

## Contribution to Beyond GDP „Virtual Indicator Expo“

<http://www.beyond-gdp.eu>

Name of the indicator/method: **Comparing welfare of nations**

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### **Why it is necessary to use composite indicators and make sensitivity test of them:**

In my paper<sup>1</sup> I have done an attempt to show how a complex reality can be illustrated using different statistical methods. The purpose of this report was not to exhibit the actual results of analysis, but rather to show the methods used to arrive at those results. The example chosen for analysis was a comparison of the level of welfare in OECD countries and the efficiency of these countries to create a high economic standard and welfare for their citizens. Because welfare is an extremely ambiguous concept, it is very difficult to measure. There are no given answers on the meaning of the concept of welfare, nor any explanations on how to measure it. Attempts to do so are thus much debated. In simple terms, a composite indicator is a way of putting apples and oranges together in order to decide which fruit basket is the most attractive. But this indicator can be problematic. For example, to someone who only likes grapes, it doesn't matter how many apples and oranges there are in the baskets. Furthermore, many statisticians also believe that only single variables can be reported in a satisfactory way. But neither decision-makers nor the general public wants a report that looks like a huge catalogue where variable after variable is listed page after page as a base for their understanding. Even though subjectivity is inevitable, they prefer to find out which fruit basket is probably the most interesting, rather than a list that states how many twenty or so different kinds of fruit each basket contains.

In this analysis, the composite indicator that is created is an attempt to measure welfare in the OECD countries. A sensitivity analysis of this chosen example has been conducted to study how the results are affected if certain partial components and extreme values are excluded. In addition, the significance of different valuations of variables is tested. The correlations between these components have also been studied, as well as the correlations between them and the measurement of welfare. A composite indicator for the input has also been created. The significance of different valuations of the various inputs for the ranking of the countries has been studied for this index as well. The ability of the input indicator and the factors that are included in it, to explain the differences between countries in economic standard and welfare has also been tested. Finally, it has been studied which countries are most effective in creating economic standards and welfare, respectively.

## **The indicator**

The first part of the indicator is of course the economic resources in a country. I have argued that GNI is a better measure of that than GDP. But work is not everything why I did try to assess the existing labour input in the different countries by determining how much has been set aside for leisure time in the form of shorter work weeks, longer holiday leave, early retirement, housewives and other reasons that people of working age are not part of the labour force. However, other factors affect one's well being besides consumption space and leisure time. Of employed persons, Koreans take the lead by far in working the most hours per year, and the Icelanders have the highest proportion of people of working age that are employed. However, people from Netherlands, Italy and France have on the whole chosen to give up a significant share of their potential economic standard by using a large share of this potential in leisure time.

Not everything can be bought with money, even though economic resources are very important in many areas. Health is one of these other factors. How to measure people's health is justifiably a debatable subject. However, nearly all illnesses and health aspects affect length of life. In principle, we can maintain that there is another dimension to health other than survival and that dimension is suffering. Of course, no international statistics exist on such a subjective occurrence as reducing pain and increasing comfort, even if these occurrences would be of great significance for well being as well as for welfare. In addition, these measures most likely also increase length of life indirectly, just as many other factors that increase quality of life. The environment is also significant for welfare. In the end, the environment is also a question of survival and affects all aspects of health. But the effects on health may only be visible a relatively long time afterwards, so it is a good idea to also include the environment in the concept of welfare. This section discusses suitable indicators for the environment. The selected indicators show that the geographically large countries with heavy industry such as Australia, Canada and the US have by far the highest emissions of environmentally hazardous gases per inhabitant. However, New Zealand and the Czech Republic are at the other end of the scale.

In the end, the environment is also a question of survival and affects all aspects of health. But the effects on health may only be visible a relatively long time afterwards, so it is a good idea to also include the environment in the concept of welfare. The state of the environment will then be a kind of early warning of health aspects and the quality of life in the future. Besides, the threat of a worsening environment usually affects how we regard quality of life, long before it can be traced as an effect on length of life. Besides health risks, a worsening environment can also deteriorate quality of life in other ways, while a good environment can be seen as quality of life in itself. All in all, it is preferable to include the environment in the design of this welfare indicator.

