RETHINKING THE MONITORING OF THE LISBON STRATEGY'S TARGETS

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Motivation

- The Lisbon Strategy (LS) is a ten year-strategy (Lisbon European Council, 2000) focused in reaching a leadership economic position in dynamic and competitive terms.
  - Although it is an overall strategy, it can be disaggregated in particular objectives and ways to achieve them.
- In order to measure and monitor the Strategy process, a complex system of around a hundred of indicators was developed
  - A means for the Commission to draw up an annual synthesis report relating to five areas: employment, innovation, economic reform, social cohesion and environment
  - A process of simplification of this Indicators System occurred: from the initial 107 to the final 14 indicators
- This simplification process has followed the objective of the Commission "indicators easy to read and understand" but forgets one of the initial characteristics of the LS "the multiplicity of objectives"

Objectives

- **1st objective**: A description of the Lisbon Strategy is made:
  - Analysis of its objectives
  - Monitoring of the strategy: list of structural indicators (linked to targets)
  - An overall evaluation
- **2nd objective**: An analysis of the evolution of the structural indicators against general economic background indicators, focusing on economic growth and convergence
  - The annual reports of the Commission only review the evolution of the different indicators. This analysis can be complemented with a discussion about the implications that the evolution of these indicators may have on economic growth.
  - Growth is a key aspect (general economic background) + Multidimensionality of the indicators + Commission states that a composite indicator is needed in the Innovation and Research area

We focus on the relationship between **Innovation and Research** and **Economic Growth** and define a system of **composite indicator system** of this dimension (evolution of this system of composite indicators and its relationship with growth)

Outline

- Introduction. Motivation and Objectives
- Description of the Lisbon Strategy
  - Objectives
  - Structural indicators
  - Overall situation
- Analysis of the structural indicators evolution during the last decade and its relationship with growth
- Innovation and Research and growth
  - Empirical discussion of correlations between I&R indicators and growth
  - How knowledge based economic indicators influence convergence
  - Composite measurements for I&R

Objectives

- The Lisbon Strategy is a ten year-strategy (Lisbon European Council, 2000) focused in reaching a leadership economic position in dynamic and competitive terms, based in **four axes**:

A. Reaching a knowledge-based economy after
B. Modernising the European social model
C. Developing a framework of appropriate and stability oriented macroeconomic policies
D. Achieving sustainable development.

Particular objectives:

A.1. Information society for all
A.2. Establishing a European Area of Research and Innovation
A.3. Creating a friendly environment for starting up and developing innovative businesses,
A.4. Economic reforms for a fully operational internal market
A.5. Efficient and integrated financial markets
B.6. Education and training for living and working in the knowledge society
B.7. More and better jobs for Europe: developing an active employment policy
B.8. Modernising social protection
B.9. Promoting social inclusion
C.10. Coordinating macro-economic policies: fiscal consolidation, sustainability of public finances
D.11. A strategy for sustainable development

Structural Indicators

In order to measure and monitor the progress made in achieving these strategic goals, the Council invited the Commission to draft an **annual synthesis report** (Spring Report) on the progress of the LS on the basis of commonly agreed **structural indicators** (easy to read and understand).

Since 2000, a complex system of around a hundred indicators has been developed (107 indicators), all of them related to the five next dimensions:

- **Employment**
- **Innovation**
- **Economic Reforms**
- **Social Cohesion**
- **Environment**

+ General Economic Background

In the "Structural Indicators" Report (2003), the Commission did a process of simplification of this Indicators System: from the initial 107 to the final **14 indicators**. In any case, in this Report, **new indicators** are suggested to be developed in the near future.

GENERAL ECONOMIC BACKGROUND

Structural Indicators:

1.Gross Domestic Product per capita in Purchasing Power Standards (GDP pc in PPS)
Source: EUROSTAT; National Accounts
Availability: Coverage: all MS, all ACCs, US, Japan, Norway, Iceland. Time series: 1991-2001 (forecasts for 2002-2005; non data available for some years for ACCs).
Overall policy objective: Standard of living, and Social and environmental welfare.
Interpretation: Temporal comparison, expecting its increase over time and the reduction of the gap with main competitors.

2. Labour productivity per person employed (GDP in PPS per person employed)
Source: EUROSTAT; National Accounts and OECD
Availability: Coverage: all MS, all ACCs, US, Japan, Iceland and Norway.
Time series: 1991-2001 (forecasts for 2002-2004; non data available for some years ACCs).
Overall policy objective: Overall efficiency of the economy.
Interpretation: Temporal comparison, expecting its increase over time and the reduction of the gap with main competitors.

