Formulation and operationalization of the capability approach: Well-being of Chinese elders

by

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Contents

Chapter 1 General Introduction

1.1 Background

Improving individual well-being has always been the ultimate goal of pursuing economic development and the constant concern of policy-makers. Therefore, discussing welfare implications of economic theories or public policies is an indispensable part of economic research. Determining the appropriate method to measure individual well-being is a topic central to welfare economics. However, surprisingly, traditional welfare economics do not provide many means to evaluate well-being. In recent years, it has become widely recognized that traditional measures neglect much of the relevant information such as the unidimensional monetary measure (e.g., income), or subjective measure (e.g., life satisfaction) has serious limitations in capturing individual well-being.

Different measures provide different messages, and sometimes rather confusing messages are conveyed. China is a typical example. Per capita GDP and consumption increased at least fourfold under the unprecedented economic growth during 1990–2010. However, it is found that the huge increase in income and consumption had not brought about an increase in life satisfaction, and perhaps some overall decline (Easterlin et al., 2012). It is surprising that people do not feel more satisfied, or even feel less satisfied, with their lives under such dramatic economic growth.

Another intuitive example is shown by data from the China Health and Retirement Longitudinal Survey (CHARLS) of 2015. In China, urban and rural areas are generally at different stages of development. If different measures are adopted to make comparisons, we may retrieve quite different views of well-being between these two areas. Figure 1.1 shows that the mean per capita household assets of urban areas is almost three times higher than that of rural areas. However, if we turn the focus to life satisfaction (Figure 1.2), the mean value is very close. Similar to the above example, it seems that subjective well-being is not particularly sensitive to economic development in China. CHARLS also investigates life dimensions that are supposed to be important to older people. In Figure 1.3, it is observed that a greater proportion of urban older people participate in social activities, sleep well, have better mental health status, and less urban older people work or take care of grandchildren. It seems that economic development does create a more desirable life.

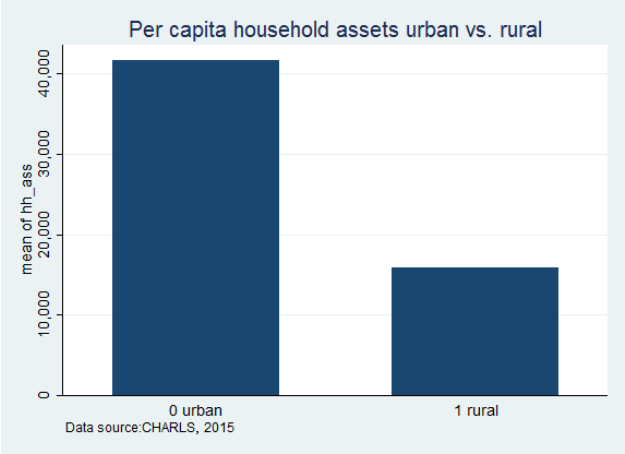

Figure 1.1 Mean per capita household assets

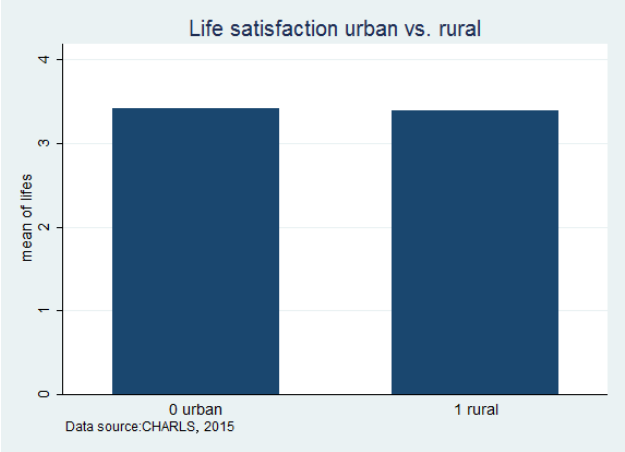

Figure 1.2 Mean life satisfaction

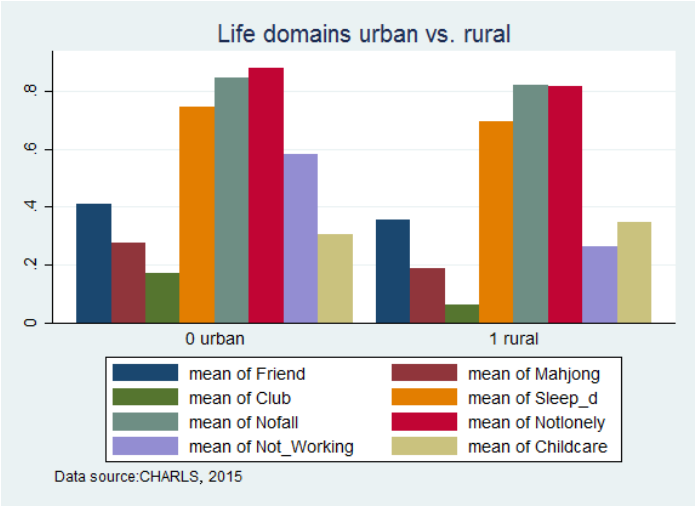

Figure 1.3 Various life aspects

It is obvious that capturing individual well-being in an appropriate way is crucial. It affects the design and assessment of policies and judgement regarding social change. As the above examples illustrate, traditional approaches provide insufficient information for drawing judgement. Alternative approaches can play a complementary role as well as provide more perspectives, which is helpful for understanding well-being more comprehensively. Under such a trend, capability approach was developed. This was first proposed by Noble Prize winner Amartya Sen in the Tanner Lecture given at Stanford University in 1979 and later published as a paper named "Equality of What?" in 1980 (Sen 1993, p. 30). Before long, Sen himself and other researchers applied the capability approach in a wide range of studies, particularly in studies on poverty, health, disability, development, gender, and education.

In recent years, various kinds of multidimensional measures based on the capability approach have been developed. Macro indicators, such as the Human Development Index (HDI), increase from 0.499 in 1990, 0.588 in 2000, 0.699 in 2010, to 0.761 in 2019, indicating improvement of human development during the last three decades in China.[1] Other indicators such as the Gender Development Index and the Women's Empowerment Index provided by the United Nations Development Program (UNDP), show different aspects of China's development. In addition, the Multidimensional Poverty Index (MPI), which is calculated based on individual-level data, also shows a dramatic poverty reduction along with economic development in China. Using data from

[1] Data source: Human Development Report 2020 published by UNDP. Please check the website for details: http://hdr.undp.org/sites/default/files/hdr2020.pdf.

the China Health and Nutrition Survey (CHNS), Yu (2013) found that the proportion of poor households decreased from 31.65% to 5.08% between 2000 and 2009. Alkire and Shen (2017) have shown that China's MPI was 0.035 in 2010 and decreased significantly to 0.017 in 2014 by using the China Family Panel Studies (CFPS) data. A recent study by Wang et al. (2020) estimated the trends of overall well-being in China between 2005 and 2015 using data from the Chinese General Social Survey (CGSS). The results indicated that achievement in well-being increased by 50% during the period. Altogether, multidimensional measures of poverty and overall well-being indicate that economic growth not only increased income but also significantly improved many life dimensions in China.

After four decades, the capability approach's impact on economics has remained rather limited. Most previous studies were concerned with developing multidimensional measures. Studies on the formulation and operationalization of capability approach are far from adequate. Kuklys (2005) points out that one of the main reasons is that the capability approach may be too philosophical to be appealing to most economists, and that to establish whether the capability approach has something to offer to traditional welfare economics, we need a characterization and analysis of the capability approach using the methodology and language standardly employed in economics. Therefore, formulating the capability approach in an economic context is considered to be helpful for understanding the approach. In practice, due to the unspecified feature, how to operationalize the capability approach empirically is still under exploration.

1.2 Framework of the capability approach

Compared to traditional approaches, the framework of the capability approach is particularly broad and complex, consisting of multiple informational spaces, including resources, utilization ability, conversion factors, opportunities, functioning achievements and subjective evaluation. The relationship among different concepts is depicted in the following figure.

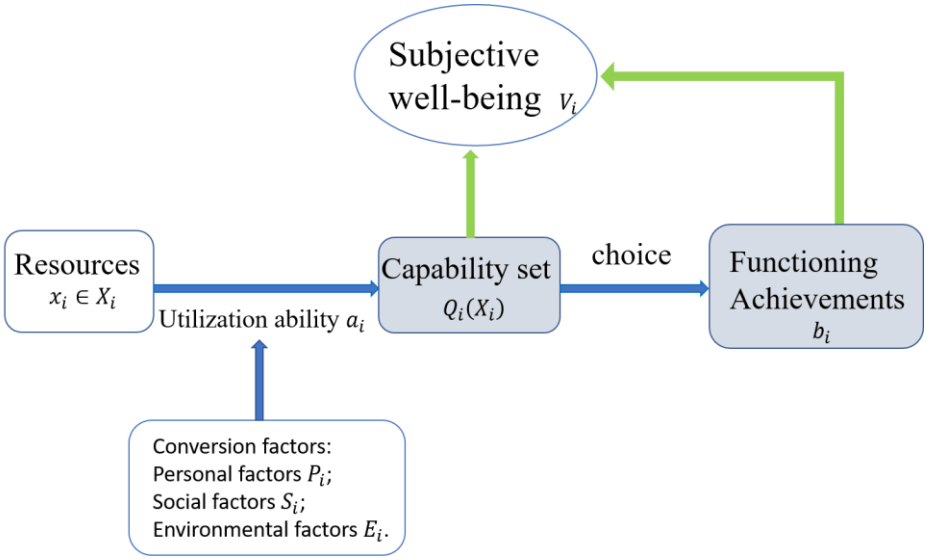

Figure 1.4 The framework of the capability approach

Sen acknowledges that alternative approaches to well-being are relevant, arguing for a shift in evaluations of well-being from the space of resources and subjective evaluation to the space of functionings or capability set. Sen states that "I tried to explore a particular approach to well-being and advantage in terms of a person's ability to do valuable acts or reach valuable states of being (Sen 1993, p.30)." In order to capture various life dimensions, the concepts of functioning and capability set are introduced. Functionings represent the state of an individual, in particular the various things that an individual manages to do or be in living their life, for example, being well-sheltered, being well-nourished, moving freely, and having self-respect. Besides the actually achieved functionings, potentially achievable functionings are taken into account, which is denoted as capability set. Capability set indicates the individual's real opportunities to pursue well-being, containing all functioning vectors that an individual can achieve.

Utilization ability reflects the extent to which individuals can transform resources into functionings, which is similar to the role of technology in production theory. In turn, utilization ability is considered to be determined by various conversion factors. Robeyns (2005, p.99) categorizes these conversion factors into three types: personal factors (e.g., physical condition, sex, intelligence), social factors (e.g., public policies, social norms, gender roles), and environmental factors (e.g., climate, geographical location). Focusing exclusively on resources neglects the heterogeneity of individuals in converting resources into well-being.

For a formal description, we introduce the following notation where individual i's utilization ability (a_i) is determined by conversion factors, including personal factors (P_i), social factors (S_i) and environmental factors (E_i),

$$a_i = A_i(P_i, S_i, E_i).$$

In general, conversion factors capture non-monetary constraints that the individual faces. Individual i's functionings achievement depends on the employed goods vector x_i and utilization ability a_i,

$$b_i = f_i(x_i, a_i).$$

Evaluating b_i requires the individual to rank the functioning vectors. The value of functioning vector b_i is defined as

$$v_i = v_i\,(b_i\,) = v_i(f_i(x_i, a_i)).$$

The evaluation exercise attaches a scalar value to each b_i to represent how satisfied the individual feels with that functioning vector—the particular achievement of doings and beings.[2]

The capability set comprising all potential functioning vectors an individual can achieve is defined as

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

where X_i represents the set of all goods vectors that an individual can access, and F_i is the set of all possible utilization functions $f_i(\cdot)$ that the individual can choose from. Then, the value of well-being that an individual can possibly achieve is represented by

$$V_i = \{v_i \mid v_i = v_i(b_i), \text{for } \forall\, b_i \in Q_i\}.$$

Achieved functionings and capabilities are both related to subjective well-being. A classic example involves comparing two individuals who are both undernourished but for different reasons. While the first individual is undernourished because of a lack of food, the second individual has plenty of food but chooses to fast. In such a situation, while their achievements in functioning are identical (i.e., undernourishment), their capability sets are different (i.e., the capability to obtain food). The choices that an individual has can be reflected in the valuation process, and previous studies (Anand et al., 2009; 2015) have explored the relationship between subjective well-being and capabilities. Due to a lack of data on the freedom to choose, however,

[2] Sen does not deny the possibility of defining SWB in other ways; for example, it could be redefined in the goods space to reflect the joy produced by the possession of goods (Sen, 1985).

the empirical analyses in this thesis focus on exploring the relationship between subjective well-being and achieved functionings.

The capability approach possesses some distinguished features compared with traditional approaches.

- Multidimensional

Unidimensional measures such as income and subjective well-being are widely used. In contrast, functioning and capability[3] are multidimensional measures. As early as the end of the 1970s, some pioneer works (e.g., Kolm, 1977; Sen, 1984) in the field shifted the attention to a multidimensional view of what constitutes a good life. Measuring well-being multidimensionally creates the difficulty of specifying a definitive list. In general, any kind of activities and situations that individuals recognize to be important is in the scope of discussion. The identification of what individuals value as well as the selection of functionings is not an easy task; no consensus on a single list exists so far. Sen keeps the issue open to allow for plurality and suggests that depending on the issue in discussion and circumstances, the scope and length of the list varies. In this thesis, the functionings are selected based on previous empirical literature (e.g., Anand et al., 2005) and data available in the survey questions.

- Interpersonal heterogeneity

Capability approach underlines the importance of incorporating interpersonal heterogeneity into the discussion of well-being, especially objective heterogeneity, which is largely ignored in traditional welfare economics. At least two kinds of human diversity are discussed in the literature. First, it is common to observe situations in which individuals with similar resources end up with different levels of well-being (in terms of functionings). Hence, utilization ability is introduced to reflect these objective heterogeneities among individuals. Second, it is argued that subjective well-being should derive from what individuals have achieved or the potential choices they have, rather than from the direct possession of resources. Proponents of the capability approach argue

[3] According to Robeyns (2006), the conceptualization of the term "capability" in Sen's earlier work is synonymous with capability set, which consists of a combination of potential functionings. However, many other scholars define potential functionings as "capabilities," and in that terminology, the capability set consists of a number of capabilities. In Sen's later writings, he uses both terms interchangeably. This study does not draw a strict distinction between the use of these two terminologies.

that different individuals may have different opinions about what makes a good life and that we should respect this diversity.

- Freedom aspects

None of the traditional measures have focused on the freedom aspects of well-being. The capability set is objectively determined by accessible resources and individual utilization ability, which can be thought of as the production possibility set of functionings. It contains all the potentially achievable functionings that individuals have, reflecting the intrinsic value of choices. With this feature, the whole set that contains all the potential choices becomes the primary focus of analysis, rather than the optimal choice as in traditional economics.

1.3 Functioning selection

Well-being or poverty is multidimensional. However, there is no consensus on how to select dimensions. Sen has refrained from developing a list of capabilities (or functionings) or a procedure for identifying which categories should have priority. Therefore, the capability approach is expected to be applied differently depending on the context to be studied and data availability. Alkire (2002, 2013) surveyed lists of dimensions that have been published in a broad range of studies, including poverty, cross-cultural psychology, moral philosophy, quality of life, participatory development, and basic needs. Capabilities may relate either to items closer to survival (the capability to drink clean water) or to items that are less central (the capability to visit one's aunt, the capability to eat rich sweets), indicating that the definition of capability does not delimit a certain subset of capabilities as being of particular importance (Alkire, 2002). In recent years, MPI has gained in popularity. Table 1 summarizes MPI studies related to China. The main dimensions poverty studies focus on are health, education, living standards, and income; however, the indicators selected to capture each dimension vary depending on the study. This might due to data availability in different datasets.

Furthermore, the deprived dimensions are changing along with economic growth and society change. Taking China as an example, Alkire and Fang (2019) found that people in rural areas are deprived in sanitation, drinking water, and cooking fuel; however, this is not the case for people in urban areas. The authors pointed out that people in urban areas may be deprived in different dimensions, such as clean environment, accommodation, and employment. They suggest building another indicator system to conduct multidimensional poverty measurements in urban areas.

Table 1 Dimensions and indicators selected to measure MPI.

Author	Dataset	Functionings	Indicators
Yu (2013)	CHNS	Health	Body Mass Index
		Education	Completion of primary school
		Living standard	Drinking water Sanitation Electricity Cooking fuel
		Income	Household income
		Social security	Medical insurance
Nozaki and Oshio (2016)	CGSS	Health	SF-6D
		Education	Years of schooling
		Income	Household income
		Social security	Health insurance coverage
Alkire and Shen (2017)	CFPS	Health	Child Mortality Nutrition
		Education	Years of schooling Child attendance
		Living standard	Drinking water Sanitation Electricity Cooking fuel Assets ownership
Alkire and Fang (2019)	CHNS	Health	Child Mortality Nutrition
		Education	Years of schooling Child attendance
		Living standard	Drinking water Sanitation Electricity Cooking fuel Assets ownership Floor

Sources: By author

The indeterminacy of the approach has resulted in empirical literature that often measures well-being over an ad hoc range of different functionings. Table 2 summarizes two recent studies that attempted to measure multidimensional well-being in China and in the U.S., respectively. In both studies, the dimensions and indicators they selected for use are quite divergent.

Table 2 Dimensions and indicators selected to measure multidimensional well-being.

Author	Objective	Dataset	Functionings	Indicators
Wang et al. (2020)	Estimating trends of well-being in China between 2005 and 2015	CGSS	Public action	Medical service Living security for the elderly people Basic education National security Fighting against crime Fair law enforcement Act with justice Environment protection Assist the poor
			Health	General health Physical health Psychological health
			Learning ability	Educational attainment Frequency of reading Frequency of surfing the net Frequency of getting together with friends
			Protective security	Wehter have medical insurance Wether have pension insurance
			Economic resources and Life satisfaction	Satisfaction of life Whether economic status higher than 3 years ago Economic status of family
			Shelter	Property right of current dwelling Number of houses
Mitra et al. (2020)	Estimating well-being of older people in the U.S., including disabilities	Panel Study on Income Dynamics	Material well-being	Famliy income in past year Net wealth covers Satisfaction with current financial situation
			Health	Self assessed health status
			Personal activities	Worker, volunteered or cared for someone outside household Satisfaction with daily activities Physical activities Activities for enjoyment
			Social connections and relationships	Marital / relationship satisfaction Feelings of family appreciation Talking on the phone with friends or family Socializing in person with friends or famliy
			Insecurity	Health insurance

Sources: By author

It should also be noted that although multidimensional measurement studies have attracted a great deal of attention, they only represent one application of the capability approach. Other studies focus on exploring determinants of functionings or capabilities or the associations between different aspects of well-being. Table 3 contains two examples of functionings selected in these kinds of studies that focus on different individual groups. The selection of functionings depends on the question at hand. In general, any functioning that is considered to be relevant to well-being—or that the research literature points to, common sense suggests, or empirical results indicate—can be included (Anand et al., 2015). Hence, there could be a greater variation in functioning selection in such situations; in this thesis, the selection of functionings follows this vein.

Table 3 Functionings and capabilities selected for non measurement study.

Author	Dataset	Target group	Functionings	Capabilities
Anand et al. (2015)	English Longitudinal Survey of Ageing	Age 50+ in the UK	Go to cinema Eating out Go to art gallery Go to theatre Member of sports club Member of social club Member of church Daily newspaper Hobby Day trip in the last 12 months Use internet / e-mail	Cinema more Eating out more Gallery more Theatre more
Anand et al. (2016)	German Socio-Economic Panel Survey	Children aged 2 and 3 years old	Singing children's songs Taking walking outdoors Painting or doing arts and crafts Reading or telling stories Looking at picture books Going to the playground Visiting other families with children Going shopping with the child Watching TV	Talking ability Everyday skills Movement skills Social skills

Sources: By author

Four major advantages make CHARLS the best choice for the present study. First, it is the latest data available for studying older people, and its coverage is more comprehensive compared to other large surveys such as the Chinese Longitudinal Healthy Longevity Survey (CLHLS) and CHNS. Second, while CLHLS and CHNS contain detailed information related to resources, utilization ability, and subjective well-being, they contain less information on functioning aspects.[4] Third, the structure of subjective well-being questions in CHARLS are more appropriate for the present study. In CLHLS and CHNS, respondents are simply asked: How do you rate your life at present? By contrast, CHARLS asks respondents in the following way: Please think about your life-as-a-whole. How satisfied are you with it? Are you completely satisfied, very satisfied, somewhat satisfied, not very satisfied, or not at all satisfied? Considering that subjective well-being is defined as the evaluation of various functioning achievements, the way subjective well-being questions are asked in CHARLS is more ideal for the present study. Fourth, unlike other surveys where only one respondent from each household was asked about their subjective well-being and functionings, CHARLS interviewed both husband and wife, which makes it possible to study the interplay between husband and wife in the present study.

1.4 Why focus on older people in the empirical studies?

People are living longer lives than ever before. Combined with a continuing decline in fertility rates, older people account for a growing proportion of the population. Population ageing is now a global phenomenon; almost every country is experiencing age structure change. According to World Population Ageing (2019), in 2019, 9% of the world's population was more than 65 years old, and this is projected to rise further to 16% in 2050. The rate is increasing particularly fast in Eastern Asia compared to other regions of the world. In China, the proportion aged 65 and older reached 11.5% in 2019, and is projected to grow to 16.9% in 2030, and to 26.1% by 2050.

A longer life is accompanied by both opportunities and challenges. From the optimistic point of view, additional years enable older people to pursue new activities such as learning a new language or skill, developing a long-cherished hobby, travelling around the world, or starting a new business. They can also contribute to their families (e.g., providing care for family members), local community (e.g., maintaining road safety for school-age children), or the whole of society in many ways. From the pessimistic point of view, older people may have greater demand for

[4] Although CLHLS contains less information about functionings, it covers a longer period (from 1998 to 2014), which makes it a good candidate for future study.

public services, which may increase public spending by the government. More fundamentally, the demographic shift with less working people and more older people challenges a society's long-term sustainability.

Whether older people provide new opportunities or become burdens of the society depends heavily on key factors such as health and independency. It is obvious that a declining health condition has significant impacts on life quality in later age. For instance, older people may be forced out of work due to poor health. According to the WHO report, healthy ageing is more than just the absence of disease. For most older people, the maintenance of functional ability has the highest importance. Functional ability comprises the health-related attributes that enable people to be and to do what they have reason to value (WHO, 2015). In addition, it is recognized that public policy needs to respond to diverse needs of older people (WHO, 2015; Gopinath, 2018). These considerations of old age are consistent with the concerns of the capability approach.

It is obvious that a narrow framework cannot satisfy complex demands in analyzing the well-being of older people. Instead, the capability approach offers a broad conceptual framework with the concern centered on individuals, taking consideration of the role of utilization ability as well as human diversity. These insights are considered to be helpful to think about later life (Gopinath, 2018). Understanding well-being in later life is an important issue for policy-makers in the context of such a rapidly ageing population. The empirical studies that address the issue of China based on the capability approach framework are still very few. Therefore, for empirical explorations, the capability approach is employed to investigate the well-being of Chinese older people. It is believed that with the right policies and services in place, population ageing can be viewed as a rich new opportunity for both individuals and societies (WHO, 2015).

1.5 Chapter summary

This thesis consists of four chapters contributing to the formulation and operationalization of the capability approach using methodology standardly employed in economics. The remainder of this thesis proceeds as follows.

In Chapter 2, we try to formulate the capability concept in an economic context based on production theory. Following previous literature, by considering individuals as entrepreneurs, who take resources as inputs and utilization ability as technology, the functioning-generating process could be seen as the production process of firms. A two goods and two functionings model is constructed. The difference between the present study and previous studies (Gotoh 2014, 2017)

is that, relating to the application of optimality analysis, instead of synthetizing the utility maximization process and production process, we separate these two processes. Further, the case in which at least one good can be used to pursue multiple functionings is particularly focused on. Capability set is identified as the production possibility set of functionings. We also show the conditions needed for reaching optimal points in both goods space and functionings space. In addition, based on the model constructed, doubt about the necessity of introducing the capability concept to evaluate well-being as raised by Basu (1987) is discussed. We argue that it is necessary to explicitly distinguish goods space and functionings space when defining opportunity set. Individual capability set is objectively determined, rather than arbitrarily definable as in goods space. Basu's doubt about the usefulness of the capability concept is invalid in the case that goods have multiple uses.

