JRC Scientific and Technical Reports

Towards a set of Composite Indicators on Flexicurity: a Comprehensive Approach

Anna Rita Manca, Matteo Governatori and Massimiliano Mascherini

EUR 24329 EN - 2010

JRC EUROPEAN COMMISSION

ipsc Institute for the Protection and Security of the Citizen

The mission of the JRC-IPSC is to provide research results and to support EU policy-makers in their effort towards global security and towards protection of European citizens from accidents, deliberate attacks, fraud and illegal actions against EU policies.

European Commission
Joint Research Centre
Institute for the Protection and Security of the Citizen

Contact information
Anna Rita Manca
European Commission- Joint Research Centre
Address: Via Enrico Fermi 2749, Ispra, Italy
E-mail: Anna.Manca@jrc.ec.europa.eu
Tel.: +39(0)332789314
Fax: +39(0)332785733
http://ipsc.jrc.ec.europa.eu/
http://www.jrc.ec.europa.eu/

Matteo Governatori
Directorate General for Employment, Social Affairs and Equal Opportunities
Employment Analysis
Address: Rue Joseph II 27, 1049 Brussels, Belgium
E-Mail: Matteo.Governatori@ec.europa.eu
Tel.: +32(0)22993436
Fax: +32(0)22994233

Massimiliano Mascherini
European Foundation for the Improvement of the Living and Working Condition
Address: Wyattville Road Loughlinstown, Dublin 18, Ireland
E-Mail: Massimiliano.Mascherini@ eurofound.europa.eu
Tel.:+35312043108
Fax.:+35312826456

JRC 58069

EUR 24329 EN
ISBN 978-92-79-15591-8
ISSN 1018-5593
DOI 10.2788/84431

Luxembourg: Publication Office of the European Union

Contents

1 Introduction

In recent years, the European Employment Strategy (EES) has stressed the need to protect workers from the risk of exclusion from the labour market as a result of a rapidly changing economic environment due to globalization, development of new technologies, demographic ageing of the European society and the rising speed of circulation of information and people. As citizens, employees are part of a civil society where their need to find or maintain a job at every stage of their active life should be preserved.

Following the recent recession, national and international institutions face challenges such as rising unemployment, segmentation of the labour market, and the need to adapt workers' skills while protecting more vulnerable workers' categories. In order to remain competitive in a changing economy, companies need to adapt their work force by recruiting staff with better skills. Hiring and firing of workers may then occur more frequently, raising the role of labour market policies and institutions as tools to ensure social security while combining appropriately rights and obligations for welfare beneficiaries.

The European Commission's Lisbon Agenda aims to enhance both flexibility and security in the labour markets in order to reconcile competitiveness and sustainable economic growth with more and better jobs and greater social cohesion (COM(2007)359). The pursuit of a balance between flexibility and security addresses simultaneously

- the flexibility of labour markets, work organization and labour relations, and
- security, including employment and social security for weaker groups in and out of the labour market.

This is the concept of flexicurity whereby flexibilisation of employment and labour markets is advocated to support productivity, competitiveness and growth, while security is advocated from a social policy perspective emphasising the importance of preserving social cohesion within society (Wilthagen, 1998).

In order to benefit from economic and social change, several challenges have to be tackled such as skill gaps among workers, rising income and wage inequalities, production outsourcing and relocation. In this perspective flexibility is not in the exclusive interest of employers since employees may also need a more flexible organization of work in order to better combine it with private responsibilities or to be able to undergo training and acquire new skills. In addition flexibilization policies have the purpose of adjusting labour market and/or social security arrangements that are considered too protective or static (Wilthagen and Tros, 2003).

The European Commission calls on Member States to do more to improve the adaptability of workers and enterprises and to create a more open and responsive labour markets.

The approach of flexicurity implies that the policies for more and better jobs are developed in coordination with social partners from both sides, i.e. employees and employers, through public or private partnership and are aimed to ensure security to workers in and out of the labour market reducing risks of social exclusion (Wilthagen and Tros, 2004). Moreover, flexicurity also concerns progress of workers into better jobs, development of talent and support of transitions during life course, e.g. from school to work, from job to job, between unemployment and employment and from work to retirement. Therefore, security implies equipping people with the skills that enable them to progress in their working lives, and helping them find a new job rapidly when unemployed. It is also about adequate unemployment benefits to facilitate transitions towards new jobs. Finally, it encompasses training opportunities for all workers, especially weaker groups such as the low skilled and older workers.

This paper has been developed in this framework and presents the findings of a research project carried out by the Joint Research Centre- (Unit G09-Econometrics and Applied Statistics) and DG Employment (Unit D1 – Employment Analysis) of the European Commission[1]. The project aimed to develop statistical tools to measure flexicurity achievements of EU Member States through a set of four composite indicators corresponding to the four dimensions of flexicurity identified by the Commission (COM(2007)359), i.e.

- Lifelong Learning (LLL),
- Active Labour Market Policies (ALMP),
- Modern Social Security Systems (MSS) and
- Flexible and Reliable Contractual Arrangements (FCA).

This project represents a significant step forward with respect to previous analyses of flexicurity, in many respects:

1. Comprehensiveness. This is by far the broadest numeric analysis of flexicurity to date, covering a much richer range of aspects than all existing work in the literature and hence giving full justice to the multidimensionality of flexicurity both across and within the four dimensions.

To give some examples, the Reliable Contractual Arrangements (FCA) component is normally captured by only (or mainly) looking at the indicator of strictness of employment protection legislation (Nardo et al., 2005), whereas in this analysis both external and internal (i.e. working time) flexibility are covered, together with labour market segmentation. In the case of lifelong learning (LLL), the analysis is not only limited to indicators of participation to education and training (as is usually the case), but covers also the intensity of training (in terms of costs and hours). In the case of ALMPs, this analysis does not simply look at overall spending as a share of GDP but

[1] "*Statistical analysis in support of Flexicurity policy*", Administrative Arrangements 30566-2007-03 A1CO ISP BE.

distinguishes across different activation programs, while also including the intensity of Market Policies (ALMP) spending per participant and per person wanting to work. Finally, in the case of Modern Social Security Systems (MSS) the analysis is particularly rich, including overall spending on passive support measures, generosity and duration of unemployment benefits, financial incentives of unemployed and inactive people to get a job[2] and availability of childcare services.

2. Soundness and transparency of statistical methodology used. A composite indicator is "a mathematical combination of individual indicators that represent different dimensions of a concept whose description is the objective of the analysis". As flexicurity is a highly multidimensional concept composite indicators appear as the ideal tool to provide a summary measure of it. On the other hand, flexicurity analyses are generally based on batteries of indicators which are not appropriately integrated so that possibilities for trade-offs, compensating changes and functional equivalents are not fully accounted for.

Moreover, composite indicators are a theoretically solid and established statistical technique[3] which has already been applied to calculate summary measures of other complex socio-economic concepts. One often mentioned caveat of composite indicators is that they may 'hide' divergent developments across components and sub-components. This criticism is widely tackled in this exercise by, first, calculating a composite indicator for each of the four components rather than a single flexicurity indicator; secondly, by being clear and transparent on their structure[4] and, thirdly, by showing country-by-country results via radar plots and tables which disaggregate the indicators' scores by individual input indicators or sub-components (see Annex 1 on country profiles).

3. Solid theoretical framework on flexicurity. The framework used to characterise flexicurity builds on previous analysis undertaken by DG EMPL services on measurement of flexicurity (see Employment in Europe 2006 and 2007) and is well rooted on socio-economic and labour market literature. The socio-economic rationale of every input indicator included is thoroughly provided. Moreover, such indicators are often grouped into sub-components based on clear theoretical considerations (e.g. external and internal flexibility within the FCA indicator, or size of unemployment benefits and financial incentives to take up a job within the MSS component). Finally, input indicators contribute to the composite index either with a positive or a negative sign, reflecting their divergent contribution to flexicurity based on theoretical arguments.

This is the first attempt to integrate two parallel but potentially contradictory policy messages on social security systems:

- the need to provide adequate income support to the unemployed and, ,

[2] i.e. indicators of unemployment and inactivity traps.
[3] see OECD/JRC handbook on Composite indicators, 2008.
[4] I.e. list of input indicators, sub-components, weights, signs, etc.

- the need to reduce financial disincentives to take up jobs for unemployment insurance (UI) recipients.

Indicators for both aspects (respectively, generosity/duration of UI and unemployment/inactivity traps) are included in the MSS index, but with opposite signs. A similar distinction is made, within the FCA index, between strictness of Employment Protection Legislation (EPL) on regular contracts (with negative sign) and the relative strictness of temporary vs. regular contracts (i.e. a measure of labour market segmentation, with a positive sign). All these elements make this exercise much more articulated and subtle than previous attempts to measure flexicurity.

4. Policy relevance: possibility to replicate the exercise for policy monitoring. The Commission has issued several policy recommendations to Member States linked to flexicurity. However, progress cannot be ensured unless a proper framework for monitoring of flexicurity achievements is put in place. Such framework has to be based on indicators which are regularly (i.e. yearly) updated, so that monitoring can be systematically repeated. This issue has been widely debated by EU institutions and a methodology has been endorsed by the EU Employment Committee (EMCO) in 2009. However, no monitoring exercise has been carried out thus far.

The methodology proposed in this paper is similar in several respects to the EMCO one[5], albeit being richer in the set of indicators included, and is based on institutional data sources (Eurostat, EMCO Compendium etc.) which are generally updated every year; hence it is particularly suitable to underpin policy monitoring. Moreover composite indicators are much more effective than a large battery of individual indicators in identifying trends, benchmarking and monitoring performances on multi-dimensional policy goals such as flexicurity. In this respect this methodology appears to be superior to the one of EMCO which picks somewhat arbitrarily only one indicator per each of the four pillars.

5. Robustness of results is extensively assessed. The study does not simply attribute a set of weights and signs to input indicators and aggregate them into composite indicators. Country scores and ranking based on the chosen structure are evaluated against a large set of alternative assumptions in the process of construction of each composite index, such as the exclusion of individual indicators, different weighting systems and different standardisation and aggregation methods, in order to assess the robustness of results. This is shown in annex 2 on uncertainty and sensitivity analysis (Saisana et al., 2005).

Still, this research has to be considered as work in progress as an important caveat remains. There is no distinction between inputs (policies) and outcomes, so that correlation or causal impact of the former on the latter cannot be investigated. Indicators included are of a mixed nature with prevalence of policy ones. This distinction is left for future econometric analysis which should in particular encompass indicators of size and quality of labour market mobility (e.g. labour turnover, transition rates across activity

[5] e.g. on the structure along the four pillars, several indicators in common, use of radar charts

status, contract type etc.). The EMCO methodology is in this respect superior to the current one as distinction between input, process and outcome indicators is made.

Intermediate results of this project have been presented to the Ad-Hoc Indicators Group of the EU Employment Committee (EMCO IG), which has a specific expertise on the statistical measurement of flexicurity given its extensive work on the elaboration of the above mentioned monitoring methodology endorsed by EMCO in 2009. The EMCO IG is also responsible, together with Commission services, for selecting and updating the Compendium of indicators for monitoring and analysis of Member States' progress towards the objectives set in the Employment Guidelines, which was the main source used in this project. Comments received by EMCO IG members are gratefully acknowledged.

2. The list of Dimensions of the Flexicurity Project

The concept of “flexicurity” is primarily based on the idea that the two dimensions of flexibility and security are not contradictory, but mutually supportive, particularly in the context of the new challenges – such as globalisation – faced by developed economies.

The Commission and the Member States, drawing on experience and analytical evidence, have reached a consensus that flexicurity policies can be designed and implemented across four policy components:

- *Comprehensive lifelong learning (LLL) strategies* to ensure the continual adaptability and employability of workers, particularly the most vulnerable;

- *Effective active labour market policies (ALMP)* that help people cope with rapid change, reduce unemployment spells and ease transitions to new jobs;

- *Modern Social Security Systems* that provide adequate income support, encourage employment and facilitate labour market mobility. This includes broad coverage of social protection provisions (unemployment benefits, pensions and healthcare) that help people combine work with private and family responsibilities such as childcare;

- *Flexible and reliable contractual arrangements* (from the perspective of the employer and the employee, of "insiders" and "outsiders") through modern labour laws, collective agreements and work organization.

2.1 The methodological assumptions

The choice of composite indicators as tools to measure flexicurity has been driven by their capability of aggregating multidimensional concepts into simplified and stylised measures.

The role of composite indicators as benchmarking countries performance and for assessing policies is constantly increasing. This reflects the need of society to be better informed about socio-economic phenomena to support policy decisions. Statistical indicators can satisfy this demand (Stiglitz et al. 2009), although their use still raises some debate between those who advocate the combination of indicators to produce a synthetic index and those who believe that it is sufficient to select an appropriate set of indicators without proceeding to any aggregation (Saltelli, 2007, Sharpe 2004). The Stiglitz report emphasizes the need to be transparent in the normative assumptions underlying the measure.
The main *pros and cons* of the use of composite indicators is presented in table 1

Table 1 Pros and Cons around the use of composite indicators

Pros	Cons
Can summarize complex, multi-dimensional realities with a view to supporting decision makers	May send misleading policy messages if poorly constructed or misinterpreted
Are easier to interpret than a battery of many separate indicators	May invite simplistic policy conclusions
Can assess progress of countries over time	May be misused, *e.g.* to support a desired policy, if the construction process is not transparent and/or lacks sound statistical or conceptual principles.
Reduce the visible size of a set of indicators without dropping the underlying information base.	The selection of indicators and weights could be the subject of political dispute.
Thus make it possible to include more information within the existing size limit.	May disguise serious failings in some dimensions and increase the difficulty of identifying proper remedial action, if the construction process is not transparent
Place issues of country performance and progress at the centre of the policy arena.	May lead to inappropriate policies if dimensions of performance that are difficult to measure are ignored.
Facilitate communication with general public (*i.e.* citizens, media, *etc.*) and promote accountability.	
Help to construct/underpin narratives for lay and literate audiences.	
Enable users to compare complex dimensions effectively.	

Source: Nardo et. al, 2005

The quality of a composite indicator as well as the soundness of the messages it conveys depend both on the methodology used in its construction, which has to be transparent in the assumptions and tested trough an exhaustive and robust sensitivity analysis, and on the quality of the framework and the data used.

Nardo et al. (2005) define a composite indicator as "a mathematical combination of individual indicators that represent different dimensions of a concept whose description is the objective of the analysis" (p.7). Following this logic, we applied this methodology to build four different indexes summarizing the four pillars of flexicurity as defined by the European Commission into numbers; encompassing all relevant dimensions for which data are currently available. Each indicator is independent from the others and altogether they provide a comprehensive view of flexicurity. Data availability was one of the main issues in this project.

Table 2 Data sources for all the dimension of flexicurity

Continuity Vocational Training	LLL			
Labour Market Policy		AMLP		
Compendium			MSS	FCA
OECD'EPL				FCA
Labour Force Survey	LLL			FCA

The dimension of Lifelong learning has been constructed based on two institutional data sources: the Eurostat's Labour Force Survey (LFS) and the Eurostat's Continuing Vocational Training Survey (CVT). Regarding the dimension of Active labour market

policies all the basic indicators are drawn from a unique data source: the Eurostat's Labour Market Policies database. The Modern Social Security System composite indicator is based on two different sources including, mainly, the Compendium of indicators developed by the Employment Committee (EMCO) to monitor Member States' progress towards the objectives set in the Employment Guidelines (hereinafter the Compendium) and the Labour Market Policies Database of Eurostat. Finally Flexible and Reliable Contractual Arrangements are measured based on different sources: the Compendium of indicators developed by the Employment Committee (EMCO), the Labour Force Survey Database of Eurostat and the OECD's EPL database. The quality of data of all indicators has been assessed through commonly used statistical criteria. Each aspect has been evaluated from a maximum (++) to a minimum (--), following standards adopted in the LIME project[6] of the Commission.

To create the set of composite indicators the methodological guidelines of Nardo et al. (2005) were thoroughly followed.

A composite indicator is ultimately the sum of all its parts; hence the methodological assumptions made for its calculation need to be clear and well justified. In general, different methodological decisions can be taken, provided that they are supported by the relevant theoretical framework and their effects on the indicators' final values are carefully evaluated. In the present exercise, methodological choices need to be made with respect to the following elements:

a) the structure of the composite indicator
b) the imputation of missing data.
c) the aggregation rule
d) the standardization formula
e) the weighting system

Based on the theoretical framework developed in cooperation with Unit D1 in DG Employment, the composite indicators on flexicurity have been constructed. In the following sessions the methodological assumptions for each indicator are specified and discussed.

2.1 Life Long Learning Composite Indicator

Based on the recommendations formulated within the LIME project and the suggestions provided in the Compendium, and following a consultation with the Flexicurity team of DG Employment, a set of 9 indicators has been selected for the construction of the Life Long Learning Composite Indicator. These indicators have been extracted from two institutional data sources: the Eurostat's Labour Force Survey (LFS) and the Eurostat's Continuing Vocational Training Survey (CVTs). For this reason the overall quality of the data and country coverage of the set of indicators is overall satisfactory. In particular, the

[6] Lisbon Assessment Methodology.

two indicators extracted from the Eurostat'Labour Force Survey cover all Member States, while those drawn from the CVTS cover 23 Member States and refer to 2005 only. The quality of the data has been assessed through commonly used statistical criteria, ranging from a maximum (++) to a minimum (--). Table 3 below contains the list of indicators used:

Table 3 List of Indicators of the Lifelong Learning Composite Indicator

Indicators and Dimensions	short name	Source	Also in..
Percentage of firms providing CVT			
Percentage of enterprises providing CVT courses	trng_cvts3_06	CVTs 3	
Participation in CVT			
Percentage of employees (all enterprises) participating in CVT courses - Male	trng_cvts3_42_M	CVTs 3	LIME and EMCO
Percentage of employees (all enterprises) participating in CVT courses - Female	trng_cvts3_42_F	CVTs 3	LIME and EMCO
Hours in CVT courses per employee (all enterprises)	trng_cvts3_71	CVTs 3	
Investment in CVT			
Cost of CVT courses as % of total labour cost (all enterprises)	trng_cvts3_54	CVTs 3	LIME and EMCO
Cost of CVT courses per employee (all enterprises) - Corrected Direct Cost	trng_cvts3_61_1	CVTs 3	
Cost of CVT courses per employee (all enterprises) - Direct Cost	trng_cvts3_61_2	CVTs 3	
Cost of CVT courses per employee (all enterprises) - Labour Cost of Participants	trng_cvts3_61_3	CVTs 3	
LifeLong Learning			
Participation of the adult population aged 25-64 participating in education and training (over the four weeks prior to the survey); Male.	part_25-64_M	LFS	LIME and EMCO
Participation of the adult population aged 25-64 participating in education and training (over the four weeks prior to the survey); Female.	part_25-64_F	LFS	LIME and EMCO

The indicators chosen cover several aspects of life-long learning policies. Besides including participation rates to education and training (which is often the only aspect considered) they also encompasses training provision at firms' level by looking both at the share of enterprises offering training programs and the share of employees within enterprises participating to them (broken down by gender) to capture how accessible such

programs are. However, knowing how many people or firms are involved in training tells nothing on how large and intense such training is. Hence, an attempt to capture this aspect is made by including indicators on costs and number of hours of those programs.

The **time coverage** of the Life Long Learning composite indicator is 2005. In fact, the indicators extracted from the Labour Force Survey are available from 2000 to 2006 but CVTS data only refer to 2005 as not all indicators were monitored in the previous survey carried out in 1999. Using the LIME statistical standards, the time coverage for the composite indicator on Life Long Learning can be rated with a "+".

The **geographical coverage** is rated "++" by using the LIME standard. In fact, data for at least 23 member states are available for all the indicators. In table 2, the set of countries with available data are shown.

The **direction of the indicator** has been assumed to be positive for all the indicators, i.e. the higher the score recorded, the better is the performance. This decision is not trivial. In fact for some indicator the opposite decision can be considered valid as well. This is the case for example of the indicators measuring the cost of CVT per courses. A higher cost could mean a better course whereas a lower cost could imply a more efficient use of funds.

The **weighting scheme** adopted for the construction of the Life Long Learning Composite Indicator strictly follows the suggestion addressed in the LIME project. All indicators were assigned the same weight (100). Indicators referred to gender (Male and Female) were given the weight of 50. All the weights have been then rescaled to sum 1. In table 4 the list of weights is presented.

Table 4 - Weighting scheme of the LLL composite indicator

Indicators and Dimensions	short name	weight
Percentage of firms providing CVT		
Percentage of enterprises providing CVT courses	trng_cvts3_06	100
Participation in CVT		
Percentage of employees (all enterprises) participating in CVT courses - Male	trng_cvts3_42_M	50
Percentage of employees (all enterprises) participating in CVT courses - Female	trng_cvts3_42_F	50
Hours in CVT courses per employee (all enterprises)	trng_cvts3_71	100
Investment in CVT		
Cost of CVT courses as % of total labour cost (all enterprises)	trng_cvts3_54	100
Cost of CVT courses per employee (all enterprises) - Corrected Direct Cost	trng_cvts3_61_1	100
Cost of CVT courses per employee (all enterprises) - Labour Cost of Participants	trng_cvts3_61_3	100
LifeLong Learning		
Participation of the adult population aged 25-64 participating in education and training (over the four weeks prior to the survey); Male.	part_25-64_M	50
Participation of the adult population aged 25-64 participating in education and training (over the four weeks prior to the survey); Female.	part_25-64_F	50

2.1.1 The structure of the LLL composite indicator.

The structure of the composite indicator is very simple. It was decided not to include different levels of aggregation of the indicators. The composite indicator is computed putting all input indicators at the same level. Figure 1 shows the structure of the composite indicator (the reader should refer to table 1 for full indicator names).

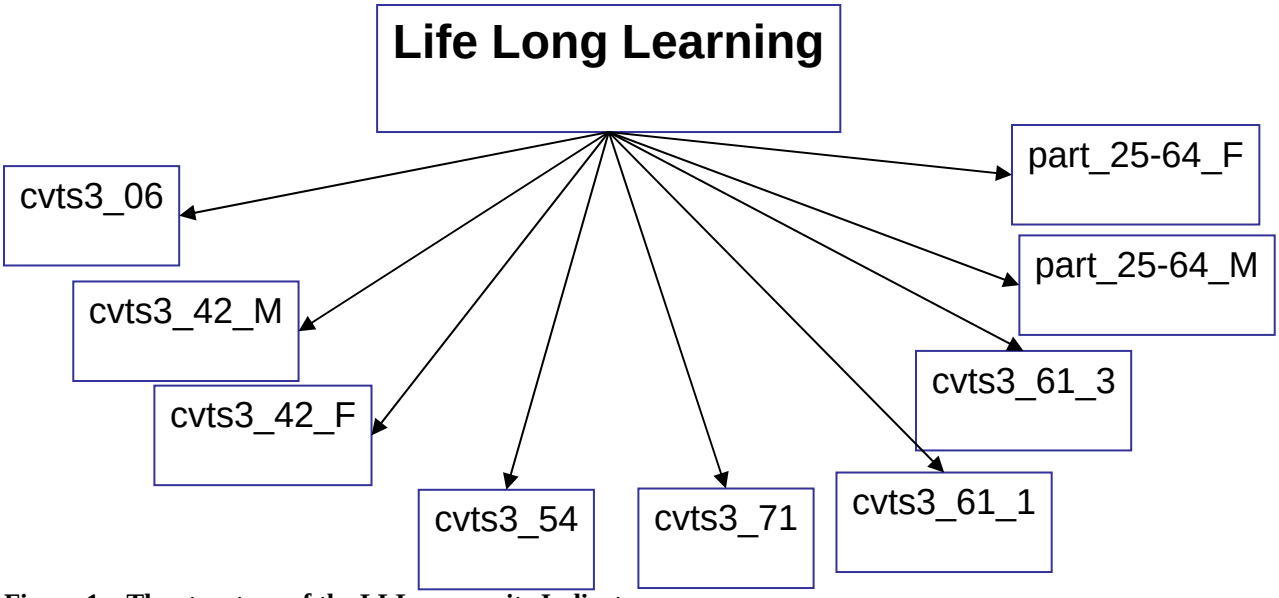


Figure 1 – The structure of the LLL composite Indicator

2.1.2 Results of the Lifelong learning Composite Indicator

Having defined the structure, the weighting scheme and the standardization procedure, the computation of the Life Long Learning Composite indicator can be performed. In this section the results of the LLL composite indicator are presented – first - examining the results of each dimension and then presenting the results of the combined index.

The results of the aggregation of the indicators are shown in figure 2.

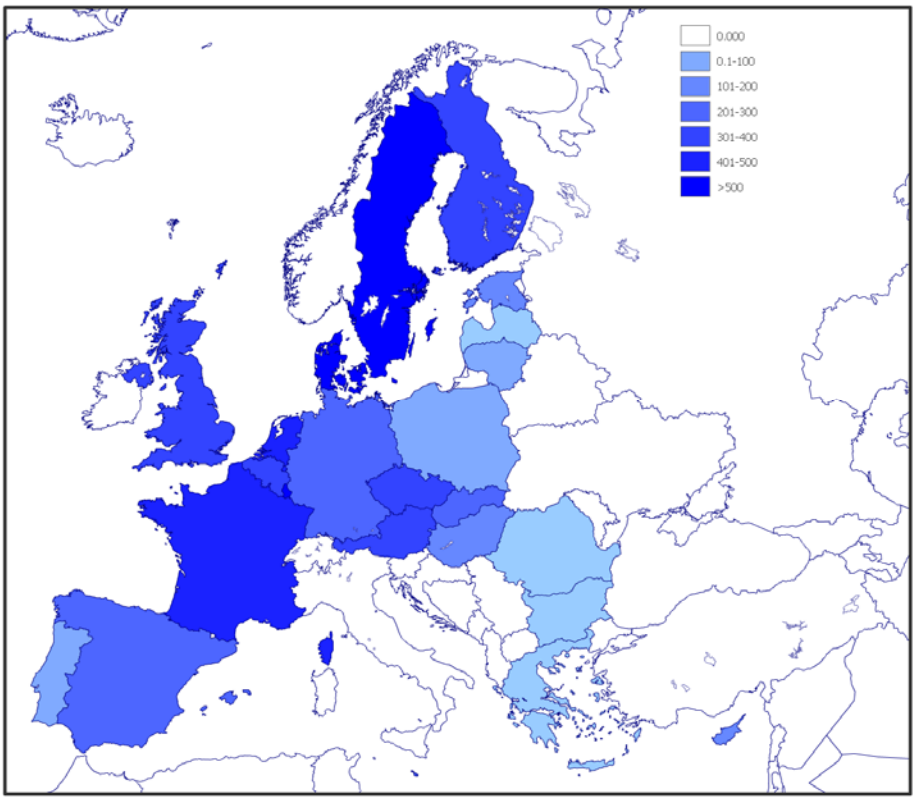


Figure 2 - Map of the LLL composite indicator for 2005

The map represents the overall index distribution. Red colour means an overall bad performance of the country. On the other hand, green colour is assigned for top performance countries. As we see, Nordic Countries such as Denmark and Sweden rank at the top of the league, followed by France, Luxembourg and the Netherlands. Then, Czech Republic over-performs the rest of Eastern Europe achieving an overall good performance, followed by Belgium, Austria and the United Kingdom. On the other hand Germany exhibits a worse performance than the rest of Central Europe, whereas Spain performs better than the rest of Mediterranean countries. Finally, Eastern and Southern European Member States fall at the bottom of the ranking.

Table 5 - Country ranking of the LLL composite Indicator.

Rank	Country	LLL CI 2005
1	SE	808
2	DK	801
3	LU	703
4	FR	692
5	NL	621
6	CZ	551
7	BE	539
8	AT	488
9	UK	472
10	MT	429
11	DE	405
12	SK	382
13	ES	356
14	CY	317
15	EE	296
16	HU	282
17	PT	228
18	PL	175
19	LT	131
20	RO	113
21	LV	74
22	BG	69
23	EL	37

The ranking distribution of the scores is presented in table 5 where an overall good performance of Nordic Countries, which achieve a very high score, compared with the other countries, together with France, Luxembourg and the Netherlands. All remaining countries tend to be closer to each other in terms of score values.

2.2 The Active labour market policies (ALMP) Composite Indicator

The list of basic indicators for the ALMP composite indicator is mainly based on the compendium of indicators developed by the Employment Committee to monitor Member States' progress towards the objectives set in the Employment Guidelines (hereinafter the Compendium). A set of 16 indicators were selected, all of them drawn from a unique data source: the Eurostat's Labour Market Policies database. This source covers all labour market policies or *interventions* undertaken by Member States, which are divided in three main categories:

1. Services: This category refers to labour market interventions where the main activity of participants is job search-related and where participation usually does not result in a change of labour market status.

2. Regular Activation Measures: This category refers to labour market interventions where the main activity of participants is other than job-search related and where participation usually results in a change in labour market status.

3. Support: This category refers to interventions that provide financial assistance, directly or indirectly, to individuals for labour market reasons or which compensate individuals for disadvantages caused by labour market circumstances.

The LMP database is based on the collection of information from administrative sources, relating to public expenditure on and participants to the different types of labour market programs.

As the construction of the ALMP index is exclusively focused on active policies, only indicators referring to the first two categories (i.e. services and activation measures) were retained. In fact, support measures essentially concern monetary transfers, i.e. measures of a more passive nature; hence they will be the focus of the Composite indicator on the social security component of flexicurity (see below).

The quality of data and the geographical coverage of the indicators are overall satisfactory, although a significant number of missing values remains. The different aspects of data quality have been assessed through the application of commonly used statistical criteria. Each aspect has been classified following the standards adopted in the LIME project, with an evaluation ranging from a maximum (++) to a minimum (--).

Table 6 - List of indicators part of ALMP Composite Indicator

Indicators and Dimensions	Short name	Source
Expenditure as percentage of GDP		
LMP expenditure by type of action: cat 1, Labour market services	XTGDP1	EUROSTAT_LMP
LMP expenditure by type of action: cat. 2, Training	XTGDP2	EUROSTAT_LMP
LMP expenditure: cat.3, Job sharing and job rotation	XTGDP3	EUROSTAT_LMP
LMP expenditure: cat.4, Employment incentives	XTGDP4	EUROSTAT_LMP
LMP expenditure: cat.5, Supported employment and rehabilitation	XTGDP5	EUROSTAT_LMP
LMP expenditure: cat.6, Direct job creation	XTGDP6	EUROSTAT_LMP
LMP expenditure: cat.7, Start-up incentives	XTGDP7	EUROSTAT_LMP
Spending per participant in millions euros		
Spending per participant Training	spending2	EUROSTAT_LMP
Spending per participant Job sharing and job rotation	spending3	EUROSTAT_LMP
Spending per participant Employment incentives	spending4	EUROSTAT_LMP
Spending per participant Supported employment and rehabilitation	spending5	EUROSTAT_LMP
Spending per participant Direct job creation	spending6	EUROSTAT_LMP
Spending per participant Start-up incentives	spending7	EUROSTAT_LMP
Spending/participants per person wanting to work		
LMP services (cat 1): spending per person wanting to work	LMPservices	EUROSTAT_LMP
LMP measures (cat 2-7): spending per person wanting to work	LMPmeasures	EUROSTAT_LMP
Total regular activation: % of participants in LMP measures (cat. 2-7) over total number of persons wanting to work	tot ra	EUROSTAT_LMP

Table 6 reports the complete list of indicators used for the calculation of the ALMPs Composite Indicator divided by three dimensions.

The first dimension captures the overall amount of expenditure on the different Active Labour Market Policies. Hence, it includes the expenditure on services and activation measures expressed as share of GDP and broken down by type of program (7 indicators in total, see table 1 for details).

The second dimension captures the intensity of ALMPs provision per participant. Hence it includes the expenditure on activation measures (in Millions of Euros) per participant. The indicator is broken down by type of program, so that overall 6 indicators are included, one less than in the previous dimension as for category 1 (services), being it a general measure, no number of participants is reported in the LMP database.

After overall spending and spending per participant, the third dimension measures the intensity of Member States' activation efforts relative to the overall number of people who should be, in principle, targeted by such efforts. Hence, it includes two kinds of indicators:

- The amount of spending on services and activation measures (the first two indicators, respectively) per person wanting to work

- The number of participants to activation measures (third indicator), expressed as percentage of the total number of persons wanting to work.

The **time coverage** of the ALMPs Composite indicator goes from 2004 to 2007. Using the LIME statistical standards, such time coverage can be rated with a "++". The nature of the LMP database would make it possible to update the ALMP composite indicator annually.

The **geographical coverage** is rated as "++" following the LIME standards and counts 24 member states.

The **number of missing data** is quite significant with only a few countries having a complete dataset. This aspect of quality of data can be then rated with a "--". As a pre-condition to compute the composite indicator, the problem of missing data is to some extent tackled through imputation techniques.
This calls for particular caution; hence the effect of imputed values on final results of the composite indicator was assessed through uncertainty analysis. Moreover, as a way to limit the use of imputation techniques to the minimum, member states presenting a number of missing data greater than six in any year over the chosen time horizon were excluded from the data-set for those years. This resulted in the total removal of Denmark, Malta, Greece and Cyprus from the analysis.

The **direction of indicators** has been assumed to be positive for all of them, i.e. the higher the score recorded, the better the performance.

The **weighting scheme** adopted for the construction of the Composite Indicator consists of attributing equal weights to all indicators within the same dimension. This strategy avoids rewarding those dimensions which include more indicators (e.g. Expenditure as percentage of GDP) relative to those with fewer ones (e.g. Spending/participants per person wanting to work). As a result, although variables are not given the same weight overall, all dimensions included in the indicator are equally important. Table 7 below presents the numerical values of the weights.

Table 7 - Weighting scheme for the ALMP composite indicator

Dimension	Weight	Basic Indicator	Weight	Normalized Value
LMP expenditure taken as share of GDP	1/3	*XTGDP1*	1/7	0.0476
		XTGDP2	1/7	0.0476
		XTGDP3	1/7	0.0476
		XTGDP4	1/7	0.0476
		XTGDP5	1/7	0.0476
		XTGDP6	1/7	0.0476
		XTGDP7	1/7	0.0476
Spending per participant	1/3	*spending cat.2*	1/6	0.0556
		spending cat.3	1/6	0.0556
		spending cat.4	1/6	0.0556
		spending cat.5	1/6	0.0556
		spending cat.6	1/6	0.0556
		spending cat.7	1/6	0.0556
Activation Support	1/3	*LMP tot*	1/3	0.1111
		LMP measures	1/3	0.1111
		LMP services	1/3	0.1111

2.2.1 The structure of the ALMP composite indicator

The composite indicator for ALMPs has a relatively simple structure although, unlike the indicator for LLL, it includes different levels of aggregation of input indicators. It consists of three different pillars or dimensions, corresponding to those highlighted in section 2 and in table 1 above:

1. Overall expenditure on ALMPs (i.e. *spending as a share of GDP); including* 7 indicators corresponding to the different types of policies.
2. *ALMPs spending per participant*; including 6 indicators (as there is no participants' number for labour market services).
3. *Intensity of ALMPs per person wanting to work;* including 3 indicators.

