimum	Maximum
year	year of obs.	1999	1999	2.58	1995	2003
gdp	gdp per capita	89.29	87.75	41.92	25.40	219.10
lab	labour productivity	86.40	99.10	33.39	28.50	156.70
emp	employment rate	62.30	62.30	7.34	45.80	77.50
fem	female particip.rate	54.50	55.75	11.37	25.70	80.10
old	old age employ. rate	39.77	37.45	13.13	17.30	68.60
edu	education enrolment	76.42	77.85	12.80	39.00	96.10
exp	R&D expenditure	1.50	1.34	0.91	0.23	4.27
inv	business investment	18.33	18.00	3.21	9.50	32.10
pri	prices	87.90	89.05	33.50	27.10	198.70
pov	risk at poverty	15.21	15.00	3.95	8.00	25.00
une	unemployment rate	3.90	3.50	2.75	0.20	12.20
dis	regional emply. disp	9.29	9.10	4.31	1.60	17.50
emi	emission rate	93.55	98.30	24.37	35.00	149.70
ene	energy use	494.75	259.27	486.14	119.00	2543.78
fre	freight	100.81	100.00	19.50	31.80	190.00

Table 2. Pearson correlation of non-normalized indicators, 34 countries, 1995-2003, 306 observations.

	gdp	lab	emp	old	fem	edu	exp	inv	pri	pov	une	dis	emi	ene	fre
gdp	1.00														
lab	0.91a	1.00													
emp	0.55a	0.35a	1.00												
Fem	0.39a	0.22a	0.83a	1.00											
old	0.23a	0.09c	0.69a	0.51a	1.00										
edu	-0.16a	-0.14a	0.17a	0.16a	0.06	1.00									
exp	0.63a	0.60a	0.51a	0.46a	0.38a	-0.05	1.00								
inv	-0.19a	-0.24a	0.01	0.00	-0.15a	0.13a	-0.25a	1.00							
pri	0.79a	0.81a	0.53a	0.43a	0.38a	-0.07	0.71a	-0.30a	1.00						
pov	-0.32a	-0.23a	-0.39a	-0.43a	0.00	-0.21a	-0.53a	0.10c	-0.25a	1.00					
une	-0.57a	-0.39a	-0.69a	-0.40a	-0.53a	0.06	-0.43a	0.06	-0.47a	0.23a	1.00				
dis	-0.03	0.02	-0.33a	-0.26a	-0.17a	-0.20a	-0.16a	-0.04	-0.00	0.21a	0.17a	1.00			
emi	0.45a	0.53a	0.22a	-0.02	0.24a	-0.30a	0.29a	-0.10c	0.49a	0.07	-0.42a	-0.05	1.00		
ene	-0.65a	-0.74a	-0.28a	-0.04	-0.19a	0.18a	-0.51a	0.07	-0.70a	0.10c	0.45a	0.05	-0.69a	1.00	
fre	0.02	0.05	0.08	0.01	0.20a	-0.08	-0.14a	0.16a	0.10c	0.24a	-0.20a	0.08	0.13b	-0.13b	1.00

Notes: Significant at the less than 1% (a), 1-5% (b) and 5-10%(c) levels of significance.
Abbreviations: GDP per capita (gdp), labour productivity (lab), employment rate (emp), female participation rate (fem), old age employment rate (old), Education enrolment (edu), R&D expenditure (exp), business investment (inv), prices (pri), risk at poverty (pov), Unemployment rate (une), regional employment distribution (dis), emission rate (emi), energy use (ene), freight (fre).

Table 3. Pearson correlation matrix of normalized indicators, 1995-2003, 306 observations.

	igdp	ilab	iemp	ifem	iold	iedu	iexp	iinv	ipri	ipov	iune	idis	iemi	iene	ifre
igdp	1.00														
ilab	0.90a	1.00													
iemp	0.52a	0.34a	1.00												
ifem	0.37a	0.21a	0.82a	1.00											
iold	0.23a	0.09c	0.67a	0.50a	1.00										
iedu	-0.18a	-0.15a	0.17a	0.16a	0.05	1.00									
iexp	0.64a	0.60a	0.49a	0.44a	0.38a	-0.06	1.00								
iinv	-0.21a	-0.25a	-0.00	-0.01	-0.16a	0.12b	-0.26a	1.00							
ipri	-0.77a	-0.80a	-0.53a	-0.42a	-0.38a	0.07	-0.70a	0.32a	1.00						
ipov	0.31a	0.22a	0.39a	0.43a	-0.00	0.20a	0.52a	-0.09c	-0.25a	1.00					
iune	0.53a	0.37a	0.70a	0.39a	0.51a	-0.05	0.39a	-0.05	-0.45a	0.22a	1.00				
idis	0.03	-0.02	0.32a	0.25a	0.17a	0.19a	0.16a	0.03	-0.00	0.21a	0.16a	1.00			
iemi	-0.46a	-0.51a	-0.16a	0.04	-0.24a	0.31a	-0.30a	0.10c	0.44a	0.08	-0.34a	-0.05	1.00		
iene	0.65a	0.74a	0.29a	0.04	0.20a	-0.18a	0.52a	-0.10c	-0.69a	0.10c	0.45a	0.05	-0.67a	1.00	
ifre	-0.035	-0.01	-0.01	0.03	-0.16a	0.07	0.09c	0.02	0.01	0.21a	-0.07	0.02	0.17a	-0.08	1.00

Notes: Significant at the less than 1% (a), 1-5% (b) and 5-10%(c) levels of significance.
Abbreviations: GDP per capita (gdp), labour productivity (lab), employment rate (emp), female participation rate (fem), old age employment rate (old), Education enrolment (edu), R&D expenditure (exp), business investment (inv), prices (pri), risk at poverty (pov), Unemployment rate (une), regional employment distribution (dis), emission rate (emi), energy use (ene), freight (fre).
The prefix 'i' on front of a variable indicates normalized variable (see Table 8).