Chapter 3 contributes to empirically investigate two arguments of the capability approach: (i) individual utilization ability which acts as the technology part in converting resources into functionings, is determined by personal, social and environmental factors; (ii) along with resources, utilization ability plays a role in determining functioning achievements. It is one of the very few studies in the field which have focused on individual utilization ability. The results suggest that personal factors (e.g., physical conditions or educational attainment), social factors (e.g., gender roles or the healthcare and social security systems), and environmental factors (e.g., residential environment) may affect Chinese older people's utilization ability (Basic Activities of Daily Living and Instrumental Activities of Daily Living). It is also shown that utilization ability significantly affects Chinese older people's functionings, including being in work, participating in social activity (including interacting with friends, playing Mahjong, going to a club), and providing childcare. In addition, it is found that there are inter-group differences between rural and urban areas in the determination of utilization ability and its effects on functionings in China.

In Chapter 4, using balanced panel data from the CHARLS and correlated random effects models, the determinants of Chinese older people's functioning achievements and how older people evaluate different dimensions of their lives are examined. Following the multidimensional nature of capability approach, eight functionings are focused on: interacting with friends, playing Mahjong, going to a club, being in work, providing childcare, getting enough sleep, feeling lonely, and falling down. The results indicate that along with resources, utilization abilities such as activities of daily living and education significantly affect older people's functioning achievements. The results also confirm that functioning achievements are significantly associated with subjective well-being. In addition, inter-group differences between older females and males are investigated. It is observed that the influences of utilization ability on functionings are

different between groups, and the two groups evaluate various dimensions of their lives differently. These results provide empirical evidence to the arguments of the capability approach and give insights to well-being in later life.

Chapter 5 investigates the determinants of subjective well-being from a capability approach perspective with a particular focus on distinguishing comparison effects from family and non-family members. The influence of individuals' own functioning achievements and one's achievements relative to others, in relation to subjective well-being, are examined. Two reference groups are here analyzed: one's spouse and others in the community. The results indicate that one's own and one's spouse's achievements have a positive impact on subjective well-being, while community achievements may have a negative impact. Within households, a husband's achievements have a larger impact on his wife's subjective well-being than do a wife's achievements on her husband's, but the difference is insignificant. Additionally, the mean level of community achievements is found to be significantly and negatively associated with urban males' subjective well-being, and the negative impact is large enough to cancel out the positive impact of urban males' own achievements, implying that urban males are especially sensitive to inequality in well-being. Furthermore, for older people in rural areas, the positive impact of one's spouse is larger than the negative impact of others in the community, while the opposite is true for older people in urban areas. This may indicate that along with economic development, the negative impact of inequality in well-being becomes larger, which explains why Chinese people do not feel more satisfied with lives when income increases. The study concludes by stressing the importance of distinguishing comparison effects between family and non-family members in China. Without distinguishing, individuals' feeling about inequality in well-being may be largely underestimated. Moreover, as it is usually impossible to observe intra-household distribution of resources, therefore, this study also shows how the capability approach may contribute to the traditional economic studies.

Finally, Chapter 6 summarizes the preceding chapters and includes a discussion on the main findings, limitations of the study as well as future work.

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Chapter 2 Formulation of individual capability set considering that goods have multiple uses

2.1 Introduction

The capability approach has been proposed for forty years. However, its impact on economics has remained rather limited. Kuklys (2005) points out that one of the reasons for this is that the capability approach may be too philosophical to be appealing to most economists. Here, two key concepts are introduced to evaluate individual well-being in the capability approach: functioning and capability. These concepts are new and abstract. Formulation is considered to be useful to clarify ambiguities in economics; however, less attention has been devoted to describing concepts in terms of formulation thus far. Without sufficient discussion, even the necessity of introducing the capability concept to evaluate well-being is in doubt. To fill this research gap, this chapter attempts to formulate the capability approach through the lens of production theory.

Sen (1985) uses notation to illustrate the relationships between different concepts in the capability approach. Based on this notation, Gotoh (2014, 2017) applies the utility maximization approach to identify an individual's capability set; the author also discusses issues related to the optimal conditions in goods space and functionings space. The present study is inspired by Gotoh (2014, 2017), in which individuals are seen as entrepreneurs, using resources to produce various functionings via the utilization function. Functioning-generating processes can be thought of as an individual using inputs to produce multiple outputs. The utilization function can be seen as a production function that reflects the pattern an individual creates when converting resources into functionings. The capability set is then objectively determined by accessible resources and utilization function, which is similar to the production possibility set.

The difference between the present study and that of Gotoh's (2014, 2017) is that, relating to the application of the optimality analysis, instead of synthesizing the utility maximization process and production process, this study separates these two processes. One important characteristic of the capability approach is introducing the capability concept to capture the freedom aspect of individual well-being, which contains all the actual opportunity that each individual has. Here, the extent of freedom enjoyed by an individual is the primary focus rather than the optimal point. Thus, the size of the set from which we can choose is taken to be central to social evaluation (Sen 1993, p. 527). Correspondingly, the evaluation of an individual's well-being should be focused on ranking capability sets; therefore, identifying an individual's capability set is more important than finding the optimal point that an individual chooses. Sen himself points out that "Indeed, one

of the assumptions used in the standard formulation (viz. self-welfare maximizing behaviour) can in fact be dropped" (Sen 1993, p. 537). In other words, the utility maximization process is no longer a necessary process in the capability approach. Hence, the present study applies production theory to identify an individual's capability set via defining the frontier of capability set.

This study extends previous research first by placing a particular focus on the possibility that goods have multiple uses in achieving functionings and then by identifying individual capability sets in such a situation. It also shows the conditions that are needed to reach optimal points in both goods space and functionings space. In addition, based on the model constructed, a doubt about the necessity of introducing the capability concept that Basu (1987) raises is discussed.[5]

The remainder of this chapter is structured as follows. A literature review of the idea of considering individuals as entrepreneurs is given in section 2. Then, a two goods two functionings model is constructed in section 3, and an example is illustrated in section 4. In section 5, we discuss the doubt related to the usefulness of the capability concept. The last section concludes the chapter.

2.2. The idea of considering individuals as entrepreneurs

Neoclassical theory tends to draw a clear distinction between production theory and consumption theory (Gronau, 1986). Correspondingly, production decisions and consumption decisions are made by different behavior subjects separately. Companies are assumed to seek profit maximization, and production decisions are confined to the market. Consumers are expected to seek utility maximization in the home sector; however, since the 1960s, more and more economists have begun to realize that consumption behavior is more complex than previously believed. In many situations, market goods are not the direct source of the utilities of individuals or households. A production process is involved, where market goods can be regarded as inputs to produce welfare-bearing outputs, and the demand for goods in the market is only a derived demand. In this way, production decisions are no longer confined to the market. The individual or household is considered a small factory in the well-being generating process, and it acts similarly to a company in terms of maximizing outputs with inputs. Therefore, blurring the line between production theory and consumption theory helps us to better understand individual behavior. Early studies have contributed to the synthetization of consumer theory and production theory, and researchers such as Morishima (1959), Becker (1965), and Lancaster (1966) have had

[5] The same doubt was also raised in Basu and López-Calva (2011).

a huge impact on economics in this research field.

In the capability literature, the idea of considering individuals as functioning-producing entrepreneurs is not a new one. It has been discussed in the work of Kuklys (2005), Chiappero-Martinetti and Salardi (2008), Gotoh (2014, 2017), and Chiappero-Martinetti et al. (2018). Although sharing some similar ideas with previous studies, there are key distinctions that we need to be aware of. First, the sources (outputs of production) of utilities are different. Becker (1965) views home production activities (e.g., preparing a meal) as a combination of different market goods that are the source of the utility. Lancaster (1966) believes that the characteristics (e.g., the nutritional and aesthetic characteristics) of the goods provide the source of the utility. In contrast, Sen (1985a) argues that functionings (e.g., being well-nourished) or capabilities should be taken as the sources. Second, individual variations in pursuing well-being are explicitly taken into consideration in the capability approach. While the transformation from goods into characteristics is identical for all individuals, the heterogeneity of the utilization of goods is out of the scope of Lancaster (1966), and it is not the focus of Becker (1965)'s work. Third, functionings and capabilities have intrinsic value and can be objects of direct social concern that are independent of evaluation. Therefore, solving utility maximization is not a necessary process in the capability approach.[6] Sen (1985a, p.20) states, "The functioning view has an easier run than the utility view partly because it avoids premature fixity. It divides the problem of evaluation of well-being into two distinct (though not independent) parts, viz., (i) specification of functioning achievements, and (ii) valuation of functioning achievements." Therefore, the functioning-generating process and the subjective evaluation process can be considered two separate processes rather than a single process. In contrast, Becker (1965) and Lancaster (1966) do not have this feature. The present study mainly focuses on the functioning-generating process.

2.3 Model

A familiar two-good, two-functioning model illustrates the idea, where an individual is considered a multi-product entrepreneur. Given the market prices p_1, p_2, a budget set can be written as:

$$\mathrm{B(p)} = \{(x_1, x_2) \in \mathbb{R}^2_+ | \mathrm{p_1 x_1 + p_2 x_2 \leq M}\} \tag{1}$$

[6] Indeed, utility maximization is never the sole objective in the capability approach. Individuals also have the "agency aspect" in the assessment of states and actions. For a detail discussion, refer to Sen (1985b).

where x_i denotes i^{th} goods, and M is income.[7] $f_i(\cdot)$ denotes the utilization function with properties that are assumed to be normal, i.e., they are strictly quasi-concave and twice differentiable with a positive marginal product, with non-increasing returns to scale (NIRS). Similar to the production function, which represents a company's technology for converting inputs into outputs, $f_i(\cdot)$ captures individual variations in converting goods into functionings. Given the same resources, individuals with higher levels of utilization ability can achieve relatively higher levels of functionings. Note that goods are exchangeable in the market while functionings are well-being relevant states of individuals and are immobile. Therefore, the process of converting goods into functionings must be done by individuals themselves. For example, no matter how rich an individual is, there is no path to "being well-nourished" by having others eat for him or her. With b_i as the amount of achieved functioning and based on the above construction, two cases are considered separately.

Case 1: Each good can only be used to achieve one functioning.

Without a loss of generality, suppose that good 1 is used to achieve functioning 1, and good 2 is used to achieve functioning 2. The functioning-generating process can be written as:

$$b_1 = f_1(x_1) \tag{2}$$

$$b_2 = f_2(x_2). \tag{3}$$

In such a case, it is easy to illustrate the relationship between the goods space and the functionings space. In Figure 1, the first quadrant is the functionings space, the third is the goods space, and individual utilization functions are described in the second and fourth quadrants, respectively. With any given goods vector, such as (x_1^*, x_2^*) in the goods space, a corresponding functioning vector (b_1^*, b_2^*) can be obtained in the functionings space. Through this way, we can find that a capability set exists in the functionings space corresponding to the budget set in the goods space. Functioning vectors, which are obtained from the goods vectors on the budget line, are on the boundary of the capability set. Any functioning vector with equal or fewer achievements is contained inside.

[7] The superscript that represents the individual has been omitted for simplicity.

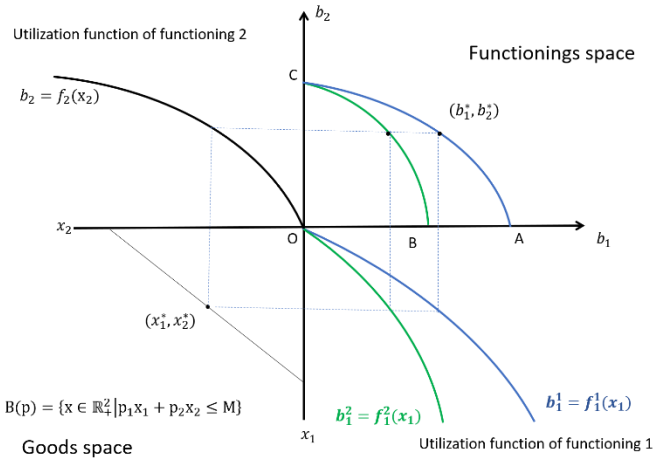

Figure 1. Relationship between the goods space and the functionings space

A distinguished feature of the capability approach is that it captures interpersonal well-being differences caused by factors other than resources. Individual heterogeneity in transforming resources into well-being is of special concern. As can be seen in Figure 1, two individuals differ in their utilization ability of functioning 1; further, individual 1 has a higher level of utilization ability. This results in individual 2's capability set (BOC) being dominated by that of individual 1's (AOC). Even though they face the same budget constraint, there exists some functioning vectors that are unachievable for individual 2. Thus, individual 2's inferior utilization ability causes disadvantages in having opportunities to pursue a good life.

One issue Gotoh (2017) discusses is the relationship the optimal points have between the goods spaces and the functionings space. Here, the study uses the following two examples to show how heterogeneity in utilization ability influences an individual's optimal choice in goods space. Suppose two individuals have the same budget set in goods space. Individual 1 has a higher level of utilization ability in transforming good 1 into functioning 1, and individual 2 has a higher level of utilization ability in transforming good 2 into functioning 2. The AOB is individual 1's capability set, and the COD is individual 2's capability set. Because each individual has an advantage in transforming one kind of good, nobody's capability set is dominated by the other's. Suppose they choose to achieve the same functioning vector b^*, which is the intersection point of their capability sets. Obviously, b^* is on both individuals' capability frontier, so it is an optimal point for both individuals. However, because the two individuals differ in utilization ability, different goods vectors are required to achieve the same functioning vector b^*. The corresponding goods vector is x_1^* for individual 1 and x_2^* for individual 2. Therefore, in order to achieve the same functioning vector, differences in utilization ability cause the two individuals to have different optimal points in goods space, as shown in Figure 2. In other words, only when preference for

goods coincides with derived demands for achieving functionings can the optimal points in the two spaces be arrived at simultaneously.

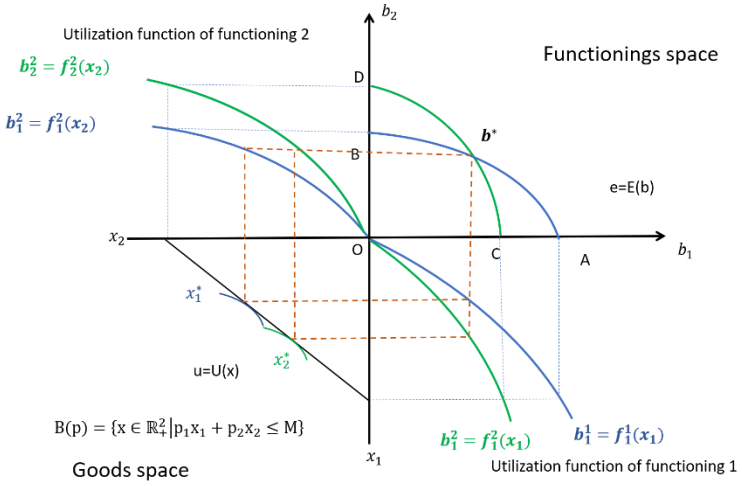

Figure 2. The influence of heterogeneity in utilization ability on optimal points in goods space

Next, the study illustrates that when evaluation function in the functionings space is considered, a similar conclusion can be obtained. As shown in Figure 3, suppose two individuals face the same budget set and the same evaluation function in functionings space, but they differ in their utilization ability to transform goods into functionings. With the same evaluation function E(b), individual 1's optimal point in functionings space is b_1^*, and individual 2's optimal point is b_2^*. To achieve the optimal functioning vectors, the individuals need to have goods vector x_1^* and x_2^*, respectively, indicating that the individuals have different optimal points in the goods space (see the third quadrant in Figure 3). In order to achieve the same level of evaluation in the functionings space, heterogeneity in utilization ability causes different derived demands of goods. This in turn requires that two individuals have different preferences over the two goods, and that each individual's optimal choice in the goods space must be that individual's precisely derived demands of goods.[8] In other words, only when the equilibrium of competitive market happens to be each individual's derived demand goods vector can the individuals reach optimality in both spaces simultaneously.

[8] See Gotoh (2017) for similar discussions.

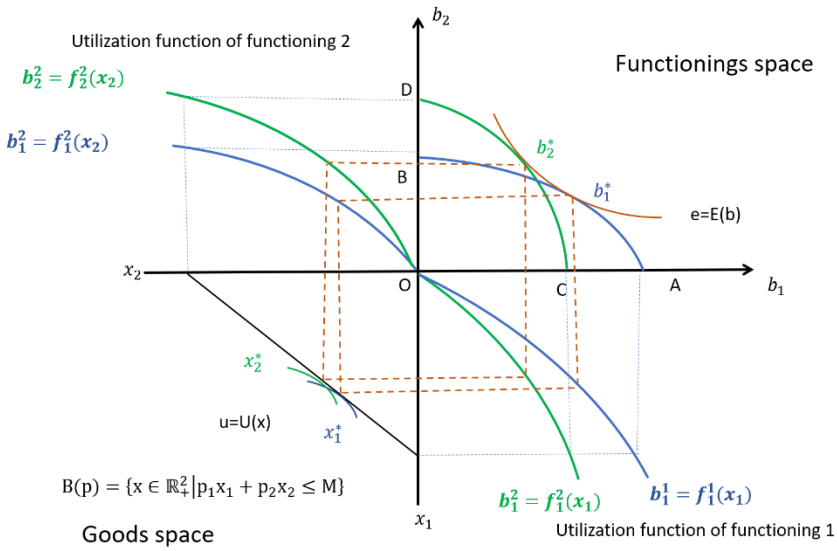

Figure 3. Optimal points in the goods space and the functionings space

Formally, the condition for the individuals to reach the optimal points in both spaces can be explicitly shown in the following calculation. Let the individual's utility function in goods space be U (x_1, x_2). The optimal condition in goods space can be achieved by solving the usual utility maximization problem.

$$\max \mathrm{U}\,(x_1, x_2) \tag{4}$$

$$\text{s.t. } \mathrm{p_1x_1} + \mathrm{p_2x_2} = \mathrm{M} \tag{5}$$

The first order optimality condition is

$$\frac{\partial \mathrm{U}/\partial\, x_1}{\partial \mathrm{U}/\partial x_2} = \frac{p_1}{p_2}\,. \tag{6}$$

Then, let the evaluation function in functionings space be E (b_1, b_2). The evaluation function is maximized subject to the goods achievable.

$$\max \mathrm{E}\,(f_1(x_1), f_2(x_2)) \tag{7}$$

$$\text{s.t. } \mathrm{p_1x_1} + \mathrm{p_2x_2} = \mathrm{M} \tag{8}$$

The Lagrangian may be expressed as

$$L= E\,(f_1(x_1), f_2(x_2))+ \lambda(M - p_1x_1 - p_2x_2). \quad (9)$$

We can then obtain the optimality condition

$$\frac{\partial E/\partial f_1 \cdot \partial f_1/\partial x_1}{\partial E/\partial f_2 \cdot \partial f_2/\partial x_2} = \frac{p_1}{p_2}, \quad (10)$$

which requires that the ratio of the marginal utility of functionings multiplied by the marginal product of goods is equal to the ratio of goods prices. Therefore, in order to reach the optimal points in both spaces simultaneously, it is required that

$$\frac{\partial U/\partial x_1}{\partial U/\partial x_2} = \frac{p_1}{p_2} = \frac{\partial E/\partial f_1 \cdot \partial f_1/\partial x_1}{\partial E/\partial f_2 \cdot \partial f_2/\partial x_2}. \quad (11)$$

This condition connects the goods space and functionings space, indicating that for the individuals, the ratio of the marginal utilities of the two goods must be equal to the ratio of the marginal utility of the functionings multiplies the marginal product of goods.

Or, it can be expressed as

$$\frac{\partial U}{\partial x_i} = \frac{\partial E}{\partial f_i} \cdot \frac{\partial f_i}{\partial x_i} \quad (12)$$

which means that the individuals' utility from goods is generated from two parts, including utility from functioning and marginal product of goods. In other words, if utility is defined in this way, then the individuals will achieve optimal points in both spaces simultaneously.

Case 2: At least one good can be used to achieve more than one functioning.

When goods have multiple uses, individuals must decide how to allocate the goods among the different functioning-generating processes. In such situations, when a goods vector is given, although the amount of each good is fixed, the allocation of goods among different functioning-generating processes is flexible. Individuals can achieve different functioning vectors by adjusting the allocation of goods.[9] If we denote the input of good j in producing functioning i as x_{ij}, then:

[9] Joint production is not considered here, so each functioning should be achieved separately.

$$b_1 = f_1(x_{11}, x_{12}) \tag{13}$$
$$b_2 = f_2(x_{21}, x_{22}). \tag{14}$$

With any goods vector, $(x_1^*, x_2^*) \in \mathrm{B(p)}$, the optimal allocation of goods among functionings can be obtained by solving the following optimization maximization problem:

$$\max f_2(x_{21}, x_{22}) \tag{15}$$
$$\text{s.t. } f_1(x_{11}, x_{12}) = \overline{\mathrm{b_1}} \tag{16}$$
$$x_{11} + x_{21} = x_1^* \tag{17}$$
$$x_{12} + x_{22} = x_2^*. \tag{18}$$

Equation (8) and (9) represent resource constraints, and Equation (7) represents a particular level of functioning 1. This problem states that the individual maximizes functioning 2, subject to meeting a certain level of functioning 1 and the given resources. It can be solved by constructing a Lagrangian function:

$$L = f_2(x_{21}, x_{22}) + \alpha[f_1(x_{11}, x_{12}) - \overline{\mathrm{b_1}}] + \lambda_1[x_1^* - x_{11} - x_{21}] + \lambda_2[x_2^* - x_{12} - x_{22}] \tag{19}$$

where $\alpha, \lambda_1, \lambda_2$ are Lagrangian multipliers. By differentiating this function partially with respect to $x_{11},\ x_{21},\ x_{12},\ x_{22}, \alpha, \lambda_1, \lambda_2$, we obtain the optimal condition:

$$\frac{\partial f_1 / \partial x_{11}}{\partial f_1 / \partial x_{12}} = \frac{\lambda_1}{\lambda_2} = \frac{\partial f_2 / \partial x_{12}}{\partial f_2 / \partial x_{22}} \tag{20}$$

which requires the marginal rate of technical substitution to be equal between two functionings. This means that goods allocation must be on the contract curve in the Edgeworth box, as shown in Figure 4.

Moreover, as there are 7 variables in 7 equations, we can solve for $x_{11},\ x_{21},\ x_{12},\ x_{22}, \alpha, \lambda_1, \lambda_2$. The solution of $x_{11},\ x_{21},\ x_{12},\ x_{22}$ depends on three parameters, $\overline{\mathrm{b_1}}, x_1^*, x_2^*$, which are on the right-hand side of the above problem. Therefore, the goods used to achieve functioning 2 can be written as:

$$\mathrm{x_{21}} = \mathrm{x_{21}}\left(\overline{\mathrm{b_1}}, x_1^*, x_2^*\right) \tag{21}$$
$$x_{22} = \mathrm{x_{22}}\left(\overline{\mathrm{b_1}}, x_1^*, x_2^*\right). \tag{22}$$

Taking this solution into functioning 2's utilization function, we obtain:

$$b_2 = f_2(x_{21}, x_{22}) = f_2\left(z_{21}(\overline{b_1}, x_1^*, x_2^*), z_{22}(\overline{b_1}, x_1^*, x_2^*)\right) = F(\overline{b_1}, x_1^*, x_2^*). \tag{23}$$

When the goods vector $(x_1^*, x_2^*) \in B(p)$ is given, by varying the required level of $\overline{b_1}$, optimal goods allocation and the level of functioning 2 changes correspondingly. Therefore, when a particular goods vector is given, various functioning vectors are obtainable. All of the obtainable functioning vectors consist of the capability set corresponding to the goods vector. Similarly, if another goods vector,$(\widehat{x_1}, \widehat{x_2}) \in B(p)$, is considered, potentially achievable functioning 2 can be represented as:

$$b_2 = F(\overline{b_1}, \widehat{x_1}, \widehat{x_2}). \tag{24}$$

Therefore, a different capability set corresponding to $(\widehat{x_1}, \widehat{x_2})$ can be obtained. Figure 7 illustrates the capability sets corresponding to different goods vectors in the functionings space.

