Measuring reality is quite complex
Two illustrations

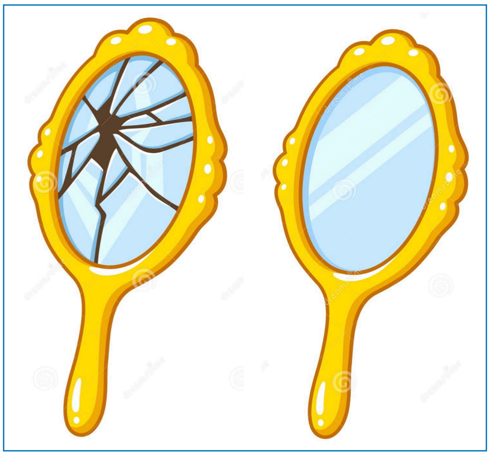
Data: a mirror that shows how we grasp reality

For time immemorial, humans have tried to measure reality to describe and understand it better. Censuses of people and animals have been conducted since ancient times and are deemed to date back nearly 4000 years.

More recently, particularly from the 19th century, data have taken a central place in social and economic policy decision making, to the extent that some are now talking of 'governance by the numbers' [read in French], while others refer to 'evidence-based governance' or 'evidence-based policy' [read]. In this context, data and statistics have become indispensable inputs and tools for decision making.

However, managing data and using statistics are marred by difficulties and shortcomings that, sometimes, undermine their credibility in the eyes of some. These difficulties arise from the efforts and resources needed to collect and analyse data, and from the models used and assumptions made for organising them and rendering them usable for describing reality and grasping it in order to make 'appropriate' decisions in view of the objectives pursued by those who govern.

Difficulties also result from the way data is being utilised and presented in analyses made: the typical example for illustrating this point is that the choice of a base year may change the conclusion reached on how a particular variable evolves over time. The shortcomings are compounded in case data is being estimated by processing collected data and produced through models built on the way reality is being understood. The economic literature is full of examples on how results of models are used to reinforce the assumptions underlying them.



based on Irina Miroshnichenko

This has sometimes led to extreme statements such as the 'There are three kinds of lies: lies, damned lies, and statistics' attributed to Benjamin Disraeli by Mark Twain [read].

Whereas Disraeli's view may apply in some cases, in most occurrences, inadequacy between data and reality is the result of a poor understanding of the latter. The consequence of this being that, when the understanding evolves, models evolve as well, and so does the data. This dual relation is well illustrated in the two following illustrations: successive estimates of the number of undernourished, and the issue of GDP[1] and its alternatives.

First illustration: The case of estimates of the number of undernourished

In 2013, on hungerexplained, we were wondering what the real number of undernourished people in the world was [read].

This question had just been raised by Frédéric Dévé in an article published on the website Reporterre [read in French] following the release of the 2012 State of Food Insecurity in the World (SOFI) in which the method used for estimating the number of chronically undernourished persons was explained [read Annex 2, p.46].

In summary, the method was (and is) based on the computation of 'the probability that a randomly selected individual from the reference population is found to consume less than his/her calorie requirement for an active and healthy life'.

To make this computation, several data are required for a given country:

- the average level of calorie consumption in the country (this is derived from available statistics) [consult]. Since 2012, this level has been calculated after the introduction of a factor capturing food losses;
- the minimum dietary energy requirement associated with a representative individual of the population, considering the age and sex structure of the population, the average stature and level of physical activity of people (this is based on the method developed by WHO that uses demographic data, anthropometric measurements and sociological information) [read];
- a probability density function of individual energy dietary intake that takes into account variability and eventual asymmetry of food consumption, these characteristics of consumption being typically derived from household surveys, especially those focusing on household expenditures.

In addition, the actual form of the probability density function has to be chosen, and several such forms are available, which each have their advantages and disadvantages. In 2012, a new functional form was selected.

Introducing a factor for food losses and changing the functional form used (which both denote a revised way of grasping some aspects of food consumption) had a major impact on the result obtained from the computation, including for estimates of the number of undernourished in the past. For example, while this number had been estimated at

[1] GDP: Gross domestic product.