Indicators to be developed in the future:

1. **Potencial output**
2. **Total factor productivity**

EMPLOYMENT

Structural Indicators:

3. Employment rate (Employed persons aged 15-64 as a share of the total population of the same age group)
Source: EUROSTAT; Labour Force Survey
Availability: Coverage: all MS, all ACCs, Iceland and Norway. No comparable data for the US and Japan. Time series: 1990-2002.
(non data available for some years for ACCs)
Overall policy objective: Full employment. Combating social exclusion.
Interpretation:. Strategic target: EU should achieve an average employment rate as closes as possible to 70% by 2010 (60% for females).

4. Employment rate of older workers (Employed persons aged 55-64 as a share of the population of the same age group)
Source: EUROSTAT; Labour Force Survey
Availability: Coverage: all MS, all ACCs, Iceland and Norway. No comparable data for the US and Japan. Time series: 1990-2002. (Non data available for some years for ACCs)
Overall policy objective: Full employment. Combating social exclusion.
Interpretation: Temporal comparison, expecting non decrease over time.

Indicators to be developed in the future:

1. **Vacancies**
2. **Quality of work**
3. **Poverty trap (marginal effective tax rate)**
4. **Childcare facilities**

INNOVATION AND RESEARCH

Structural Indicators:

5. GERD: Gross Domestic Expenditure on Research and Development (Gross Domestic Expenditure on R&D as a percentage of the GDP)
Source: Eurostat questionnaire
Availability: Coverage: MS (except Luxembourg), ACCs (except Malta), Iceland, Norway, Japan; USA. Time series: 1991-2001 (2002 and 2003 for some MS).
Overall policy objective: R&D effort
Interpretation: Temporal comparison, expecting its increase over time. Strategic target: Rise overall spending in the Union on R&D with the aim of approaching 3% of GDP by 2010.

6. Youth educational attainment level (Percentage of the population aged 20 to 24 having completed at least upper secondary education)
Source: Eurostat; EU Labour Force Survey.
Availability: Coverage: MS, ACCs (except Turkey), Switzerland, Iceland, Norway. No data for USA and Japan. Time series: 1992-2003 (non data available for some years for ACCs)
Overall policy objective: Quality of human resources.
Interpretation: Temporal comparison, expecting an increase over time.

Indicators to be developed in the future:

1. **Composite indicators on the knowledge-based economy**
2. **Public and private expenditure on human capital.**
3. **E-government**
4. **ICT investment**
5. **Broadband internet access**

ECONOMIC REFORMS

Structural Indicators:

7. Comparative price levels (Comparative price levels of final consumption by private households including indirect taxes)
Source: Eurostat; OECD
Availability: Coverage: MS, ACCs, Norway, Iceland, USA, Japan. Time series: 1991-2001 (provisional for 2002; some years for some countries).
Overall policy objective: Product market integration. Market efficiency.
Interpretation: Temporal comparison, expecting a decrease over time.

8. Business investment (Gross fixed capital formation by the private sector as a % of GDP)
Source: Eurostat; National Accounts
Availability: Coverage: MS, ACCs, Norway. Time series: varies from one country to the other (the longest series start in 1980).
Overall policy objective: Private investment effort
Interpretation: Temporal comparison, expecting an increase over time.

Indicators to be developed in the future:

1. **Cost of capital**
2. **Financial integration**

SOCIAL COHESION

Structural Indicators:

9. At-risk-poverty rate after social transfers (Share of persons with an equivalised disposable income below risk-of-poverty threshold after social transfers, which is set at 60% of the national median equivalised disposable income).
Source: Eurostat; European Community Household Panel (ECHP)
Availability: Coverage: MS, ACCs. No comparable data available for US, Japan. Time series: 1994-2003 (non data available for some years for some countries)
Overall policy objective: Combating poverty and social exclusion
Interpretation: Temporal comparison, expecting a decrease over time.

10. Dispersion of regional employment rates (Coefficient of variation of employment rates across regions- NUTS 2 level-within countries)
Source: Eurostat; Labour Force Survey
Availability: Coverage: MS, several ACCs. Indicator not relevant for DK, IRL and L. Time series: 1999-2002 (non data available for some years for some countries)
Overall policy objective: Cohesion
Interpretation: Temporal comparison, expecting a decrease over time.

11. Total long-term unemployment rate (Long-term unemployed -12 months or more- as a % of total active population aged 15-64)
Source: Eurostat/Labour Force Survey
Availability: Coverage: MS, ACCs, US, Japan Iceland and Norway. Time series: 1990-2002 (non data available for some years for some countries)
Overall policy objective: Full employment. Combating social exclusion.
Interpretation: Temporal comparison, expecting a decrease over time.

