The econometrics of inequality and poverty

*Lecture 2: Why should we be concerned by inequality and poverty?*

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1 Human Development Index

The notions of inequality and poverty are related, but distinct (we shall see how in the sequel). They are related to the notions of justice on one side and of economic development on the other side. There are a lot of concepts that we shall not detail in this lecture, such as justice, equity, fairness. There are excellent books for that (see Fleurbaey (1996) for instance). See also the book ”on Kolm’s theory of Macrojustice” Springer (2011).

1.1 Measuring economic growth and economic well-being

Macroeconomic indicators are important because they serve as objectives for economic policy. These indicators focusses on economic growth and business cycle. They however hide too many things. First, GDP/head is a gross indicator and not a net indicator because it does not take into account the depreciation of natural capital. Second, GDP/head is a mean indicator that does not take into account income distribution. GDP/head increases for instance when a single person get richer while others remain at the same level. This situation happened in the UK under the rule of Margaret Thatcher.

The Human Development Index is one of the attempts to propose an alternative method of measure economic well-being and wealth.

1.2 Definition and origin


The HDI is a statistical index, created by United Nation Program for human development in 1990. It was meant to measure and compare the human development in the world. The previous index which was used was too crude as it was based only on GDP per capita. This index draws heavily on the work of the Indian economist Amartya Sen.

The index was launched by the Pakistani economist Mahbub ul Haq with the idea of promoting the functionings and capabilities approach of Sen. Sen was at the origin opposed to the idea of a building a single index because he thought that it was not possible to aggregate in the single index the diversity of human capabilities. But Haq managed to convince him of the utility of such an index as it could shift the attention of policy makers toward a better concern for human development. It is used to rank countries. The formula used for the index has changed over time and experienced variants. We must note that it is still widely critised and lead to different rankings according to its variant. It is difficult to summarise in a single index the diversity of development.

The HDI is a composite index at value between 0 (awful) and 1 (perfect) based on the mixing of three basic indices aiming at representing on an equal footing measures of health, education and standard of living. More precisely, its 2005 version was based on:
1. health status and life expectancy. Indirectly this index takes into account the satisfaction of basic needs of the population such as food, water, medicine, housing quality.

2. Education level measured by the percentage of teenagers (15) being able to read and understand a basic text related to everyday life. And the rate of school enrolment.

3. Standard of living measured as the log of GDP per head

   Basically the index aims at transforming raw variables into a free scale index at value in $[0,1]$

   $$ x - \text{index} = \frac{x - \min(x)}{\max(x) - \min(x)}. $$

   The HDI is then computed as a uniformly weighted sum of the three basic indices:

   $$ \text{HDI} = \frac{A + D + E}{3}, $$

   where $A$, $D$ and $E$ are respectively the index of life expectancy, education level and standard of living. More precisely, they are computed as follows The $\text{HDI}$ was computed for 182 countries which provided the necessary statistical information in 2007.

1.3 New definition 2011

The formula for computing the HDI was updated in 2011, replacing arithmetic mean by geometric mean for instance. The geometric mean intend at avoiding substitution effects (more income compensating less life expectancy). But its fundamental components were not altered.

   The HDI still combines three dimensions:

1. A long and healthy life: Life expectancy at birth. Life Expectation index $LEI$.

2. Education index: Mean years of schooling and Expected years of schooling. Education index $EI$.
3. A decent standard of living: GNI per capita (PPP US$). Income Index \( II \)

The HDI is formed by the geometric mean of these three normalized indices:

\[
HDI = \sqrt[3]{LEI \cdot EI \cdot II}.
\]

The detailed definitions are as follows:

1. **Life Expectancy Index**

\[
LEI = \frac{LE - 20}{82.3 - 20}
\]

with LE: Life expectancy at birth.