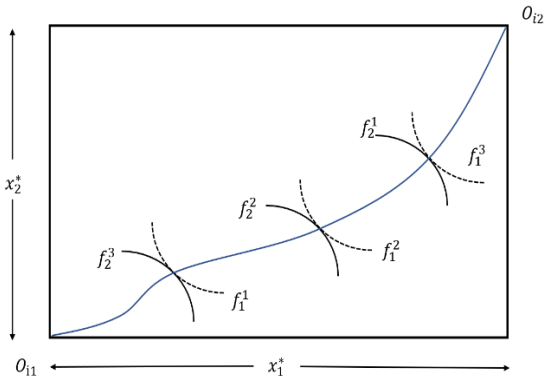

Figure 4. Edgeworth box

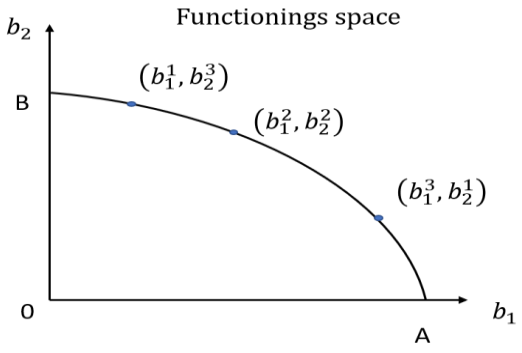

Figure 5. Capability set

In Figure 4, (x_1^*, x_2^*) is taken as the goods endowments of individual i. The length of the box is x_1^*, which is the total endowment of good 1 for individual i; its height is x_2^*, the total endowment of good 2. In the Edgeworth box, the goods used in functioning 1 are measured from the lower left corner; those used in functioning 2 are measured from the upper right corner. The isoquants of two functionings are depicted in the box. Any point in the box represents a division of goods

between two functionings. The tangent points that satisfy condition (20) indicate the efficient allocations between functionings. The set of all functioning vectors that are achievable with the given goods vector are depicted in Figure 5. Here, the set AOB is the individual's capability set corresponding to goods vector (x_1^*, x_2^*). Functioning vectors on the frontier of AOB arise from goods allocations lying in the contract curve in Figure 4.

As there is an infinite number of goods vectors in the budget set (see Figure 6), hence, there is a correspondingly infinite number of capability sets that can be obtained in the functionings space (see Figure 7). Capability sets corresponding to the goods vectors on the budget line will not be dominated by the other capability sets. When an income is given, it is the combination of all of these capability sets containing all of the potentially achievable functioning vectors. Furthermore, there is an envelope curve covering all of the possible capability sets from above. Thus, it is this envelope curve and all of the included functioning vectors that form the individual capability set corresponding to the given income. Functioning vectors on the envelope curve are optimal as it is impossible for individuals to reassign allocations among different functioning-generating processes to achieve more of a particular functioning without achieving less of another. For functioning vectors inside the envelope curve, it is possible for individuals to increase the achievement of at least one of the functionings without decreasing another.

The individual capability set is defined as C={ $(b_1, b_2) \in \mathbb{R}_+^2 : b_1 \leq f_1(x_{11}, x_{12}),\ b_2 \leq f_2(x_{21}, x_{22})$, where $x_{11} + x_{21} \leq x_1, x_{12} + x_{22} \leq x_2$ for $(x_1, x_2) \in$ B(p) }.

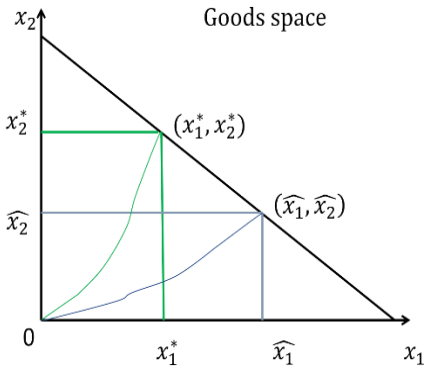

Figure 6. Edgeworth box in the goods space

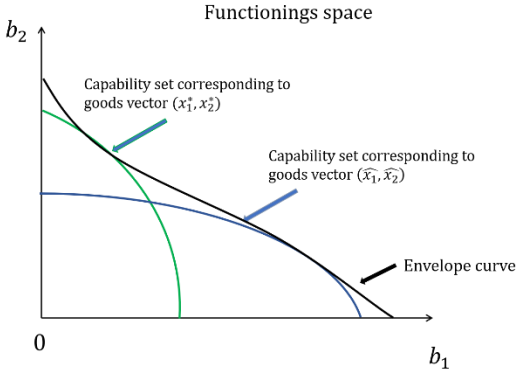

Figure 7. Capability sets in the functionings space

Theorem 1. If the utilization functions $f_1(x_{11}, x_{12})$ and $f_2(x_{21}, x_{22})$ are strictly quasi-concave functions characterized by NIRS, then the capability frontier $b_2 = F(\mathrm{b}_1, x_1, x_2)$ corresponding to each goods vector $(x_1, x_2) \in \mathrm{B(p)}$ is a concave function of b_1.[10]

Proof.
Specify two distinct values of b_2, say b_2' and b_2'', where $b_2' \leq f_2(x_{21}', x_{22}')$ and $b_2'' \leq f_2(x_{21}'', x_{22}'')$, so that b_2' and b_2'' are feasible.

Let the optimal goods allocations be $((x_{11}', x_{12}'), (x_{21}', x_{22}'))$ and $((x_{11}'', x_{12}''), (x_{21}'', x_{22}''))$. The corresponding functioning vectors on the capability frontier are (b_1', b_2'), (b_1'', b_2'') respectively. Therefore,

$$b_1' = f_1(x_{11}', x_{12}') \tag{25}$$
$$b_2' = f_2(x_{21}', x_{22}') = F(b_1', x_1, x_2) \tag{26}$$
$$b_2'' = f_2(x_{21}'', x_{22}'') \tag{27}$$
$$b_2'' = f_2(x_{21}'', x_{22}'') = F(b_1'', x_1, x_2) \tag{28}$$

Although goods allocation in the two functioning vectors are different, they are on the same capability frontier, hence, they corresponding the same goods vector (x_1, x_2). They only differ in good allocation between functionings. For each good, the total amount of good used in two functionings are equal, which can be written as,

$$x_{11}' + x_{21}' = x_{11}'' + x_{21}'' = x_1 \tag{29}$$
$$x_{12}' + x_{22}' = x_{12}'' + x_{22}'' = x_2. \tag{30}$$

Then, define

$$\widehat{\mathrm{b}_1} = f_1\big(\lambda(x_{11}', x_{12}')\big) + f_1((1-\lambda)(x_{11}'', x_{12}'')) \tag{31}$$
$$\widehat{\mathrm{b}_2} = f_2\big(\lambda(x_{21}', x_{22}')\big) + f_2((1-\lambda)(x_{21}'', x_{22}'')) \tag{32}$$

where $0 < \lambda < 1$.

The input goods are

[10] This theorem is an application of Theorem 2 in Dalal (2006).

$$\lambda x'_{11} + \lambda x'_{21} + (1-\lambda)x''_{11} + (1-\lambda)x''_{21} = x_1 \quad (33)$$
$$\lambda x'_{12} + \lambda x'_{22} + (1-\lambda)x''_{12} + (1-\lambda)x''_{22} = x_2\,. \quad (34)$$

Therefore, $(\widehat{\mathrm{b}_1}, \widehat{\mathrm{b}_2})$ is a feasible functioning vector.

Define

$$\overline{\mathrm{b}_1} = \lambda b'_1 + (1-\lambda)b''_1 \quad (35)$$
$$\overline{\mathrm{b}_2} = \lambda b'_2 + (1-\lambda)b''_2. \quad (36)$$

NIRS implies

$$\widehat{\mathrm{b}_1} = f_1\big(\lambda(x'_{11}, x'_{12})\big) + f_1\big((1-\lambda)(x''_{11}, x''_{12})\big) \geq \lambda f_1(x'_{11}, x'_{12}) + (1-\lambda) f_1(x''_{11}, x''_{12}) = \overline{\mathrm{b}_1} \quad (37)$$
$$\widehat{\mathrm{b}_2} = f_2\big(\lambda(x'_{21}, x'_{22})\big) + f_2\big((1-\lambda)(x''_{21}, x''_{22})\big) \geq \lambda f_2(x'_{21}, x'_{22}) + (1-\lambda) f_2(x''_{21}, x''_{22}) = \overline{\mathrm{b}_2}. \quad (38)$$

Since $(\widehat{\mathrm{b}_1}, \widehat{\mathrm{b}_2})$ is feasible and $\widehat{\mathrm{b}_1} \geq \overline{\mathrm{b}_1}$, clearly, $(\overline{\mathrm{b}_1}, \widehat{\mathrm{b}_2})$ is also feasible. However, $\widehat{\mathrm{b}_2}$ need not be optimal when $\mathrm{b}_1 = \overline{\mathrm{b}_1}$. Therefore,

$$F\big(\overline{\mathrm{b}_1}, x_1, x_2\big) \geq \widehat{\mathrm{b}_2} \geq \overline{\mathrm{b}_2} = \lambda b'_2 + (1-\lambda)b''_2 = \lambda F(b'_1, x_1, x_2) + (1-\lambda)F(b''_1, x_1, x_2), \quad (39)$$

which proves the desired result. Note that the first inequality is implied by the fact that $F(\mathrm{b}_1, x_1, x_2)$ is the frontier, therefore, any feasible functioning output is inside or on it. □

It is important to mention that even though each capability set corresponding to each goods vector is convex, the combination of these capability sets is not convex. Thus, the individual capability set that corresponds to the whole budget set is not convex. This is directly from the property of the convex set, which states that in general, the union of convex sets is not convex. The linear case shown in Figure 8 is taken as an example.

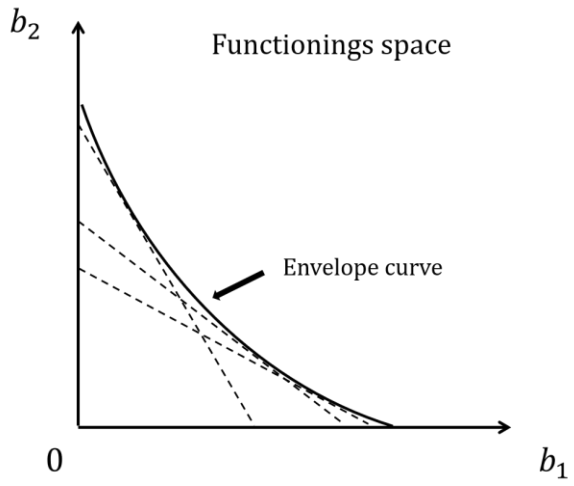

Figure 8. The upper envelope

Similarly as in Case 1, if evaluation function in the functionings space is considered, we can obtain the optimal condition by solving the following maximization problem.

$$\max \mathrm{E}\,(f_1(x_{11}, x_{12}), f_2(x_{21}, x_{22})\,) \tag{40}$$

$$\text{s.t. } p_1(x_{11} + x_{21}) + p_2(x_{12} + x_{22}) = M \tag{41}$$

The Lagrangian may be expressed as

$$L = \mathrm{E}\,(f_1(x_{11}, x_{12}), f_2(x_{21}, x_{22})\,) + \lambda[\mathrm{M} - p_1(x_{11} + x_{21}) - p_2(x_{12} + x_{22})]. \tag{42}$$

Then we can obtain the optimal condition

$$\frac{\partial f_1 / \partial\, x_{11}}{\partial f_1 / \partial x_{12}} = \frac{p_1}{p_2} = \frac{\partial f_2 / \partial x_{12}}{\partial f_2 / \partial x_{22}}\,. \tag{43}$$

This condition indicates that when both goods are used in the same functioning-generating process, it requires the ratio of marginal products to be equal to the ratio of goods prices. This also implies that the goods are allocated among functionings to equalize the evaluation value of its marginal product in pursuing different functionings.

2.4 Example

An example is shown in this section to make the model intuitive. Suppose an individual uses two goods—food and drink—to pursue two functionings, called "being well-nourished" and "having a social life." The individual can achieve various functioning vectors via allocating goods differently. Suppose that she uses up all of her income to purchase 9 units of food and 6 units of drink;[11] her utilization functions are as follows:

$$f_1(x_{11}, x_{12}) = (x_{11})^{2/3}(x_{12})^{1/3} \tag{44}$$

$$f_2(x_{21}, x_{22}) = (x_{21})^{1/3}(x_{22})^{2/3}. \tag{45}$$

$f_1(x_{11}, x_{12})$ represents "being well-nourished," which is relatively intensive in food; $f_2(x_{21}, x_{22})$ represents "having a social life," which is relatively intensive in drink. If she consumes all of the food and drink by herself, she achieves the highest level of being well-nourished, so the achieved functioning vector will be $\mathrm{b} = \left(3\sqrt[3]{18}, 0\right)$. If she decides to hold a party and invite friends to share all the goods, the achieved functioning vector will be $\mathrm{b} = \left(0, 3\sqrt[3]{12}\right)$. Now, suppose she chooses to realize 3 units of being well-nourished; in this case, she can achieve the optimal functioning vector when we solve the following optimization problem:

$$\max\ (x_{21})^{1/3}(x_{22})^{2/3} \tag{46}$$

$$\text{s.t. } (x_{11})^{2/3}(x_{12})^{1/3} = 3 \tag{47}$$

$$x_{11} + x_{21} = 9 \tag{48}$$

$$x_{12} + x_{22} = 6. \tag{49}$$

The solution is obtained by solving the Lagrangian function, where the goods allocation is $\left((x_{11}, x_{12}), (x_{21}, x_{22})\right) = \left((4.63, 1.26), (4.37, 4.74)\right)$, and the achieving functioning vector is $\mathrm{b} = (3,\ 4.61)$. By solving the above problem for varying levels of functioning 1, we can identify all of the optimal allocations for the goods vector $(9,\ 6)$. Therefore, a corresponding capability set in the functionings space containing all of the achievable functioning vectors is obtained. When another goods vector is purchased, the corresponding capability set will change.

[11] She can also choose any other alternative goods vector as long as it is affordable.

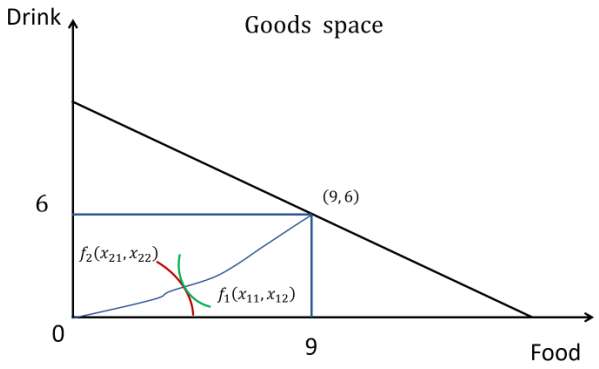

Figure 9. Optimal allocation of goods among functionings

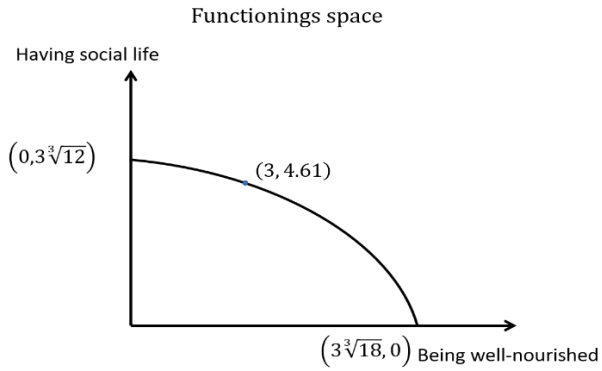

Figure 10. Capability set corresponding to the goods vector $(9,\ 6)$

2.5 Doubt about the usefulness of capability concept

2.5.1 Summary of Basu's argument

One outstanding feature of the capability approach is that the freedom aspects of well-being are focused on. A capability set contains all of the potentially achievable functioning vectors, indicating one's real opportunities in pursuing well-being. However, there is doubt about this concept. On one hand, Basu (1987) admits that individual well-being should be evaluated by functionings as well as the importance of freedom aspect. On the other hand, Basu doubts the usefulness of the capability concept. His points are summarized as follows.

Basu starts by arguing that it is unimportant to distinguish in which space to discuss the opportunity set because regardless of the discussion made in the goods space, as in traditional

studies, or in the functionings space, as in the capability approach, the cores are analogous. He then chooses to explain the issue in the goods space in his work.

Basu criticizes the illusory way in which the opportunity set is defined in economics. Due to this problem, evaluating well-being based on the opportunity set does not make any practical sense. By "illusory," he is referring to the situation of the interdependent relationship between individuals in the economy, which means that individuals are not really free to choose at any point within their own opportunity sets. That is, what one individual can obtain in the market also depends on what another individual chooses. Furthermore, a more serious problem is that as long as the equilibrium remains unchanged, there is the possibility of defining a larger opportunity set that dominates the original one without any actual improvement in well-being.

Basu illustrates the problem with the following Edgeworth box of a two-individual, two-good exchange economy. The initial endowment of two individuals is w. Market prices are depicted by line AB; GH and EF are the indifference curves, and tangent point e is the equilibrium point. According to the traditional approach, CABO_1 is defined as individual 1's opportunity set, and ABDO_2 is individual 2's opportunity set.

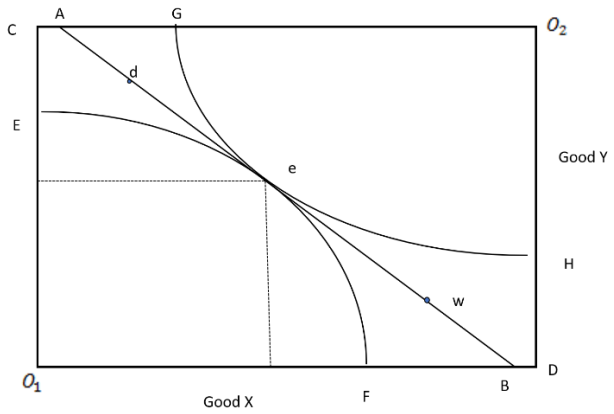

Figure 11. Edgeworth box of a two-individual two-good exchange economy

In an exchange economy, an interdependent relationship between individuals is unavoidable. It is impossible for one individual to choose d while the other chooses e even though both goods vectors are in their opportunity sets. Once individual 2 has chosen e, the only choices actually open to 1 are those in the rectangle area between e and O_1. Hence, individual 1's belief that she can choose at any point in her opportunity set is illusory. Moreover, even when the equilibrium remains unchanged, the opportunity set can be defined differently. For instance, considering set DFeECO_2 and removing all of the points on the curve FeE, except the equilibrium point e. This

set can be defined as individual 2's opportunity set, and it is obvious that it dominates the original set ABDO_2. Thus, if individual well-being is evaluated from an opportunity perspective, the new way of defining an individual's opportunity set leads a higher evaluation even though there is no actual change for the individuals in the economy. Therefore, the concept of the opportunity set is criticized for being hollow and without any practical significance.

2.5.2 Goods with multiple uses

As we can see above, the illusoriness problem is mainly caused by defining equilibrium and the opportunity set in the same space. Therefore, the starting point of Basu is problematic. In contrast to Basu, we argue that it is necessary to distinguish the goods space and the functionings space explicitly. One obvious defect of defining the opportunity set in the goods space is that it raises the problem of ignoring individual heterogeneity in utilization ability. As goods are only used as a means to pursue well-being, what an individual can achieve also depends on one's utilization ability. To reflect this heterogeneity, it is necessary to distinguish the two spaces.

Nevertheless, it is insufficient to avoid the illusoriness problem only by distinguishing the goods space and the functionings space. In Case 1 above, if each good can only be used to achieve one functioning, then there is a one-to-one correspondence between the two spaces. However, if at least one good has multiple uses, individuals can achieve various functioning vectors through making different allocations among the functioning-generating processes. In such situations, although goods are exchangeable in the marketplace, what to do with available goods is more like autarky. Individuals have the freedom to choose within the capability set corresponding to the goods vector.

When equilibrium is determined, the goods vector available to an individual is determined. Hence, the capability set corresponding to the equilibrium is determined in the functionings space. Therefore, one individual's capability set indirectly depends on others' choices in the goods space, so different individuals' capability sets are interdependent. However, the capability set is determined objectively, depending both on the available goods and the utilization ability. When equilibrium is determined, the variation in the capability set can only be caused by the changing of the utilization ability. There is no way to define the capability set as arbitrary, as above. Obviously, Basu's doubt arises from neglecting Case 2, in which goods have multiple uses to pursue different types of functionings.

2.6 Conclusion

This chapter formulates the capability approach by considering individuals as entrepreneurs and aims to understand the capability approach by using an economic vocabulary. It has been illustrated that besides resources, utilization ability also plays a role in determining well-being. In addition, the present study argues the importance of distinguishing the goods space and the functionings space when defining the opportunity set.

Because the two spaces are not interconnected, individuals' opportunity sets defined in the functionings space are interdependent. However, individuals still have the freedom to choose within their capability set. Therefore, the so-called illusoriness problem does not exist in such situations.

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Chapter 3 The Determinants of Utilization Ability and the Effects on the Functionings of Elders: Evidence from China[12]

3.1. Introduction

In recent years, the capability approach (CA) has attracted interest from policy makers and researchers in a broad variety of fields like development, poverty, and inequality. This trend has been motivated for the most part by the increasing need for analysis from relevant alternative approaches on individual well-being. The traditional approaches such as a resource-based approach or a utility-based approach have been criticized for a long time. It is argued that there are weaknesses, such as unidimensional features, ignoring human diversity, or relying too much on mental states. These drawbacks make it an inadequate measurement of individual well-being (Sen 1985a; 1992).

The CA is an alternative multi-dimensional approach which uses functionings or capabilities to capture individual well-being. Unlike traditional approaches, the CA takes human diversity into consideration through the utilization ability or conversion rates.[13] It is thought that utilization ability may determine the obtainable level of functioning achievement by using a certain amount of resources. One of the main distinctions between the CA and the traditional approaches is that the CA stresses the importance of taking individual utilization ability into consideration in the process of generating well-being.

An exemplar case may clarify this point. The same protein-rich foods are given to person A and person B. Person B is healthy but person A has Phenylketonuria (PKU). PKU inhibits nutrients absorption and therefore Person A cannot achieve as high a level of functioning as person B. This example indicates that the interpersonal variations in converting resources into functionings must be considered in studies on individual well-being. Previous studies which take an economics perspective may focus on the influence of resources on well-being, such as the effects of income on happiness. There are few empirical studies which investigate the determinants of individual utilization ability and its effects on well-being using the CA.

In the last two decades, empirical studies based on the CA for the most part investigate the

[12] This chapter is based on joint work with Professor Xinxin Ma.

[13] Conversion rates are used in some CA literature (e.g., Sen 1999, p.110; Chiappero-Martinetti and Salardi 2008; Bruni et al., 2008; Chiappero-Martinetti et al., 2018). In this study utilization ability is used because it may be more familiar to economists.

determinants of functionings or capabilities, only a few relate to utilization ability or conversion factors. Previous studies which analyze utilization ability or conversion factors can be categorized as follows. First, Lelli (2005), Kuklys (2005), and Zaidi and Burchardt (2005) use an equivalence scale approach to compare the income or cost which is needed by an individual or a household with a disadvantage, like a disability or being illiterate, with the non-disadvantage group. Hick (2016) investigates the existence and influence of conversion factors and their influence on poverty for the UK. Second, Binder and Broekel (2011, 2012) introduce the efficiency frontier methods of empirical studies into the CA. These studies discuss the conversion efficiency of transforming resources or income into functionings.[14] Third, Chiappero-Martinetti and Salardi (2008) consider the process of generating functionings is similar to the production process and the role of utilization ability to be a technology or skill. It is not new to consider functioning generating process to be a production process. This idea has also been considered by other CA researchers, for example Kuklys (2005), and more recently by Gotoh (2014, 2017) and Gotoh and Kobayashi (2018). Gotoh (2014, 2017) discusses the idea from a theoretical perspective. Chiappero-Martinetti and Salardi (2008) employ an empirical study utilizing the "functioning production function" based on the CA and point out that conversion factors act as "technical" constraints to determine the utilization ability. These studies of the CA indicate that it would be useful to analyze the determinants of the utilization ability and its effects on functionings.

