

# **Some Reflections**

## **on Operationalising the Capability-set and a Definition of Poverty as Capability Failure**

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### **Abstract**

Much of the empirical work on the capability approach has focused on the question which functionings or capabilities to take into account and the search for adequate indicators. Usually, the term "capability" is used interchangeably with the term "functioning" or as referring to the potential as opposed to the achieved level of a functioning. At the same time, the literature on opportunity sets has concentrated on the evaluation of capability-sets, taking them as given. This paper starts with clarifying the concept of capability underlying the following reflections. Therefore, it compares the usage of the term "capability" by Sen and Nussbaum. The comparison shows that the differences between their versions of the approach are not restricted to the interpretation of the term but affect the modelling and measurement of capabilities. The paper refers to the concept of capability outlined by Sen (1985a). It discusses some methodological issues regarding the identification of the capability-set in empirical terms. This is viewed as a prerequisite to its evaluation. Firstly, it discusses some properties of the capability-set; secondly, it presents and classifies approaches for estimation of the capability-set and thirdly, it examines the proposal of Sen to apply fuzzy set theory to it. Finally, a (formal) definition of poverty as capability failure is proposed that is based on Sen's example on the difference between hunger and fasting. No empirical application is given throughout the paper.

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# 1 Introduction

Much has been written on the capability approach and its usefulness as a framework of thought. Its power to direct attention to the importance of freedom has been praised. It provides the multidimensional approach to welfare analysis that has been long called for. At the same time the question has been posed whether the capability approach can be operationalised. At best the question has been left open or else been answered in the negative.<sup>1</sup> The attractiveness of the capability approach is based on the concept of capability being both a conception of freedom of choice and an alternative way to measure the standard of living.

Most of the empirical work has concentrated on the latter using a notion of capability that interprets capability as indicating the potential ability of a person to do or to be something. This interpretation simplifies the underlying structure of the capability approach as will be argued in this paper. At the same time much of the empirical work is dedicated to the search for adequate indicators and aims at showing the influence of variables other than income on the standard of living. While this is an important task only minor attention has been paid to the capability-set. The capability-set in Sen's approach represents the menu from which an individual can choose a combination of functionings it considers valuable.

The notion of the capability-set is the focus of interest in much of the social choice literature and the contributions on opportunity sets<sup>2</sup> inspired by the capability approach. This literature investigates the appropriateness of the capability-set as a conception of freedom. In this line of work the capability-set is usually taken as given and priority is attached to the question of evaluation in view of the various criteria applicable in this process.

This paper will identify a gap between those two branches of research. In spite of the difficulty that only one element of the capability-set - namely the vector of achieved functionings - is observable the paper develops some ideas how it may be assessed. Assessment of the capability-set in empirical terms is a prerequisite for applying concepts of set-evaluation set forth in the literature on opportunity sets. Although the paper aims at making the concept of capability operational it does so on a conceptual level without providing an empirical application.

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<sup>1</sup> See e.g. Basu (1987), Robeyns (2001) and Comin (2001).

<sup>2</sup> An overview on the literature on opportunity-sets is given by Barbera/Bossert/Pattanaik (2004). Sugden (1998) first integrated the idea of opportunity as the basis for welfare and the proposals for evaluating opportunity-sets.

Gasper (1997) has made the link between capability and opportunity explicit when he has suggested to distinguish O-capability (O for opportunity) from P- and S-capability (P for potential and S for skill). Santibanez (2001) is another example of approaching opportunity-sets from a capability perspective.

The paper is organised as follows: In section 2 a brief discussion of Sen's concept of capability is presented. The existing confusion with regard to the concept is illustrated through comparing Sen's and Nussbaum's use of the term "capability". Having stated the meaning of capability clearly section 3 takes up the question how the capability-set may be operationalised. First, the section identifies boundaries of the capability-set related to characteristics of the functionings considered. Further, it asks for the properties of the capability-set and examines the usual assumptions of convexity, connectedness and closedness. Then the section presents ideas to estimate capability-sets on the basis of resources, personal attributes and functioning achievements. Finally, the section examines the suggestion of Sen (1994) to apply fuzzy set theory to the capability-set. It will be argued that this suggestion has much intuitive appeal, but hinges upon the possibility to find a convincing definition of the membership function. Section 4 asks what role capabilities play in the definition of poverty. The subject of poverty is one of the main concerns of the capability approach but no working definition of poverty is offered by Sen (or Nussbaum for that matter). This section presents a definition of poverty that makes use of the notion of capability-sets. Of course, the usefulness of this definition depends on the ability to assess capability-sets in a proper way. Section 5 concludes.