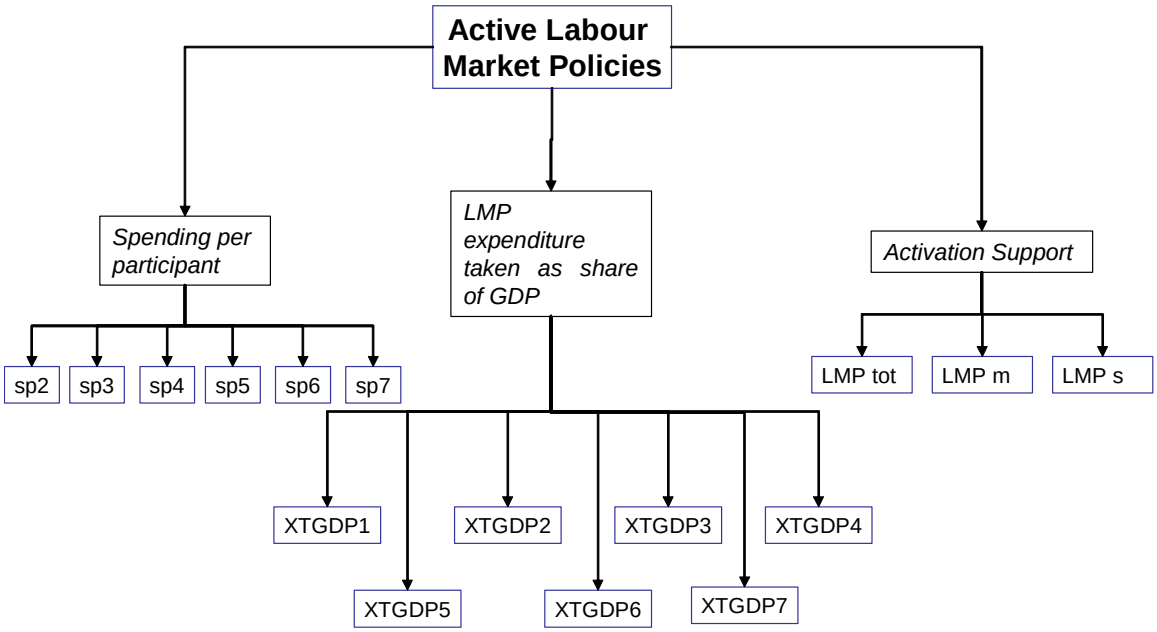


Figure 3: The structure of the ALMPs Composite Indicator

2.2.2 Results of the Active labour market policies Composite Indicator

After having defined the structure, the weighting scheme and the standardization procedure, the computation of the ALMP composite indicator can be performed. This section presents and discusses the results of the indicator in terms of Member States' ranking over the four-years period considered.

Table 8 presents results by country for 2005-2007. There are no major deviations from the ranking in 2004, as countries in the top four positions are still the same, with Sweden and Norway switching their position with each other. Finland is ranked 5th , followed by Ireland and Belgium. Italy is still ranked first among Mediterranean countries, i.e. in 11th position, followed by Spain, 12th, and Portugal, 13th, the latter country performing better than in 2004. Poland ranks first among new Member States, followed by Bulgaria in 18th position and Hungary in 19th position.

Table 8 – 2005-2007 ALMP composite indicator

Rank	Country	Score 2005
1	LU	414.57
2	SE	347.92
3	NO	339.82
4	NL	328.16
5	FI	279.75
6	BE	277.85
7	IE	258.54
8	DE	251.51
9	AT	236.42
10	FR	211.05
11	IT	196.44
12	ES	178.27
13	PT	162.83
14	UK	159.48
15	PL	113.49
16	SI	104.08
17	SK	75.92
18	BG	72.52
19	HU	62.98
20	CZ	50.31
21	RO	42.89
22	LT	41.08
23	LV	38.66
24	EE	37.88

Rank	Country	Score 2006
1	LU	390.80
2	SE	376.38
3	NL	328.11
4	NO	299.60
5	FI	288.93
6	BE	287.70
7	AT	271.02
8	IE	263.60
9	DE	257.87
10	FR	224.11
11	ES	217.92
12	IT	200.32
13	UK	149.38
14	PT	142.30
15	PL	114.90
16	SI	92.77
17	SK	72.80
18	BG	68.39
19	HU	59.89
20	LT	54.06
21	CZ	53.66
22	LV	48.84
23	RO	45.51
24	EE	31.58

Rank	Country	Score 2007
1	LU	468.18
2	NL	365.95
3	BE	356.97
4	NO	321.95
5	SE	320.30
6	FI	294.55
7	IE	282.15
8	DE	261.68
9	AT	255.17
10	FR	245.77
11	ES	191.22
12	IT	189.47
13	UK	140.02
14	PL	134.12
15	PT	127.32
16	HU	74.60
17	SI	63.38
18	SK	62.99
19	LT	61.84
20	CZ	58.87
21	BG	58.14
22	LV	39.22
23	RO	35.28
24	EE	29.28

Regarding 2006, Luxembourg maintains its first position, whereas the Netherlands improves its ranking by moving to the 3rd position, followed by Norway, Spain (11th) becomes the top performer among Mediterranean Member States, followed by Italy, 12th, and Portugal, 14th. Poland and Slovenia rank better compared to the other new Member States which, again, tend to rank at the bottom as a group. Again, overall scores need to be taken with caution as, for instance, Latvia performs rather well with respect to the expenditure in employment incentives, where the country is ranked in the 3rd position, despite being located at the lower end of the scale with respect to the composite indicator. Estonia is ranked in the last position. In figure 4 the map of ALMP indicator is showed.

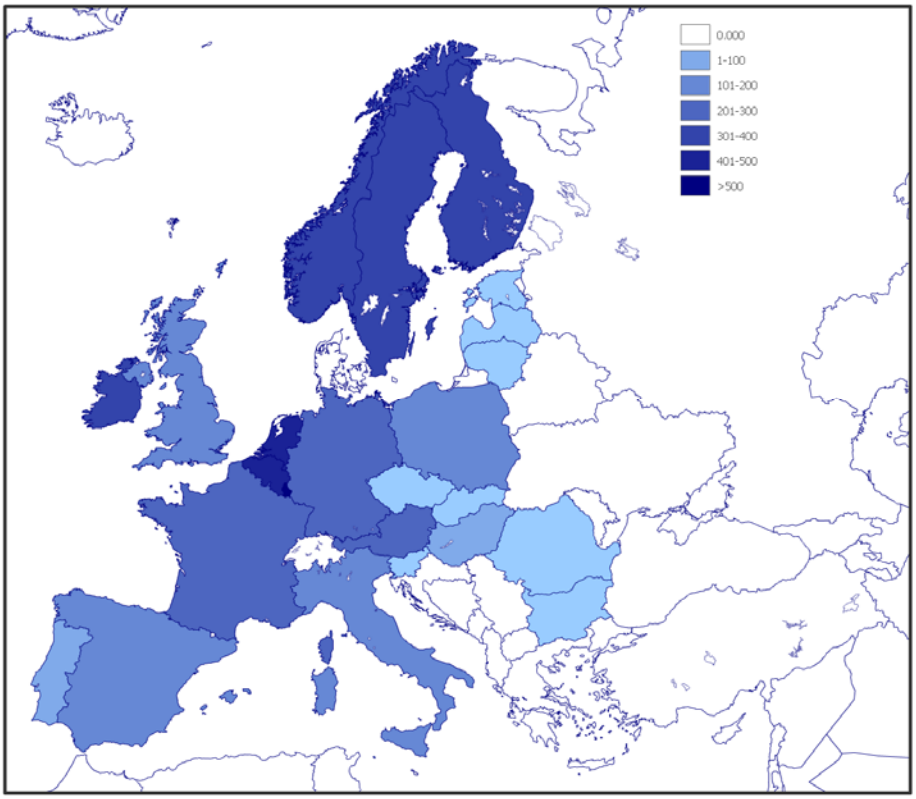


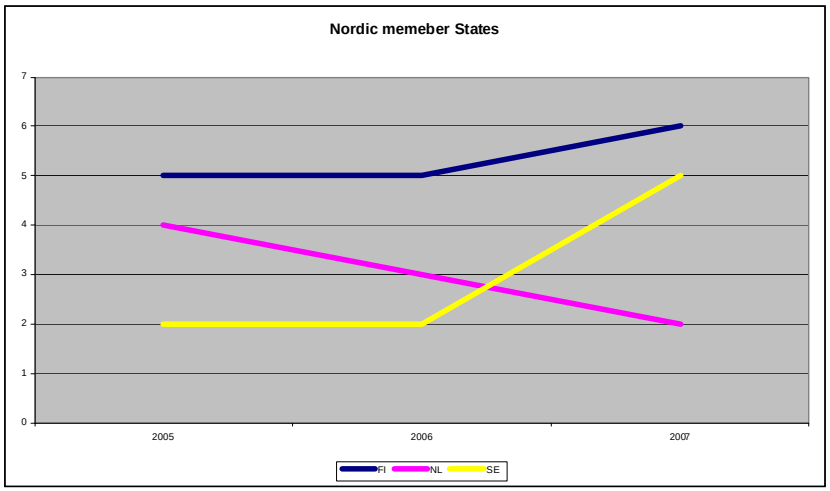
Figure 4 - Map of the ALMP composite indicator for 2007

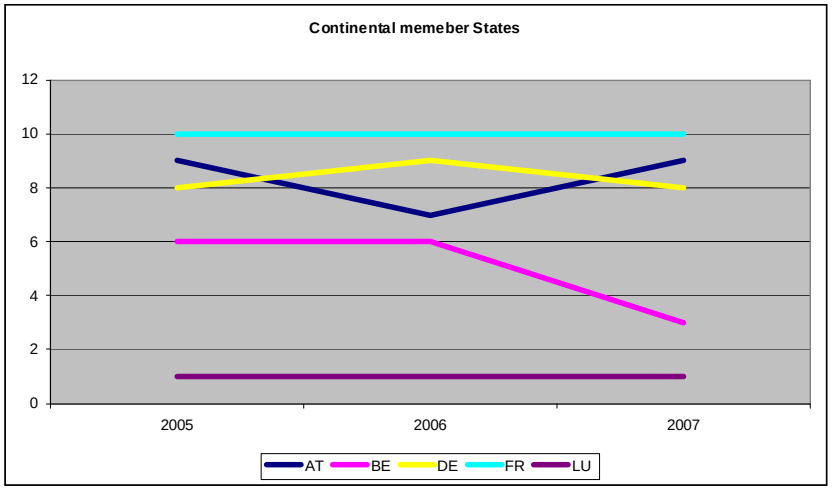
Regarding results for 2007, it highlights only slight differences compared to previous years. Luxembourg still ranks at the top, followed by the Netherlands and Belgium. Nordic countries such as Norway, Sweden and Finland also rank in the upper end of the scale. Spain, in 11th position, performs better among Mediterranean Countries, followed by Italy, whereas Poland maintains its top ranking among new Member States, followed by Hungary and Slovenia. Romania and Estonia are located in the last two positions.

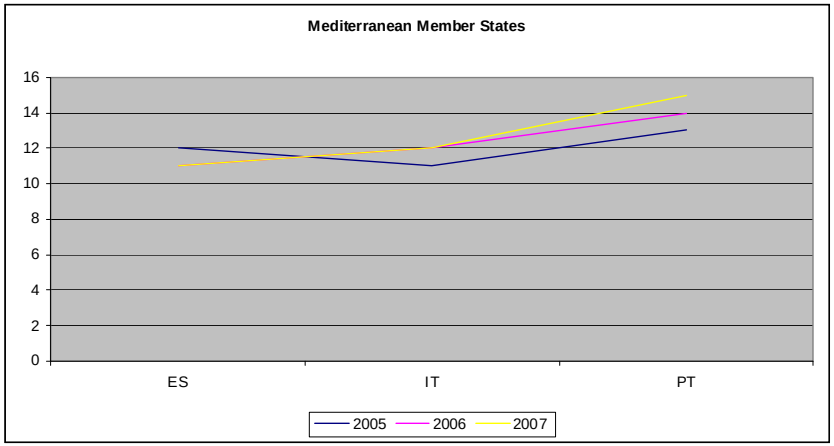
Figure 5 and table 9 compare member states' rankings across the four years considered. Overall, the ranking is quite stable over time with only slight changes between 2005 and 2007. Nordic countries, together with Luxembourg and Belgium constantly rank in top positions, whereas Southern Member States tend to rank in intermediate positions, together with the UK and, finally, New Member States systematically cluster on the lower end of the ranking. However, some changes over time can still be observed. Romania, for instance, presents a better performance in 2004 than in the remaining years, whereas Slovakia improves its performance from the 21st position in 2004 to the 18th in 2007 and Lithuania moves from the 22nd to the 18th position throughout the period. Finally, many countries register just slight changes, such as Austria which gravitates around position 8, Italy (around position 11th) and the Czech Republic (around position 20th).

Table 9 – ALMP Comparison of the rankings 2004-2007

	2005	2006	2007
AT	9	7	9
BE	6	6	3
BG	18	18	21
CZ	20	21	20
DE	8	9	8
EE	24	24	24
ES	12	11	11
FI	5	5	6
FR	10	10	10
HU	19	19	16
IE	7	8	7
IT	11	12	12
LT	22	20	19
LU	1	1	1
LV	23	22	22
NL	4	3	2
NO	3	4	4
PL	15	15	14
PT	13	14	15
RO	21	23	23
SE	2	2	5
SI	16	16	17
SK	17	17	18
UK	14	13	13







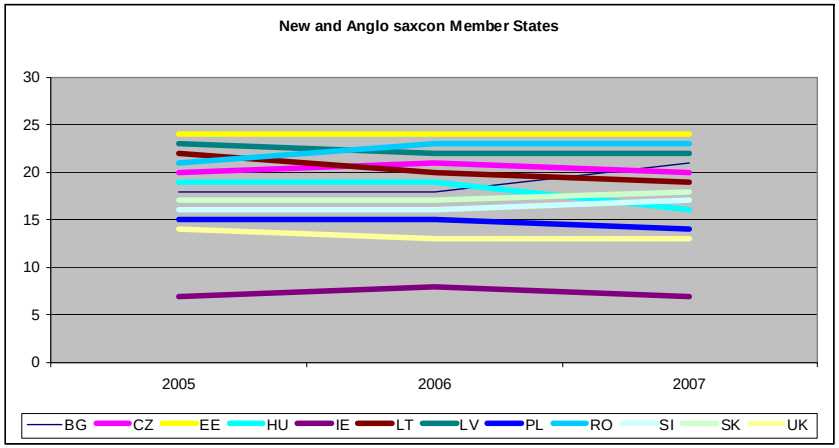


Figure 5 – ALMP Ranking Comparison 2005-2007

2.3 The Modern Social Security Systems (MSS) Composite Indicator

The social security systems are considered in a narrow sense, as the focus lies mainly on transfers to the unemployed, thereby disregarding other categories of welfare spending such as health care, pensions etc. This choice is justified, firstly, by the fact that the analysis aims at looking at the component of welfare states which directly concerns the risk of unemployment and the resulting incentives to take up jobs, and, secondly, by the need to avoid a too large number of basic indicators, which would prevent a meaningful interpretation of the composite indicator.

20 indicators have been selected from different sources including, mainly, the Compendium of indicators developed by the Employment Committee (EMCO) to monitor Member States' progress towards the objectives set in the Employment Guidelines (hereinafter the Compendium), the Labour Market Policies Database of Eurostat and the joint Commission-OECD project on tax and benefits (see below for further details on sources). 5 more indicators have also been identified, 1 concerning non financial incentives to take up a job for unemployment benefits recipients (i.e. monitoring of job search effort, availability to job offers, benefits' sanctions etc.) and 4 regarding unemployment benefits' coverage of 'flexible' workers (i.e temporary, part-time and self-employed). However, these were only available for one year (2004 for the former and 2007 for the latter), so that they were excluded from the main index presented here. However, two extra-indicators for 2004 and 2007, respectively, were also calculated in order to include these aspects, the reader can find them in the special report on the Modern Social Security composite index (Governatori, Manca and Mascherini, 2009).

Those indicators were chosen in order to cover different aspects of social security mainly related to the amount and coverage of transfers to the unemployed, both at the country-level (e.g. overall spending) and for the individual benefit's recipient, as well as the employment incentives implied by such systems, both financial (in combination with taxation) and non-financial. The availability of child-care services is also captured, given its role to facilitate the combination of work with private Eurostat and family responsibilities. Specific aspects, such as the unemployment benefits' coverage of non-standard forms of employment (e.g. temporary work) and the extent of financial incentives to take up jobs for inactive people, are also covered.

Therefore, the Modern Social Security (MSS) index covers five dimensions, each including a number of indicators varying from 3 to 7:

1. *Overall spending and coverage of unemployment benefits.* This dimension includes three indicators, i.e. the amount of resources devoted by Member States to income support for unemployed expressed both as a share of GDP and as average spending per person wanting to work and the number of unemployment benefits' recipients as a percentage of all people wanting to work. The source of these indicators is the LMP database (Eurostat).

2. *Financial incentive to take up work for people out of employment.* This dimension includes five indicators which measure the percentage of gross extra-income which is "taxed away" when an individual moves from non-employment to employment as a combined effect of the withdrawal of welfare benefits and the increase of income taxation (including social security contributions). Two indicators concern people moving from unemployment to employment (and they are therefore called unemployment traps) whereas the remaining three look at employment incentives for inactive people, which are not entitled to unemployment benefits but often receive other forms of social assistance (i.e. inactivity traps). Unemployment and inactivity traps are normally calculated for different family types and wage levels. As financial incentives to move out of non-employment tend to be particularly weak in case of low-pay jobs, only indicators for a wage level of 67% of Average Wage (AW) are included. Finally, two family types are covered for both the unemployment and the inactivity trap, i.e. single person without children and 1-earner couple with two children, as benefit's levels and tax burden can vary substantially according to family situation (due e.g. to tax allowances for children). In the case of inactivity trap, the indicator for a two-earner couple with two children is also included to specifically account for employment incentives for the second family earner. Trap indicators have been calculated within the joint Commission-OECD project on Tax and Benefit systems.

3. *Amount and duration of individual unemployment benefits.* As opposed to the first dimension, which looks at the extent and coverage of income support for unemployed at the macro-level, this dimension looks at the main features of individual unemployment transfers and includes seven indicators. Essentially, three aspects are covered: the size of the transfer after-tax, relative to the wage previously received (i.e. the net replacement rate, NRR) after 6 and 12 months of unemployment; the length of the eligibility period, measured indirectly by the NRR after 5 years of unemployment; the stringency of non-financial incentives to move back to employment for benefits' recipients (e.g. job-search obligations, availability for work, sanctions etc.). Figures for the NRR are drawn from the Commission-OECD Tax and Benefits.

4. *Childcare services.* This dimension is included in order to capture the extent to which national welfare systems facilitate the combination of work with private and family responsibilities by providing comprehensive childcare services. Six indicators are included, all of them measuring the share of children in three different age groups (from 0 to 2 years, from 3 to compulsory school age and from school age to 12 years) which are taken care of by public childcare services for either less than or at least 30 hours per week on average. All childcare indicators considered are drawn from the Compendium

The quality of data and the geographical coverage of the selected indicators are very satisfactory, overall, as the number of missing values is quite small. The different aspects of data quality have been assessed through commonly used statistical criteria. Each aspect has been evaluated from a maximum (++) to a minimum (--), following

standards adopted in the LIME project[7]. Table 10 reports the full list of indicators used for the calculation of the Composite Index by dimension.

Time coverage: the main index covers the period from 2005 to 2007. Using the LIME statistical standards, such time coverage can be rated with a "++".

Geographical coverage: the main index covers 25 member states over the whole period considered (from 2005 to 2007), leading to a "++" rating following the LIME standards.

Table 10 - List of indicators part of Modern Social Security Systems Composite Indicator

Indicators and dimensions	***Short name***	***Source***
Overall spending and coverage of unemployment benefits		
% of persons wanting to work receiving out-of-work income support	19m2	Eurostat
Expenditure on out-of-work income maintenance (% of GDP)	19a5	Eurostat
Expenditure on out-of-work income maintenance per person wanting to work.	19a6	Eurostat
Financial incentives to take up a job		
Unemployment trap: Marginal effective tax rate for an unemployed person (67% AW, single person)	19m7_1	Eurostat
Unemployment trap: Marginal effective tax rate for an unemployed person (67% AW, one-earner couple with 2 children)	19m7_2	Eurostat
Inactivity trap (low wage-earner): Marginal effective tax rate when moving from social assistance to work (67% AW, single person)	inactivity trap_1	Eurostat
inactivity trap (low wage-earner): Marginal effective tax rate when moving from social assistance to work (67% AW, one-earner couple with 2 children)	inactivity trap_2	Eurostat
inactivity trap (low wage-earner): Marginal effective tax rate when moving from social assistance to work (67% AW, two-earner couple with 2 children)	inactivity trap_3	Eurostat
Amount and duration of individual unemployment benefits		
Net replacement rate after 6 months - Single 67% AW	Net_replacement_rate_1	Eurostat
Net replacement rate after 12 months - Single 67% AW	Net_replacement_rate_2	Eurostat
Net replacement rate after 60 months - Single 67% AW	Net_replacement_rate_3	Eurostat
Net replacement rate after 6 months - 1 earner 2 children, 67% AW	Net_replacement_rate_4	Eurostat
Net replacement rate after 12 months - 1 earner 2 children, 67% AW	Net_replacement_rate_5	Eurostat
Net replacement rate after 60 months - 1 earner 2 children, 67% AW	Net_replacement_rate_6	Eurostat
Childcare services		
childcare 0-2 (1-29 hours)	18m3_1	Eurostat
childcare 0-2 (30 hours or more)	18m3_2	Eurostat
3 years to compulsory school age(1-29 hours)	18m3_3	Eurostat
3 years to compulsory school age (30 hours or more)	18m3_4	Eurostat
Compulsory school age - 12 years (1-29 hours)	18m3_5	Eurostat
Compulsory school age - 12 years (30 hours or more)	18m3_6	Eurostat

Note : AW=Average wage

[7] Lisbon Assessment Methodology.

Missing data: the main MSS index (covering the period from 2005 to 2007) is based on 20 indicators. This does not necessarily mean that data for all of them are actually available for all EU Member States and all years considered. Table 2 below presents the number of indicators with available data by country and year. The situation is good, overall as only a few member states present data limitations. Major exceptions are Bulgaria and Romania which have been completely excluded from the dataset.

The **direction** has been assumed to be positive (i.e. the higher the score, the better the performance of the country) for the dimensions of "childcare services", "overall spending and coverage of unemployment benefits" and "unemployment benefit's coverage for flexible workers". The rationale is that more resources for and larger coverage of income support for unemployed, larger availability of care services for children and better access of non-standard workers to unemployment benefits all contribute positively to the achievement of flexicurity.

On the other hand, all indicators within the dimension of financial incentives are given a negative sign as flexicurity policies should ensure that the combined effect of tax and benefits systems does not lead to overly weak incentives to move from unemployment or inactivity to employment (especially in the case of low paid jobs).

Finally, indicators included in the third dimension, i.e. "Amount and duration of unemployment benefit", enter with opposite sign. Net Replacement Rates after 6 and 12 months of unemployment contribute positively to the composite index, the rationale being that sufficient income support should be provided to workers entering unemployment according to the flexicurity approach. On the other hand, NRR after 60 months enters with a negative sign, as a long duration of the eligibility period to unemployment insurance tends to lead to longer unemployment spells via reduced incentives to job search. Finally, the degree of strictness of rules for recipients of unemployment benefits enters with a positive sign, as flexicurity policies call for an appropriate balance of rights and obligations in the design of unemployment insurance, implying that non-financial incentives to active job search should be incorporated in such systems, such as reporting to Public Employment Services, availability to job offers, partial or total benefit withdrawal in case of lack of job search efforts.

For the MSS composite indicator **missing data** were mainly tackled by excluding from the dataset those Member States which were more seriously affected by this problem. The exclusion was total for RO and BG. Then, indicators presenting a too large number of missing data were also excluded

After these corrections, the number of remaining missing data was rather limited (see table 7) and could be tackled through specific statistical techniques.

Number of missing by indicator: all countries

Year	19m2	19m7_1	19m7_2	19a5	19a6	18m3_1	18m3_2	18m3_3	18m3_4	18m3_5	18m3_6	dofs	Intrap_1	Intrap_2	Intrap_3	net_repl1	net_repl2	net_repl3	net_repl4	net_repl5	net_repl6
2004	19%	26%	26%	15%	19%	52%	74%	52%	74%	96%	100%	26%	30%	30%	30%	30%	30%	30%	30%	30%	30%
2005	11%	7%	7%	11%	11%	7%	7%	7%	7%	7%	7%	100%	7%	7%	7%	7%	7%	7%	7%	7%	7%
2006	4%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	100%	7%	7%	7%	7%	7%	7%	7%	7%	7%
2007	4%	7%	7%	4%	4%	11%	11%	7%	7%	7%	7%	100%	7%	7%	7%	7%	7%	7%	7%	7%	7%

Number of missing by indicator: selected countries

Year	19m2	19m7_1	19m7_2	19a5	19a6	18m3_1	18m3_2	18m3_3	18m3_4	18m3_5	18m3_6	dofs	Intrap_1	Intrap_2	Intrap_3	net_repl1	net_repl2	net_repl3	net_repl4	net_repl5	net_repl6
2004	10%	0%	0%	5%	10%	30%	60%	30%	60%	90%	95%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2005	8%	0%	0%	8%	8%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2006	4%	0%	0%	8%	8%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2007	4%	0%	0%	4%	4%	8%	8%	4%	4%	4%	4%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 11: Number of missing data by indicators in two different scenarios

The **weighting scheme** adopted for the construction of the MSS index consists of attributing equal weights to all indicators *within the same dimension*. This strategy avoids rewarding those dimensions which include more indicators (e.g. financial incentives) relative to those with fewer ones (e.g. overall spending and coverage of unemployment benefits). The only exceptions concern the dimension of *childcare services*, where a double weight was attributed to indicators of care availability for 30 hours or more, relative to those for less than 30 hours. As a result, all dimensions included in the index are equally important, although individual variables do not necessarily have the same weight across different dimensions. Table 12 below presents the numerical values of the weights.

Table 12 - Weighting scheme for the MSS composite indicator

Dimension	Dimension weight			Direction	Indicator	Indicator weight within the dimensions			Normalized weight
	I(05-07)	I(04)	I_2(07)			I(05-07)	I(04)	I_2(07)	
spending and	1/4	1/4	1/5	+	% person covered	1/3	1/3	1/3	0.083
coverage of benefits				+	Spending % GDP	1/3	1/3	1/3	0.083
				+	Spending per person	1/3	1/3	1/3	0.083
Financial incentive	1/4	1/4	1/5	-	UT single	1/5	1/5	1/5	0.05
				-	UT 1e-2c	1/5	1/5	1/5	0.05
				-	IT single	1/5	1/5	1/5	0.05
				-	IT 1e-2c	1/5	1/5	1/5	0.05
				-	IT 2e-2c	1/5	1/5	1/5	0.05
Amount and	1/4	1/4	1/5	+	NRR 6-s	1/6	1/8	1/6	0.042
				+	NRR 12-s	1/6	1/8	1/6	0.042
duration of				-	NRR 60-s	1/6	1/8	1/6	0.042
benefits				+	NRR6-1e2c	1/6	1/8	1/6	0.042
				+	NRR12-1e2c	1/6	1/8	1/6	0.042
				-	NRR60-1e2c	1/6	1/8	1/6	0.042
Childcare	1/4	1/4	1/5	+	0-2 (0-29h)	1/9	1/2	1/9	0.037
				+	0-2 (>30h)	2/9	NA	2/9	0.047
				+	3-sa (0-29h)	1/9	1/2	1/9	0.037
				+	3-sa (>30h)	2/9	NA	2/9	0.047
				+	Sa-12 (0-29h)	1/9	NA	1/9	0.037
				+	Sa-12 (>30h)	2/9	NA	2/9	0.047
Coverage flexible	NA	NA	1/5	+	TE	NA	NA	1/4	NA
				+	PTE	NA	NA	1/4	NA
workers				+	SE	NA	NA	1/4	NA
				+	Tot FE	NA	NA	1/4	NA

Notes: * Normalised weights are shown only for the main indicator covering the period from 2005 to 2007. UT = Unemployment Trap; IT = Inactivity Trap; NRR = Net Replacement Rate, TE = Temporary Employment; PTE = Part Time Employment; FE = Flexible Employment.S = Single; 1e2c = 1-earner couple with 2 children; 2e2c = 2-earners couple with 2 children; NA = Not Available

2.3.1 The structure of MSS composite indicator

The three composite indicators for Modern Social Security Systems share a simple structure.

As explained above the main indicator for 2005-2007 consists of four different dimensions:

1 *Overall expenditure and coverage of unemployment benefits,* including three indicators.

2 *Financial Incentives to take up a job,* including 5 indicators.

3 Amount and duration of individual unemployment benefits; including 6 indicators, as the strictness of rules for unemployment benefits' recipients is excluded.
4 Childcare services, including 6 indicators.

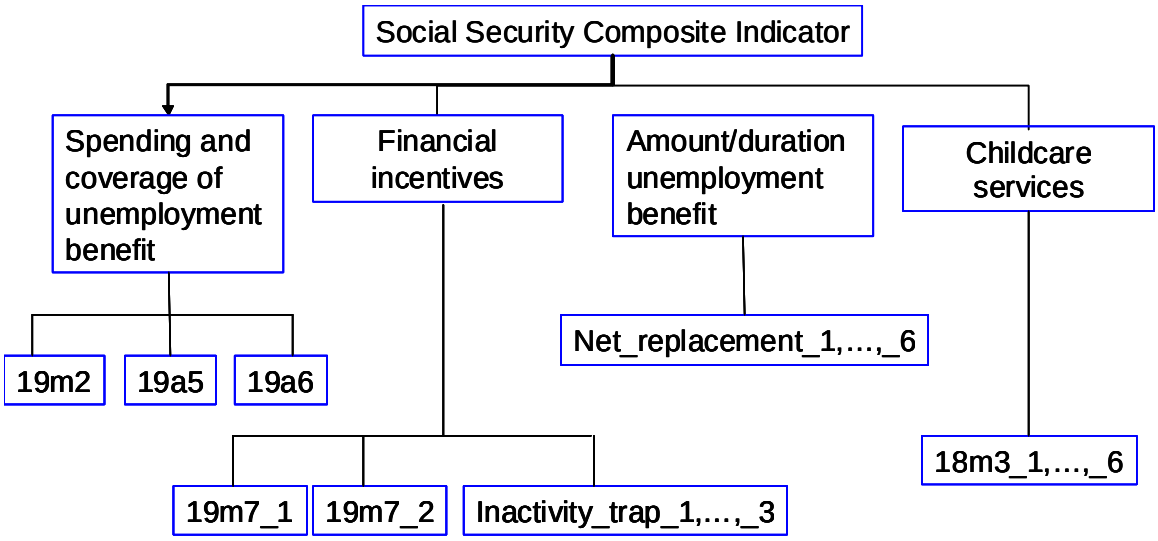


Figure 6: The structure of the Modern Social Security Systems Composite Indicator 2005-2007

2.3.2 Results of Modern Social Security Systems Composite Indicator 2005-2007

After having defined the structure, the weighting scheme and the standardization procedure, the computation of the MSS composite indicator can be performed. This section presents and discusses the results of the indicator in terms of Member States' ranking over the four-years period considered.

Table 13 presents the score of the main composite indicator by country for 2005, 2006 and 2007. A higher score should be interpreted as a sign that the corresponding Member State has a Social Security System which is relatively more in line with the flexicurity approach, by providing adequate income support to the unemployed while maintaining sufficient financial and non-financial (i.e. childcare) incentives to take up a job for unemployed and inactive people.

Denmark, Portugal and Belgium rank in the top three positions both in 2005 and 2006. Continental Member States rank in intermediate-to-upper positions. Hungary (in 14th

position) has the highest ranking among New Member States while a number of Southern Member States (Italy, Cyprus and Greece) as well as The Netherlands and Ireland rank in intermediate-to-upper positions. New Member States tend to rank at the lower end of the scale together.

Like for every composite indicator, the overall score may mask divergent situations across individual dimensions or basic variables.

Table 13 – 2005-2007 Modern Social Security Systems composite indicators

Rank	Country	Score 2005
1	DK	530.37
2	PT	499.01
3	BE	485.91
4	FR	479.52
5	ES	470.63
6	DE	459.63
7	IT	459.50
8	CY	450.66
9	GR	447.30
10	SE	438.88
11	NL	422.99
12	FI	409.77
13	IE	404.60
14	HU	403.90
15	MT	387.79
16	EE	373.64
17	UK	371.87
18	AT	370.93
19	LU	366.84
20	SK	344.76
21	LV	335.87
22	CZ	328.95
23	SI	328.91
24	LT	295.40
25	PL	290.26

Rank	Country	Score 2006
1	DK	540.41
2	PT	507.25
3	BE	490.49
4	ES	476.25
5	FR	469.50
6	DE	456.01
7	IT	446.39
8	GR	438.46
9	SE	426.56
10	CY	423.58
11	FI	407.49
12	NL	401.18
13	IE	397.07
14	MT	384.25
15	EE	381.34
16	AT	368.39
17	SK	367.63
18	LU	361.37
19	HU	357.46
20	UK	351.73
21	SI	343.40
22	CZ	335.37
23	LV	325.37
24	LT	300.02
25	PL	287.39

Rank	Country	Score 2007
1	BE	553.95
2	ES	532.86
3	PT	523.52
4	FR	512.65
5	DE	507.05
6	NL	492.22
7	IT	463.12
8	IE	453.81
9	GR	451.25
10	DK	450.40
11	LU	449.05
12	SE	445.41
13	CY	433.59
14	FI	429.83
15	AT	409.27
16	MT	389.31
17	EE	385.24
18	SK	363.35
19	SI	355.01
20	UK	351.45
21	HU	348.95
22	LV	330.98
23	CZ	325.36
24	LT	301.11
25	PL	300.02

Differences in ranking between 2005 and 2006 are quite limited overall with the greatest change concerning Hungary, which loses five positions and Slovakia and UK which shift their position. Apart from that, only shifts by one position are observed.

As regards 2007, some deviations can be observed relative to the previous two years. Belgium, Spain and Portugal rank in the first three positions followed by France Germany and The Netherlands. A few Member States (i.e. Cyprus, Denmark, Finland and Sweden) have worsened their positions compared to 2005 and 2006. Changes tend to concentrate on the upper end of the scale. Cyprus significantly deteriorates its ranking (from the 10^{th} in 2006 to the 13^{th} in 2007), whereas Spain, Ireland and The Netherlands improve it. New Member States still predominantly cluster in the lower end of the scale. Figure 7 shows the map for the MSS composite indicator for 2007.

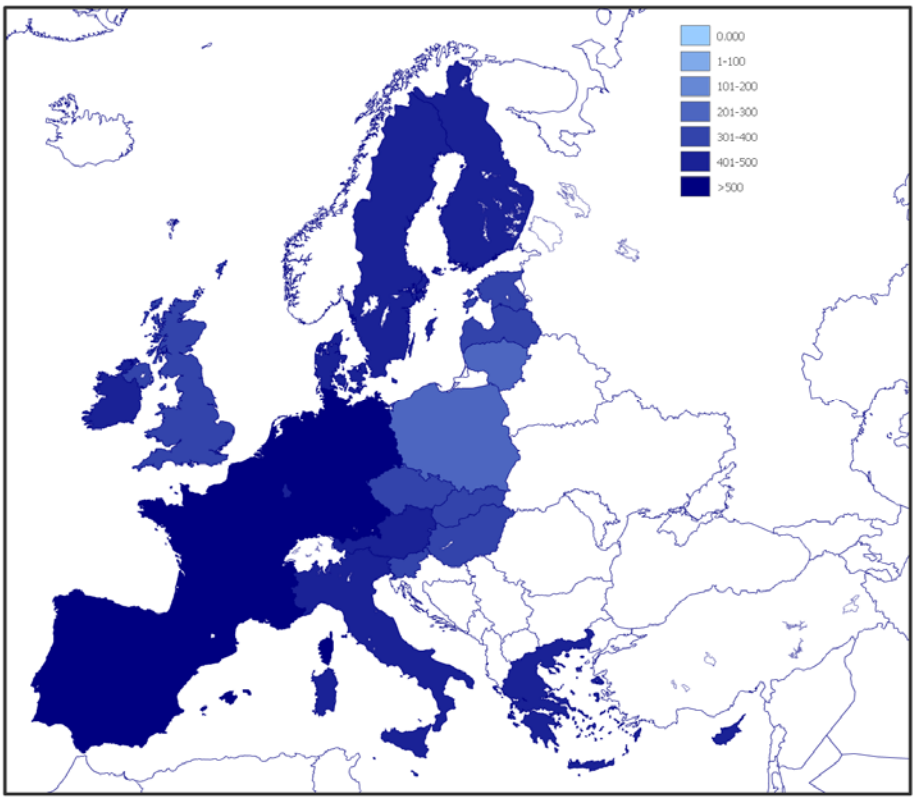


Figure 7 - Map of the MSS composite indicator for 2007

Table 14 and figure 8 below track the evolution of member states' ranking over the three years considered. Overall, the ranking varies moderately over the period considered, and Member States tend to be systematically distributed across geographical clusters. Denmark, Portugal, Belgium systematically rank on the top end of the scale; Continental Member States tend to rank in intermediate positions and, finally, New Member States, systematically cluster on the lower end. The largest changes concern Cyprus, Denmark, Finland and Sweden, which significantly worsen their ranking, and Spain and The Netherlands , which improve it.