The four main contributions of this study to international debate are firstly, it utilizes Basic Activities of Daily Living (BADL) and Instrumental Activities of Daily Living (IADL) data as the indices of utilization ability and investigates the determinants of BADL and IADL.[15] According to CA, the determinants of utilization ability consist of personal factors, social factors and environmental factors (Robeyns, 2005). Therefore, an empirical study is used to investigate the influences of these three kinds of conversion factors on utilization ability. The results provide empirical evidence to test the utilization ability hypotheses and theories.

Secondly, analysis of the influence of utilization ability on functionings provides empirical evidence about the process of functioning generation.

Thirdly, (1) according to empirical study methodology permanent income is a better index of economic resources than temporary income, yet in the previous studies temporary income is

[14] It should be noted that an individual with low utilization ability may be efficient in the conversion process.

[15] For detailed introduction of the utilization ability indices (BADL and IADL), please see Section 3.3 "Variable setting for the utilization function" in the paper.

usually used: there are few studies that use permanent income.[16] This study uses permanent income indices: household assets and domicile ownership status. (2) The income found in the longitudinal survey data for the prior survey year is used to address the endogeneity problem.

Fourthly, most previous studies are of European countries, for example, Chiappero-Martinetti and Salardi (2008) for Italy, Anand and Roope (2016) for Germany, and for the UK, Kuklys (2005), Binder and Broekel (2011, 2012) and Anand et al. (2015). To the writers' knowledge very few empirical studies of functionings based on a CA framework have addressed the issue in China, notably Alkire and Shen (2015) and Nozaki and Oshio (2016). China is a rapidly developing country with a very large ageing population. Therefore, the nature of the determinants of the utilization ability of elders and the effects on elderly functionings based on the CA is increasing in importance. This study provides new evidence for China, a major developing country.

The remainder of this paper proceeds as follows. Section 2 introduces the capability approach, particularly the utilization ability and its determinants (conversion factors) and four hypotheses for empirical study. Section 3 discusses the empirical analyses methodology including the models, data and variable setting. Section 4 presents and explains the empirical results, and conclusions are exhibited in Section 5.

3.2 Theoretical framework: the capability approach

With respect to traditional well-being measurements, Sen (1985; 1992) comments that income merely provides a means to pursue ends, and the measurement of happiness is subjective and not reliable. Sen admits that resources are important in expanding the real opportunity to pursue a good life and thereby enhances one's freedom of choice. However, it does not provide information about how well an individual may convert resources into well-being. An individual with difficulties in converting the means into the ends may suffer from deficiencies in functionings or capabilities, even though they may be rich in resources. Equally, the utility-based approach which measures the subjects' self-assessment of well-being does not provide sufficient information to judge individual well-being. For instance, a deprived individual could appear in the data as happy if he or she is adaptive to circumstances.

Sen argues that individual well-being should be measured using data about functionings and

[16] Hick (2016) utilizes the current and five-year average income as indices of temporary income and permanent income.

capabilities, because this captures individual well-being from the perspective of the actual achievements and the freedom to achieve. More precisely, a functioning is one of the person's achievements, or what a person succeeds in doing with the resources at his or her command. The functionings can be thought to be the person's beings or doings, e.g., being well-nourished, participating in social activity and so on. It reflects a 'state' of the person. Sen argues that how well a person is must be a matter of what kind of life he or she is living and what the person is succeeding in 'doing' or 'being' (Sen, 1985a). On the other hand, capabilities refer to the real opportunities that the person has, which represent the opportunity someone has to achieve functionings. A person's capabilities include varied combinations of functionings that are achievable with the given resources and utilization ability.

In empirical studies on the determinants of functionings based on the CA, the process of converting resources into functionings is usually captured by the utilization function (or conversion function). Utilization function reflects a pattern of using resources. Each individual may have different sets of utilization functions. Disadvantage in the conversion process, rather than the lack of resources, may lead to deprivation of functionings. For example, there may be a huge inequality in functionings between individuals with equal resources.

Utilization ability reflects the ability of an individual to convert resources into functionings, the differences in individual utilization ability may explain why some individuals achieve higher functionings than others even with the same amount of resources (or why someone can achieve the same level of functionings with less resources). The variation of utilization ability can be caused by a set of factors. Robeyns (2005) distinguishes the conversion factors into three types: personal factors (e.g., physical condition, sex, intelligence), social factors (e.g., public policies, social norms, gender roles) and environmental factors (e.g., climate, geographical location). It should be noticed that the utilization ability (or conversion rates) and the conversion factors are two different concepts. Chiappero-Martinetti and Salardi (2008) clarify the linkages between these concepts based on production theory which is similar to the production theory in neoclassical economics. They emphasize that "the utilization or conversion function, is similar with a production function, transforms inputs (resources, public and private goods and commodities) into outputs (achieved functionings). The amount of output generally depends on the amount of inputs but also on the 'technology', represented here as the result of the interaction of the conversion factors. These factors act as 'technical' constraints and determine the conversion rates."

Although Sen states that attention should be paid to the utilization ability or conversion factors in his studies (Sen 1980; 1987; 1992; 1999; 2009), he does not provide an empirical method to

investigate the utilization ability. Other researchers find no effective method to measure the utilization ability (e.g., Brandolini and D'Alessio, 1998; Chiappero-Martinetti and Salardi, 2008; Chiappero-Martinetti *et al.*, 2018). In some cases the conversion variation problems are complex, especially for sociological issues, such as participating in the life of the community (Sen 1992). Another unavoidable difficulty is stated by Comim (2008), he argues that "the CA provides a justification for using broader informational spaces in normative evaluations but offers no guidance about how different informational spaces are to be filled in, combined, or sequenced." There are few empirical studies to investigate the determinants of utilization ability because of the difficulties and complexities of applying the CA. This study offers a methodological solution.

Based on the CA and the empirical study results for other countries, this study employs an empirical method to test the H1-1 and H2-1 hypotheses for Chinese elders (see below). Some studies find inter-group differences remain for the determinants of utilization ability and its effects on functionings. For instance, Anand *et al.* (2015) found a gender gap in the UK based on the CA perspective. Since 1958 Chinese society has been segmented by the rural and urban registration system (*Hukou* system). The economic development level (GDP per capita), public health care, public education, and social security systems differ with the *Hukou* systems, therefore, there may be great differences in the determinants of utilization ability and functionings between rural and urban elders. To consider this aspect of Chinese society the H1-2 and H2-2 hypotheses, which are not analyzed in the previous studies, are tested.

H1-1: The utilization ability of Chinese elders is determined by conversion factors, including personal factors, social factors and environmental factors.

H1-2: There are inter-group differences in the determination of utilization ability between the rural elder group and the urban elder group.

H2-1: Utilization ability affects the Chinese elder functionings.

H2-2: Utilization ability affects functionings differ for the rural elder group and the urban elder group.

The H1-1 and H1-2 are for the determinants of the utilization ability, and the H2-1 and H2-2 are for the influences of utilization ability on the individual functionings.

3.3 Methodology

3.3.1 Models

First, to test the H1-1 and H1-2, the ordered bivariate probit models are utilized to investigate the influence of personal, social and environmental factors on the utilization ability (BADL and IADL) as follows

$$y_{1t}^{*} = \alpha_1 + \beta_{1P}P_{1(t-2)} + \beta_{1S}S_{1(t-2)} + \beta_{1E}E_{1(t-2)} + \varepsilon_1$$

$$y_{1t} = 1, \text{if } y_{1t}^{*} < \mu_{11}, = 2, \text{if } \mu_{11} < y_{1t}^{*} < \mu_{12}, \cdots, = 4, \text{if } \mu_{13} < y_{1t}^{*} \quad (1.1)$$

$$y_{2t}^{*} = \alpha_2 + \beta_{2P}P_{2(t-2)} + \beta_{2S}S_{2(t-2)} + \beta_{2E}E_{2(t-2)} + \varepsilon_2$$

$$y_{2t} = 1, \text{if } y_{2t}^{*} < \mu_{21}, = 2, \text{if } \mu_{21} < y_{2t}^{*} < \mu_{22}, \cdots, = 4, \text{if } \mu_{23} < y_{2t}^{*}. \quad (1.2)$$

When Equations (1.1) and (1.2) are correlated, they can be jointly estimated on the assumption that ε_1 and ε_2 have the binomial standard normal distribution, where ρ is the covariance of errors.

$$\binom{\varepsilon_1}{\varepsilon_2} \sim N\left(\binom{0}{0}, \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}\right) \quad (1.3)$$

In Equations (1.1), (1.2) and (1.3), y_{1t} and y_{2t} are the observed utilization ability, y_{1t}^{*} and y_{2t}^{*} are the corresponding unobserved latent variables. *t-2* stands for the prior period which is two years before the survey year. $P_{1(t-2)}, S_{1(t-2)}, E_{1(t-2)}$ and $P_{2(t-2)}, S_{2(t-2)}, E_{2(t-2)}$ are exogenous variables, corresponding to the personal factors, social factors and environmental factors. $\mu_{11}, \mu_{12}, \mu_{13}$ and $\mu_{21}, \mu_{22}, \mu_{23}$ are the threshold parameters. $\beta_{1P}, \beta_{1S}, \beta_{1E}$, $\beta_{2P}, \beta_{2S}, \beta_{2E}$ are coefficients. α_i are the constants and ε_i are the error terms, where *i*=1, 2. The bivariate ordered probit models are used to estimate $\beta_{1P}, \beta_{1S}, \beta_{1E}$, $\beta_{2P}, \beta_{2S}, \beta_{2E}$, $\mu_{11}, \mu_{12}, \mu_{13}$, $\mu_{21}, \mu_{22}, \mu_{23}$, and ρ simultaneously using maximum likelihood method. When the null hypothesis that ρ equals zero cannot be rejected, it is thought that running the usual ordered probit models separately will lead to biased estimation results. In order to compare the results of two different kinds of models the usual ordered probit models are used to analyze the BADL and IADL separately under the assumption that ρ equals zero. In all estimations robust standard errors are computed to correct for potential heteroscedasticity.

To test H1-1, the whole samples including both the urban and rural regions are used to employ the analyses based on the Equations (1.1) and (1.2). When $\beta_{1P}, \beta_{1S}, \beta_{1E}, \beta_{2P}, \beta_{2S}, \beta_{2E}$ are statistically significant, H1-1 is supported. To test H1-2, the samples are divided into two subsamples, the rural elder group and urban elder group and the results of $\beta_{1P}, \beta_{1S}, \beta_{1E}, \beta_{2P}, \beta_{2S}, \beta_{2E}$ are compared.

When the values and statistical significances differ for the rural elder group and urban elder group H1-2 is supported.

Second, to test H2-1 and H2-2, probit regression models are used to analyze the influence of the utilization ability on functionings as follows

$$f_{ijt}^{*} = \alpha_1 + \beta_1 R_{i(t-2)} + \gamma Z_{it} + \varepsilon_i, \text{ where j=1, 2, 3}$$

$$\Pr(f_{ijt} = 1) = \Pr(f_{ijt}^{*} > 0) = \Pr(\varepsilon_i > -\alpha_1 - \beta_1 R_{i(t-2)} - \gamma Z_{it}) \quad (2.1)$$

$$f_{ijt}^{*} = \alpha_2 + \beta_2 Y_{i(t-2)} + \gamma Z_{it} + \varepsilon_i, \text{ where j=1, 2, 3}$$

$$\Pr(f_{ijt} = 1) = \Pr(f_{ijt}^{*} > 0) = \Pr(\varepsilon_i > -\alpha_2 - \beta_2 Y_{i(t-2)} - \gamma Z_{it}) \quad (2.2)$$

$$f_{ijt}^{*} = \alpha_3 + \beta_1 R_{i(t-2)} + \beta_2 Y_{i(t-2)} + \gamma Z_{it} + \varepsilon_i, \text{ where j=1, 2, 3}$$

$$\Pr(f_{ijt} = 1) = \Pr(f_{ijt}^{*} > 0) = \Pr(\varepsilon_i > -\alpha_3 - \beta_1 R_{i(t-2)} - \beta_2 Y_{i(t-2)} - \gamma Z_{it}) \quad (2.3)$$

In Equations (2.1), (2.2) and (2.3), f_{ijt} is the observed functioning *j* of the *i*th individual at year *t*, f_{ijt}^{*} is the corresponding unobserved latent variable. $Y_{i(t-2)}$ stands for the utilization ability (the BADL and the IADL). $R_{i(t-2)}$ is the resource variables, including household assets and ownership of living house, and Z_{it} represents the demographic variables. β_1, β_2, γ are the coefficients. α_i are the constants and ε_i are the error terms, where *i*=1, 2, 3.

To test H2-1, the whole samples are used including both the urban and rural regions to employ the analyses based on the Equations (2.1), (2.2) and (2.3). When the β_2 is statistically significant, H2-1 is supported. To test H2-2, the samples are divided into two subsamples, the rural elder group and the urban elder group and the results of β_2 are compared for these two groups. H2-2 is supported when the coefficient values and statistical significances differ by these two groups.

3.3.2 Data

The individual-level data used in the analyses is from the China Health and Retirement Longitudinal Survey (CHARLS). The CHARLS which is conducted by Peking University every two years covers the representative regions in China. Its survey objects are individuals aged 45 and older. The baseline national wave of CHARLS conducted in 2012 includes about 10,000

households and 17,500 individuals in 150 counties/districts and 450 villages/resident committees. The first and second follow-up survey waves are for 2014 and 2016.

Individual-level information such as demographic characteristics, family structure, intra-household transfer, health care and insurance, health status and physical functions, employment status and pension, income and assets, housing and other related information can be obtained from the CHARLS.

To analyze the social factors and environmental factors, we utilize the individual information in the CHARLS as well as government published regional data from *China Statistical Yearbook* (2012) and *China Health Statistics Yearbook* (2012, 2013) to construct a new individual-region matched dataset.

This study uses the samples that are present in all three waves of the CHARLS (CHARLS 2011, 2013 and 2015). The samples aged below 45 in the first wave (2011) and those whose key variables are missing are excluded. As a result, the total sample is 11,812 observations.

3.3.3 Variable setting for the utilization ability estimations

For the utilization ability estimations, the main dependent and independent variables are constructed as follows.

For the dependent variables, as the indices of utilization ability, the ADL (Activities of Daily Living) are utilized. Comparing to the specific physical conditions that are usually considered in the previous studies (e.g., disability), the ADL reflects an individual's general functional status. The ADL is used in this study. It is composed of the Basic Activities of Daily Living (BADL), often used to measure an individual's ability to perform basic tasks, and the Instrumental Activities of Daily Living (IADL), often used to measure an individual's ability to perform more complex tasks. The BADL reflects the individual's ability to care for themselves, and the IADL reflects an individual's ability to accomplish more complex tasks in daily life and is often used to judge whether the individual could live independently or not. In the context of elders, it is reasonable to think that individual functional status is associated with their ability to achieve functionings. Therefore, the BADL and the IADL are used as the indices of individual utilization ability.

The Basic Activities of Daily Living has six items in the CHARLS: (i) dressing, (ii) bathing, (iii) eating, (vi) getting into or out of bed, (v) using the toilet and (vi) controlling urination and defecation. The Instrumental Activities of Daily Living covers five items: (i) doing household

chores, (ii) preparing hot meals, (iii) shopping for groceries, (iv) taking the right portion of medication on time and (v) managing money. The CHARLS asks the respondents if they have any difficulty in doing each item and lets them choose each item from 1 (No, I don't have any difficulty.), 2 (I have difficulty but can still do it.), 3 (Yes, I have difficulty and need help.), to 4 (I cannot do it.). The values are reversed using the following rules: when the individual chooses the item of "I cannot do it", the value is equal to 1; while when the individual chooses the item of "No, I don't have any difficulty", it is equal to 4. Then the BADL category variable is constructed as follows: when the respondent has no difficulty in doing all six items, the individual's BADL score is equal to 4 (I don't have any difficulty.). When the individual cannot do at least one of the items, his/ her BADL is scored as 1 (I cannot do it.). When the individual finds difficulty finishing these actions and needs help for at least one of the items, then the individual's BADL is scored as 2 (I have difficulty and need help.). Similarly, when "I have difficulty but can still do it" is chosen with at least one item, then the BADL is scored as 3. The IADL category variable is defined in the same way. Both the BADL and the IADL are used as the dependent variables in the utilization ability estimations and as the independent variables in the functioning estimations.

For the main independent variables, as in the previous study (Robeyns, 2005), the conversion factors which are composed of personal factors, social factors and environmental factors are constructed as follows.

First, for the personal factors, the individual physical condition is used as well as a set of demographic variables. Specifically, (i) the individual physical condition is expected to substantially affect both the BADL and the IADL. The CHARLS provides useful information about individual health status. This study focuses on three aspects: disability, chronic disease and body pain. Disability has been widely discussed in previous CA literature, also in empirical studies for the conversion factors (e.g., Kuklys 2005; Zaidi and Burchardt 2005). The CHARLS asks if the individual has any disabilities, including physical disabilities, brain damage/mental retardation, vision problems, hearing problems and speech impediment. The total number of disability items is used as the disability variable.

Other kinds of physical condition may affect individual utilization ability and merit further research. It has been pointed out that previous studies tend to focus on the disabled group (e.g., Hick 2016). In recent years it is extensively recognized that along with economic growth, most countries including China have experienced epidemiological transformation from acute infectious disease to predominantly chronic disease. The CHARLS data shows that the proportion of respondents with chronic disease is greater for urban residents than for rural residents. Pain is an important influence on well-being, in the dataset for this study about one third of respondents

suffer from some kind of body pain. Fourteen kinds of the chronic disease and fifteen kinds of body pain are surveyed in the CHARLS. The chronic disease and body pain variables are constructed in the same way as the disability variable using this information. (ii) As in most previous studies a set of demographic variables are constructed, that include age, gender, marital status[17], *Hukou*[18] and educational attainment[19].

Table 1 shows the joint frequency distribution of the BADL and the IADL. As shown in the Table 1, the proportion of the top category group whose scores of both the BADL and the IADL are greatest is close to three fourths (73.82%,), perhaps because the respondents in the sample are relatively young (the mean value of age is 58.51).[20] Regarding the category "I cannot do it", the proportion of the IADL (12.41%) is more than that of the BADL (2.61%). In the largest group, the proportion of the IADL (80.68%) is less than that of the BADL (84.26%), which conforms to common sense. Spearman's ρ between the BADL and the IADL is calculated as 0.4102, which is a positive value and statistically significant at 1%.

Table 1. Joint frequency distribution of BADL and IADL

BADL	IADL				
	1	2	3	4	Total (%)
1	1.74	0.11	0.15	0.61	2.61
2	0.96	0.24	0.14	0.52	1.86
3	2.82	0.67	2.06	5.73	11.28
4	6.89	1.14	2.41	73.82	84.26
Total (%)	12.41	2.16	4.76	80.68	100.01

[17] Marital status is a dummy variable, which is equal to 1 for married, and is equal to 0 when the individual is separated, divorced, widowed, or never married.

[18] *Hukou* status is a dummy variable, which is equal to 1 if the individual is of the rural *Hukou*, and is equal to 0 if the individual is of the urban *Hukou*.

[19] Originally, there are 11 categories of education in the CHARLS. The education variable is constructed with the following five categories: (i) illiterate, (ii) elementary school or lower, (iii) junior high school, (iv) senior high school or vocational school and (v) college or higher.

[20] Joint frequency distribution of BADL and IADL of samples aged older than 60 and 70 are summarized in Appendix Table 1 and Table 2, where it is found that the proportion of no difficulty decreases greatly with increasing age.

Notes: (i) 1. I cannot do it.; 2. I have difficulty and need help.; 3. I have difficulty but can still do it.; 4. I don't have any difficulty. (ii) Spearman's $\rho = 0.4102$ ($p=0.000$).

Second, the social factors and environmental factors are constructed from the combination of individual-level data from the CHARLS and the regional-level data from the *China Statistics Book* and the *China Health Statistics Boo*k. The CHARLS is a national survey which covers 28 provinces and cities, thus the 28 regions' data are used as the social and environmental factors in this study.

With regard to social factors, (i) the per capita GDP is an important indicator which reflects the regional development level. In China, the development level varies considerably from region to region, so it is necessary to consider the differences in economic circumstances. (ii) The accessibility of regional public resources may also influence individual utilization ability. Three variables are used to control the regional social health security system disparities: the health insurance coverage rate, the per capita health expenses of the local government, and the number of community health service centers and stations per 10,000 population. (iii) As suggested by the CA framework, social culture or social norms may affect the utilization ability. Thus, the gender ratio is included to control the regional gender attitude gap and intra-household gender resource gap.

With respect to environmental factors, the individual-level and the regional-level data are analyzed. (i) Residential circumstances may be associated with BADL and IADL. Therefore, two indicators of residential circumstances are included as individual-level environmental factors. Two dummy variables are constructed to identify whether there are handicapped facilities, and whether the toilet is flushable. (ii) With respect to regional environmental factors, the emission of smoke and dust is constructed as an indicator for the regional air pollution situation, as is regional forest coverage rate.

Third, three block dummy variables, the Eastern, the Central and the Western Regions are used to control the regional disparities.

3.3.4 Variable setting for the functionings estimations

Due to the multidimensional nature of the CA, three aspects of elders' functionings are considered in this study: being in work, participating in social activity and providing childcare, which reflects an elder's well-being related to society, leisure and family role.

As the dependent variables, (i) "being in work" is equal to 1 when the respondent engaged in agricultural work, the wage earning work, self-employed activities or unpaid family business work[21] for more than ten days in the past year or at least one hour in the last week. (ii) The "participating in social activity" is equal to 1 if the respondent participated at least one kind of social activity daily or weekly in the last month. A wide range of social activities have been investigated in CHARLS, in this study the focus is on the following activities: interacting with friends, playing Mahjong/chess/cards or going to a community club, going to a sport/social/or other kind of club. (iii) "Providing childcare" is equal to 1 in the case that the respondent has ever provided childcare for their grandchildren for three weeks or more over the last year.

For the independent variables, (i) utilization ability (BADL and IADL) are used. (ii) Economic resources (e.g., income) can be thought to substantially affect individual functionings. To address the endogeneity problem such as the reversal causality between income and functionings (e.g., being in work), two kinds of financial status in the prior period are selected which is two years before the survey year as the indices of resources; they are the per capita household assets[22], and the ownership status of the home. The logarithm value of the household assets is utilized in the study. The ownership status of the home is a dummy variable which is equal to 1 if the individual is an owner of the home.

The summary of the descriptive statistics of all variables is shown in Table 2 for the total, the rural group, and the urban group. It can be observed that the urban elders have better utilization ability in both the BADL and the IADL, especially for the IADL. Urban elders' household resources are three times those of the rural elders. In general, urban elders are likely to be more advantaged in both utilization ability and resources than rural elders.

Table 2. Descriptive statistics

	Total		Rural		Urban	
Variables	Mean	S.D.	Mean	S.D.	Mean	S.D.
Utilization ability						
BADL	3.772	0.608	3.763	0.613	3.812	0.583
IADL	3.537	1.018	3.491	1.058	3.732	0.797
Personal factors						

[21] In CHARLS, work does not include doing housework or doing activities without wage, such as voluntary work.

[22] The per capita household assets are calculated from the total household assets and the number of family members.