Table 4. Summary of parametric principal component analysis, 1995-2003, 306 observations.

Principal Component 1 (PC1) with original indicators

A. Eigenvalues of the Correlation Matrix

Component	Eigenvalue	Difference	Proportion	Cumulative
prin1	5.65	3.31	0.37	0.37
Prin2	2.34	0.71	0.15	0.53
Prin3	1.62	0.54	0.10	0.64
prin4	1.08		0.07	0.71

B. Eigenvectors

Indicator	Prin1	Prin2	Prin3	Prin4
Gdp	0.36	-0.13	-0.11	0.09
Lab	0.33	-0.26	-0.16	0.15
Emp	0.32	0.34	0.17	-0.02
Fem	0.24	0.41	0.04	-0.11
Old	0.22	0.23	0.38	-0.39
Edu	-0.03	0.37	-0.08	0.29
Exp	0.33	0.05	-0.25	-0.06
Inv	-0.09	0.11	0.29	0.70
Pri	0.37	-0.12	-0.07	-0.05
Pov	-0.17	-0.28	0.43	-0.16
Une	-0.30	-0.07	-0.26	0.01
Dis	-0.08	-0.30	-0.01	-0.29
Emi	0.23	-0.32	0.18	0.11
Ene	-0.30	0.30	-0.03	-0.27
Fre	0.03	-0.09	0.56	0.06

C. Summary of principal components

Component	Mean	Std Dev	Minimum	Maximum
princ1	0.00	1.00	-2.19	1.77
Princ2	0.00	1.00	-2.45	1.88
Princ3	0.00	1.00	-2.90	3.36
princ4	-0.00	1.00	-2.66	3.07

Principal Component 2 (PC2) with inverted negative factors

Component	Eigenvalue	Difference	Proportion	Cumulative
prin1	5.64	3.36	0.37	0.37
prin2	2.27	0.90	0.15	0.52
prin3	1.37	0.28	0.09	0.61
prin4	1.08		0.07	0.69

	Prin1	Prin2	Prin3	Prin4
Gdp	0.37	-0.13	0.08	0.04
Lab	0.34	-0.27	0.10	0.09
Emp	0.32	0.37	-0.10	-0.00
Fem	0.23	0.42	0.04	-0.09
Old	0.22	0.28	-0.35	-0.35
Edu	-0.02	0.37	0.18	0.27
Exp	0.32	-0.00	0.32	-0.10
Inv	-0.09	0.15	-0.17	0.72
Zpri	-0.36	0.22	0.00	-0.06
Zpov	0.14	0.22	0.59	0.20
Zune	0.25	0.18	-0.26	-0.14
Zdis	0.14	0.25	-0.13	0.22
Zemi	-0.25	0.28	0.08	-0.19
Zene	0.31	-0.22	-0.02	0.10
Zfre	-0.10	0.07	0.48	-0.28

Component	Mean	Std Dev	Minimum	Maximum
princ1	0.00	1.00	-2.16	2.07
princ2	-0.00	1.00	-2.31	2.04
princ3	0.00	1.00	-2.27	3.62
princ4	-0.00	1.00	-3.59	2.71

Abbreviations: GDP per capita (gdp), labour productivity (lab), employment rate (emp), female employment rate (fem), old age employment rate (old), Education enrolment (edu), R&D expenditure (exp), business investment (inv), prices (pri), risk at poverty (pov), Unemployment rate (une), regional employment distribution (dis), emission rate (emi), energy use (ene), freight (fre).
The prefix 'z' on front of a variable indicates, inverse of the variable (1/X).

Table 5. Summary of the non-parametric composite Lisbon development strategy indices and LSI components, 1995-2003, 306 observations.

Variable definition	Mean	Median	Std Dev	Minimum	Maximum
A. LSI components:					
geneco general economics	0.85	0.93	0.52	0.00	2.00
employ employment	1.45	1.49	0.65	0.22	2.88
inores innovation research	1.01	1.01	0.33	0.14	1.89
ecoref economic reform	1.04	0.98	0.39	0.08	1.97
soccoh social cohesion	1.74	1.77	0.54	0.52	2.82
enviro environment	1.75	1.76	0.33	0.83	2.57
B. Composite indices:					
LSI Lisbon structural index	7.85	7.79	1.47	4.59	10.93
PC1 principal comp. type 1	1.59	1.64	0.60	0.00	3.00
PC2 principal comp. type 2	1.23	1.24	0.61	0.00	2.49

Table 6. Pearson correlation matrix of different composite indices and index components, 1995-2003, 306 observations.

	geneco	employ	inores	ecoref	soccoh	enviro	LSI	PC1	PC2
geneco	1.00								
employ	0.33a	1.00							
inores	0.35a	0.47a	1.00						
ecoref	-0.67a	-0.38a	-0.37a	1.00					
soccoh	0.35a	0.58a	0.50a	-0.25a	1.00				
enviro	0.11b	-0.01	0.28a	-0.08	0.13a	1.00			
LSI	0.55a	0.78a	0.71a	-0.34a	0.83a	0.35a	1.00		
PC1	0.59a	0.86a	0.58a	-0.40a	0.76a	0.07	0.91a	1.00	
PC2	0.67a	0.76a	0.73a	-0.49a	0.78a	0.22a	0.95a	0.92a	1.00

Notes: Significant at the less than 1% (a), 1-5% (b) and 5-10%(c) levels of significance.

Abbreviations: general economics (geneco), employment (employ), innovation research (inores), economic reform (ecoref), Social cohesion (soccoh), environment (enviro), Lisbon structural index (LSI), principal component index 1 (PC1), Principal component index 2 (PC2).