Table 14 – MSS Comparison of the rankings 2005-2007

Country	Rank 2005	Rank 2006	Rank 2007
AT	18	16	15
BE	3	3	1
CY	8	10	13
CZ	22	22	23
DE	6	6	5
DK	1	1	10
EE	16	15	17
ES	5	4	2
FI	12	11	14
FR	4	5	4
GR	9	8	9
HU	14	19	21
IE	13	13	8
IT	7	7	7
LT	24	24	24
LU	19	18	11
LV	21	23	22
MT	15	14	16
NL	11	12	6
PL	25	25	25
PT	2	2	3
SE	10	9	12
SI	23	21	19
SK	20	17	18
UK	17	20	20

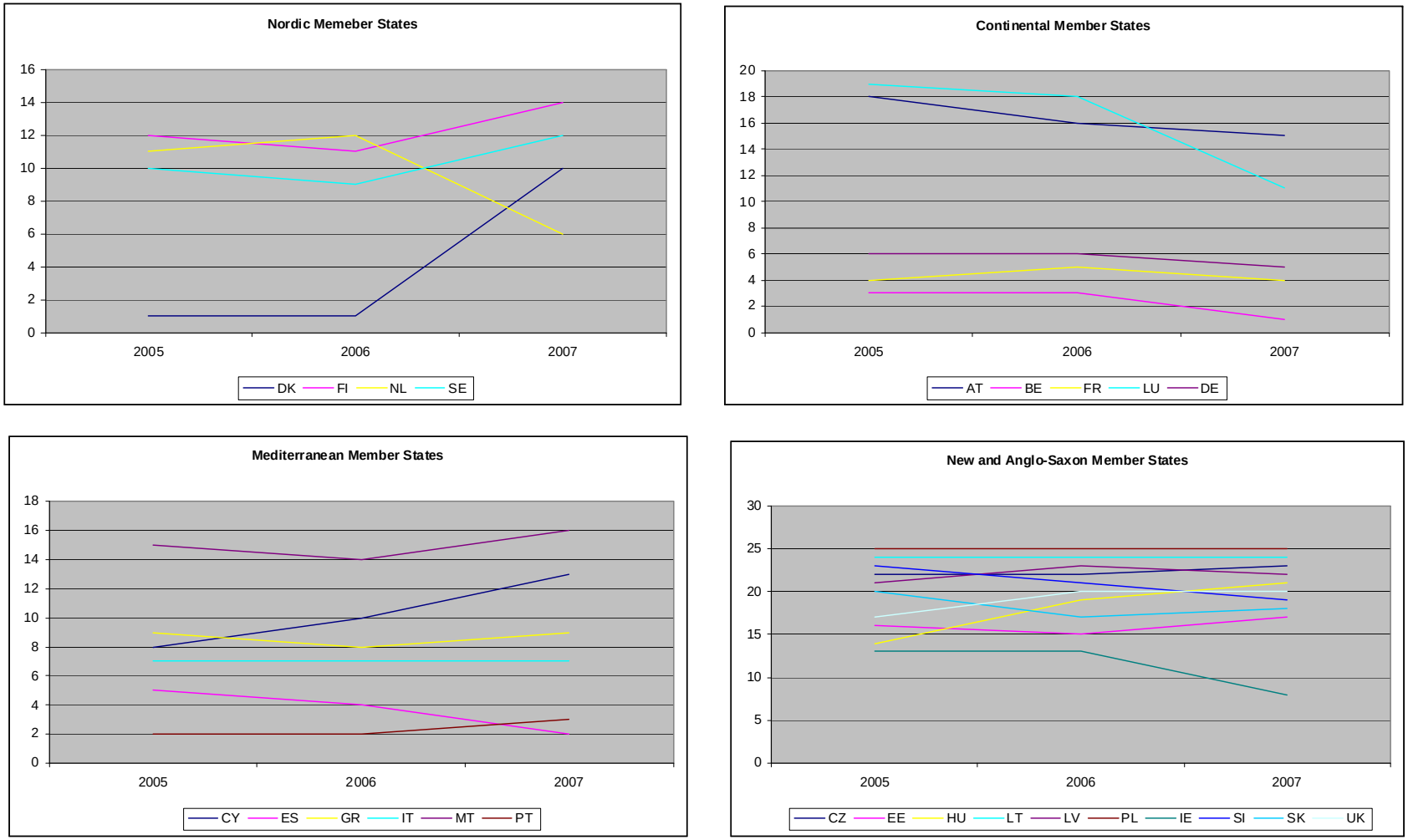


Figure 8 –MSS Ranking Comparison 2005-2007 for each cluster

2.4 The Flexible and reliable Contractual Arrangement (FCA) Composite Indicator

The flexible and reliable contractual arrangements (FCA) dimension of flexicurity is computed by using 19 indicators based on different sources such as Eurostat's Labour Force Survey, the OECD indicator on Employment Protection Legislation (EPL) and the Compendium for the monitoring and analysis of Member States' progress towards the objectives set by the Employment Guidelines, adopted by the EU Employment Committee (EMCO).

A set of 19 indicators have been selected from different sources including, mainly, the Compendium of indicators developed by the Employment Committee (EMCO) to monitor Member States' progress towards the objectives set in the Employment Guidelines (hereinafter the Compendium), the Labour Force Survey Database of Eurostat and the OECD's EPL database.

The Flexible and reliable Contractual Arrangement (FCA) index covers three dimensions, each of them including a number of indicators (which varies across dimensions). Dimensions and indicators, together with their socio-economic rationale and the sign (plus or minus) of their contribution to the composite index, are described in this section's remainder.

1) Regulations on dismissals and use of flexible contractual forms - external flexibility.

This dimension includes six indicators:

1. Three indicators concern the Strictness of Employment Protection Legislation (EPL). These are EPL on regular (i.e. open-ended) contracts, the ratio of strictness of EPL on temporary contracts over regular contracts, and the strictness of EPL on collective dismissals[8]. Taken together, the indicators on regular contracts, temporary contracts and collective dismissals compose the well-known OECD index of overall strictness of EPL, which goes from 0 to 6, with higher scores indicating more rigid rules (OECD, 2004; Venn, 2009).

   However, in this analysis the EPL components are taken separately in order to simultaneously capture two elements: first, the rigidity of contractual rules, i.e. to what extent they facilitate/hinder the adjustment of employment levels to shocks; and second, whether their articulation encourages the creation of a dual labour market whereby firms aim at circumventing overly rigid dismissals rules on regular contracts by hiring via (more flexible) temporary contracts. Dual or segmented labour markets run against flexicurity principles, as workers under temporary contracts may face great difficulties in moving to regular ones.

[8] The source is the OECD's EPL database, complemented by Cazes and Nesporova (2007) and Tonin (2006) for Lithuania and Bulgaria.

The rigidity of rules is captured by the two indicators of EPL on regular contracts and on collective dismissals; hence they both contribute with a negative sign to the composite index. Policy-driven segmentation is captured by the relative rigidity of temporary versus regular contracts (i.e. the ratio between respective EPL scores for the same country/year), which contributes positively to the composite index, as stricter regulations on the use of temporary contracts relative to hiring/dismissals rules on regular ones reduce firms' incentives to hire under temporary contracts as a way to increase employment flexibility 'at the margin' resulting in higher labour market segmentation.

2. Share of employees with fixed-term contracts. This includes two indicators, i.e. the total share and the share of involuntary fixed-term contracts[9]. The former indicator has a positive sign, as fixed-term contracts can act as gateways towards employment for disadvantaged groups (e.g. young labour market entrants or women) without necessarily leading to dual labour markets as long as transition to better jobs and regular contracts is not hindered. On the other hand, the second indicator has a negative sign as a high share of involuntary temporary employment highlights reduced chances of moving to a regular contract which in turn is a sign of labour market segmentation. The source of these indicators is the EMCO Compendium (indicator 21.M.2).

3. The share of self-employment over total employment. This indicator has a positive sign as self-employment can be a source of labour market flexibility insofar it is not covered by specific regulations. Source: EMCO Compendium (Indicator 21.M.2).

2) Flexibility of working time - internal flexibility.

Flexibility is not exclusively achieved by adjusting employment levels but also the number of hours worked per worker and the type of work organisation. The latter two strategies can be referred to as internal flexibility as they are undertaken within the firm without changing the number of workers employed. This is captured by the second dimension of the composite index.

Unfortunately, qualitative features of work organisation, such as the extent of workers' autonomy and participation to firm's decisions, team work and tasks rotation could not be included, as relevant indicators are not covered in the main questionnaire of the EU LFS and other institutional data sources at the EU level. The European Foundation for the Improvement of Living and Working Conditions runs a number of EU-level surveys including such indicators. However these are undertaken only every five years and are based on small-scale national samples. As this exercise aims at constructing a statistical tool which can potentially be used for regular (i.e. yearly) policy monitoring, these variables have not been included.

[9] I.e. employees declaring they have a fixed-term contract because they could not find a permanent job.

Hence, this dimension only covers working time flexibility, looking at several different forms the latter can take. Five (groups of) indicators are included.

1. Variability of working time. This is measured by the coefficient of variation[10] of actual working hours, as a way to capture the overall magnitude of adjustment of working hours to changing circumstances, be they related to economic conditions (product demand, business cycles, competitiveness or technology shocks etc.) or varying workers' preferences with respect to their work-life balance. The sign is positive as greater working hours variability should contribute to higher internal flexibility overall. The source is the LFS.

2. Atypical work. This is measured by five indicators which altogether count as a single variable[11]: the share of workers doing i) shift work, ii) evening work, iii) night work, iv) Saturday work and v) Sunday work. The sign is positive in all five cases. The source is the LFS.

3. Part-time. This includes two indicators: the total share of employees in part-time and the share of those who work part-time because they could not find a full-time job. Similarly to the treatment of fixed-term employment (see 2.1. above) the sign is positive for the former and negative for the latter, as part-time in general is considered as a source of working time flexibility, whereas when it is exclusively due to lack of full-time job opportunities can be interpreted as a sign of labour markets' inefficiencies. The source is in both cases the EMCO Compendium (indicator 21.M.2).

4. Overtime. This is measured by the share of employees for whom overtime is the main reason for actual hours worked being different from usual hours worked. As overtime can be a tool for adjustment to increasing products' demand, the sign attributed to this indicator is positive. The source is the EMCO Compendium (indicator 21.A.3).

5. Access to variable working hours. This is measured by the share of employees for whom variable hours is the main reason for actual hours worked being different from usual hours worked. This is considered as a proxy to the availability of flexible working time arrangements[12] and so it contributes with a positive sign to the composite index. The source is the LFS.

3) Flexibility of work organisation to help combine work and family responsibilities

According to the main EU policy documents (COM(2007)359) and relevant literature (see e.g. the flexicurity 'matrix' in Wilthagen and Tros, 2004 and Wilthagen et al., 2003) flexicurity also encompasses the possibility for workers to reconcile professional and family and other private responsibilities (i.e. work-life balance). In the 2007

[10] I.e. standard deviation divided by the mean.

[11] I.e. within the internal flexibility dimension, their weights (in the construction of the index) sum up to one (equal to the weight given, for instance, to working hours' variability alone).

[12] A better measure would be the access to flexitime, i.e. having other working time arrangements than fixed start and end of working days. Unfortunately this measure is not included in the main LFS but only in a LFS ad-hoc module run in 2004 and not repeated in the following years.

Communication, however, this aspect is mentioned within the modern social security component[13]. This has been reflected, in this project, in the inclusion of child-care indicators within the composite index of that dimension. However, as work-life balance is also clearly affected by the flexibility of working time and work organisation, it appeared natural to include a third dimension within the composite indicator on flexibility to capture this aspect. Three indicators are included:

1. The share of workers who have left last job/business for looking after children, other personal or family responsibilities and education or training. This indicator enters with a negative sign, as working time should in principle be sufficiently flexible to accommodate workers' private obligations and needs for further training without forcing them to leave their job. The source is the LFS.
2. Employment impact of parenthood. This is measured by the percentage difference in female employment rates[14] without and with presence of a child. The sign is again negative as a large gap signals insufficient room for reconciling work and child-care. The source is the EMCO Compendium (indicator 18.a.5).
3. Inactivity and part-time work due to lack of suitable care services for children. Following the same logic as for the previous two indicators, the sign is negative. The source is the EMCO Compendium (for the period 2006-2008, indicator 18.A.6) and the 2005 LFS ad-hoc module on work and family life.

Time coverage: the index covers the period from 2005 to 2008. Using the LIME statistical standards, such time coverage can be rated with a "++".

Geographical coverage: the index covers 23 member states over the whole period considered (from 2005 to 2008), leading to a "++" rating following the LIME standards. Four Member States are excluded (i.e. Romania, Latvia, Cyprus and Malta), as EPL indicators are completely lacking for those countries. However, results for those Member States excluding EPL are shown in annex.

[13] Similarly, Wilthagen and Tros (2004) speak of "combination security".

[14] The Compendium also includes the same measure for men. However, the latter is mostly negative possibly pointing to a certain resilience of the male breadwinner model and related gender stereotypes, whereby presence of a child *increases* work incentives for men while reducing it for women as the latter tend to take up much more often child care responsibilities. Given its (in most cases) negative sign, the indicator for men has not been included.

Table 15 - List of indicators part of Flexible and Reliable Contractual Arrangement Composite Indicator

Indicators and dimensions	*Label*	*Source*	*Availability*
Regulations on dismissals and use of flexible contractual forms (external flexibility)			
Total employees in fixed-term only contracts as % of persons in employment	totemplfix	Compendium	2005-2008
Share of employees with fixed-term contracts because they could not find a permanent job	fixnotjob	Compendium	2005-2008
Share of self-employment in total employment	shaempl	Compendium	2005-2008
Strictness of rules on regular contract	EPR	OECD 'EPL	2005-2008
Ratio of strictness of rule on temporary contracts vs regular ones'	EPT/EPR	OECD 'EPL	2005-2008
Strictness of rules on collective dismissals	EPC	OECD 'EPL	2005-2008
Flexibility of working time -internal flexibility			
Share of employees in part-time	shpartime	Eurostat	2005-2008
Share of employees in part-time because they could not find full-time job	partimejob	Eurostat	2005-2008
Overtime work : Share of employees for whom overtime is main reason for actual hours worked being different from usual hours worked	overtime	LFS	2005-2008
Numbers of hours actually worked during the reference week (Coefficient of variation)	hwactual	LFS	2005-2008
Share of workers doing evening work	evenwk	LFS	2005-2008
Share of workers doing night work	nightwk	LFS	2005-2008
Share of workers doing saturday work	satwk	LFS	2005-2008
Share of workers doing Sunday work	sunwk	LFS	2005-2008
Share of workers doing shift work	shiftwk	LFS	2005-2008
Variable working hours: share of employees for whom variable hours is the main reason for actual hours worked being different from usual hours worked	hourreas	LFS	2005-2008
Flexibility of work organization to help combine work and family responsibility			
Inactivity and part-time work due to lack of suitable care services for children and other dependants	lack of care/nowecar	LFS/Compendium	2005-2008
Employment impact of parenthood	parenthood women	Compendium	2004-2007
Share of workers who have left last job/business for looking after children, other personal or family responsibilities and education or training	leavreas	LFS	2004-2008

Missing data: the FCA index covering the period from 2005 to 2008 is based on 19 indicators. This does not necessarily mean that data for all of them are actually available for all EU Member States and all years considered. Table 2 below presents the number of indicators with available data by country and year. The situation is good overall as only a few member states present data limitations.

The **direction** has been assumed to be positive (i.e. a higher score leading to a better performance of the country) for the following indicators: ratio of EPL on temporary versus regular contracts, Share of employees with fixed-term contracts, Share of self-employment in total employment, the coefficient of variation of hours actually worked,

atypical work, Share of employees in part-time, overtime and share of employees with variable hours. All remaining indicators have been given negative sign.

The **weighting scheme** adopted for the construction of the FCA index consists of attributing equal weights to all indicators *within the same dimension*. This strategy avoids rewarding those dimensions which include more indicators (e.g. internal flexibility) relative to those with fewer ones (e.g. flexibility of work organization to help combine work and family responsibilities). There is only exception to this rule which concerns *atypical work*, where all five variables have been weighted as one single variable. As a result, all dimensions included in the index are equally important, although individual variables do not necessarily have the same weight across different dimensions. Table 8 below presents the numerical values of the weights.

Table 16 - Weighting scheme for the FCA composite indicator

Dinemsion	Dimension weight	*Basic indicator*	*Direction*	*Description*	*Normalised weight*
Regulations on dismissals and use of flexible contractual forms (external flexibility)					
	1/6	totemplfix	+	Total employees in fixed-term only contracts as % of persons in employment	0.056
	1/6	fixjob	-	Share of employees with fixed-term contracts because they could not find a permanent job	0.056
	1/6	shaempl	+	Share of self-employment in total employment	0.056
	1/6	epr	-	Strictness of rules on regular contrac	0.056
	1/6	ept/epr	+	Ratio of strictness of rule on temporary contracts vs regular ones'	0.056
	1/6	epc	-	Strictness of rules on collective dismissals	0.056
Flexibility of working time -internal flexibility					
	1/6	shpartime		Share of employees in part-time	0.056
	1/6	partimejob	-	Share of employees in part-time because they could not find full-time job	0.056
	1/6	overtime	+	Overtime work : Share of employees for whom overtime is main reason for actual hours worked being different from usual hours worked	0.056
	1/6	hwactual	+	Numbers of hours actually worked during the reference week (Coefficient of variation)	0.056
		evenwk	+	Share of workers doing evening work	0.011
		nightwk	+	Share of workers doing night work	0.011
	1/6	satwk	+	Share of workers doing saturday work	0.011
		sunwk	+	Share of workers doing Sunday work	0.011
		shiftwk	+	Share of workers doing shift work	0.011
	1/6	hourreas	+	Variable working hours: share of employees for whom variable hours is the main reason for actual hours worked being different from usual hours worked	0.056
Flexibility of work organization to help combine work and family responsibility					
	1/3	lack	-	Inactivity and part-time work due to lack of suitable care services for children and other dependants	0.111
	1/3	parenthw	-	Employment impact of parenthood - women	0.111
	1/3	leavreas	-	Share of workers who have left last job/business for looking after children, other personal or family responsibilities and education or training	0.111

2.4.1 The structure of the FCA composite indicator

The composite indicator for Flexible Contractual Arrangements (FCA) has a simple structure. It is composed by three dimensions:

1. *Regulations on dismissals and use of flexible contractual forms - external flexibility* which covers six indicators;
2. *Flexibility of working time - internal flexibility* which includes 10 indicators, albeit counting for 6 (see 2.2 above).
3. *Flexibility of work organisation to help combine work and family responsibilities* which includes 3 indicators.

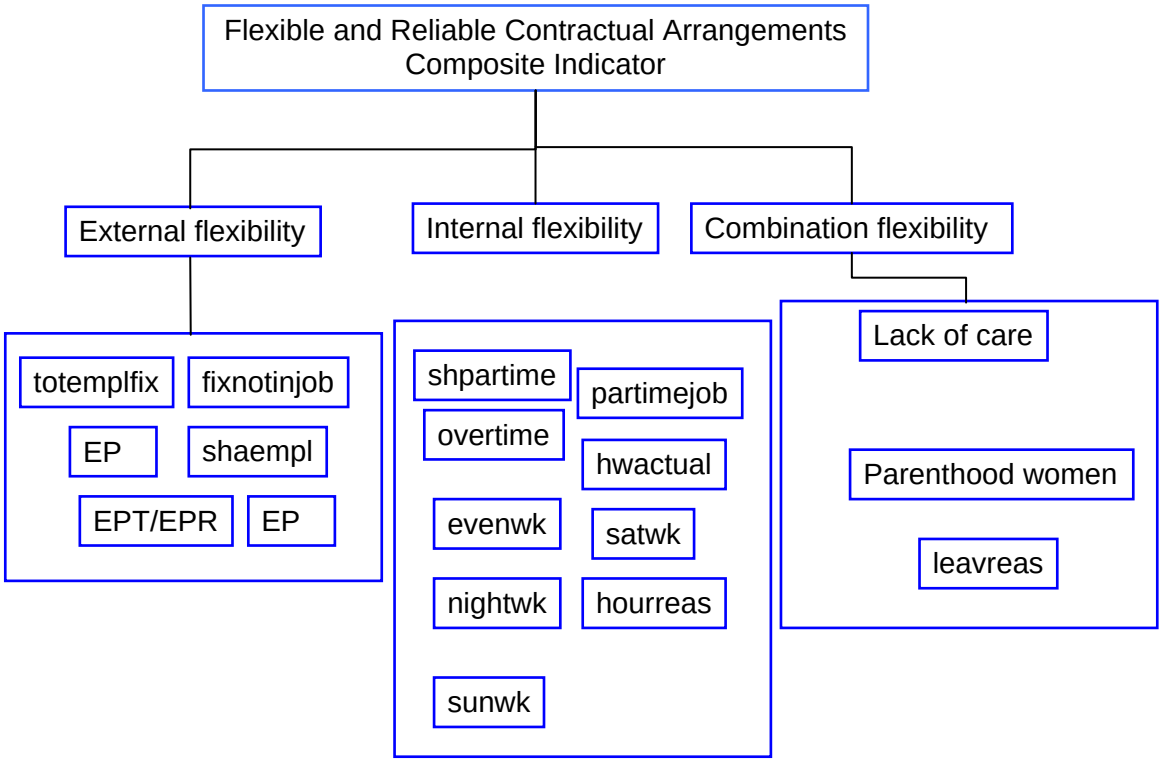


Figure 9: The structure of the Flexible and Reliable Contractual Arrangement Composite Indicator 2005-2008

2.4.2 Results for the Flexible and Reliable Contractual Arrangement Composite Indicator

After having defined the structure, the weighting scheme and the standardization procedure, the computation of the FCA composite indicator can be performed. This section presents and discusses the results of the indicator in terms of Member States' ranking over the four-years period considered.

Table 17 presents the total score of the composite indicator as well as of its three dimensions (i.e. External Flexibility, Internal Flexibility and Work-life combination flexibility) by country for 2005. A higher score should be interpreted as a sign that the corresponding Member State has more Flexible and Reliable Contractual Arrangements and hence is relatively more in line with the flexicurity approach. However, as with every composite indicator, one should always keep in mind that the overall score may mask divergent scores across dimensions and/or individual variables. In 2005 Portugal, Greece, Poland, France and Finland rank in the top five positions. The ranking of Greece in the first position is driven by the high scores obtained in the sub-dimensions of external flexibility and work-life combination flexibility, whereas its score on internal flexibility is not particularly good. The situation of Portugal is different because it ranks in the 2nd and 3rd position in the 2nd and 3rd sub-dimensions, respectively. Overall, in 2005 Member States do not seem to cluster around the geographical groups which are often mentioned in the literature (Nordic, Mediterranean etc.). For instance, the Netherlands, Slovenia, Spain, Belgium and Bulgaria rank in intermediate-to-upper positions. The Anglo-Saxon countries do not group together as the UK ranks 12th and Ireland 23rd[15]. Eastern Member States, with the exception of Poland, Slovenia and Bulgaria, rank in intermediate-to-lower positions. Sweden ranks in the 20th position due to a very low score in external flexibility.

Table 17 – 2005 Flexible Contractual Arrangement and its sub dimensions composite indicator

Flexible Contractual Arrangement			External flexibility			Internal flexibility			Working condition flexibility		
Rank	Country	CI 2005	Rank	Country	CI 2005	Rank	Country	CI 2005	Rank	Country	CI 2005
1	PT	626.30	1	EL	223.62	1	SI	163.54	1	PT	311.35
2	EL	622.55	2	FR	204.31	2	PT	153.47	2	FR	292.85
3	PL	617.11	3	ES	194.00	3	PL	144.12	3	EL	274.16
4	FR	597.19	4	PL	186.26	4	CZ	140.74	4	BE	271.12
5	FI	594.78	5	BE	184.92	5	BG	139.22	5	PL	262.56
6	NL	562.06	6	IT	183.90	6	SK	136.29	6	IT	259.31
7	SI	544.55	7	IE	180.96	7	NL	132.93	7	NL	252.10
8	ES	533.50	8	FI	179.68	8	HU	123.24	8	BG	244.46
9	BE	532.39	9	UK	171.93	9	EL	117.02	9	FI	244.36
10	BG	526.67	10	HU	168.32	10	IE	116.91	10	ES	236.13
11	IT	520.98	11	EE	168.15	11	EE	116.26	11	LT	226.78
12	UK	516.45	12	AT	162.58	12	LT	115.62	12	SK	223.31
13	LT	499.73	13	DK	156.15	13	UK	114.14	13	SI	221.42
14	DK	495.69	14	PT	153.73	14	FI	108.24	14	DE	206.50
15	SK	495.27	15	LU	152.90	15	LU	101.19	15	LU	202.59
16	AT	492.49	16	CZ	149.53	16	DE	98.66	16	AT	202.31
17	DE	466.45	17	SI	147.87	17	AT	96.84	17	DK	197.86
18	LU	461.20	18	LT	146.74	18	DK	96.65	18	SE	185.27
19	EE	460.26	19	NL	137.88	19	SE	95.12	19	UK	174.45
20	SE	455.79	20	DE	135.15	20	ES	88.80	20	EE	151.18
21	CZ	444.60	21	BG	134.16	21	IT	68.59	21	HU	144.48
22	HU	441.66	22	SE	129.73	22	BE	68.57	22	CZ	135.47
23	IE	367.04	23	SK	124.96	23	FR	64.54	23	IE	59.48

[15] Ireland is heavily penalized in the sub-dimension of work-life combination flexibility (where it ranks in the last position) whereas it ranks around intermediate positions in the remaining two sub-dimensions.

Moving to results for 2006 (see table 18 below) the country ranking changes somewhat. In particular, Finland moves up by 4 positions and ranks 1st in 2006 mainly due to an improved score in the sub-dimension of internal flexibility. Portugal still ranks in a high position, albeit moving from first to second. Denmark improves considerably relative to 2005 by moving up by 11 positions and reaching the third score overall. This is mainly due to an improvement score in the sub-dimension of work-life combination flexibility. Slovenia ranks in the 4th position thanks its first score on internal flexibility and a good score on work-life combination. The Netherlands, Poland, France and the UK rank in intermediate-to-upper positions. Greece moves downwards by 10 positions relative to 2005 and it now ranks 11th. Germany deteriorates considerably reaching the last position, due to a very low score in all the three sub-dimensions. Belgium and Bulgaria also worsen their ranking (albeit to a lesser extent, i.e. by 5 positions). Apart from the above mentioned cases, Members States tend to improve their ranking[16]

Table 18 – 2006 Flexible Contractual Arrangement and its sub dimensions composite indicator

Flexible Contractual Arrangement			External flexibility			Internal flexibility			Work-life condition flexibility		
Rank	Country	CI 2006	Rank	Country	CI 2006	Rank	Country	CI 2006	Rank	Country	CI 2006
1	FI	598.30	1	EL	222.47	1	SI	178.05	1	DK	274.25
2	PT	591.06	2	FR	204.14	2	PL	176.65	2	PT	270.97
3	DK	585.47	3	IE	195.36	3	FI	172.27	3	NL	260.30
4	SI	580.53	4	ES	194.21	4	UK	170.18	4	FR	257.39
5	NL	565.67	5	BE	183.59	5	NL	167.95	5	IT	254.03
6	PL	563.91	6	IT	183.46	6	PT	165.07	6	SI	252.87
7	FR	559.72	7	PL	182.71	7	SE	152.98	7	FI	245.85
8	UK	552.22	8	FI	180.18	8	CZ	152.16	8	LT	239.76
9	IT	525.74	9	UK	170.49	9	BG	151.14	9	AT	229.81
10	LT	522.16	10	DK	168.28	10	EE	143.86	10	BE	228.46
11	EL	517.98	11	HU	164.95	11	DK	142.94	11	LU	227.08
12	AT	514.02	12	AT	161.17	12	SK	141.56	12	UK	211.54
13	LU	495.71	13	EE	158.71	13	LT	138.53	13	SK	204.78
14	IE	489.75	14	PT	155.02	14	EL	126.68	14	PL	204.55
15	BE	485.61	15	LU	152.97	15	IE	125.54	15	BG	195.56
16	BG	477.82	16	SI	149.61	16	AT	123.04	16	SE	182.64
17	SK	469.89	17	CZ	148.77	17	HU	122.28	17	ES	172.01
18	ES	467.74	18	LT	143.87	18	DE	121.46	18	DE	170.70
19	SE	465.02	19	NL	137.42	19	LU	115.67	19	IE	168.85
20	EE	445.27	20	DE	132.64	20	ES	101.51	20	EL	168.83
21	CZ	443.47	21	BG	131.11	21	FR	98.19	21	EE	142.71
22	HU	425.67	22	SE	129.40	22	IT	88.25	22	CZ	142.54
23	DE	424.80	23	SK	123.55	23	BE	73.55	23	HU	138.44

As regards 2007 (see table 19 below) no large deviations are recorded compared to 2006. Finland still ranks first, followed by Denmark, the Netherlands, Portugal and Slovenia. Only slight changes are recorded such as, for instance, France switching its position with Poland, Austria, Ireland and Greece moving up by 3 and 1 (Greece) positions respectively, whereas Italy, Luxemburg and Slovakia register some worsening. New Member States still predominantly cluster in the lower end of the ranking.

[16] E.g. Luxemburg moves from 18th to 13th position and Lithuania moves up by 3 positions.

Table 19 – 2007 Flexible Contractual Arrangement and its sub dimensions composite indicator

Flexible Contractual Arrangement			External flexibility			Internal flexibility			Work-life condition flexibility		
Rank	Country	CI 2007	Rank	Country	CI 2007	Rank	Country	CI 2007	Rank	Country	CI 2007
1	FI	589.55	1	EL	222.35	23	UK	163.69	23	UK	196.76
2	DK	571.53	2	FR	205.56	22	SK	140.94	22	SK	181.56
3	NL	570.93	3	ES	195.67	21	SI	176.55	21	SI	235.32
4	PT	567.56	4	IE	187.17	20	SE	148.84	20	SE	175.10
5	SI	562.95	5	BE	185.04	19	PT	158.96	19	PT	252.29
6	FR	552.73	6	PL	184.23	18	PL	171.02	18	PL	188.37
7	PL	543.63	7	IT	183.62	17	NL	172.25	17	NL	253.46
8	UK	532.56	8	FI	180.74	16	LU	116.55	16	LU	190.27
9	AT	525.18	9	UK	172.12	15	LT	140.94	15	LT	188.31
10	EL	516.81	10	HU	171.55	14	IT	79.62	14	IT	239.64
11	IT	502.87	11	DK	171.37	13	IE	130.50	13	IE	157.97
12	IE	475.64	12	EE	161.84	12	HU	121.34	12	HU	126.79
13	BE	473.14	13	AT	161.78	11	FR	104.44	11	FR	242.73
14	LT	471.16	14	CZ	156.39	10	FI	175.77	10	FI	233.04
15	BG	469.63	15	PT	156.31	9	ES	99.62	9	ES	157.14
16	LU	457.93	16	LU	151.11	8	EL	123.81	8	EL	170.65
17	SE	454.83	17	SI	151.08	7	EE	140.79	7	EE	127.27
18	ES	452.42	18	NL	145.23	6	DK	139.50	6	DK	260.66
19	SK	448.32	19	LT	141.92	5	DE	121.31	5	DE	170.68
20	EE	429.91	20	DE	134.14	4	CZ	144.55	4	CZ	117.61
21	DE	426.13	21	SE	130.89	3	BG	152.01	3	BG	187.16
22	HU	419.68	22	BG	130.46	2	BE	73.15	2	BE	214.95
23	CZ	418.56	23	SK	125.82	1	AT	125.04	1	AT	238.35

Also in 2008 (see table 20), Member States' ranking does not present significant changes relative to 2007. The Netherland ranks first, followed by Denmark and Finland. France, Portugal and the UK maintain their ranking among the upper positions. On the other hand, Slovenia worsens significantly, by moving down to 9th position, whereas Germany improves its own by moving from the 21st to the 17th position. Also in 2008 changes tend to concentrate on the upper end of the ranking. New Member States still predominantly cluster in the lower end.

Table 20 – 2008 Flexible Contractual Arrangement and its sub dimensions composite indicator

Flexible Contractual Arrangement			External flexibility			Internal flexibility			Work-life condition flexibility		
Rank	Country	CI 2008	Rank	Country	CI 2008	Rank	Country	CI 2008	Rank	Country	CI 2008
1	NL	651.17	1	EL	214.45	1	NL	189.77	1	NL	264.41
2	DK	604.17	2	FR	212.36	2	FI	182.85	2	PT	264.09
3	FI	593.81	3	BE	205.15	3	PL	171.76	3	DK	262.06
4	FR	584.03	4	IE	202.83	4	SI	169.07	4	FR	258.61
5	PT	571.43	5	UK	197.58	5	UK	165.81	5	IT	252.91
6	UK	568.79	6	NL	196.99	6	PT	160.12	6	AT	245.64
7	AT	555.32	7	DK	194.30	7	SE	156.15	7	BE	243.45
8	EL	526.95	8	IT	187.70	8	EE	148.94	8	FI	226.85
9	SI	522.47	9	FI	184.11	9	CZ	148.89	9	SI	211.55
10	BE	518.40	10	AT	179.54	10	DK	147.81	10	UK	205.40
11	IT	518.05	11	ES	175.22	11	BG	147.26	11	BG	203.72
12	PL	517.54	12	EE	172.81	12	LT	140.82	12	LU	201.01
13	LU	479.40	13	HU	168.72	13	SK	138.51	13	PL	186.32
14	BG	478.84	14	LU	166.27	14	AT	130.14	14	EL	183.36
15	IE	474.74	15	PL	159.45	15	EL	129.13	15	ES	181.83
16	SE	473.98	16	CZ	153.79	16	DE	125.69	16	DE	180.17
17	DE	457.48	17	DE	151.62	17	HU	123.05	17	SE	176.50
18	ES	452.39	18	PT	147.21	18	IE	113.16	18	SK	172.88
19	EE	450.86	19	LT	141.88	19	FR	113.06	19	LT	161.26
20	LT	443.97	20	SI	141.85	20	LU	112.13	20	IE	158.74
21	SK	434.02	21	SE	141.33	21	ES	95.34	21	HU	129.14
22	HU	420.91	22	BG	127.86	22	IT	77.44	22	EE	129.12
23	CZ	408.27	23	SK	122.63	23	BE	69.79	23	CZ	105.58

Table 121 and figure 11 below track the evolution of member states' ranking over the period considered (i.e. 2005-2008). Overall, the ranking varies only moderately, with differences mainly concentrated on 2005 relative to the following three years. Figure 10 shows the FCA composite indicators for 2008.