2. **Education Index**

\[
EI = \frac{\sqrt{MYSI \cdot EYSI}}{0.951}
\]

These two sub-indices MYSI and EYSI are defined as:

- **Mean Years of Schooling Index**

\[
MYSI = \frac{MYS}{13.2}
\]

with MYS: Mean years of schooling (Years that a 25-year-old person or older has spent in schools)

- **Expected Years of Schooling Index**

\[
EYSI = \frac{EYS}{20.6}
\]

EYS: Expected years of schooling (Years that a 5-year-old child will spend with his education in his whole life)

3. **Income Index**

\[
II = \frac{\ln(GNIpc) - \ln(100)}{\ln(107,721) - \ln(100)}
\]

with GNIpc: Gross national income at purchasing power parity per capita

### 1.4 Plots and comments

It is interesting to plot the estimated density of the 2005 index. This density is clearly bi-modal with a first mode around 0.55 and a main mode around 0.85 which correspond to richer countries. A HDI is very high for values between 0.9 and 1.0, high for values 0.80 and 0.90, mid range between 0.50 and 0.80 and weak below 0.50. The first mode thus correspond to countries with a weak HDI. Computations done using R. The data comes from the United Nation Programme development (PNUD) in its 2009 report. New data can be obtained at http://hdr.undp.org/en/statistics/.
1.5 Why are these data interesting?

The traditional instrument for comparing countries is the GDP per capita. With these data, USA come first. But it reduces human development and well being to a single dimension, assuming that money represents everything. With the HDI, USA are ranked 13th in 2007 using the 2005 formula. Countries like Norway, Australia, Iceland, Canada, Ireland, the Netherlands, Sweden, France, Switzerland, Japan, Luxembourg and Finland are better ranked. Welfare is multidimensional.

The second point is that instead of presenting a large table, we decided to use a density, which in fact displays a different kind of information. This density was estimated using a non-parametric method, showing the wide interest of these methods to explore the kind of large data sets that are available when studying poverty and inequality. Note however that as the HDI is within $[0, 1]$, there are problems at the boundaries, so an histogram would be better.

2 An alternative synthetic index of well-being

The HDI can be criticised and was largely criticised. When analysing it, it simply complements the usual GDP per capita with human capital indicators. But the critics which apply to GDP as a measure of welfare can also be applied to the HDI. In particular, no account is taken of capital depreciation, both physical and natural. And no account is taken of social capital and economic inequality. There is a vast literature dealing with development indices. We have taken only one example which is the paper by Osberg and Sharpe (2002). It presents an index of Economic Well-Being for Selected OECD Countries based on
1. Consumption per capita
2. Net accumulation of productive resources
3. Income distribution
4. Economic security

The HDI complements the usual GNP per capita indicator by a series of measures dealing with human capital such as education and health status. This index is different in the sense that the per capita index is now oriented toward consumption which is completed by other economic notions dealing with capital accumulation and its depreciation, the income distribution where inequality and poverty are seen as a nuisance and economic security. The composition of this index is summarised in Figure 2. It is not the object of this lecture to detail all well-being indices. But it is remarkable to picture out the differences that they can bring in when analysing the evolution of an index over time. In Figure 3 we can notice that this index lowers the importance of economic growth. See the Figure concerning Norway. As it stresses the importance of economic security and of inequality, it gives a contrasted picture of the UK.
Figure 3: Comparing the UK and Norway
3 Welfare or not welfare

This section draws heavily on Duclos and Araar (2006).

The previous discussion around the HDI related to two opposed but nowadays complementary approaches to the measurement of inequality and poverty: the welfarist and the non-welfarist approaches. To summarise the debate that we introduced at the macro level

- Individual welfare can be measured in monetary terms and is the result of individual decision. A macro measure is the GDP per capita. It can be completed by some measure of human capital.

- A measure of individual welfare has to take into account the social context of the individual, the relation with other people and with nature. We thus have to introduce various notions of capital: physical, natural and social capital.

If we turn to economic theory, we find that the welfarist approach assumes that individuals maximise their utility function under a budget constraint in a surroundings where markets and information are perfect. So the key variable is income or eventually wealth. This is the traditional view of economists, known as revealed preferences.

The non-welfarist approach insists on the multidimensional aspect of well-being. In a world where markets are not perfect, where information is limited, the maximisation of utility under a budget constraint cannot provide all the necessary information concerning the degree of well-being reached. Other information is needed. The maximisation of individual utility function is not enough.

3.1 Pure welfarist approach

The welfarist approach relies on the notion of revealed preferences. The utility function of an individual and his level of utility can be inferred from his decisions as decisions are supposed to be taken according the principle of maximum expected utility. This does not work of course in the case of imperfect markets, imperfect information, discrimination and so on.

