QUANTITATIVE METHODS FOR THE CAPABILITY APPROACH

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Contents

Summary

This chapter is an overview of the main methodologies that have been proposed in the literature for operationalizing the capability approach. It covers descriptive as well as modeling approaches, the former focusing on developing a full picture of the well-being situation using many indicators and the latter going further to determine possible 'causes' for the situation and hence leading to potential remedies. We present both statistical data-driven techniques as well as non-statistical techniques based on 'normative' judgments.

Finally we discuss some promising directions for future research in this domain and suggest combining the different approaches to obtain an optimal well-being output integrating both the descriptive and explanatory properties and allowing for informed policy decisions.

1. Introduction

Nobel Laureate Amartya Sen's Capability Approach constitutes one of the greatest contributions to the socio-economic debate on well-being, quality of life and poverty (cf. Sen 1985b, 1987, 1992, 1993, 1999). According to this approach, the basic purpose of development is to enlarge people's choices so that they can lead the life they have reason to value. In this approach, people's choice sets are termed "capabilities" and the actual levels of achievement in the various dimensions are called "functionings". A capability set is therefore the set of all "beings" and "doings" that an individual is potentially capable of whereas achieved functionings represent a subset of them resulting from particular choices made from the capability set. All functionings, whether potential or achieved, are all affected by a person's resources and entitlements, and her ability to convert them into functionings.

By focusing on people's life choices, the capability approach naturally leads to a concept of development that is multidimensional incorporating diverse social, economic, cultural and political dimensions. Therefore, economic growth, though necessary, is not sufficient in itself to bring about development in this broad sense. It is thus a contrast to welfare-based approaches which tend to rely solely on a narrow measure of economic well-being.

One can generally distinguish four main approaches to the definition and measurement of well-being. In the classical welfare economics approach, an individual's well-being is equated to her 'utility' which is in turn postulated as a (monotonic) function of her total consumption of goods and services. Thus total consumption (or income) is often used as a measure of well-being in this approach, especially for making interpersonal comparisons. This approach is uni-dimensional as it only focuses on one aspect of life, namely that which is concerned with consumption of goods and services, in fact only 'market exchangeable' goods and services that can be expressed in monetary units using prices. Apart from the fact that total consumption or income may not be the sole contributor to utility, a more serious criticism of this approach is that it totally neglects non-utility aspects such as freedom, rights, human agency and equity in evaluating or comparing different states of affairs.

A second approach advocates the use of life-satisfaction information reported by individuals as the basis for evaluating well-being. Here well-being is equated to happiness or life satisfaction. A major issue with this approach is its subjectivity and lack of interpersonal comparability as the happiness values are self-reported, often on an arbitrarily fixed scale of say 1 to 10, and hence heavily dependent on personal interpretations. Solutions have recently been proposed in the literature to make these values comparable for instance using the vignette approach (e.g. Kapetyn *et al.*, 2011) but to our knowledge they have only been developed for a single indicator. Therefore a good deal of caution has to be taken while using these values in any analysis. Further, the policy implications of this approach are not always clear-cut and need not always favor better living conditions as sole reliance on self-reported satisfaction can promote states in which people may lack freedom in certain dimensions but still report to be happy (due to adaptive preferences). For instance, the 'acceptance' of a lower salary by

women who report to be 'satisfied' with their situation does not imply that policy should not aim for equal salaries for men and women.

A third approach recognizes that well-being is more than having a sufficient income and focuses on a few basic dimensions considered as necessary to live a good life e.g. food, clothing, shelter, water and sanitation etc. The main purpose of this 'basic needs approach' is to improve the lot of the poor as it is concerned with "the satisfaction of some elementary needs of the whole population especially in education and health" (Streeten *et al.* 1982). It rests on the idea that the basic needs of all have to be fulfilled before the 'less essential' ones of a few. Although this approach is multidimensional in nature, a major concern for deriving a definition of well-being based on this approach is the absence of many potentially valuable dimensions in its evaluative space especially in a context where these basic needs are generally fulfilled.

A fourth approach is the capability approach in which well-being is evaluated in terms of the real opportunities that people have to lead the life that they have reason to value. These real opportunities or capability sets are fundamental elements of one's well-being in this freedom-based approach. This definition of well-being makes this approach a richer but at the same time a more demanding one at an informational and methodological level compared to the other approaches, thus challenging its operationalization and its empirical applicability.

