

Researchers develop new happiness index

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A team of researchers at the Universitat Politècnica de València (UPV) and Universitat de València (UV) have developed a new index to measure a country's happiness. Named HAIN (HAppiness INdex), it is based on five areas – development, freedom, solidarity, justice and peace, each of which is evaluated based on quantitative variables taken

from various official databases such as the UN's Human Development Reports, the World Bank Open Data and Eurostat.

The work has been published in the *Journal of Computational and Applied Mathematics*, and according to the [index](#), Spain currently scores 0.72 over 1 with a slight tendency to drop in coming years.

"At the moment, happiness indexes are based on questionnaires that a certain sample of the population answer. They are therefore very subjective values. Unlike these, our index is created based on objective data, official statistics that represent a country's entire population," explains Joan C. Micó, researcher at the Multidisciplinary Mathematics Institute of the UPV.

Among its novelties, the index also stands out for including new quantitative variables such as the quality of education, migration and the exporting and importing of goods and services.

The index establishes a minimum level of 0 and a maximum of 1. To obtain the results, researchers drew from figures of the UN's Human Development Reports relative to the period between 1996 and 2014 on one hand, and the World Bank Open Data and Eurostat for years 1998 to 2015, on the other.

Equation

The equation to obtain the happiness index is the geometric mean of the values corresponding to the five aforementioned areas: development, freedom, solidarity, justice and peace. This equation is dynamic, it changes over time based on all the variables included in these areas, such as population, births, literacy rate, per capita income, life expectancy, etc.

"This index is part of a mathematic equation that provides objective guidelines on how to improve the happiness of a society (with the control variables), compared to other scenarios (exogenous variables)," explains Joan C. Micó.

This way, as well as a descriptive index, the UPV and UV researcher's work offers a decision-making tool in regards to the improvement of a society's happiness.

A slight downward trend in coming years

The new index has been used to study the evolution of happiness for Spain's population. Researchers calibrated the model for years 2004-2009, validated it for the 2010-2015 period, and performed a predictive analysis of happiness in Spain for the 2016-2030 period.

In this prediction, the UPV and UV team came up with different financial scenarios – expansion, recession and with a tendency to the past – as well as different strategies for public investment in Education, research, development and innovation, and security. "We took spending in these areas as a reference because it is where politicians can make decisions in a more realistic way," adds María T. Sanz, teacher at the Didactics of Mathematics Department of the Universitat de València.

Among its conclusions, it highlights that to raise the level of happiness in Spain, it is necessary to invest more in education, research and development.

"According to our predictions, this index will be at 0.72 for the year 2018, with a tendency to (slightly) decrease in following years, compared to the lowest real value of 0.69 from 2003 and the highest of 0.735 from 2007, before the crisis. We are not too far from Sweeden, the happiest country in 2013 according to both measures, a HAIN of 0.75 and the

UN's World Happiness Report," explains Antonio Caselles, member of The International Academy for Systems and Cybernetic Sciences.

Comparison to other countries

"We've followed the guidelines established by the UN's Human Development Reports for the creation of quality indexes, and we have compared ours to the UN's World Happiness Report from 2013, for the 13 European countries for which the complex task of obtaining all necessary data has been successful," adds David Soler, fellow UPV Multidisciplinary Mathematics Institute researcher.

According to this index, in 2013, Spain was the third happiest of a list headed by Sweden and closed by Portugal, while the UN's list, which only took the area of development into account, has Spain in sixth place. As well as these three countries, the lists include Austria, Cyprus, the Czech Republic, France, Iceland, Latvia, Lithuania, Croatia, Slovenia and the United Kingdom.

"2013 seems like a long time ago, but it is the last year for which the UN's World Happiness Report was available, and our objective was to compare both to see if there was a correlation between them, and as a way to validate our index, if there is," says David Soler.

Index improvements

Researchers say that their objective for the future is to calculate this happiness index for the largest number of countries possible, compare them and extract possible conclusions such as, for example, the relation between [happiness](#) and the geographic region, climate, religion, etc.

"We also want to polish the dynamic model for more countries, so that

we can include more social and financial variables. The end goal is that HAIN can be used to find strategies adapted to the specific governing issues of each country," concludes Antonio Caselles.

More information: María T. Sanz et al. A stochastic dynamical social model involving a human happiness index, *Journal of Computational and Applied Mathematics* (2018). [DOI: 10.1016/j.cam.2018.02.036](https://doi.org/10.1016/j.cam.2018.02.036)

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