Indicators to be developed in the future: { **1. Regional GDP per capital in PPS**

ENVIRONMENT

Structural Indicators

12. Total greenhouse gas emissions (% change in emissions of 6 main greenhouses gases-CO2, CH4,N2O,HFCs,PFCs and SF6-since base year and targets according to Kyoto Protocol/EU Council Decision for 2008-2012)
Source: European Environment Agency.
Availability: Coverage: MS, ACCs, Norway, Iceland, USA, Japan. Time series: 1990-2001
Overall policy objective: Limit climate change and implement the Kyoto Protocol.
Interpretation: Temporal comparison, expecting a decrease over time. Targets according to Kyoto Protocol/EU Council Decision for 2008-2012.

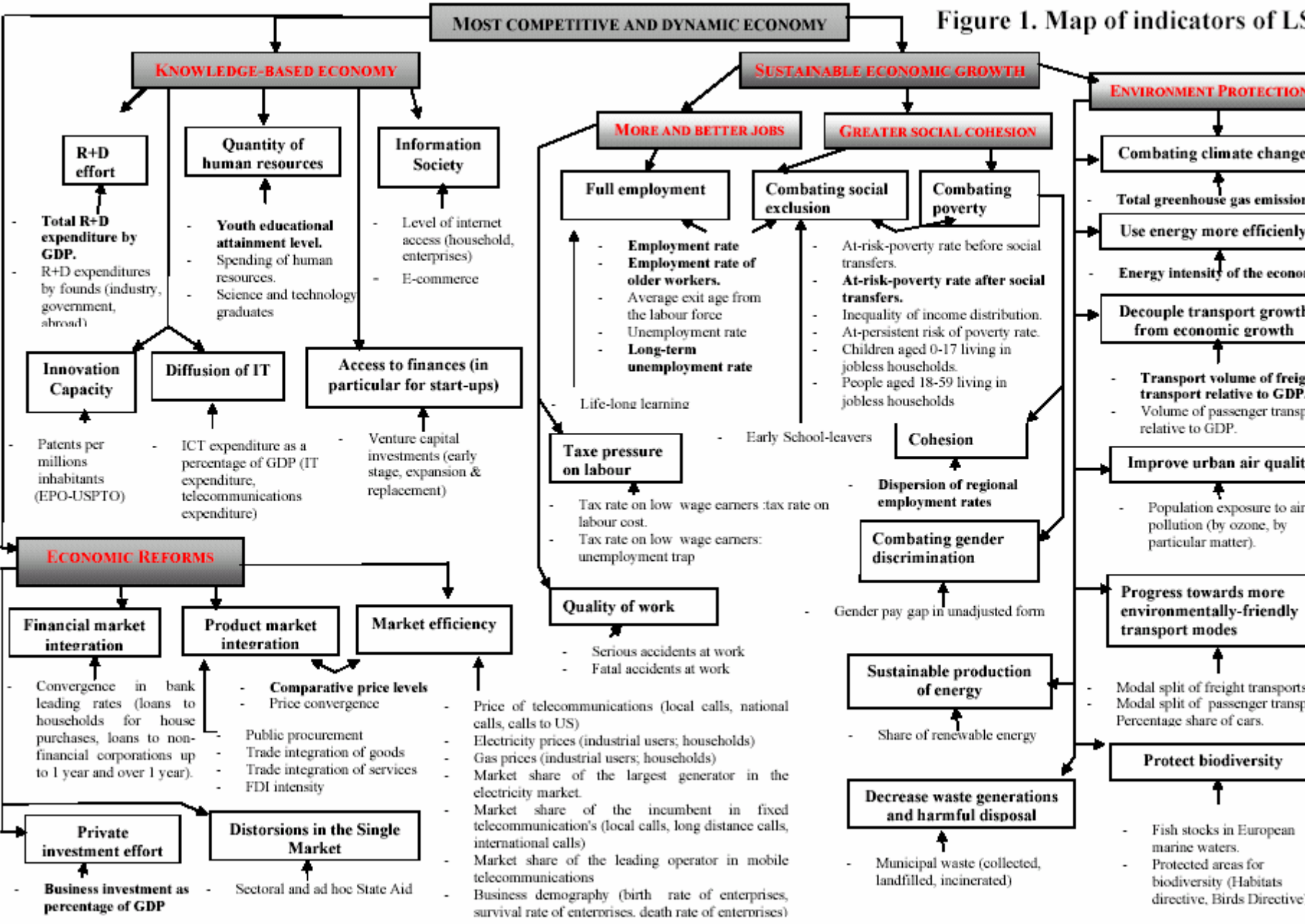
13. Energy intensity of the economy (Gross inland consumption of energy divided by GDP)
Source: Eurostat; Energy statistics
Availability: Coverage: MS, ACCs, Norway, Iceland, USA, Japan. Time series: 1991-2001
Overall policy objective: Use energy more efficiently.
Interpretation: Temporal comparison, expecting a decrease over time

