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Social protection performance in the European Union: comparison and convergence

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Abstract

In this paper we use data on five social inclusion indicators (poverty, inequality, unemployment, education and health) to assess the performance of 15 European welfare states (EU15) over a ten-year period from 1995 to 2004. Aggregate measures of performance are obtained using index number methods similar to those employed in the construction of the widely used Human Development Index (HDI). These are compared with alternative measures derived from data envelopment analysis (DEA) methods. The influence of methodology choice and the assumptions made in scaling indicators upon the results obtained is illustrated and discussed. We also analyse the evolution of performance over time, finding evidence of some convergence in performance and no sign of social dumping.

Keywords: performance measure, best practice frontier, social protection.

JEL Classification: H50, C14, D24

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1. Introduction

The European Union has adopted an interesting and intriguing approach to achieve some kind of convergence in the field of social inclusion. This approach is known as the "Open Method of Coordination" (OMC).[1] This method requires the definition of common objectives and indicators, which are then used to identify best practice performance. Member states thus regularly know how well they are performing relative to the other states. The implication being, that if a particular state is not performing as well as some other states, it will hopefully be pushed by their citizen-voters to improve its performance.[2]

Thanks to the OMC, a variety of comparable and regularly updated indicators have been developed for the appraisal of social protection policies. In this paper we focus our attention on five of the most commonly used indicators, which relate to poverty, inequality, unemployment, education and health. The definitions of the indicators that we use are listed in Table 1. Furthermore, the values of these indicators for 15 European member states[3] are listed in Table A1 in the Appendix for the 10 year period from 1995 to 2004. If we look closely at the 2004 scores in this table it is evident that some countries do well on some indicators but not on others. For example, Spain has a good health indicator but a very bad poverty indicator, while for Luxembourg it is the converse.

Thus, when comparing country *A* with country *B*, we are unable to confidently say that *A* is doing better than *B* unless all five indicators in country *A* are better than (or equal to) those in country *B*. To address this issue we could attempt to construct an aggregate indicator of social protection. Perhaps we could use methods similar to those used in constructing the widely used Human Development Indicator (HDI)?[4] That index involves the scaling of its three composite indicators (education, health and income) so

[1] The open method of coordination is a process where explicit, clear and mutually agreed objectives are defined, after which peer review enables Member States to examine and learn from the best practice in Europe. Commonly agreed upon indicators allow each member state to find out where it stands. The exchange of information is designed with the aim of institutionalizing policy mimicking. (see Pochet, 2005).

[2] OMC is related to yardstick competition. See on this Schleifer (1985). Yardstick competition is a method to overcome the information problems or the monitoring restrictions of the authority (here the European Commission). It rests on comparative welfare evaluation. Accordingly, each national government would exert more effort in order to enhance their performance relative to their neighbours. The discipline effect of comparative performance evaluation is expected to generate a sort of "yardstick competition" among national governments, with politicians mimicking the behavior of nearby governments.

[3] These are the 15 European Union members prior to the enlargement of 2005.

[4] See Anand and Sen (1994).

that they lie between zero and one, where the bounds are set to reflect minimum and maximum targets selected by the authors. The HDI is then constructed as an equal weighted sum of these three scaled indicators.

In this paper we wish to construct an aggregate index of social protection, so that we can address questions such as "Is country *A* doing better than country *B*?" and "Is country *A* improving over time?". Various choices need to be made regarding the methods we use. First, should we use a linear aggregation function as is used in the HDI? Second, how should we scale our indicators – especially those indicators where a higher value is bad (e.g., unemployment)? Third, should we allocate equal weights to each of the five indicators?[5] If not, how should we determine the weights? Should it be based on a survey of experts, as was done in the World Health Organisation health system efficiency project (see WHO, 2000) or could some form of econometric technique be used? Fourth, should we insist that all countries have the same set of weights or should we allow them to differ so as to reflect different priorities in different countries (for example, see the analysis of the WHO data by Lauer *et al.*, 2004)?[6] Fifth, should we include an input measure, such as government expenditure as a share of GDP on these activities, so as to produce a measure of the efficiency of the social protection system instead of just an output index?

Finally, on the basis of data covering 10 years, we wish to see if there is any convergence in social inclusion indicators. More importantly, we want to check whether there is any sign of social dumping. Following the increasing integration of European societies, it is feared that social protection might be subject to a "race to the bottom".[7] As we show convergence is happening and social dumping is not.

The rest of the paper is organised as follows. In the next section we assess the performance of 15 European welfare states for the most recent year, using a number of social indicators. In section 3 we discuss the issue of performance versus efficiency. In section 4 we look at the trend over a period of 10 years. A final section concludes.

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[5] The issues of weights and scaling are of course related.
[6] One could also allow the weights to vary across time periods.
[7] Cremer and Pestieau (2004).

2. Constructing an Aggregate Index

We have selected five indicators among those provided by Eurostat. Our selection was based on two concerns: choosing the most relevant data and making sure that they cover a sufficient number of years (10) and countries (15). The indicators given in Table 1 reflect different facets of social exclusion. Table 1 provides also the coefficient of correlation among these indicators. The first four indicators POV, INE, UNE and EDU are such that we want them as low as possible. EXP (life expectancy) is the only "positive" indicator.

The five indicators listed in Table 1 are measured in different units. Can we normalize them in such a way that they are comparable? The original Human Development Report (HDR, 1990) suggested that the *n*-th indicator (e.g., life expectancy) of the *i*-th country be scaled using

$$x_{ni}^* = \frac{x_{ni} - \min_k \{x_{nk}\}}{\max_k \{x_{nk}\} - \min_k \{x_{nk}\}}, \tag{1}$$

so that for each indicator the highest score is one and the lowest is zero. For “negative” indicators, such as unemployment, where “more is bad”, one could alternatively specify:

$$x_{ni}^* = \frac{\max_k \{x_{nk}\} - x_{ni}}{\max_k \{x_{nk}\} - \min_k \{x_{nk}\}} \tag{2}$$

so that the country with the lowest rate of unemployment will receive a score of one and the one with the highest rate of unemployment will receive zero.

Table 2 gives the normalized indicators for the year 2004, the most recent for which we have data. For each indicator, the performance of each country can be assessed relative to the best practice (the country with a score of one).

Not surprisingly the Nordic countries lead the pack for poverty, Sweden for inequality and both Denmark and Sweden for education. The UK is first for unemployment and Italy for longevity. The worse performers are Portugal for poverty, longevity, education and inequality, and Greece for unemployment.

How can we aggregate these five scaled indicators to obtain an overall assessment of social protection performance? One option is to again follow the HDI method and calculate the raw arithmetic average:

$$SPI1_i = \frac{1}{5}\sum_{n=1}^{5} x_{ni}^{*} \tag{3}$$

This has been done and the values obtained are reported in Table 2. As it appears, Sweden is the best ranked and Portugal last. More generally, at the top one finds the Nordic countries, plus Austria, the Netherlands and Luxembourg, and at the bottom the Southern countries.

Given the observed maximum and minimum values in the 2004 data, we can rewrite equation (3) as

$$SPI1_i = \frac{1}{5}\left[\frac{21 - x_{1i}}{21 - 11} + \frac{7.2 - x_{2i}}{7.2 - 3.3} + \frac{5.6 - x_{3i}}{5.6 - 1.0} + \frac{39.4 - x_{4i}}{39.4 - 8.5} + \frac{x_{5i} - 77.3}{80.7 - 77.3}\right] \tag{4}$$

Taking first derivatives with respect to x_{1i} we obtain:

$$\frac{\partial SPI1_i}{\partial x_{1i}} = \frac{1}{5} \times \frac{-1}{21 - 11} = -0.02\,, \tag{5}$$

and doing the same for the remaining four indicators we obtain –0.05, –0.04, –0.006 and 0.06, respectively.

The ratio of two of these values produces an implicit shadow price ratio

$$\frac{\partial SPI1_i}{\partial x_{ni}} \Bigg/ \frac{\partial SPI1_i}{\partial x_{ji}} = \frac{\partial x_{ji}}{\partial x_{ni}}\,. \tag{6}$$

For example, taking poverty and unemployment we obtain –0.04/(–0.02)=2. That is, the aggregation process implicitly assumes that reducing the long term unemployment rate by one percent is worth the same as a reduction in the poverty rate of two percent. Is this what we expected this index to do? What do these relative weights reflect? Are they meant to reflect our social preference function or do they reflect the relative quantities of resources (public expenditure) that would be needed to achieve these things?

One concern with the above approach is that the implicit weights depend upon the composition of the sample. For example, if some of the more recent EU member states were added to the sample we may find that ranges of some indicators may change and hence the relative sizes of the partial derivatives may also change. This could lead to a change in rankings for some countries.

One way to partially, but not fully, address this issue would be to adopt the approach used by Afonso *et al*. (2005) in an international comparison of public sector efficiency. They addressed the scaling issue by scaling each indicator by its sample mean. In the case of "negative" indicators they inverted them before doing this. This method is likely to be more stable because the sample mean is likely to be less sensitive in the face of sample expansion, relative to the sample range (i.e., max−min).

By calculating the means using the 2004 data, we can rewrite equation (3) as

$$SPI2_i = \frac{1}{5}\left[\frac{1}{0.069x_{1i}} + \frac{1}{0.230x_{2i}} + \frac{1}{0.521x_{3i}} + \frac{1}{0.078x_{4i}} + \frac{x_{5i}}{79.0}\right] \tag{7}$$

Taking first derivatives with respect to x_{1n} we obtain:

$$\frac{\partial SPI2_i}{\partial x_{1i}} = \frac{1}{5} \times \frac{-1}{0.069(x_{1i})^2} = -7.246(x_{1i})^{-2}. \tag{8}$$

This derivative is not a constant (unlike that in equation 5). It is smaller for larger values of the poverty indicator, *ceteris paribus*. One could argue that this is reasonable since the marginal cost of reducing poverty is likely to be large when poverty rates are very small. However, one could alternatively argue that the social value of reducing poverty in that situation is low.