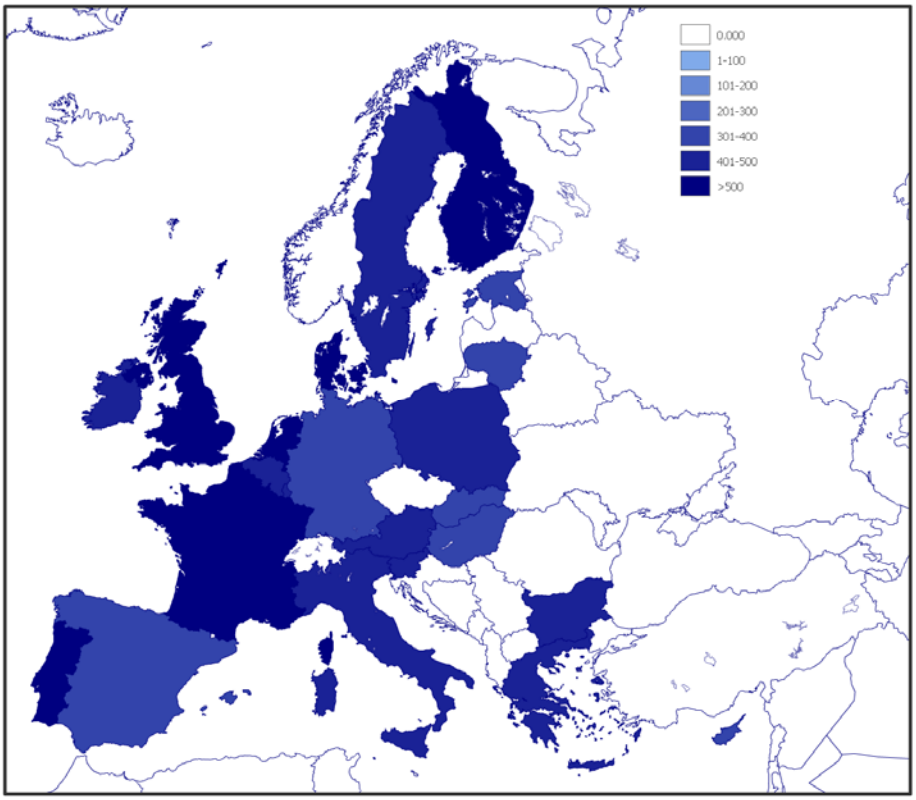


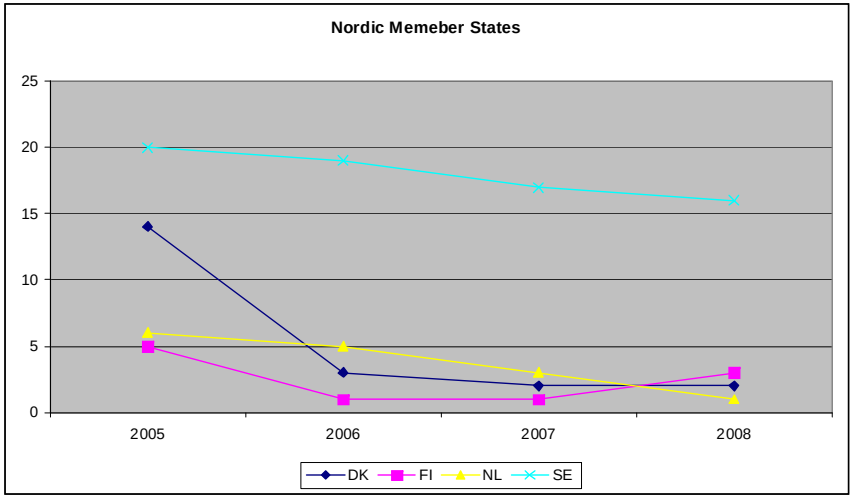
Figure 10 - Map of the FCA composite indicator for 2008

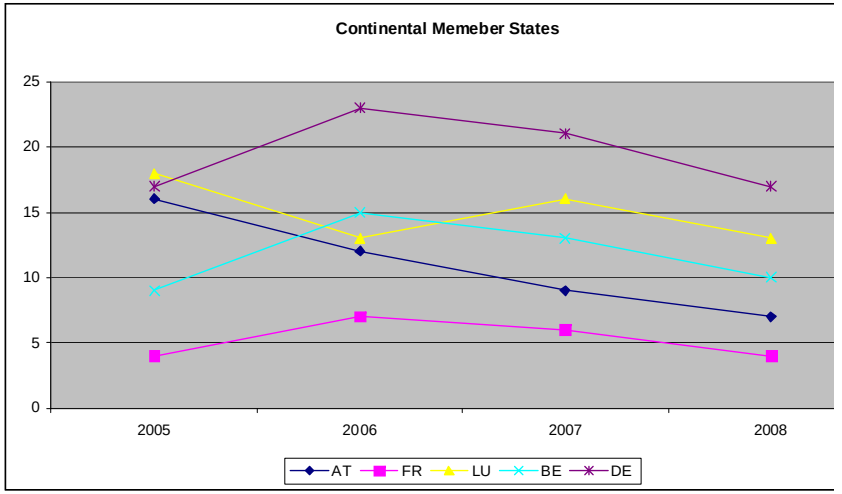
The biggest variations concern the Nordic and Mediterranean Member States, i.e. Greece ranking first in 2005 while falling in intermediate-to-upper positions in 2006-2008 and Finland and Denmark ranking among first positions in 2006-2008. However, Members States do not systematically cluster around those geographical grouping which are often mentioned in the literature, although some indication in that direction can be seen, e.g. the emergence of a 'Nordic cluster' in top positions (including Netherlands, Denmark and Finland, but with the exception of Sweden) in the last three years considered.

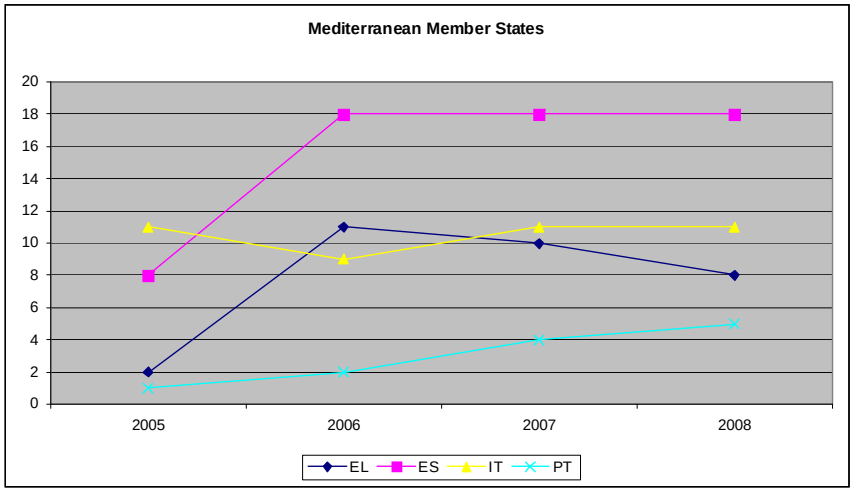
Table 21 - Comparison of the rankings 2005-2008

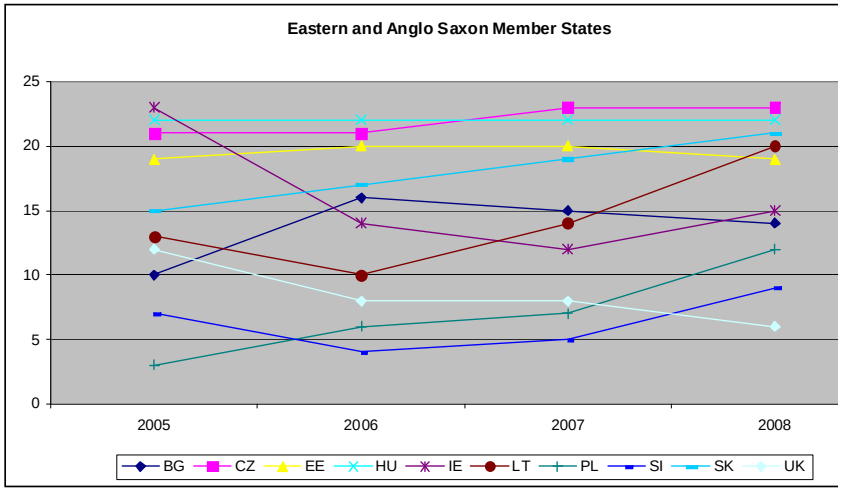
Country	CI 2005	CI 2006	CI 2007	CI 2008
AT	16	12	9	7
BE	9	15	13	10
BG	10	16	15	14
CZ	21	21	23	23
DE	17	23	21	17
DK	14	3	2	2
EE	19	20	20	19
EL	2	11	10	8
ES	8	18	18	18
FI	5	1	1	3
FR	4	7	6	4
HU	22	22	22	22
IE	23	14	12	15
IT	11	9	11	11
LT	13	10	14	20
LU	18	13	16	13
NL	6	5	3	1
PL	3	6	7	12
PT	1	2	4	5
SE	20	19	17	16
SI	7	4	5	9
SK	15	17	19	21
UK	12	8	8	6

Figure 11 - Ranking Comparison 2005-2008 for each cluster









3. Results: the four dimensions of the Flexicurity

In the previous sessions the methodology, the assumptions, the structure and the results for each composite indicator are presented, in this session the results on flexicurity as a whole are presented.

Time coverage: the Lifelong learning composite indicator covers the 2005, while the Active labour market policies index goes from 2004 to 2007, the Modern Social Security Systems covers three years from 2005 to 2007, and finally the Flexile and Reliable Contractual Arrangement goes from 2005 to 2008, as shown in figure xx

Table 22 - Comparison of the rankings 2005-2008

	2004	2005	2006	2007	2008
LLL					
AMLP					
MSS					
FCA					

Geographical coverage: the Lifelong learning composite indicator counts 23 Member States, while the Active labour market policies covers 24 Member States, the number of countries increased with the Modern Social Security composite indicator which is based on 25 Member States, finally the Flexible and Reliable Contractual Arrangement index counts 23 countries. Unfortunately this situation generates missing countries across the four dimension of flexicurity. In particular Bulgaria is not included in the dimension of MSS composite indicator, Cyprus presents two missing cell respectively for the dimensions of ALMP and FCA, Denmark and Greece are not present in the dimension of ALMP. Finland, Ireland and Italy are not counted in the dimension of LLL, while Latvia is missing for the dimension of FCA. The case of Romania is worse because is missing in both the dimension of MSS and FCA, together with Malta which is missing in the dimension of ALMP and FCA, finally UK is missing in the dimension of LLL.

Table 23 shows for each country the number of missing indicators.

Table 23 – Missing data across the Flexicurity dimensions

Country	Missing
AT	(0/4)
BE	(0/4)
BG	(1/4)
CY	(2/4)
CZ	(0/4)
DE	(0/4)
DK	(1/4)
EE	(0/4)
EL	(1/4)
ES	(0/4)
FI	(1/4)
FR	(0/4)
HU	(0/4)
IE	(1/4)
IT	(1/4)
LT	(0/4)
LU	(0/4)
LV	(1/4)
MT	(2/4)
NL	(0/4)
PL	(0/4)
PT	(0/4)
RO	(2/4)
SE	(0/4)
SI	(0/4)
SK	(0/4)
UK	(1/4)

Correlations among indicators: the correlation structure of the four dimensions of flexicurity presents a high relation between the dimensions of lifelong learning and active market labour policies, which means that the higher the score of ALMP composite indicator the higher the one of ALLL, the correlation is high (0.72). The relation between MSS and ALMP is less strong and positive, with a correlation of 0.47, but still relevant.

Table 24 – Correlation matrix for the Flexicurity dimensions

	lll	amlp	mss	fca
lll	1			
amlp	0.72	1		
mss	0.32	0.47	1	
fca	-0.23	0.03	0.22	1

The relation between MSS and LLL is positive but weak, the correlation is 0.32. A negative correlation is registered between the dimension of FCA and LLL which means that the higher is the level of FCA the lower is the level of LLL. In general the dimension of FCA is the least correlated with all the others, in particular it has basically no correlation with the dimension of ALMP, while there is a positive but weak (0.22)

relation with the dimension of MSS. Results for 2005 of all four dimensions of flexicurity are presented in table 25

Table 25 – Results of each of the four pillar of the Flexicurity

Country	LLL	AMLP	MSS	FCA
AT	488	236.42	371	492
BE	539	277.85	486	532
BG	69	72.52		527
CY	317		451	
CZ	551	50.31	329	445
DE	405	251.51	460	466
DK	801		530	496
EE	296	37.88	374	460
EL	37		447	623
ES	356	178.27	471	533
FI		279.75	410	595
FR	692	211.05	480	597
HU	282	62.98	404	442
IE		258.54	405	367
IT		196.44	459	521
LT	131	41.08	295	500
LU	703	414.57	367	461
LV	74	38.66	336	
MT	429		388	
NL	621	328.16	423	562
PL	175	113.49	290	617
PT	228	162.83	499	626
RO	113	42.89		
SE	808	347.92	439	456
SI	382	104.08	329	545
SK	472	75.92	345	495
UK		159.48	372	516

In order to compare the four dimensions of flexicurity the indicators have been rescaled by using the min-max standardisations rule.

Figure 12 shows the bivariate relation between the dimensions of ALLL and ALMP, where in particular a linear and positive trend is highlighted: higher is the level of ALMP, higher the level of ALLL. Countries are clustered in four groups which tend to reflect the geographical clusters normally found in the flexicurity literature (i.e. Nordic, Continental etc.). New Member States lie at the bottom of the picture and they are split in two groups. Romania, Lithuania, Latvia and Poland record levels of ALMP and LLL below the mean, while Czech Republic, Slovakia, Slovenia, Hungary and Estonia locate above the regression line. This picture highlights some heterogeneity across New Member States. Continental and Nordic Members States have better scores on the dimensions of LLL and ALMP, while Spain and Portugal, which constitute the Mediterranean cluster, are located in the middle between New Member States and Continental Member States, with scores similar to the former ones with respect to LLL and slightly better with respect to ALMP.

Figure 12 – Scatter plot between LLL and ALMP

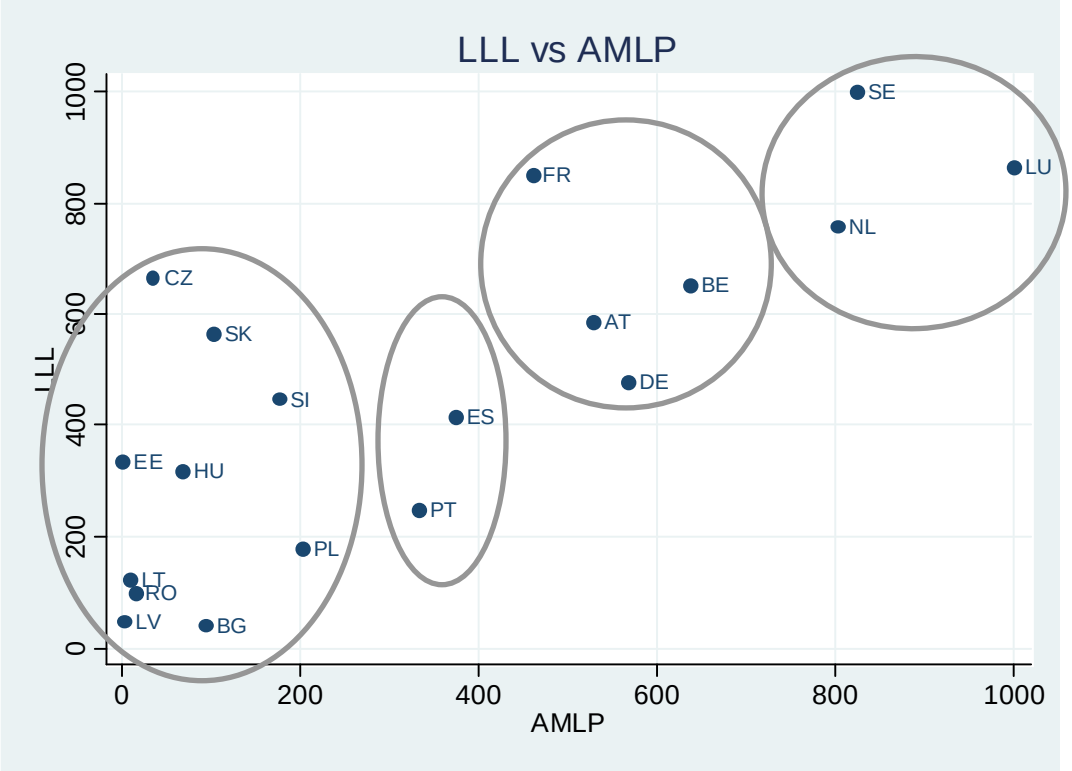
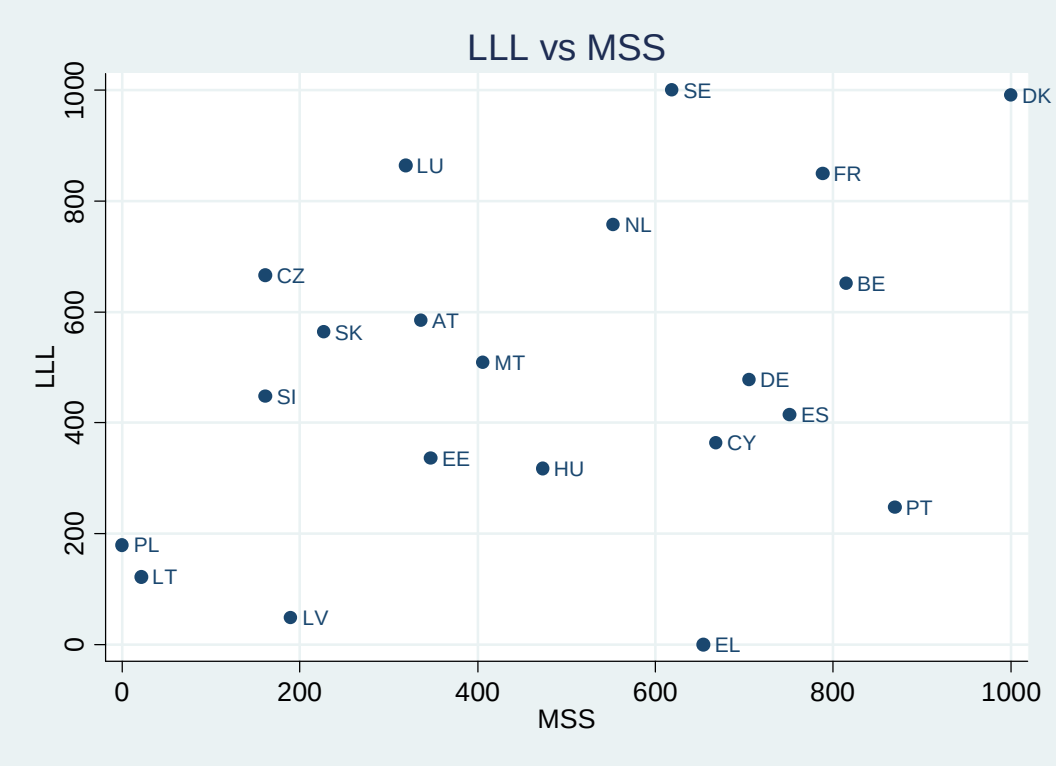


Figure 13 presents the relation between the dimensions of ALLL and MSS. Countries are spread across the Cartesian space and, unlike the previous case; clusters of countries do not seem to reflect the usual geographical clusters. There are some outliers, as for instance Greece which has a low score in the dimension of LLL and a good score in ALMP, or Denmark with the highest score in both dimensions.

Figure 14 illustrates the relation between the dimension of LLL and FCA. The relation is negative as appears from the correlation matrix in table 24. Countries are spread all over the Cartesian space and do not follow a particular path. Sweden, Denmark and Luxemburg cluster together recording a very high level in the score of LLL and a relative low level in the score of FCA, on the other hand Poland, Portugal and Greece have the highest score in the level of FCA dimension associated to a low level in the dimension of LLL.

Figure 13 - Scatter plot between LLL and MSS



In figure 15 is presented the relation between the dimension of ALMP and the MSS composite indicator where a linear and positive trend is shown. New Member States cluster together and are characterised by a very low level in the dimension of ALMP. Mediterranean countries plus France show high level in the dimension of MSS composite indicator associated with a score in the dimension of ALMP index below the average. Nordic and Continental countries as Anglo Saxon Member States are placed above the regression line. Luxemburg shows outlier behaviour across all the European Member States. The regression model behind the picture explain 24% of the variability in the model, which means that it need to be improved but can be used for a first discussion of the relation between these two dimensions.

Figure 16 shows the relation between ALMP and FCA where (as discussed before) the correlation coefficient is almost zero. Countries are spread across the Cartesian space and only new Member States cluster together and are characterized by very low score in the dimension of ALMP.

Figure 17 shows the relation between the dimension of MSS and FCA which is positive. Countries are not grouped across geographical clusters. A certain number of outliers can be identified, such as Poland which records the highest score in the dimension of FCA and the lowest one on MSS. On the other hand, Denmark reaches the highest level in the dimension of MSS and an intermediate one on FCA; whereas Ireland records the worst score in the dimension of FCA and an intermediate one on MSS.

Figure 14 - Scatter plot between LLL and FCA

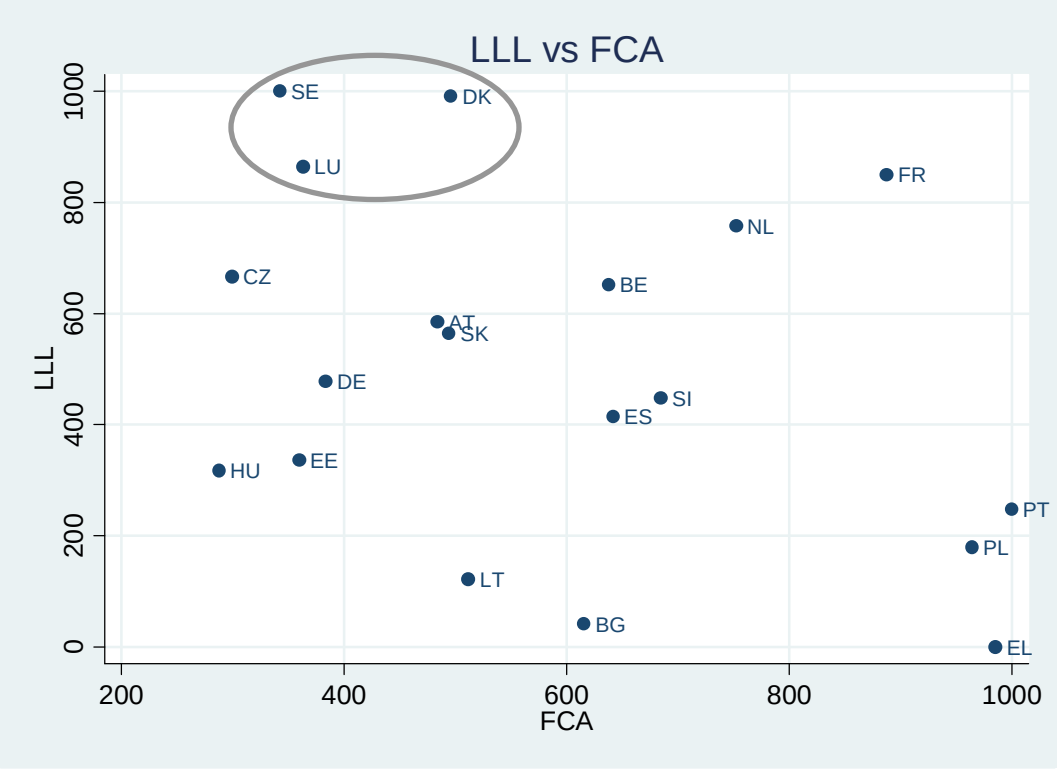


Figure 15 - Scatter plot between ALMP and MSS

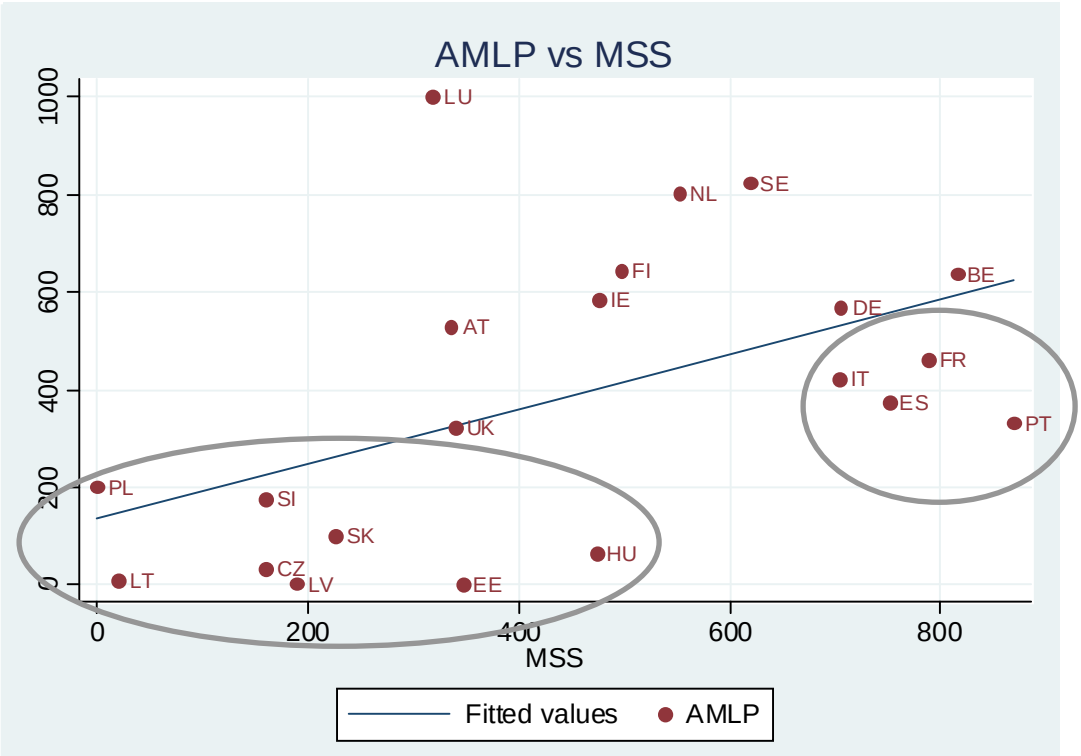


Figure 16 - Scatter plot between ALMP and FCA

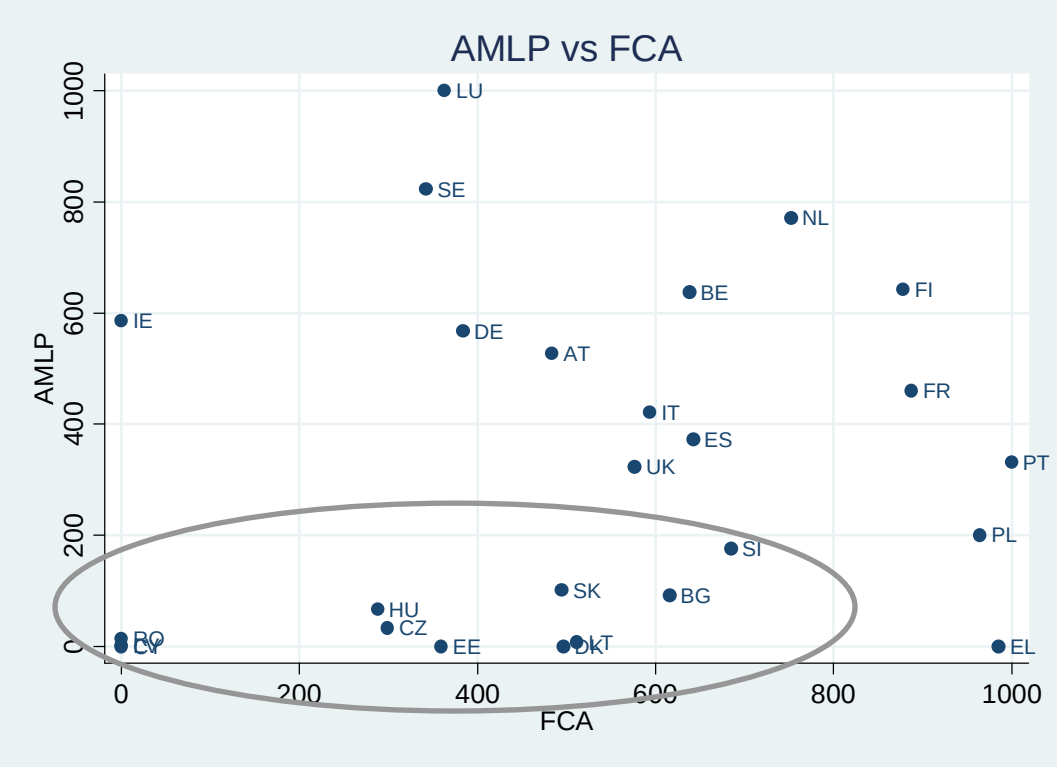
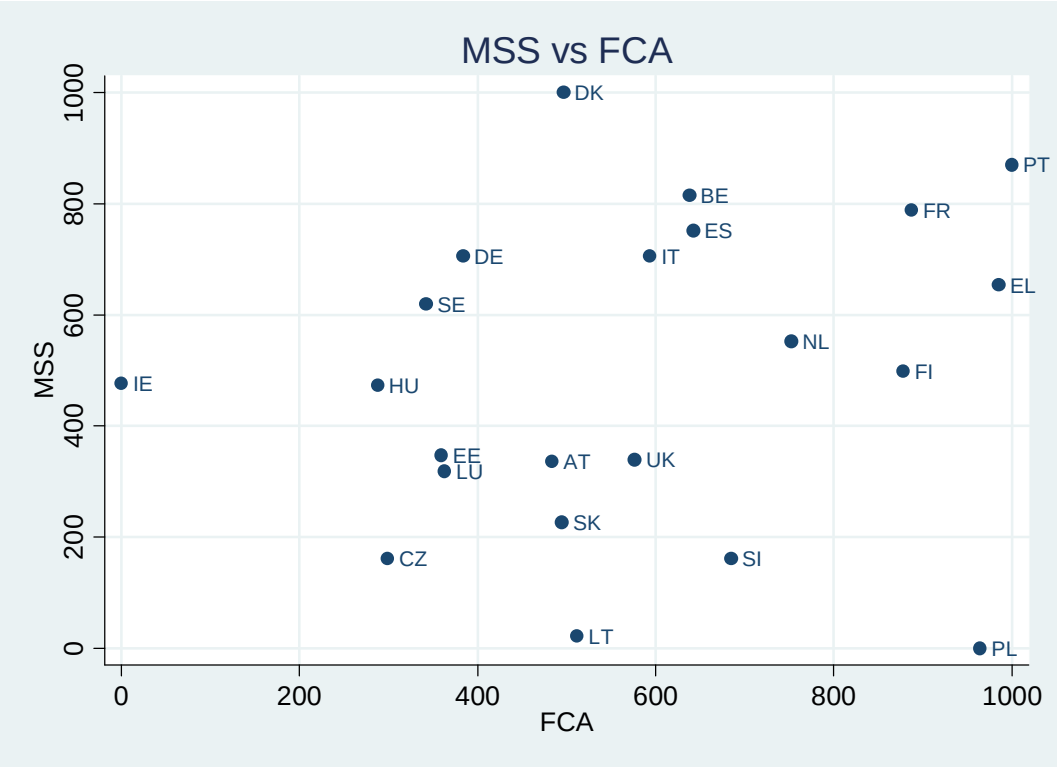


Figure 17 - Scatter plot between MSS and FCA



4. Conclusions

This project is the first attempt to construct a set of composite indicators covering the four main components of flexicurity as identified by the European Commission (see COM(2007)359): i.e. Adult Life Long Learning (ALLL), Active Labour Market Policies (ALMP), Modern Social Security Systems (MSS) and Flexible and Reliable Contractual Arrangements (FCA) with the aim of providing a statistical measure of flexicurity achievements of EU Member States. The time and geographical coverage varies slightly across the four indicators based on data availability, with 23 countries covered for one year (2005) for LLL, 24 countries for three years (2005-07) for ALMP, 25 countries for three years (2005-07) for MSS and 23 countries for four years (2005-08) for FCA.

A composite indicator is ultimately the sum of a set of individual indicators which together allow capturing a multidimensional socio-economic concept such as flexicurity. Each of the four flexicurity components is in turn the sum of several aspects, each of them measurable by a specific indicator. In this analysis, the number of indicators included varies slightly by composite indicator, with 9 indicators for LLL, 16 for ALMP, 20 for MSS and 19 for FCA.

To our knowledge this is the richest and most comprehensive attempt to measure flexicurity in Europe available in the literature. The strengths of this analysis can be summarised as follows:

1. The set of input indicators included is much broader than in any previous analysis covering a wide range of relevant aspects which were so far disregarded or only studied in isolation. This concerns in particular the inclusion of both external and internal flexibility and of labour market segmentation within the FCA component, of indicators of both levels and duration of unemployment insurance together with indicators of financial incentives to move to employment for unemployed and inactive people due to the combined effect of tax and benefits systems for the MSS component, of figures on ALMP spending both in total (share of GDP) and per participant and per person wanting to work, and, for LLL, of figures on participation to education and training as well as of costs and number of hours of training programs.

2. Composite indicators are a well established statistical technique based on a solid methodological framework (see the OECD-JRC handbook on construction of composite indicators) which has been thoroughly followed in this project.

3. The set of composite indicators is underpinned by a solid theoretical framework on flexicurity which draws on extensive analytical experience of DG EMPL services (see Employment in Europe 2006 and 2007) and vast knowledge of relevant economic and labour market literature. For each input indicator, the theoretical rationale for its inclusion is provided. Moreover, indicators contribute

either with a positive or a negative sign to the set of composite indexes in order to account for their divergent impact on flexicurity based on theory.

4. Extensive robustness checks of results have been carried out for each composite indicator (see Annex 2 below), by changing several assumptions of the methodology relative to the benchmark structure adopted in the main report, i.e. exclusion of individual indicators, different weighting, different aggregation and standardisation methods. It turns out that countries' scores and ranking in those alternative scenarios are relatively similar to the benchmark, albeit with some variability, suggesting that our results are relatively stable.

5. This methodology is very suitable for regular monitoring of flexicurity achievements of Member States as all indicators included are drawn form institutional data sources and are mostly updated every year. Member States achievements can be easily visualised via radar charts representing scores across the four components. An example of this is provided for each Member State in Annex 1 below. Hence, this exercise is a significant contribution, together with the methodology endorsed by EMCO in 2009, to identify the appropriate tool for measuring Member States' progress on flexicurity as requested by the Commission and Member States

Results of country scores and ranking highlight substantial heterogeneity across EU Member States in terms of how close they are to fulfil flexicurity "requirements". Geographical clusters which have been frequently found in literature, such as Nordic, Continental, Anglo-Saxon, Mediterranean and New Member States (see e.g. Employment in Europe 2006 and 2007) are to some extent confirmed, although with a number of exceptions and qualifications suggesting that a richer set of indicators adds valuable information on country performance on flexicurity.

Nordic Member States reach relatively high scores in all four dimensions, although with better scores in ALMP and LLL, whereas their performance on MSS is at intermediate level, suggesting that their relatively generous welfare system tends to go together with substantial financial disincentives towards employment. As far as FCA is concerned, Sweden scores at quite low level.

Continental Member States tend to perform at intermediate-to-upper level in the dimensions of ALMP, MSS and LLL. However, they tend to be quite scattered along the ranking rather than grouping together, particularly in the case of FCA with France, performing quite well while Germany is close to the bottom. Mediterranean Member States appear to have divergent performances, reaching in some case better results that normally found in the literature. In FCA they are quite scattered with Portugal and Greece in the intermediate-to-upper area and Spain close to the bottom (segmentation may be playing a role here, given the large share of involuntary fixed-term work in this country). In MSS they reach intermediate-to-upper scores signalling again that including indicators for financial disincentives changes the picture. Finally, they score in the

intermediate-to-lower area on ALMP and LLL (although they are quite scattered in the latter).

Anglo-Saxon Member States show divergent performances, with UK scoring at intermediate-to-upper level in FCA while Ireland scores worse. The reverse occurs in MSS and ALMP. Finally New Member States tend to cluster together around lower positions in all dimensions, with a few exceptions such as Slovenia and Poland in FCA, Cyprus in MSS and Czech Republic and Malta in LLL (the group being overall more scattered in this dimension).

In general there is a high and positive correlation between the dimensions of Active labour market policies and Lifelong learning, while a negative correlation (-0.23) is recorded between FCA and LLL. The dimensions of Modern Social Security and Active Labour Market Policies are also positively correlated, albeit more weakly. Modest and positive correlations are recorded also for MSS and LLL and, on the other hand, between FCA and MSS. There is no correlation between FCA and ALMP.