14. Transport-Volume of freight transport relative to GDP (Index of inland freight transport volume relative to GDP, measured in tonne-km /GDP)
Source: Eurostat; Transport Statistics
Availability: Coverage: MS, ACCs, Norway, Iceland, USA, Japan. Time series: 1991-2002 (data non available for some years for some ACCs)
Overall policy objective: Decouple transport growth from economic growth.
Interpretation: Temporal comparison, expecting an increase over time.

Indicators to be developed in the future:

1. **Consumption of toxic chemicals**
2. **Resource productivity**
3. **Healthy life years**
4. **Biodiversity index**

Figure 1. Map of indicators of LS



Overall evaluation

Implementation, albeit partially, of the reforms under the Lisbon strategy seems to be starting to bear fruit as regards the initial objectives. So, as the Commission says, the overall progress already made in four years is proof of this:

- **More than six million jobs have been created since 1999,** (total employment rate from 62.5% to 64.3% in 2002; long-term unemployment from 4% in 1999 to 3% en 2002).
- **Several key markets have been completely or partially opened up to competition**: telecommunications, rail freight, postal services, electricity and gas markets.
- **The knowledge-based economy is becoming a reality (**Internet take-up in 93% of schools, as well as in businesses, public administration and households; and gradual development of the European Research Area).
- **The sustainable development approach is being taken more fully into account in policymaking** (reforms of the pension systems/schemes to cope with the ageing of the population; paying increasingly greater heed to preserving our natural environment).

An analysis of the progress made highlights the relatively positive developments but also the **major problems** which need to be tackled urgently:

• **The need for public finances to be viable:** Budgetary and fiscal discipline has not been kept in the same way by all Member States and the average EU deficit stood at 2.7% of GDP in 2003.

•**The unsatisfactory contribution of employment and productivity to growth.** As a result, the Union cannot catch up on the United States as our per capita GDP is 72% of our American partner's. The low growth in overall productivity in Europe is due in particular to two main factors: the contribution of information and communication technologies (ICTs) is too low and investment, both public and private, in human capital is still inadequate.

•**The disappointing development of the internal market.**

•**The lack of sustainability of growth.** There is real risk of poverty increasing in several Member States, mainly due to the increase in unemployment but also to the fact that the social protection and pensions systems are not sustainable. In the environmental sphere, Member States' performance is generally inadequate. This shows a lack of awareness of the fact that growth may harm the environment and prove counter-productive in the medium and long term.

In sum, the revision of the Lisbon Agenda shows a moderate progress in most of the areas under consideration.

Analysis of the structural indicators evolution and growth

- The LS is revisited in an annual synthesis report:
  - A list of structural indicators is presented
  - Reflect the European position in economic and competitive terms

- We compute the 15 member states crossed country correlations in 3 moments in time (1994, 1997 and 2001) between 12 indicators and the 2 GEB indicators (Gross Domestic Product pc and Labour Productivity per person employed)

- We show Scatter Plots to analyse which have been the more important forces that have influenced growth of the EU countries during the last 10 years (growth of GDPpc 94-03 versus growth of each one of the structural indicators in 94-01).
  - Growth in employment, knowledge and human capital, investments or social cohesion has been accompanied with general growth?

4 main conclusions:

- GDPpc growth of of EU15 countries in 90s has been positively correlated with growth in terms of human capital, employment and business investments (factors that reveal themselves as solid forces of economic growth)
- This growth has not implied a worsening in social cohesion, at least on the lines of evolution of long-term unemployment.
- This growth has been accompanied with relative growth in prices and little sustainability (increases in greenhouse gases emissions and in the general degree of congestion and pollution)
- Some countries that grew more in terms of GDPpc during the last 10 years showed, at the beginning of the period, relatively low employment rates, low levels of expenditures on R&D youth educational attainment levels and business investments or high levels of long-term unemployment levels, reflecting a catch up process.