This derivative when evaluated at the sample mean is equal to −0.03. Furthermore, for the remaining four indicators we obtain −0.04, −0.05, −0.010 and 0.003, respectively. The resulting implicit price ratios are not the same as those obtained using the previous method. For example, the poverty and unemployment ratio reduces from 2 to 1.67.

The results of both approaches are reported in Table 2 and Table 3 where we see that the choice of indicator does affect rankings for all but three countries (Sweden, Portugal and Luxembourg). Most movements are small, although France and Ireland both move by three places, which is not insignificant in a table of 15 countries.

Also reported in Table 4 are an additional set of results. These are derived using a method closely related to the HDI approach. The only difference is that instead of using the sample minimum and maximums, alternative "goalposts" are used. This method is explained in more detail shortly.

In Table 7, we give the correlation coefficients for several indexes. The correlation between SPI1 and SPI2 is equal to 0.894. This indicates strong but not perfect correlation between these two indices.

3. Data Envelopment Analysis

In the previous section we show that the above two index construction methods use implicit weights that one could argue are rather arbitrary. One possible solution to this problem is the use of the data envelopment analysis (DEA) method.[8] DEA is traditionally used to measure the technical efficiency scores of a sample of firms. For example, in the case of farming, one would collect data on the inputs and outputs of a sample of farms. Output variables could be wheat and beef, while the input variables could be land, labour, capital, materials and services. The DEA method involves running a sequence of linear programs which fit a production frontier surface over the data points, defined by a collection of intersecting hyper-planes. The DEA method produces a technical efficiency score for each firm in the sample. This is a value between zero and one which reflects the degree to which the firm is near the frontier. A value of one indicates that the firm is on the frontier and is fully efficient, while a value of 0.8 indicates that the firm is producing 80% of its potential output given the input vector it has.[9]

In the case of the production of social protection, we could conceptualise a production process where each country is a "firm" which uses government resources to produce social outputs such as reduced unemployment and longer life expectancies. At this stage

[8] For example, see Coelli et al. (2005) for details of the DEA method.

[9] This is known as an output orientated efficiency score. It reflects the degree to which the output vector of the *i*-th firm can be proportionally expanded (with inputs fixed) while still remaining within the feasible production set defined by the DEA frontier. One can also define input orientated technical efficiency scores, which relate to the degree to which inputs can be contracted (with outputs fixed).

of the paper we will assume that each country has one "government" and hence one unit of input, and it produces the five outputs discussed above.[10]

Given access to data on N inputs and M outputs for each of I countries, a DEA model may be specified as[11]

$$
\begin{aligned}
&\max_{\theta,\lambda} \phi \\
&\text{st} \quad -\phi\mathbf{q}_i + \mathbf{Q}\boldsymbol{\lambda} \geq \mathbf{0}, \\
&\qquad \mathbf{x}_i - \mathbf{X}\boldsymbol{\lambda} \geq \mathbf{0}, \\
&\qquad \boldsymbol{\lambda} \geq \mathbf{0},
\end{aligned} \tag{9}
$$

where $\mathbf{x}_i$ is the input vector of the i-th firm; $\mathbf{q}_i$, is the output vector of the i-th firm; the $N\times I$ input matrix, $\mathbf{X}$, and the $M\times I$ output matrix, $\mathbf{Q}$, represent the data for all I firms; ϕ is a scalar and $\boldsymbol{\lambda}$ is a $I\times 1$ vector of constants. The value of ϕ obtained is the inverse of the efficiency score for the i-th firm. It satisfies: $1\leq\phi\leq\infty$, with a value of 1 indicating a point on the frontier and hence a technically efficient firm. Note that the linear programming problem is solved I times, once for each firm in the sample. A value of ϕ is then obtained for each firm.

In the event that all firms have a single unit of input, which is the case in our situation, the LP in (9) becomes

$$
\begin{aligned}
&\max_{\theta,\lambda} \phi \\
&\text{st} \quad -\phi\mathbf{q}_i + \mathbf{Q}\boldsymbol{\lambda} \geq \mathbf{0}, \\
&\qquad \boldsymbol{\lambda} \geq \mathbf{0},
\end{aligned} \tag{10}
$$

The DEA efficiency scores obtained using the LP in (10), and utilizing the three different input scaling methods, are reported in Table 5. A number of observations can be made. First, we note that the rankings are quite similar across the three sets of DEA results. Second, we observe that in these DEA models approximately 40% of the sample receives an efficiency score of one (indicating that they are fully efficient). This is not unusual in a DEA analysis where the number of dimensions (variables) is large relative to the number of observations. Third, the DEA rankings are "broadly similar" to the

[10] Later in this paper we look at the possibility of measuring the input using government expenditure measures.
[11] This is an output oriented constant returns to scale DEA model. See, for example, Färe *et al.* (1985).

index number rankings. However a few countries do experience large changes, such as Italy which is ranked 12 or 13 in the index numbers but is found to be fully efficient in the DEA results.[12]

Why do we observe differences between the rankings in DEA versus the index numbers? There are two primary reasons. First, the index numbers allocate an equal weight of 1/5 to each indicator while in the DEA method the weights used can vary across the five indicators because they are determined by the slope of the production possibility frontier that is constructed using the LP methods. Second, the implicit weights (or shadow prices) in DEA can also vary from country to country because the slope of the frontier can differ for different output (indicator) mixes.

The shadow price information produced by DEA can be illustrated by considering the dual to the output-oriented DEA LP problem in (9)[13]

$$\begin{aligned} &\min_{\mu,\nu} (\boldsymbol{\nu}'\mathbf{x}_i), \\ &\text{st} \quad \boldsymbol{\mu}'\mathbf{q}_i = 1, \\ &\quad\quad \boldsymbol{\mu}'\mathbf{q}_j - \boldsymbol{\nu}'\mathbf{x}_j \le 0, \quad j=1,2,...,I, \\ &\quad\quad \boldsymbol{\mu}, \boldsymbol{\nu} \ge \mathbf{0}, \end{aligned} \tag{11}$$

where $\boldsymbol{\mu}$ is an $M\times1$ vector of output shadow prices and $\boldsymbol{\nu}$ is a $N\times1$ vector of input shadow prices, which correspond to the M output constraints and N input constraints in the primal LP in (9).[14] Once again, this LP is solved I times (once for each country in the sample) and the technical efficiency score of the i-th country will be equal to $\boldsymbol{\mu}'\mathbf{q}_i/\boldsymbol{\nu}'\mathbf{x}_i$, which will be identical to the ϕ obtained using the primal DEA LP (a standard duality result in linear programming).[15]

If one now considers the case where each country has one unit of a single input, we see that the efficiency score becomes $\boldsymbol{\mu}'\mathbf{q}_i/\nu_1$, which is a simple linear function of the q_i. The

[12] The favourable DEA scores for Italy are due primarily to the fact that it has the best life expectancy score in the sample, which puts it at the edge of the five-dimensional data space and hence gives it a higher likelihood of being found to be efficient because of the convexity of the DEA frontier.

[13] The seminal DEA paper by Charnes, Cooper and Rhodes (1978) used an input-oriented dual formulation.

[14] See Coelli *et al.* (2005, ch. 6) for discussion of primal and dual DEA LPs.

[15] Note that there is no need to solve both the primal and dual LPs. The shadow prices can be obtained directly from the final solution matrix when the primal LP is solved.

elements of μ may be interpreted as normalized shadow prices. Thus the ratio of any two elements of μ can be interpreted in the same way as equation (6) above.

As noted above, the DEA weights can vary from country to country when the output mix varies. For example, consider Figure 1 where we illustrate a simple case where there are six countries with two output indicators. Countries A, B and C define the frontier and hence are fully efficient, while countries D, E and F are inside the frontier and hence inefficient. Country F has a technical efficiency score of 0F/0F*=0.7, indication that it is producing 70% of its potential output. The slope of the frontier is equal to $-\mu_2/\mu_1$. The slope of the line AB is 1 while that of BC is 2. Thus we could say that country F (and country E) allocates weights of 0.33 and 0.67 to outputs 1 and 2, respectively, while country D allocates equal weights of 0.5 to the two outputs.[16]

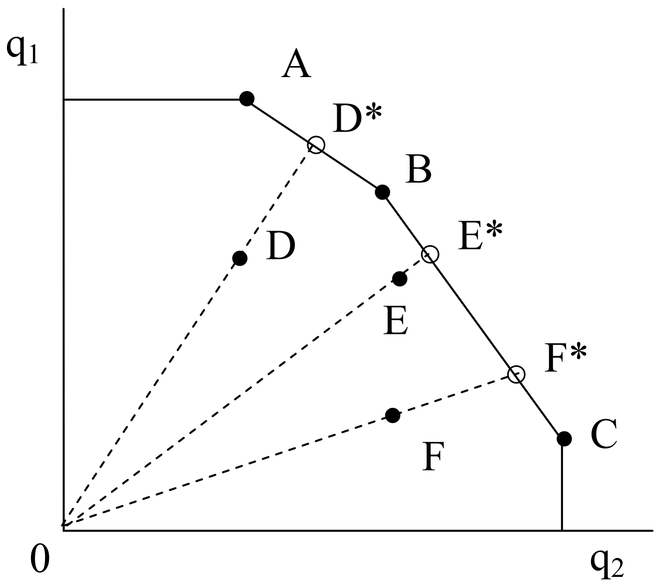

Figure 1: DEA frontier

It is interesting to investigate the degree to which the implicit weights in the DEA models differ from the 1/5 weight used in the index numbers. To investigate this we

[16] We have scaled the weights so that they add up to one to make the discussion more easily comparable to the index numbers above.

have used the shadow price information from the dual DEA LP to obtain implicit price weights for each country, the means of which are listed in Table 6. The first thing we note is that the scaled inequality indicator is given a very small weight in the DEA models. This suggests that a one unit reduction in this indicator will lead to minimal increases in the other indicators (in terms of movement along the surface of the DEA frontier). This may reflect the fact that these countries generally allocate lower priority to income inequality versus the other four indicators considered in this analysis. Otherwise, with the exception of this inequality indicator, the other weights in the *DEA1* model are quite uniform, all being in the region of 1/4.