No. of disabilities	0.209	0.514	0.218	0.523	0.170	0.474
No. of chronic diseases	1.370	1.392	1.324	1.351	1.564	1.539
No. of body pains	1.447	2.849	1.582	2.953	0.872	2.265
Age	58.51	8.894	58.20	8.778	59.81	9.264
Gender	0.487	0.500	0.476	0.499	0.534	0.499
Education	2.200	0.988	2.026	0.872	2.940	1.102
Spouse	0.901	0.299	0.902	0.298	0.898	0.303
Social factors						
Regional GDP (Yuan)	37,144	13,967	36,700	13,807	39,030	14,475
Health insurance coverage rate	98.39	7.725	98.72	7.384	96.98	8.896
Health expense (Yuan)	1,689	389.9	1,666	335.5	1,786	554.9
Community health centers/stations	0.234	0.220	0.230	0.219	0.249	0.225
Gender ratio	104.6	4.454	104.6	4.502	104.4	4.239
Environmental factors						
Handicap facilities	0.275	0.447	0.295	0.456	0.194	0.395
Toilet flushable	0.368	0.482	0.296	0.457	0.673	0.469
Smoke and dust	52.82	27.10	52.47	27.35	54.33	25.92
Forest coverage rate	32.35	15.69	32.32	15.80	32.52	15.20
Functionings						
Working	0.643	0.479	0.709	0.454	0.363	0.481
Participating in social activity	0.310	0.463	0.289	0.453	0.400	0.490
Providing child care	0.363	0.481	0.371	0.483	0.329	0.470
Resources						
Household assets (Yuan)	11,316	30,087	8,254	23,421	24,305	47,021
Ownership of home	0.865	0.341	0.872	0.334	0.835	0.371
Regional blocks						
East	0.345	0.475	0.350	0.477	0.327	0.469
Central	0.329	0.470	0.312	0.464	0.398	0.490
West	0.326	0.469	0.338	0.473	0.275	0.447
Observations	11812		9559		2253	

Source: (i) Personal factors and regional blocks are drawn from CHARLS (2011). (ii) Utilization ability and resources data are from CHARLS (2013). (iii) Functionings data are from CHARLS (2015). (iv) Social and environmental factors are constructed from CHARLS (2011), China Statistical Yearbook (2012) and China Health Statistics Yearbook (2012, 2013).

3.4 Results

3.4.1 The determinants of utilization ability: Testing results of H1-1

Table 3 summarizes the results by the bivariate ordered probit model (Model 1) as well as the usual ordered probit models that are separately estimated for the BADL and IADL (Model 2 and

Model 3). Even though the results based on Model 1 and Model 2/Model 3 are similar, because the coefficient of ρ is 0.611 with a standard error of 0.021, and the results of the Wald statistic for the test of the null hypothesis that ρ is equal to zero is 835.62, which is well above the critical value of the chi-squared with a single restriction at 1% level, it is indicated that there remains a correlation between the BADL and the IADL, and the bivariate ordered probit models should be utilized in analyses.[23] Therefore, the results based on the Model 1 to test H1-1 are used.

Table 3. Results of determinants of utilization ability

Dependent Variables	BADL		IADL	
	Model 1	Model 2	Model 1	Model 3
Personal factors				
No. of disabilities	-0.180***	-0.176***	-0.297***	-0.296***
	(0.025)	(0.025)	(0.025)	(0.026)
No. of chronic diseases	-0.119***	-0.120***	-0.055***	-0.056***
	(0.010)	(0.011)	(0.010)	(0.011)
No. of body pains	-0.044***	-0.045***	-0.033***	-0.034***
	(0.005)	(0.005)	(0.005)	(0.005)
Age	-0.027***	-0.027***	-0.038***	-0.038***
	(0.002)	(0.002)	(0.002)	(0.002)
Gender	0.126***	0.115***	0.136***	0.130***
	(0.031)	(0.031)	(0.030)	(0.030)
Spouse	0.082*	0.072	0.067	0.074*
	(0.044)	(0.045)	(0.042)	(0.043)
Hukou	-0.117***	-0.123***	-0.230***	-0.231***
	(0.045)	(0.045)	(0.046)	(0.046)
Education	0.080***	0.077***	0.295***	0.289***

[23] A bivariate model has the advantage of considering the correlation between the error terms in the two equations. However, although the BADL and IADL are statistically correlated based on the analysis, the theoretical basis is unclear.

	(0.018)	(0.019)	(0.020)	(0.020)
Social factors				
lnregion_gdp	-0.206**	-0.210**	0.059	0.058
	(0.097)	(0.099)	(0.087)	(0.087)
Health insurance coverage rate	0.008***	0.008***	0.004	0.003
	(0.003)	(0.003)	(0.003)	(0.003)
Health expense	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Community health centers/stations	0.249*	0.254*	0.057	0.065
	(0.133)	(0.135)	(0.115)	(0.115)
Gender ratio	-0.003	-0.003	-0.006	-0.006
	(0.004)	(0.004)	(0.004)	(0.004)
Environmental factors				
Handicap facilities	0.025	0.028	0.034	0.035
	(0.032)	(0.033)	(0.032)	(0.032)
Toilet_flushable	0.073**	0.068*	0.083**	0.083**
	(0.034)	(0.035)	(0.035)	(0.035)
Smoke and dust	-0.001*	-0.002*	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Forest coverage rate	0.000	0.000	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)
East	0.316***	0.319***	0.198***	0.200***
	(0.060)	(0.061)	(0.058)	(0.058)
Central	0.051	0.043	0.034	0.032
	(0.043)	(0.043)	(0.040)	(0.040)
Athrho	0.611***			
	(0.021)			
Rho	0.545			
	(0.015)			

Notes: (i) Robust standard errors in parentheses. (ii)*** p<0.01, ** p<0.05, * p<0.1. (iii) The number of observations is 11,812. (iv) For the bivariate ordered probit model, Wald test of ρ=0: chi2(1) = 835.62.

The main findings are as follows. First, for the personal factors, (i) all the coefficients of the physical condition related covariates are negative values and they are statistically significant for both the BADL and the IADL, it is indicated that the disability, chronic disease and body pain may decrease individual utilization ability. (ii) The utilization ability (both the BADL and the IADL) is low for older people, rural residents, women and the low-education groups. It is shown that higher educational attainment may help elders to improve their utilization ability, which implies that elders may obtain benefit from education even in old age. Marriage status positively affects the BADL, while it is statistically insignificant for the IADL.

Second, for social factors, the health insurance coverage rates and the numbers of community health centers and stations influence the BADL positively and statistically significantly, whereas the regional per capita GDP negatively affects the BADL.

Third, for the environmental factors, the results show that better residential circumstances such as a flushable toilet in the house may increase the elders' utilization ability. The emission of smoke and dust negatively affects the BADL. Moreover, to compare with the elders in the western area, the utilization ability (both the BADL and the IADL) is higher for the elders in the eastern area.

It is found that even though almost all of the individual-level factors affect the IADL as well as the BADL significantly, the influence of the regional-level social and environmental factors on the IADL are not statistically significant. Two reasons may explain these results. First, it indicates the effects of the public policy implementations on the IADL may be small. Second, although current public policy may improve the basic needs it may not be effective in improving the advanced needs of the elder group. These results merit further research.

The results for personal factors, social factors and environmental factors support the H1-1 (The utilization ability of Chinese elders is determined by conversion factors, including personal factors, social factors and environmental factors.).

3.4.2 The determinants of utilization ability by rural group and urban group: Testing results of H1-2

Table 4 summarizes the estimation results of bivariate ordered probit models for the rural resident group and for the urban resident group. The main findings are as follows.

Table 4. Results of the determinants of utilization ability by the rural group and urban group

Dependent Variables	Rural		Urban	
	BADL	IADL	BADL	IADL
Personal factors				
No. of disabilities	-0.166***	-0.274***	-0.263***	-0.431***
	(0.028)	(0.027)	(0.065)	(0.069)
No. of chronic diseases	-0.132***	-0.061***	-0.068***	-0.027
	(0.012)	(0.012)	(0.024)	(0.024)
No. of body pains	-0.044***	-0.034***	-0.047***	-0.033**
	(0.005)	(0.005)	(0.014)	(0.014)
Age	-0.028***	-0.038***	-0.028***	-0.037***
	(0.002)	(0.002)	(0.004)	(0.004)
Gender	0.127***	0.153***	0.138*	-0.005
	(0.034)	(0.033)	(0.076)	(0.078)
Spouse	0.062	0.059	0.153	0.154
	(0.049)	(0.047)	(0.103)	(0.103)
Education	0.069***	0.305***	0.100***	0.265***
	(0.022)	(0.023)	(0.035)	(0.039)
Social factors				
lnregion_gdp	-0.266**	-0.007	-0.097	0.032
	(0.117)	(0.110)	(0.222)	(0.226)
Health insurance coverage rate	0.011***	0.004	0.002	0.003
	(0.003)	(0.003)	(0.006)	(0.007)
Health expense	0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Community health centers/stations	0.216	-0.064	0.310	0.622**
	(0.158)	(0.140)	(0.315)	(0.315)
Gender ratio	-0.004	-0.008*	0.013	0.016
	(0.005)	(0.005)	(0.014)	(0.012)
Environmental factors				
Handicap facilities	0.059*	0.054	-0.171**	-0.113
	(0.035)	(0.034)	(0.086)	(0.098)
Toilet flushable	0.102***	0.095**	-0.068	-0.019
	(0.039)	(0.038)	(0.081)	(0.085)
Smoke and dust	-0.001	-0.001	-0.001	-0.000
	(0.001)	(0.001)	(0.002)	(0.002)
Forest coverage rate	0.000	0.002*	0.001	-0.002
	(0.001)	(0.001)	(0.003)	(0.004)
Eastern	0.345***	0.235***	0.263*	0.135
	(0.070)	(0.068)	(0.136)	(0.144)
Central	0.077	0.083*	-0.054	-0.098
	(0.051)	(0.049)	(0.094)	(0.096)
Athrho	0.599***		0.684***	
	(0.023)		(0.059)	
Rho	0.536		0.594	
	(0.016)		(0.038)	
Observations	9,559	9,559	2,253	2,253

Notes: (i) Robust standard errors in parentheses. (ii) *** p<0.01, ** p<0.05, * p<0.1. (iii) For the bivariate ordered probit model, Wald test of ρ=0: chi2(1) = 701.59 for rural and chi2(1) = 134.12 for urban.

First, for personal factors, chronic disease and being male significantly influence the rural elders' utilization ability (IADL), while they are not statistically significant for the urban elder group.

Second, for social factors, (i) both the per capita regional GDP and the regional gender ratio negatively affect the rural elders' utilization ability, whereas the influence of these two factors is not statistically significant for the urban elder group. (ii) The health insurance coverage rate positively affects the rural elders' utilization ability, but its influence is not statistically significant for the urban elder group. (iii) The health services provided by the community health care centers and stations may improve the urban elders' utilization ability (IADL), whereas its influence on the rural elders' IADL is not statistically significant.

Third, for environmental factors, the residential circumstances affect elder utilization ability significantly, whereas the influence of the local environment factors is not statistically significant. Handicapped facilities negatively influence the IADL for urban elder group, whereas its influence on the rural elders is positive. Access to flushable toilets may positively affect both the BADL and the IADL for the rural elder group, whereas its influence is not statistically significant for the urban elder group.

These results support the H1-2 (There are inter-group differences in the determination of utilization ability between the rural elder group and the urban elder group.).

3.4.3 The influence of utilization ability on Chinese elder functionings: Testing results of H2-1

Table 5 summarizes the determinants of three functionings of Chinese elders: being in work, participating in social activity and providing childcare. To investigate the influence of the utilization ability and other factors including resources, three models are estimated based on Equations (2.1), (2.2) and (2.3). The main findings are as follows.

Table 5. Estimation results of functionings

Dependent	Being in work			Participating in social activity			Providing child care		
Variables	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Resources									
lnhousehold_assests	0.014**		0.003	0.035***		0.030***	-0.004		-0.008
	(0.006)		(0.006)	(0.006)		(0.006)	(0.006)		(0.006)
Ownership	0.081**		0.072*	-0.002		-0.008	0.127***		0.123***
	(0.037)		(0.038)	(0.036)		(0.037)	(0.036)		(0.036)
Utilization ability									
BADL		0.233***	0.232***		0.060***	0.055**		0.025	0.025
		(0.023)	(0.023)		(0.023)	(0.023)		(0.022)	(0.022)
IADL		0.130***	0.129***		0.104***	0.098***		0.073***	0.074***
		(0.014)	(0.014)		(0.015)	(0.015)		(0.014)	(0.014)
Demographic variables									
Age	-0.056***	-0.052***	-0.051***	-0.000	0.002	0.003*	-0.020***	-0.018***	-0.017***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Gender	0.514***	0.498***	0.498***	-0.143***	-0.159***	-0.157***	-0.188***	-0.196***	-0.198***
	(0.028)	(0.028)	(0.028)	(0.026)	(0.026)	(0.026)	(0.025)	(0.025)	(0.025)
Spouse	0.201***	0.213***	0.212***	-0.126***	-0.104***	-0.125***	0.240***	0.234***	0.240***
	(0.034)	(0.034)	(0.034)	(0.033)	(0.032)	(0.033)	(0.033)	(0.033)	(0.033)
Hukou	0.844***	0.877***	0.878***	-0.155***	-0.165***	-0.142***	0.058*	0.077**	0.068**
	(0.034)	(0.034)	(0.034)	(0.033)	(0.032)	(0.033)	(0.033)	(0.033)	(0.033)
Education	-0.079***	-0.103***	-0.104***	0.126***	0.123***	0.113***	-0.002	-0.014	-0.012
	(0.016)	(0.016)	(0.016)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
East	-0.170***	-0.216***	-0.220***	0.094***	0.090***	0.076**	-0.187***	-0.200***	-0.201***
	(0.032)	(0.032)	(0.032)	(0.030)	(0.030)	(0.030)	(0.029)	(0.029)	(0.030)
Central	-0.092***	-0.106***	-0.105***	0.151***	0.152***	0.146***	-0.058**	-0.067**	-0.063**
	(0.032)	(0.032)	(0.033)	(0.030)	(0.030)	(0.030)	(0.029)	(0.029)	(0.030)
Constant	2.925***	1.523***	1.419***	-0.808***	-1.297***	-1.487***	0.716***	0.360**	0.277*
	(0.152)	(0.169)	(0.179)	(0.138)	(0.159)	(0.169)	(0.134)	(0.155)	(0.164)
Pseudo R2	0.1738	0.1923	0.1926	0.0206	0.0236	0.0255	0.0277	0.0293	0.0302
Observations	11,812	11,812	11,812	11,812	11,812	11,812	11,812	11,812	11,812

Notes: (i) Robust standard errors in parentheses. (ii) *** p<0.01, ** p<0.05, * p<0.1.

First, the coefficients of both the BADL and IADL in the Model 2 and Model 3 are positive values and they are statistically significant. To compare the results of Model 2 with the results of Model 3, it is observed that the significances of the coefficients of the BADL and the IADL do not change for the three functionings (being in work, participating in social activity, providing childcare). These results support the H2-1 (Utilization ability affects the Chinese elder functionings.).

Second, for the other factors, (i) the probability of both being in work and providing childcare is lower for the older age group than the younger age group, while the probability of participating in social activity is higher for the older age group. (ii) There are gender gaps for the three functionings. The results show that the probability of being in work is higher for the male group than for the female group, while the probability of participating in social activity and providing childcare is lower for the male. (iii) The elder with a spouse is more likely to be in work and provide childcare, but he or she may be less likely to participate in social activity. (iv) The probability of being in work and providing childcare is higher for the rural elder group than for the urban group, while the probability of participating in social activity is lower for the rural elder group. (v) The probability of being in work is lower for the high-education group, while the probability of participating in social activity is greater for the high-education group. (vi) The probability of being in work and caring for grandchildren is lower for the group in the eastern and central areas than for elders living in the western area. The probability of participating in social activity is higher for elders in the eastern and central areas.

3.4.4 The influence of utilization ability on functionings for the rural group and urban group: Testing results of H2-2

The results of the determinants of functionings for the rural elder group are summarized in Table 6. The results of the determinants of functionings for the urban elder group are summarized in Table 7. The main findings are as follows.

Table 6. Results of determinants of functionings for the rural resident group

Dependent	Being in work			Participating in social activity			Providing child care		
Variables	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Resources									
lnhh_assets	0.025***		0.013*	0.038***		0.033***	-0.009		-0.013**
	(0.007)		(0.007)	(0.007)		(0.007)	(0.006)		(0.006)
Owner of home	0.088**		0.081*	-0.042		-0.046	0.083**		0.080*
	(0.043)		(0.044)	(0.042)		(0.042)	(0.041)		(0.041)
Utilization ability									
BADL		0.253***	0.250***		0.040	0.036		0.028	0.029
		(0.025)	(0.025)		(0.025)	(0.025)		(0.025)	(0.025)
IADL		0.138***	0.136***		0.094***	0.089***		0.063***	0.065***
		(0.015)	(0.015)		(0.016)	(0.016)		(0.015)	(0.015)
Demographic variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constants	3.267***	1.868***	1.682***	0.930***	1.302***	1.480***	0.986***	0.584***	0.577***
	(0.167)	(0.181)	(0.195)	(0.152)	(0.172)	(0.186)	(0.146)	(0.166)	(0.179)
Pseudo R2	0.1160	0.1413	0.1419	0.0145	0.0162	0.0185	0.0310	0.0327	0.0333
Observations	9,377	9,377	9,377	9,377	9,377	9,377	9,377	9,377	9,377

Notes: (i) Robust standard errors in parentheses. (ii) *** p<0.01, ** p<0.05, * p<0.1. (iii) Demographic variables in this table is from CHARLS (2015).

Table 7. Results of determinants of functionings for the urban resident group

Dependent	Being in work			Participating in social activity			Providing child care		
Variables	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Resources									
lnhh_assets	-0.013		-0.018	0.029**		0.021*	0.008		0.003
	(0.012)		(0.012)	(0.011)		(0.011)	(0.012)		(0.012)
Owner of home	0.086		0.076	0.117		0.104	0.253***		0.244***
	(0.079)		(0.080)	(0.072)		(0.072)	(0.075)		(0.075)
Utilization ability									
BADL		0.108*	0.111*		0.127**	0.122**		-0.002	-0.004
		(0.060)	(0.060)		(0.052)	(0.053)		(0.053)	(0.053)
IADL		0.101**	0.105**		0.182***	0.175***		0.149***	0.145***
		(0.048)	(0.048)		(0.042)	(0.042)		(0.042)	(0.041)
Demographic variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4.511***	3.639***	3.643***	0.954***	2.043***	2.208***	0.080	-0.283	-0.517
	(0.300)	(0.378)	(0.387)	(0.250)	(0.329)	(0.339)	(0.250)	(0.327)	(0.335)
Pseudo R2	0.1828	0.1862	0.1872	0.0155	0.0246	0.0263	0.0187	0.0198	0.0233
Observations	2,435	2,435	2,435	2,435	2,435	2,435	2,435	2,435	2,435

Notes: (i) Robust standard errors in parentheses. (ii) *** p<0.01, ** p<0.05, * p<0.1. (iii) Demographic variables in this table is from CHARLS (2015).

First, the BADL and the IADL positively and significantly affect the probability of being in work for the rural elder group and for the urban elder group (see Model 2 and Model 3 in Table 6 and Table 7), but it is more significant for the rural elder group than for the urban elder group. Second, the influences of the BADL is not statistically significant for the rural elder group but the IADL positively affects the probability of participating in social activity. The BADL and the IADL positively affect the probability of participating in social activity for the urban elder group. Third, the IADL positively affects the probability of providing childcare for both the rural elder group and urban elder group but the influence of the BADL is not statistically significant. In general, these results support the H2-2 (Utilization ability affects functionings differ for the rural elder group and the urban elder group.).

3.5 Conclusions

This study employs an empirical method to investigate the determinants of utilization ability and its influence on Chinese elder functionings. It applies the capability approach, using three waves data from the China Health and Retirement Longitudinal Survey (CHARLS) from 2011 to 2015 and the bivariate ordered probit regression models.

The main findings are as follows. First, the influence of three conversion factors: personal, social and environmental on utilization ability (BADL and IADL) are statistically significant, therefore H1-1 (The utilization ability of Chinese elders is determined by conversion factors, including personal factors, social factors and environmental factors.) is supported. Second, the influence of conversion factors on utilization ability differs for the rural elder and urban elder groups, therefore H1-2 (There are inter-group differences in the determination of utilization ability between the rural elder group and the urban elder group.) is supported. Third, utilization ability (BADL and IADL) significantly affects individual functionings including being in work, participating in social activity and providing childcare. These results support H2-1 (Utilization ability affects the Chinese elder functionings.). Fourth, the influence of the utilization ability on functionings differs for the rural elder group and urban elder group: H2-2 is supported.

These results provide empirical evidence and support Sen's argument that along with resources, utilization ability plays an important role and should be considered in research on well-being. Moreover, the statement by Robeyns (2005) that the determinants of utilization ability are composed of three kinds of conversion factors (personal, social, and environmental factors) is confirmed by the empirical study. The results provide new evidence about human diversity (inter-group differences) in the process of pursuing well-being.

These results have two important implications. First, it is indicated that public policies such as the public health care system may improve the BADL rather than the IADL. The current public health care policy only focuses on the basic needs of elders (BADL), whereas public support for more advanced needs (IADL) may not be adequate. Second, economic development seems likely to decrease individual utilization ability (BADL). More detailed research is needed about the Kuznets hypothesis (Kuznets, 1955) that income inequality increases with economic growth, and this increased income inequality may decrease the utilization ability of Chinese elders.

This study usefully employs an empirical study to investigate the determinants of utilization ability and its effects on Chinese elder well-being based on the CA. However, the study has three limitations. First, based on the questionnaires of the CHARLS, this study uses the BADL and the IADL as the indices of utilization ability. In the CA, utilization ability is mostly discussed from a theoretical perspective, the challenge for the future is how to operationalize, how to define utilization ability and measure it with empirical research. Second, Sen (1992) argues that in some cases, conversion variation problems are extremely complex, especially those relating to social issues, such as lifestyle or social capital in a community. A priority for the future is to explore better way to develop methodologies to capture these complexities. Third, due to limitations of the data about well-being only three functionings (being in work, participation in social activity and providing childcare) have been examined in this study. In order to better capture elder well-being, a broader range of functionings as well as the freedom aspects (capabilities) should be discussed and even more targeted and detailed surveys should be constructed in the future.

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Appendix Table-1. Joint frequency distribution of BADL and IADL of the elderly aged 60+

BADL	IADL				
	1	2	3	4	Total (%)
1	3.07	0.18	0.28	0.78	4.31
2	1.63	0.38	0.16	0.60	2.77
3	4.90	0.88	2.65	6.77	15.20
4	11.32	1.33	2.81	62.26	77.72
Total (%)	20.92	2.77	5.90	70.41	100.00

Notes: (i) 1. I cannot do it.; 2. I have difficulty and need help; 3. I have difficulty but can still do it.; 4. I don't have any difficulty. (ii) Spearman's $\rho = 0.4001$ ($p=0.000$).

Appendix Table-2. Joint frequency distribution of BADL and IAD of the elderly aged 70+

BADL	IADL				
	1	2	3	4	Total (%)
1	5.20	0.20	0.33	1.07	6.80
2	2.40	0.60	0.20	0.53	3.73
3	7.59	1.00	3.66	6.86	19.11
4	16.32	2.07	3.40	48.57	70.36
Total (%)	31.51	3.87	7.59	57.03	100.00

Notes: (i) 1. I cannot do it.; 2. I have difficulty and need help; 3. I have difficulty but can still do it.; 4. I don't have any difficulty. (ii) Spearman's $\rho = 0.3743$ ($p=0.000$).

Chapter 4 Well-being over 45 from a capability approach perspective: Evidence from China

4.1 Introduction

For a long time, monetary indicators have played a major role in assessing economic performance, based on the assumption that wealth is the most important element in promoting individual well-being. However, in past decades, this idea has been disputed, and it is widely recognized that we cannot narrow our focus down to the inputs aspect (e.g., resources) alone when measuring individual well-being (Sen 1985, 1992, 1999). In fact, judgements on well-being should be based on broader sources of information. Nowadays, in welfare economics, two of the most prominent alternative research approaches are the subjective well-being (SWB) approach and the capability approach (CA). Even though these two approaches provide different ways of understanding and assessing well-being, they used to be discussed separately, with no crossover between the two; however, the situation began to change around 2005,[24] and currently, researchers have begun to accept both theories. It has been argued that there are potential synergies between the CA and the SWB approach, and efforts have been made to bridge the gap between the two approaches (Comim 2005; Bruni et al. 2008).