The second difficulty comes from the fact that we want to compare individual utilities to form a social judgment. How are we going to measure the actual pleasure derived from experiencing economic well-being? Even if we manage to establish a relation between individual utility and collective well-being, it is highly problematic to compare that level of utility across individuals—It is well known that such a procedure poses serious ethical difficulties: preferences are heterogeneous, personal characteristics, needs and enjoyment abilities are diverse, households differ in size and composition, and prices vary across time and space.

To be operational, pure welfarism requires the observation of sufficiently informative revealed preferences. For instance, for someone to be declared poor or not poor, it is not enough to know that person’s current characteristics and income status: it must also be inferred from that person’s actions whether he judges his utility status to be above a certain poverty utility level.
The “working” definition of poverty for the welfarist approach is therefore a lack of command over commodities, measured by low income or consumption. These money-metric indicators are often adjusted for differences in needs, prices, and household sizes and compositions. The main tool is the welfare function which has as argument the income distribution, where income is corrected for household composition, housing prices and so on.

Income and consumption clearly represent far-from-perfect indicators of utility and well-being. **Indeed, economic theory tells us little about how to use consumption or income to make consistent interpersonal comparisons of well-being.** Besides, the consumption and income proxies are rarely able to take full account of the role for well-being of public goods and non-market commodities, such as safety, liberty, peace, health. In principle, such commodities can be valued using reference or “shadow” prices. In practice, this is difficult to do accurately and consistently.

### 3.2 Non-welfarist approaches

The concept of **functionings**, largely developed by Sen (1992) focuses on the need to attain some basic multidimensional outcomes that can be observed and monitored relatively easily. Functionings can be understood to be constitutive elements of well-being. One lives well if he enjoys a sufficiently large level of functionings. The functioning approach would generally not attempt to compress these multidimensional elements into a single dimension such as utility or happiness. Utility or happiness is viewed as a reductive aggregate of functionings, which are multidimensional in nature. The functioning approach usually focuses instead on the attainment of multiple specific and separate outcomes, such as the enjoyment of a particular type of commodity consumption, being healthy, literate, well-clothed, well-housed, socially empowered. Modern household panels have a whole set of questions concerning basic functioning such as a well heated house, good relations with neighbours, health status and so on.

The **capability** approach, also pioneered and advocated in the last three decades by the work of Sen. The capability approach is defined by the capacity to achieve functionings, as defined above. Having the capability to achieve ”basic” functionings is the source of freedom to live well, and is thereby sufficient in the capability approach for one not to be poor or deprived. It put considerable value on freedom of choice: a person will not be judged poor even if he chooses not to achieve some functionings, so long as he would be able to achieve them if he so chose. This distinction between outcomes and the capability to achieve these outcomes also recognises the importance of preference diversity and individuality in determining functioning choices. It is, for instance, not everyone’s wish to be well-clothed or to participate in society, even if the capability is present.

The non-welfarist approach causes **difficulties of implementation**. First of all, functionings are more easily measured than capabilities. Achievement of all basic functionings implies non-deprivation in the space of all capabilities. But the converse is not true. Failure to achieve all basic functionings does not imply capability deprivation.

The multi-dimensionality of the non-welfarist criteria also translates into greater implementation difficulties than for the usual proxy indicators of the welfarist approach. In the welfarist
approach, the size of the multidimensional budget set is ordinarily summarised by income or total consumption, which can be thought of as a one-dimensional indicator of freedom. So it is rather trivial to define a poverty level for the welfarist approach. It is much more difficult to define a poverty level for each dimension of multidimensional approach. And we do not know what to say if one is constrained in one dimension, but not in the others. There is a difficulty of aggregation.

3.3 Happiness economics as a provisional solution

The main object of the controversy between the two approaches is a question related to the measurement of individual welfare. Is income sufficient, or should we use other indicators for individual welfare. Income is relatively easy to measure. Building a social welfare function is then a textbook exercise. The approach by functionings is more appealing, but there are problems of measurement and aggregation.

The last chapter of this course will be devoted to Happiness economics. The main claim of happiness economics is that individuals can report a subjective well-being evaluation and that this reporting has an economic content. It can be explained by various socio-economic indicators, including income.