## **Sensitivity analysis, importance of choice of indicators**

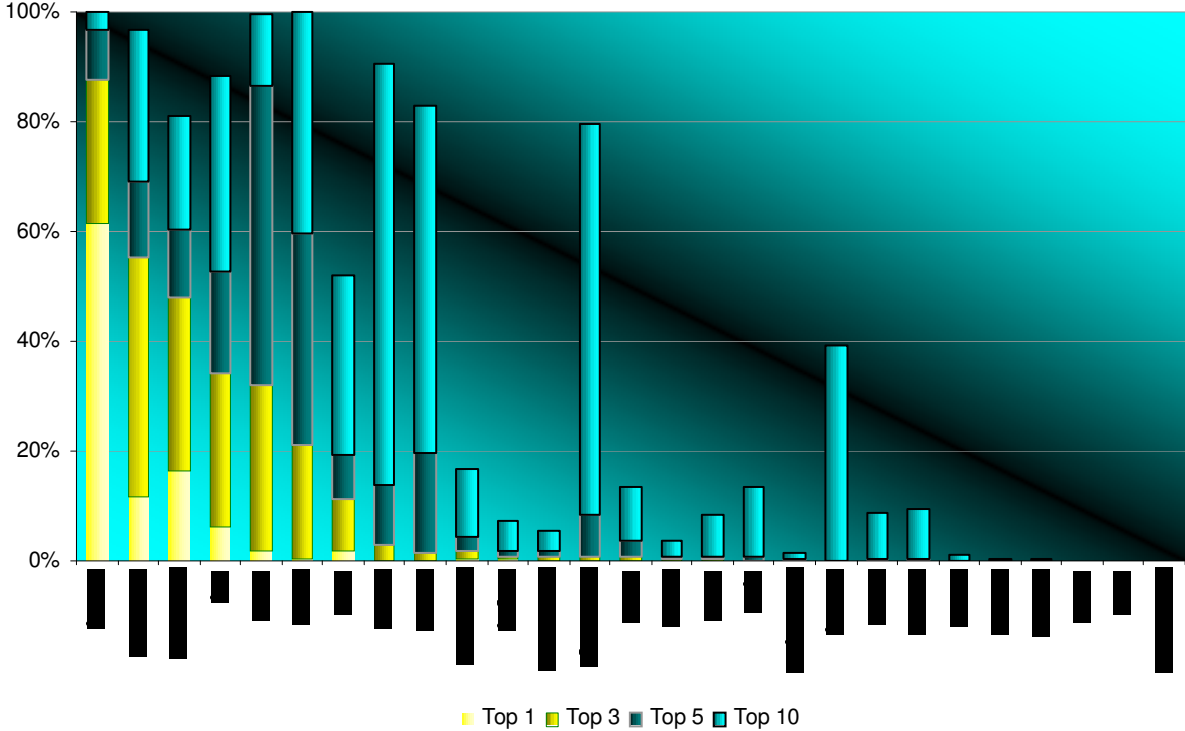
A sensitivity analysis of the welfare index has been done by studying the effects of removing components, sub-components and extreme values. An attempt to find correlations between the different indicators is also made. Here it is only room for showing how robust the ranking order of countries is for changes in the weight system. To analyse the importance of which weight that has been given to the different factors, a comprehensive sensitivity analysis has been done. In this analysis, the 8 different standardised indicators have been weighed with random weights, after which of the different countries have been ranked according to the value on their welfare index. This has been done for a million alternative weights.

The program generates a list of the number of times each country has been ranked with the highest value on the welfare index, the second highest value etc. down to the 27th place and the lowest value. To obtain an overall picture of the results, a figure has been made showing how often each country has come first, among the 3 best, among the 5 best, and finally the 10 best. The choice of these limits is based on how the structure of the actual results looked.

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<sup>1</sup>[http://www.scb.se/statistik/OV/OV9999/2004A01/OV9999\\_2004A01\\_BR\\_X100ST0415.pdf](http://www.scb.se/statistik/OV/OV9999/2004A01/OV9999_2004A01_BR_X100ST0415.pdf)