In the rest of the paper we analyse the relationship between economic growth and the improvements made in the area of innovation and research (either with present indicators and with the composite indicators we develop)

Knowledge and economic growth

- Knowledge and Economic growth (theoretical basis):
  - Smith, Ricardo and Schumpeter : economic growth is due to a balanced growth of physical productive capital
  - Solow (1957) : long run per capita growth is determined by exogenous technology (not explained in the model)
  - Endogenous growth models : includes a rather realistic knowledge and technology creation mechanism:
    - Technological change is an output resulting from investment in human capital (education and training), employment of specialised labour (R&D personnel)
    - Abandoning the unrealistic assumption of universally availability towards the assumption of excludability of technology : patenting is a way to exclude others form using it
    - The endogenous character of innovation means that the process is rooted within each country.

Measuring innovative and research activity

- No universal solution has been found
- Starting from the concept of Knowledge production function, 2 types:
  - Technology input : R&D expenditures, number of scientists and technicians employed in R&D
  - Outputs of R&D : patents and new product announcements
- Criticisms:
  - They embrace firms' efforts for invention and innovation together with imitation activities and do not take into account for informal technological activity
  - Patenting propensity varies among sectors
- The problems of measurement of R&D are recognised but their existence can not invalidate the economic character of activities creating knowledge and technology
- The LS considers 20 indicators : input and output side, related to human capital and related to the use that population and firms make of technology

Table 4. List of innovation and research indicators

Spending on Human Resources (public expenditure on education) as a percentage of GDP
GERD (Gross domestic expenditure on R&D) - As a percentage of GDP
GERD (Gross domestic expenditure on R&D) by source of funds - industry - Percentage of GERD financed by industry
GERD (Gross domestic expenditure on R&D) by source of funds - government - Percentage of GERD financed by government
GERD (Gross domestic expenditure on R&D) by source of funds - abroad - Percentage of GERD financed by abroad
Level of Internet access - households - Percentage of households who have Internet access at home
Level of internet access - enterprises - Percentage of enterprises who have Internet access
Science and technology graduates - total - Tertiary graduates in science and technology per 1000 of population aged 20-29
Science and technology graduates - females - Female tertiary graduates in science and technology per 1000 of female population aged 20-29
Science and technology graduates - males - Male tertiary graduates in science and technology per 1000 of male population aged 20-29
Patents EPO - Number of patent applications to the European Patent Office (EPO) per million inhabitants
Patents USPTO - Number of patents granted by the United States Patent and Trademark Office (USPTO) per million inhabitants
Venture capital investments - early stage - relative to GDP, breakdown by investment stages
Venture capital investments - expansion & replacement - relative to GDP, breakdown by investment stages
ICT expenditure - IT expenditure - Expenditure on Information Technology as a percentage of GDP
ICT expenditure - Telecommunications expenditure - Expenditure on Telecommunications Technology as a percentage of GDP
E-commerce - Percentage of enterprises' total turnover from e-commerce - Share of turnover sold via the internet by enterprises with 10 or more persons employed
Youth education attainment level - total - Percentage of the population aged 20 to 24 having completed at least upper secondary education
Youth education attainment level - females - Percentage of the female population aged 20 to 24 having completed at least upper secondary education
Youth education attainment level - males - Percentage of the male population aged 20 to 24 having completed at least upper secondary education

INNOVATION AND RESEARCH INDICATORS

List of indicators to be developed and included in the Communication from the Commission "Structural Indicators" COM-2003 585 final

1. **Composite indicators on the knowledge-based economy**
2. **Public and private expenditure on human capital.**
3. **E-government**
4. **ICT investment**
1. **Broadband internet access**