Table 7. Pearson correlation matrix of social coherence and economic performance, 1995-2003, 306 observations.

	gdp	lab	dgdp	dlab	igdp	ilab	geneco	soccoh
gdp	1.00							
lab	0.91a	1.00						
dgdp	-0.11b	-0.10c	1.00					
dlab	-0.26a	-0.29a	0.70a	1.00				
igdp	0.98a	0.90a	-0.11b	-0.26a	1.00			
ilab	0.90a	0.99a	-0.11b	-0.30a	0.90a	1.00		
geneco	0.96a	0.97a	-0.11b	-0.29a	0.97a	0.98a	1.00	
soccoh	0.44a	0.27a	-0.13b	-0.15a	0.42a	0.27a	0.35a	1.00

Notes: Significant at the less than 1% (a), 1-5% (b) and 5-10%(c) levels of significance.
Abbreviations: GDP per capita (gdp), labour productivity (lab), % change in GDP per capita (dgdp), % change in labour productivity (dlab), Normalized GDP per capita (igdp), normalized labour productivity (ilab), general economics (geneco), social cohesion (soccoh)

Table 8. mean normalized indicators by individual country, country groups and over time, 1995-2003, 306 observations.

country	igdp	ilab	ipri	ipov	iemp	ifem	iold	iune	idis	iedu	iexp	iinv	ifre	iemi	iene
A. Mean by country															
Sweden	0.52	0.65	0.29	0.97	0.81	0.81	0.97	0.83	0.83	0.85	1.00	0.10	0.50	0.41	0.93
Norway	0.68	0.80	0.21	0.56	1.00	0.87	0.98	0.99	0.99	0.98	0.39	0.32	0.27	0.36	0.96
USA	0.74	0.91	0.46	0.56	0.85	0.75	0.81	0.99	0.25	0.65	0.66	0.38	0.52	0.32	0.88
Denmark	0.57	0.64	0.24	0.88	0.93	0.81	0.74	0.90	0.25	0.67	0.53	0.42	0.55	0.35	0.99
Netherlands	0.55	0.64	0.46	0.83	0.78	0.65	0.35	0.87	0.98	0.57	0.47	0.42	0.47	0.38	0.95
Austria	0.58	0.66	0.44	0.73	0.70	0.62	0.19	0.91	0.97	0.79	0.45	0.57	0.39	0.38	0.98
CzechRep	0.24	0.26	0.91	1.00	0.62	0.58	0.39	0.74	0.76	0.95	0.24	0.86	0.49	0.62	0.56
Finland	0.49	0.69	0.30	0.89	0.60	0.68	0.45	0.67	0.69	0.83	0.77	0.28	0.50	0.38	0.91
Germany	0.50	0.64	0.42	0.77	0.57	0.57	0.39	0.60	0.76	0.63	0.59	0.47	0.45	0.58	0.97
Korea	0.23	0.21	0.84	0.67	0.46	0.44	0.87	0.64	0.82	0.64	0.61	0.52	0.62	0.38	0.96
UK	0.50	0.65	0.45	0.39	0.77	0.70	0.66	0.83	0.68	0.59	0.45	0.22	0.51	0.52	0.94
Luxembourg	1.00	1.00	0.45	0.77	0.46	0.40	0.12	0.95	0.25	0.44	0.40	0.37	0.60	0.67	0.95
Japan	0.53	0.57	0.00	0.56	0.72	0.57	0.93	0.92	0.25	0.65	0.74	0.38	0.48	0.35	1.00
France	0.50	0.81	0.42	0.58	0.45	0.52	0.23	0.62	0.70	0.72	0.55	0.28	0.47	0.41	0.96
Belgium	0.52	0.85	0.45	0.66	0.36	0.42	0.09	0.56	0.61	0.72	0.48	0.45	0.54	0.39	0.94
Slovenia	0.26	0.35	0.70	0.83	0.50	0.59	0.05	0.68	0.25	0.86	0.33	0.67	0.51	0.46	0.87
Iceland	0.57	0.69	0.28	0.56	0.47	1.00	0.36	0.61	0.25	0.12	0.58	0.38	0.46	0.39	0.82
Romania	0.00	0.00	0.96	0.45	0.50	0.56	0.60	0.73	0.86	0.70	0.05	0.35	0.56	0.81	0.30
Ireland	0.53	0.80	0.41	0.30	0.46	0.44	0.51	0.66	0.25	0.75	0.26	0.48	0.32	0.21	0.96
Hungary	0.15	0.28	0.89	0.83	0.23	0.40	0.02	0.66	0.54	0.77	0.14	0.49	0.49	0.68	0.73
Portugal	0.28	0.33	0.69	0.23	0.65	0.60	0.64	0.80	0.89	0.06	0.13	0.66	0.30	0.13	0.93
Cyprus	0.33	0.42	0.61	0.52	0.64	0.54	0.64	0.91	0.25	0.80	0.00	0.22	0.48	0.00	0.91
Slovakia	0.12	0.20	0.94	0.23	0.37	0.49	0.06	0.11	0.60	0.99	0.14	0.94	0.83	0.67	0.55
Poland	0.10	0.16	0.86	0.51	0.28	0.43	0.22	0.33	0.75	0.84	0.11	0.37	0.56	0.67	0.67
Estonia	0.09	0.10	0.84	0.41	0.51	0.60	0.64	0.55	0.25	0.77	0.11	0.74	0.03	0.89	0.33
Lithuania	0.07	0.06	0.92	0.47	0.44	0.59	0.44	0.35	0.25	0.76	0.08	0.45	0.45	0.89	0.33
Greece	0.27	0.51	0.62	0.25	0.26	0.27	0.43	0.48	0.82	0.70	0.09	0.47	0.20	0.24	0.92
Latvia	0.04	0.06	0.88	0.52	0.40	0.54	0.38	0.30	0.25	0.65	0.04	0.57	0.25	0.97	0.64
Croatia	0.08	0.60	0.50	0.56	0.18	0.38	0.18	0.18	0.25	0.93	0.24	0.38	0.46	0.60	0.95
Spain	0.37	0.63	0.61	0.36	0.19	0.23	0.35	0.36	0.46	0.42	0.18	0.60	0.36	0.18	0.94
Italy	0.49	0.77	0.53	0.35	0.18	0.23	0.18	0.37	0.00	0.46	0.22	0.33	0.44	0.37	0.96
Malta	0.29	0.53	0.71	0.58	0.21	0.13	0.20	0.60	0.25	0.00	0.45	0.29	0.46	0.14	0.90
Turkey	0.02	0.07	0.87	0.00	0.01	0.00	0.34	0.87	0.25	0.65	0.08	0.40	0.37	0.50	0.81
Bulgaria	0.01	0.01	0.99	0.64	0.09	0.38	0.06	0.05	0.52	0.65	0.07	0.10	0.73	0.87	0.00