## **2 The concept of "capability"**

There is some confusion about the meaning of the term "capability". In part this is due to the use of the term by Sen himself. However, he has referred frequently back to his formal description of the capability approach in Sen (1985a). This is the starting point in this paper. Then Sen's conception of "capability" is compared to the one of Nussbaum. It is argued that the difference between both is not restricted to the interpretation but affects the way measurement is outlined.

### **2.1 Sen's definition of capability**

"Capabilities are notions of freedom" Sen (1987, p. 36) writes and he explains that capability is the freedom of a person to lead the kind of life she values (see Sen 1999, p. 18). Constitutive of a person's life or being are functionings that is "the various 'doings' and 'beings' a person achieves" (Sen 1987, p. 29). The kind of functionings considered may vary from elementary ones such as "being adequately nourished, being in good health, avoiding escapable morbidity and premature mortality" (Sen 1992, p. 39) "to very complex activities or personal states such as being able to take part in the life of the community and having self-respect" (Sen 1999, p. 75).

Capability “represents the various combinations of functionings (beings and doings) that the person can achieve” (Sen 1992, p. 40) and a “person’s capability-set can be defined as the set of functioning vectors within his or her reach” (Sen 1985b, p. 201). A capability-set thus consists of all combinations (vectors, bundles, n-tuples) of functionings feasible for a person and gives a full description of the lives a person is able to live.

There are two aspects that determine the feasibility of certain bundles of functionings for an individual: on the one hand the resources a person can get hold on and on the other hand the personal features that enable somebody to use the resources in a certain way. At least this is the way Sen (1985a, p. 11-13) puts it in his formal description of the capability approach:

Let  $x_i$  be the vector of commodities possessed by person  $i$ , then  $f_i(\cdot)$  represents a personal “utilization function” of  $i$  reflecting one pattern of use of commodities that  $i$  can actually make. The person  $i$  may choose a utilization function  $f_i$  out of her personal set of utilization functions  $F_i$ . Therefore the vector of achieved functionings  $b_i$  will be given by applying the chosen utilization function  $f_i$  to the commodity vector  $x_i$ :  $b_i = f_i(x_i)$ . The functioning vectors feasible for person  $i$  with a given commodity vector  $x_i$  are given by the set  $P_i(x_i) = \{b_i | b_i = f_i(x_i), \text{ for some } f_i(\cdot) \in F_i\}$ . Allowing the person to choose the commodity vector  $x_i$  from her budget set  $X_i$ , all functioning vectors feasible for the person are given by the capability set  $Q_i$ :

$$Q_i(X_i) = \{b_i | b_i = f_i(x_i), \text{ for some } f_i(\cdot) \in F_i \text{ and for some } x_i \in X_i\}.$$

There has been the proposal to alter this definition a bit by some authors (e.g. Robeyns 2001, Kuklys 2004) in order to take the influence of the society on the individual capability-set into account. Although this is a valuable and reasonable way to develop the capability approach further, I stick to the definition given in Sen (1985a) in order to keep the formal description simple.<sup>3</sup> One may as well think of the utilization functions as reflecting the social imprint on the individual.

## 2.2 Comparison of Sen’s and Nussbaum’s conception

The reason for presenting the concept of “capability” in such detail is the confusing use of the term in most of the literature. Sen himself is sometimes inclined to use the term in a loose way, e.g. when he speaks of “the *capability* to appear in public without shame” after explaining “such *functionings* as not being ‘ashamed to appear in public’” (Sen 1987, p. 17,

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<sup>3</sup> I am encouraged by the fact that Sen (2000, p. 74) maintains his conception.

emphasis added, O.L.). In this example Sen does not distinguish between functioning and capability. Another example of his tendency to play with words is his short paraphrase of the connection between capability and functionings as “the capability to function” (e.g. in Sen 1992, p. 111).

Nussbaum (1988, p. 160) adopts the paraphrase and goes on to explore the conditions of “the capability to function well”. Thereby she changes the meaning of “capability”. She - and many other writers<sup>4</sup> - use the term “capability” as a name for one dimension of the approach. In contrast Sen emphasises that the capability-set and achieved functionings “both are defined in the same space, namely, the space of functionings” (Sen 1993, p. 442). Again, in Sen (1996a, p. 118f) he states: “functioning is only a *dimension*”.