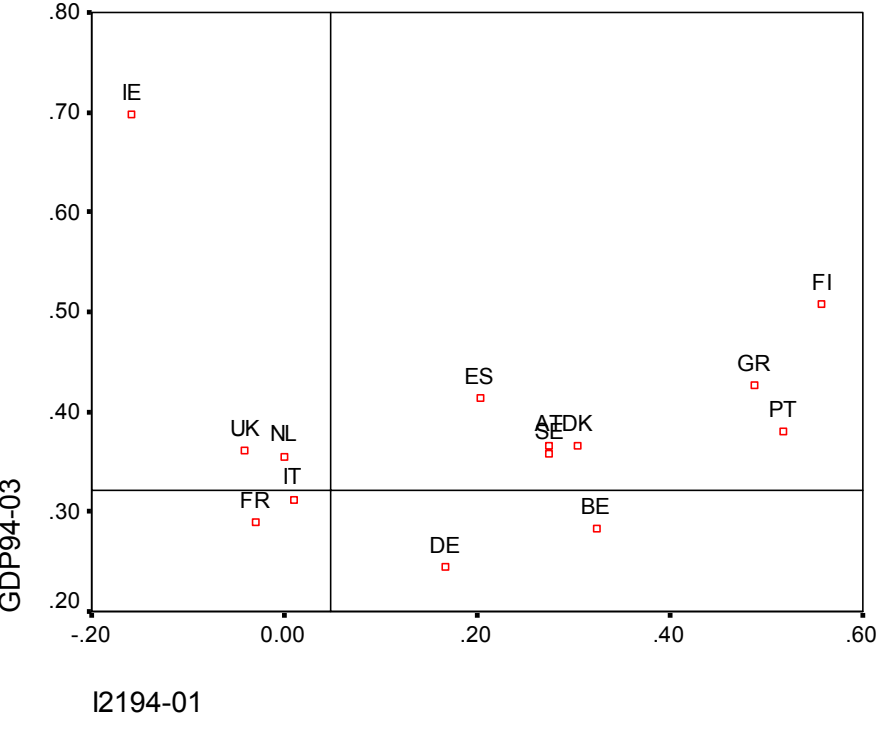
Innovation and Research

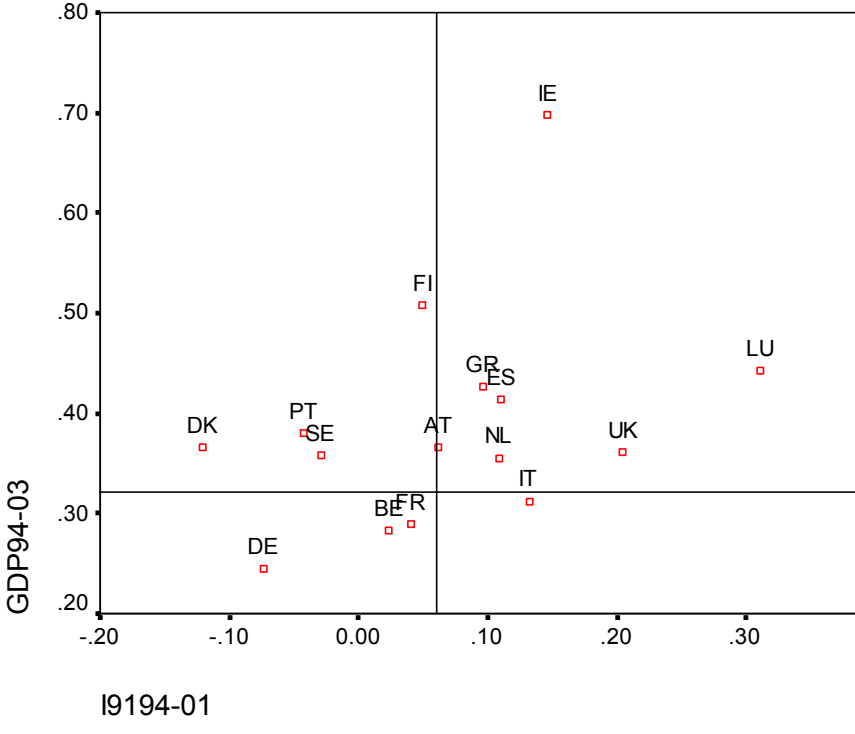
- effect on growth
- effect on convergence
- composite measures

Correlations between I&R growth and economic growth

- Many correlations show low values, against a first intuition
- Positive correlation with economic growth:
  - Patents, Youth education attainment level, Level of internet access (from 1999)
- Negative correlation with economic growth:
  - Human resources
- Non-significant correlation
  - Gross domestic expenditure on R&D and Venture capital
- In scatter plots (GDPpc growth vs R&D indicator growth) it is observed that the correlation is highly dependent on Ireland.
  - If Ireland is eliminated, all the correlations become positive.

4. A knowledge based economy





How knowledge indicators influence convergence

- Neoclassical growth models:
  - Supports a convergence process based on decreasing returns in K
  - This circumstance explains the existence of a steady state level for the main magnitudes to which the economy will tend after any transitory shocks
  - Poor economies will grow at higher rates than rich ones

- Endogenous growth models:
  - Give mechanisms that determine the absence of convergence
  - Not imposing decreasing returns to K and the existence of mechanisms in which technological growth is a non-decreasing function of some factors (e.g. resources devoted to R&D) lead to models in which there is not a steady state or long run equilibrium.
  - No limits to growth.