The capability approach is a normative theory offering a framework of thought for evaluating people's well-being and a government's policies (cf. Sen 1992, Robeyns 2005a, Qizilbash 2008, Robeyns 2011). Unlike the previous approaches, it has two evaluative spaces - capabilities (freedoms or choice sets) and functionings (actual outcomes or achievements). Equally important in this framework should be the circumstances, material and non-material, that shape and influence people's capabilities and functionings. These circumstances come about at two levels: a) individual - a person's resources and ability to 'convert' resources into effective functionings, and b) societal - the cultural, political, institutional and social settings in which the person lives, that could be either capability enhancing or capability reducing. Although the role of social, political and institutional factors is not fully made explicit in Sen's mathematical formulation (see Section 2 below), a full operationalization should ideally be able to go beyond a mere description or measurement of capabilities or functionings and provide insights on what factors (economic, social, institutional, political) contribute to their enhancement.

Capability approach is also concerned with agency and empowerment; however, from the point of view of operationalization, these concepts have not received as much attention as those of well-being and deprivation. Agency freedom refers to the ability to act for one's valued goals and change the circumstances for oneself and one's community. On the other hand, empowerment of a person (or a group) is the capacity to make own choices and effectively influence decisions that affect her or the group (Ibrahim and Alkire 2007).

Before going on to describe what is in this chapter, mention should be made of other surveys on the capability approach in practice namely Robeyns 2006, Chiappero

Martinetti and Roche 2009, and Lessmann 2012, and the reader is encouraged to consult these along with the present review.

This chapter is organized as follows. In the next section we briefly present the main features of the capability approach emphasizing on elements that are important for its operationalization. This is followed by a short overview of the major operationalization methodologies that have been proposed in the literature along with their strengths and weaknesses.

Sections 4 to 8 re-examine each of these methods in more detail starting with composite indices constructed as weighted averages, going on to more sophisticated descriptive techniques such as fuzzy sets, which is of particular relevance in describing situations of partial well-being or deprivation, and moving further to structural modeling frameworks offering insight on the underlying causes and influences, passing through purely statistical principal components. After a succinct section on the use of classical regression techniques in this context, we discuss how subjective data on capabilities can be analyzed from a quantitative angle. Finally we touch upon concepts closely related to capabilities and functionings, namely agency, empowerment and equality of opportunity, which are beginning to receive increasing attention from empirical researchers. We end the chapter with some concluding remarks on some promising future directions of research in this area.

2. The Basics of Capability Approach

In this section, we will summarize the essential features of the capability approach, especially from the point of view of its operationalization. There are excellent surveys on this approach that cover other aspects such as its philosophical underpinnings, its ethical implications or even its usefulness for formulating a theory of justice. The reader is referred to Robeyns (2005a, 2006, 2011), Fleurbaey (2002), Comim, Qizilbash and Alkire (2008), Deneulin (2009) for a wider coverage of these aspects of the approach.

Now the main features. Capabilities are defined as the real choices that a person has to lead the life she wants to live (e.g. being able to be healthy, being able to be educated) while functionings are outcomes i.e. what the person manages to do or to be (e.g. being healthy, being educated), depending on the particular choices exercised from the capability set.

This distinction between capabilities and achievements, and between their respective evaluative spaces is a unique feature of this approach which differentiates it from other approaches which rely solely on single evaluative concepts (uni- or multi-dimensional) such as utility, resources or happiness.

Another important characteristic is the differentiation between means and ends. The means and resources necessary for enabling a capability or functioning do not enter the definition of well-being. Thus income, access to clean water, adequate sanitation, clean air, access to schools etc. that are say pre-requisites for being healthy and educated are only important in so far as they augment the capability in these dimensions.

Similarly the environmental conditions that allow the individual to exercise her freedom without restraint are not part of well-being but are valuable means for the end of well-being which is the set of capabilities that they offer.

The approach also recognizes the heterogeneity of individuals at many levels - at the level of the resources that they have, at the level of their ability to 'convert' resources into effective functionings, at the level of the social structure that they live in and finally at the level of their physical surroundings. Thus the opportunity set that matters for the evaluation of well-being is one that is made feasible by the available resources, and individual, social and environmental 'conversion' factors.