In Nussbaum’s version of the capability approach the dimensions are given by the “central functional capabilities” whereas the term “functioning” is reserved for the level of a capability a person has achieved. When Nussbaum agrees “wholeheartedly with Sen’s claims about the *capability space*” (Nussbaum 2000, p. 12, emphasis added, O.L.), she overlooks the fact that Sen does not call it *capability space* but *functioning space*. If “capability” is seen as the ability to exercise a certain function it represents the extent of possible achievement in this functioning by the person under favourable conditions. Then capability describes the potential excellence of a person and not an actual option for her.

This difference between Sen and Nussbaum with regard to the meaning of the term capability has already been noted by Crocker<sup>5</sup> who sums it up in the following statement:

“Hence, for Sen, capabilities are not powers of the person that might or might not be realized in different situations. They are, rather, options (sets of compossible options) for actions. These options may refer to but are not identical with traits of a person.” (Crocker 1995, p. 163)

However, Crocker (and Gasper) do not fully acknowledge the effect of that difference on the structure of the approach: A vector in Sen’s functioning space represents a combination of functionings and indicates the levels achievable in these functionings. The capability-set of a person contains all those functioning vectors feasible for that person. Nussbaum, however, sets up a capability space. Every vector of her capability space has to be a vector of capabilities. Each component of such a vector of capabilities indicates the skill of the person to function (and some external conditions if it is a vector of what she calls “combined capabilities”). There is no meaningful definition of a set of such vectors with reference to only one person.

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<sup>4</sup> To name but a few: Hossein (1990), Klasen (2000), Robeyns (2000).

<sup>5</sup> Gasper (1997) discusses the differences between Nussbaum’s and Sen’s capabilities approach as well.

Throughout the remaining part of the paper I hold on to the definition of capability-sets given in section 2.1. A capability is always understood as a bundle of functionings that may be represented by a vector in the multidimensional space of functionings.

### **3 Identifying capability-sets**

Understanding the concept of the capability-set is a prerequisite for operationalising it. Simultaneously one appealing feature of the capability approach is the claim that it covers directly the standard of living. As Sen has put it:

“It is easy to see that the well-being of a person must be thoroughly dependent on the nature of his or her being, i.e. on the functionings achieved. Whether a person is well-nourished, in good health, etc., must be intrinsically important for the wellness of that person’s being.” (Sen 1992, p. 40)

Generally, Sen regards functionings as being observable and as the best indicators of welfare available. Sen (1987, p. 16) has called the switch to functionings as the basis for welfare analysis a “movement in the objectivist direction away from utility”.

Although capabilities are defined in the space of functionings as the functionings themselves (Sen 1993d, S. 442) capabilities are not observable in the same way:

“In fact the capability set is not directly observable and has to be constructed on the basis of presumptions ... . Thus, in practice, one might have to settle often enough for relating well-being to the achieved - and observed - functionings, rather than trying to bring in the capability set (when the presumptive basis of such a construction would be empirically dubious).” (Sen 1992, p. 52)

As Sen (1999, p. 76) points out the chosen functioning vector is an element of the capability-set we know for sure. But this is almost everything we can be certain of. Otherwise Sen (1992, p. 53) himself regards data limitation as a possible impediment for the assessment of well-being and freedom in terms of capabilities.

In summary: Further information on the capability-set is necessary to make the concept work. The remaining part of the section explores three directions to take in order to open up the option of applying the concept empirically. First, I examine the properties of the capability-set. On the one hand features of the functionings involved restrict the capability-set. On the other hand the properties usually assumed are challenged by some examples. Secondly, various approaches for the estimation of utilization functions are presented. The section introduces a classification scheme according to the assumptions underlying the approaches. Several approaches assume identity of the individuals with respect to utilization functions, others assume homogeneity of reference groups determined by personal attributes whereas

clustering presumes homogeneity of reference groups displaying similar functioning achievements. Thirdly, the application of fuzzy-set theory to the capability is discussed as a means to capture the uncertainty with regard to capabilities. In response to the work of Chiappero-Martinetti (1994)<sup>6</sup> Sen has suggested to apply the idea of “fuzziness” to capabilities (instead of the poverty of achieved functionings as she does). The last part of this section provides some examples that support this suggestion. Additionally the examples offer an interpretation of the membership function on the basis of which membership functions may be calculated.