848 million in 2011 for the period 1990/92, it was revised upwards to 1000 million in 2012 (see **Table1**).

Table 1: Estimates of the number of undernourished in the world for three-year periods as they appear in successive SOFI publications (1999-2024)

Period of estimates ↓ / Successive SOFIs →	1990/ 92	1995/ 97	1996/ 98	1997/ 99	1998/ 00	1999/ 01	2000/ 02	2001/ 03	2003/ 05	2004/ 06	2005/ 07	2006/ 08	2007/ 09	2008/ 10	2009/ 11	2010/ 12	2011/ 13	2012/ 14	2014/ 16	2015/ 17	2016/ 18	2017/ 19	2018/ 20	2019/ 21	2020/ 22	2021/ 23
1999		825,5																								
2000			791,9																							
2001	816,3			803,7																						
2002	818,5				829																					
2003	816,3	779,7				831,5																				
2004	823,8	796,7					842,9																			
2005	823,8						814,6																			
2006	823,1							844,9																		
2007																										
2008	841,9	831,8							848																	
2009	845,3	824,9					856,8			872,9																
2010	843,4	787,5					833				847,5															
2011	848,4	791,5					836,2					850														
2012	1000					919				898			867			868										
2013	1015,3						957,3				906,6			878,2			842,3									
2014	1014,5						929,9				946,2				840,5			805,3								
2015	1010,6						929,6				942,3					820,7			794,6							
2017										919,6									789,1							
2018										938,4										803,1						
2019										940,5											809,9					
2020										819,3												673				
2021										804													683,9			
2022										798,9														702,7		
2023										786,7															725,1	
2024										788,8																722

Figures in red refer to 'developing countries', in blue to 'developing countries and countries in transition', and in black to the whole world.

Source: SOFI

The method used for making these estimates has been the subject of several criticisms, some of which are presented in Annex 2 of the 2012 SOFI [read]. They include:

- the focus on only caloric intake as indicator, when protein or oligo-elements intake also matters;
- the impossibility of capturing those people who may have experienced temporary difficulties in accessing sufficient food, with possible dramatic consequences for their nutritional status;
- lack of consideration of inequalities within households (e.g. between men, women and children of a same family).

To these criticisms, Dévé added the fact that the computation method underestimates the energy requirement by assuming that undernourished persons have a sedentary lifestyle which corresponds to an energy requirement of 1.55 times the basal metabolic rate (energy requirement at rest) typical of an urban lifestyle, while in many countries - particularly those affected by food insecurity - a very large proportion of people live in rural areas and have a much more active lifestyle requiring an energy equivalent to 2 to 2.4 times the basal metabolic rate [read]. If one were to adopt these higher requirements for making the estimates, the number of undernourished would then have been more than 2.5 billion people and, moreover, the trend of this number would have been increasing instead of decreasing as in the published FAO estimates for the last decade of the 20th century and the first decade of this century.

This example demonstrates the sensitivity of estimates to the assumptions made in the computation.

Tables 1 and **2** illustrate how successive adjustments in assumptions as well as the progressive updating of available data on variables such as variability and eventual asymmetry of caloric intake coming from various censuses, surveys and studies, all impacted on estimates for the past.

Table 2 shows that the updates can be considerable. For example, the estimate made in 2018 of the number of undernourished for year 2017 (820.8 million) was revised downwards in the year 2024 to ‘only’ 541.3 million, showing an impact of nearly 35% of changes of input statistics as well as minor adjustments in the computation method [for more explanations see Box 1 on p. 5].