The weights in the *DEA2* model however are less uniform, with the life expectancy indicator given a large weight of in excess of 0.50. This is likely to be a consequence of the fact that it is the only indicator that was not inverted prior to inclusion in the DEA model. This observation should serve as a warning to others who may apply data transformations to indicators prior to including them in an equal-weighted aggregate index calculation. The choice of what transformation to use (in this case inversion version linear transformation) can have a substantive effect upon the results obtained.

It is also interesting to note that the mean efficiency scores differ between the DEA models. For example, from a mean of 0.921 for *DEA1* to 0.990 for *DEA2*. Unfortunately, the invariance properties of DEA models are not widely recognised. Most standard DEA models are invariant to multiplicative scaling but they are generally not invariant to additive translation or nonlinear transformations, such as inversion. See Lovell and Pastor (1995) for a detailed discussion of scaling and translation invariance properties in DEA models.

The importance of these issues can be illustrated by adjusting the indicator scaling methods used in our *SPI1* according to the advice provided in Anand and Sen (1994). In that paper, the authors note that using in the original HDR (1990) minimum and maximum sample values in the scaling process will be problematic when between year comparisons are made because the minimum and maximum sample values will differ from year to year. They instead suggested the use of “goalpost” values, which reflect their assessments of retrospective and prospective limits. For example, they suggest a range of 35 to 85 for life expectancy and 0 to 100 for education. Using similar logic to theirs we could argue that the ranges for poverty and unemployment should also be 0 to 100. Identifying a range for the inequality indicator is more difficult. Hence we have decided to invert it and multiply it by 100, meaning that it now has a natural range from 0 (the poorest 20% earn nothing) to 100 (the poorest 20% earn the same amount as the richest 20%).

Using these transformations we have produced the *DEA3* results reported in Table 5, where we observe that the ranks are quite similar to those obtained using the *DEA1* model but the magnitude of the scores has changed markedly, from a mean score of 0.921 in *DEA1* to 0.992 for the *DEA3* model.

For completeness, we have also used these "goalpost" scaled indicators to construct an equal-weighted index that we denote *SPI*3. These numbers were presented in Table 4. One item of note is that the mean score for *SPI*3 is 0.754, which is much less than the mean *DEA3* score of 0.992. This discrepancy is due to that fact that *SPI3* is measured relative to a theoretical ideal where we have no unemployment, no poverty, etc., while *DEA3* is measured relative to the current observed best practice.

Given our results, and the fact that the inequality indicator is strongly correlated with the poverty indicator (and has a low weight in the DEA models), we also calculated the DEA measures of performance with the inequality indicator removed. The results we obtain (not reported here) are found to be almost identical to those of Table 5.

In Table 7 we provide sample correlations across our 6 indicators. One observes reasonably strong correlations between all the performance indexes used so far, which is reassuring. Thus, in section 5, when we study the evolution of performance over a decade, we will focus our attention on one set of indicators: *DEA1* and *SPI1*, without the risk of our choice having a large effect on our results.

4. Measuring efficiency with or without inputs

In traditional measures of production efficiency of public services or public utilities, we gather data on both outputs and inputs and construct a best practice frontier using either a parametric (regression) or non-parametric (e.g., DEA) technique. So doing we are able to say that if a production unit has a certain degree of inefficiency, it means that it can do better with the same quantity of inputs or do as well with less inputs. This approach is very useful and should be used to assess the efficiency of the public sector under two key conditions: availability of data and the existence of an underlying technology. For example, measuring the efficiency of railways companies with this approach makes sense. Railways transport people and commodities (hopefully with comfort and punctuality) using a certain number of identifiable inputs.

When dealing with the public sector as a whole and more particularly social protection, one can easily identify its missions: social inclusion in terms of housing, education, health, work and consumption. Yet, it is difficult to relate indicators pertaining to these missions (e.g., our five indicators) to specific inputs. A number of papers[17] use social spending as the input, but one has to realize that for most indicators of inclusion, social spending explains little. For example, it is well known that for health and education factors such as diet and family support are often just as important as public spending. This does not mean that public spending in health and in education is worth nothing; it just means that it is part of a complex process in which other factors play a crucial and complementary role.

In Table 8, we present the DEA measures using social spending as an input[18]. The results are not surprising. Countries that spend little and had a low performance now become the most efficient. This is the case of Ireland and Spain (for *DEA1*). Can we conclude that by spending differently Germany or France would do better? Not necessarily. Doing better can be related to matters independent from social programs: a better diet, a less stressful life, an increased parental investment in education, a more flexible labor market, … For these matters there might be room for public action but not in financial terms.

Does that mean that the financing side does not matter? Not really. It is important to make sure that wastes are minimized, but wastes cannot be measured at such an aggregate level. As a consequence, indicators such as presented in Table 8 have little meaning if any. To evaluate the efficiency slacks of the public sector, it is desirable to analyse micro-components of the welfare states such as schools, hospitals, public

[17] Alonso *et al.* (2006, 2005a,b, 2004).
[18] See Table A2 in the appendix for data on social expenditure by country in the period 1995-2004.

agencies, public institution, railways, etc.[19] [20] At the macro level, one should stop short of measuring technical inefficiency and restrict oneself to performance ranking.

To again use the analogy of a classroom, it makes sense to rank students according to how they perform in a series of exams. Admittedly one can question the quality of tests or the weights used in adding marks from different fields. Yet in general there is little discussion as to the grading of students. At the same time we know that these students may face different "environmental conditions" which can affect their ability to perform.. For example, if we have two students ranked number 1 and 2 and if the latter is forced to work at night to help ailing parents or to commute a long way from home, it is possible that he can be considered as more deserving or meritorious than the number 1 whose material and family conditions are ideal. This being said there exists no ranking of students according to merit. The concept of "merit" is indeed too controversial. By the same token, we should not use social spending as an indicator of the "merit" of social protection systems.

5. Convergence

Up to now we focused on the year 2004. We now use data on five social indicators covering 10 years. It is interesting to see whether or not we observe any trend and particularly any convergence. In other words, do we see that countries that didn't fare well at the beginning of this ten-year period do progressively catch up? To study that evolution, we use our two approaches: average indicator and DEA, but we restrict the analysis to the HDI normalization.

For the average indicator *SPI1*, we have normalized the primary indicators over the whole period. In other words the mark 1 is given to the country and the year that has the best indicator (e.g., the lowest poverty rate) and vice-versa for the mark 0. These normalized indicators are listed in Table A1 in the appendix. Consider the poverty indicator. With the lowest poverty rate we have Sweden in 1995-1999 and Finland in 1995-1997. Their normalized indicator is thus 1. The highest poverty rate is in Portugal in 1995. Summing up these normalized indicators and dividing by 5, we obtain an

[19] For example, see Pestieau and Tulkens (1993).
[20] See Ravaillon (2005) for discussion of this issue.

average indicator for each country and each year. These are presented in Table 9 and Figure 2.

In Figure 2 it is evident that in all countries (except Sweden) there has been a sharp improvement, particularly among the lagging countries: Spain, Ireland and Portugal. This seems to indicate some catching up with the best student of the "European class", namely Sweden. To check whether there is convergence, one can regress the variation in the indicator at hand, here *SPI1*, against its value in 1995. The results of this regression are presented in Figure 3. As we can see, with a slope coefficient of -1.27 and an R^2 of 0.8, we have clear convergence.[21]

DEA technical efficiency measures for each year are reported in Table 9. Here too we can see that many countries with a score below 1 improve over the 10-year period. However we have to keep in mind that these DEA technical efficiency measures are relative to a best practice frontier that is constructed using data only from the year at hand. Hence, movements in this frontier from year to year are not captured by the technical efficiency measure.

In other words, the performance of a country over time can be decomposed in two elements. Take two countries *A* and *B*, and two years. *A* is on the frontier in the two years, but it is doing better from one year to the other, which means that the frontier moves up. We look at the performance of *B* with respect to that moving best practice frontier; we can decompose it into (i) the change in distance with respect to the best practice frontier, (ii) the change of the best practice frontier itself. Table 9 is only concerned with the first change.

To decompose the two types of changes, we use a technique that is used in production theory. It rests on the Malmquist index that gives the rate at which the frontier moves up and the rate at which the distance to the frontier changes over time.[22] Table 10 gives the yearly changes and the average change. The countries with the lowest average increase are the three Nordic countries that are also those with the highest levels.

[21] For the SPI and the DEA we have tested the case of convergence for the 3 types of scaling. However we only report here the results pertaining to the first type. The other results are available on request.
[22] See Coelli *et al.* (2005) for details.

The indicators presented on Table 10 can be decomposed in a change in the frontier (Technical change) and a change in the distance to the frontier (Efficiency change).[23] Those two components are given in Table A3 in the appendix.