5. Reference

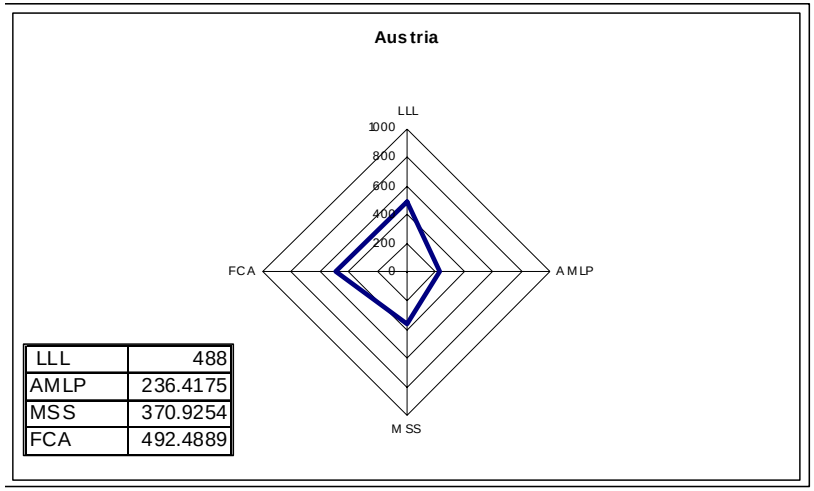
- European Commission (2001a), Summary Innovation Index, DG Enterprise,European Commission, Brussels.
- European Commission (2006), *Flexibility and security in the EU labour markets*, in Employment in Europe, DG Employment, European Commission, Brussels.- European Commission (2007), *Working time, work organisation, and internal flexibility – flexicurity models in the EU*, in Employment in Europe, DG Employment, European Commission, Brussels.
- Fagerberg J. (2001), Europe at the crossroads: The challenge from innovation basedgrowth in the Globalising Learning Economy, B. Lundvall and D.Archibugi eds., Oxford Press.
- Freudenberg, M. (2003), Composite indicators of country performance: a criticalassessment, OECD, Paris.
- Gilks, W. R., Richardson, S. and Spiegelhalter, D. J. (1996) Markov Chain Monte Carlo in Practice, Chapman and Hall, London
- Governatori, M., Manca A.R. and Mascherini, M. "Towards a set of composite indicators on Flexicurity: The Indicator on Modern Social Security Systemss" EUR REPORT 24091 EN.-
- Jamison, D. and Sandbu, M. (2001), "WHO ranking of health system performance", Science, 293, 1595-1596.
- Little R.J.A (1997), Biostatistical Analysis with Missing Data, in Armitage P. and Colton T. (eds.) Encyclopaedia of Biostatistics, London: Wiley.
- Little R.J.A. and Rubin D.B. (2002), Statistical Analysis with Missing Data, Wiley Interscience, J. Wiley& Sons, Hoboken, New Jersey.
- Little R.J.A. and Schenker N. (1994), Missing Data, in Arminger G., Clogg C.C., and Sobel M.E.(eds.) Handbook for Statistical Modeling in the Social and Behavioral Sciences, pp.39-75, New York:Plenum.
- Manca A.R, Governatori, M., and Maschrerini"Towards a set of composite indicators on Flexicurity: The Indicator on Flexible and Reliable Contractual Arrangement" EUR REPORT 24330 EN
- Mascherini, M., Manca A.R. "Towards a set of composite indicators on Flexicurity: The Composite Indicator on Active Labour Market Policies" EUR REPORT 23957 EN.-
- Nardo, M., Saisana, M., Saltelli, A., and Tarantola, S. (EC/JRC), Hoffman, A. and Giovannini, E., (OECD). (2005). *Handbook on constructing composite indicators: methodology and user guide* OECD Statistics Working Paper.
- Rubin,D.B. and Schenker N. (1986), Multiple imputation for interval estimation from simple random samples with ignorable nonresponse - Journal of the American Statistical Association, Vol. 81, No. 394 (Jun., 1986), pp. 366-374
- Saltelli A. (2002), Making best use of model valuations to compute sensitivity indices, Computer Physics Communications, 145, 280-297.
- Saltelli, A., Chan,K. And Scott, M.. (2000a). *Sensitivity Analysis*. Probability and Statistics Series. New York: John Wiley & Sons.
- Saltelli, A., Ratto, M., Andres, T., Campolongo, F., Cariboni, J., Gatelli, D. Saisana, M., -Tarantola, S., (2008) , *Global Sensitivity Analysis. The Primer*, John Wiley & Sons publishers.

- Saltelli, A., Tarantola S. and Campolongo F. (2000b). *Sensitivity Analysis as an Ingredient of Modelling*. Statistical Science 15:377-395.
- Schafer J.L. (1999), Multiple imputation: a primer, Statistical Methods in Medical Research, Vol. 8, No. 1, 3-15.
- Tarantola S., Jesinghaus J. and Puolamaa M. (2000), Global sensitivity analysis: a quality assurance tool in environmental policy modelling. In Sensitivity Analysis (eds - Saltelli A., Chan K., Scott M.) pp. 385- 397. New York: John Wiley & Sons.
- World Economic Forum (2002), Environmental Sustainability Index.
http://www.ciesin_org/indicators/ESI/index.html.
-Mascherini, M., "Towards a set of composite indicators on flexicurity: the lifelong learning composite indicator" EUR REPORT 23516 EN.-
-Saisana, M. Saltelli, A. and Tarantola, S. (2005) Uncertainty and sensitività analysis techniques as tools for the qualità assessment of composite indicators. Journal of the Royal Statistical Society A 168(2), pp1-17.
-Saltelli A (2007), Composite Inidcators between analysis and advocacy, Social Indicator Research (2007) 81:65-77.
Stiglitz, J. , Sen, A. and Fitoussi, J.P. (2009), Report by the commissionon the measurement of economic performance et social progress.
-Wilthagen, T. (1998a), *Flexicurity: A New Paradigm for Labour Market Policy Reform?* Berlin: WZB Discussion Paper FS I 98-202.
-Wilthagen, T. and F. Tros (2004), *The Concept of Flexicurity: A New Approach to Regulating Employment and Labour Markets*, European Review of Labour and Research, Vol. 10(2).
-Wilthagen, T., F. Tros and H. van Lieshout (2003), *Towards "flexicurity?: balancing flexibility and security in EU member states*. Invited paper prepared for the 13th World Congress of the International Industrial Relations Association (IIRA), Berlin September 2003.

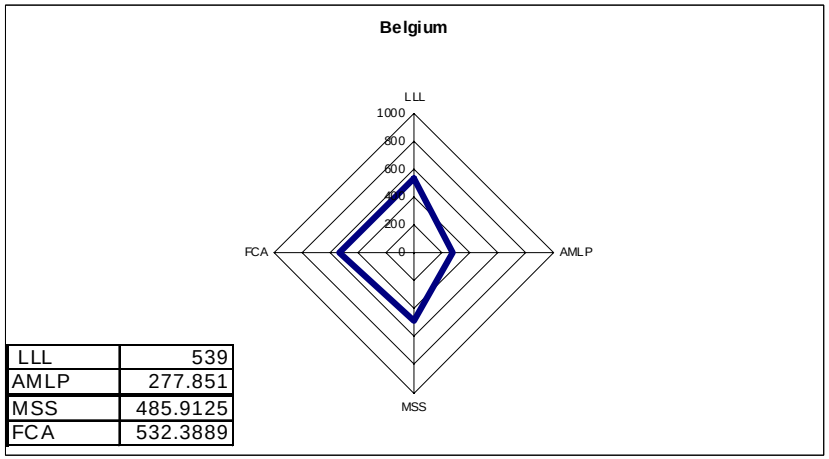
ANNEX 1: COUNTRY PROFILES

Country Profiles

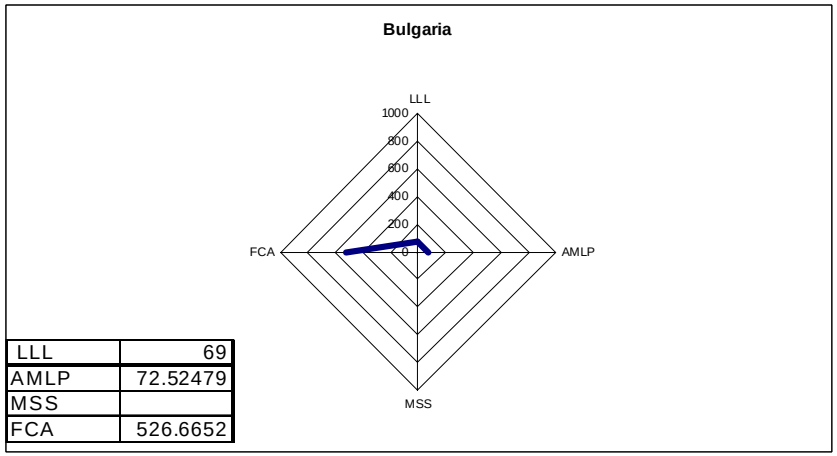
In this section we analyse the individual country profiles for the four indicators of flexicurity in 2005. A radar plot shows the performance of each Member State in all four dimensions for the reference year and it is supported by a table presenting the composite indicators score of each pillar. The scale for all charts is the same in order to facilitate countries comparisons. The direction of the scale means that a point further away from the origins of the axis means a better result.The composite indicators are listed using their short name. In addition the robustness of the country ranking in the composite index in each dimension of flexicurity is presented with the results of the uncertainty and sensitivity analysis.



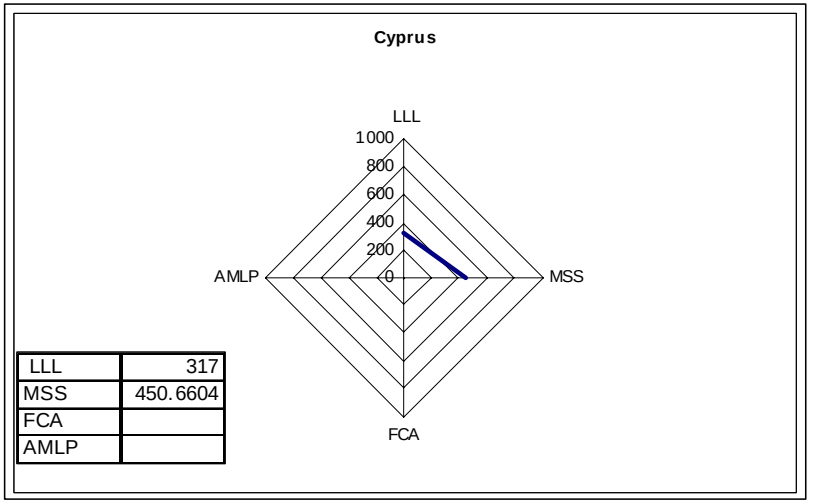
LLL	488
AMLP	236.4175
MSS	370.9254
FCA	492.4889



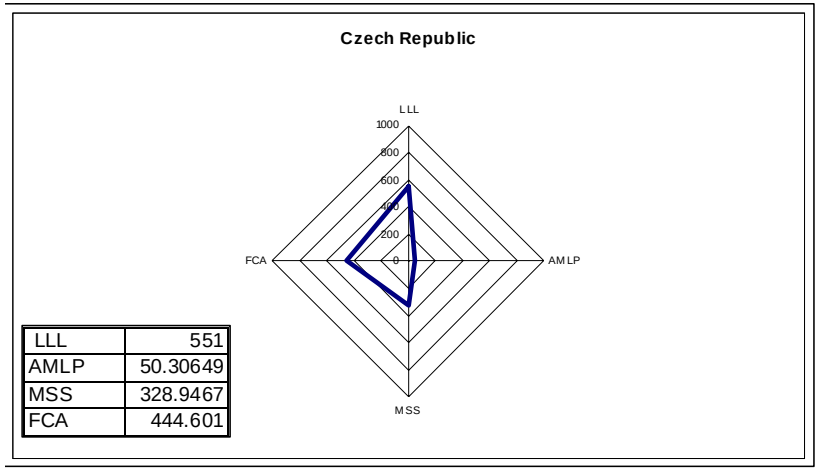
LLL	539
AMLP	277.851
MSS	485.9125
FCA	532.3889



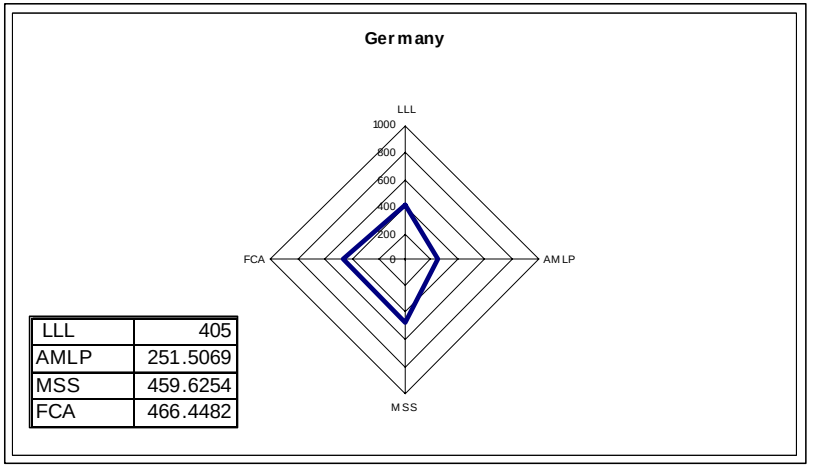
LLL	69
AMLP	72.52479
MSS	
FCA	526.6652



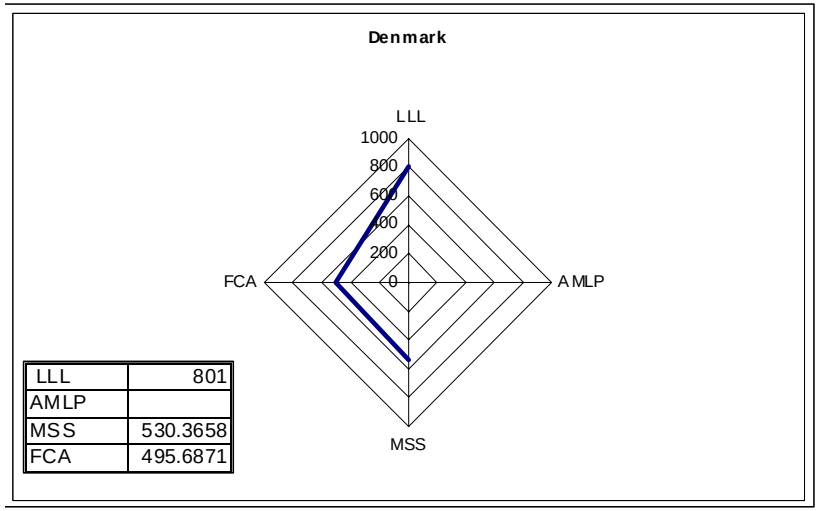
LLL	317
MSS	450.6604
FCA	
AMLP	



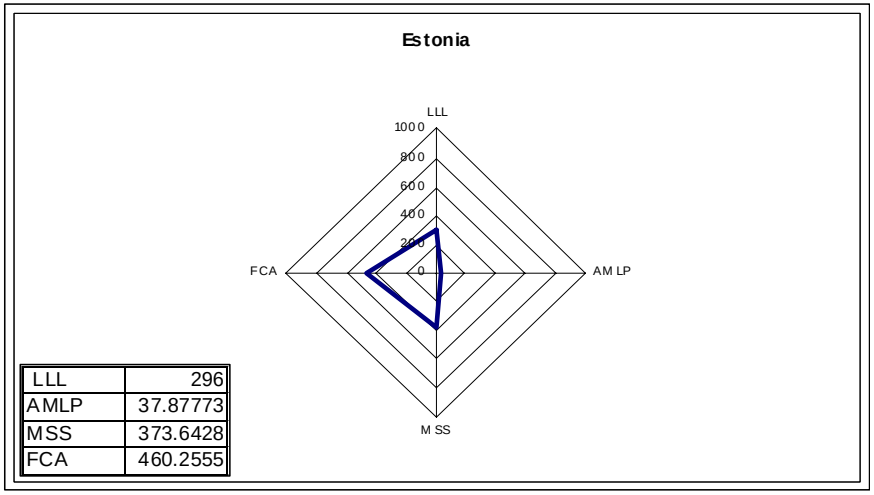
LLL	551
AMLP	50.30649
MSS	328.9467
FCA	444.601



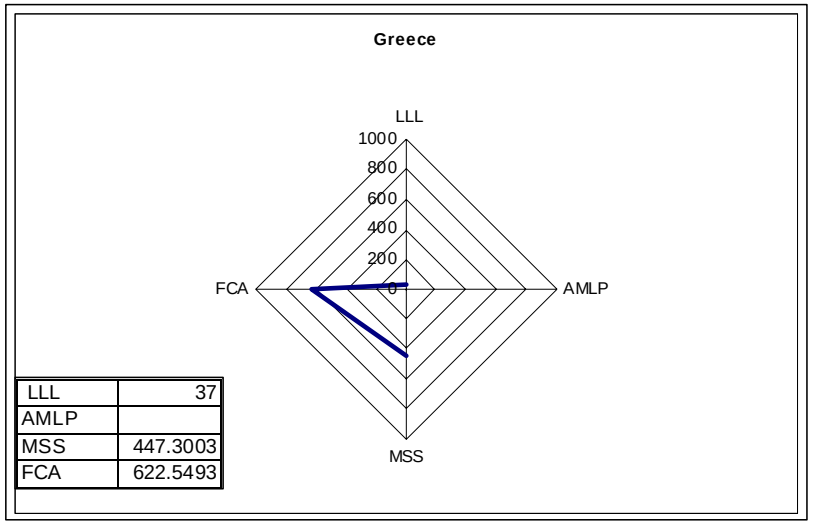
LLL	405
AMLP	251.5069
MSS	459.6254
FCA	466.4482



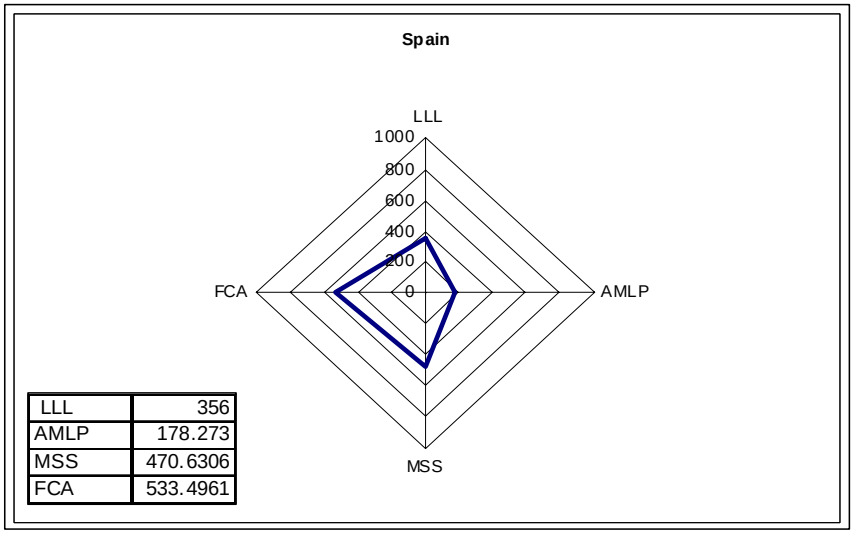
LLL	801
AMLP	
MSS	530.3658
FCA	495.6871



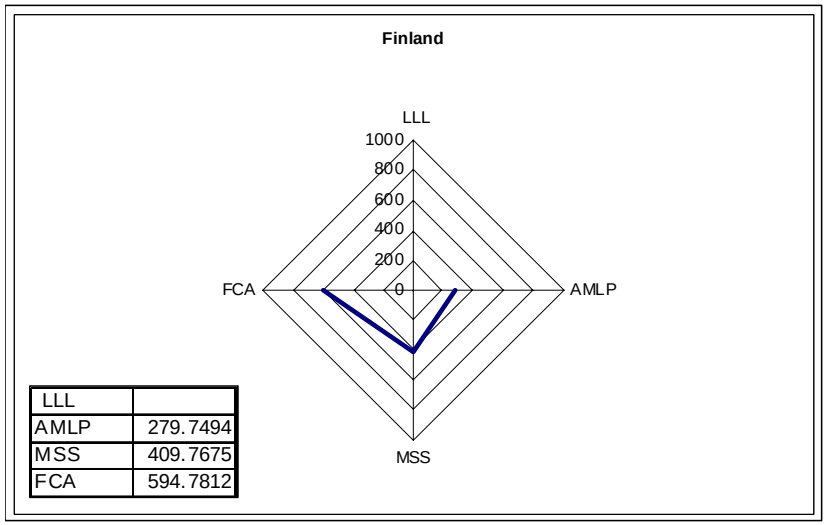
LLL	296
AMLP	37.87773
MSS	373.6428
FCA	460.2555



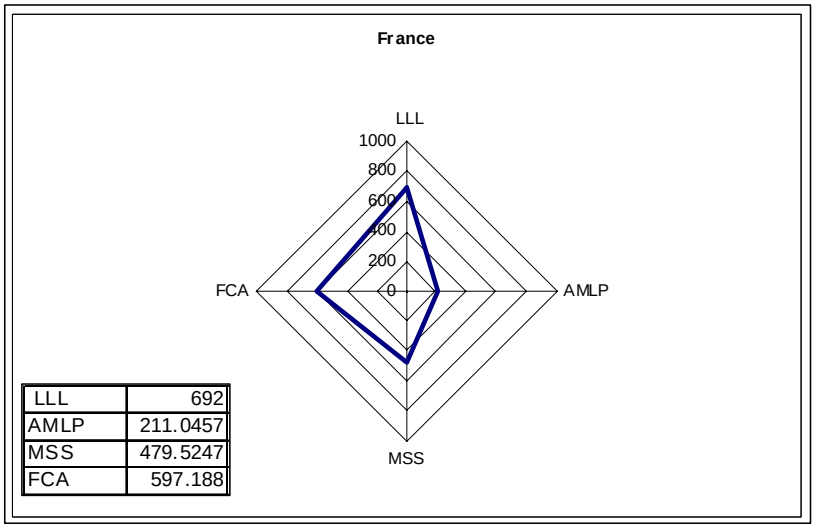
LLL	37
AMLP	
MSS	447.3003
FCA	622.5493



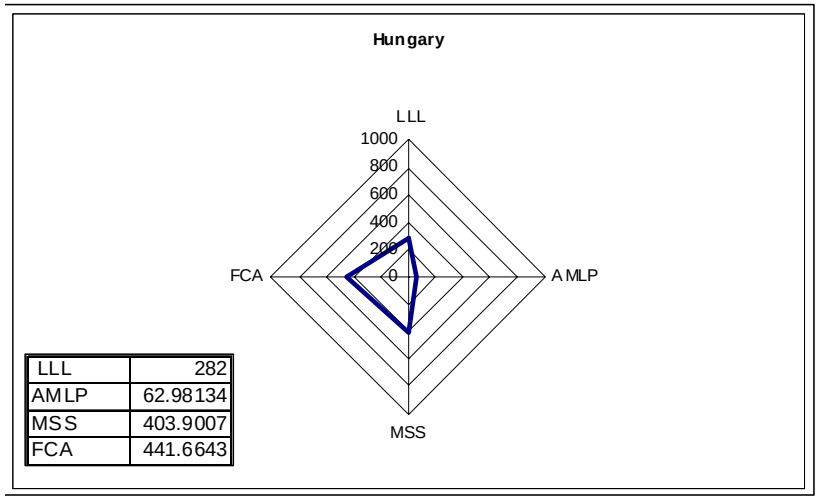
LLL	356
AMLP	178.273
MSS	470.6306
FCA	533.4961



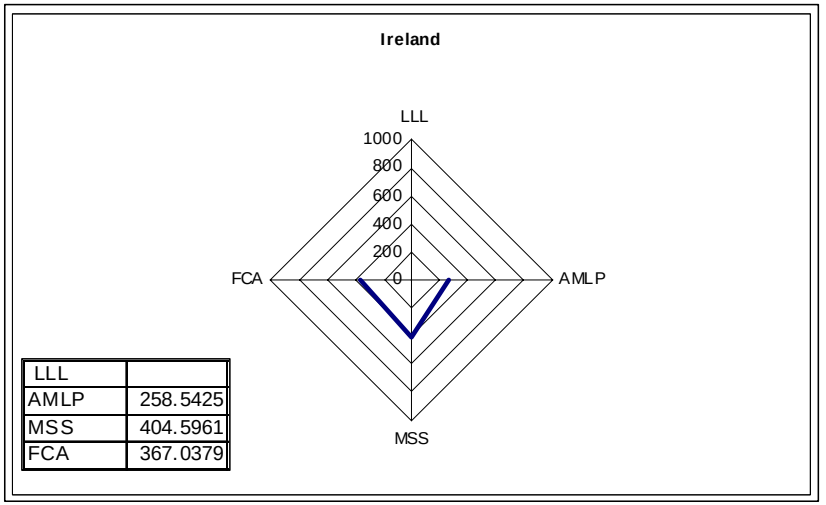
LLL	
AMLP	279.7494
MSS	409.7675
FCA	594.7812



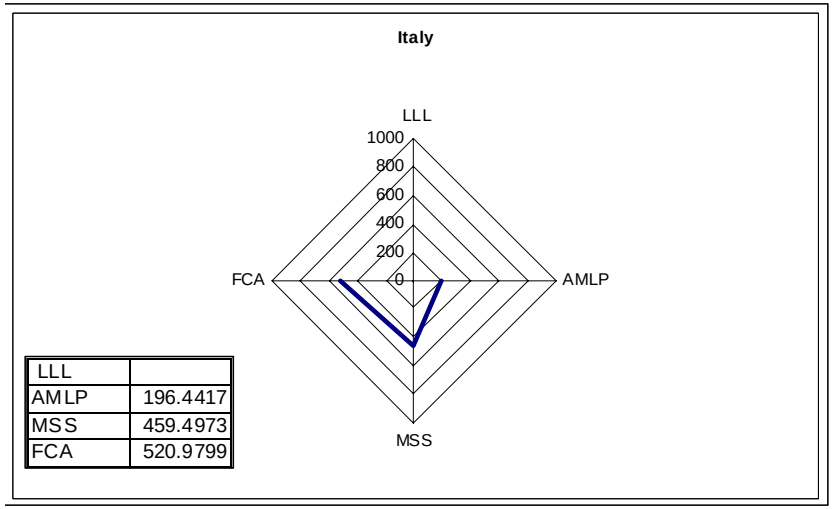
LLL	692
AMLP	211.0457
MSS	479.5247
FCA	597.188



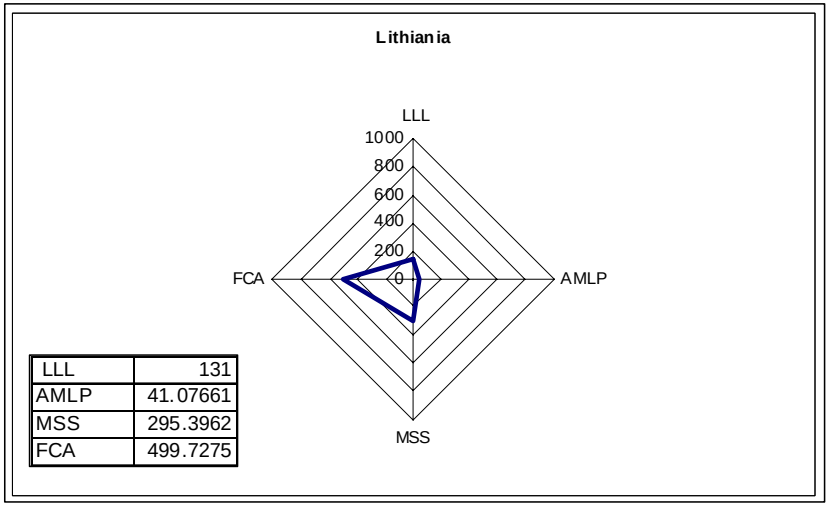
LLL	282
AMLP	62.98134
MSS	403.9007
FCA	441.6643



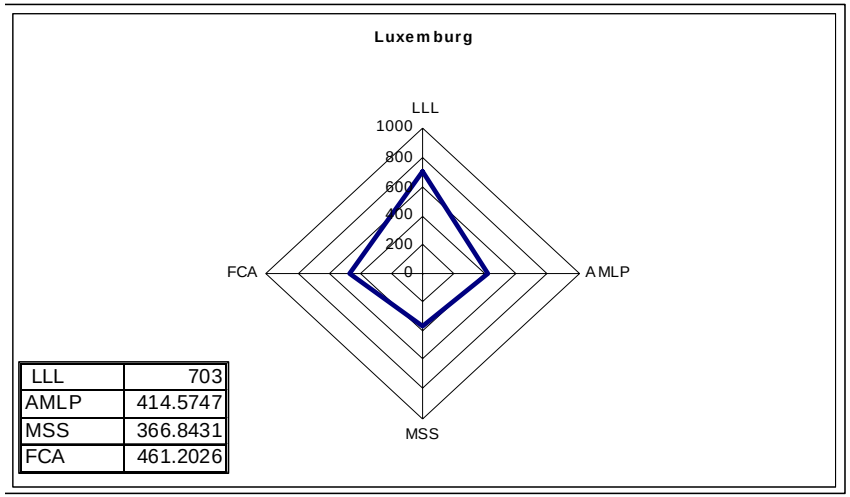
LLL	
AMLP	258.5425
MSS	404.5961
FCA	367.0379



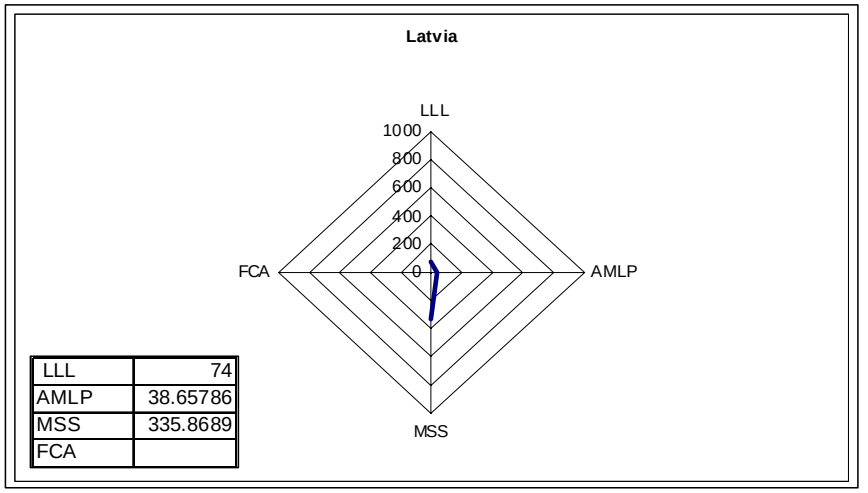
LLL	
AMLP	196.4417
MSS	459.4973
FCA	520.9799



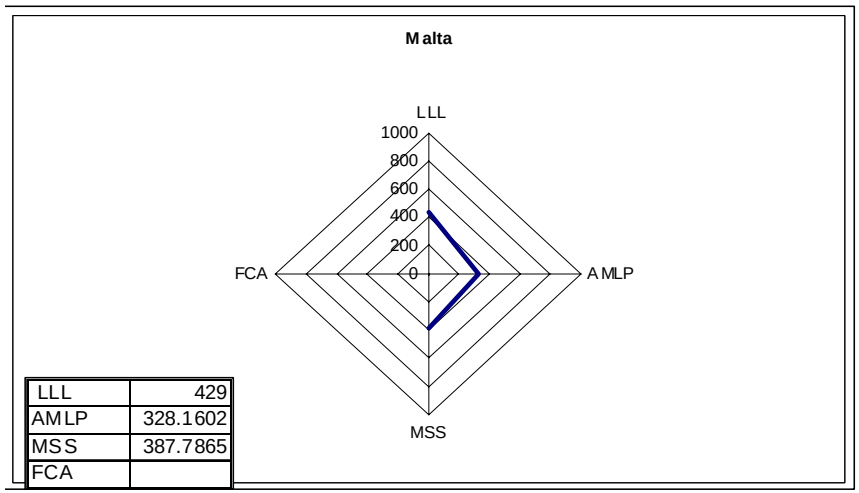
LLL	131
AMLP	41.07661
MSS	295.3962
FCA	499.7275



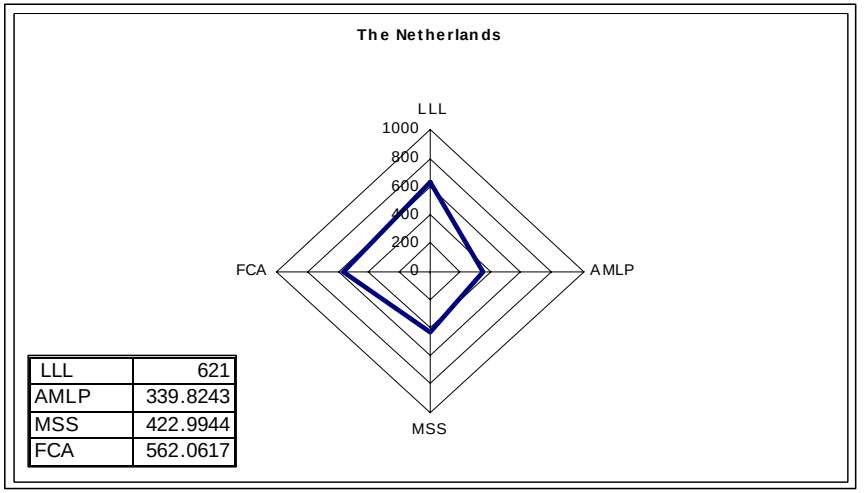
LLL	703
AMLP	414.5747
MSS	366.8431
FCA	461.2026



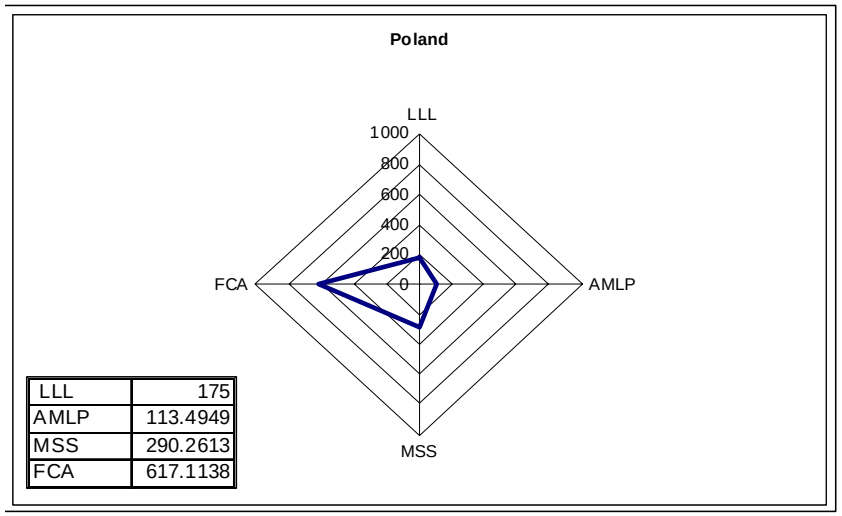
LLL	74
AMLP	38.65786
MSS	335.8689
FCA	



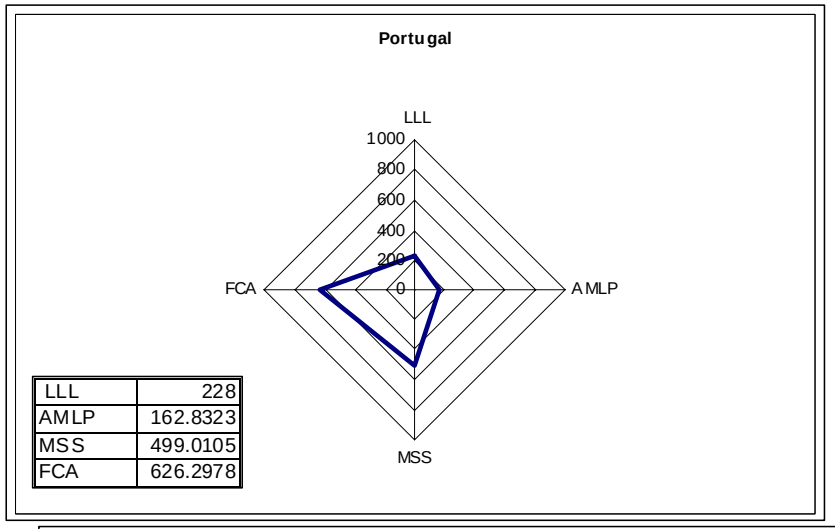
LLL	429
AMLP	328.1602
MSS	387.7865
FCA	



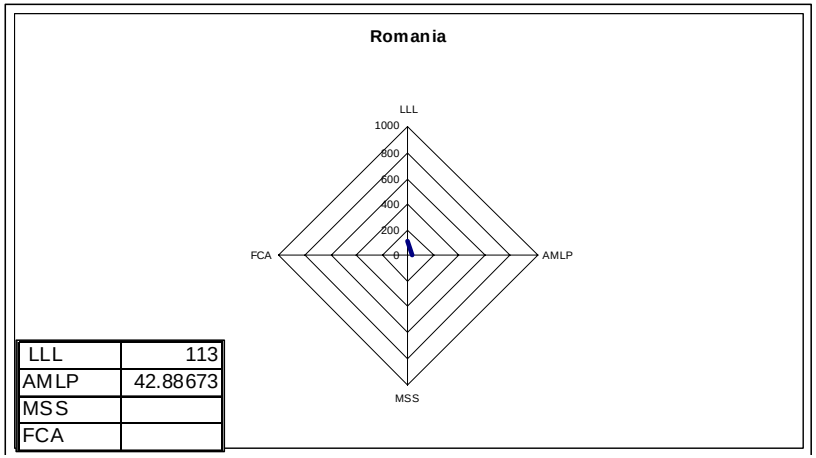
LLL	621
AMLP	339.8243
MSS	422.9944
FCA	562.0617



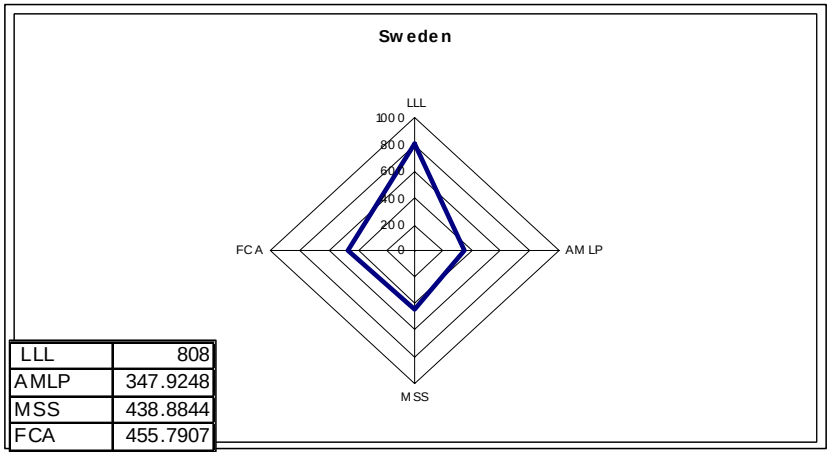
LLL	175
AMLP	113.4949
MSS	290.2613
FCA	617.1138



LLL	228
AMLP	162.8323
MSS	499.0105
FCA	626.2978

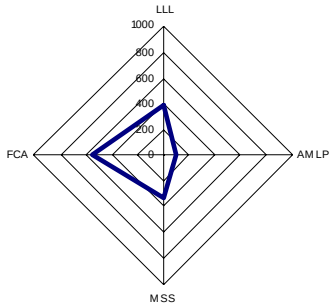


LLL	113
AMLP	42.88673
MSS	
FCA	



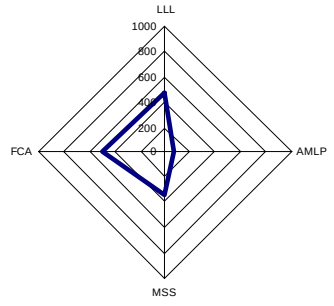
LLL	808
AMLP	347.9248
MSS	438.8844
FCA	455.7907

Slovenia



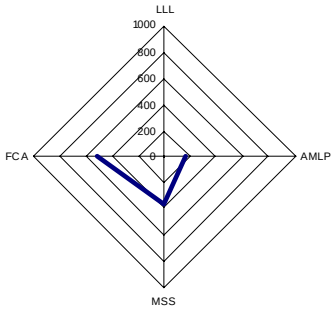
LLL	382
AMLP	104.0832
MSS	328.906
FCA	544.5488

Slovakia



LLL	472
AMLP	75.91561
MSS	344.759
FCA	495.2671

United Kingdom



LLL	
AMLP	159.4776
MSS	371.8678
FCA	516.4522

Austria

The performance of Austria across the four dimensions of flexicurity is overall quite good. In particular Austria records a very good score on the dimension of Flexible and Reliable Contractual Arrangement and on Lifelong Learning, while achieving modest results on Active labour market policies and Modern Social Security Systems.