The fundamental difference between the resource-based approach, the SWB approach, and the CA lies in the information basis used to measure individual well-being. The resource-based approach uses material-related indicators (e.g., income) to assess how well individuals are. Proponents of the SWB approach believe self-reported indicators (e.g., life satisfaction or happiness[25]) are more comprehensive and have the advantage of capturing well-being beyond the resource aspect only. Proponents of the CA argue that well-being should be evaluated in terms of what individuals actually achieve in daily lives (called "functionings" in CA terminology) and what they have the potential to achieve (called "capabilities" in CA terminology). On the one hand, advocates of the CA argue that focusing on resources or SWB exclusively is inadequate;

[24] Bruni et al. (2008, p.3): "…the two approaches have been developed independently, with very few cross-references. A first step in bringing together the two approaches has been taken by the 2005 *Review of Social Economy* special edition on 'Capabilities and Happiness', but much remains to be done."

[25] In economy literature, the terms "life satisfaction," "happiness" and "SWB" are often used interchangeably (Easterlin 2005; Ding 2017).

on the other hand, these same researchers admit the usefulness of the information provided by the resource-based and SWB approaches (Sen 1992, 1999; Diener and Seligman 2004; Comim 2008). It has been stated that resources provide the means of pursuing well-being, which can expand one's real opportunities (Sen 1985) while the SWB gives information about how an individual feels or evaluates his or her own life. Therefore, in the discussion of well-being, information provided by the resource-based and SWB approaches should be utilized rather than discarded. Nonetheless, in previous empirical studies, much of the focus has been on investigating the associations between the CA and the SWB approach (Anand et al. 2015; Anand and Roope 2016) while the associations between the CA and the resource-based approach have been largely ignored. Therefore, in this study, we go beyond previous studies by investigating the associations among these three approaches from a CA perspective.

To date, a substantial body of empirical literature has been devoted to exploring the associations between SWB indicators (e.g., life satisfaction) and their determinants. These studies have been focused on investigating determinants such as income, income inequality, health status, social capital, unemployment, intra-household bargaining power, and other relevant demographic or socioeconomic variables (Clark 1994; Easterlin 2001; Frey and Stutzer2002; Dolan 2008; Ram 2010; Ma 2016; Ma and Piao 2018). In general, a consensus that SWB measures something useful has been reached. Moreover, these empirical studies show statistically significant and theoretically understandable relationships between SWB and socioeconomic as well as demographic variables (Schokkaert 2007). In addition, some of these aspects are very similar to functionings or capabilities in the CA. Hence, it seems that compared to the resource-based approach, the CA and SWB approach have more in common.

Indeed, in opposition to the SWB approach, CA researchers have different opinions about what are the determinants of SWB. It has been argued that SWB should itself be considered a valuable functioning or used as an evaluation of other functioning achievements rather than demographic or socioeconomic variables (Sen 1985, 2008; Schokkaert 2007). Empirical studies investigating the associations between the SWB approach and the CA from the CA perspective have been conducted, and evidence has shown that functionings or capabilities are statistically associated with SWB (Anand et al. 2005; Anand and van Hees 2006; Anand et al. 2011; Anand et al. 2015; Anand and Roope 2016).

Studies on SWB in China have increased rapidly in recent years; however, almost all of these studies have been conducted in the usual way, by exploring the determinants of happiness or life satisfaction and focusing on demographic or socioeconomic variables such as income, employment, the social security system, and health status (Luo 2006; Brown et al. 2009; Li et al.

2013; Ma 2015; Ding 2017). To the best of our knowledge, no study in the field has been conducted from a CA perspective using data from China. Therefore, the current study focuses on Chinese older people, investigating functioning achievements and their associations with SWB as well as resources from the CA perspective to fill this research gap.

More precisely, there are three main purposes of this study. First, it seeks to investigate the associations between the CA and the resource-based approach through examining the influences of individual utilization ability on functionings. Confirming the role of utilization ability in determining functionings can provide empirical evidence that the traditional resource-based approach lacks because it neglects important aspects of capturing well-being. Sen (1992, 1999, 2009) argues that utilization ability or conversion factors need serious attention. Individuals with unfavorable utilization ability cannot achieve the same level of functionings as others, given the same amount of resources. Therefore, it is necessary to take utilization ability into consideration in the analyses. However, studies discussing the role of utilization ability or conversion factors in determining well-being are very limited (Chiappero-Martinetti and Salardi 2008; Hick 2016; Chiappero-Martinetti et al. 2018; Wang and Ma 2019).

Second, by taking SWB as the valuation function of functionings, how Chinese older people evaluate various dimensions of their lives is also examined. Eight specific functionings are focused on, reflecting older people's life related to leisure, society, family role, mental status, and physical health.

Third, intergroup differences between female and male elders are investigated. In contrast to mainstream welfare economics, the CA pays close attention to human diversity in pursuing well-being. At least two kinds of differences exist: one is individual variation in converting resources into functionings, and the other is subjective variations in evaluating different dimensions of our lives. This study examines whether gender differences exist in these two aspects in China.

The rest of the paper is structured as follows. Section 2 introduces the framework of the CA and its associations with the resource-based and SWB approaches. Section 3 discusses the empirical analysis methodology, including the models, data, and variable setting. Section 4 presents and explains the empirical results, and concluding remarks are given in section 5.

4.2 The CA and its associations with the resource-based and SWB approaches

4.2.1 The framework of the CA

The CA was proposed by Amartya Sen in the beginning of the 1980s. It is argued that individual

well-being should be measured in terms of functionings and capabilities, which evaluate well-being from the perspective of actual achievement and the freedom to achieve (Sen 1992). A functioning is an individual's achievement, which represents what an individual succeeds in doing with the resources at his or her command. Functionings can be thought of as an individual's beings or doings, e.g., being well-nourished, participating in social activities and so on. Sen argues that how well an individual is must be related to the kind of life he or she is living. Capabilities refer to the real opportunities that an individual has, reflecting the freedom aspect of well-being. An individual's capabilities include various combinations of functionings that are achievable with the given resources and utilization functions (Sen 1985).

The conceptual framework of the CA and its associations with the resource-based and SWB approaches can be shown in a diagram. As seen in **Figure 1**, resources are treated as inputs, utilization ability plays the role of technology, and these two factors determine what an individual can potentially achieve (capability set). The individual chooses what to realize from the capability set. In this framework, SWB arise from functioning achievements or the capability set, but not from resource possession directly.

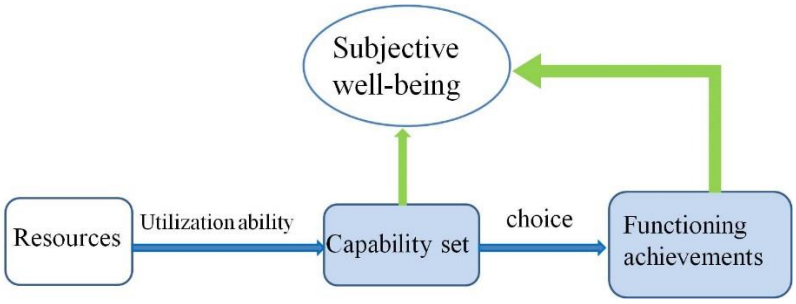

Figure 1. The CA conceptual framework

The diagram also indicates that the CA can make use of information from the resource-based and SWB approaches. Sen (1985) argues that resources merely provide a means to pursue ends and that SWB is too subjective and not reliable. It is obvious that focusing on either inputs or outputs exclusively cannot provide us with adequate information. To reveal the intermediate process of the well-being generating process leads to the issue of how to handle the multiple information spaces in the CA framework. As pointed out by Comim (2008, p.160), "The CA provides a justification for using broader informational spaces in normative evaluations but offers no guidance about how different informational spaces are to be filled in, combined, or sequenced."

Due to the complexities of the framework as well as its demanding information requirements, how to operationalize the CA appropriately is still under exploration.

4.2.2 Associations among the three approaches

In mainstream welfare economics, individuals are always treated as identical. However, in the real world, individuals differ from each other in terms of their abilities to convert resources into well-being and their evaluations of what a good life is. The CA explicitly takes these two types of human diversity into consideration. In the CA, utilization ability reflects the extent to which an individual can convert resources into functionings and considers the possibility that deprivations in functionings are caused by disadvantages in utilization ability rather than lack of resources. Therefore, it becomes crucial to examine the role of utilization ability in influencing well-being. At the same time, considering the role of utilization ability in determining well-being reflects the added value of the CA compared to the resource-based approach.

With respect to the CA and the SWB approach, it is argued that both approaches have limitations that can be overcome by drawing strength from each other (Comim 2005), which motivates the interest of proponents of both approaches to look for potential synergies between the CA and SWB approach.[26] For instance, one of the major limitations of the SWB approach lies in the fact that the same level of SWB may accompany very different social circumstances, opportunities, freedoms, and no direct attention is usually payed to these aspects. Therefore, taking objective aspects of well-being into consideration may help the SWB approach overcome this shortcoming. On the other hand, due to the multidimensional nature of the CA, a bundle of functionings or capabilities is usually selected to measure well-being. The problem of how to make intra- or interindividual comparisons is crucial to the CA. Schokkaert (2007) argues that "[t]rade-offs between different functionings are often crucial for an analytical assessment of specific policy proposals—and if one refuses to make these trade-offs explicit, they will implicitly be revealed in policy choices." Individuals may evaluate various aspects of their lives differently, and CA respects individuals' own opinions in the evaluation process. In this respect, SWB illuminates critical information about what makes individuals feel more satisfied with their lives as a whole. Hence, CA can utilize SWB as a valuation function and draw from SWB's insights

[26] For a collection of work related to the discussion of the CA and SWB approach, readers can refer to the special issue of the *Review of Social Economy* (2005), the special issue of the *Journal of Socio-Economics*, 39 (2010), and Bruni et al. (Eds) (2008).

on how an individual evaluates the trade-offs between the different dimensions of well-being.[27]

In conclusion, the resource-based approach, the SWB approach, and the CA share the same objective of assessing individual well-being, and there are several associations among them. According to Sen's (1985) argument, an individual's well-being is best seen as an index of the individual's functionings. Functionings have intrinsic value in themselves, and they are connected both to resources and SWB. Therefore, in the current study, we focus on functionings and explore their associations with resources as well as SWB. In addition, intergroup differences in utilizing resources and evaluation variations are examined by focusing on the gender differences of Chinese older people.

Based on the CA and the empirical study results from other countries, this study employs an empirical method to test the following hypotheses for elderly Chinese individuals. H1-1 focuses on investigating the role of utilization ability in functioning generating processes. H1-2 is to explore whether intergroup differences exist in terms of how utilization ability influences functionings. After that, how Chinese older people evaluate different dimensions of their lives and whether intergroup differences exist in the evaluation process are examined in H2-1 and H2-2, respectively.

H1-1: Along with resources, utilization ability affects Chinese older people's functionings.

H1-2: Utilization ability has different effects on the functionings of female and male older people.

H2-1: Chinese older people's SWB is the evaluation of functioning achievements.

H2-2: There are intergroup differences between female and male older people in the evaluation of functioning achievements.

4.3 Methodology

4. 3.1 Estimation Method

4.3.1.1 Estimations of functionings

[27] There are also researchers utilizing the CA framework to enrich the SWB perspective (Binder 2014).

In the CA, it has been argued that it is not only the resources that an individual owns but also one's utilization ability is important in pursuing well-being (Sen 1985). Therefore, in search of the associations between the CA and the resource-based approach, this paper aims to test the importance of individual utilization ability on functioning achievements. Eight functionings are extracted from the China Health and Retirement Longitudinal Survey (CHARLS) dataset to capture older people's well-being. Among them, three are discrete ordered categorical variables, and the rest are binary variables. Micro-panel data is used in the empirical analysis, which makes it possible to take into account individual heterogeneity that cannot be observed but which determines one's functioning achievements. The unobserved individual heterogeneity is controlled by including individual specific effects that account for the unobservable characteristics that are constant across time but different for each individual. In the usual random effect models, unobserved individual specific effects are assumed to be not correlated with the observed explanatory variables. In order to relax this strict assumption, the solution proposed by Mundlak (1978) is employed to address the issue. Following the above discussion, the estimation of functionings can be written in the following way:

$$f_{ijt}^{*} = \beta_1 U_{it} + \beta_2 R_{it} + \gamma Z_{it} + \lambda T_t + v_i + \varepsilon_{it}$$

$$\Pr(f_{ijt} = m) = \Pr(\mu_{(m-1)} < \beta_1 U_{it} + \beta_2 R_{it} + \gamma Z_{it} + \lambda T_t + v_i < \mu_m), \text{ where } j=1, 2, 3$$

$$f_{ijt} = 1, \text{if } f_{ijt}^{*} < \mu_1; =2, \text{if } \mu_1 < f_{ijt}^{*} < \mu_2; \cdots; = 5, \text{if } \mu_4 < f_{ijt}^{*}$$

$$\Pr(f_{ijt} = 1) = \Pr(f_{ijt}^{*} > 0) = \Pr(\varepsilon_{it} > -\beta_1 U_{it} - \beta_2 R_{it} - \gamma Z_{it} - \lambda T_t - v_i), \text{ where } j=4, \cdots, 8$$

where f_{ijt} is the observed functioning j (j=1, ⋯,8) of the i^{th} individual (i=1, ⋯,N) in period t (t=1, 2, 3), and f_{ijt}^{*} is the corresponding latent variable. U_{it} stands for the vector of utilization ability, R_{it} are the resource variables, and Z_{it} represents the demographic variables. T_t are year dummies that represent the time fixed effects, and v_i is the individual specific time invariant component. β_1, β_2, γ, and λ are the coefficients. $\mu_1, \cdots, \mu_4$ are the threshold parameters, and ε_{it} is the usual error term.

To allow for the correlation between the individual specific effects and the observed explanatory variables, the following structure of this correlation is assumed:

$$v_i = \alpha \overline{X}_i + u_i$$

where $\overline{X_i}$ is the average of selected observed explanatory variables across time, which pick up the correlation between the individual specific effects and the observed explanatory variables. Variables such as utilization ability and resources are included in the vector $\overline{X_i}$ in the estimations. u_i is the error term, which is not correlated with the observed explanatory variables.

Therefore, the correlated random effects (ordered) probit models are employed in the estimation of functionings. To test H1-1, the whole sample is used for the analysis, based on the equations above. When β_1 is statistically significant, H1-1 is supported. Then, to test H1-2, the samples are divided into two subsamples—female and male groups. The results of β_1 of each group are compared. When the statistical significances and magnitudes differ for the two groups, H1-2 is supported.

4.3.1.2 Estimations of SWB

To search for the associations between the CA and SWB approach, SWB is taken as a valuation function of functioning achievements. The underlying latent variable models can be written as follows:

$$s_{it}^* = \beta f_{it} + \gamma Z_{it} + \lambda T_t + v_i + \varepsilon_{it}$$

$$\Pr(s_{it} = h) = \Pr\left(\mu_{(h-1)} < \beta f_{it} + \gamma Z_{it} + \lambda T_t + v_i < \mu_h\right), \text{ where } h=1, \cdots, 5$$

$$s_{it} = 1, \text{ if } s_{it}^* < \mu_1; =2, \text{ if } \mu_1 < s_{it}^* < \mu_2; \cdots; = 5, \text{ if } \mu_4 < s_{it}^*$$

where s_{it} is the self-reported SWB of individual i (i=1,⋯,N) in period t (t=1, 2, 3), and s_{it}^* is the corresponding unobserved latent variable. f_{it} is the vector of functioning achievement. Z_{it} represents the demographic variables. T_t are year dummies, and v_i is the individual specific time invariant component. β, γ, and λ are the coefficients. $\mu_1, \cdots, \mu_4$ are the threshold parameters, and ε_{it} is an error term. The unobserved individual specific effects are assumed to have the following structure:

$$v_i = \alpha \overline{f_i} + u_i$$

where $\overline{f_i}$ is the vector of average functioning achievement across time of individual i, and u_i is the error term.

Three random effects ordered probit models are conducted to estimate SWB. In Model 1, the

estimation is made under the assumption that there would be no correlation between the unobserved individual specific effects and the observed explanatory variables. In Model 2, this assumption is relaxed, and the correlation between the individual specific effects and the observed explanatory variables is allowed. Then, based on Model 2, educational attainment is included in the analysis as a functioning achievement in Model 3.

To test H2-1, the whole sample is used. When β is statistically significant, H2-1 is supported. To test H2-2, the samples are divided into two subsamples by gender, and the results of the β of the two groups are compared. When the statistical significances and magnitudes differ, H2-2 is supported.

4.3.2 Data

The data utilized in the analyses is from CHARLS, which is conducted by Peking University every two years and covers the representative regions in China. Its survey subjects are individuals aged 45 and older. The baseline national wave conducted in 2012 includes about 10,000 households and 17,500 individuals in 150 counties/districts and 450 villages/residential committees. Individual-level information such as demographic characteristics, intrahousehold transfer, health status and physical function, employment status and pension, income and assets, and other related information can be obtained from the CHARLS. A balanced panel dataset is constructed using the three waves of the CHARLS (CHARLS 2011, 2013, 2015). The respondents aged younger than 45 in the first wave and those whose key variables are missing are excluded. As a result, the total sample is 25,962 observations.

4.3.3 Variable setting for functioning estimations

For the dependent variables, due to the multidimensional nature of the CA, eight functioning variables are constructed. All of the functioning variables are used as dependent variables in the estimations of functioning and as independent variables in the estimations of SWB. Among the functionings, three of them are ordered categorical variables, and five are binary variables. (i) In line with previous studies on elder well-being (Anand et al. 2015), participating in social activities is believed to be important in elderly individuals' daily lives. Therefore, three variables reflecting this aspect are specified, including "interacting with friends," "playing Mahjong/chess/cards/going to a community club (playing Mahjong)," and "going to a sport/social/or other kind of club (going to club)." The CHARLS asks respondents about the

frequency of participating in each of the above activities in the previous month, with categories defined as 1 (never), 2 (not regularly), 3 (almost every week) and 4 (almost daily). (ii) "Being in work" is equal to 1 when the respondent was engaged in agricultural work, wage-earning work, self-employment activities, or unpaid family business work[28] for more than ten days in the previous year or at least one hour in the previous week. (iii) "Providing childcare" is a binary variable, which is equal to 1 if the respondent had provided childcare for their grandchildren for three weeks or more in the previous year. (iv) "Getting enough sleep" is measured as a binary variable to identify whether the respondent gets sufficient sleep. The CHARLS asks respondents to report the actual hours of sleep at night and naps after lunch. We first calculate the total hours that the respondent sleeps in a day and then define the functioning to be 1 if the duration is between seven to nine hours; correspondingly, the reference is defined as less than seven or more than nine hours a day.[29] (v) Emotional state is thought to be important for elderly individuals, so a binary variable called "feeling lonely" is defined to indicate whether the respondent often feel lonely. The cutoff point is taken to be more than two days or not during the previous week, which is equal to 1 for feeling lonely for more than two days. (vi) The last binary variable is "falling down," which is equal to 1 if the respondent had fallen down in the previous two years.

With respect to the independent variables, utilization ability, resources and demographic variables are specified. Utilization ability acts as the technology part, which reflects an individual's ability to transform resources into well-being. Three variables intended to reflect the intelligence and physical aspects are selected as indicators of utilization ability. Education level, which reflects an elderly individual's knowledge and skills, is treated as a proxy for the intelligence aspect of utilization ability. Educated individuals supposedly have more knowledge, which can help them make better use of resources to achieve a higher level of well-being. For the physical aspect, the activities of daily living (ADLs) is used. Compared to the specific physical conditions (e.g., disability) that are usually considered in previous studies (Kuklys 2005), the ADLs reflect an elderly individual's general functional status. More precisely, the ADLs comprise the basic activities of daily living (BADLs) and the instrumental activities of daily living (IADLs), which are often used to measure an individual's ability to perform certain kinds of tasks in their

[28] In the CHARLS, work does not include doing housework or doing activities without pay, such as volunteer work.

[29] One previous study (Hirshkowitz et al. 2015) recommends that seven to nine hours of sleep for adults (26–64 years old) and seven to eight hours of sleep for older adults (over 65 years) are appropriate amounts of sleep.

daily lives. BADLs are more essential for survival, reflecting the individual's ability to care for himself or herself. The IADLs reflect an individual's ability to accomplish more complex tasks and is often used to judge whether the individual can live independently or not. In the context of elderly individual, it is reasonable to think that physical functional status is associated with their ability to achieve a broad range of functionings. Therefore, BADLs and IADLs are used to reflect the physical aspects of utilization ability.

BADLs have six items in CHARLS, including (i) dressing, (ii) bathing, (iii) eating, (vi) getting into or out of bed, (v) using the toilet, and (vi) controlling urination and defecation. IADLs cover five items, which are, (i) doing household chores, (ii) preparing hot meals, (iii) shopping for groceries, (iv) taking the right portion of medication on time, and (v) managing money. The CHARLS asks respondents if they have any difficulty in doing each item and lets them choose from 1 (no, I don't have any difficulty), 2 (I have difficulty but can still do it), 3 (yes, I have difficulty and need help), to 4 (I cannot do it). The values are reversed. The BADLs variable is then constructed by taking the average value of the difficulty levels of all six items, with a higher value indicating higher utilization ability. The IADLs variable is defined in the same way.

Economic resources are usually thought to be the most important factors for determining individual well-being. To address the endogeneity problem such as the reverse causality between resources and functionings (e.g., being in work), two types of relatively long-term financial variables are selected as the proxy for resources; these variables are the per capita household assets[30] and ownership status of the home. The logarithm value of household assets is used. Ownership status is a dummy variable that is equal to 1 if the individual is an owner of the home.

In addition to utilization ability and resources, a set of demographic variables frequently discussed in previous studies are included, including age, gender, marital status and *hukou* status.[31] Marital status is a dummy variable that is equal to 1 for married and to 0 if the respondent is separated, divorced, widowed or never married. *Hukou* status is a dummy variable that is equal to 1 if the individual has rural *hukou*, and to 0 if the individual has urban *hukou*. In addition, three block dummy variables, namely, the eastern, central and western regions are used to control for

[30] The per capita household assets of individuals with partners are calculated by dividing the total household assets by 2.

[31] The *hukou* system, in place since 1958, is a household registration system in China. The system strictly categorizes residents into rural and urban households, which inadvertently created large gaps over the years in the kinds of benefits residents could access.

regional disparities.

4.3.4 Variable setting for SWB estimations

Self-reported life satisfaction is used as the SWB indicator. The CHARLS asks respondents to think about their life as a whole and choose from among five scales, with 1 as "completely satisfied," 2 as "very satisfied," 3 as "somewhat satisfied," 4 as "not very satisfied," and 5 as "not at all satisfied." The order of choices is reversed, so a higher value indicates more satisfaction with life.

For the independent variables, (i) all eight functionings are included. (ii) The demographic variables are taken as the control variables. (iii) Educational attainment is usually treated as a functioning in the CA literature, with the Human Development Index as a typical example. Therefore, education is included as a functioning achievement in Model 3.

A summary of the descriptive statistics of all the variables is presented in Table 1 for the total and for the female and male groups. It is observed that, (i) a greater proportion of female older people interacts with friends and goes to clubs compared to the males while in the case of playing Mahjong, the situation is the opposite. (ii) It seems that there is an intrahousehold division of labor, with more males being in work and more females providing care and support for grandchildren. (iii) With respect to sleep, feeling lonely and falling down, females are more vulnerable in all of these compared to males. (iv) For demographic variables, on average, female older people are a little younger than male older people. More females live in rural areas and without spouses. (v) The male group has advantages in terms of both resources and utilization ability, and a huge gap in education is observed. Additionally, male older people are more satisfied with their lives compared to female older people. (vi) In a recent study by Easterlin et al. (2012), a u-shaped pattern with no change or a declining trend between 1990 and 2010 for China's life satisfaction is found. In our data, it is observed that older people's life satisfaction increases between 2011 and 2015.[32]

[32] The average value of life satisfaction in 2011 is 3.068; in 2013, it is 3.126; and in 2015, it is 3.398.