As with the indicator *SP11*, we wish to check whether or not there is some catching up with our *DEA1* measure. In Figure 4 we regress average Malmquist measure of performance growth against the DEA1 measure in 1995. As we can see, there is convergence with a R^2 = 0.58. When we only consider the variation in "technical efficiency" the convergence appears to be stronger with a R^2 = 0.95 as it appears on Figure 5. This seems to imply that relative to their own best practice frontier, European countries tend to converge unambiguously.

6. Conclusions

The purpose of this paper was to present some guidelines as to the question of measuring the performance of social protection. We believe that such measurement is unavoidable for two reasons. First, people constantly compare welfare states on the basis of questionable indicators. Second, a good measure can induce national governments that are not well ranked to get closer to the best practice frontier. This is the spirit of the European OMC (Open Method of Coordination) that has lead to the annual publication of indicators of social inclusion for the EU member countries.

In this paper we propose two approaches: one based on a simple average of partial indicators and the other based on Data Envelopment Analysis. The advantage of DEA is to provide flexible and endogenous weights for our inclusion indicators. Another issue we deal with is that of normalization. We show that our results are somehow sensitive to the scaling indicators. We consider three types of scaling and do not have solid grounds to prefer one over the other. All of them imply that our two performance measures, the sum of partial indicators and the DEA, violate the principle of independence of irrelevant alternatives. The three scaling techniques we discuss lead to scores that are closely related and for most of the ensuing discussion we use the first scaling, that with a range (0,1).

[23] The formula is given by Malmquist + 1 = (efficiency change + 1) * (technical change + 1).

DEA scores look higher because they are relative to observed best practices and not to a theoretical benchmark like the index numbers.

We then discuss two questions: (i) do we have to limit ourselves to a simple performance comparison or can we conduct an efficiency study? (ii) how does our performance measure evolves over time? Do we witness any race to the bottom? Even though we realize that our performance measures depend on the resources invested by the state to finance alternative social protection programs, we deliberately restrict ourselves to performance comparison and do not want to calculate efficiency measures as it is usually done for micro-units. The reason is simple: the link between public spending and most of our inclusion indicators is not clear and does not reveal a clear-cut production technology. More concretely, factors that can affect performance are missing. For example, climate can affect health and social attitudes can affect education.

Another finding of our paper is that there appears to be some clear convergence in performance among European countries, suggesting that the Open Method of Coordination may be achieving its desired outcome. This latter result is pretty interesting. There is so much talk of social dumping and race to the bottom that it comforting to realize that most countries perform better and in a converging way.

The fact that even with an enlarged measure of social inclusion the Nordic countries lead the pack is not surprising. It is neither surprising to see that Mediterranean countries are not doing well. What is surprising is to see that with such an enlarged concept Anglo-Saxon welfare states do as well as the Continental welfare states such as Germany and France.

As a final comment let us come back to the selection of social inclusion indicators. The gist of this paper is to measure the performance of social protection on the basis of its two main objectives: poverty and inequality reduction and protection against lifetime risks. If there were no problem with data availability, the indicators we would like to use would primarily concern the distribution of individual welfare over the lifecycle and across individuals. That ideal measure of welfare would include consumption, education, health and employment. Unfortunately, such evidence does not exist for the EU15 over a sufficiently long period. Hence, we had to resort to the indicators made available in the framework of the OMC.

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Table 1: Indicators of exclusion. Definitions and correlations

	Definition
POV :	<u>At-risk-of-poverty rate</u> after social transfers as defined as the share of persons with an equivalised disposable income below the risk-of-poverty threshold, which is set at 60% of the national median equivalised disposable income (after social transfers).
INE :	<u>Inequality</u> of income distribution as defined as the ratio of total income received by the 20% of the population with the highest income (top quintile) to that received by the 20% of the population with the lowest income (lowest quintile). Income must be understood as equivalised disposable income.
UNE :	<u>Long term unemployed</u> (12 months or longer) as a share of the total active population harmonised with national monthly unemployment estimates.
EDU :	<u>Early school leavers</u> as the percentage of the population aged 18-24 with at most lower secondary education and not in further education or training.
EXP :	<u>Life expectancy</u> as the number of years a person may be expected to live, starting at age 0.

	Correlation				
	POV	INE	UNE	EDU	EXP
POV	1.000				
INE	0.912	1.000			
UNE	0.420	0.409	1.000		
EDU	0.668	0.782	0.252	1.000	
EXP	-0.069	-0.098	0.084	-0.203	1.000

Source: the five indicators are taken from the Eurostat database on Laeken indicators (2007).

Table 2: HDI normalization and *SPI1* - 2004

	POV	INE	UNE	EDU	EXP	*SPI1*	Rank
AT	0.80	0.87	0.93	0.99	0.57	0.83	2
BE	0.60	0.82	0.33	0.89	0.53	0.63	8
DE	0.50	0.72	0.04	0.88	0.58	0.54	10
DK	1.00	0.97	0.96	1.00	0.07	0.80	4
ES	0.10	0.54	0.48	0.25	0.91	0.46	13
FI	1.00	0.95	0.76	0.99	0.00	0.74	6
FR	0.70	0.77	0.37	0.82	0.87	0.70	7
GR	0.10	0.31	0.00	0.79	0.51	0.34	14
IE	0.00	0.56	0.87	0.86	0.35	0.53	11
IT	0.20	0.41	0.35	0.55	1.00	0.50	12
LU	1.00	0.90	0.98	0.86	0.35	0.82	3
NL	0.90	0.82	0.87	0.82	0.54	0.79	5
PT	0.00	0.00	0.57	0.00	0.00	0.11	15
SE	1.00	1.00	0.96	1.00	0.90	0.97	1
UK	0.30	0.49	1.00	0.79	0.47	0.61	9
Mean	0.55	0.68	0.63	0.77	0.51	0.63	

Table 3: Afonso *et al.* normalization and *SPI2* - 2004

	POV	INE	UNE	EDU	EXP	*SPI2*	Rank
AT	1.12	1.14	1.48	1.48	1.00	1.25	4
BE	0.97	1.09	0.47	1.08	1.00	0.92	9
DE	0.91	0.99	0.36	1.06	1.00	0.86	11
DK	1.33	1.28	1.60	1.52	0.98	1.34	2
ES	0.73	0.85	0.56	0.41	1.02	0.71	14
FI	1.33	1.24	0.91	1.48	0.98	1.19	5
FR	1.04	1.04	0.49	0.91	1.02	0.90	10
GR	0.73	0.72	0.34	0.86	1.00	0.73	12
IE	0.69	0.87	1.20	1.00	0.99	0.95	8
IT	0.77	0.78	0.48	0.58	1.02	0.72	13
LU	1.33	1.17	1.75	1.01	0.99	1.25	3
NL	1.22	1.09	1.20	0.92	1.00	1.08	6
PT	0.69	0.60	0.64	0.33	0.98	0.65	15
SE	1.33	1.32	1.60	1.50	1.02	1.35	1
UK	0.81	0.82	1.92	0.86	1.00	1.08	7
Mean	1.000	1.000	1.000	1.000	1.000	1.000	

Table 4: "Goalpost" normalization and *SPI3* - 2004

	POV	INE	UNE	EDU	EXP	*SPI3*	Rank
AT	0.870	0.263	0.987	0.913	0.885	0.784	3
BE	0.850	0.250	0.959	0.881	0.882	0.764	8
DE	0.840	0.227	0.946	0.879	0.885	0.755	9
DK	0.890	0.294	0.988	0.915	0.851	0.788	2
ES	0.800	0.196	0.966	0.683	0.908	0.711	14
FI	0.890	0.286	0.979	0.913	0.846	0.783	4
FR	0.860	0.238	0.961	0.858	0.905	0.764	7
GR	0.800	0.167	0.944	0.851	0.881	0.729	12
IE	0.790	0.200	0.984	0.871	0.870	0.743	11
IT	0.810	0.179	0.960	0.777	0.914	0.728	13
LU	0.890	0.270	0.989	0.873	0.870	0.778	5
NL	0.880	0.250	0.984	0.860	0.883	0.771	6
PT	0.790	0.139	0.970	0.606	0.846	0.670	15
SE	0.890	0.303	0.988	0.914	0.907	0.800	1
UK	0.820	0.189	0.990	0.851	0.878	0.746	10
Mean	0.845	0.230	0.973	0.843	0.881	0.754	

Table 5: DEA efficiency scores. 2004

	DEA1		*DEA2*		*DEA3*	
	Scores	rank	Scores	rank	Scores	rank
AT	0.995	7	0.988	9	0.999	7
BE	0.892	12	0.983	12	0.972	14
DE	0.886	13	0.984	10	0.975	13
DK	1.000	1	1.000	1	1.000	1
ES	0.939	8	0.997	7	0.996	8
FI	1.000	1	1.000	1	1.000	1
FR	0.937	9	0.997	7	0.995	9
GR	0.795	14	0.981	13	0.969	15
IE	0.900	10	0.976	14	0.995	10
IT	1.000	1	1.000	1	1.000	1
LU	1.000	1	1.000	1	1.000	1
NL	0.900	10	0.984	10	0.995	10
PT	0.565	15	0.959	15	0.980	12
SE	1.000	1	1.000	1	1.000	1
UK	1.000	1	1.000	1	1.000	1
Mean	0.921		0.990		0.992	

Note: DEA1, DEA2 and DEA3 results correspond to HDI, Afonso *et al.* and "goalspot" normalization data respectively.