country	igdp	ilab	ipri	ipov	iemp	ifem	iold	iune	idis	iedu	iexp	iinv	ifre	iemi	iene
B. Mean by country group															
EU12	0.51	0.69	0.48	0.53	0.50	0.49	0.39	0.67	0.55	0.56	0.36	0.43	0.43	0.37	0.95
EU3	0.53	0.67	0.34	0.86	0.70	0.70	0.54	0.81	0.83	0.82	0.74	0.32	0.47	0.39	0.94
EU10	0.17	0.24	0.83	0.59	0.42	0.49	0.30	0.52	0.42	0.74	0.16	0.56	0.46	0.60	0.65
Japan	0.53	0.57	0.00	0.56	0.72	0.57	0.93	0.92	0.25	0.65	0.74	0.38	0.48	0.35	1.00
Korea	0.23	0.21	0.84	0.67	0.46	0.44	0.87	0.64	0.82	0.64	0.61	0.52	0.62	0.38	0.96
Others	0.23	0.36	0.64	0.46	0.37	0.53	0.42	0.57	0.52	0.67	0.24	0.32	0.48	0.59	0.64
USA	0.74	0.91	0.46	0.56	0.85	0.75	0.81	0.99	0.25	0.65	0.66	0.38	0.52	0.32	0.88
C. Mean by year															
1995	0.39	0.50	0.64	0.54	0.47	0.49	0.43	0.61	0.53	0.65	0.37	0.37	0.00	0.40	0.80
1996	0.40	0.51	0.56	0.56	0.45	0.50	0.44	0.58	0.53	0.64	0.35	0.32	0.40	0.41	0.81
1997	0.39	0.50	0.57	0.57	0.45	0.51	0.44	0.57	0.53	0.65	0.36	0.45	0.43	0.40	0.82
1998	0.37	0.48	0.54	0.58	0.46	0.52	0.45	0.59	0.53	0.69	0.36	0.41	0.57	0.46	0.81
1999	0.35	0.46	0.62	0.58	0.47	0.53	0.43	0.61	0.53	0.66	0.36	0.49	0.64	0.47	0.80
2000	0.33	0.45	0.68	0.58	0.48	0.53	0.42	0.63	0.52	0.67	0.32	0.54	0.50	0.50	0.80
2001	0.34	0.48	0.63	0.58	0.51	0.54	0.40	0.70	0.51	0.66	0.33	0.41	0.53	0.50	0.80
2002	0.34	0.49	0.58	0.58	0.53	0.54	0.40	0.72	0.49	0.69	0.32	0.54	0.52	0.49	0.80
2003	0.33	0.50	0.52	0.58	0.57	0.55	0.42	0.71	0.52	0.67	0.32	0.42	0.57	0.65	0.80

Abbreviations: GDP per capita (gdp), labour productivity (lab), employment rate (emp),female employment rate (fem),old age employment rate (old), Education enrolment (edu), R&D expenditure (exp), business investment (inv), prices (pri), risk at poverty (pov),Unemployment rate (une), regional employment distribution (dis), emission rate (emi), energy use (ene), freight (fre).
Prefix 'i' on front of a variable indicates normalized variable.

Table 9. Mean composite indices and their components by country and country groups and over time, 1995-2003, 306 observations.