**The robustness of the ranking of countries according to the welfare index for different weights for the sub-indices**



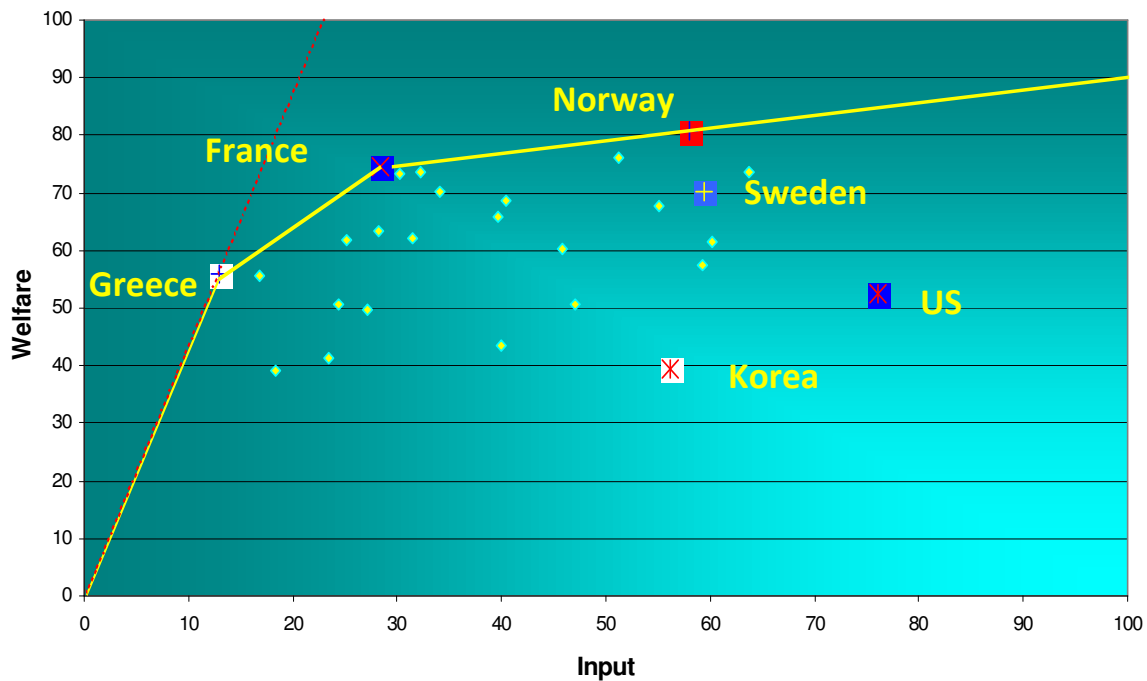
**What is the cost of welfare?**

A composite indicator for the input factor has also been chosen. Sensitivity for selected weights is tested in the same way as for the welfare index. Further, the correlations between the different components are analysed. The correlation between the components that can be said to form indicators on the knowledge society; quality of the labour force, formation of knowledge and IT use are strongly correlated. However, the quantitative input of labour is independent of all these other indicators. To determine if a country has succeeded in producing welfare effectively, the results must relate to the resources a country has invested to obtain welfare. The vital resource is labour, and since there is comparable data for the share of the population of working age, which is the relevant measure in this case, the choice is simple. However, in addition to quantity, quality is also significant. The broadest available measure of quality of the labour force is the level of education of the labour force, measured in a number of ways.

Besides the level of education of the labour force, other formation of knowledge is also important. Therefore, other indicators such as research and development innovation activities are often included among the selected input indicators. In this example, R&D costs per inhabitant, adjusted for differences in cost levels among countries (PPP adjusted), have been used. Another area of growth is IT development. The IT revolution is very important for development in many areas, even though it is not directly evident that IT investments have led to larger production profits. This applies on a more aggregated level, but studies of individual enterprises or smaller groups of enterprises have shown clear effects of more developed IT use. Combinations of organisational changes and IT investments have produced results.

There is a considerable variation in values of the welfare indicator between different countries, even if they have about the same value on the input indicator.

## A frontier production function with the welfare indicator as the production variable and the input indicator as the input variable



Korea, Iceland and the US are among those countries that have high values on the input index, but considerably lower values on the welfare index. Meanwhile countries such as Italy and France have high values on the welfare indicator with low inputs. Those countries that have obtained a relatively high welfare with small investments can be regarded as efficient in this respect. An effective instrument to find out which countries belong in this category (and how far behind other countries are) is known as the frontier production function.

### The general conclusion

The general conclusion of this analysis is that if we want to compare the complex concept of welfare in different countries, we must be ready to evaluate and compare factors of very different character. Since there are no undisputable choices, different evaluations and access to data can lead to more or less separate conclusions of analyses of the same phenomenon. For this reason it is very important for credibility of results that the data that is used and choices that have been made are openly reported. It is also important that a comprehensive sensitivity analysis has been carried out and is presented together with the main results. Furthermore, it is worthwhile to point out that the technique with random weights is a very relevant and effective instrument in the sensitivity analysis of the weight system. Concerning comparisons of efficiency, the frontier production function is also a good tool.

Finally, even if the composite indicators provides a valuable base for preparing basic information for political processes, we must realize that these results only give us an overview of one area. When forming concrete political measures, a more detailed analysis of separate phenomena is required. Then what has the analysis of the chosen example of a welfare index and the attempt to illustrate this measure in different ways provided us with? First, a general reservation must be made, namely that the conducted analysis has in no way shown what the consequences would have been if other factors had been included. It is of course possible to justify with very good reasons why many other aspects of welfare should be included in this example. In general, it is also apparent that other factors besides those that create economic standard are important to study, if the goal is to obtain a high level of welfare (as has been defined in this example).