Table 1 Descriptive variables

	Total		Female		Male	
Variables	Mean	S.D.	Mean	S.D.	Mean	S.D.
Functionings						
Interacting with friends	1.818	1.171	1.888	1.215	1.746	1.118
Playing Mahjong	1.394	0.852	1.314	0.785	1.477	0.908
Going to club	1.188	0.693	1.220	0.744	1.154	0.635
Being in work	0.706	0.456	0.653	0.476	0.760	0.427
Providing childcare	0.347	0.476	0.377	0.485	0.316	0.465
Sleep time (hours)	6.905	2.069	6.668	2.145	7.150	1.958
Feeling lonely	0.147	0.354	0.172	0.377	0.121	0.326
Falling down	0.159	0.366	0.180	0.384	0.137	0.344
Resources						
Household assets (Yuan)	12,307	37,481	11,625	36,894	13,012	38,066
Ownership	0.864	0.343	0.860	0.347	0.868	0.339
Utilization ability						
BADL	3.935	0.213	3.926	0.216	3.943	0.209
IADL	3.876	0.360	3.855	0.373	3.896	0.344
Education	3.476	1.912	2.904	1.872	4.066	1.767
Demographic variables						
Age	60.18	8.595	59.38	8.444	61.00	8.672
Gender	0.492	0.500	0	0	1	0
Hukou	0.789	0.408	0.809	0.393	0.768	0.422
Spouse	0.888	0.316	0.862	0.345	0.914	0.280
East	0.348	0.476	0.345	0.476	0.350	0.477
Central	0.328	0.470	0.326	0.469	0.330	0.470
West	0.324	0.468	0.328	0.470	0.319	0.466
Life satisfaction	3.197	0.736	3.181	0.763	3.214	0.707
Number of observations	25,962		13,191		12,771	
Number of individuals	8,654		4,397		4,257	

Source: China Health and Retirement Longitudinal Survey (2011, 2013, 2015).

4.4 Results

4.4.1 The influence of utilization ability on functionings: Testing results of H1-1

Table 2 summarizes the estimation results of functionings for the whole sample. It shows that unobserved individual heterogeneity accounts for at least 31% of the total variance. The estimated panel-level variance components are all significantly different from 0, suggesting that the random effects (ordered) probit model should be preferred over a standard (ordered) probit regression model.

Table 2 Estimation of functionings

Variables	Friend	Mahjong	Club	Working	Childcare	Sleep	Lonely	Fall down
Utilization ability								
BADL	0.140*	0.164	-0.105	0.103	-0.072	0.207***	-0.345***	-0.556***
	(0.073)	(0.113)	(0.164)	(0.098)	(0.087)	(0.077)	(0.085)	(0.081)
IADL	0.120***	0.192***	0.109	0.293***	0.079	0.046	-0.199***	-0.176***
	(0.042)	(0.067)	(0.091)	(0.056)	(0.050)	(0.044)	(0.050)	(0.048)
Education	0.028***	0.086***	0.159***	-0.119***	-0.040***	0.028***	-0.051***	-0.005
	(0.007)	(0.014)	(0.013)	(0.012)	(0.010)	(0.007)	(0.010)	(0.008)
Resources								
lnhh_assest	0.021***	0.010	0.018**	0.016**	0.004	0.002	-0.008	0.009
	(0.005)	(0.007)	(0.009)	(0.007)	(0.006)	(0.005)	(0.007)	(0.006)
Ownership	0.039	0.023	0.024	-0.031	0.030	0.007	0.051	0.018
	(0.034)	(0.048)	(0.067)	(0.048)	(0.041)	(0.036)	(0.048)	(0.044)
Demographic variables								
Age	-0.004**	-0.001	0.011***	-0.083***	-0.014***	-0.007***	-0.006***	0.010***
	(0.001)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Gender	-0.201***	0.442***	-0.572***	0.932***	-0.199***	0.172***	-0.141***	-0.196***
	(0.023)	(0.049)	(0.047)	(0.045)	(0.034)	(0.024)	(0.033)	(0.029)
Hukou	0.074**	-0.241***	-0.904***	1.524***	0.092**	0.006	0.187***	0.065*
	(0.029)	(0.057)	(0.051)	(0.052)	(0.041)	(0.030)	(0.043)	(0.036)
Spouse	-0.267***	-0.080	-0.100	0.415***	0.399***	0.094***	-0.940***	-0.061
	(0.034)	(0.067)	(0.067)	(0.057)	(0.050)	(0.036)	(0.044)	(0.041)
East	0.141***	0.206***	-0.029	-0.323***	-0.223***	0.197***	-0.279***	-0.214***

	(0.027)	(0.058)	(0.053)	(0.050)	(0.039)	(0.028)	(0.038)	(0.033)
Central	0.154***	0.426***	-0.013	-0.124**	-0.052	0.058**	-0.149***	-0.051
	(0.027)	(0.058)	(0.053)	(0.050)	(0.039)	(0.028)	(0.037)	(0.033)
Year2013	0.101***	0.156***	0.255***	0.000	0.509***	-0.029	-0.208***	-0.021
	(0.021)	(0.029)	(0.041)	(0.031)	(0.026)	(0.022)	(0.031)	(0.028)
Year2015	-0.076***	0.045	0.203***	-0.153***	0.469***	-0.025	0.019	0.005
	(0.022)	(0.032)	(0.043)	(0.033)	(0.028)	(0.024)	(0.032)	(0.029)
Within mean of covariates								
Mean BADL	-0.192	-0.201	0.448	0.541***	0.250	0.259**	-0.317**	-0.230*
	(0.118)	(0.248)	(0.277)	(0.196)	(0.163)	(0.125)	(0.144)	(0.133)
Mean IADL	0.155**	0.572***	0.138	0.941***	0.035	0.158**	-0.297***	0.028
	(0.071)	(0.151)	(0.155)	(0.115)	(0.096)	(0.073)	(0.087)	(0.081)
Mean lnhh_assets	0.015*	0.120***	0.057***	-0.035***	-0.011	0.025***	-0.040***	-0.029***
	(0.008)	(0.015)	(0.015)	(0.013)	(0.011)	(0.008)	(0.011)	(0.010)
Mean ownership	0.054	0.151	-0.003	0.217**	0.073	0.114*	-0.118	-0.098
	(0.056)	(0.108)	(0.109)	(0.093)	(0.077)	(0.059)	(0.078)	(0.069)
Sigma2_u	0.449***	2.566***	1.039***					
	(0.020)	(0.105)	(0.075)					
Constant				-2.731***	-1.384***	-2.912***	4.959***	2.227***
				(0.560)	(0.443)	(0.323)	(0.374)	(0.329)
lnsig2u				0.550***	0.194***	-0.772***	-0.382***	-0.727***
				(0.046)	(0.040)	(0.049)	(0.061)	(0.065)
Rho	0.310	0.713	0.509	0.634	0.548	0.316	0.406	0.326
	(0.010)	(0.008)	(0.018)	(0.011)	(0.010)	(0.011)	(0.015)	(0.014)
No. of observations	25,962	25,962	25,962	25,962	25,962	25,962	25,962	25,962
No. of individuals	8,654	8,654	8,654	8,654	8,654	8,654	8,654	8,654

Notes: (i) The first three columns are random effects ordered probit models. Thresholds are not reported. The rest are random effect probit models. (ii) Rho reports the percentage of unobserved variation explained by individual-specific effect. (iii) Standard errors in parentheses. (iv) *** p<0.01, ** p<0.05, * p<0.1.

The main findings are as follows. For utilization ability, (i) both BADLs and IADLs have positive effects on interacting with friends and negative effects on feeling lonely and falling down. Additionally, BADLs also have a positive effect on getting enough sleep while IADLs have positive effects on playing Mahjong and being in work. (ii) Education influences almost all of the

functionings significantly, except for falling down. The results indicate that higher utilization ability may help older people achieve valuable functionings. Moreover, the coefficients of education on being in work and providing childcare are negative, indicating that educated older people may be less likely to achieve these two functionings.

With respect to resources, current household assets are significantly and positively associated with interacting with friends, going to a club, and being in work while current home ownership influences none of the functionings significantly. It is also observed that long-term financial status (mean household assets and mean ownership) influences a wider range of functionings compared to the current financial status, which indicates that a stable long-term financial status is more important for elderly individuals, especially for functionings such as playing Mahjong, getting enough sleep, feeling lonely, and falling down.

Furthermore, in order to compare the effects of utilization ability and resources on elderly individuals' functionings, average partial effects (APEs) are calculated. The results are presented in Table A1 in the Appendix for the utilization ability and resources variables.[33] For all functionings, the APEs of utilization ability are clearly larger than the APEs of resources, which suggests that for older people, utilization ability is relatively more important than resources in determining well-being. Previous SWB literature (Ferrer-i-Carbonell 2005) points out that the relationship between resources and well-being in terms of SWB is not very strong. This study provides new insight that resources are only weakly related to well-being in terms of functionings as well.

For the demographic variables, (i) along with age increases, the probability of going to a club and falling down also increases while the probability of interacting with friends, being in work, providing childcare, getting enough sleep, and feeling lonely all decreases. (ii) Gender differences in functionings are observed, and the results are consistent with what has been seen in the descriptive statistics. Compared to female older people, male older people are more likely to play Mahjong, work, and get enough sleep while they are less likely to interact with friends, go to a club, provide childcare, feel lonely, and fall down. (iii) Besides the gender differences, rural–urban differences are also observed. Compared to urban older people, the probability of

[33] The ordered categorical variables (Friend, Mahjong, Club) are defined as binary variables in the calculation of APEs that are equal to 1 if the individual has engaged in the activity in the previous month. Then the APEs of all eight functionings are calculated the same way, following Wooldridge (2010).

interacting with friends, being in work, providing childcare, feeling lonely, and falling down increases for the rural older people while the probability of playing Mahjong and going to a club decreases. (iv) Elderly individuals with spouses are more likely to work, provide childcare, and get enough sleep; however, they are less likely to interact with friends and feeling lonely. (v) Compared to older people who live in the western region, those living in eastern or central regions are more likely to interact with friends, play Mahjong, and get enough sleep. At the same time, they are less likely to work, provide childcare, feel lonely, and fall down.

4.4.2 The influence of utilization ability on female and male older people: Testing results of H1-2

Tables 3 and 4 present the estimation results for the two subsamples, the female and male older people respectively, with the aim of investigating if there are any differences in the way utilization ability influences functionings between the two groups. For all of the functionings, there are quite remarkable unobserved individual specific effects, which account for 31% to 74% of the total variance, suggesting that the random effects (ordered) probit model should be preferred over a standard (ordered) probit regression.

The main findings are as follows. (i) With respect to the physical aspect of utilization ability, current BADLs affect a broader range of functionings for females while in the case of IADLs, they affect more functionings for males. In addition, there are more long-term differences. It is found that the long-term BADLs (mean BADLs) affect completely different functionings for the two subsamples. For female older people, BADLs are significantly associated with being in working, getting enough sleep, and falling down while for male older people, they have significant effects on going to a club, providing childcare, and feeling lonely. In the case of mean IADLs, they have significant effects on playing Mahjong and being in work for both subsamples. In addition, they are also significantly associated with interacting with friends, going to a club, and feeling lonely for the females while for males, they have only a significant effect on getting enough sleep. (ii) Education affects all of the functionings in the same way, except that it has a significantly negative effect for females on providing childcare while its influence on males is insignificant. (iii) For resources, current household assets have positive effects on interacting with friends for both subsamples. In addition, it also significantly affects playing Mahjong and falling down for females and being in work and feeling lonely for males. Again, long-term financial status influences more functionings compared to the current financial status. Mean household assets are significantly associated with playing Mahjong, going to a club, getting enough sleep,

and feeling lonely for both subsamples. In addition, it also has significant effects on falling down for females and on interacting with friends and being in work for males. Moreover, home ownership seems to be more important for males than for females. Mean ownership has significant effects on playing Mahjong, feeling lonely, and falling down for males while it only affects being in work for females.

Table 3 Estimation of functionings-Female

Variables	Friend	Mahjong	Club	Working	Childcare	Sleep	Lonely	Fall down
Utilization ability								
BADL	0.242**	0.221	-0.108	0.071	-0.013	0.240**	-0.374***	-0.537***
	(0.096)	(0.168)	(0.210)	(0.129)	(0.113)	(0.105)	(0.111)	(0.105)
IADL	0.046	0.215**	0.142	0.260***	0.070	0.054	-0.189***	-0.165***
	(0.054)	(0.097)	(0.123)	(0.071)	(0.064)	(0.057)	(0.063)	(0.062)
Education	0.017*	0.117***	0.166***	-0.119***	-0.074***	0.023**	-0.052***	0.001
	(0.009)	(0.021)	(0.019)	(0.017)	(0.014)	(0.010)	(0.013)	(0.012)
Resources								
lnhh_assest	0.025***	0.029***	0.020	0.007	0.001	0.002	0.004	0.019**
	(0.007)	(0.010)	(0.012)	(0.009)	(0.008)	(0.007)	(0.009)	(0.009)
Ownership	0.035	0.055	0.041	-0.066	0.012	0.007	-0.004	-0.054
	(0.046)	(0.075)	(0.089)	(0.064)	(0.057)	(0.051)	(0.063)	(0.059)
Within mean of covariates								
Mean BADL	-0.243	-0.473	0.223	0.649**	0.035	0.454***	-0.143	-0.388**
	(0.159)	(0.369)	(0.373)	(0.261)	(0.217)	(0.169)	(0.190)	(0.175)
Mean IADL	0.244***	0.692***	0.416*	0.753***	0.087	0.093	-0.385***	-0.015
	(0.092)	(0.225)	(0.218)	(0.150)	(0.126)	(0.097)	(0.111)	(0.105)
Mean lnhh_assets	0.007	0.097***	0.061***	-0.027	0.005	0.025**	-0.048***	-0.040***
	(0.011)	(0.023)	(0.021)	(0.018)	(0.015)	(0.011)	(0.015)	(0.013)
Mean ownership	0.044	0.056	0.005	0.310**	0.033	0.145*	-0.010	-0.004
	(0.077)	(0.166)	(0.152)	(0.126)	(0.107)	(0.082)	(0.103)	(0.094)
Demographic variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sigma2_u	0.447***	2.897***	1.264***					
	(0.028)	(0.187)	(0.115)					
Constant				-2.828***	0.040	-3.615***	4.900***	2.678***

				(0.783)	(0.625)	(0.463)	(0.515)	(0.465)
lnsig2u				0.570***	0.225***	-0.792***	-0.482***	-0.731***
				(0.060)	(0.055)	(0.070)	(0.083)	(0.088)
Rho	0.309	0.736	0.558	0.639	0.556	0.312	0.382	0.325
	(0.014)	(0.011)	(0.022)	(0.014)	(0.014)	(0.015)	(0.020)	(0.019)
No. of observations	13,191	13,191	13,191	13,191	13,191	13,191	13,191	13,191
No. of individuals	4,397	4,397	4,397	4,397	4,397	4,397	4,397	4,397

Notes: (i) The first three columns are random effects ordered probit models. Thresholds are not reported. The rest are random effect probit models. (ii) Rho reports the percentage of unobserved variation explained by individual-specific effect. (iii) Standard errors in parentheses. (iv) *** p<0.01, ** p<0.05, * p<0.1.

Table 4 Estimation of functionings-Male

Variables	Friend	Mahjong	Club	Working	Childcare	Sleep	Lonely	Fall down
Utilization ability								
BADL	-0.024	0.121	-0.068	0.139	-0.157	0.174	-0.309**	-0.585***
	(0.112)	(0.155)	(0.270)	(0.151)	(0.136)	(0.113)	(0.134)	(0.128)
IADL	0.241***	0.172*	0.081	0.344***	0.104	0.035	-0.214***	-0.193**
	(0.068)	(0.095)	(0.139)	(0.092)	(0.081)	(0.069)	(0.083)	(0.078)
Education	0.042***	0.055***	0.146***	-0.113***	-0.009	0.035***	-0.047***	-0.011
	(0.010)	(0.018)	(0.019)	(0.018)	(0.014)	(0.010)	(0.015)	(0.012)
Resources								
lnhh_assest	0.016**	-0.006	0.015	0.030***	0.009	0.002	-0.024**	-0.002
	(0.007)	(0.009)	(0.014)	(0.011)	(0.009)	(0.007)	(0.011)	(0.010)
Ownership	0.044	-0.003	0.008	0.017	0.055	0.008	0.121*	0.106
	(0.050)	(0.063)	(0.101)	(0.073)	(0.060)	(0.052)	(0.073)	(0.065)
Within mean of covariates								
Mean BADL	-0.079	0.032	0.760*	0.366	0.470*	0.030	-0.568**	-0.036
	(0.179)	(0.338)	(0.426)	(0.298)	(0.249)	(0.185)	(0.224)	(0.207)
Mean IADL	0.034	0.448**	-0.203	1.192***	-0.022	0.255**	-0.167	0.071
	(0.110)	(0.206)	(0.221)	(0.179)	(0.147)	(0.112)	(0.140)	(0.128)
Mean lnhh_assets	0.023**	0.140***	0.056***	-0.048**	-0.025	0.024**	-0.031*	-0.016
	(0.011)	(0.019)	(0.022)	(0.020)	(0.015)	(0.012)	(0.017)	(0.015)
Mean ownership	0.059	0.238*	-0.029	0.090	0.119	0.084	-0.254**	-0.228**

	(0.082)	(0.143)	(0.157)	(0.138)	(0.112)	(0.085)	(0.120)	(0.102)
Demographic variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sigma2_u	0.446***	2.326***	0.791***					
	(0.029)	(0.124)	(0.095)					
Constant				-1.793**	-3.033***	-2.030***	4.984***	1.517***
				(0.800)	(0.640)	(0.452)	(0.553)	(0.475)
lnsig2u				0.496***	0.134**	-0.758***	-0.269***	-0.731***
				(0.070)	(0.059)	(0.069)	(0.091)	(0.098)
Rho	0.308	0.691	0.442	0.622	0.533	0.319	0.433	0.325
	(0.014)	(0.011)	(0.030)	(0.017)	(0.015)	(0.015)	(0.022)	(0.022)
No. of observations	12,771	12,771	12,771	12,771	12,771	12,771	12,771	12,771
No. of individuals	4,257	4,257	4,257	4,257	4,257	4,257	4,257	4,257

Notes: (i) The first three columns are random effects ordered probit models. Thresholds are not reported. The rest are random effect probit models. (ii) Rho reports the percentage of unobserved variation explained by individual-specific effect. (iii) Standard errors in parentheses. (iv) *** p<0.01, ** p<0.05, * p<0.1.

The APEs of utilization ability and resources variables on functionings for the female and male groups are presented in Tables A2 and A3, respectively.[34] The discussion focuses on APEs that are significant for both subsamples. It is observed that both BADLs and IADLs have larger effects on feeling lonely and falling down for females than for males. However, both current and long-term IADLs have larger effects on being in work for males than for females. The effects of education on functionings are somewhat complicated; it is larger for females on playing Mahjong, going to a club, being in work, and feeling lonely. For males, education has larger effects on interacting with friends and getting enough sleep.

4.4.3 Evaluation of functioning achievements: Testing results of H2-1

The estimation results of the three models, following the presentation in Section 3.1.2, for all three subsamples, including all older people, the female group, and the male group, are presented in Table 5.

The discussion hereafter focuses on Model 3. For the entire sample, going to a club, being in

[34] The ordered categorical variables (Friend, Mahjong, Club) are defined as binary variables in the calculation of APEs in Tables A2 and A3, which is the same as in Table A1.

work, and providing childcare are statistically significant and positively associated with SWB. The effect of providing childcare is inconsistent with a previous study on developed countries such as the UK (Anand et al. 2015), where being a grandparent is negatively related to SWB. However, our result is consistent with a previous study on China, in which a positive effect is found in Chyi and Mao (2012).

Not surprisingly, feeling lonely and falling down have negative effects on older people's SWB. For the other functionings, including interacting with friends, playing Mahjong, and getting enough sleep, although their current period coefficients are insignificant, the long-term coefficients are all significant. In particular, feeling lonely and falling down seem to be very important to older people, and they have significantly negative effects on SWB both in the current and long terms. In conclusion, all eight functionings are significantly associated with SWB. This result is consistent with the previous study in the UK (Anand et al. 2015), which also confirmed that SWB is related to a wide variety of activities. Therefore, SWB may be seen as the evaluation of functioning achievements. In addition, it is observed that educational attainment is significantly and negatively related to SWB, which indicates that being educated may decrease older people's SWB in China. One possible explanation is that individuals with higher levels of education may have higher aspirations about their lives. However, these aspirations cannot be fulfilled in Chinese society. Graham et al. (2017) also found a negative correlation between education and SWB in China, while Clark and Oswald (1996) observed a similar result in the United Kingdom.