Sen (1987) gives the following formal framework for his approach. Denote by z_i the commodity vector possessed by any individual i. These commodities in turn have certain characteristics $c(z_i)$ that the individual makes use of to achieve certain "beings" and "doings" denoted by $b_i = f_i(c(z_i))$ where f_i characterizes the 'making use of' or the 'utilization' of the commodities. Thus, the capability set is the set of all possible b_i's that a person can achieve using any one of the possible f_i's that she can choose from. Sen also adds another equation to link a person's happiness or utility to her capability set. Now we go on to see how one can operationalize this theoretical framework.

3. Approaches to Operationalization

Why operationalize a theory? A direct answer is that it is all well and good to have a sound theory but it is even better if it can be put to use for improving the state of affairs in a society. Thus we believe that operationalization of capability approach is necessary for

- Evaluating well-being in a society,
- Assessing its change over time,
- Comparing well-being across different groups,
- Analysing the impact of a policy on well-being, and
- Suggesting policy recommendations for improving the well-being.

In practice, data sets containing information on all the above conceptual elements, $b_i, f_i, z_i, c(z_i)$, are rare, if not non-existent. Very often all that one observes is the vector of commodities z_i (resources) possessed by an individual, her achieved functionings and her environmental conditions. What is crucially missing in data is information on the choice sets (the set of possible functionings b_i) and the conversion functions f_i. However, as we have emphasized all along, the capability metric of welfare is the single most distinguishing feature of this approach with respect to the other approaches discussed in the introductory section.

One therefore needs to find some way out to quantify the 'freedom content' of an individual's capability set from which she has made particular choices leading to the observed outcomes. This is not to understate the importance of achieved functionings as they are also relevant for well-being in this approach.

The ideal solution is to be able to get the information on the choice set from the individual herself. There are only a few surveys that have been recently designed to obtain information on the individual's freedom to choose. Anand and van Hees (2006) and Anand *et al.* (2009) have implemented a survey instrument with explicit questions on capabilities in different dimensions of life. As mentioned earlier while discussing the happiness approach to well-being, answers to these questions are of a highly subjective nature and one should take extreme caution in making interpersonal comparisons using this type of information. We will later present some analyses carried out with such data sets which have taken account of subjectivity and individual heterogeneity.

The bulk of the literature on the operationalization of capability approach has relied on secondary data i.e. household surveys that were not meant for measuring capabilities and hence only contain data on achieved functionings (in certain domains) along with some socio-economic variables. The advantages of these data sets are that they are generally large, representative of the whole population, often repeated over time and contain both quantitative and qualitative information on a broad range of aspects related to the quality of life at an individual/household level. Thus they allow the researcher to study human behavior from a multidisciplinary perspective.

The first aspect to be incorporated in any practical study on capabilities is the multidimensional nature of the well-being concept. This means that as a first step, one has to make a list of dimensions that are important for the study and then define appropriate indicators for measuring well-being outcomes in each dimension. It is essential to explicitly go through this two level structure (dimension and indicator) in the selection process as they represent two distinct levels as far as theoretical reasoning is concerned. The first one is more philosophical and normative as it involves a decision on what aspects of life are important for well-being. The second one is more empirical trying to address the question of what type of variables appropriately measure well-being within a given dimension.

To take an example, at the first level one determines whether health is an important dimension in life and at the second level one examines the suitability of anthropometric indicators as measures of health well-being. Sen's works do not give any dimension list that can be used in practice. On the other hand he insists (Sen 2005) that the list has to be a consensual one arrived at through a democratic process and public reasoning. Robeyns (2003, 2006b) proposes some procedural criteria to ensure that the list finally selected is devoid of personal and disciplinary biases of the researcher or policy maker.

The earliest quantification attempts consisted in selecting different outcome indicators and calculating a weighted average of these indicators as a measure of well-being. By using outcome variables, they measure functionings rather than capabilities. The adequacy of the chosen indicators for well-being in the corresponding dimension and the 'arbitrariness' in the choice of weights for combining them are important issues to be dealt with prior to applying these simple procedures. In recent years, the literature has gone beyond weighted averages and proposed indices derived from an underlying theoretical model that provides an explanation for the inclusion of the variables composing the index as well as an endogenous determination of the weights in the construction of the index.

Model-based approaches are appealing because they offer an explanation for the observed state of well-being in addition to providing a way of summarizing the available set of indicators. Models using latent variables assume that a) the capability set or the freedom to choose is not directly observable but manifests itself in many observable outcomes; b) any single indicator can only be a partial measure of the degree of freedom in the underlying dimension. The 'weights' that enter the expression of the index resulting from these models are data-driven (endogenous) and reflect the quality of information contained in the different observed variables. Factor analysis, Multiple Indicators Multiple Causes (MIMIC) models, Structural Equation Models (SEM) and their later extensions come under the category of latent variable models. We will look at these models in detail in Sections 4 to 8 which are largely inspired from Krishnakumar (2008) and Krishnakumar and Nagar (2008).