### 3.1 Properties of the capability-set

Throughout the paper the functioning space is presumed to be the non-negative orthant of the Euclidean  $n$ -space  $b_i \in \mathfrak{R}_+^n$ . The capability-set is, thus, a subset of the non-negative orthant of the Euclidean space,  $Q_i \subseteq \mathfrak{R}_+^n$ . The entries of the functioning vectors are interpreted as quantities of the functionings. Further an ordering on each functioning is assumed to hold, i.e. a higher entry with respect to a functioning is regarded to represent a better situation with respect to that functioning. It should be noted that this kind of quantitative specification preclude the possibility that a functioning variable can be of qualitative type - for instance of the type whether the housing is old or new.

Following, the nature of the functionings involved is considered as a means for restricting the capability-set further. Then, some properties usually regarded as “standard assumptions” (Herrero 1996, Basu/Lopez-Calva 1999) are challenged by exemplifying and discussing the route from resources to functionings and capabilities.

#### *Restrictions through the nature of functionings*

There are some facts about the nature of the functionings considered that could be taken into account in order to derive restrictions of the capability-set. For example the level of attainment a person has achieved in education can be regarded as the **lower boundary** of future capability sets of the person with respect to education. The reason is immediately clear if we regard the attainment level in terms of school examinations, university degrees or training certificates: Those who have obtained a certificate of their educational success are allowed to continue their education on the next level even if the certification has been some time ago.<sup>7</sup> But the argument is also valid in the context of learning and gaining an ability, at

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<sup>6</sup> Chiappero-Martinetti has developed the measurement of poverty by using fuzzy-set methodology further in Chiappero-Martinetti (1996, 2000).

<sup>7</sup> Generally that is true, but there are examples of only limited validity of certificates, e.g. in Finland after passing the final examinations in school one has to start studying during the next three years or otherwise loses the permission to study.

least in the short run. Somebody who has just acquired a skill will be able to apply it for some time. Consequently a level of education lower than the one already achieved is not feasible for the person, her capability set is limited from below with regard to the functioning of being educated.

There are other examples of functionings that depend on the course of time and the sequence of choice situations. Many functionings develop with age the best example being fertility. It is possible to derive an **upper and a lower boundary** for fertility depending on age.

The health status may in a rough simplification be regarded as a functioning that develops thanks to an initial endowment at birth and advantageous conditions during childhood and youth reaching a peak at the age of early adulthood and declining afterwards. The health status achieved by an adult person can then be said to indicate an **upper boundary** for future capability-sets of that person.

Of course, application of the ideas presented in this section hinges upon the availability of data on functioning achievements in previous periods. Nevertheless, they show a way to infer boundaries to individual capability-sets without specific assumptions, relying only on common knowledge on the nature of some functionings. The idea may prove useful to a certain degree but it cannot be applied to every functioning and therefore fails to give a comprehensive characterisation of the capability-set.

#### *Challenging the standard assumptions on capability-sets*

Sometimes functioning vectors that differ substantially belong to the same capability-set. To give an example, think of the range of commodity bundles within the budget-set. An individual is forced by his budget-set to decide whether to go for a holiday or to buy a Personal Computer. The capabilities offered by a holiday and a PC respectively are distinct depending further on the individual set of utilization functions. The holiday is a kind of consumption good while a PC is a durable good that opens up opportunities later on. During a holiday an individual moves about, gets to know other regions, other people and their characteristics, whereas the user of a PC is forced to stay in front of the monitor but is enabled to trips to the virtual world, to communicate with people all over the world and to work in certain branches. Whatever the individual utilization functions, is it reasonable to suggest that the capabilities offered by a holiday on the one hand and a PC on the other hand form a **convex** set?

In addition, there are other scarce resources such as time. As in the case of financial resources an individual has to decide whether to spend her time enjoying herself or to “invest” it in learning something that is useful later on. In this example the resource “time” is used in different ways and I think it reasonable to conclude that the functionings feasible by

using it in either way differ substantially. Even if the set of functioning vectors feasible given a certain resource bundle ( $P_i(x_i)$  in the formal description) is assumed to be convex, how can we conclude that the capability-set - being the union of all those sets  $P_i(\cdot)$  of functioning vectors feasible with resource bundles belonging to the budget set - is a union of **connected** sets **and** further more that it is **convex**?