Table 6: Means of the DEA implicit weights

	POV	INE	UNE	EDU	EXP
DEA1	0.267	0.005	0.237	0.306	0.185
DEA2	0.215	0.005	0.157	0.057	0.566
DEA3	0.205	0.067	0.351	0.013	0.364

Table7: Correlations between indexes

	SPI1	*SPI2*	*SPI3*	*DEA1*	*DEA2*	*DEA3*
SPI1	1.000					
SPI2	0.894	1.000				
SPI3	0.959	0.883	1.000			
DEA1	0.801	0.643	0.750	1.000		
DEA2	0.669	0.517	0.598	0.903	1.000	
DEA3	0.583	0.576	0.405	0.679	0.656	1.000

Table 8: DEA efficiency scores with social expenditures as input. 2004

	DEA1 Scores	rank	*DEA2* Scores	rank	*DEA3* Scores	rank
AT	0.917	8	0.882	6	0.759	7
BE	0.809	12	0.719	10	0.717	9
DE	0.769	13	0.635	14	0.625	15
DK	0.824	11	0.903	5	0.801	5
ES	1.000	1	0.879	7	0.887	4
FI	0.943	6	1.000	1	0.895	3
FR	0.924	7	0.651	13	0.644	14
GR	0.752	14	0.669	12	0.662	13
IE	1.000	1	1.000	1	1.000	1
IT	0.988	5	0.688	11	0.684	10
LU	1.000	1	1.000	1	1.000	1
NL	0.864	9	0.762	9	0.738	8
PT	0.444	15	0.676	15	0.683	11
SE	1.000	1	0.837	8	0.770	6
UK	0.825	10	0.945	4	0.671	12
Mean	0.871		0.816		0.769	

Note: DEA1, DEA2 and DEA3 results correspond to HDI, Afonso *et al.* and “goalspot” normalization data respectively.

Table 9: Average indicator (*SPI1*) and DEA measures (*DEA1*) - 1995-2004

	DEA1										*SPI1*									
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AT	1.000	1.000	1.000	0.998	1.000	1.000	0.995	0.979	1.000	1.000	0.694	0.703	0.745	0.764	0.774	0.805	0.817	0.806	0.797	0.813
BE	0.780	0.928	0.887	0.839	0.869	0.917	0.871	0.894	0.889	0.915	0.532	0.583	0.620	0.610	0.635	0.670	0.699	0.685	0.692	0.699
DE	0.820	0.932	0.890	0.871	0.882	1.000	0.909	0.894	0.884	0.904	0.578	0.622	0.668	0.697	0.708	0.745	0.753	0.656	0.651	0.646
DK	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.748	0.733	0.761	0.780	0.783	0.793	0.814	0.796	0.757	0.799
ES	0.500	0.509	0.457	0.462	0.493	0.590	0.680	0.687	0.701	0.744	0.285	0.328	0.319	0.402	0.435	0.505	0.509	0.538	0.560	0.547
FI	1.000	1.000	1.000	1.000	1.000	1.000	0.968	1.000	1.000	1.000	0.723	0.734	0.762	0.769	0.753	0.774	0.770	0.783	0.803	0.766
FR	0.770	0.843	0.833	0.808	0.835	0.866	0.882	0.912	0.913	0.851	0.613	0.628	0.640	0.652	0.660	0.682	0.752	0.771	0.762	0.738
GR	0.653	0.723	0.706	0.692	0.765	0.776	0.774	0.787	0.840	0.830	0.381	0.403	0.406	0.386	0.402	0.441	0.465	0.445	0.424	0.496
IE	0.929	0.939	0.976	1.000	1.000	1.000	0.958	0.941	0.942	0.949	0.354	0.386	0.423	0.461	0.506	0.537	0.568	0.578	0.590	0.599
IT	0.459	0.459	0.470	0.520	0.571	0.609	0.592	0.585	0.613	0.686	0.350	0.372	0.417	0.462	0.493	0.530	0.531	0.539	0.540	0.583
LU	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.602	0.617	0.667	0.683	0.721	0.760	0.749	0.769	0.800	0.802
NL	0.869	0.850	0.956	0.989	0.979	0.996	1.000	1.000	0.990	0.948	0.676	0.657	0.756	0.775	0.760	0.758	0.778	0.781	0.770	0.782
PT	1.000	1.000	1.000	1.000	1.000	0.976	1.000	0.969	0.938	1.000	0.178	0.234	0.235	0.246	0.291	0.323	0.340	0.306	0.331	0.298
SE	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.882	0.884	0.890	0.886	0.917	0.873	0.905	0.884	0.901	0.905
UK	0.788	0.811	0.849	0.909	0.921	0.928	0.935	0.961	0.979	1.000	0.403	0.470	0.522	0.518	0.541	0.572	0.589	0.592	0.617	0.643

Table 10: Malmquist indices

	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	Average
AT	-1.2%	0.1%	0.4%	0.8%	1.2%	0.9%	-1.1%	-0.1%	0.1%	0.1%
BE	5.4%	0.0%	-5.4%	-2.0%	5.4%	-3.8%	3.7%	-1.4%	2.7%	0.4%
DE	-0.4%	-0.8%	-2.5%	-1.0%	7.3%	-6.2%	-5.8%	-1.4%	1.8%	-1.1%
DK	-6.6%	-1.3%	-2.8%	-1.3%	-2.8%	1.2%	-3.6%	-3.8%	-0.6%	-2.4%
ES	-3.2%	-11.5%	-1.7%	5.4%	19.1%	15.3%	0.0%	0.0%	4.4%	2.7%
FI	-0.8%	1.6%	-2.8%	-4.9%	0.9%	-2.7%	0.6%	0.8%	2.1%	-0.6%
FR	0.8%	0.9%	-2.2%	0.9%	2.9%	0.4%	2.3%	0.6%	-7.2%	-0.1%
GR	1.4%	0.9%	-1.5%	4.8%	1.2%	2.5%	2.8%	3.8%	-0.5%	1.7%
IE	-3.8%	-2.1%	-3.2%	3.0%	-6.0%	-10.1%	-4.2%	-1.7%	-0.4%	-3.2%
IT	-6.0%	0.5%	8.5%	9.8%	4.2%	-0.4%	-4.2%	3.7%	11.5%	2.9%
LU	0.7%	-0.3%	-0.3%	1.7%	1.3%	-0.2%	-1.0%	3.2%	-4.5%	0.0%
NL	-2.5%	13.7%	4.9%	0.5%	3.6%	1.5%	-0.9%	-2.8%	-6.0%	1.2%
PT	1.3%	-6.1%	-4.3%	-2.0%	-7.2%	-5.4%	-7.5%	-3.2%	2.9%	-3.5%
SE	-0.5%	-0.5%	-1.2%	1.9%	-5.7%	1.8%	-8.0%	-0.4%	-0.5%	-1.5%
UK	1.6%	4.6%	7.4%	2.3%	2.0%	0.6%	1.8%	-0.2%	0.7%	2.3%