Belgium

Belgium ranks very well across all dimensions of flexicurity, and especially on the MSS composite indicatorALMP.

Bulgaria

The situation of Bulgaria is not good overall, despite the very good performance on the dimension of FCA, as its scores on the dimension of LLL and ALMP are very low. Bulgaria has been excluded in the computation of MSS index because of missing data.

Cyprus

The performance of Cyprus is recorded only for the dimensions of LLL and MSS indexes where the country reaches, respectively, a modest and a very good score. The remaining pillars (i.e. ALMP and FCA) do not include Cyprus because of missing data.

Czech Republic

The performance of Czech Republic is very good in the dimension of LLL, whereas on FCA and MSS it is much worse. Finally the country reaches a very low score in the dimension of ALMP.

Germany

Germany presents a very good performance in the dimension of MSS. However, its score is lower in the remaining three dimensions with the worst performance registered in the pillar of FCA.

Denmark

Denmark is in top position in the dimensions of LLL and MSS, while registering a modest performance for the FCA pillar.

Estonia

The performance of Estonia is not very good as it reaches only modest scores in the dimensions of LLL, MSS and FCA, while ranking in the last position on the ALMP pillar.

Spain

The best performance of Spain is achieved in the dimension of MSS and FCA, while the country reaches modest results for the dimensions of LLL and ALMP.

Finland

Finland shows a very good performance in the dimension of FCA, and intermediate scores in the dimensions of ALMP and MSS. Finland has been excluded in the computation of LLL composite indicator because of missing data.

France

France records a very good performance in the dimensions of LLL, FCA and MSS, while for the score is more modest for ALMP.

Greece

The performance of Greece is very good in the dimension of FCA while it ranks last for the LLL index, and at an intermediate level for the MSS composite indicator. The dimension of ALMP has not been computed for Greece because of missing data.

Hungary

Hungary does not present a very good performance overall, whit an intermediate score in the dimension of MSS and more modest scores on LLL and FCA and a very low score on the ALMP dimension.

Ireland

The performance of Ireland is not so good as the country reaches its best position in the dimension of ALMP followed by MSS, while the worst score is recorded in the dimension of FCA. Ireland is not included in the computation of LLL index because of missing data.

Italy

The best performance achieved by Italy concerns the dimension of MSS, followed by FCA. A worse performance is recorded for ALMP. Italy has not been included in the computation of LLL composite indicator because of missing data.

Lithuania

Lithuania does not perform very well in most dimensions of flexicurity, with the best result being the intermediate score registered in the dimension of FCA. The worst performance iconcerns the dimension of ALMP.

Luxemburg

Luxemburg shows a quite good performance on flexicurity overall, albeit with significant differences across dimensions. The country ranks in first position in the dimension of ALMP and shows a very good performance also for LLL, while it reaches modest results in the indexes of MSS and FCA.

Latvia

The performance of Latvia is not good: its best performance is recorded in the dimension of MSS (still with a very modest score) whereas the results presented in the remaining dimensions, LLL and ALMP, are very bad. Latvia is not present in the computation of FCA composite indicator because of missing data.

Malta

Malta records an intermediate performance in the dimensions of LLL and MSS, while it is not present in the remaining two dimensions (FCA and ALMP) because of missing data.

The Netherlands

The best performance achieved by the Netherlands concerns the dimensions of LLL, ALMP and FCA. Overall, the performance of this country on flexicurity is very good despite an intermediate score in the dimension of MSS.

Poland

The overall performance of Poland on flexicurity is not very good, even if the country reaches the top position in the dimension of FCA. On the other hand, Poland records very modest scores in the dimensions of LLL and ALMP and finally it ranks in the last position in the pillar of MSS.

Portugal

Portugal scores in top position in the dimension of FCA, and has a high score on MSS. On the other hand, in the pillar of LLL and ALMP it records a relatively modest performance.

Romania

The overall performance of Romania is negative as it registers a very low score in the dimensions of LLL and ALMP. Regarding the remaining two pillars, Romania has been excluded from the computation of the indicators because of problems of missing data.

Sweden

The performance of Sweden is at the top in the dimension of LLL while being very good also in the dimension of ALMP. An intermediate score is reached on the pillar of MSS while a modest one is recorded for FCA.

Slovenia

Slovenia does not perform well overall even if it reaches intermediate scores in the dimensions of FCA and LLL. On the other hand, results for ALMP and MSS are quite low.

Slovakia

Slovakia achieves its best performance for the dimensions of LLL and FCA but the overall performance on flexicurity is not good. Scores are quite low in the dimensions of ALMP and MSS.

United Kingdom

The performance of United Kingdom is quite good overall, with its highest score being registered in the dimension of FCA followed by MSS and ALMP. The country has been excluded in the computation of the LLL composite indicator because of problems of missing data.

ANNEX 2: UNCERTAINTY AND SENSITIVITY ANALYSIS

Composite indicators may send misleading, non-robust policy messages if they are poorly constructed or misinterpreted. In fact, the construction of composite indicators involves stages where judgment has to be made: the selection of sub-indicators, the choice of a conceptual model, the weighting of indicators, the treatment of missing values etc. All these sources of subjective judgment will affect the message brought by the CI's in a way that deserve analysis and corroboration. A combination of uncertainty and sensitivity analysis can help to gauge the robustness of the composite indicator, to increase its transparency and to help framing a debate around it.

General procedures to assess uncertainty in the MSS composite indicators building are in this section applied and analyzed. In particular, five main sources of uncertainty can be highlighted and their combined effect on country rankings needs to be tested:

1) Data Normalization
2) Weighting Scheme
3) Composite Indicator Formula (Aggregation Rule)
4) Inclusion/Exclusion of Basic Indicators
5) Imputation of Missing Data via MCMC.

Two combined tools are suggested to assess the uncertainty in the MSS Composite Indicator: Uncertainty Analysis (UA) and Sensitivity Analysis (SA). UA focuses on how uncertainty in the input factors propagates through the structure of the composite indicator and affects the composite indicator values. SA studies how much each individual source of uncertainty contributes to the output variance.

In the field of building composite indicators, UA is more often adopted than SA (Jamison and Sandbu, 2001; Freudenberg, 2003) and the two types of analysis are almost always treated separately. A synergistic use of UA and SA is proposed and presented here, considerably extending earlier attempts in this direction (Tarantola et al., 2000).

With reference to the uncertainty sources (1 to 5 above), the approach taken to propagate uncertainties could include in theory all of the steps below:

1) Inclusion-Exclusion of basic indicators
2) Using alternative data normalization schemes, such as rescaling, standardization, use of raw data.
3) Using several weighting schemes, i.e. Equal Weights, predetermined set of weights, Principal Components weights, Data envelopment analysis weights.
4) Using several aggregation systems, i.e. linear, another based on geometric mean of un-scaled variable.
5) Testing different set of missing data randomly simulated

General Framework of the Analysis

As described above, we shall frame the analysis as a single Monte Carlo experiment, e.g. by plugging all uncertainty sources simultaneously, as to capture all possible synergistic effects among uncertain input factors. This will involve the use of triggers, e.g. the use of uncertain input factors used to decide e.g. which aggregation system and weighting scheme to adopt. To stay with the example, a discrete uncertain factor which can take integer values between 1 and 3 will be used to decide upon the aggregation system and another also varying in the same range for the weighting scheme. Other trigger factors will be generated to select which indicators to omit, the aggregation rule, the normalization scheme and so on. Below, the sources of uncertainty affecting the MSS composite indicator are analyzed.

Inclusion – exclusion of individual sub- indicators

No more than one indicator at a time is excluded for simplicity. A single random variable is used to decide if any indicator will be omitted and which one. Note that an indicator can also be practically neglected as a result of the weight assignment procedure. Although this is not the case of the MSS composite indicator, for instance imagine a very low weight is assigned by an expert to a sub-indicator q . Every time we select that expert in a run of the Monte Carlo simulation, the relative sub-indicator q will be almost neglected for that run.

Normalization

As described in (Nardo et al. 2005) several methods are available to normalise sub-indicators. The methods that are most frequently met in the literature are based on the re-scaled values or on the standardized values or on the raw indicator values. In the robustness assessment of the MSS composite indicator the Z-score standardization, the Min-Max standardization and the Ranking-based standardization are applied. These three methods are shortly described below.

The Min-Max Standardization

The basic standardization technique that has been applied is the Min-Max approach. Each indicator, q, was standardized based on the following rule:

$$I^{t}_{qc} = \frac{x^{t}_{qc} - \min_c(x_q^{2005-2007})}{\max_c(x_q^{2005-2007}) - \min_c(x_q^{2005-2007})} \cdot 1000 \quad .$$

Using this method, all indicators have been rescaled in such a way as to lie between 0 (laggard $x_{qc}=\min_c(x^{2005\text{-}2007}_q)$) and 1000 (leader, $x_{qc}=\max_c(x^{2005\text{-}2007}_q)$).

Where $\max_c(x^{2005\text{-}2007}{}_q)$ and $\min_c(x^{2005\text{-}2007}{}_q)$ are respectively the maximum and the minimum value of the indicator over all countries and years considered.

Standardisation (or Z-scores)

For each sub-indicator $x_{qc}^{2005-2007}$, the average across countries $\bar{x}_{qc}^{2005-2007}$ and the standard deviation across countries $\sigma_{x_{qc}}^{2005-2007}$ are calculated. The normalization formula is:

$$I_{qc}^{2005-2007} = \frac{x_{qc}^{2005-2007} - \bar{x}_{qc}^{2005-2007}}{\sigma_{x_{qc}}^{2005-2007}},$$

So that all the y_{mn} have similar dispersion across countries. This approach converts all indicators to a common scale with an average of zero and standard deviation of one, yet the actual minima and maxima of the standardized values across countries vary among the sub-indicators.

Ranking of indicators across countries

The simplest normalization method consists in ranking each indicator across countries. The main advantages of this approach are its simplicity and the independence to outliers. Disadvantages are the loss of information on absolute levels and the impossibility to draw any conclusion about difference in performance.

$$I_{qc}^{2005-2007} = Rank(x_{qc}^{2005-2007})$$

Weighting Scheme

Central to the construction of a composite index is the need to combine in a meaningful way different dimensions measured on different scales. This implies a decision on which weighting model will be used and which procedure will be applied to aggregate the information.

Addressing the reader to (Nardo et al. 2005) for an exhaustive list of weighting schemes, in the robustness analysis of MSS composite indicator, three different weighting schemes are adopted and described below.

Equal Weights

In many composite indicators all variables are given the same weight when there are no statistical or empirical grounds for choosing a different scheme. Equal weighting (EW) could imply the recognition of an equal status for all sub-indicators (e.g. when policy assessments are involved).

Alternatively, it could be the result of insufficient knowledge of causal relationships, or ignorance about the correct model to apply (like in the case of Environmental Sustainability Index – World economic forum, 2002), or even

stem from the lack of consensus on alternative solutions (as happened with the Summary Innovation Index - European Commission, 2001a). In any case, EW does not mean any weighting, because EW anyway implies an implicit judgment on the weights being equal. The effect of EW also depends on how component indicators are divided into categories or groups: weighting equally categories regrouping a different number of sub-indicator could disguise different weights applied to each single sub-indicator.

Factor Analysis Weights

Principal component analysis (PCA) and more specifically factor analysis (FA) group together sub-indicators that are collinear to form a composite indicator capable of capturing as much of common information of those sub-indicators as possible. The information must be comparable for this approach to be used: sub-indicators must have the same unit of measurement. Each factor (usually estimated using principal components analysis) reveals the set of indicators having the highest association with it. The idea under PCA/FA is to account for the highest possible variation in the indicators set using the smallest possible number of factors. Therefore, the composite no longer depends upon the dimensionality of the dataset but it is rather based on the "statistical" dimensions of the data. According to PCA/FA, weighting only intervenes to correct for the overlapping information of two or more correlated indicators, and it is not a measure of importance of the associated indicator. If no correlation between indicators is found, then weights can not be obtained estimated with this method. For methodological details we address the reader to (Nardo et al. 2005).

Data Envelopment Analysis, (DEA), Weights

Data envelopment analysis (DEA) employs linear programming tools (popular in Operative Research) to retrieve an efficiency frontier and uses this as benchmark to measure the performance of a given set of countries.17 The set of weighs stems from this comparison. Two main issues are involved in this methodology: the construction of a benchmark (the frontier) and the measurement of the distance between countries in a multi-dimensional framework.

The construction of the benchmark is done by some simple assumptions as: positive weights (the higher the value of one sub-indicator, the better for the corresponding country); non discrimination of countries that are best in any single dimension (i.e. sub indicator) thus ranking them equally; a linear combination of the best performers is feasible (convexity of the frontier). The distance of each country with respect to the benchmark is determined by the location of the country and its position relative to the frontier. The countries supporting the frontier are classified as the best performing, other countries are then ordered according to the distance with respect to the benchmark. For methodological details we address the reader to (Nardo et al. 2005).

The benchmark could also be determined by a hypothetical decision maker (Korhonen et al. 2001, for an indicator of performance of academic research) who is asked to locate the target in the efficiency frontier having the most preferred combination of sub-indicators. In this case the DEA approach could merge with the budget allocation method (see below) since experts are asked to assign weights (i.e. priorities) to sub-indicators.

Aggregation Rules

The literature of composite indicators offers several examples of aggregation techniques. The most used are additive techniques that range from summing up country ranking in each sub indicator to aggregating weighted transformations of the original sub-indicators. However, additive aggregations imply requirements and properties, both of component sub-indicators and of the associated weights, which are often not desirable, at times difficult to meet or burdensome to verify. To overcome these difficulties the literature proposes other and less widespread, aggregation methods like multiplicative (or geometric) aggregations or non linear aggregations like the multi-criteria or the cluster analysis. For the MSS composite indicator we focus our attention on additive methods and geometric aggregation.

Additive methods

The simplest additive aggregation method entails the calculation of the ranking of each country according to each sub-indicator and the summation of resulting ranking (e.g. Information and Communication Technologies Index - Fagerberg J. 2001). By far the most widespread linear aggregation is the summation of weighted and normalized sub-indicators:

$$Y_c^t = \sum_{i=1}^{3} w_i \sum_{j=1}^{k_i} w_j^* I_{ijc}^t$$

Where t is the year of reference, w are the weights of the 3 dimensions, w^* are the weights of basic indicators within each dimension, I the basic indicators and c the country index.

Geometric aggregation

An undesirable feature of additive aggregations is the full compensability they imply: poor performance in some indicators can be compensated by sufficiently high values of other indicators. For example if a hypothetical composite were formed by inequality, environmental degradation, GDP per capita and unemployment, two countries, one with values 21, 1, 1, 1; and the other with 6,6,6,6 would have equal composite if the aggregation is additive. Obviously the two countries would represent very different social conditions that would not be reflected in the composite.

If multicriteria analysis entails full non-compensability, the use of a geometric aggregation (also called deprivational index) is an in-between solution.

$$Y_c^t = \prod_{i=1}^{3} \prod_{j=1}^{k} I_{ijc}^{t\ w_i w_j^*}$$

Where *t* is the year of reference, *w* are the weights of the 3 dimensions, w^* are the weights of basic indicators within each dimension, *I* the basic indicators and *c* the country index.

Uncertainty Analysis

All points showed above chain of composite indicator building can introduce uncertainty in the output variables Rank(I^t_c). Thus we shall translate all these uncertainties into a set of scalar input factors, to be sampled from their distributions. As a result, all outputs Rank(I^t_c) are non-linear functions of the uncertain input factors, and the estimation of the probability distribution functions (pdf) of Rank(I^t_c) is the purpose of the uncertainty analysis. The UA procedure is essentially based on simulations that are carried on the various equations that constitute our model. As the model is in fact a computer programme that implements different scenarios, the uncertainty analysis acts on a computational model. Various methods are available for evaluating output uncertainty.

In the following, the Monte Carlo approach is applied, which is based on performing multiple evaluations of the model with k randomly selected model input factors. The procedure involves different steps and we address the reader to (Nardo et al, 2005, Saltelli et al. 2000a, Saltelli et al. 2000b, Saltelli, A. 2002, Saltelli et al. 2008).

The selected random factors for which the uncertainty is assessed to the MSS composite indicator are four and are listed below in table 16:

Table 25 - Uncertainty factors for the MSS composite indicator

X_1	Standardization
1	Z-Score
2	Min-Max
3	Ranking across countries

X_2	Weighting Scheme
1	Equal Weight
2	Predetermined set of Weights
3	PCA weights
4	DEA weights

X_3	Aggregation Rule
1	Linear
2	Geometric
3	No further Aggregation (for DEA)

X_4	Excluded Sub-Indicator
1	Indicator 1 omitted
2	Indicator 2 omitted
3	Indicator 3 omitted
...	...
19	Indicator 19 omitted
20	Indicator 20 omitted

X_5	Imputation of Missing Data via MCMC
1	Sample 1 of the set of missing data randomly simulated.
2	Sample 2 of the set of missing data randomly simulated.
3	Sample 3 of the set of missing data randomly simulated.
…	...
100	Sample 100 of the set of missing data randomly simulated..

Where, trigger X_1 is used to select the standardization methods (Z-score, Min-Max, Ranking of Indicators across countries), trigger X_2 is used to select the weighting scheme (Equal weights, Predetermined set of weights, PCA weights, DEA weights).Then trigger X_3 is used to select the aggregation rule (linear/additive, geometric, no further aggregation (just in case of DEA). Trigger X_4 is generated to select which sub-indicator – if any, should be omitted. Finally, trigger X_5 is used to sample 100 set of missing data randomly simulated. Each input factor can be characterized by a probability density function; here we assume uniform distribution for the entire five input factors in order to do not penalize/reward any possible trigger modality.

After having generated the input factors distributions in step 1, we can now generate randomly N combinations of independent input factors X^i, i= l, 2 ,…,N where X^i is a set of outcomes of input factors, called a sample. For each trial sample $X^{l\backslash i}$ the computational model can be evaluated, generating values for the scalar output variable Y_l, where Y_l is the Rank(I^t_c) , the value of the rank assigned by the composite indicator to each country.

On figures 7-10 the frequency distribution in all four composite indicators for all countries rank is presented. On table 17 an example of frequency distribution of a country rank is presented. A color code is used to distinguish different frequencies as illustrated in table 16:

Table 26 - Colour Codes

	Frequency lower than 10%
	Frequency between 10% and 20%
	Frequency between 20% and 35%
	Frequency between 35% and 50%
	Frequency higher than 50%
bold	Position in the ALMP composite indicator
Italic	median
Red	mode of the distribution

Moreover, **Bold**, *Italic* and Red represent the country rank in the ALMP composite indicator, the median and the mode of the 23800 simulations, respectively. For example Austria in 2004 has a distribution encoded as follows in table 17:

Table 27 – Frequencies of Austria performance in the 23800 scenarios in 2004.

Rank	4	5	6	7	8	9	10
AUSTRIA	1.36%	3.97%	14.74%	25.14%	***17.96%***	8.59%	28.24%

This means that the country is ranked in positions 4th to 10th among the 23800 simulations performed. In particular, Austria is ranked in position 4th, 5th and 9th with a frequency lower than 10%, in position 6th and 8th with a frequency between 15% and 30% and in position 7th and 10th with a frequency between 25% and 35%. Position 10th is the mode, whereas the median falls in position 8th which is also the position of the country in the composite indicator.

The results of the uncertainty analysis for each composite indicator are presented below

Uncertainty analysis for Lifelong Learning Composite Indicator

A first consideration is that the overall ranking is quite stable; in fact considering the whole 126 simulations all countries clustered unambiguously. No doubt that the top performing countries are Sweden, Denmark, Luxembourg, France and the Netherlands.

Then, Czech Republic, Belgium, Austria, United Kingdom, Malta, Germany, Slovakia and Spain follow the leaders and they show the highest variability. All the rest of the countries can be considered with a bad performance with respect to the Life Long Learning. However, these countries show a very stable ranking in all the 126 scenarios.

		SWE	DNK	LUX	FRA	NLD	CZE	BEL	AUT	GBR	MLT	DEU	SVK	ESP	CYP	EST	HUN	PRT	POL	LTU	ROM	LVA	BGR	GRC
Rank	1	102	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rank	2	24	83	18	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rank	3	0	15	62	40	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rank	4	0	4	41	69	9	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rank	5	0	0	5	15	93	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rank	6	0	0	0	1	14	35	59	8	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rank	7	0	0	0	0	0	37	47	29	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rank	8	0	0	0	0	0	27	15	56	24	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Rank	9	0	0	0	0	0	13	5	32	57	11	5	1	2	0	0	0	0	0	0	0	0	0	0
Rank	10	0	0	0	0	0	0	0	1	17	48	45	2	14	0	0	0	0	0	0	0	0	0	0
Rank	11	0	0	0	0	0	0	0	0	3	19	42	35	27	0	0	0	0	0	0	0	0	0	0
Rank	12	0	0	0	0	0	0	0	0	1	28	28	42	26	0	0	0	0	0	0	0	0	0	0
Rank	13	0	0	0	0	0	0	0	0	0	17	6	41	57	5	0	0	0	0	0	0	0	0	0
Rank	14	0	0	0	0	0	0	0	0	0	0	0	5	0	120	0	1	0	0	0	0	0	0	0
Rank	15	0	0	0	0	0	0	0	0	0	0	0	0	0	1	105	18	2	0	0	0	0	0	0
Rank	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	65	40	0	0	0	0	0	0
Rank	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	84	2	0	0	0	0	0
Rank	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	124	0	0	0	0	0
Rank	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	121	5	0	0	0
Rank	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	110	11	0	0
Rank	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	73	33	9
Rank	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	53	36
Rank	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	40	81
Total		126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126

Figure 15 - Results of the Uncertainty Analysis, ranking distribution per country

The overall variation in the position is shown is synthesized in Figure 6. The width of the 5%-95% percentile bounds across the 126 simulation represent the different rankings achieved by each country. Black marks correspond to the median LLL composite indicator rank and whiskers show best and worst rank occupied by a country considering the 126 simulations. The confidence bound proved the stability and robustness of the ranking. In fact over the 126 simulations 20 are the countries which shift less than 3 positions (approx. the 10% of the total number of countries) and just three countries show higher variability. These countries are Czech Republic, United Kingdom and Germany. This fact confirms that the ranking is very stable. The strong stability of the ranking can be due to the high correlation between indicators as assessed in section 2.

In the relevant literature, the median rank is proposed as a summary measure of a rank distribution. The median rank of all combinations of assumptions indicates that for 20 out of 23 countries the LLL rank corresponds with the most likely (median) rank. Thus, for the remaining countries the difference between the LLL rank and the most likely (median) rank is less than 2 positions. So that, for all the countries studied, the very modest sensitivity of the LLL ranking to the four input factors (standardization, weighting scheme, aggregation rule and inclusion/exclusion of a single indicator) implies

a considerably high degree of robustness of the index for all the countries. The comparison of the median of the distribution of the 126 simulations with the overall ranking of the LLL shows that Czech republic, Malta and Spain show a different median values. The comparison is shown in table 12.

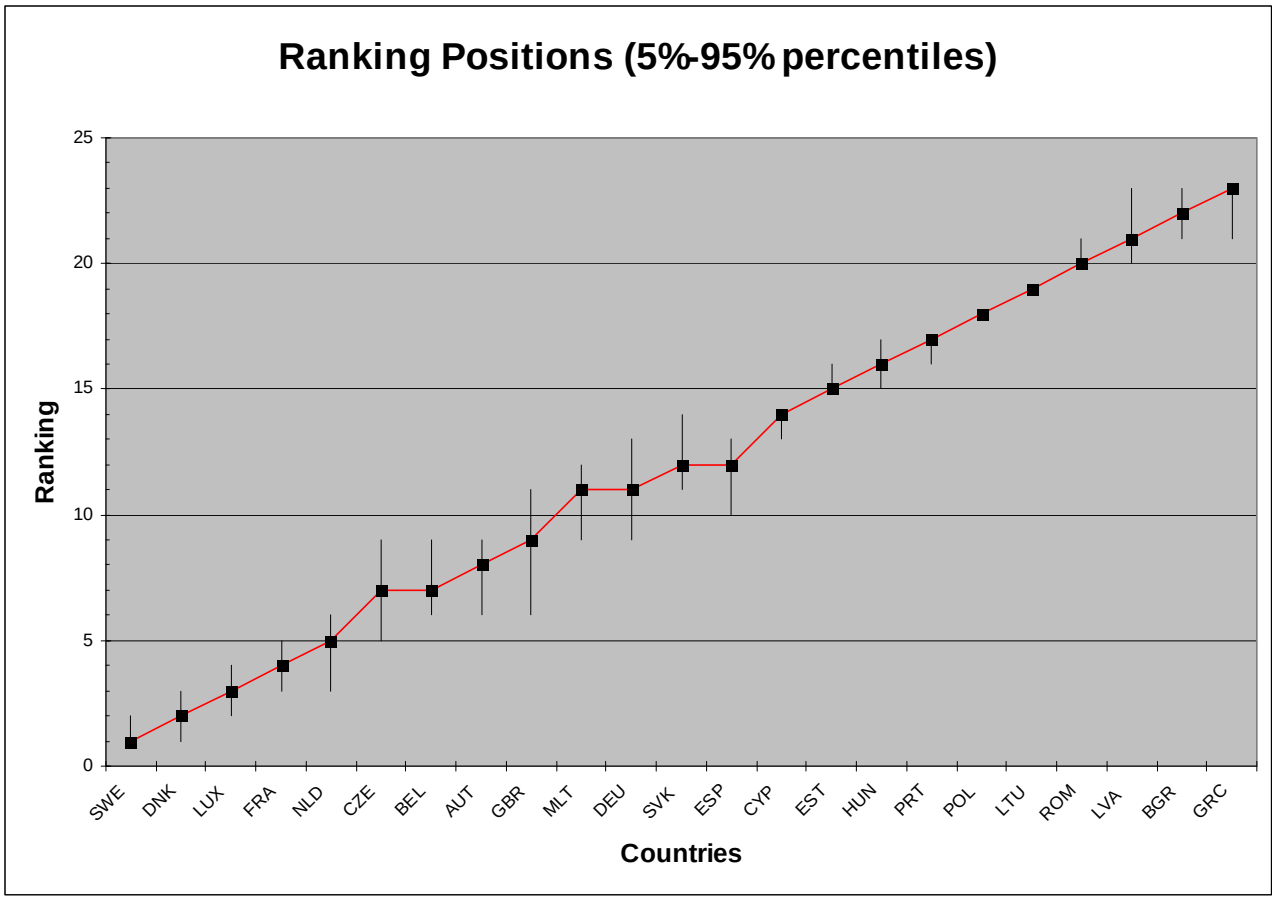


Figure 16 - Results of the Uncertainty Analysis - Ranking Positions (5%-95%) percentiles

Table 17 - Comparison of median values and LLL composite indicator ranking

	SWE	DNK	LUX	FRA	NLD	CZE	BEL	AUT	GBR	MLT	DEU	SVK	ESP	CYP	EST	HUN	PRT	POL	LTU	ROM	LVA	BGR	GRC
median	1	2	3	4	5	7	7	8	9	11	11	12	12	14	15	16	17	18	19	20	21	22	23
rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

Uncertainty analysis for Active labour market policies Composite Indicator

Due to the huge number of simulation performed, just frequencies higher than 5% are shown. Most countries show a moderate degree of variability in their ranking, mainly as a result of imputation of missing data. The extent of such variability varies to some extent across countries.

Results for 2005 highlight some increase in the variability in countries' ranking although the overall situation still does not contradict the composite indicator presented above. Despite the increase in variability, all countries record a rank which varies across a maximum of +/- 2 positions compared with that identified in the composite indicator. This trend is confirmed in more than 70% of the 23800 different scenarios considered. Moreover, results are even more robust in some countries, such as Portugal, Poland, or Slovakia. In those cases the rank varies within 3 positions in more than 85% of the different scenarios. The situation is even better for France and Estonia which show a very robust situation with a ranking varying across just two positions in more than 85% of the cases. On the other hand, some bi-modal patterns appear for Sweden and Norway, implying that some assumptions in the possible sources of uncertainty can affect the country ranking in some cases.

The results of the uncertainty analysis for 2006, despite presenting a slight increase in the variability of country ranking, confirm the country positions of the composite indicator shown in table 10. The frequency matrix for 2006 is presented in Figure 5. As for previous years Luxemburg, Sweden and the Netherlands, respectively the first, the second and the third of the "league", rank in the first three positions in almost 80% of the cases. Less robust is the rank of Belgium which spreads from the 4^{th} to the 9^{th} position in 73% of possible scenarios. Germany presents a similar situation to Belgium: these results are likely to be due to the imputation of missing data. On the other hand the situation is better for countries such as France, Italy and Poland, the ranking of which changes within 3 positions in more than 90% of different scenarios. The situation is even better for Slovenia, Romania and Estonia which show a very robust situation with a ranking varying between only two positions in more than 90% of the cases.

Finally the uncertainty analysis results for 2007 also confirm the country position identified in the composite indicator. Among the four years considered, on the whole, 2007 is characterized by more missing data and for this reason the rank is less robust than for previous years. Despite this fact, most countries record a ranking which varies for a maximum of +/- 2 positions compared with that identified in the composite indicator. This trend is observed in more than 50% of the 23800 different scenarios considered. In particular Luxemburg, the leader of the "league", varies between the first two positions in 50% of cases and ranks in the first position in 43% of the 23800 different scenarios performed. The situation is better for some countries such as Italy, Spain, Poland, Hungary and Lithuania, because in those cases the rank varies within 2 positions in more than 70% of the different scenarios. The situation is even better for Romania and Estonia which present a very robust situation where the ranking of the country varies between two positions in more than 90% of the cases. On the other hand, the case of the Netherlands presents a less robust situation with a bi-modal pattern due to some assumptions in the sources of uncertainty.