So, there are some doubts about the convexity of the capability-set. In contrast the **closedness** of a capability-set follows if the budget-set is closed and the utilization function continuous.

In summary the examples reveal three reasons why the capability-set may not be convex: First the technical argument that the union of convex sets need not be convex itself nor simply connected. The second argument is that different commodity bundles induce different bundles of functionings that may or may not belong to a connected and convex set. The third argument asks for the options for the future inherent in different commodity and the subsequent functioning bundles.

### 3.3 Estimating the capability-set

The formal description of the capability approach is the obvious starting point if the aim is estimating the capability-set. The capability-set  $Q_i(X_i)$  depends on the budget set  $X_i$  and the individual set of utilization functions  $F_i$ . What empirical variables refer to the former seems obvious enough, but what variables may serve as indicators for the latter is still an open question. Data on personal features such as age, gender, profession, origin, residential area are candidates that come to mind. No matter whether information on resources or on personal features is used, a hypothesis is set up implicitly on "normal" behaviour or "average" abilities to live a life one values. Here, the propositions are classified according to the reference group to whom the hypothesis is applied. First, all individuals are assumed to be identical with respect to the utilization functions. Then, homogeneity is assumed for reference groups sharing some personal attributes. Finally, homogeneity is assumed for reference groups displaying similar behaviour in terms of functionings achievement.

As Harrison (2001, p. 14) has pointed out such hypotheses contradict the emphasis Sen puts on recognising the diversity of people. That should be kept in mind throughout the presentation.

#### *Identical individuals*

Individuals transform resources into functionings according to their personal abilities and limitations. By estimating a transformation function on the basis of data on resources and achieved functionings it is possible to draw conclusions on the feasible but not chosen

elements of the capability-set. Of course the estimated transformation function results from data on many individuals but is applied to individual resources to estimated *individual* capability-sets.

There are several empirical studies following by and large this line of thought. Lovell et al. (1990) view commodities as "input" and functionings as "output" and construct an index for each. Eventually they investigate the correlation between both in order to get a measure for what they call "transformation efficiency". They do not estimate capability-sets but they state that resources are distributed more equally than functionings and that individuals differ in their ability to transform resources into functionings (Lovell et al. 1990, p. 801-802). Ruggeri Laderchi (1997) explores the role of income as an indicator for well-being by using a probit analysis. She also does not estimate capability-sets but points to the difficulty of identifying links between income and functionings (Ruggeri Laderchi 1997, p. 359). The work of Klasen (2000) is also related to the question whether income is a good indicator of well-being. He compares the result of an income based poverty measure to a deprivation based measure.

#### *Homogeneity in terms of personal attributes*

While the estimation of the transformation function in the previous section relies only on information on resources and the functionings achieved in this section data on personal characteristics like age, gender or profession is used to narrow down a reference group for each individual. The population is partitioned into subgroups accordingly. People who share certain personal characteristics are assumed to be able to transform resources into functionings in a similar way.

The first one who has taken this line of reasoning is Hossein (1990). He calculates the probability of a person to achieve a certain functioning (e.g. being well-nourished) on the condition that this person belongs to a specific group (e.g. being a share-cropper). His "hypothetical measure" for the feasibility of a functioning is thus the frequency of achievements by individuals of the same group.

An effort to explore the relation between resources, personal characteristics and functionings more detailed is done by Kuklys (2004). She broadens the meaning of resources to cover education additionally to income. Apart from resources she takes personal attributes such as gender, age, job status as causal variables. She does not estimate the transformation function as such, but uses a structural equation model to measure two functionings (health and housing conditions) on the basis of more than one indicator.

#### *Homogeneity in terms of functioning achievements*

In the previous section reference groups are determined through personal characteristics. Personal characteristics and their likeness is taken as an indicator for similar utilization

functions. Kuklys even interprets personal attributes as causal variables. Cluster analysis, in contrast, can be applied to achieved functionings.<sup>8</sup> The aim is to find patterns of functioning achievement and to identify groups of individuals who resemble each other and differ from members of other groups in terms of functioning achievement. Similarities in resources and personal attributes serve as an explanation and confirmation of the findings without being employed in the first place.