- Growth equation (Barro and Sala-i-Martin, 1995):

$$g_{GDP\,i} = a - (1 - e^{-\beta T}) \log(GDP_{i0}) + u_i$$

How knowledge indicators influence convergence

We estimate a growth equation for:

- Sample of 15 member states of the EU
- 1994-2003
- To avoid heteroskedasticity problems: weighted least squares with population as the weighted variable
- In a first stage, we test the existence of absolute convergence as predicted in neoclassical models in the estimation of the model above
- In a second stage, we aggregate it with some variables that could be affecting the steady state (introduced ad-hod in the way à la Barro):

$$g_{GDP\,i} = a - (1 - e^{-\beta T}) \log(GDP_{i0}) + \gamma\, Service_{i0} + \rho\, g_{INNOVATION\,i} + u_i$$

  - Service: share of value added in service sectors (sectoral structure)
  - $g_{INNOVATION}$: growth rate of each indicator in the area of I&R (1994-2001)

How knowledge indicators influence convergence

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Constant	4.356*** (0.812)	4.530*** (0.579)	-1.289 (0.946)	3.891*** (0.648)	-1.187 (0.729)	-1.867*** (0.577)	-2.727*** (0.606)	3.364*** (0.621)	3.517*** (0.627)	-1.817** (0.593)
Ln GDP_0	-0.415*** (0.083)	-0.484*** (0.582)	0.249* (0.122)	-0.372*** (0.053)	0.277*** (0.082)	0.273*** (0.086)	0.461*** (0.672)	-0.354*** (0.059)	-0.364*** (0.059)	0.339*** (0.071)
Service		0.748*** (0.245)	-1.149** (0.387)	0.48 (0.457)	-1.707*** (0.170)	-0.848** (0.383)	-2.001*** (0.222)	0.569* (0.281)	0.487 (0.270)	-1.707*** (0.175)
Spending			-0.310* (0.162)							
GERD				-0.118 (0.101)						
Science and technology graduates					-0.045 (0.025)					
Patents EPO						0.125** (0.041)				
Patents USPTO							-0.053 (0.0.043)			
Venture capital (early stage)								-0.000 (0.001)		
Venture capital (expansion)									-0.001 (0.004)	
Youth education attainment level										0.244*** (0.076)
R^2	0.655	0.860	0.938	0.838	0.969	0.899	0.896	0.830	0.828	0.942
Log likelihood	18.398	20.769	25.322	24.888	22.979	26.925	23.273	23.017	22.939	25.537

Composite Measurements for I&D

An inherent difficulty in measuring knowledge exists and, although a list of indicators can be built, it can be **quite heterogeneous**. This variety of indicators offer opposite results on the European growth and convergence.

Thus, the selection of only two ***structural indicators*** is difficult. We see that:

- –*Gross Domestic Expenditure on Research and Development (GERD)* is particularly related with Spending on Human Resources, Patents, Venture Capital Investment and Level of Internet Access
- –*Youth Education Attainment Level* is much correlated with Science and Technology Graduates

These points drive us to think on the possibility of building **composite indicators** on the knowledge-based economy, reducing the multidimensionality of the area (as is stated in the Communication from the Commission COM-2003 585 final).

Composite Measurements for I&D

We have followed a **double strategy** for reducing the multidimensionality:

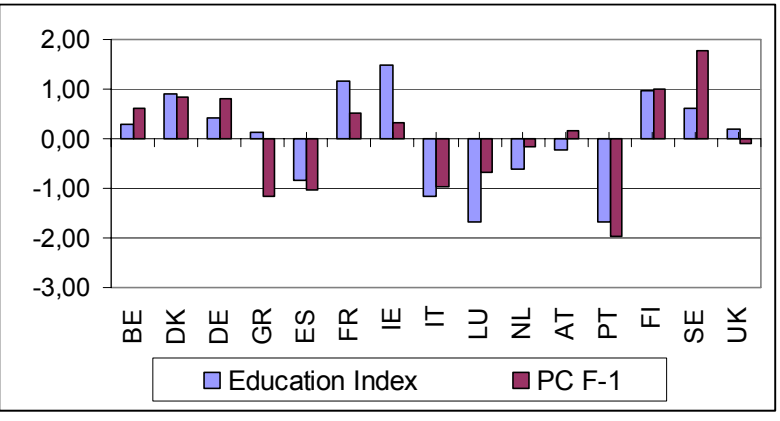
- Principal components:
  - pick up the information common to all variables
  - components are weighted with the proportion of variance in the original set of variables
  - first two factors = 64% of total variance
- Structural index methodologies: based on an *ad hoc* structure, grouping Education indicators against Innovation indicators
  - pick up all the information in the variables considered (more appropriate)
  - same weight to all the variables

	Index 1 (Education)	Index 2 (Innovation)	Principal Components factor 1	Principal Components factor 2
Index 1 (Education)				
Index 2 (Innovation)	0.352			
Principal Components factor 1	**0.738**	-0.218		
Principal Components factor 2	0.526	**0.955**	0.000	