Among the non-statistical techniques proposed in this context, a popular one is the application of fuzzy sets theory (its initial formulation is non-statistical though empirical distribution-based membership functions have been proposed later on, see Section 4.3). This method is based on the notion that membership to the class of well-off or poor is not a zero-one situation but should rather take a continuous value between zero and one. These methods will also be presented while discussing descriptive approaches.

At this stage, it is important to note that all aggregation or weighting procedures, exogenous or endogenous, implicitly assume some degree of substitutability between the different indicators/dimensions and involve some value judgments, even when the weights are equal. From a policy perspective, it may be optimal to think of a mixed aggregation procedure in which the weights are endogenous (model-based) within dimensions and exogenous (based on normative judgments) across dimensions (e.g. Ballon and Krishnakumar 2011).

There is no 'one size fits all' answer to the operationalization question; the solution depends to a large extent on the intended aim of the operation. The plurality of approaches only shows the diversity of problems that can be tackled within this framework and the scope for future advancements and refinements. Whatever be the approach taken, one should always be aware of its restrictions while interpreting the results and strive to find ways to remove them to the extent possible.

Before we go on to look at each method in detail, we would like to clarify that we do not aim to cover multidimensional studies *in general* on well-being, development and poverty but only focus on methods that attempt to operationalize the capability approach. There are many studies in the well-being literature that advocate a multidimensional perspective on standard of living or poverty without necessarily referring to the capability approach (some examples of such studies on quality of life or living conditions are Morris 1979, Townsend 1979, Erikson *et al.* 1987, Slottje 1991, Boelhouwer and Stoop 1999, Boelhouwer 2002). In fact most of these papers have strongly argued that in order to be able to design an effective action program, policy-makers should have a complete vision of people's living conditions covering physical, economic, social, cultural and other aspects, a view that is also endorsed by the capability approach.

4. Descriptive Methods

Under this heading we cover the main approaches that are followed to summarize and describe a person's well-being. As explained in the beginning of Section 2 it is important to be able to get an overall picture of one's well-being in order to either evaluate its progress over time or compare it with that of another individual.

4.1. Composite Indices (With Exogenous Weights)

This subsection includes all indices that use weighting and aggregating structures decided by the analyst. In other words, the aggregation scheme and the weights are selected exogenously based on some 'normative value judgment'. The selection of indicators is often based on its perceived relevance to the concept under study.

The most well-known among them is the Human Development Index (HDI) proposed by UNDP (annual, from 1990). Here the aggregation function is of the geometric type (the initial index was an arithmetic average) and the weights are equal for all dimensions. HDI is composed of three dimensions: health and longevity (measured by life expectancy at birth), instruction and access to knowledge (measured by mean years and expected years of schooling) and a third dimension representing conditions for a decent life (for which income is taken as a proxy).

Given that these indicators cannot be combined as such, the indicators are converted into comparable dimension indexes taking values from 0 to 1 using the following formula:

$$Dimension\ index = \frac{Actual\ value - MIN}{MAX - MIN}$$

where the MIN and MAX are values to be defined. The intuition of this normalization is to obtain a value on a scale that is commonly used in many situations to describe progress or development, i.e. a scale of 0 to 1 where the closer the value is to 1 the higher the 'development'. The minimum and maximum values are based on the observed values for the period from 1980 to 2011 and some imposed values.

Given that there are two indicators in education, a special procedure is applied in this dimension. First the two indicators are normalized to produce I_{edu1} and I_{edu2}. The geometric mean is then applied to these two values:

$$I_{\text{edu}}^{*} = \sqrt{I_{\text{edu1}} \times I_{\text{edu2}}}$$

This combined index is once again normalized using the maximum observed value to obtain the education index I_{edu}.