country	geneco	employ	inores	ecoref	soccoh	enviro	Rank1	LSI	Rank2	PC1	Rank3	PC2
A. Mean by country												
Sweden	1.18	2.60	1.85	0.40	2.64	1.86	1	10.54	2	2.49	2	2.40
Norway	1.48	2.86	1.37	0.54	2.55	1.60	2	10.43	1	2.87	1	2.42
USA	1.65	2.43	1.31	0.85	1.80	1.73	3	9.79	4	2.28	7	1.93
Denmark	1.21	2.49	1.20	0.66	2.04	1.90	4	9.51	3	2.34	3	2.12
Netherland	1.19	1.78	1.04	0.88	2.69	1.81	5	9.42	6	2.19	5	2.00
Austria	1.24	1.52	1.24	1.01	2.63	1.77	6	9.42	5	2.26	4	2.00
CzechRep	0.50	1.60	1.20	1.77	2.51	1.68	7	9.27	10	1.92	9	1.68
Finland	1.18	1.73	1.60	0.59	2.26	1.81	8	9.19	8	2.05	6	1.95
Germany	1.15	1.54	1.23	0.89	2.14	2.01	9	8.98	11	1.91	10	1.67
Korea	0.44	1.78	1.25	1.36	2.13	1.97	10	8.96	13	1.74	17	1.30
UK	1.16	2.14	1.04	0.68	1.91	1.98	11	8.93	9	1.98	12	1.45
Luxembourg	2.00	0.99	0.85	0.83	1.98	2.23	12	8.89	18	1.61	11	1.52
Japan	1.11	2.22	1.40	0.38	1.74	1.83	13	8.71	7	2.18	8	1.73
France	1.31	1.21	1.27	0.71	1.90	1.84	14	8.28	17	1.68	13	1.42
Belgium	1.37	0.88	1.21	0.90	1.84	1.87	15	8.09	20	1.54	16	1.35
Slovenia	0.62	1.14	1.19	1.37	1.77	1.85	16	7.98	19	1.59	14	1.40
Iceland	1.26	1.84	0.71	0.67	1.43	1.68	17	7.61	14	1.72	18	1.36
Romania	0.00	1.67	0.75	1.31	2.05	1.68	18	7.49	23	1.29	29	0.69
Ireland	1.33	1.42	1.02	0.89	1.22	1.50	19	7.40	15	1.71	15	1.20
Hungary	0.43	0.66	0.92	1.39	2.04	1.91	20	7.38	25	1.14	22	0.88
Portugal	0.61	1.89	0.19	1.35	1.93	1.37	21	7.37	12	1.88	20	0.96
Cyprus	0.76	1.82	0.80	0.83	1.69	1.40	22	7.32	16	1.71	19	1.11
Slovakia	0.33	0.92	1.13	1.88	0.95	2.06	23	7.29	27	1.04	23	0.82
Poland	0.27	0.94	0.95	1.23	1.60	1.91	24	6.93	29	1.01	27	0.70
Estonia	0.19	1.76	0.88	1.59	1.22	1.26	25	6.92	21	1.52	24	0.79
Lithuania	0.14	1.48	0.85	1.37	1.08	1.67	26	6.61	28	1.03	30	0.63
Greece	0.79	0.97	0.80	1.09	1.56	1.37	27	6.59	22	1.41	25	0.78
Latvia	0.10	1.33	0.70	1.45	1.09	1.87	28	6.56	26	1.07	31	0.56
Croatia	0.69	0.75	1.17	0.88	1.00	2.02	29	6.54	30	1.00	21	0.91
Spain	1.00	0.78	0.61	1.21	1.19	1.49	30	6.29	24	1.19	28	0.70
Italy	1.27	0.59	0.68	0.87	0.73	1.78	31	5.95	31	0.87	26	0.72
Malta	0.82	0.55	0.45	1.00	1.45	1.52	32	5.81	32	0.87	32	0.51
Turkey	0.09	0.35	0.73	1.27	1.12	1.68	33	5.27	33	0.70	34	0.04
Bulgaria	0.02	0.54	0.73	1.09	1.22	1.60	34	5.22	34	0.15	33	0.27

country	geneco	employ	inores	ecoref	soccoh	enviro	Rank1	LSI	Rank2	PC1	Rank3	PC2
B. Mean by country group												
EU12	1.20	1.39	0.93	0.91	1.76	1.76	5	7.98	5	1.69	4	1.32
EU3	1.20	1.95	1.56	0.67	2.51	1.81	2	9.72	2	2.26	1	2.11
EU10	0.42	1.22	0.91	1.39	1.54	1.71	6	7.21	6	1.29	7	0.91
Japan	1.11	2.22	1.40	0.38	1.74	1.83	4	8.71	3	2.18	3	1.73
Korea	0.44	1.78	1.25	1.36	2.13	1.97	3	8.96	4	1.74	5	1.30
Others	0.59	1.34	0.91	0.96	1.56	1.71	7	7.09	7	1.29	6	0.95
USA	1.65	2.43	1.31	0.85	1.80	1.73	1	9.79	1	2.28	2	1.93
C. Mean by year												
1995	0.89	1.40	1.02	1.01	1.69	1.21	9	7.25	9	1.46	9	1.12
1996	0.91	1.40	0.99	0.88	1.68	1.64	8	7.53	8	1.49	8	1.15
1997	0.89	1.41	1.01	1.03	1.68	1.66	7	7.70	7	1.54	7	1.19
1998	0.86	1.44	1.05	0.96	1.71	1.85	6	7.88	6	1.59	6	1.23
1999	0.81	1.44	1.03	1.12	1.73	1.92	3	8.07	5	1.61	5	1.25
2000	0.79	1.44	0.99	1.22	1.74	1.81	4	8.01	4	1.63	4	1.28
2001	0.83	1.45	0.99	1.04	1.80	1.83	5	7.97	2	1.65	3	1.29
2002	0.83	1.48	1.01	1.12	1.80	1.81	2	8.07	3	1.64	2	1.30
2003	0.84	1.55	1.00	0.94	1.82	2.03	1	8.19	1	1.67	1	1.31

Abbreviations: general economics (geneco), employment (employ), innovation research (inores), economic reform (ecoref), Social cohesion (soccoh), environment (enviro), Lisbon structural index (LSI), principal component1/2 (PC1/PC2).

Table 10. Percent changes in indices and index components by country, country groups and over time, 1995-2003, 306 observations.