Figure 2: Average indicator SPI1 1995-2004

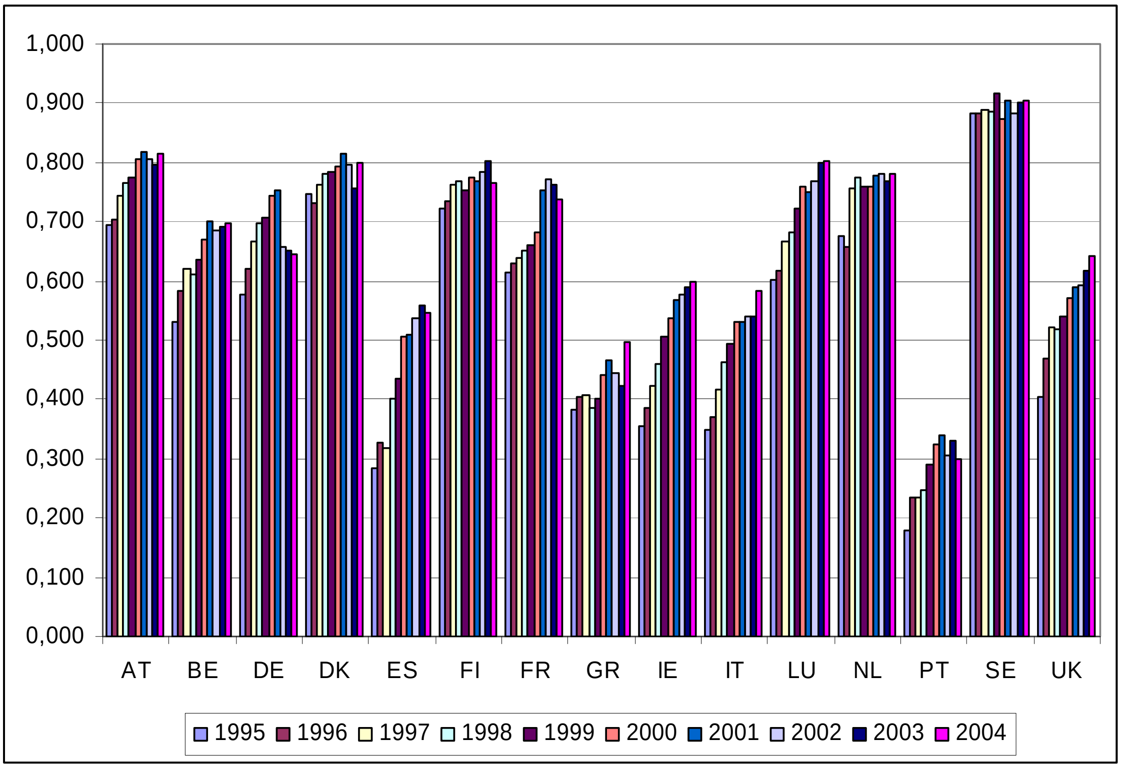


Figure 3: Convergence of SPI1

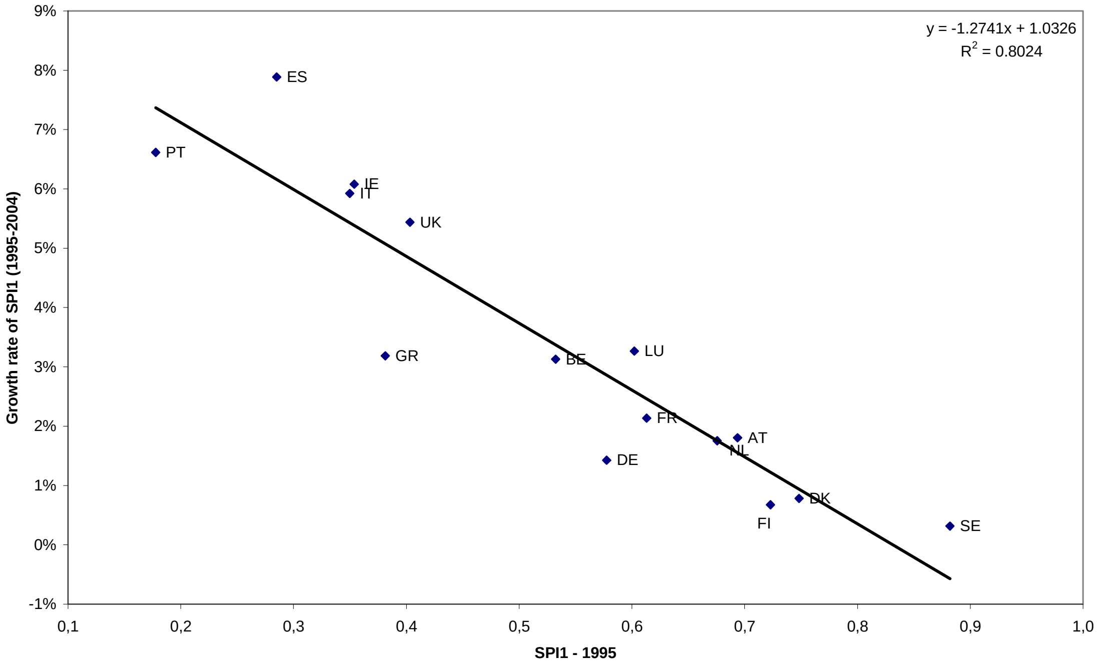


Figure 4: Convergence of *DEA1* according to Malmquists change

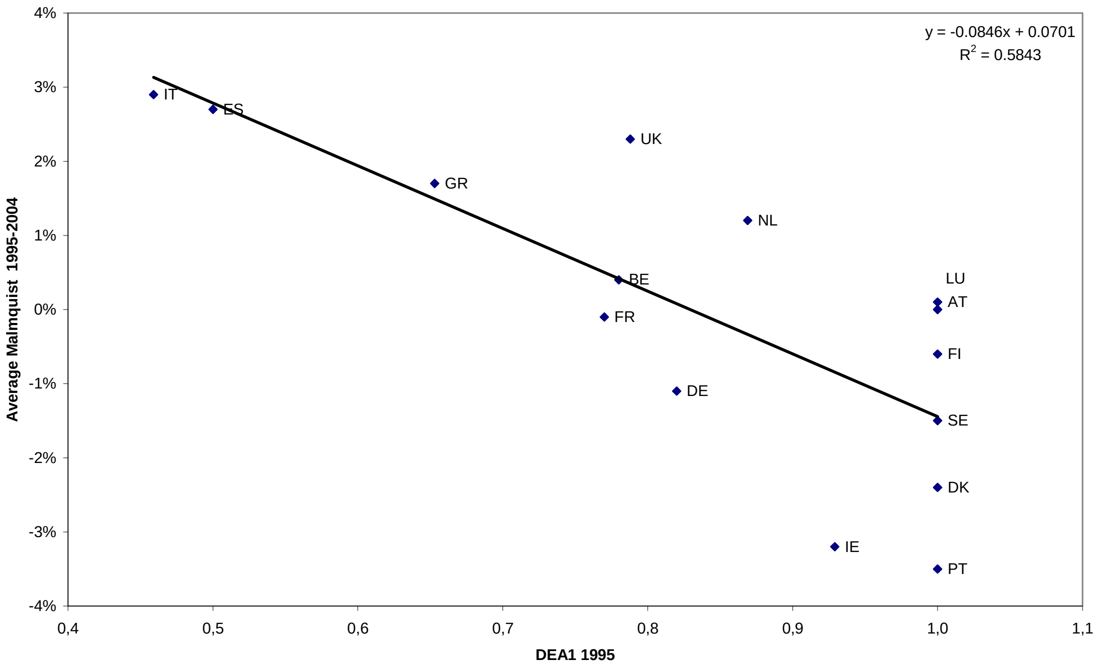
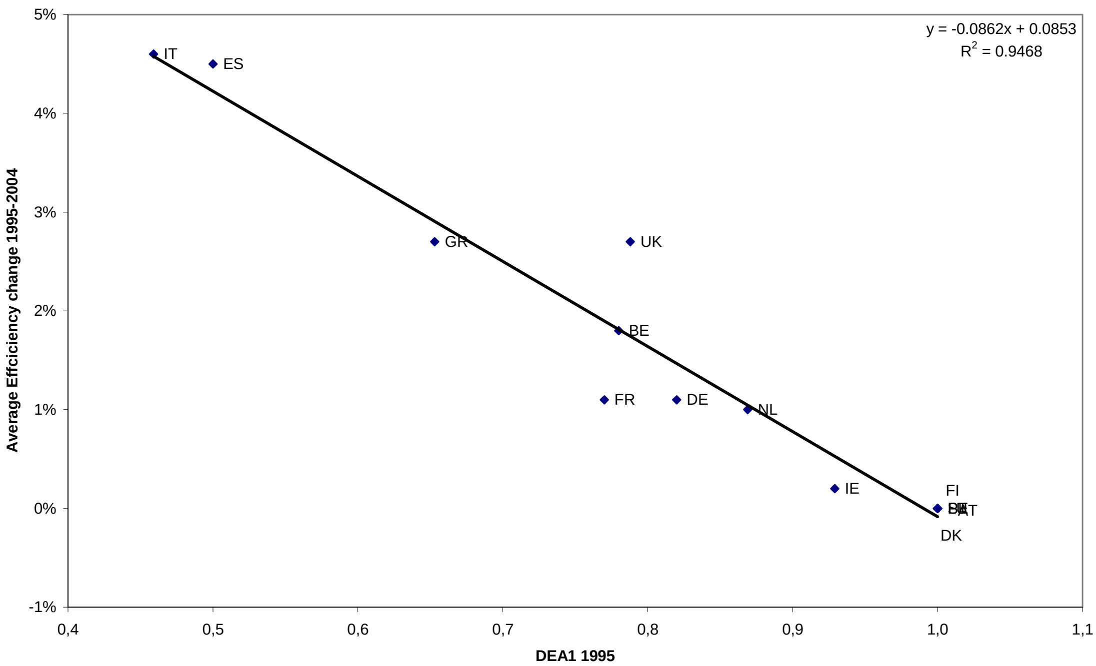


Figure 5: Convergence of *DEA1* according to "technical efficiency" change



Appendix

Table A2: Social spending

Country	Social spending as a % of GDP									
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AT	28.7	28.6	28.6	28.3	28.7	28.2	28.6	29.1	29.5	29.1
BE	27.4	28	27.4	27.1	27	26.5	27.3	28	29.1	29.3
DE	28.2	29.3	28.9	28.8	29.2	29.2	29.3	29.9	30.2	30.7
DK	31.9	31.2	30.1	30	29.8	28.9	29.2	29.7	30.7	30.7
ES	21.6	21.5	20.8	20.2	19.8	19.7	19.5	19.8	19.9	20
FI	31.5	31.4	29.1	27	26.2	25.1	24.9	25.6	26.5	26.7
FR	30.3	30.6	30.4	30	29.9	29.5	29.6	30.4	30.9	31.2
GR	22.3	22.9	23.3	24.2	25.5	25.7	26.7	26.2	26	26
IE	18.8	17.6	16.4	15.2	14.6	14.1	15	16	16.5	17
IT	24.2	24.3	24.9	24.6	24.8	24.7	24.9	25.3	25.8	26.1
LU	20.7	21.2	21.5	21.2	20.5	19.6	20.8	21.4	22.2	22.6
NL	30.6	29.6	28.7	27.8	27.1	26.4	26.5	27.6	28.3	28.5
PT	21	20.2	20.3	20.9	21.4	21.7	22.7	23.7	24.2	24.9
SE	34.3	33.6	32.7	32	31.7	30.7	31.3	32.3	33.3	32.9
UK	28.2	28	27.5	26.9	26.4	27.1	27.5	26.4	26.4	26.3

Source: Eurostat (2007).