The declared level of subjective well-being can be used as a gauge for aggregating (using a regression) various indicators of deprivation in order to build a poverty index, an inequality or a development index.

3.4 Policy implications

The point of view adopted, welfarist or non-welfarist has serious implication for economic policy. A welfarist approach would favour opportunities of getting a higher income. But individuals might not use this greater income for educating for instance because the return of education are too far away in the future. A non-welfarist approach would provide free and compulsory education, as Jules Ferry did in France. The fulfilling of basic functionings (health, education) requires investment in public goods. Furthermore, social cohesion concerns are arguably not well addressed by the maximisation of private utility, and raising income opportunities will not fundamentally solve problems caused by adverse intra-household distributions of well-being, for instance. However, that approach can be criticised too. The welfarist school conversely emphasises that individuals are generally better placed to judge what is good for them. Freedom of choice.
4 Why should we be concerned by inequality and poverty

Up to now, we have given no reason why we should be interested in measuring poverty and inequality, and we have not even defined exactly what is poverty.

4.1 Historical foundations of the concerns for poverty and inequality

In a contributed paper of (2009) the historian Isabelle Koch underlines that both Plato (The Republic) and Aristotle (The Politics) consider poverty as a factor of social instability and a lack of social cohesion and integration. How to integrate the poor in the functioning of society? The main question is not to redistribute resources in order to progress in the field of justice. The main question is totally pragmatic: how to redistribute in order to prevent the poor from starting riots. The analysis of poverty in term of social justice started only after the christianisation of the Roman empire.

Let us briefly describe the social and political situation in the Athens of the fourth century BC. The city is political independent. Its population is divided into citizens (people who receive this quality due to their birth), foreigners (meteques) who are living in the city, but are born from parents foreign to the city and slaves. Being a citizen gives political rights and political duties: take part to political assemblies where laws are voted and to judicial assemblies. Being a citizen gives the economic right to own a piece of land. This right is denied to the foreigners.

There is not a one to one mapping between the social classes and the distribution of wealth. The social value is to take part to the democratic life. For this, you need time and thus work is not valued, except for peasants. There are some very rich slaves ruling domains or banks (very rare in number in fact) and poor citizens. Being rich for a citizen means having enough money to pay somebody to work for you. In the nineteen century, to be rich meant having sufficient rents to avoid working.

There is no solidarity between the different classes of poor (slaves, citizens, foreigner) because they do not the same rights. Rich citizens provide large redistributive contributions which are in between taxes and sponsorship and which meant to contribute to the functioning of the city: organising banquets, preparing the war, organising festivals. These private spending are a source of honour for the rich, but they can lead them to a financial disaster too. However, it is quite difficult to escape them. One reason being that these spending are not perceived as an act of charity by the poor, but as a right. The rich have to redistribute to the poor so that they take part to the political assembly and vote according to their views.

In order to avoid a too great influence of a minority of rich citizens, the city (in fact Pericles) created a kind of salary to take part to the public assemblies. The sum perceived is not important, but cumulating them provides a way for getting a minimum income. There were a lot of discussions on the bad effects of these allocations because it led political decisions to be taken by maybe incompetent people. But they are a cement for the city because they benefit mainly to the poor.
4.2 Modern theoretical foundations

The Athenian situation is illuminating for several reasons.

- It provides an objective definition of the poor: not being rich enough to buy a slave. This is an absolute definition of poverty.
- Poverty and inequality are considered within a social contract expressed by being a citizen of Athens.
- Inequality in the distribution of wealth and income is accepted, but wealth is not exactly private. It is seen as a common belonging of the city. This justifies the obligation of redistribution.
- There is a kind of basic income, a topic which is very much debated nowadays.

The modern theory of economic justice is not at ease with these topics. It lead to the writing of the three famous papers, two by Atkinson (1970), Atkinson (1987) and one by Sen (1976). Basically, these papers deals with an axiomatic construction around a welfare function having individual incomes as an argument.