Schwenk (1999) has followed this procedure aiming at the exposition of social strata in Germany. Although he does not call his variables functioning achievements but fulfilment of objectives in life the concept underlying his analysis equals Sen's concept of capabilities fairly well.<sup>9</sup>

### 3.3 The capability-set as a fuzzy set

Chiappero-Martinetti introduces fuzzy set theory to the capability approach because it provides a way to capture **uncertainty**:

“What made [the fuzzy set theory] particularly interesting was the possibility of explicitly introducing the uncertainty and inaccuracy that inhere in most situations into a reference pattern which easily adjusts to various conceptual requirements. Without foregoing the necessary formal rigour it often makes it possible to reduce the gap between theoretical formulations and their applicability, and proves particularly useful whenever a robust theory is matched by complex real situations that jeopardize its applicability.” (Chiappero-Martinetti 1994, p. 372)

Until now, the application of fuzzy set theory in relation to the capability approach has been confined to the group of the poor.<sup>10</sup> In response to the work of Chiappero-Martinetti Sen (1994, p. 343) has suggested to apply fuzzy set theory to the capability-set instead.<sup>11</sup> That is a reasonable suggestion in view of the uncertainty that exists about the answer to question like: Which functioning vectors belong to the capability-set apart from the vector of achieved functionings? What presumptions can be reasonably made in response to this question?

Williams (1987) has already posed these questions nearly twenty years ago discussing the concept of capability. He has in particular asked the question as to “[h]ow far should we consider the costs of doing something, when we are trying to decide whether someone has

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<sup>8</sup> Hirschberg, Maasoumi and Slottje (2001) apply cluster analysis with reference to the capability approach in order to group quality of life indicators. So, they are concerned with selecting valuable functionings, a question that is not discussed here.

<sup>9</sup> I show the similarity of those approaches in my PhD thesis: Lessmann (2004).

<sup>10</sup> Chiappero-Martinetti (1994, 1996, 2000) has pioneered this approach. See also Lelli (2001) and Balamoune (2003).

<sup>11</sup> He also mentions the possibility of fuzziness in footnote 43, p. 310 of Sen (1999).

the capability of doing it?" (Williams 1987, p. 99). He takes the example of his going to Cortina d'Ampezzo for the winter. This is a feasible option for him *if* he deserts his family, resigns his job, mortgages his house etc.. Therefore the **costs** of doing so are high. Should this option be seen as belonging to his capability-set?

Harrison (2001, p. 13) asks a related question when she discusses "how far 'back' to go in search for the reason for a person's lack of functionings". She is not concerned with the cost of achieving a functioning in particular but with the reasons behind the failure to achieve a functioning for example the functioning of being enrolled at school. She argues that at first view the reason for not being enrolled at school is that a child works. Examining the situation in more detail the reason for the child working is the need to support its family which results from the fact that one family member spends most of the disposable income for alcohol since that family member has lost its job because ... . The **chain of reasons** need not end here.

The functioning of being enrolled at school is feasible to the child only at the expense of leaving its family without a sufficient income. Or else, the functioning may be feasible as a part of a functioning vector differing completely from the one achieved: no family member unemployed, no need for additional income from the child working, school enrolment being regarded as a constituent of childhood. There may exist functioning vectors well apart from the one achieved that are feasible but with courage and special knowledge. Are these functioning vectors elements of the capability-set of the person concerned?

These examples leave the impression that a lot of uncertainty exists whether some functioning vectors count as elements of the capability-set or not. Thus, the examples constitute a good **motivation** for applying fuzzy set theory.

Basically, a **fuzzy set** differs from a crisp set in allowing for uncertainty about the membership of an element. The crisp set theory only knows the possibility of an element to belong to a set or not whereas the fuzzy set theory defines an area of transition in which the quality of being a member in the set develops gradually. This is done by defining a membership function, i.e. a function that determines the degree to which an element belongs to the (core of the) set. Usually the membership function is defined as a continuous and monotonically increasing or decreasing function with respect to the defining variable and takes values in the range  $[0,1]$ .

What variables may be used to define a **membership function**? In the above examples, fuzziness refers to the possibility that a functioning vector may be considered as being rather improbable, but feasible. The example of leaving the family and the job behind and mortgaging the house in order to go to Cortina d'Ampezzo for holidays illustrates the case of a feasible but inconvenient and therefore improbable functioning vector. Hence, the membership function may be interpreted as reflecting the probability of a functioning vector

to be realised. The probability of a functioning vector to occur may be calculated on the basis of information on resources and/or personal attributes as suggested in the previous section. Thus, the “normality” hypothesis is changed slightly. The capability-set of an individual is not said to equal the set of all functioning vectors achieved by the reference group but only to equal this set to a certain degree depending on the probability.