Table A1: Social cohesion indicators

	Primary indicators					HDR normalization				
	POV	INE	UNE	EDU	EXP	POV	INE	UNE	EDU	EXP
1995										
AT	13	4.0	1.0	13.6	76.7	0.67	0.76	0.96	0.81	0.73
BE	16	4.5	5.8	15.1	76.9	0.47	0.64	0.46	0.78	0.69
DE	15	4.6	3.9	13.5	76.6	0.53	0.62	0.66	0.82	0.75
DK	10	2.9	2.0	6.1	75.3	0.87	1.00	0.86	1.00	0.98
ES	19	5.9	10.3	33.8	78.0	0.27	0.33	0.00	0.32	0.49
FI	8	3.0	5.3	11.5	76.6	1.00	0.98	0.52	0.87	0.75
FR	15	4.5	4.4	15.4	78.0	0.53	0.64	0.61	0.77	0.49
GR	22	6.5	4.6	22.4	77.7	0.07	0.20	0.59	0.60	0.55
IE	19	5.1	7.6	21.4	75.7	0.27	0.51	0.28	0.62	0.91
IT	20	5.9	7.1	32.8	78.2	0.20	0.33	0.33	0.34	0.45
LU	12	4.3	0.7	33.4	76.7	0.73	0.69	0.99	0.33	0.73
NL	11	4.2	3.1	18.0	77.5	0.80	0.71	0.74	0.71	0.58
PT	23	7.4	3.1	41.4	75.3	0.00	0.00	0.74	0.13	0.98
SE	8	3.0	2.3	8.0	78.8	1.00	0.98	0.82	0.95	0.35
UK	20	5.2	3.5	32.3	76.7	0.20	0.49	0.70	0.35	0.73
1996										
AT	14	3.8	1.2	12.1	77.0	0.60	0.80	0.94	0.85	0.67
BE	15	4.2	5.7	12.9	77.2	0.53	0.71	0.47	0.83	0.64
DE	14	4.0	4.1	13.3	76.8	0.60	0.76	0.64	0.82	0.71
DK	10	3.0	1.8	12.1	75.7	0.87	0.98	0.88	0.85	0.91
ES	18	6.0	9.4	31.4	78.1	0.33	0.31	0.09	0.38	0.47
FI	8	3.0	5.2	11.1	76.8	1.00	0.98	0.53	0.88	0.71
FR	15	4.3	4.5	15.2	78.2	0.53	0.69	0.60	0.78	0.45
GR	21	6.3	5.2	20.7	77.8	0.13	0.24	0.53	0.64	0.53
IE	19	5.1	7.0	18.9	75.9	0.27	0.51	0.34	0.68	0.87
IT	20	5.6	7.3	31.7	78.4	0.20	0.40	0.31	0.37	0.42
LU	11	4.0	0.8	35.3	76.7	0.80	0.76	0.98	0.28	0.73
NL	12	4.4	3.0	17.6	77.5	0.73	0.67	0.75	0.72	0.58
PT	21	6.7	3.3	40.1	75.2	0.13	0.16	0.72	0.16	1.00
SE	8	3.0	2.7	7.5	79.0	1.00	0.98	0.78	0.97	0.31
UK	18	5.0	3.1	29.2	76.9	0.33	0.53	0.74	0.43	0.69
1997										
AT	13	3.6	1.3	10.8	77.4	0.67	0.84	0.93	0.88	0.60
BE	14	4.0	5.4	12.7	77.4	0.60	0.76	0.51	0.84	0.60
DE	12	3.7	4.6	12.9	77.2	0.73	0.82	0.59	0.83	0.64
DK	10	2.9	1.5	10.7	76.0	0.87	1.00	0.91	0.89	0.85
ES	20	6.5	8.7	30.0	78.6	0.20	0.20	0.16	0.41	0.38
FI	8	3.0	4.9	8.1	77.0	1.00	0.98	0.56	0.95	0.67
FR	15	4.4	4.7	14.1	78.6	0.53	0.67	0.58	0.80	0.38
GR	21	6.6	5.3	19.9	78.2	0.13	0.18	0.52	0.66	0.45
IE	19	5.0	5.6	18.9	76.0	0.27	0.53	0.48	0.68	0.85
IT	19	5.3	7.3	30.1	78.7	0.27	0.47	0.31	0.41	0.36
LU	11	3.6	0.9	30.7	77.0	0.80	0.84	0.97	0.39	0.67
NL	10	3.6	2.3	16.0	77.9	0.87	0.84	0.82	0.76	0.51
PT	22	6.7	3.2	40.6	75.6	0.07	0.16	0.73	0.15	0.93
SE	8	3.0	3.1	6.8	79.3	1.00	0.98	0.74	0.98	0.25
UK	18	4.7	2.5	26.0	77.2	0.33	0.60	0.80	0.51	0.64
1998										
AT	13	3.5	1.3	10.7	77.8	0.67	0.87	0.93	0.89	0.53
BE	14	4.0	5.6	14.5	77.5	0.60	0.76	0.48	0.79	0.58
DE	11	3.6	4.5	13.9	77.6	0.80	0.84	0.60	0.81	0.56
DK	10	3.0	1.3	9.8	76.4	0.87	0.98	0.93	0.91	0.78
ES	18	5.9	7.5	29.6	78.7	0.33	0.33	0.29	0.42	0.36
FI	9	3.1	4.1	7.9	77.2	0.93	0.96	0.64	0.96	0.64
FR	15	4.2	4.5	14.9	78.7	0.53	0.71	0.60	0.78	0.36
GR	21	6.5	5.8	20.7	77.9	0.13	0.20	0.46	0.64	0.51
IE	19	5.2	3.9	18.0	76.2	0.27	0.49	0.66	0.71	0.82
IT	18	5.1	6.8	28.4	78.8	0.33	0.51	0.36	0.45	0.35
LU	12	3.7	0.9	25.2	77.2	0.73	0.82	0.97	0.53	0.64

	Primary indicators					HDR normalization				
	POV	INE	UNE	EDU	EXP	POV	INE	UNE	EDU	EXP
NL	10	3.6	1.5	15.5	77.9	0.87	0.84	0.91	0.77	0.51
PT	21	6.8	2.2	46.6	75.9	0.13	0.13	0.84	0.00	0.87
SE	8	3.4	2.6	6.9	79.4	1.00	0.89	0.79	0.98	0.24
UK	19	5.2	1.9	22.9	77.3	0.27	0.49	0.87	0.59	0.62
1999										
AT	12	3.7	1.2	10.7	77.9	0.73	0.82	0.94	0.89	0.51
BE	13	4.2	4.8	15.2	77.7	0.67	0.71	0.57	0.78	0.55
DE	11	3.6	4.1	14.9	77.8	0.80	0.84	0.64	0.78	0.53
DK	10	3.0	1.1	11.5	76.6	0.87	0.98	0.95	0.87	0.75
ES	19	5.7	5.7	29.5	78.7	0.27	0.38	0.47	0.42	0.36
FI	11	3.4	3.0	9.9	77.5	0.80	0.89	0.75	0.91	0.58
FR	15	4.4	4.1	14.7	78.9	0.53	0.67	0.64	0.79	0.33
GR	21	6.2	6.5	18.6	78.1	0.13	0.27	0.39	0.69	0.47
IE	19	4.9	2.4	17.1	76.1	0.27	0.56	0.81	0.73	0.84
IT	18	4.9	6.7	27.2	79.2	0.33	0.56	0.37	0.48	0.27
LU	13	3.9	0.7	19.1	77.9	0.67	0.78	0.99	0.68	0.51
NL	11	3.7	1.2	16.2	77.9	0.80	0.82	0.94	0.75	0.51
PT	21	6.4	1.8	44.9	76.2	0.13	0.22	0.88	0.04	0.82
SE	8	3.1	1.9	6.9	79.5	1.00	0.96	0.87	0.98	0.22
UK	19	5.2	1.7	19.7	77.4	0.27	0.49	0.89	0.66	0.60
2000										
AT	12	3.4	1.0	10.2	78.2	0.73	0.89	0.96	0.90	0.45
BE	13	4.3	3.7	12.5	77.8	0.67	0.69	0.68	0.84	0.53
DE	10	3.5	3.7	14.9	78.1	0.87	0.87	0.68	0.78	0.47
DK	10	3.1	0.9	11.6	76.9	0.87	0.96	0.97	0.86	0.69
ES	18	5.4	4.6	29.1	79.2	0.33	0.44	0.59	0.43	0.27
FI	11	3.3	2.8	8.9	77.7	0.80	0.91	0.77	0.93	0.55
FR	16	4.2	3.5	13.3	79.1	0.47	0.71	0.70	0.82	0.29
GR	20	5.8	6.2	18.2	78.1	0.20	0.36	0.42	0.70	0.47
IE	20	4.7	1.6	16.2	76.5	0.20	0.60	0.90	0.75	0.76
IT	18	4.8	6.3	25.3	79.6	0.33	0.58	0.41	0.53	0.20
LU	12	3.7	0.6	16.8	78.0	0.73	0.82	1.00	0.74	0.49
NL	11	4.1	0.8	15.5	78.0	0.80	0.73	0.98	0.77	0.49
PT	21	6.4	1.7	42.6	76.7	0.13	0.22	0.89	0.10	0.73
SE	11	3.5	1.4	7.7	79.7	0.80	0.87	0.92	0.96	0.18
UK	19	5.2	1.4	18.4	77.9	0.27	0.49	0.92	0.70	0.51
2001										
AT	12	3.5	0.9	10.2	78.6	0.73	0.87	0.97	0.90	0.38
BE	13	4	3.2	13.6	78.1	0.67	0.76	0.73	0.81	0.47
DE	11	3.6	3.7	12.5	78.5	0.80	0.84	0.68	0.84	0.40
DK	10	3	0.9	9.0	77.0	0.87	0.98	0.97	0.93	0.67
ES	19	5.5	3.7	29.2	79.3	0.27	0.42	0.68	0.43	0.25
FI	11	3.7	2.5	10.3	78.1	0.80	0.82	0.80	0.90	0.47
FR	13	3.9	3.0	13.5	79.3	0.67	0.78	0.75	0.82	0.25
GR	20	5.7	5.5	17.3	78.1	0.20	0.38	0.49	0.72	0.47
IE	21	4.5	1.3	15.3	77.2	0.13	0.64	0.93	0.77	0.64
IT	19	4.8	5.7	26.4	79.8	0.27	0.58	0.47	0.50	0.16
LU	12	3.8	0.6	18.1	78.0	0.73	0.80	1.00	0.70	0.49
NL	11	4	0.6	15.3	78.3	0.80	0.76	1.00	0.77	0.44
PT	20	6.5	1.5	44.0	77.0	0.20	0.20	0.91	0.06	0.67
SE	9	3.4	1.0	10.5	79.9	0.93	0.89	0.96	0.89	0.15
UK	18	5.4	1.3	17.7	78.1	0.33	0.44	0.93	0.71	0.47
2002										
AT	12.5	3.75	1.1	9.5	78.8	0.70	0.81	0.95	0.92	0.35
BE	14	4	3.7	12.4	78.2	0.60	0.76	0.68	0.84	0.45
DE	15	4.4	3.9	12.6	78.4	0.53	0.67	0.66	0.84	0.42
DK	11	3.3	0.9	8.6	77.2	0.80	0.91	0.97	0.94	0.64
ES	19	5.1	3.7	29.9	79.7	0.27	0.51	0.68	0.41	0.18
FI	11	3.7	2.3	9.9	78.3	0.80	0.82	0.82	0.91	0.44
FR	12	3.9	3.1	13.4	79.5	0.73	0.78	0.74	0.82	0.22
GR	20.5	6.15	5.3	16.7	78.1	0.17	0.28	0.52	0.74	0.47
IE	21	4.8	1.4	14.7	77.8	0.13	0.58	0.92	0.79	0.53
IT	19	5.2	5.1	24.3	79.9	0.27	0.49	0.54	0.55	0.15
LU	11	3.9	0.7	17	78.2	0.80	0.78	0.99	0.73	0.45