Figure 18 – ALMP Results of the Uncertainty Analysis, ranking distribution per country for 2004

2004		LU	SE	NO	NL	DE	BE	FI	AT	IE	FR	IT	ES	UK	RO	PT	BG	HU	CZ	SK	LT	EE	LV
Rank	1	40.01%	27.63%	15.35%		10.35%																	
Rank	2	16.83%	28.17%	11.24%	17.63%	19.69%	5.87%																
Rank	3	10.94%	23.55%	15.03%	18.14%	13.94%	14.08%																
Rank	4	10.12%	6.95%	16.66%	14.17%	12.85%	28.92%																
Rank	5	6.82%		12.71%	12.24%	29.81%	17.85%	7.26%															
Rank	6			21.03%	12.05%	10.05%	18.34%	8.85%	14.74%														
Rank	7						7.64%	16.98%	25.14%	20.67%	12.26%												
Rank	8							23.29%	17.96%	23.67%	19.77%												
Rank	9							24.67%	8.59%	32.75%	20.86%												
Rank	10							11.63%	28.24%	17.35%	31.05%												
Rank	11											23.09%	49.26%	26.67%									
Rank	12											48.43%	25.95%	17.17%									
Rank	13											23.45%	21.55%	34.63%	7.78%	12.58%							
Rank	14													16.95%	26.95%	48.69%							
Rank	15														53.68%	30.22%			6.18%				
Rank	16																23.09%	56.03%	15.99%				
Rank	17																17.30%	37.59%	38.84%				
Rank	18																56.86%		38.76%				
Rank	19																			53.60%	35.43%	8.43%	
Rank	20																			21.66%	35.53%	24.91%	17.24%
Rank	21																			14.83%	27.31%	23.82%	34.04%
Rank	22																			7.86%		42.30%	48.38%

Figure 19 – ALMP Results of the Uncertainty Analysis, ranking distribution per country for 2005

2005		LU	SE	NO	NL	FI	BE	IE	DE	AT	FR	IT	ES	PT	UK	PL	SI	SK	BG	HU	CZ	RO	LT	LV	EE
Rank	1	34.88%	20.18%	5.63%	21.89%																				
Rank	2	18.39%	25.24%	7.78%	36.26%																				
Rank	3	18.48%	29.39%	13.37%	16.24%	8.54%	4.03%		9.42%																
Rank	4	7.42%	9.22%	31.79%	13.23%	14.45%	14.12%		6.38%																
Rank	5	5.38%		15.31%	5.71%	29.02%	19.22%		13.07%																
Rank	6			9.76%		13.68%	18.82%	10.28%	28.29%	11.07%															
Rank	7			11.91%		15.97%	14.42%	17.71%	19.92%	13.27%															
Rank	8					5.07%	7.02%	27.45%	12.86%	35.58%															
Rank	9						5.31%	31.55%	8.41%	31.71%	8.95%														
Rank	10										69.36%		5.18%		7.47%										
Rank	11										15.47%	17.01%	5.42%	45.57%	14.84%										
Rank	12											26.05%	13.25%	23.59%	18.65%		13.17%								
Rank	13											31.95%	21.22%	16.94%	19.67%		6.81%								
Rank	14											12.05%	40.95%	6.25%	22.22%	10.53%	8.00%								
Rank	15											7.01%	9.52%		4.82%	50.06%	28.50%								
Rank	16														9.79%	37.94%	41.93%								
Rank	17																	51.76%		37.67%					
Rank	18																	14.25%	27.25%	32.55%	25.45%				
Rank	19																	23.91%	16.71%	26.36%	25.34%		5.36%		
Rank	20																	5.12%	35.13%		39.06%	5.26%	10.73%		
Rank	21																		10.75%		5.08%	20.20%	45.72%	13.52%	
Rank	22																		7.97%			14.58%	25.60%	44.79%	6.51%
Rank	23																					47.71%	8.72%	24.72%	18.44%
Rank	24																					11.06%		12.25%	72.76%

Figure 20 – ALMP Results of the Uncertainty Analysis, ranking distribution per country for 2006

2005	LU	SE	NO	NL	FI	BE	IE	DE	AT	FR	IT	ES	PT	UK	PL	SI	SK	BG	HU	CZ	RO	LT	LV	EE
Rank 1	34.88%	20.18%	5.63%	21.89%																				
Rank 2	*18.39%*	***25.24%***	7.78%	*36.26%*																				
Rank 3	18.48%	29.39%	**13.37%**	16.24%	8.54%	4.03%		9.42%																
Rank 4	7.42%	9.22%	*31.79%*	**13.23%**	14.45%	14.12%		6.38%																
Rank 5	5.38%		15.31%	5.71%	***29.02%***	*19.22%*		13.07%																
Rank 6			9.76%		13.68%	**18.82%**	10.28%	*28.29%*	11.07%															
Rank 7			11.91%		15.97%	14.42%	**17.71%**	19.92%	13.27%															
Rank 8					5.07%	7.02%	*27.45%*	**12.86%**	*35.58%*															
Rank 9						5.31%	*31.55%*	8.41%	**31.71%**	8.95%														
Rank 10										***69.36%***		5.18%		7.47%										
Rank 11										15.47%	**17.01%**	5.42%	*45.57%*	14.84%										
Rank 12											*26.05%*	**13.25%**	23.59%	18.65%		13.17%								
Rank 13											*31.95%*	*21.22%*	**16.94%**	*19.67%*		6.81%								
Rank 14											12.05%	*40.95%*	6.25%	**22.22%**	10.53%	8.00%								
Rank 15											7.01%	9.52%		4.82%	***50.06%***	*28.50%*								
Rank 16														9.79%	37.94%	***41.93%***								
Rank 17																	***51.76%***		*37.67%*					
Rank 18																	14.25%	**27.25%**	*32.55%*	25.45%				
Rank 19																	23.91%	*16.71%*	**26.36%**	*25.34%*		5.36%		
Rank 20																	5.12%	*35.13%*		***39.06%***	5.26%	10.73%		
Rank 21																		10.75%		5.08%	**20.20%**	*45.72%*	13.52%	
Rank 22																		7.97%			14.58%	**25.60%**	*44.79%*	6.51%
Rank 23																					*47.71%*	8.72%	**24.72%**	18.44%
Rank 24																					11.06%		12.25%	***72.76%***

Figure 21 – ALMP Results of the Uncertainty Analysis, ranking distribution per country for 2007

2007	LU	NL	BE	NO	SE	FI	IE	DE	AT	FR	ES	IT	UK	PL	PT	HU	SI	SK	LT	CZ	BG	LV	RO	EE
Rank 1	***43.06%***	6.50%	27.20%		11.95%	9.70%																		
Rank 2	*13.05%*	**19.47%**	13.58%	8.91%	*24.77%*	9.53%				8.39%														
Rank 3	8.22%	7.24%	***19.84%***	13.67%	*21.46%*	18.10%		6.26%																
Rank 4	6.31%	6.21%	*20.63%*	**15.02%**	17.89%	*21.96%*				6.11%														
Rank 5	5.82%	6.50%	10.08%	*22.39%*	**8.43%**	*24.55%*		11.74%	5.70%	4.56%														
Rank 6	6.40%	*7.46%*	7.39%	*27.54%*		**12.74%**		*21.26%*	5.46%	5.29%														
Rank 7	6.26%	6.30%		9.59%			**21.07%**	*26.61%*	17.17%	5.83%														
Rank 8							*31.45%*	**14.34%**	*26.82%*	*9.48%*														
Rank 9							28.71%	10.29%	***29.54%***	15.66%														
Rank 10		*19.81%*					14.32%		11.95%	***38.76%***	8.41%													
Rank 11		6.46%									***47.36%***	28.45%			11.48%									
Rank 12											28.76%	***34.64%***	6.11%	8.42%	17.51%									
Rank 13											7.42%	8.69%	**17.38%**	*55.26%*	*10.10%*									
Rank 14												11.23%	*18.56%*	**27.61%**	28.20%	8.07%								
Rank 15													*34.33%*	7.92%	**31.20%**	7.94%			7.24%	5.65%				
Rank 16																***38.11%***			*37.20%*	12.70%				
Rank 17																*39.58%*	**10.23%**	6.26%	26.87%	8.15%				
Rank 18																4.26%	*41.22%*	**16.35%**	11.94%	*16.81%*				
Rank 19																	30.66%	19.15%	**6.70%**	*25.87%*	7.80%			
Rank 20																	9.82%	*41.92%*	7.99%	**14.68%**	*16.89%*			
Rank 21																		13.13%		13.52%	***48.67%***	19.68%		
Rank 22																					22.98%	***63.42%***	12.82%	
Rank 23																						10.84%	*40.34%*	8.00%
Rank 24																							6.51%	***91.89%***

The overall variation in the position is synthesized for each year (figures 11-14). The width of the 5%-95% percentile bounds across the 23800 simulations represent the different rankings achieved by each country. Black marks correspond to the median ALMP composite indicator rank and whiskers show best and worst rank occupied by a country considering the 23800 simulations. The confidence bound proved the stability and robustness of the ranking. In fact for instance in 2004 over the 23800 simulations 2 are the countries which shift less than 3 positions while about 12 countries present only 1 shift position in the ranking. In 2005 only 5 countries (approximately the 20% of the total number of countries) shift of 2 positions, in 2006 less than 10% of countries present a variability of 3 positions, while in 2007 just one country, The Netherlands, present a variability of 8 positions.

In the relevant literature, the median rank is proposed as a summary measure of a rank distribution. The median rank of all combinations of assumptions indicates that for instance in 2006 for 13 out of 24 countries the ALMP rank corresponds with the most likely (median) rank. Thus, for the remaining countries the difference between the ALMP rank and the most likely (median) rank is less than 3 positions. So that, for all the countries studied in all the four years, the very modest sensitivity of the ALMP ranking to the five input factors (standardization, weighting scheme, aggregation rule, inclusion/exclusion of a single indicator and missing imputation) implies a considerably high degree of robustness of the index for all the countries. The comparison in all four years is shown from table 18 to table 21.

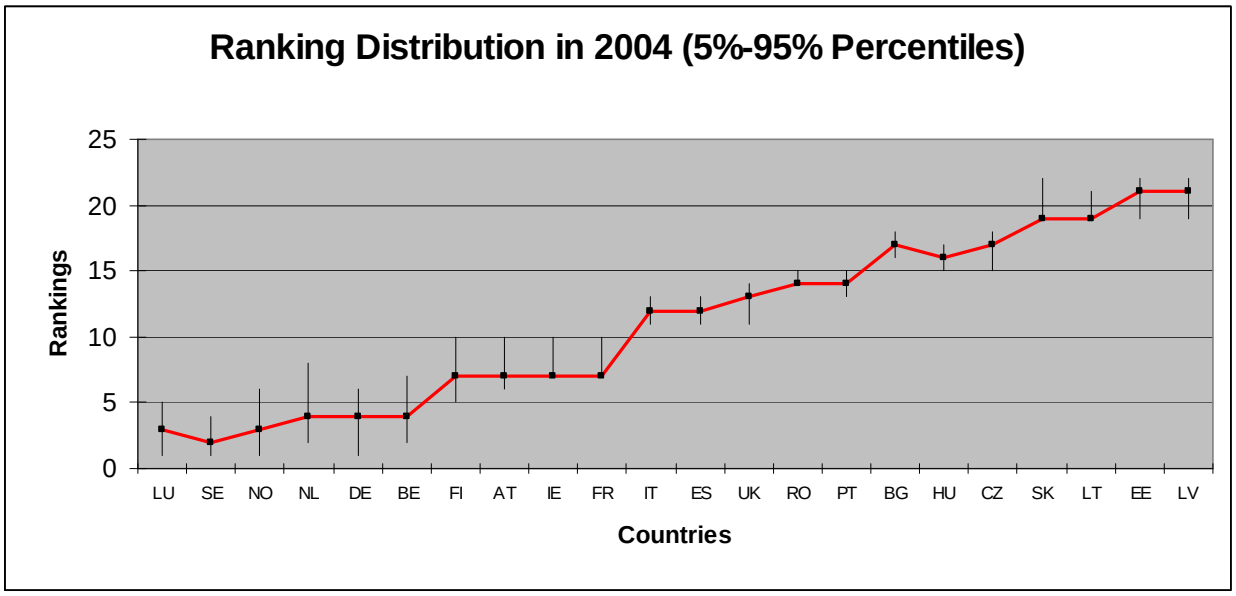


Figure 22: ALMP Results of the Uncertainty Analysis: Ranking Position in 2004 (5%-95% percentiles)

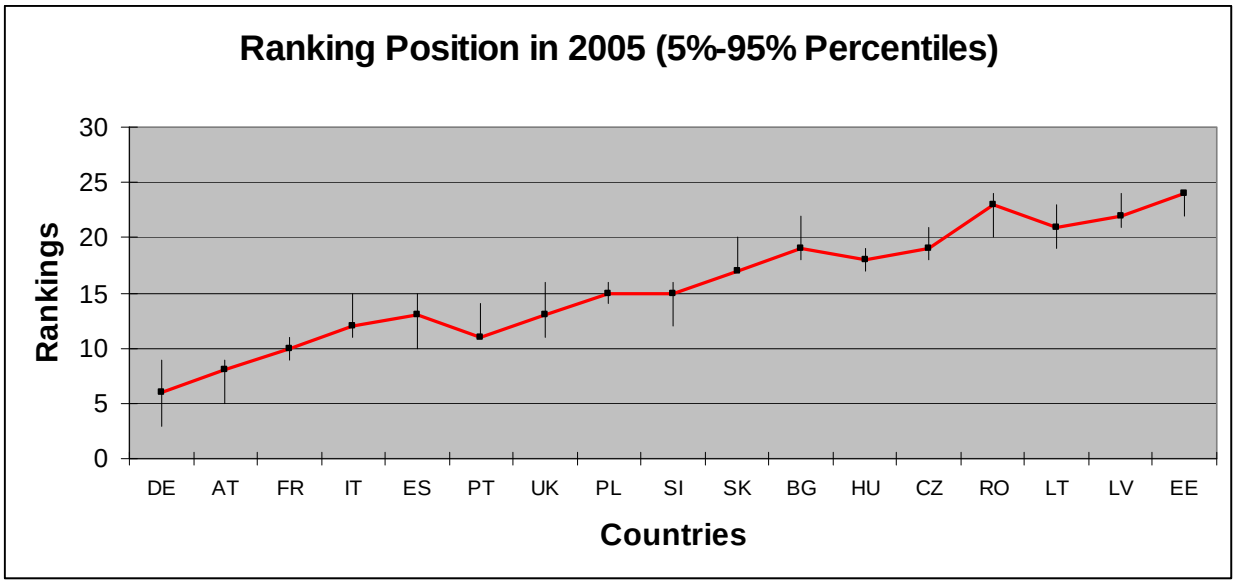


Figure23: ALMP Results of the Uncertainty Analysis: Ranking Position in 2005 (5%-95% percentiles)

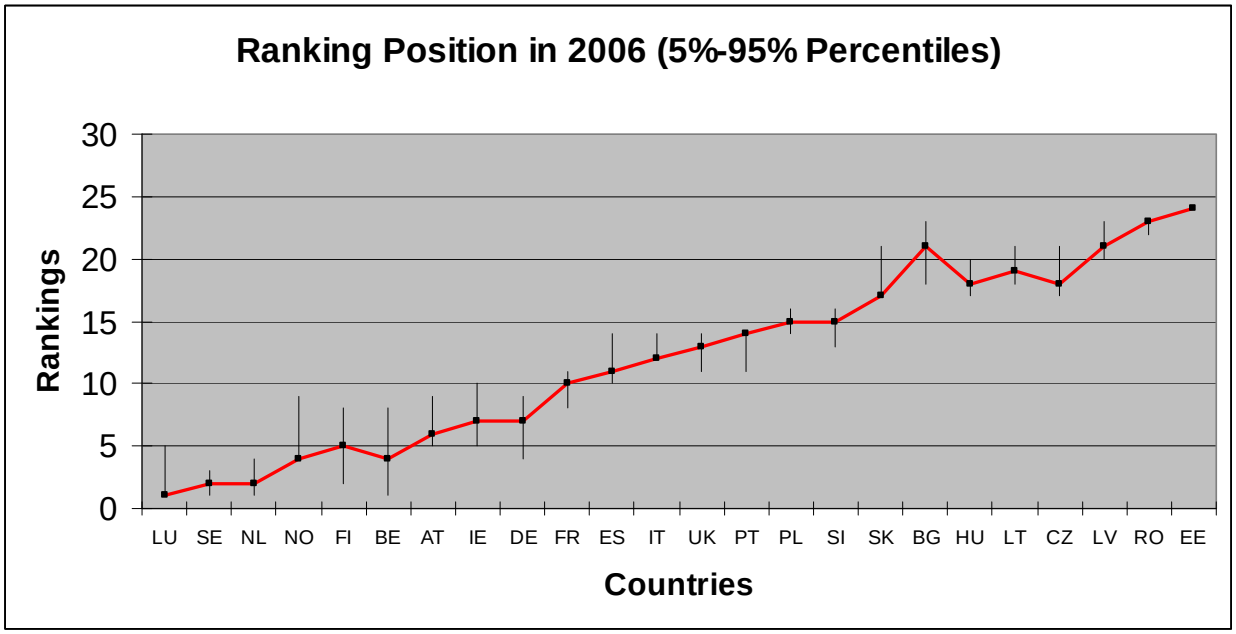


Figure 24: ALMP Results of the Uncertainty Analysis: Ranking Position in 2006 (5%-95% percentiles)

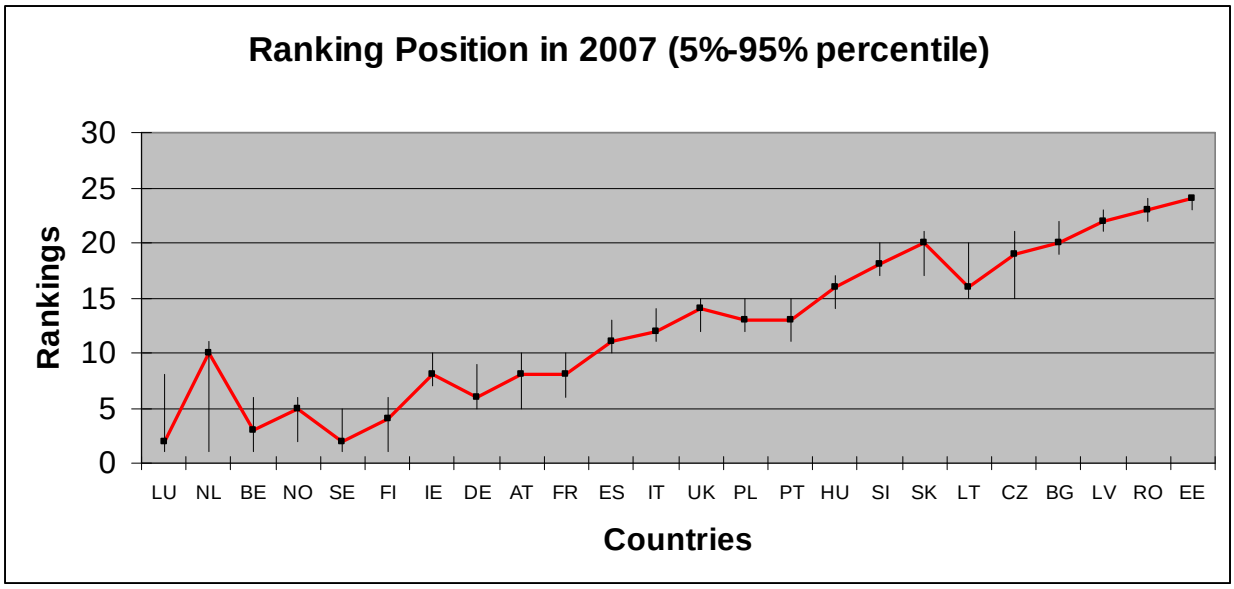


Figure 25: ALMP Results of the Uncertainty Analysis: Ranking Position in 2007 (5%-95% percentiles)

Table 26: Comparison of median values and ALMP composite indicator ranking in 2004

2004	LU	SE	NO	NL	DE	BE	FI	AT	IE	FR	IT	ES	UK	RO	PT	BG	HU	CZ	SK	LT	EE	LV
median	3	2	3	4	4	4	7	7	7	7	12	12	13	14	14	17	16	17	19	19	21	21
rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22

Table 27 Comparison of median values and ALMP composite indicator ranking in 2005

2005	LU	SE	NO	NL	FI	BE	IE	DE	AT	FR	IT	ES	PT	UK	PL	SI	SK	BG	HU	CZ	RO	LT	LV	EE
median	2	2	4	2	5	5	9	6	8	10	12	13	11	13	15	15	17	19	18	19	23	21	22	24
rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Table 28 Comparison of median values and ALMP composite indicator ranking in 2006

2006	LU	SE	NL	NO	FI	BE	AT	IE	DE	FR	ES	IT	UK	PT	PL	SI	SK	BG	HU	LT	CZ	LV	RO	EE
median	1	2	2	4	5	4	6	7	7	10	11	12	13	14	15	15	17	21	18	19	18	21	23	24
rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Table 29 Comparison of median values and ALMP composite indicator ranking in 2007

2007	LU	NL	BE	NO	SE	FI	IE	DE	AT	FR	ES	IT	UK	PL	PT	HU	SI	SK	LT	CZ	BG	LV	RO	EE
median	2	10	3	5	2	4	8	6	8	8	11	12	14	13	13	16	18	20	16	19	20	22	23	24
rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Uncertainty analysis for Modern Social Security Composite Indicator

The frequency matrix for 2005 is shown in Figure 3. Although the results of uncertainty analysis for this year show some variability in the ranking of countries, the overall situation does not contradict the ranking of the composite indicator presented in table 2. In particular, Denmark is the leader of the ranking in the 76% of the 29400 different scenarios performed and in almost 22% of the cases is ranked in 2nd positions. The same holds for Portugal which is ranked in the top 2 positions in 85% of the cases. The ranking of Belgium is more variable, although the country is ranked in the 3rd position in more than 50% of the cases. France presents a high variability in the ranking which goes from the 4th to the 10th position, the mode falls in the 4th position in 21% of the cases, whereas the position of the composite indicator falls in the 9th. Finland and Ireland respectively in 12th and 13th position show a bi-modal distribution of frequencies, with the median of the distribution respectively in 13th and 14th position. Also Malta and Greece have a bi-modal distribution but in both cases the median of the distribution corresponds to the position recorded in the composite indicator. For most countries ranking is robust as, for instance, for Austria, Luxemburg, Czech Republic it is concentrated in their position in the index in more than 85% of scenarios considered. Similar results are found for the remaining countries.

Results for 2006 highlight some increase in the variability of countries' ranking although the overall situation does not contradict the composite indicator presented above. Despite the increase in variability, for most countries record a rank which varies across a maximum of +/- 2 positions compared with that identified in the composite indicator. This trend is confirmed in more than 90% of the 29800 different scenarios considered. Moreover, results are still robust in some countries, such as Cyprus, Ireland , or Estonia where the rank varies within 3 positions in more than 75% of the different scenarios. The situation is even better for different countries such as Hungary, United Kingdom, or Slovenia which show a very robust situation with a ranking varying across just two positions in more than 85% of the cases. On the other hand, some bi-modal patterns appear for Ireland implying that some assumptions in the possible sources of uncertainty can affect the country ranking in some cases. Other countries present a bi-modal distribution, such as Italy or Greece, but in both cases the median of the distribution corresponds to the position recorded in the composite indicator.

Finally the uncertainty analysis results for 2007, despite presenting a slight increase in the variability of countries' ranking, confirms for most of them the positions of the composite indicator. This is not the case only for Belgium, which ranks from the 2nd to the 4th position in 50% of the cases or Portugal which ranks from the 4th to the 8th position in 40% of the cases. Three other countries present a similar situation: Italy, Greece and Luxemburg which respectively rank between the 6th and 8th position in 70% of cases, between the 5th and 9th in 85% of cases and between the 10th and 15th in 80% of cases. This ranking variability is mainly due to the imputation of missing data. However, most countries record a ranking which does not deviate more than +/- 2 positions relative to the

one in the composite indicator. In particular, the Netherland moves across the first two positions in more than 85% of cases. Cyprus, Estonia, Slovakia and Slovenia have their ranking varying by two positions in more than 70% of cases. The situation is even better for Hungary, Latvia Czech Republic and Poland which show a very robust situation with a ranking varying between only two positions in more than 90% of the cases.

Figure 30 – MSS Uncertainty Analysis frequency matrix for 2005

2005	DK	PT	BE	FR	ES	DE	IT	CY	GR	SE	NL	FI	IE	HU	MT	EE	UK	AT	LU	SK	LV	CZ	SI	LT	PL
Rank 1	76.54%	22.00%	0.54%																						
Rank 2	22.03%	63.53%	8.40%	4.99%			0.45%																		
Rank 3	1.00%	13.65%	50.60%	15.39%	10.16%		6.88%	0.22%	2.10%																
Rank 4	0.05%	0.79%	10.20%	20.23%	*22.97%*		17.20%	7.10%	21.46%																
Rank 5	0.13%	0.03%	3.73%	*13.21%*	45.62%	5.00%	10.63%	7.95%	13.68%																
Rank 6			0.88%	4.54%	14.22%	***15.44%***	*26.98%*	30.29%	5.01%	2.05%	0.16%														
Rank 7			*11.03%*	6.24%	5.71%	16.58%	30.31%	16.57%	7.86%	2.45%	1.51%	1.74%													
Rank 8			0.68%	19.18%	0.38%	5.93%	7.18%	***28.58%***	19.51%	10.19%	3.44%	4.91%													
Rank 9			1.18%	3.20%		38.20%	0.37%	8.54%	***17.19%***	17.38%	5.66%	7.17%		0.33%	0.77%										
Rank 10			5.97%	7.26%		13.86%		0.59%	11.81%	35.15%	9.73%	11.24%		2.74%	1.65%										
Rank 11				5.18%		4.98%		0.17%	0.86%	*20.80%*	30.88%	18.03%	0.37%	6.50%	11.59%	0.63%									
Rank 12									0.41%	9.71%	10.54%	18.59%	15.57%	38.59%	3.26%	2.99%									
Rank 13									0.09%	1.88%	*15.52%*	*11.07%*	24.19%	*27.26%*	4.16%	15.17%									
Rank 14										0.39%	16.99%	8.23%	*21.05%*	**18.31%**	15.32%	17.94%	0.05%	0.04%							
Rank 15											5.58%	6.35%	23.38%	4.46%	***16.88%***	32.38%	6.02%	0.06%	1.11%						
Rank 16												10.11%	13.31%	1.82%	20.26%	***22.58%***	25.45%	0.37%	5.78%						
Rank 17												1.61%	2.05%		21.98%	7.90%	36.62%	4.86%	24.97%						
Rank 18												0.72%	0.06%		3.98%	0.28%	*26.31%*	**16.07%**	52.32%	0.09%	0.17%				
Rank 19												0.03%				0.13%	5.05%	69.97%	**13.78%**	7.63%	1.00%		2.38%		
Rank 20																	0.50%	6.01%	2.04%	***39.71%***	45.04%	1.92%	4.78%		
Rank 21																		2.68%		43.69%	***42.41%***	8.93%	2.30%		
Rank 22																		0.04%		8.89%	11.34%	***73.48%***	6.24%		
Rank 23																					0.03%	14.99%	***18.87%***	52.46%	6.24%
Rank 24																						0.68%	18.22%	***16.53%***	64.57%
Rank 25																							47.20%	23.61%	***29.18%***

Figure 31 - Uncertainty Analysis frequency matrix for 2006

2006	DK	PT	BE	ES	FR	DE	IT	GR	SE	CY	FI	NL	IE	MT	EE	AT	SK	LU	HU	UK	SI	CZ	LV	LT	PL
Rank 1	***88.10%***	10.54%	0.34%	0.68%																					
Rank 2	10.88%	*57.46%*	*20.41%*	10.23%		0.68%																			
Rank 3	0.68%	29.61%	42.53%	*10.85%*	0.68%	5.10%	9.18%	1.03%	0.34%																
Rank 4		1.70%	8.86%	20.08%	4.43%	13.57%	34.02%	13.95%	3.06%																
Rank 5			0.66%	7.17%	***22.11%***	*25.84%*	10.20%	7.13%	26.89%																
Rank 6			7.14%	3.70%	8.83%	40.14%	8.85%	7.84%	*17.11%*		5.70%														
Rank 7			3.42%	4.09%	31.61%	8.86%	**15.64%**	*14.94%*	10.87%	1.00%	1.40%	7.82%													
Rank 8			2.37%	6.47%	25.81%	5.46%	*13.95%*	26.95%	11.12%	0.35%	3.44%	4.09%													
Rank 9			2.38%	13.61%	5.19%	0.34%	5.12%	25.45%	**21.46%**	6.45%	12.20%	6.80%	1.01%												
Rank 10			5.10%	9.86%	1.35%	0.00%	1.44%	2.38%	7.85%	***13.19%***	39.07%	18.71%	0.70%		0.33%										
Rank 11				13.27%			0.93%		1.29%	30.02%	***36.81%***	11.21%	6.12%		0.35%										
Rank 12							0.34%			23.81%	1.03%	29.60%	*13.26%*	3.05%	27.21%	1.36%									
Rank 13										10.89%		*13.93%*	18.05%	*17.32%*	24.82%	12.59%			2.34%						
Rank 14										11.22%		3.42%	14.96%	**16.32%**	17.36%	31.65%	0.34%		3.04%						
Rank 15										3.07%		3.38%	14.61%	21.78%	***21.08%***	*30.61%*	3.74%		0.72%						
Rank 16												0.68%	12.92%	24.17%	8.85%	**15.65%**	17.70%	13.56%	3.42%						
Rank 17												0.01%	7.14%	10.20%		1.38%	49.97%	*21.14%*	9.19%	0.34%					
Rank 18												0.34%	10.88%	6.48%		6.43%	*26.88%*	24.83%	*23.81%*	0.34%					
Rank 19													0.34%	0.68%		0.34%	1.36%	12.59%	46.60%	37.41%				0.68%	
Rank 20																		27.89%	10.88%	*56.46%*				4.76%	
Rank 21																				5.44%	*66.67%*	13.95%	1.36%	12.59%	
Rank 22																					25.85%	*57.49%*	12.24%	3.40%	1.02%
Rank 23																					5.10%	13.94%	*74.84%*	3.74%	2.38%
Rank 24																					1.36%	10.20%	10.20%	*37.63%*	*40.60%*
Rank 25																					1.02%	4.42%	1.36%	*37.20%*	*56.00%*

Figure 32 – MSS Uncertainty Analysis frequency matrix for 2007

2007	BE	ES	PT	FR	DE	NL	IT	IE	GR	DK	LU	SE	CY	FI	AT	MT	EE	SK	SI	UK	HU	LV	CZ	LT	PL
Rank 1	**9.11%**	67.04%	6.59%	15.90%	0.68%																				
Rank 2	*18.23%*	**15.89%**	9.91%	46.33%	7.13%																				
Rank 3	29.65%	4.96%	**7.31%**	*18.14%*	29.78%	6.10%	3.96%																		
Rank 4	23.84%		13.04%	**13.51%**	29.61%	5.46%	7.14%		6.80%																
Rank 5	2.91%		12.15%		***17.82%***	8.32%	5.45%	2.83%	40.71%																
Rank 6	2.02%		9.18%			***24.82%***	29.44%	12.13%	16.65%																
Rank 7	2.02%		*9.18%*			35.61%	**8.31%**	4.76%	*32.65%*																
Rank 8	11.12%		14.64%			17.30%	*15.65%*	***26.87%***	2.38%					6.15%											
Rank 9							22.11%	47.07%	**0.34%**	2.72%				6.00%											
Rank 10								6.33%		41.50%	2.04%	9.86%	6.80%	25.31%											
Rank 11										*31.93%*	**23.13%**	*11.22%*	11.95%	12.59%											
Rank 12										15.43%	15.65%	**16.05%**	41.11%	8.70%	2.72%										
Rank 13										6.26%	7.17%	15.24%	***21.10%***	*16.21%*	*34.03%*										
Rank 14										2.16%	*17.66%*	10.54%	18.70%	**22.37%**	12.23%		*16.33%*								
Rank 15											28.45%	7.83%			43.53%	5.23%	9.18%	5.11%							
Rank 16											5.23%	13.94%			6.81%	**18.24%**	45.59%	6.46%	3.06%						
Rank 17												5.78%				42.86%	**13.61%**	18.71%	5.79%	11.90%					
Rank 18																*21.09%*	9.87%	***25.91%***	14.24%	27.93%					
Rank 19																	5.43%	35.65%	***32.38%***	16.61%					
Rank 20																		8.16%	44.54%	**39.14%**				3.74%	
Rank 21																				3.74%	63.34%	17.97%		14.96%	
Rank 22																					20.28%	74.71%	2.28%	2.73%	
Rank 23																					10.63%	6.98%	74.23%	8.16%	
Rank 24																					5.75%		23.49%	***28.58%***	*41.84%*
Rank 25																								41.84%	58.16%

The overall variation in the position is synthesized for each year (figures 6-10). The width of the 5%-95% percentile bounds across the 29400 simulations represent the different rankings achieved by each country for the main indicator, 25200 simulation for the indicator of 2004 and finally 35000 simulations for the second indicator for 2007. Black marks correspond to the median MSS composite indicator rank and whiskers show best and worst rank occupied by a country considering the 29400 simulations. The confidence bound proved the stability and robustness of the ranking. In fact for instance in 2005 over the 29400 simulations only 1 country shift more than 3 positions while most countries present only 1 shift position in the ranking. In 2005 only 10 countries, (approximately the 40% of the total number of countries) shift of 1 positions, in 2006 just one country present a variability of 3 positions, while in 2007 less than 20% of countries present a variability of more than 3 positions.

In the relevant literature, the median rank is proposed as a summary measure of a rank distribution. The median rank of all combinations of assumptions indicates that for instance in 2005 for 15 out of 25 countries the MSS rank corresponds with the most likely (median) rank. Thus, for the remaining countries the differences between the MSS rank and the most likely (median) rank is less than 3 positions. So that, for all the countries studied in all the three years, the very modest sensitivity of the MSS ranking to the five input factors (standardization, weighting scheme, aggregation rule, inclusion/exclusion of a single indicator and missing imputation) implies a considerably high degree of robustness of the index for all the countries. The comparison in all three years is shown from table 19 to table 23.