Table 2 Estimates of the yearly number of undernourished in the world as they appear in successive SOFI publications (2017-2024)

Years of estimates → / Successive SOFIs ↓	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
2017	910	926					795			775		777	815							
2018		945	911,4	876,9	855,1	839,8	820,5	812,8	805,7	794,9	783,7	784,4	804,2	820,8						
2019		947,2					822,3					785,4	796,5	811,7	821,6					
2020		825,6					668,2				628,9	653,3	657,6	653,2	678,1	687,8				
2021		810,7					636,8				606,9	615,1	619,6	615	683,4	650,3	768			
2022		805,5					601,3				571,6	588,6	573,3	575,3	590,6	618,4	721,7	767,9		
2023		793,4					597,8				563,9	588,9	586,4	571,8	586,8	612,8	701,4	738,9	735,1	
2024		798,3					604,8				538,7	570,2		541,3	557	581,3	669,3	708,7	723,8	733

Source: SOFI

While these changes are generally justified, they can create confusion and, sometimes, a lack of confidence in the data published.

This points to another important question: relying on one unique indicator to describe the food insecurity situation (e.g. the number of chronically undernourished) as was basically the case between 1999 and 2012, is risky. Adopting a set of indicators helps to give a better picture of reality, particularly if they are consistent (in case they are inconsistent, this raises questions that can help to better grasp what is going on, … or improve the method of calculation).

The publication, in 2014, of the data on perceived food insecurity based national surveys using the Food Insecurity Experience Scale (FIES) and of indicators relying on anthropometric measurements are, in this context, welcome complements.

These indicators themselves, of course, have their own limits. ‘Perceived food insecurity’ is a subjective concept that may, in some cases, reflect diverse strategies of people consulted, and more generally, surveys have their own limits that are a topic that goes beyond this article.

The emergence of Artificial Intelligence (AI) and deep learning, which are increasingly important in data analysis [read], makes that a growing part of the algorithms used in data analysis becomes opaque to researchers, as AI’s capability to develop internally its own rules and ‘understanding’ of the data structure increases and evolves while remaining mostly invisible to scientists and data users. This is an issue with consequences that require more in-depth thinking by scientists.

Second illustration: The case of GDP and its alternatives

GDP size and growth have since long become the best indicators in the eyes of political leaders to 'show whether things seem to be getting better or getting worse' [read]. These indicators are widely used in a great variety of contexts as key arguments for adopting a particular policy orientation.

Yet, for decades, an avalanche of criticisms has demonstrated the biases and shortcomings of having GDP as the reference on which to base economic policy.

The most frequent and fundamental shortcomings of GDP mentioned, appear in a context where human wellbeing and sustainability matter [read]. They include in particular:

- GDP values goods and services produced during a year in a country at market prices, and we know that these prices do not reflect non-market costs and benefits of production and consumption [read];
- it does not take into account goods and services that do not involve monetary transactions such as voluntary work or care provided in a family context;
- it does not make a difference between welfare generating activities from those who have negative consequences (the production of weapons[2] and toxic products is accounted for in the same way as that of food, clothes, construction and healthcare);
- it does not consider social outcomes such as poverty and inequality;
- it is focused on the short term; and,
- it neglects the cost of environmental degradation and of depletion of natural resources. It does not account for the depletion of forests and of mineral resources, or for costs generated by climate change and loss of biodiversity. In fact, it will account military expenditures and those made to rehabilitate an area devastated by a storm as… wealth generation!

Although GDP only provides a very partial and biased description of reality, it remains one of the main criteria for economic decision making. It embodies a world vision where the market is all and money central, and the short-term economic growth paradigm is king.

Over the last decades, particularly since the early 1990s and the Rio de Janeiro Earth Summit, and with the emergence of the sustainability concept that has economic, social and environmental dimensions, the world vision has evolved considerably. Several attempts have been made to create alternative GDPs that are consistent with this new perspective, but they have so far failed to be widely accepted and adopted, and there is no consensus which of these proposals is the best alternative. GDP is solidly established as it now is well standardised, institutionalised and used throughout the world [read].

It seems, therefore, unlikely that the existing concept of GDP will be replaced by an alternative in the short and even medium term that would mirror this new vision, although several countries have taken steps to establish 'Beyond GDP measurement frameworks'. But it is not clear to what extent their results effectively feed into decision making. In fact, for the economic, social and environmental situation as for food insecurity, it is rather better to avoid relying on one unique indicator that would necessarily by simplistic [read]. A set of indicators would certainly, here too, be preferable.