	Primary indicators					HDR normalization				
	POV	INE	UNE	EDU	EXP	POV	INE	UNE	EDU	EXP
NL	11	4	0.7	15	78.4	0.80	0.76	0.99	0.78	0.42
PT	20	7.3	1.7	45.1	77.3	0.20	0.02	0.89	0.04	0.62
SE	11	3.3	1	10.4	79.9	0.80	0.91	0.96	0.89	0.15
UK	18	5.5	1.1	17.8	78.2	0.33	0.42	0.95	0.71	0.45
2003										
AT	13	4	1.1	9.3	79.0	0.67	0.76	0.95	0.92	0.31
BE	15	4	3.7	12.8	78.8	0.53	0.76	0.68	0.83	0.35
DE	15	4.3	4.5	12.8	78.5	0.53	0.69	0.60	0.83	0.40
DK	12	3.6	1.1	10.3	77.2	0.73	0.84	0.95	0.90	0.64
ES	19	5.1	3.7	31.3	80.5	0.27	0.51	0.68	0.38	0.04
FI	11	3.6	2.3	8.3	78.5	0.80	0.84	0.82	0.95	0.40
FR	12	3.8	3.7	13.7	79.5	0.73	0.80	0.68	0.81	0.22
GR	21	6.6	5.3	15.5	78.1	0.13	0.18	0.52	0.77	0.47
IE	21	5.1	1.6	12.3	78.3	0.13	0.51	0.90	0.85	0.44
IT	19	5.2	4.9	23.5	79.7	0.27	0.49	0.56	0.57	0.18
LU	10	4	0.9	12.3	78.3	0.87	0.76	0.97	0.85	0.44
NL	12	4	1	14.2	78.5	0.73	0.76	0.96	0.80	0.40
PT	19	7.4	2.2	40.4	77.4	0.27	0.00	0.84	0.15	0.60
SE	11	3.3	1	9	80.2	0.80	0.91	0.96	0.93	0.09
UK	18	5.3	1.1	16.8	78.5	0.33	0.47	0.95	0.74	0.40
2004										
AT	13	3.8	1.3	8.7	79.3	0.67	0.80	0.93	0.94	0.26
BE	15	4	4.1	11.9	79.1	0.53	0.76	0.64	0.86	0.29
DE	16	4.4	5.4	12.1	79.3	0.47	0.67	0.51	0.85	0.26
DK	11	3.4	1.2	8.5	77.6	0.80	0.89	0.94	0.94	0.57
ES	20	5.1	3.4	31.7	80.4	0.20	0.51	0.71	0.37	0.05
FI	11	3.5	2.1	8.7	77.3	0.80	0.87	0.85	0.94	0.62
FR	14	4.2	3.9	14.2	80.3	0.60	0.71	0.66	0.80	0.08
GR	20	6	5.6	14.9	79.1	0.20	0.31	0.48	0.78	0.30
IE	21	5	1.6	12.9	78.5	0.13	0.53	0.90	0.83	0.40
IT	19	5.6	4	22.3	80.7	0.27	0.40	0.65	0.60	0.00
LU	11	3.7	1.1	12.7	78.5	0.80	0.82	0.95	0.84	0.40
NL	12	4	1.6	14	79.2	0.73	0.76	0.90	0.80	0.28
PT	21	7.2	3	39.4	77.3	0.13	0.04	0.75	0.18	0.62
SE	11	3.3	1.2	8.6	80.4	0.80	0.91	0.94	0.94	0.06
UK	18	5.3	1	14.9	78.9	0.33	0.47	0.96	0.78	0.33

Source: Eurostat Laeken Indicators. Income and Living Conditions Database (2007).

Table A3: Malmquist decomposition

	1995-1996		*1996-1997*		*1997-1998*		*1998-1999*		*1999-2000*		*2000-2001*		*2001-2002*		*2002-2003*		*2003-2004*	
	Eff. change	Tech. change	Eff. change	Tech. change	Eff. change	Tech. change	Eff. change	Tech. change	Eff. change	Tech. change	Eff. change	Tech. change	Eff. change	Tech. change	Eff. change	Tech. change	Eff. change	Tech. change
AT	0.0%	-2.0%	0.0%	0.0%	-0.2%	0.0%	0.2%	0.0%	0.0%	1.0%	-0.5%	1.0%	-1.6%	0.0%	2.1%	-3.0%	0.0%	0.0%
BE	19.0%	-12.0%	-4.5%	4.0%	-5.4%	-1.0%	3.6%	-6.0%	5.5%	-1.0%	-5.0%	1.0%	2.6%	1.0%	-0.5%	-1.0%	2.9%	-1.0%
DE	13.7%	-13.0%	-4.5%	3.0%	-2.1%	-1.0%	1.3%	-3.0%	13.3%	-6.0%	-9.1%	3.0%	-1.7%	-5.0%	-1.1%	-1.0%	2.3%	-1.0%
DK	0.0%	-7.0%	0.0%	-2.0%	0.0%	-3.0%	0.0%	-2.0%	0.0%	-3.0%	0.0%	1.0%	0.0%	-4.0%	0.0%	-4.0%	0.0%	-1.0%
ES	1.8%	-5.0%	-10.1%	-2.0%	0.9%	-3.0%	6.8%	-2.0%	19.7%	-1.0%	15.3%	0.0%	1.0%	-1.0%	2.1%	-2.0%	6.2%	-2.0%
FI	0.0%	-1.0%	0.0%	1.0%	0.0%	-3.0%	0.0%	-5.0%	0.0%	0.0%	-3.2%	0.0%	3.3%	-3.0%	0.0%	0.0%	0.0%	2.0%
FR	9.5%	-8.0%	-1.2%	2.0%	-3.1%	0.0%	3.4%	-3.0%	3.6%	-1.0%	1.9%	-2.0%	3.5%	-2.0%	0.1%	0.0%	-6.8%	-1.0%
GR	10.6%	-9.0%	-2.3%	3.0%	-2.1%	0.0%	10.6%	-6.0%	1.4%	-1.0%	-0.2%	2.0%	1.7%	1.0%	6.7%	-3.0%	-1.2%	0.0%
IE	1.1%	-5.0%	3.9%	-6.0%	2.5%	-6.0%	0.0%	3.0%	0.0%	-6.0%	-4.2%	-7.0%	-1.9%	-3.0%	0.2%	-2.0%	0.7%	-2.0%
IT	-0.1%	-6.0%	2.5%	-2.0%	10.7%	-2.0%	9.8%	0.0%	6.6%	-3.0%	-2.8%	2.0%	-1.1%	-4.0%	4.7%	-1.0%	11.9%	-1.0%
LU	0.0%	0.0%	0.0%	-1.0%	0.0%	-1.0%	0.0%	1.0%	0.0%	1.0%	0.0%	-1.0%	0.0%	-1.0%	0.0%	3.0%	0.0%	-5.0%
NL	-2.3%	-1.0%	12.5%	1.0%	3.5%	1.0%	-1.1%	1.0%	1.7%	1.0%	0.4%	1.0%	0.0%	-1.0%	-1.0%	-2.0%	-4.3%	-2.0%
PT	0.0%	1.0%	0.0%	-7.0%	0.0%	-5.0%	0.0%	-2.0%	-2.4%	-5.0%	2.5%	-8.0%	-3.1%	-5.0%	-3.2%	0.0%	6.7%	-4.0%
SE	0.0%	-1.0%	0.0%	-1.0%	0.0%	-2.0%	0.0%	1.0%	0.0%	-6.0%	0.0%	1.0%	0.0%	-8.0%	0.0%	-1.0%	0.0%	-1.0%
UK	2.9%	-2.0%	4.7%	-1.0%	7.0%	0.0%	1.3%	1.0%	0.8%	1.0%	0.7%	0.0%	2.9%	-1.0%	1.9%	-2.0%	2.1%	-2.0%

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