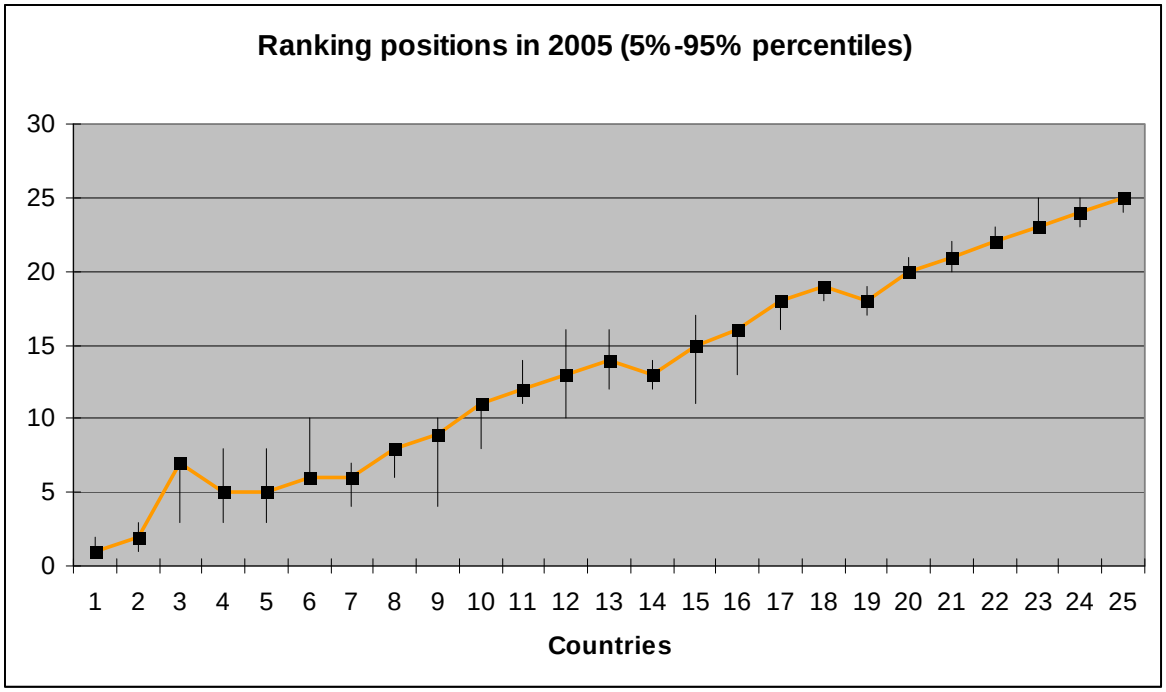


Figure 33 – MSS Results of the Uncertainty Analysis: Ranking Position in 2005 (5%-95% percentiles)

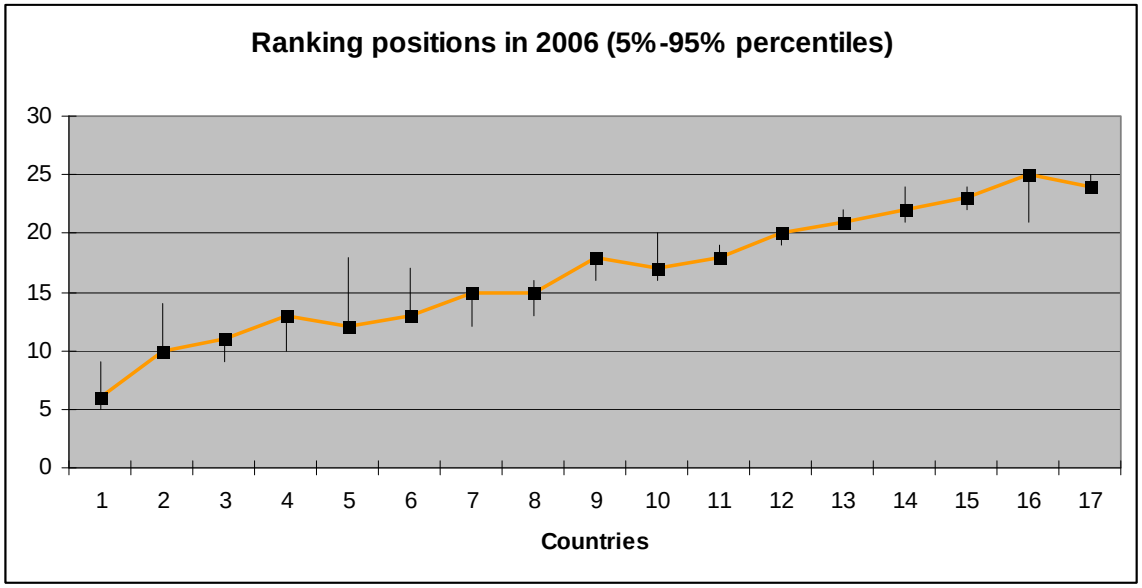


Figure 34 – MSS Results of the Uncertainty Analysis: Ranking Position in 2006 (5%-95% percentiles)

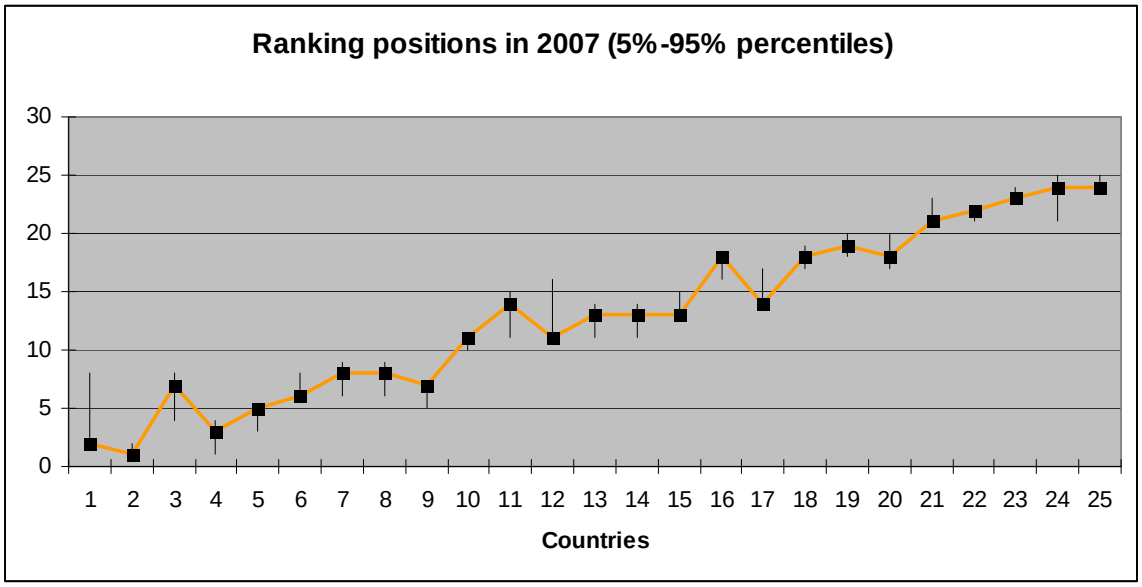


Figure 35 – MSS Results of the Uncertainty Analysis: Ranking Position in 2007 (5%-95% percentiles)

2005	DK	SE	NL	BE	FI	DE	FR	IE	LU	SI	PT	CY	LV	UK	ES	AT	PL	MT	CZ	HU	EE	LT	IT	SK	GR
median	1	2	7	5	5	6	6	8	9	11	12	13	14	13	15	16	18	19	18	20	21	22	23	24	25
rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Table 36 – Comparison of median values and MSS composite indicator ranking in 2005

2006	DK	SE	NL	BE	DE	FI	IE	FR	LU	PT	SI	CY	ES	LV	UK	AT	MT	PL	HU	CZ	LT	EE	SK	IT	GR
median	1	2	2	3	5	5	8	7	6	10	11	13	12	13	15	15	18	17	18	20	21	22	23	25	24
rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Table 37 – Comparison of median values and MSS composite indicator ranking in 2006

2007	DK	NL	BE	IE	LU	DE	SE	FR	FI	SI	PT	ES	AT	CY	UK	MT	CZ	HU	LV	PL	LT	EE	SK	IT	GR
median	2	1	7	3	5	6	8	8	7	11	14	11	13	13	13	18	14	18	19	18	21	22	23	24	24
rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Table 38 – Comparison of median values and MSS composite indicator ranking in 2007

Uncertainty analysis for Flexible and Reliable Contractual Arrangement Composite Indicator

In the following tables, the frequency matrices for the period 2005-2008 are presented. Due to the huge number of simulations performed, only frequencies higher than 10% are shown. A first consideration is that the overall ranking is quite stable; in fact, considering the main indicator, over the whole set of 12000 simulations all countries clustered unambiguously. This is true in particular for the first and the last positions which show a very low degree of variability across the three years. The imputation of missing data affects the results of the uncertainty analysis only to a minor extent. In this section a general overview of the results of uncertainty analysis is given, whereas the specific situation of each country is commented in the country profile section.

The frequency matrix for 2005 is shown in Figure 3. Although the results of uncertainty analysis for this year show some variability in the ranking of countries, the overall situation does not contradict the ranking of the composite indicator presented in table 2. In particular, Portugal is the leader of the ranking in the 30% of the 12000 different scenarios performed. A similar situation holds for Greece which is ranked in the top 3 positions in 70% of the cases. The ranking of Poland is quite robust as this country ranks in the first 3 positions in more than 90% of cases. France presents a high variability in the ranking which goes from the 3rd to the 6th position, the mode falls in the 5th position in almost 34% of the cases, whereas it ranks 4th in the main scenario shown in section 4 above. The ranking of Finland varies from 1st to 5th, with median in 3rd position and 5th position in the (main) indicator. The Netherlands, Slovenia and Spain present a high ranking variability[17]. Apart from these cases, for most countries ranking is robust and it is concentrated in their position in the index in general in 50% of scenarios considered.

Results for 2006 highlight some increase in the variability of countries' ranking although the overall situation does not contradict the composite indicator presented above. Despite the increase in variability, most countries record a rank which varies across a maximum of +/- 2 positions compared with that identified in the composite indicator. This trend is confirmed in more than 90% of the 12000 different scenarios considered. The ranking of Ireland shows the highest variability implying that some assumptions in the sources of uncertainty affect the country ranking in some cases. For some countries, such as the UK, Italy, Austria, or Belgium, ranks vary within 3 positions in more than 55% of cases. Other countries present a bi-modal distribution, such as Germany or Bulgaria, but in both cases the median of the distribution corresponds to the position recorded in the composite indicator.

The uncertainty analysis results for 2007, despite presenting a slight increase in the variability of countries' ranking, confirms for most of them the positions of the composite indicator. This is not the case for Portugal, which ranks from the 3rd to the 9th position in

[17] The Netherland ranks between the 6th and the 8th positions in 60% of cases, Slovenia falls between the 7th and the 8th position in 255 of the cases while Spain ranks between the 6th ad 8th position in 34% of cases.

50% of the cases, or Poland which ranks from the 2nd to the 9th position in 70% of the cases. Three other countries present a similar situation: Denmark, the Netherlands and Slovenia which rank between the 2nd and 6th position in 75% of cases, between the 2nd and 6th in 60% of cases and between the 4th and 9th in 60% of cases, respectively. This ranking variability is mainly due to the weak correlations within the basic indicators. However, most countries record a ranking which does not deviate more than +/- 3 positions relative to the one in the composite indicator. In particular, Greece moves between the 10th and 12th position in more than 55% of cases. Germany, Czech Republic and Hungary have their ranking varying by three positions in more than 70% of cases. Spain, Italy and Slovakia show a bi-modal distribution of the frequencies, but in all cases the median of the distribution corresponds to the position recorded in the composite indicator.

Figure 6 shows the results of the uncertainty analysis for 2008. Although these show some variability in the ranking of countries, for most of them the positions of the composite indicator shown in table 12 are confirmed. Exceptions are France, which ranks from the 4th to the 6th position in 75% of cases and Germany which ranks between the 16th and the 17th position in 35% of cases. Ranking variability across 4 positions is observed for the UK, Belgium, Italy, Poland, Estonia and Sweden. This is mainly due to imputation of missing data and weak correlations among basic indicators. Luxemburg, Bulgaria and Ireland present a bi-modal distribution of frequencies, but in all cases the median corresponds to the position in the main composite indicator.
Ranking is particularly robust for Finland, which ranks 1st in 79% of cases, and Denmark where the ranking only varies within 2 positions in more than 60% of cases.

Figure 39 – FCA Uncertainty Analysis frequency matrix for 2005

2005		PT	EL	PL	FR	FI	NL	SI	ES	BE	BG	IT	UK	LT	DK	SK	AT	DE	LU	EE	SE	CZ	HU	IE
Rank	1	**30.02%**	16.47%	37.55%	3.86%	8.08%																		
Rank	2	12.38%	**24.67%**	35.11%	0.90%	25.30%																		
Rank	3	9.28%	33.08%	**21.82%**	7.79%	24.25%																		
Rank	4	17.86%	18.28%		**26.26%**	20.37%																		
Rank	5	20.93%			33.54%	**18.01%**																		
Rank	6				19.53%		**34.36%**		13.25%															
Rank	7						26.68%	**13.66%**	11.18%	12.06%														
Rank	8						11.09%	11.88%	**8.64%**	25.41%	10.78%	11.26%												
Rank	9									**30.59%**	14.76%	17.26%	10.92%											
Rank	10									15.02%	**16.25%**	21.27%	14.34%											
Rank	11										14.58%	**16.23%**	16.17%	9.31%										
Rank	12										10.98%	9.58%	**16.63%**	15.33%	10.50%	8.88%								
Rank	13										7.22%		11.66%	**24.13%**	15.09%	9.08%								
Rank	14										10.22%		10.59%	18.76%	**17.39%**	8.68%	12.49%							
Rank	15													10.23%	17.77%	**11.70%**	16.10%	13.69%						
Rank	16														14.20%	11.33%	**11.18%**	17.69%						
Rank	17															12.28%		**24.63%**	12.02%	16.48%				
Rank	18																	11.50%	**14.30%**	33.83%	13.45%			
Rank	19																		12.92%	**23.27%**	11.69%	16.26%	14.29%	
Rank	20																		15.03%	9.15%	**14.70%**	11.53%	23.79%	
Rank	21																		9.33%		20.18%	**22.73%**	22.03%	9.37%
Rank	22																		24.48%		21.83%	23.61%	**18.34%**	5.11%
Rank	23																						9.73%	**79.20%**

Figure 40 – FCA Uncertainty Analysis frequency matrix for 2006

2006		FI	PT	DK	SI	NL	PL	FR	UK	IT	LT	EL	AT	LU	IE	BE	BG	SK	ES	SE	EE	CZ	HU	DE
Rank	1	**69.54%**	14.20%		7.49%																			
Rank	2	16.29%	**16.91%**	16.96%	13.87%		27.70%																	
Rank	3	7.62%	10.78%	**21.01%**	28.53%		11.03%																	
Rank	4		11.73%	14.65%	**18.83%**		14.20%	6.18%																
Rank	5		7.69%	22.31%	12.70%	**19.48%**	10.92%	5.16%																
Rank	6		10.48%	11.74%		8.43%	**10.87%**	26.85%	11.85%															
Rank	7					17.67%	14.28%	**22.76%**	13.64%		7.00%													
Rank	8					14.92%		9.43%	**31.02%**	7.40%	11.98%													
Rank	9					10.04%		13.17%		**23.22%**	17.05%	5.88%	9.87%											
Rank	10					10.86%		5.90%		13.67%	**25.97%**	10.61%	13.35%											
Rank	11									29.91%	17.18%	**8.40%**	13.91%											
Rank	12									9.88%	11.05%	15.36%	**18.34%**		7.60%	15.98%								
Rank	13											8.38%	4.39%	**17.08%**	7.58%	30.22%			8.05%					
Rank	14											12.59%		13.52%	**5.26%**	26.28%	7.86%		9.88%					
Rank	15											7.89%		19.00%	5.94%	**7.64%**	20.71%	10.47%	10.23%					
Rank	16													9.96%	5.37%		**22.88%**	21.31%	10.80%	7.88%				
Rank	17													10.33%	8.91%		9.53%	**16.39%**	14.93%	17.23%				
Rank	18													9.46%	6.87%		6.64%	14.08%	**14.08%**	17.93%	5.51%	7.33%		
Rank	19														7.51%		10.66%	8.08%	10.78%	**17.53%**	11.26%	4.04%	10.80%	
Rank	20														4.73%		5.42%		5.13%	11.41%	**22.84%**	13.43%	11.40%	14.33%
Rank	21														3.48%		10.50%			7.62%	13.71%	**27.24%**	16.52%	8.77%
Rank	22														2.60%					8.97%	18.23%	19.41%	**26.71%**	14.00%
Rank	23														8.13%						20.80%	12.65%	25.88%	**19.09%**

Figure 41 – FCA Uncertainty Analysis frequency matrix for 2007

2007		FI	DK	NL	PT	SI	FR	PL	UK	AT	EL	IT	IE	BE	LT	BG	LU	SE	ES	SK	EE	DE	HU	CZ
Rank	1	70.56%																						
Rank	2	13.84%	**13.91%**	22.68%				13.95%		12.57%														
Rank	3		18.40%	**16.12%**	11.64%			14.68%		15.68%														
Rank	4		14.35%	13.88%	**12.78%**	13.58%	19.55%	9.74%		5.06%														
Rank	5		22.00%	13.18%	4.33%	**19.63%**	15.33%	8.77%		2.35%														
Rank	6		14.32%	17.73%	6.97%	5.82%	**19.43%**	12.78%		10.04%														
Rank	7				9.53%	6.04%	14.58%	**20.33%**	17.13%	8.63%		12.28%												
Rank	8				5.94%	16.08%			**16.66%**	21.11%	4.62%	5.86%												
Rank	9				10.37%	12.15%			17.95%	**15.14%**	8.97%	9.93%												
Rank	10								18.08%	7.68%	23.57%	11.28%		7.28%										
Rank	11										13.18%	**37.32%**	10.11%	11.10%										
Rank	12										11.97%		**15.98%**	26.14%	14.77%									
Rank	13												10.78%	**34.11%**	15.95%	10.58%		10.56%						
Rank	14												9.08%	8.11%	**21.30%**	14.24%		11.54%	11.48%					
Rank	15												11.17%			**26.92%**	5.25%	11.68%	7.13%			8.14%	9.53%	
Rank	16															16.99%	**12.87%**	16.62%	5.58%			5.89%	6.24%	
Rank	17															12.36%	11.44%	**14.47%**	15.71%		8.14%	6.28%	5.91%	
Rank	18																17.59%		**17.84%**	11.80%	7.67%	4.51%	9.19%	
Rank	19																9.98%		9.78%	**19.53%**	8.40%	13.90%	6.83%	
Rank	20																5.73%			20.04%	**15.50%**	14.52%	8.52%	
Rank	21																16.63%			7.30%	14.25%	**20.10%**	13.70%	11.16%
Rank	22																			4.66%	18.79%	6.73%	**27.47%**	24.53%
Rank	23																			10.69%	22.47%	8.77%	9.29%	**36.58%**

Figure 42 – FCA Uncertainty Analysis frequency matrix for 2008

2008		NL	DK	FI	FR	PT	UK	AT	EL	SI	BE	IT	PL	LU	BG	IE	SE	DE	ES	EE	LT	SK	HU	CZ
Rank	1	79.14%	2.56%	16.78%																				
Rank	2	12.18%	45.99%	12.33%		10.29%		12.63%																
Rank	3		21.90%	**33.71%**		9.18%	12.26%	11.13%																
Rank	4		12.48%	16.32%	**31.08%**	4.48%	13.88%	15.08%																
Rank	5				32.31%	**11.63%**	22.48%	10.74%																
Rank	6				16.58%	8.43%	**33.43%**	22.66%																
Rank	7					21.21%		**18.74%**					24.43%											
Rank	8					10.12%			**11.09%**	9.25%	19.95%	21.19%	13.99%											
Rank	9								9.88%	**13.49%**	24.38%	21.15%	14.03%											
Rank	10								9.81%	10.84%	**27.75%**	16.82%	17.33%											
Rank	11								12.22%	15.02%	10.09%	**17.93%**	13.97%			14.18%								
Rank	12								11.13%	29.80%	7.92%	9.42%	**9.59%**			9.62%		9.24%						
Rank	13								10.72%	12.20%				**11.30%**	15.85%	7.72%	11.14%	4.48%	17.10%					
Rank	14													11.90%	11.43%	11.03%	13.35%	9.93%	18.35%					
Rank	15													9.28%	8.83%	**15.30%**	21.58%	8.93%	7.52%					
Rank	16													9.52%	6.84%	8.89%	**17.12%**	19.44%	7.52%		10.73%			
Rank	17													5.04%	7.31%	9.13%	9.06%	**18.33%**	8.07%	14.86%	10.22%			
Rank	18													5.18%	6.70%	4.44%		9.42%	**15.21%**	12.02%	15.72%			
Rank	19													7.03%	8.57%	5.08%				**19.77%**	13.30%	14.74%		
Rank	20													7.01%	12.70%					10.50%	**23.42%**	11.52%		
Rank	21													9.60%	12.69%							**27.31%**	14.15%	
Rank	22													10.64%	5.54%							12.49%	**31.45%**	19.27%
Rank	23													9.94%	0.03%							16.88%	18.33%	**49.95%**

The overall variation in the position is synthesized for each year (figures 6-10). The width of the 5%-95% percentile bounds across the 12000 simulations represent the different rankings achieved by each country for the main indicator. Black marks correspond to the median FCA composite indicator rank and whiskers show best and worst rank occupied by a country considering the 12000 simulations. The confidence bound proved the stability and robustness of the ranking. In fact for instance in 2005 over the 12000 simulations only 2 countries shift more than 3 positions while most countries present only 1 shift position in the ranking. In 2005 11 countries, approximately the 47% of the total number of countries, do not shift position at all, while approximately the 40% of the total number of countries shift of 1 positions, in 2006 even if one country present a variability of 4 positions, approximately 52% of the total number of countries remain in the same position of the median. In 2007 70% of the countries confirm the ranking position of the indicator with the median position, and in 2008 only 3 countries present a variability of 3 positions.

In the relevant literature, the median rank is proposed as a summary measure of a rank distribution. The median rank of all combinations of assumptions indicates that for instance in 2005 for 11 out of 23 countries the FCA rank corresponds with the most likely (median) rank. Thus, for the remaining countries the differences between the FCA rank and the most likely (median) rank is less than 3 positions. So that, for all the countries studied in all the fourth years, the very modest sensitivity of the FCA ranking to the five input factors (standardization, weighting scheme, aggregation rule, inclusion/exclusion of a single indicator and missing imputation) implies a considerably degree of robustness of the index for all the countries. The comparison in all three years is shown from table 19 to table 22.

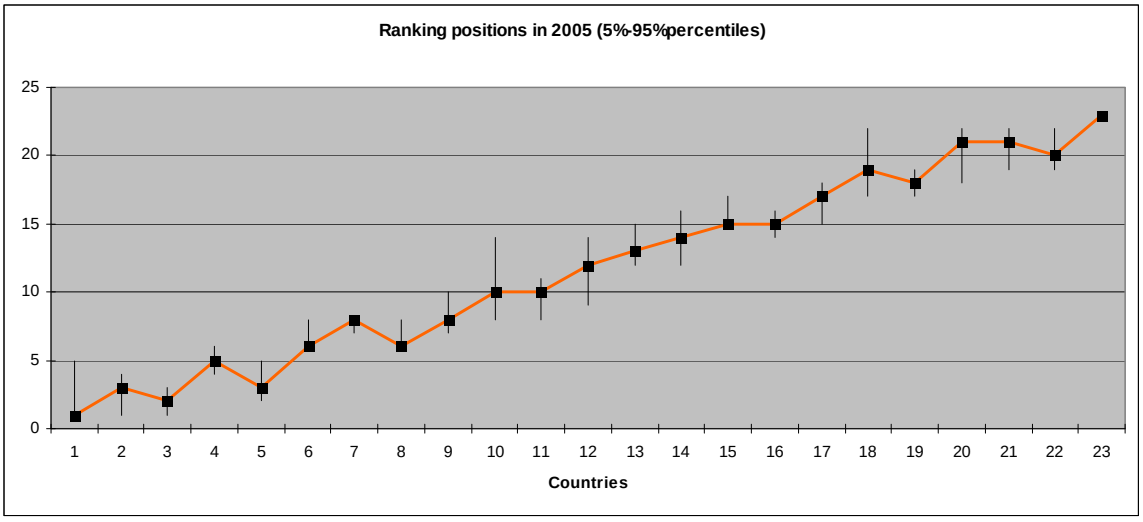


Figure 43– FCA Results of the Uncertainty Analysis: Ranking Position in 2005 (5%-95% percentiles)

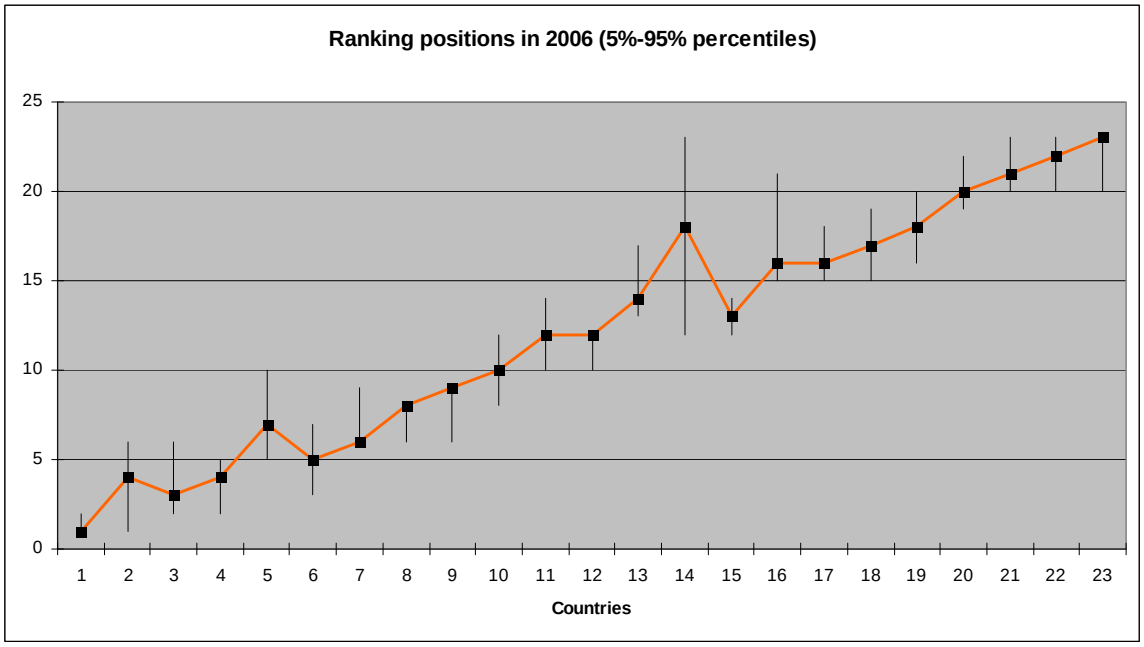


Figure 44 – FCA Results of the Uncertainty Analysis: Ranking Position in 2006 (5%-95% percentiles)

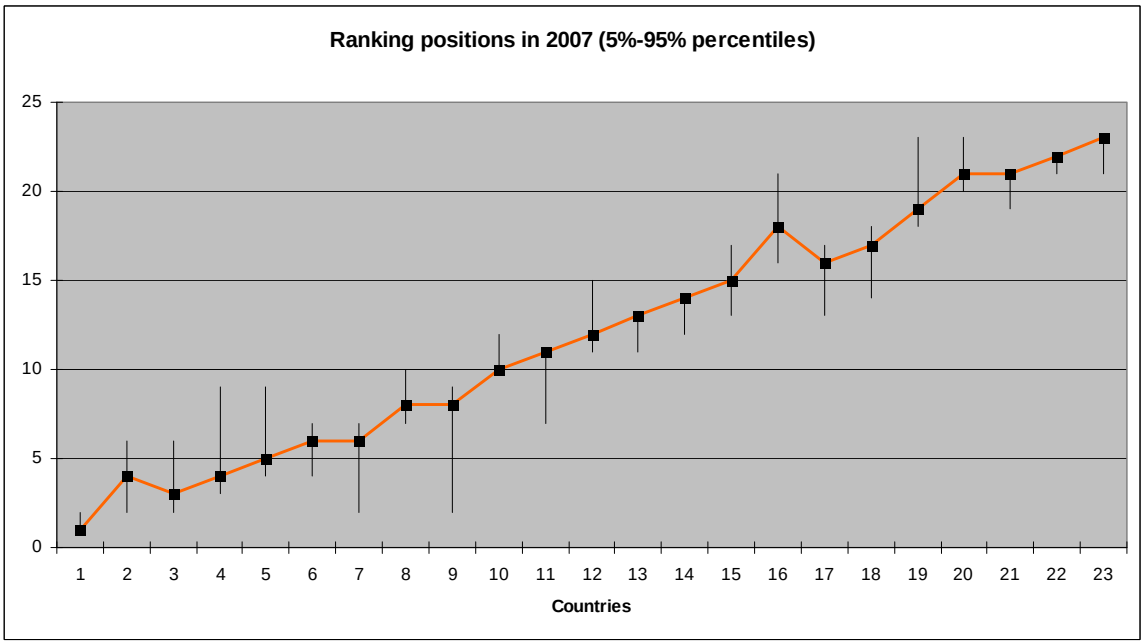


Figure 45 – FCA Results of the Uncertainty Analysis: Ranking Position in 2007 (5%-95% percentiles)

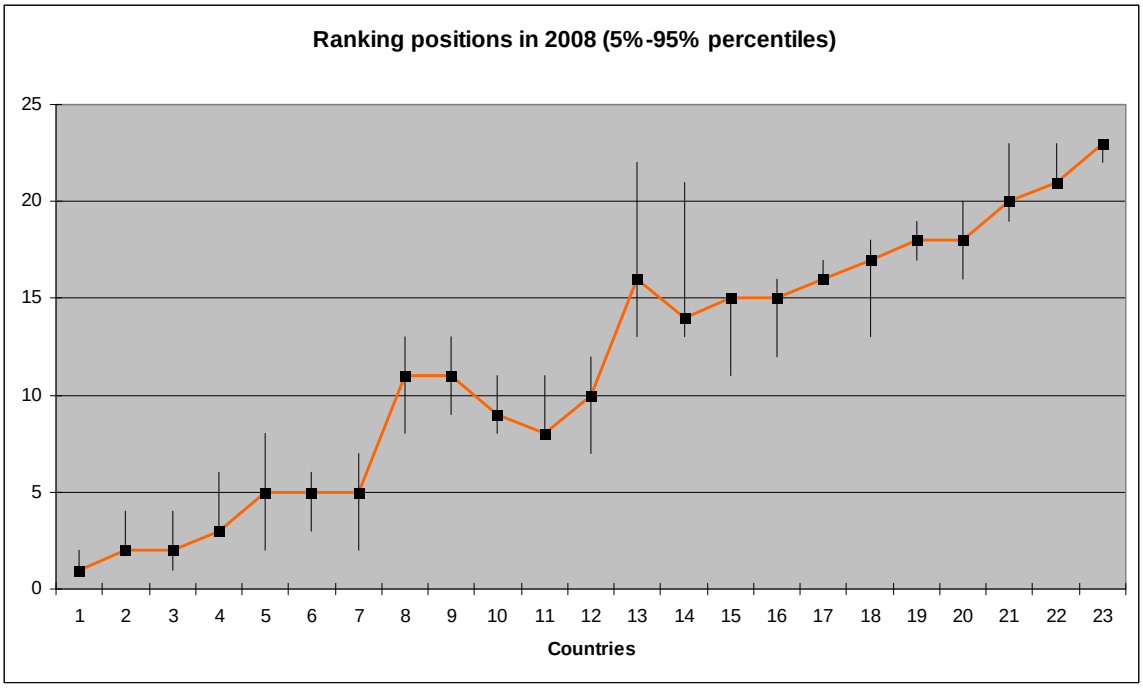


Figure 46 – FCA Results of the Uncertainty Analysis: Ranking Position in 2008 (5%-95% percentiles)

2005	PT	EL	PL	FR	FI	NL	SI	ES	BE	BG	IT	UK	LT	DK	SK	AT	DE	LU	EE	SE	CZ	HU	IE
median	1	3	2	5	3	6	8	6	8	10	10	12	13	14	15	15	17	19	18	21	21	20	23
rank	1	2	3	4	5	6	8	8	9	10	11	12	13	14	15	15	17	18	19	20	22	22	23

Table 47 – Comparison of median values and FCA composite indicator ranking in 2005

2006	FI	PT	DK	SI	NL	PL	FR	UK	IT	LT	EL	AT	LU	IE	BE	BG	SK	ES	SE	EE	CZ	HU	DE
median	1	4	3	4	7	5	6	8	9	10	12	12	14	18	13	16	16	17	18	20	21	22	23
rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

Table 48 – Comparison of median values and FCA composite indicator ranking in 2006

2007	FI	DK	NL	PT	SI	FR	PL	UK	AT	EL	IT	IE	BE	LT	BG	LU	SE	ES	SK	EE	DE	HU	CZ
median	1	4	3	4	5	6	6	8	8	10	11	12	13	14	15	18	16	17	19	21	21	22	23
rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

Table 49 – Comparison of median values and FCA composite indicator ranking in 2007

2008	FI	DK	NL	PT	SI	FR	PL	UK	AT	EL	IT	IE	BE	LT	BG	LU	SE	ES	SK	EE	DE	HU	CZ
median	1	2	2	3	5	5	5	11	11	9	8	10	16	14	15	15	16	17	18	18	20	21	23
rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

Table 50 – Comparison of median values and FCA composite indicator ranking in 2008

European Commission

EUR 24329 EN – Joint Research Centre – Institute for the Protection and Security of the Citizen
Title: Towards a set of Composite Indicators on Flexicurity: a Comprehensive Approach
Author(s): Anna Rita Manca, Matteo Governatori and Massimiliano Mascherini
Luxembourg: Pubblication Office of the European Union
2010 – 118 pp. – 21 x 29.70 cm
EUR – Scientific and Technical Research series – ISSN 1018-5593
ISBN 978-92-79-15591-8
DOI 10.2788/84431

Abstract
The European Commission's Lisbon Agenda aims to enhance both flexibility and security in the labour markets in order to reconcile competitiveness and sustainable economic growth with more and better jobs and greater social cohesion (COM(2007)359). The pursuit of a balance between flexibility and security addresses simultaneously

-the flexibility of labour markets, work organization and labour relations, and
-security, including employment and social security for weaker groups in and out of the labour market.

This is the concept of flexicurity whereby flexibilisation of employment and labour markets is advocated to support productivity, competitiveness and growth, while security is advocated from a social policy perspective emphasising the importance of preserving social cohesion within society (Wilthagen, 1998).

The approach of flexicurity implies that the policies for more and better jobs are developed in coordination with social partners from both sides, i.e. employees and employers, through public or private partnership and are aimed to ensure security to workers in and out of the labour market reducing risks of social exclusion (Wilthagen and Tros, 2004). Moreover, flexicurity also concerns progress of workers into better jobs, development of talent and support of transitions during life course, e.g. from school to work, from job to job, between unemployment and employment and from work to retirement. Therefore, security implies equipping people with the skills that enable them to progress in their working lives, and helping them find a new job rapidly when unemployed. It is also about adequate unemployment benefits to facilitate transitions towards new jobs. Finally, it encompasses training opportunities for all workers, especially weaker groups such as the low skilled and older workers.

This paper has been developed in this framework and presents the findings of a research project carried out by the Joint Research Centre- (Unit G09-Econometrics and Applied Statistics) and DG Employment (Unit D1 – Employment Analysis) of the European Commission[18]. The project aimed to develop statistical tools to measure flexicurity achievements of EU Member States through a set of four composite indicators corresponding to the four dimensions of flexicurity identified by the Commission (COM(2007)359), i.e.

- Lifelong Learning (LLL),
- Active Labour Market Policies (ALMP),
- Modern Social Security Systems (MSS) and
- Flexible and Reliable Contractual Arrangements (FCA).

[18] "*Statistical analysis in support of Flexicurity policy*", Administrative Arrangements 30566-2007-03 A1CO ISP BE.

This project represents a significant step forward with respect to previous analyses of flexicurity, in many respects:

1. Comprehensiveness. This is by far the broadest numeric analysis of flexicurity to date, covering a much richer range of aspects than all existing work in the literature and hence giving full justice to the multidimensionality of flexicurity both across and within the four dimensions.

2. Soundness and transparency of statistical methodology used. A composite indicator is "a mathematical combination of individual indicators that represent different dimensions of a concept whose description is the objective of the analysis". As flexicurity is a highly multidimensional concept composite indicators appear as the ideal tool to provide a summary measure of it. On the other hand, flexicurity analyses are generally based (Tangian, 2008) on batteries of indicators which are not appropriately integrated so that possibilities for trade-offs, compensating changes and functional equivalents are not fully accounted for.

3. Solid theoretical framework on flexicurity. The framework used to characterise flexicurity builds on previous analysis undertaken by DG EMPL services on measurement of flexicurity (see Employment in Europe 2006 and 2007) and is well rooted on socio-economic and labour market literature. The socio-economic rationale of every input indicator included is thoroughly provided. Moreover, such indicators are often grouped into sub-components based on clear theoretical considerations (e.g. external and internal flexibility within the FCA indicator, or size of unemployment benefits and financial incentives to take up a job within the MSS component). Finally, input indicators contribute to the composite index either with a positive or a negative sign, reflecting their divergent contribution to flexicurity based on theoretical arguments.

This is the first attempt to integrate two parallel but potentially contradictory policy messages on social security systems:

- the need to provide adequate income support to the unemployed and, ,
- the need to reduce financial disincentives to take up jobs for unemployment insurance (UI) recipients.

Indicators for both aspects (respectively, generosity/duration of UI and unemployment/inactivity traps) are included in the MSS index, but with opposite signs. A similar distinction is made, within the FCA index, between strictness of Employment Protection Legislation (EPL) on regular contracts (with negative sign) and the relative strictness of temporary vs. regular contracts (i.e. a measure of labour market segmentation, with a positive sign). All these elements make this exercise much more articulated and subtle than previous attempts to measure flexicurity.

4. Policy relevance: possibility to replicate the exercise for policy monitoring. The Commission has issued several policy recommendations to Member States linked to flexicurity. However, progress cannot be ensured unless a proper framework for monitoring of flexicurity achievements is put in place. Such framework has to be based on indicators which are regularly (i.e. yearly) updated, so that monitoring can be systematically repeated. This issue has been widely debated by EU institutions and a methodology has been endorsed by the EU Employment Committee (EMCO) in 2009. However, no monitoring exercise has been carried out thus far.

5. Robustness of results is extensively assessed. The study does not simply attribute a set of weights and signs to input indicators and aggregate them into composite indicators. Country scores and ranking based on the chosen structure are evaluated against a large set of alternative assumptions in the process of construction of each composite index, such as the exclusion of individual indicators, different weighting systems and different standardisation and aggregation methods, in order to assess the robustness of results. This is shown in annex 2 on uncertainty and sensitivity analysis (Saisana et al., 2005).

How to obtain EU publications

Our priced publications are available from EU Bookshop (http://bookshop.europa.eu), where you can place an order with the sales agent of your choice.

The Publications Office has a worldwide network of sales agents. You can obtain their contact details by sending a fax to (352) 29 29-42758.

The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

LB-NA-24329-EN-C