country	geneco	employ	inores	ecoref	soccoh	enviro	LSI	PC1	PC2
A. Mean changes by country									
Austria	-2.28	0.10	1.24	2.22	-0.05	8.23	1.21	0.69	0.53
Belgium	-1.51	4.23	0.88	-0.07	2.89	9.90	2.54	2.28	3.11
Bulgaria	14.60	5.56	-1.48	2.03	3.44	11.16	3.71	-10.54	17.03
Croatia	0.08	-1.09	-1.04	-0.34	2.13	4.17	0.85	1.03	1.52
Cyprus	-3.23	1.56	-0.61	-3.55	0.33	6.53	0.36	1.00	1.20
CzechRep	-1.15	-0.43	0.14	-1.64	-0.96	7.50	0.14	-1.06	-0.18
Denmark	-1.42	1.70	-1.67	1.98	0.70	11.38	1.82	0.54	0.74
Estonia	12.77	-0.30	-0.69	2.25	0.14	-0.23	0.44	5.24	3.45
Finland	-0.79	4.51	1.60	3.13	0.61	8.03	2.42	2.96	1.06
France	-1.92	3.14	-1.58	1.73	1.55	7.61	1.56	1.69	1.42
Germany	-2.71	0.59	-2.42	-3.16	0.78	7.28	0.45	-0.75	0.71
Greece	1.28	2.43	2.11	5.64	1.57	4.59	2.73	5.06	7.09
Hungary	2.38	8.15	1.78	0.87	2.28	5.39	3.07	6.15	6.92
Iceland	-2.35	0.83	7.07	-4.25	1.70	5.77	1.14	1.97	2.90
Ireland	1.70	7.72	0.75	0.91	5.99	6.12	3.78	9.60	7.14
Italy	-2.96	5.51	2.96	-1.00	6.09	8.89	2.77	5.10	4.94
Japan	-2.09	-0.39	-0.55	5.08	0.29	9.24	1.24	-0.69	0.05
Korea	2.79	-1.70	-1.23	-4.03	-0.63	12.19	0.49	-2.31	0.18
Latvia	16.77	2.25	-2.59	7.91	4.25	1.28	2.83	11.06	9.39
Lithuania	16.88	0.46	-0.16	-0.43	2.08	6.04	1.34	4.46	4.93
Luxembour	0.00	4.65	4.71	-0.91	0.06	8.34	1.94	2.53	2.92
Malta	-2.74	0.84	-2.74	-0.21	1.26	9.82	1.29	1.53	1.09
Netherlan	-1.80	6.16	-0.88	-0.98	0.93	9.44	2.35	2.57	2.31
Norway	0.66	-0.24	-0.21	-14.27	0.62	6.05	0.27	0.35	0.71
Poland	5.07	-7.31	-0.11	1.42	-5.91	7.10	-0.65	-5.79	-2.22
Portugal	-1.63	2.48	2.87	0.64	1.78	6.90	2.05	2.83	3.41
Romania	39.17	-5.27	-3.96	3.69	-1.10	7.27	-0.26	-2.02	-3.22
Slovakia	3.72	-1.51	-1.72	0.82	-2.98	10.62	1.24	-2.42	1.61
Slovenia	1.17	0.92	-0.17	1.61	0.66	8.20	1.97	1.20	1.84
Spain	-0.57	14.62	1.62	3.80	9.45	7.17	5.14	13.07	10.58
Sweden	-1.82	1.20	-0.43	4.80	0.44	8.07	1.03	0.95	0.66
Turkey	5.15	-8.32	0.87	-0.95	-0.76	7.00	1.12	-2.03	-12.86
UK	-0.23	1.87	1.28	-2.07	3.32	7.94	2.44	2.50	3.51
USA	-0.86	0.21	-0.86	-1.79	0.88	10.04	1.12	0.17	0.68

country	geneco	employ	inores	ecoref	soccoh	enviro	LSI	PC1	PC2
B. Mean changes by country group									
EU12	-0.98	4.59	0.89	0.54	2.93	7.96	2.47	3.92	3.99
EU3	-1.63	1.94	0.81	3.38	0.33	8.11	1.55	1.53	0.75
EU10	5.16	0.46	-0.69	0.90	0.12	6.23	1.20	2.14	2.80
Japan	-2.09	-0.39	-0.55	5.08	0.29	9.24	1.24	-0.69	0.05
Korea	2.79	-1.70	-1.23	-4.03	-0.63	12.19	0.49	-2.31	0.18
Others	9.55	-1.42	0.21	-2.35	1.01	6.90	1.14	-1.87	1.01
USA	-0.86	0.21	-0.86	-1.79	0.88	10.04	1.12	0.17	0.68
C. Mean changes by year									
1996	4.13	-0.55	-1.21	-15.23	-0.86	36.21	4.10	1.94	2.24
1997	2.15	0.80	2.39	21.69	-0.34	1.33	2.34	3.01	6.13
1998	-4.55	3.09	3.48	-7.72	2.83	11.93	2.44	3.16	5.86
1999	-1.07	0.24	-2.06	21.27	1.99	4.02	2.44	2.51	1.07
2000	4.20	-0.16	-2.82	10.43	0.83	-5.68	-0.61	1.08	5.29
2001	3.54	0.89	0.29	-16.54	3.73	1.50	-0.51	0.46	-0.50
2002	5.88	2.75	2.44	8.97	0.83	-1.31	1.48	-0.70	-0.77
2003	7.40	5.91	-1.39	-20.31	1.32	11.99	1.49	2.41	0.71

Abbreviations: general economics (geneco), employment (employ), innovation research (inores), economic reform (ecoref), Social cohesion (soccoh), environment (enviro), Lisbon structural index (LSI), principal component1/2 (PC1/PC2. Prefix 'd' on front of a variable indicates percentage change.

Table 11. Comparing mean value of composite indices and their components for individual and groups of countries, 1996 and 2003, 306 observations.