[2] You will probably remember the genuine surprise shown by some economists when it appeared that the Russian GDP grew relatively well during 2020. In fact this is an obvious consequence of the way it is computed.

Meanwhile, as long as a narrow simplistic and reductionist vision of reality through the lens of economic growth prevails, it is probable that policy decision making will further guide humanity towards a more unsustainable development.

To conclude on a note of humour (for once)

Data are useful as they help illustrate and provide a measurable basis to policy narratives.

They should, however, not be taken for granted and should always be considered with a spirit of constructive criticism in the light of the constraints and objectives of those who produce and promote them.

Two true examples, presented below, illustrate this point.

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First example: Overseas

In order to achieve a more balanced regional development, the authorities of a country decided to develop region-specific databases.

This effort was an opportunity to check available statistical data that had been designed a few years earlier so as to have reliable figures for every region.

In one of the regions who is mostly rural and agricultural, the person in charge of the programme was struck by the great variability of the number of livestock recorded. While the sudden decrease of the numbers could possibly have been explained by some event that might have caused high mortality, the quick recovery, in one year, of the size of the regional heard could not be explained, even though the region was on the border. Indeed, the size of the variation would have implied a livestock migration that would not have gone unnoticed.

During one of his visits to the region, the person in charge went to see the regional livestock officer to discuss the matter. The officer did not have any valid explanation of the data variation.

The person in charge asked to meet with the officers in charge of data collection. Their answer came following a lengthy discussion:

> '*Well, you know, sir, things are not easy in our region. The data collection period falls during the rainy season. Years when the rain is abundant, a large part of the region becomes inaccessible - we call it "overseas". So to be consistent with the guidelines we have and the data collection method we use, we can only report our estimates for the part of the region that is accessible… and observable*'

Source: the author

<u>Second example</u>: Over-care

Authorities of a country wanted to introduce cotton production.

For this, they asked a group of experts to identify areas that were suitable for this crop. One of the criteria was rainfall.

Trials were organised in each of the suitable areas. They were successful in all but one area where the crop had failed apparently due to excessive rainfall.

While a cotton development programme was implemented in the successful areas, a new trial was made in the area where cotton had failed in the first year.

The trial failed again. One of the experts was sent to the area to better analyse the failure. Once more, it seemed that rain was the cause. Puzzled by the repetition of events, the expert went to visit the station where meteorological data was collected.

The person in charge of the station showed the data collection system to the expert. Everything seemed to be in order. During the discussion, the man said:

> '*You know, sir, I am a very careful person. Every time I see that there is going to be a big storm, I cover the equipment so that it does not get damaged…*'

Source: testimony collected by the author

To know more:

- Jansen, A. et al., Beyond GDP: a review and conceptual framework for measuring sustainable and inclusive wellbeing, The Lancet Planetary Health, Volume 8, Issue 9, e695 - e705, 2024.
- Baron, J, et al., A Brief History of Evidence-Based Policy, The ANNALS of the American Academy of Political and Social Science, 2018.
- Gertner, J., The Rise and Fall of the G.D.P., The New York Times, 2010.
- FAO, WFP and IFAD, The State of Food Insecurity in the World 2012. Economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition, Rome, FAO, 2012.

Earlier articles on hungerexplained.org related to the topic:

- Facts and figures on world food insecurity and malnutrition - World food insecurity back to what it was 15 years ago - Lack of food and money not a valid reason, 2024.
- The digital revolution in food and agriculture - Exciting promises, mixed results and risky bet, 2021.
- The real cost of food - Can the market alone guide our food systems towards more sustainability? 2020.
- Facts and figures on world food insecurity - An alarming deterioration, 2020.
- The dangers of a "partial" impact analysis: the example of a study on the impact of a 100% conversion to organic farming in England and Wales, 2019.
- What is the real number of hungry people in the world? 2013.

As well as other articles gathered under "Methodological corner".