In order to judge and compare between different social welfare functions (i.e. to judge and compare different income distributions), a convenient paradigm is the veil of ignorance experiment. This is the story about individuals that have the choice to immigrate between two different countries. Once in the chosen country, their social position will be chosen at random. Inequality represents a risk in that decision. The immigrant would chose the country for which the expected utility is maximum

$$\max_i \int U(x)f_i(x)dx.$$  

The aversion for inequality in the distribution of income $f_i(x)$ corresponds to the concavity of the utility function $U(x)$ which means risk aversion. A social welfare function is defined as $W(x) = \int U(x)f_i(x)dx$. This function is central to the paper of Atkinson (1970).

Poverty is defined in Sen (1976) in reference to a poverty line $z$. A poverty index has to verify some axioms. These axioms lead to the definition of Sen’s poverty index.

Progressive income taxation means that $t(x)/x$ is an increasing function of $x$. It arises from principles of vertical equity. Taxes are designed so as everyone experiences an equal loss of utility. A concave utility function justifies progressive income taxation because it assumes a decreasing marginal utility of income.

5 Exercices

Using $\mathbb{R}$ (see the next chapter for an introduction), compare the distribution of the HDI index using the data based on original definition and the data obtained using the new definition. The
data are available on Wikipedia after some transformations or at

References


APPENDIX

A The Stiglitz’ commission


Depuis longtemps, des interrogations croissantes se sont exprimées sur la pertinence des mesures actuelles de la performance économique, notamment celles fondées sur les chiffres du PIB. En outre, la remise en question de ces chiffres vise plus largement leur validité comme mesures du bien-être social, ainsi que du développement durable économique, écologique et social.

Le but de la commission est d’identifier les limites du PIB comme indicateur de performance économique et de progrès social, d’examiner quel supplément d’information est nécessaire pour
produire une image plus pertinente, de discuter quelle en serait la présentation la plus appropriée, et de vérifier la faisabilité des instruments de mesure proposés.


A.1 Advantages and limits

Problèmes économiques

les insuffisances du PIB comme repère de progrès et sur certaines réformes possibles des comptes nationaux.

Parmi les autres points très positifs, signalons : une assez forte présence de la question des inégalités et de l’insécurité économique et sociale (y compris pour mieux cerner des effets cumulatifs sur certaines personnes ou certains groupes sociaux), aussi bien dans le chapitre 1 que dans le 2, mais pas dans le 3 ; l’insistance à diverses reprises sur des enquêtes de budget temps plus systématiques et plus fréquentes dans tous les pays ; le souci de mieux valoriser (monétairément ou non) le non-marchand et le non-monétaire, les services publics et leurs contributions. La notion de “dépenses défensives” fait l’objet d’appréciations positives (il s’agit de situations où des activités qui augmentent le PIB correspondent à de purs réparations de dégâts occasionnés par d’autres activités qui augmentent le PIB. . . ).

Les indicateurs économiques dominants nous trompent en ne nous envoyant pas les signaux permettant d’agir et de prévenir à temps les crises majeures, ils ne nous disent rien du bien-être durable, des inégalités, de la pression environnementales, etc. Il en faut d’autres pour cela.

l’insistance des auteurs sur la monétarisation comme seule méthode vraiment satisfaisante. La très juste critique du PIB n’est pas allée jusqu’à une critique des limites de la comptabilité nationale monétaire, impuissante à intégrer des problèmes pour lesquels elle n’a pas été créée.

A.2 Sumary (Wikipédia)

Le rapport a préconisé l’élaboration d’un tableau de bord regroupant plusieurs indices autour de trois grands axes :

1. Axe économie avec une amélioration de la façon de calculer le PIB

2. Axe bien-être. Avec une évaluation tant au niveau subjectif (ce que pensent les gens) qu’objectif avec prise en compte de la consommation, de la répartition des revenus et du patrimoine. En France, l’Insee a commencé à s’engager dans cette voie. Il a publié dès
le 17 novembre 2009 des données sur les inégalités[6]. Il a présenté en 2010 une série d’analyses sur les très hauts revenus, les inégalités de patrimoine, le mal-logement et le capital humain [7]

3. Axe soutenabilité du développement avec deux grands angles d’approche:

- Indicateur monétaire synthétique de soutenabilité

- Des indicateurs physiques dont l’un d’eux indique clairement dans quelle mesure nous approchons de niveaux dangereux d’atteinte à l’environnement (cas du changement climatique ou des ressources halieutiques par exemple)