A. Mean changes by year

	EU10		EU12		EU3		Japan		Korea		USA	
variable	1996	2003	1996	2003	1996	2003	1996	2003	1996	2003	1996	2003
Geneco	0.42	0.43	1.29	1.17	1.32	1.13	1.29	1.04	0.46	0.50	1.80	1.64
Employ	1.25	1.29	1.22	1.61	1.83	2.13	2.26	2.18	1.94	1.68	2.39	2.39
Inores	0.92	0.89	0.88	0.92	1.50	1.57	1.41	1.36	1.29	1.20	1.33	1.27
Ecoref	1.25	1.34	0.72	0.79	0.44	0.52	0.27	0.37	1.40	1.05	0.81	0.75
Soccoh	1.55	1.57	1.61	1.90	2.44	2.57	1.75	1.74	2.30	2.12	1.77	1.83
Enviro	1.68	1.80	1.66	2.15	1.63	2.19	1.63	2.31	1.75	2.49	1.54	2.24
LSI	7.10	7.35	7.40	8.57	9.17	10.14	8.64	9.03	9.17	9.06	9.66	10.15
PC1	1.25	1.38	1.47	1.85	2.12	2.36	2.19	2.08	1.97	1.59	2.23	2.21
PC2	0.88	0.99	1.15	1.44	2.03	2.15	1.73	1.70	1.32	1.30	1.81	1.84

B. Percent changes between two years (1996 and 2003)

	EU10	EU12	EU3	Japan	Korea	Others	USA
Geneco	0.02	-0.09	-0.13	-0.18	0.08	-0.10	-0.09
Employ	0.02	0.32	0.16	-0.03	-0.13	-0.07	0.00
Inores	-0.02	0.04	0.05	-0.03	-0.07	-0.00	-0.04
Ecoref	0.06	0.10	0.19	0.33	-0.24	0.02	-0.06
Soccoh	0.01	0.17	0.05	-0.00	-0.07	0.06	0.03
Enviro	0.06	0.29	0.34	0.41	0.42	0.25	0.45
LSI	0.03	0.15	0.10	0.04	-0.01	0.04	0.05
PC1	0.10	0.25	0.11	-0.05	-0.19	0.02	-0.00
PC2	0.12	0.24	0.06	-0.01	-0.01	0.11	0.01

Abbreviations: general economics (geneco), employment (employ), innovation research (inores), economic reform (ecoref), Social cohesion (soccoh), environment (enviro), Lisbon structural index (LSI), principal component index 1 (PC1), Principal component index 2 (PC2).

Figure 1. Lisbon Development Strategy Index (LIS) components.

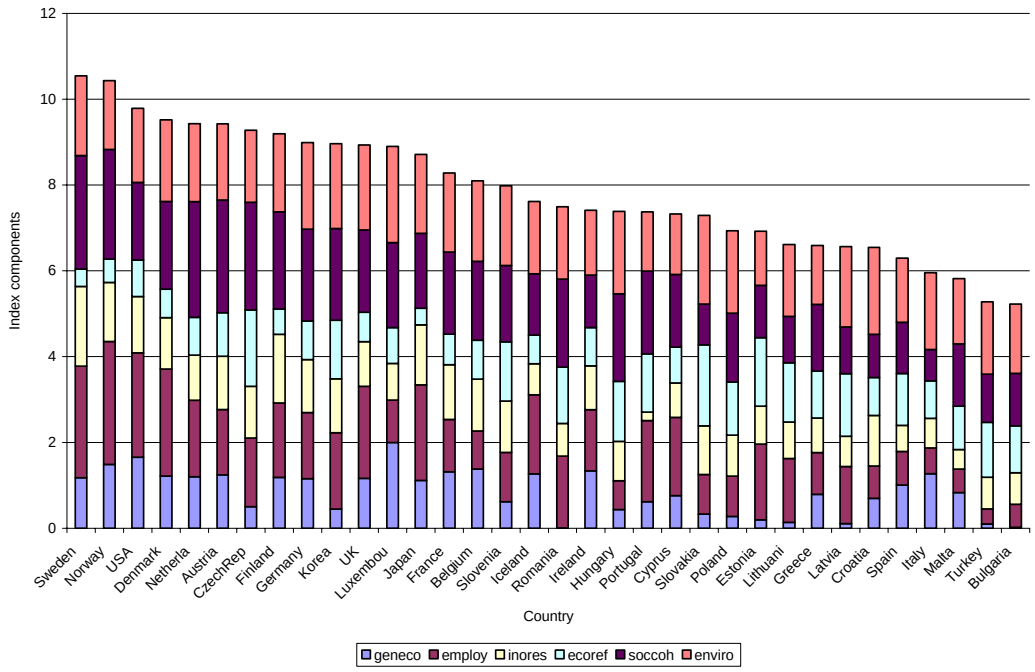

Figure 2. Lisbon development strategy index (LSI), principal component index (PC1) and accounting for negative effects (PC2) normalized at USA level.