In a final step, the Human Development Index (HDI) is defined as the geometric mean of the three dimension indexes:

$$HDI = \sqrt[3]{I_{\text{health}} \times I_{\text{edu}} \times I_{\text{inc}}}$$

There is also an inequality adjusted HDI based on Alkire and Foster (2010). A measure of the Atkinson family is used to estimate the inequality in each dimension. The general formula is given by:

$$A_x = 1 - \frac{1}{\bar{X}} \sqrt[n]{\prod_{i=1}^{n} X_i}$$

where the numerator of the ratio is the geometric mean and the denominator the simple average. Whenever all $X_i = \bar{X}$, meaning that everybody has the same value, the geometric mean is identical to the simple average, hence the ratio equals 1. As a consequence, A_x becomes 0 indicating absence of any inequality. Whenever the X_i values are different, the geometric mean will be smaller and therefore the ratio will be smaller than 1 and $A_x > 0$. The higher A_x is, the greater the inequality. This measure is then used to derive the inequality adjusted dimension index by multiplying the index used in the HDI computation by $1 - A_x$:

$$\tilde{I}_x = I_x(1 - A_x) = I_x \frac{1}{\bar{X}} \sqrt[n]{\prod_{i=1}^{n} X_i}$$

The inequality adjusted HDI is finally given by:

$$IHDI^* = \sqrt[3]{\tilde{I}_{\text{health}} \times \tilde{I}_{\text{education}} \times \tilde{I}^*_{\text{income}}}$$

where the asterisk signifies HDI and IHDI computed with the non-logged income index. This allows us to fully take into account the inequality in the income distribution. In fact HDI can also be calculated without the log-transformation in the income dimension, leading to:

$$HDI^* = \sqrt[3]{I_{\text{health}} \times I_{\text{education}} \times I^*_{\text{income}}}$$

To see how much a country looses in terms of HDI due to inequality, one can compute:

$$Loss = 1 - \frac{IHDI^*}{HDI^*}$$

Other composite indices with exogenous weights have also been proposed by UNDP for instance the Multidimensional Poverty Index and the Gender Inequality Index with the former comprising the same three dimensions as HDI with equal weights whereas a more 'complex' weighting structure involving arithmetic, geometric and harmonic means is used in the case of the latter. The MPI methodology is briefly outlined below.

As all these indices undergo regular changes, the reader is invited to consult the latest UNDP report (HDR) for updates.

MPI considers the same three dimensions as the HDI, but this time the indicators are based on household data. For each of the two dimensions health and education, two indicators are used, whereas for the living conditions 6 indicators are used. Each dimension has a relative importance of $1/3$. All the indicators have a dichotomous character, taking the value 1 if the household is deprived and 0 otherwise. A household with all indicators equal to 1, being deprived from everything, reaches a value of 10, whereas a household that is not deprived at all has a value of 0. All households showing a value higher than 3.33 are considered to be *multidimensionally poor* (MDP).

Once all the MDP households are identified, the headcount ratio is computed as

$$H = \frac{q}{n}$$

where q is the number of people living in MDP households and n is the total population. Next, an average intensity of deprivation is calculated as follows:

$$A = \frac{\sum_{1}^{q} c}{qd}$$

where c is the total number of weighted deprivations of poor people, d is the highest possible degree of deprivation (in this case 10) and q is the number of people living in MDP households. In other words, the deprivation value of each household is multiplied by the number of people living in the household. The sum of all these household based values is then divided by the highest possible deprivation (i.e. if all poor were fully deprived) and normalized. Thus, the intensity of multidimensional poverty A takes the value 1 whenever all MDP are fully deprived in all indicators and a lower value when it is not the case.

Finally MPI is calculated as the product of A and H :

$$MPI = A * H$$

Let us add that all these measures are heavily dependent on the choice of indicators, weights and aggregation techniques. As they are weighted averages of actual outcomes, they remain at the level of functionings.

Many extensions of the 'weighted average methodology' are available in the literature, which use multiple indicators spanning several dimensions, either as such or after aggregation for assessing well-being. Some studies simply compare their summary statistics across sub-samples (countries, regions, States) (e.g. Brandolini and D'Alessio 1998, Phipps 2002) while others propose generalized versions of means as aggregation functions (for instance Massoumi and Nickelsburg 1988 propose a generalized mean index that minimizes a divergence criterion between the aggregate and component distributions, and Bourguignon and Chakravarty 2003 propose a CES-type aggregation function for a multidimensional poverty index). Typically the latter methods involve

some parameter(s) whose value(s) is (are) dictated by normative judgments. Bandura (2005) surveys 130 indices and Nardo *et al.* (2005) discuss the different stages in the construction of composite indices.

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Bibliographical Sketch

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