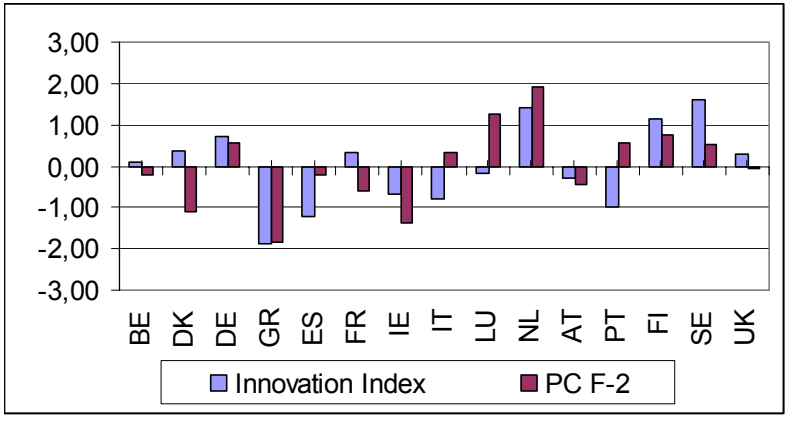
Finally, both strategies exhibit very similar results!

Composite Measurements for I&D

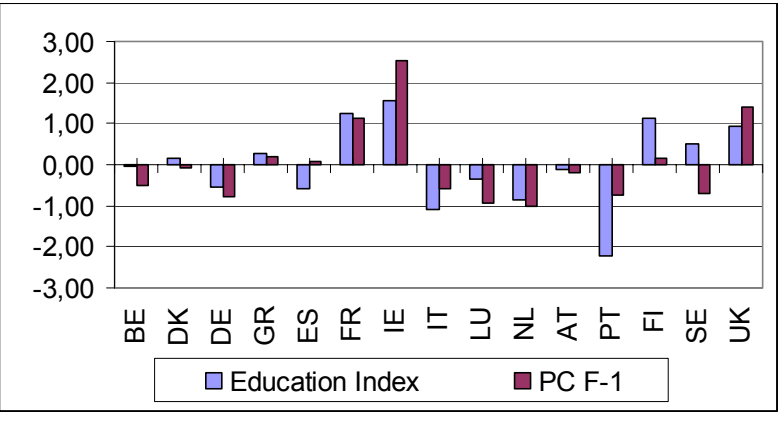
Education



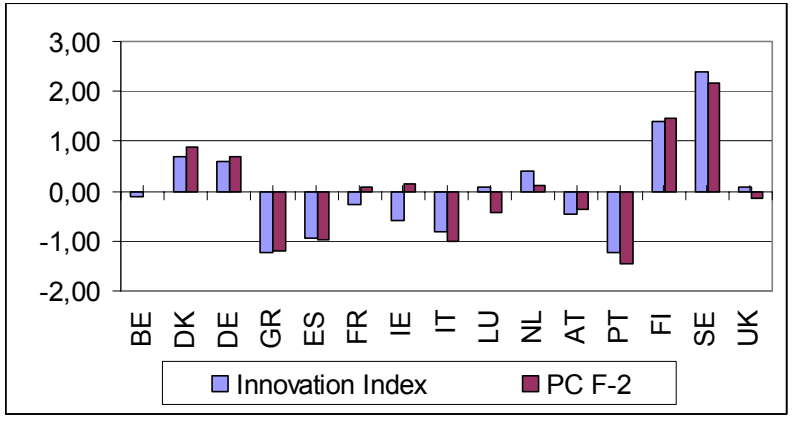
Innovation



1995



2001



Composite Measurements for I&D

These measurements allow us for:

- Ranking countries
- Have metric measurements of the level of innovation and research
- In the computed *ad hoc* indices, following Royuela, Suriñach and Reyes (2003), we can compute the 2001 index based on 1995=100, and allowing for **temporal comparisons**.

This last point allows for computing again the convergence equation, against growth of Innovation and Research indicators

Composite Measurements for I&D

	(1)	(2)
Constant	-2.142** (0.784)	-4.467** (0.596)
Ln GDP_0	0.415*** (0.089)	0.663*** (0.0739)
Service	-3.303 *** (0.231)	-2.520 *** (0.237)
Education Index Growth	0.0669 ** (0.026)	
Innovation Index growth		0.0482 ** (0.016)
R^2	0.911	0.922
Log likelihood	21.619	22.611

We finally find a positive influence of both Education and Innovation on GDP per capita growth, although, as obtained in several former estimates, no overall convergence process is found.