In summary, the application of fuzzy set theory to capability-sets may well be motivated, but the establishment of membership functions is a difficult task. This paper suggests to interpret the membership function as indicating the degree of probability. This interpretation may provide a basis for establishing membership functions that refer to the probability of a functioning to be achieved by a person given her membership to a certain reference group.

#### **4 A definition of poverty as capability failure**

Poverty has been called the “motivating interest” of Sen's capability approach by Cohen (1994, p. 118). Indeed, a substantial part of Sen's work on the capability approach is dedicated to poverty and he emphasises especially in this context that “the focus of attention of poverty analysis has to be capability as opposed to achievement (even though we may sometimes use information about achievement to try to *surmise* the capability enjoyed by a person)” (Sen 1992, p. 112).

However, Sen does not offer a definition of poverty that makes use of his concept of capability but only provides some arguments in favour of measuring poverty by capabilities as opposed to achieved functionings. In this context he gives the following example again and again:<sup>12</sup>

“The example ... of the person who *fasts* out of choice as opposed to another who *has to starve* because of lack of means, is relevant here. Both may end up starving and fail to be adequately nourished, but the person without the means - and thus without the capability to be adequately nourished - is poor in a way that the fasting person is not.” (Sen 1992, p. 111)

In other words, poor functioning achievements are not sufficient as indicators of poverty because what matters is the feasibility - and not the actual achievement - of decent levels of functionings. Implicit Sen makes use of a kind of minimal standard with reference to the functioning involved when he talks of “being adequately nourished”. This minimal standard serves for identifying those who can be regarded as non-poor with certainty because they achieve functioning bundles above the minimal standard. Whereas those who achieve functioning bundles below the minimal standard may have *chosen* to fail the standard or

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<sup>12</sup> See as well: Sen 1999, p. 76; 19

lack the opportunity to achieve it. The former should be regarded as non-poor and only the latter define the group of poor people. Poverty may thus be defined as following:

**Definition of poverty as capability failure:** A person  $i$  is poor, if her capability set  $Q_i$  does not contain a functioning vector  $b_i$  being at least as good as the vector of minimal standards  $z$ .

Then, the group of the poor is defined as consisting of all those who are poor with reference to a given vector of minimal standards:  $D(z) := \{i \mid \text{not } b_i \succ z \ \forall b_i \in Q_i\}$ .

Does this definition catch the **meaning of capabilities** appropriately? When Sen considers the reasons why it is capabilities and not functionings we should be concerned with, he argues as follows:

“The advantage of an enhanced capability includes (1) the fact that a wider freedom gives one more *opportunity* to achieve valuable functionings ..., and (2) the possibility that a person's achievement itself depends on the *process* of choice involved - the fact that the achievements were chosen by the person herself ... .”  
(Sen 1990, p. 466, original emphasis)

So, freedom of choice is an important argument in favour of capabilities and it entails the “volume”, i.e. the number of elements of the capability-set. Only if there is more than one element in a set, choice is possible.<sup>13</sup>

But at the same time Sen argues that it is not the process alone that is important but the results as well:

“A set of three alternatives we see as ‘bad’, ‘awful’ and ‘dismal’ cannot, we think, give us as much real freedom as a set of three others we prefer a great deal more and see as ‘great’, ‘terrific’ and ‘wonderful’. The idea of effective freedom cannot be dissociated from our preferences. Freedom is not just a matter of having a larger number of alternatives, it depends on what kind of alternatives they are.” (Sen 1990, p. 470)

The capability-set is meant as a concept that meets both proceduralist and consequentialist requirements. The evaluation of the standard of living in terms of capabilities should pay attention to those two kinds of reasoning as well. Sen summarises his arguments as follows:

“The evaluation of the freedom I enjoy from a certain menu must depend to a crucial extent on how I value the elements included in that menu. Any plausible

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<sup>13</sup> In this way the capability approach takes the proceduralist idea into account that it matters *how* a decision comes off.

axiomatic structure in the comparison of the extent of freedom would have to take some note of the person's preferences." (Sen 1991, p. 22)

How does the above definition of poverty fulfil these requirements? Does it respect freedom of choice sufficiently? Does it pay enough attention to the quality of the elements included in a capability-set?