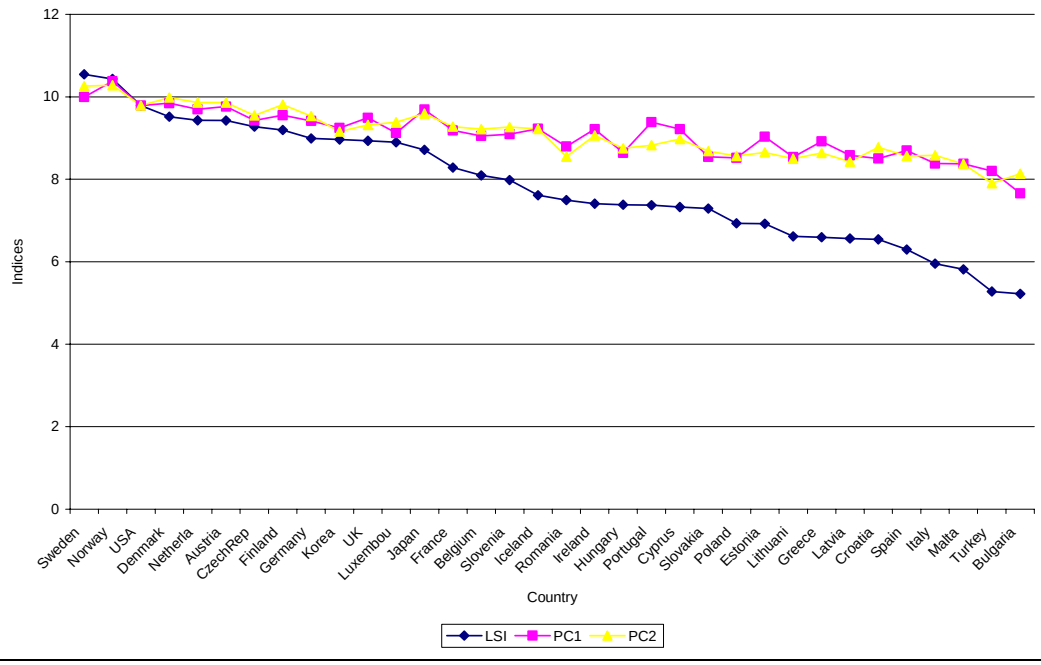

Figure 3. Lisbon Devlopment Strategy Index (LSI) components.

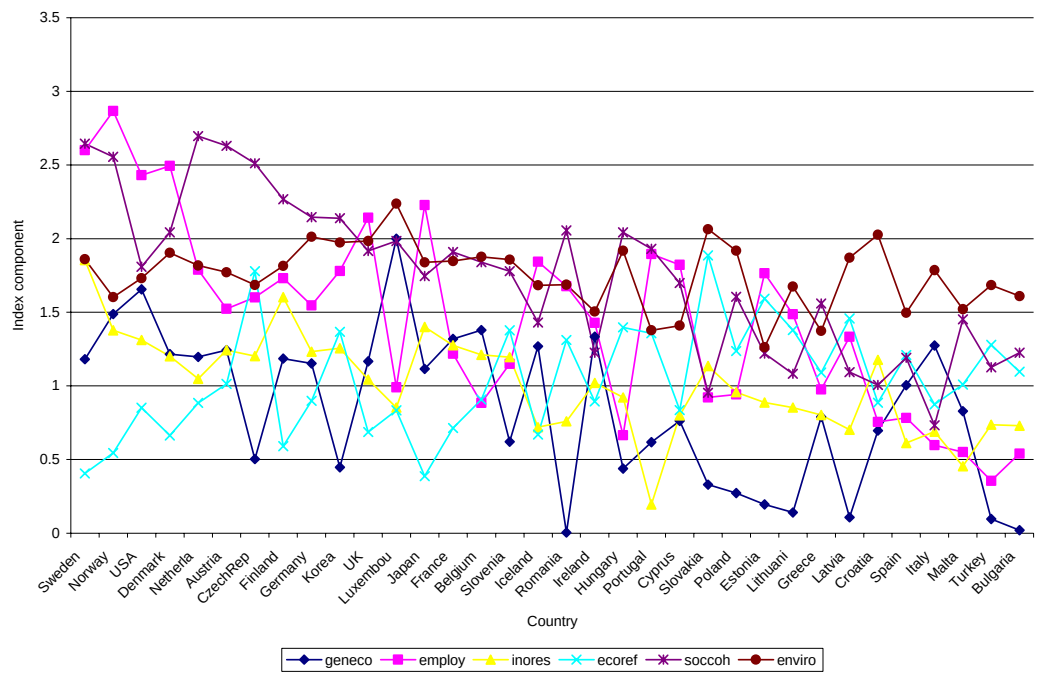

Figure 4. Lisbon Development Strategy Indices by country group.

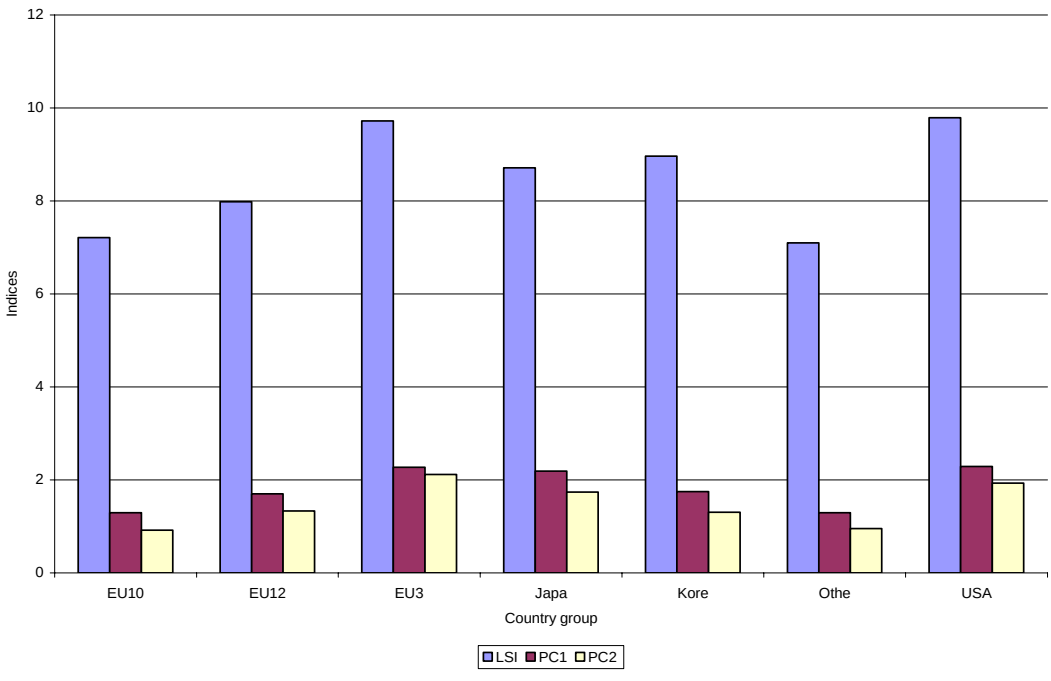

Figure 5. Development of Lisbon Strategy Indices over time.