Of course, poverty consists in lacking both **freedom of choice and good quality options**. If no element of the capability-set meets the minimal standard, the capability-set may entail many options but of poor quality and limited diversity. So, somebody who has not the chance to achieve functionings at least as good as the minimal standard can be regarded as possessing only limited options in terms of number and diversity of the options.

The quality of the options is measured by the minimal standard and therefore does not depend on the **preferences** of the individual concerned. Is this consistent with the capability approach?

There is a general debate on the subject whose preferences should be taken as the basis for evaluating opportunity sets (Sugden 1998, Barbera/Bossert/Pattanaik 2004). Sugden (1998, p. 322-326) argues in favour of regarding "potential preferences" in the sense of preferences "any reasonable person could have" (in analogy to the definition of primary goods by Rawls). The minimal standard introduced in the above definition may be regarded as resulting from such "potential preferences". They constitute a threshold with respect to living conditions that are viewed as poor by those "potential preferences". But the minimal standard may also stem from an empirical investigation on actual preferences held by a majority of the population in question. Sen himself is fairly optimistic that there is a broad agreement on the importance of basic functionings (Sen 1992, p. 108).

However the minimal standard is deduced and interpreted it only marks a single reference point and not a complete preference ordering. It is still possible that preference orderings differ in other respects. Agreement is only required on the threshold.

The definition of poverty as capability failure may be convincing conceptually, but what do we gain with regard to measuring poverty empirically? Is the definition **applicable**?

Finally, the poor can only be identified if some method for measuring their capability-sets is found. But the definition of poverty as capability failure narrows down the number of potentially poor people. The first step is sorting out those who are non-poor with certainty because they have achieved functioning bundles above the minimal standard. The second step consists of examining the capability-sets of those who have realised a functioning bundle below the minimal standard whether they contain a bundle of functionings above or

not. The definition, thus, does not provide a complete solution to the problem of poverty measurement, but shows a route to take that is in line with the capability approach.

## 5 Conclusion

In this paper I have laid out some ideas on the capability-set, its meaning, ways to operationalise it and its role in poverty measurement. In particular I have pointed out that a difference exists between the concepts of Sen and Nussbaum. This paper follows Sen's conception of a capability-set representing all *bundles* or vectors of functionings feasible for a person. There is no straightforward way to overcome the difficulty that we know but one element of the capability-set, namely the vector of achieved functionings. Since we cannot observe the capability-set we should use all information available to derive its shape and properties. This paper introduces three lines of reasoning in order to gain information on capability-sets: First, it examines the properties of capability-sets. Secondly, it presents some approaches for the estimation of capability-sets. Thirdly, it provides a motivation and an interpretation for applying fuzzy set theory to capability-sets.

Although the capability approach is especially concerned with poverty no definition of poverty based on the concept of capability-sets has been proposed until now. In this paper I suggest such a definition and discuss it in the light of the remarks on set evaluation by Sen.

Two remarks on areas that deserve further attention conclude the paper.

Time has entered the discussion in this paper in various ways. First, decisions are taken in the course of time, some are irreversible others can be abolished but the choice situation may have changed in the meantime. Secondly, there exists uncertainty about how the choice of functionings today will affect the capability-set in the future. This problem is discussed in the literature on opportunity sets as preference for flexibility. Thirdly, human life proceeds in time. Some functionings depend on the age of the acting person like fertility, others can only be realised in a certain physical condition gained through age (like carrying heavy luggage) and others still depend on the experience that takes time to be gathered like excellence in craftsmanship. The conception of capability-sets should take note of the effects of time as well as the methodological tools applied to the task of assessing the capability-set. Thus, this is an area for further research.<sup>14</sup>

Another area worth of some further scrutiny is the issue of the properties of the capability-set and the conditions under which they hold. This paper challenges the standard assumptions through illustrating examples. Another line of thoughts that should be followed is based on the properties of the underlying sets and of the conversion function: The properties of the capability-set depends systematically on the properties of the budget set and the set of

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<sup>14</sup> Last years Conference on the Capabilities Approach has already taken some efforts in that direction as well as many separate papers, but there is still much to be done.

utilization functions. Of course, the assumption of a well-behaved set is useful as a starting point but the paper has risen several doubts on the appropriateness of this assumption and suggests further inquiries on the subject.

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