Table 5 Estimation of SWB

	Total			Female			Male		
Variables	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Functionings									
Friend	0.020***	0.009	0.009	0.030***	0.016	0.017	0.004	-0.002	-0.002
	(0.007)	(0.009)	(0.009)	(0.010)	(0.012)	(0.012)	(0.011)	(0.013)	(0.013)
Mahjong	0.049***	0.022	0.022	0.045***	-0.000	-0.000	0.056***	0.042**	0.042**
	(0.011)	(0.015)	(0.015)	(0.016)	(0.023)	(0.023)	(0.015)	(0.021)	(0.021)
Going to Club	0.045***	0.031**	0.031**	0.043***	0.042**	0.042**	0.049**	0.018	0.018
	(0.013)	(0.016)	(0.016)	(0.017)	(0.021)	(0.021)	(0.020)	(0.024)	(0.024)
Be in working	0.041*	0.053*	0.053*	0.005	0.058	0.057	0.096***	0.048	0.048
	(0.022)	(0.029)	(0.029)	(0.028)	(0.038)	(0.038)	(0.034)	(0.045)	(0.045)
Child care	0.072***	0.044*	0.044*	0.081***	0.038	0.038	0.060**	0.049	0.049
	(0.018)	(0.023)	(0.023)	(0.025)	(0.032)	(0.032)	(0.027)	(0.034)	(0.034)
Sleep	0.099***	0.030	0.030	0.122***	0.027	0.027	0.075***	0.034	0.034
	(0.017)	(0.020)	(0.020)	(0.023)	(0.028)	(0.028)	(0.024)	(0.029)	(0.029)
Feeling lonely	-0.513***	-0.219***	-0.219***	-0.474***	-0.206***	-0.207***	-0.564***	-0.234***	-0.234***
	(0.024)	(0.029)	(0.029)	(0.032)	(0.037)	(0.037)	(0.039)	(0.046)	(0.046)
Falling down	-0.164***	-0.062**	-0.062**	-0.210***	-0.102***	-0.101***	-0.103***	-0.006	-0.005

	(0.023)	(0.027)	(0.027)	(0.030)	(0.035)	(0.035)	(0.035)	(0.041)	(0.041)
Education			-0.038***			-0.044***			-0.029***
			(0.006)			(0.009)			(0.010)
Demographic variables									
Age	0.017***	0.019***	0.017***	0.020***	0.021***	0.018***	0.015***	0.018***	0.017***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Gender	-0.018	-0.056**	-0.010						
	(0.022)	(0.022)	(0.023)						
Hukou	-0.001	0.052*	0.002	-0.004	0.060	-0.004	-0.002	0.038	0.004
	(0.027)	(0.028)	(0.029)	(0.038)	(0.040)	(0.042)	(0.038)	(0.040)	(0.041)
Spouse	0.084**	-0.013	-0.008	0.055	-0.022	-0.022	0.159***	0.032	0.042
	(0.033)	(0.033)	(0.033)	(0.042)	(0.042)	(0.042)	(0.053)	(0.054)	(0.054)
East	0.037	-0.026	-0.020	0.030	-0.049	-0.047	0.045	-0.000	0.007
	(0.026)	(0.026)	(0.026)	(0.035)	(0.035)	(0.035)	(0.037)	(0.037)	(0.037)
Middle	0.034	0.003	0.010	0.013	-0.033	-0.025	0.061	0.045	0.052
	(0.026)	(0.026)	(0.026)	(0.036)	(0.035)	(0.035)	(0.038)	(0.038)	(0.038)
Year2013	0.054***	0.065***	0.069***	0.039	0.049**	0.055**	0.074***	0.081***	0.085***
	(0.018)	(0.018)	(0.018)	(0.025)	(0.025)	(0.025)	(0.026)	(0.027)	(0.027)
Year 2015	0.582***	0.573***	0.582***	0.534***	0.528***	0.539***	0.639***	0.623***	0.630***
	(0.019)	(0.019)	(0.019)	(0.026)	(0.027)	(0.027)	(0.027)	(0.028)	(0.028)
Within mean of covariates									
Mean Friend		0.032**	0.033**		0.038*	0.038*		0.017	0.019
		(0.016)	(0.016)		(0.021)	(0.021)		(0.024)	(0.024)
Mean Mahjong		0.036*	0.042*		0.064**	0.072**		0.021	0.024
		(0.022)	(0.022)		(0.033)	(0.032)		(0.029)	(0.029)
Mean Club		0.022	0.039		-0.018	0.000		0.087**	0.102**
		(0.027)	(0.027)		(0.034)	(0.034)		(0.043)	(0.043)
Mean Working		-0.028	-0.039		-0.126**	-0.139**		0.117*	0.109
		(0.044)	(0.044)		(0.057)	(0.057)		(0.069)	(0.069)
Mean Childcare		0.050	0.042		0.095*	0.079		0.004	0.002
		(0.037)	(0.037)		(0.050)	(0.050)		(0.056)	(0.056)
Mean Sleep		0.182***	0.191***		0.275***	0.284***		0.084	0.092*
		(0.037)	(0.037)		(0.051)	(0.051)		(0.053)	(0.053)
Mean Lonely		-0.925***	-0.939***		-0.841***	-0.858***		-1.023***	-1.034***
		(0.052)	(0.052)		(0.068)	(0.067)		(0.083)	(0.083)
Mean Fall down		-0.297***	-0.300***		-0.320***	-0.322***		-0.278***	-0.281***
		(0.050)	(0.050)		(0.066)	(0.066)		(0.078)	(0.078)
Sigma2_u	0.491***	0.469***	0.465***	0.465***	0.441***	0.434***	0.517***	0.496***	0.494***
	(0.019)	(0.018)	(0.018)	(0.025)	(0.024)	(0.024)	(0.028)	(0.027)	(0.027)
Rho	0.3293838	0.3192967	0.3173799	0.3173495	0.3058282	0.3027689	0.3405974	0.3314142	0.3306369
	-0.008394	-0.00831	-0.008318	-0.011683	-0.011533	-0.011548	-0.0121411	-0.0120414	-0.0120472
No. of observations	25,962	25,962	25,962	13,191	13,191	13,191	12,771	12,771	12,771
No. of individuals	8,654	8,654	8,654	4,397	4,397	4,397	4,257	4,257	4,257

Notes: (i) Thresholds are not reported. (ii) Rho reports the percentage of unobserved variation explained by individual-specific effect. (iii) Standard errors in parentheses. (iv) *** p<0.01, ** p<0.05, * p<0.1.

The APEs of functionings on SWB are presented in Table A4 in the Appendix. The probability of reporting the second highest category ("very satisfied") is calculated for selected functionings and age. It is observed that emotional status plays the most important role among all the functionings, and the total effect of feeling lonely on SWB is as high as −0.2257;[35] in particular, the long-term effect of feeling lonely has a much larger effect than the other functionings. Next to that is falling down and getting enough sleep.

For the demographic variables, only age has a significant and positive effect on SWB. A positive year trend is observed during the period between 2011 and 2015. However, the other variables, including gender, *hukou*, marriage status, and living area are all insignificant. Even the effect of age on SWB is much smaller in comparison with functionings in our study. Actually, all of the functionings have larger effects than age. Previous SWB literature, for instance, Ferrer-i-Carbonell (2005), shows that age contributes most to SWB, even more than income in the context of Germany.

4.4.4 Evaluation of functioning achievements by female and male older people: Testing results of H2-2

The discussion in this section focuses on the gender differences presented in Table 5. The results show that female and male older people have similar evaluations of feeling lonely both in the current and long terms and getting enough sleep and falling down in the long term. In addition, for females, going to a club and falling down also have significant effects on SWB while for males, playing Mahjong is significantly related to SWB. Moreover, in the long term, interacting with friends, playing Mahjong, and being in work have significant effects on female SWB while going to a club is significantly related to male SWB. It should be noted that being in work has a negative effect on female SWB, but this is not the case for males.

The APEs presented in Table A4 show that feeling lonely has approximately the same magnitude for females and males in the current period; however, its effect is larger for male than female older people in the long term. Falling down and educational attainment have larger negative effects on female SWB than on male SWB, and the positive effect of getting enough sleep is larger for female than male older people.

[35] The total value of the current and long-term APEs.

4.5 Conclusions

Through investigating the associations among the three main well-being measurement approaches in welfare economics, this study has shown the added value of the CA. The analyses use functionings as measures of individual well-being. The results show that even though a stable long-term financial status is important to elderly individuals, its effects on functionings are very small compared to utilization ability. In other words, in the context of elderly individuals, utilization ability plays a much more important role than resources do in determining well-being.[36] It is also confirmed that SWB can be used as a way to evaluate functionings. In this way, the information upon which the resource-based and SWB approaches are based can be utilized in the CA. Moreover, expanding information basis can help us better understand individual well-being. Hence, the premise of CA that broad information should be utilized in capturing well-being is justified.

Another advantage of analyzing well-being based on CA is illustrated by the role of education. In this study, education is treated as utilization ability in the estimation of functionings and as a functioning in the estimation of SWB. It has been pointed out by CA studies (Jean Drèze and Amartya Sen 2002; Robeyns 2006) that education can play several roles, both instrumental and intrinsic. The results provide empirical evidence for this argument. In the context of Chinese older people, on one hand, education significantly affects a wide range of functionings, which indicates its importance in pursuing well-being in the life course. On the other hand, education has a significant and negative effect on SWB, and the effect is larger for females than males. If only the intrinsic importance of education is focused on, the negative effect caused by education may lead to a passive attitude towards education. This indicates the danger of conducting SWB analysis directly on demographic variables. However, if the instrumental importance of education is taken into consideration, it is impossible to reject the role of education in expanding individuals' real opportunity to pursue a good life. This shows the merits of what a comprehensive framework can provide us.

Some limitations remain in the study. First, even though using SWB as an evaluation function in the CA literature has been widely recognized in recent years, the deficiencies of using SWB indicators directly should be kept in mind. For instance, it is argued by Schokkaert (2007) that there is a need to clean noise from the SWB indicators, and an example of how to correct the

[36] Wang and Ma (2019) provide an empirical investigation relating to the determinants of older people's utilization ability that interested readers can refer to.

undesirable side effects of SWB is illustrated. The motivation of doing this is clear: imagine a situation in which individuals are particularly emotional, pessimistic, or optimistic or where there are individuals who do not make full use of their freedom to achieve a high level of well-being. There is no reason for public policy to give any compensation for situations like these. Therefore, if the noise can be cleaned out, the SWB indicators can be better used. This is an insightful point and would be interesting to explore in the future empirical study.

Second, functionings are estimated separately in this study; however, there may be substitutions or complements among the different functionings. For instance, educated female older people may pursue a more colorful life by participating in various kinds of social activities. This may be the reason for why they are less likely to work or provide childcare. Additionally, older people who participate in social activities may also interact with friends more often. How to take this kind of interrelationship into analysis needs to be explored.

Third, proponents of the CA argue that it is not only what the individual has achieved but also what is potentially achievable that should be taken into consideration. Due to lack of data reflecting the freedom aspects of well-being, only functionings have been examined in this study. In addition, well-being in terms of functionings has a multidimensional nature. It is almost unavoidable to neglect important aspects in one study. Therefore, other aspects of functionings as well as the freedom aspects should be explored in the future.

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Appendix

Table A1 Average partial effects on functionings

Variables	Friend	Mahjong	Club	Working	Childcare	Sleep	Lonely	Fall down
Utilization ability								
BADL	0.0341	0.0192	-0.0070	0.0170	-0.0173	0.0665	-0.0552	-0.1068
	(0.0242)	(0.0173)	(0.0145)	(0.0160)	(0.0210)	(0.0246)	(0.0136)	(0.0155)
IADL	0.0390	0.0235	0.0082	0.0480	0.0192	0.0150	-0.0319	-0.0338
	(0.0140)	(0.0101)	(0.0081)	(0.0092)	(0.0121)	(0.0141)	(0.0080)	(0.0093)
Education	0.0144	0.0139	0.0139	-0.0196	-0.0098	0.0090	-0.0081	-0.0010
	(0.0022)	(0.0021)	(0.0012)	(0.0020)	(0.0023)	(0.0023)	(0.0016)	(0.0016)
Resources								
lnhh_assest	0.0075	0.0009	0.0015	0.0027	0.0010	0.0006	-0.0012	0.0018
	(0.0016)	(0.0010)	(0.0008)	(0.0012)	(0.0014)	(0.0017)	(0.0011)	(0.0012)
Ownership	0.0114	0.0028	0.0037	-0.0050	0.0074	0.0024	0.0082	0.0034
	(0.0114)	(0.0075)	(0.0059)	(0.0079)	(0.0099)	(0.0116)	(0.0076)	(0.0084)
Within mean of covariates								
Mean BADL	-0.0556	-0.0231	0.0349	0.0887	0.0605	0.0832	-0.0508	-0.0441
	(0.0388)	(0.0369)	(0.0241)	(0.0322)	(0.0393)	(0.0402)	(0.0231)	(0.0255)
Mean IADL	0.0461	0.0902	0.0145	0.1545	0.0085	0.0509	-0.0475	0.0053
	(0.0231)	(0.0224)	(0.0135)	(0.0189)	(0.0231)	(0.0235)	(0.0139)	(0.0156)
Mean lnhh_assets	0.0053	0.0186	0.0053	-0.0058	-0.0027	0.0079	-0.0063	-0.0056
	(0.0026)	(0.0022)	(0.0013)	(0.0022)	(0.0026)	(0.0026)	(0.0018)	(0.0019)
Mean ownership	0.0116	0.0247	-0.0034	0.0356	0.0177	0.0368	-0.0190	-0.0189
	(0.0186)	(0.0162)	(0.0095)	(0.0153)	(0.0187)	(0.0190)	(0.0125)	(0.0133)

Note: Standard errors in parentheses.

Table A2 Average partial effects on functionings-Female

Variables	Friend	Mahjong	Club	Working	Childcare	Sleep	Lonely	Fall down
Utilization ability								
BADL	0.0580	0.0269	-0.0094	0.0129	-0.0032	0.0768	-0.0685	-0.1114
	(0.0327)	(0.0210)	(0.0202)	(0.0235)	(0.0280)	(0.0335)	(0.0203)	(0.0218)
IADL	0.0194	0.0180	0.0124	0.0475	0.0172	0.0171	-0.0346	-0.0342
	(0.0182)	(0.0119)	(0.0118)	(0.0129)	(0.0157)	(0.0182)	(0.0115)	(0.0128)
Education	0.0113	0.0154	0.0157	-0.0218	-0.0183	0.0072	-0.0095	0.0002
	(0.0031)	(0.0026)	(0.0018)	(0.0031)	(0.0034)	(0.0031)	(0.0023)	(0.0024)
Resources								
lnhh_assest	0.0095	0.0030	0.0019	0.0012	0.0003	0.0007	0.0007	0.0039
	(0.0023)	(0.0013)	(0.0012)	(0.0017)	(0.0020)	(0.0023)	(0.0017)	(0.0018)
Ownership	0.0083	0.0103	0.0064	-0.0121	0.0029	0.0022	-0.0008	-0.0111
	(0.0160)	(0.0095)	(0.0086)	(0.0117)	(0.0140)	(0.0162)	(0.0115)	(0.0122)
Within mean of covariates								
Mean BADL	-0.0558	-0.0571	0.0169	0.1187	0.0087	0.1452	-0.0262	-0.0805
	(0.0529)	(0.0449)	(0.0352)	(0.0477)	(0.0534)	(0.0541)	(0.0347)	(0.0362)
Mean IADL	0.0643	0.0949	0.0403	0.1377	0.0216	0.0297	-0.0706	-0.0031
	(0.0307)	(0.0274)	(0.0206)	(0.0275)	(0.0311)	(0.0310)	(0.0204)	(0.0218)
Mean lnhh_assets	0.0014	0.0123	0.0061	-0.0050	0.0011	0.0079	-0.0088	-0.0084
	(0.0036)	(0.0028)	(0.0020)	(0.0033)	(0.0037)	(0.0037)	(0.0027)	(0.0028)
Mean ownership	0.0126	0.0073	-0.0049	0.0567	0.0082	0.0464	-0.0019	-0.0007
	(0.0260)	(0.0201)	(0.0143)	(0.0230)	(0.0264)	(0.0262)	(0.0188)	(0.0196)

Note: Standard errors in parentheses.

Table A3 Average partial effects on functionings-Male

Variables	Friend	Mahjong	Club	Working	Childcare	Sleep	Lonely	Fall down
Utilization ability								
BADL	-0.0025	0.0084	-0.0008	0.0201	-0.0371	0.0563	-0.0420	-0.1028
	(0.0364)	(0.0280)	(0.0215)	(0.0220)	(0.0323)	(0.0367)	(0.0182)	(0.0225)
IADL	0.0683	0.0309	0.0047	0.0499	0.0245	0.0112	-0.0291	-0.0340
	(0.0220)	(0.0170)	(0.0110)	(0.0133)	(0.0192)	(0.0222)	(0.0113)	(0.0137)
Education	0.0187	0.0109	0.0114	-0.0164	-0.0021	0.0113	-0.0064	-0.0020
	(0.0032)	(0.0033)	(0.0015)	(0.0027)	(0.0033)	(0.0033)	(0.0021)	(0.0022)
Resources								
lnhh_assest	0.0054	-0.0015	0.0010	0.0043	0.0020	0.0005	-0.0032	-0.0003
	(0.0023)	(0.0017)	(0.0011)	(0.0016)	(0.0020)	(0.0024)	(0.0014)	(0.0017)
Ownership	0.0151	-0.0058	0.0013	0.0025	0.0129	0.0026	0.0165	0.0187
	(0.0162)	(0.0117)	(0.0080)	(0.0106)	(0.0141)	(0.0167)	(0.0099)	(0.0114)
Within mean of covariates								
Mean BADL	-0.0421	0.0229	0.0552	0.0531	0.1111	0.0096	-0.0773	-0.0063
	(0.0576)	(0.0602)	(0.0335)	(0.0432)	(0.0588)	(0.0599)	(0.0305)	(0.0364)
Mean IADL	0.0253	0.0753	-0.0131	0.1728	-0.0053	0.0827	-0.0227	0.0125
	(0.0353)	(0.0364)	(0.0175)	(0.0260)	(0.0349)	(0.0362)	(0.0190)	(0.0225)
Mean lnhh_assets	0.0092	0.0260	0.0047	-0.0070	-0.0058	0.0078	-0.0042	-0.0028
	(0.0037)	(0.0035)	(0.0017)	(0.0029)	(0.0036)	(0.0038)	(0.0024)	(0.0026)
Mean ownership	0.0075	0.0462	-0.0030	0.0130	0.0281	0.0272	-0.0345	-0.0401
	(0.0265)	(0.0256)	(0.0123)	(0.0201)	(0.0264)	(0.0275)	(0.0163)	(0.0180)

Note: Standard errors in parentheses.

Table A4 Average partial effects on SWB

Variable	Total	Female	Male
Playing Mahjong	0.0043	0.0000	0.0075
	(0.0030)	(0.0047)	(0.0037)
Going to club	0.0061	0.0086	0.0033
	(0.0031)	(0.0043)	(0.0043)
Being in work	0.0103	0.0117	0.0086
	(0.0057)	(0.0078)	(0.0082)
Providing childcare	0.0086	0.0077	0.0088
	(0.0046)	(0.0066)	(0.0062)
Feeling lonely	-0.0427	-0.0423	-0.0421
	(0.0057)	(0.0077)	(0.0083)
Falling down	-0.0120	-0.0208	-0.0010
	(0.0052)	(0.0072)	(0.0073)
Education	-0.0074	-0.0090	-0.0053
	(0.0013)	(0.0018)	(0.0017)
Age	0.0033	0.0037	0.0030
	(0.0003)	(0.0004)	(0.0004)
Mean interacting with friends	0.0065	0.0079	0.0034
	(0.0031)	(0.0043)	(0.0043)
Mean playing Mahjong	0.0081	0.0147	0.0043
	(0.0042)	(0.0067)	(0.0053)
Mean going to club	0.0077	0.0000	0.0183
	(0.0052)	(0.0070)	(0.0077)
Mean be in working	-0.0075	-0.0284	0.0196
	(0.0085)	(0.0117)	(0.0124)
Mean providing childcare	0.0082	0.0162	0.0004
	(0.0073)	(0.0103)	(0.0101)
Mean sleep	0.0373	0.0583	0.0166
	(0.0071)	(0.0104)	(0.0096)
Mean feeling lonely	-0.1830	-0.1757	-0.1862
	(0.0102)	(0.0138)	(0.0149)

Mean falling down	-0.0585	-0.0660	-0.0506
	(0.0098)	(0.0134)	(0.0141)

Note: (i) The probability of reporting the second highest category of SWB (very satisfied) is reported. (ii) Standard errors in parentheses

Chapter 5 Spouse as positive, community as negative: An empirical analysis of the comparison effect from a capability approach perspective

5.1 Introduction

The question of what makes individuals feel satisfied with their lives is important in economic analysis. When exploring this topic, the vast majority of studies investigate how subjective well-being (SWB) is related to material aspects such as income or wealth, both in absolute and relative terms. Only a handful of studies explore the issue from a capability approach (CA) perspective, focusing on the relationship between SWB and functionings or capabilities but tending to confine this evaluation to absolute terms. It is obvious that interpersonal relative position is relevant to one's feelings about or evaluation of life, and this should therefore be incorporated into the SWB analysis. Frey and Stutzer (2002, p.411) pointed out that, "It is not the absolute level of income that matters most but rather one's position relative to other individuals." Meanwhile, Bookwalter and Dalenberg (2010, p.347) argued that, "There are no theoretical reason and little empirical evidence suggesting that comparisons along income or wealth are more important than any number of other household and community factors." Following this line of thinking, instead of income, the present study tests the role of functioning achievements and achievements relative to others in determining SWB. It may be a first attempt at exploring the comparison effect from a CA perspective.

Many empirical studies, using a variety of data, confirm that the comparison effect has a significant impact on SWB and that it is one of the key determinants, along with other socioeconomic factors. Its importance has been confirmed in American (e.g., Luttmer, 2005), South African (e.g., Kingdon and Knight, 2007), and Asian countries, including China, Japan, and Korea (e.g., Oshio et al., 2011). Some studies observed a similar or even larger effect of comparison with others than of the absolute effect of income on SWB. For instance, Ferrer-i-Carbonell (2005) found that a reference group's income was about as important as one's own income in establishing SWB in a German population. The results from Knight et al. (2009) also implied that a comparison income effect, rather than an absolute income effect, is important in determining SWB in rural China. Similarly, Bookwalter and Dalenberg (2010) discovered that, in South Africa, a positive comparison effect is approximately three times more significant in determining SWB than is an absolute income effect. As a result of this strong evidence, researchers now suggest including relative component as an element of the standard utility function (e.g., Luttmer, 2005; Clark et al., 2008).

Meanwhile, other studies have demonstrated the potential limitations of focusing exclusively on income as a predictor of SWB and instead encourage examining the mechanisms through various subjective and objective relative indicators (Otis, 2017). Moreover, proponents of the CA criticize relying entirely on income or SWB to assess individual well-being, arguing that these indicators are far from adequate for carrying out well-being assessment (e.g., Sen 1985, 1992). Instead, well-being should be evaluated from the perspective of actual achievements and the freedom to achieve; hence, functionings and capability are supposed to be the more appropriate indicators of well-being. Functionings constitute an individual's "beings and doings," representing what an individual succeeds in doing with the resources at hand, such as being well-nourished, participating in social activities, and so on. Capabilities reflect the various alternative functioning bundles that an individual can attain. Functionings have an intrinsic value in themselves, serving as important indicators of individual well-being—that is, when one achieves more functionings, a higher level of well-being can be said to be obtained. Sen (1985) argued that the assessment of how well an individual is should relate to the kind of life that individual is living and argued that an individual's well-being is best seen as an index of functionings. At the same time, subjective indicators provide important information about an individual's feelings about or evaluation of life, which can be used in the valuation of what one has achieved in one's daily life (e.g., Sen 1985, 2008; Schokkaert, 2007). Recent studies showed that functionings and capabilities are significantly related to SWB (e.g., Anand et al., 2005; Anand and van Hees, 2006; Anand et al., 2009; Anand et al., 2011; Anand et al., 2015; Anand and Roope, 2016); however, the way in which achievements relative to others influence SWB has not yet been investigated. Therefore, this study aims to fill this research gap.

There are several indications that, instead of income, functionings are an appropriate domain on which to focus in the evaluation of SWB. First, in past decades, China has witnessed remarkable economic growth, during which individuals experienced the change from living in a planned economy with state-guaranteed jobs and a full social safety net to living in a free market economy that has an increasing unemployment rate and is undergoing a rebuilding of the social security system. Such huge economic and social changes have conflicting effects on SWB. On one hand, the income increases brought about by economic growth provide more resources to allow individuals to pursue a good life, which normally positively affects SWB; on the other hand, unemployment, inadequate social security and the enlargement of inequality generally negatively affect SWB. Therefore, focusing on any specific factor, such as income or unemployment, will not capture the comprehensive impact of a changing economy, such as that of China, on individuals. By contrast, functionings are the outcome of accessible resources as well as relevant

personal, social, and environmental factors and may, therefore, more comprehensively reflect the effect of such dramatic economic changes on individuals.

Second, on an individual level, individuals tend to either not know or only vaguely know the actual income of others[37] and instead infer this by observing others' lives, such as whether their neighbors travel abroad for vacations. Further, even if individuals know others' incomes, it is inaccurate to suppose that they focus exclusively on income and purposely ignore all other relevant factors when they compare their own lives with others' lives. Consider, for example, a case in which one has a rich neighbor who also has a disability; here, despite a good income, the neighbor's physical disadvantage may be seen to limit his or her ability to pursue a good life (e.g., causing the neighbor to be unable to attend community activities as others do). In this situation, it is more realistic that, in addition to income, an individual would take this physical disadvantage into consideration when comparing their lives. Therefore, focusing on what individuals have successfully achieved may be more appropriate in evaluating SWB.

Third, some previous studies have found that the correlation between income and SWB is not high (e.g. Clark and Oswald, 1994; McBride, 2001; Ferrer-i-Carbonell, 2005). Knight et al. (2009) even concluded that, in China, economic variables are relatively unimportant determinants of SWB compared to psychological and sociological factors. Furthermore, for older people, material aspects seem to be less important. Hsieh (2011) found that the impact of income on SWB is significantly smaller for older people than it is for other age groups. By contrast, empirical results from a CA perspective implied that functionings are significantly associated with SWB for older people (e.g., Anand et al., 2015). The current study focuses on individuals aged 45 and above in China; therefore, investigating the issue in terms of non-material aspects may allow for new insights to be gained in understanding the determinants of SWB.

This study contributes to the literature in three main ways. First, studies on the comparison effect mostly focus on material aspects, such as income or wealth; non-material aspects are rarely discussed in economic literature. Under the assumption that individuals compare themselves with others in terms of functionings, this study aims to add new empirical evidence to the literature. Second, although the comparison effect has been widely studied, the within-household comparison effect is a less researched area. Moreover, in most cases, only one randomly selected individual per household is studied (e.g., Qian and Qian, 2015; Hajdu and Hajdu, 2018). Differing from existing studies, this study focuses on married couples and explores the interplay between husband and wife in shaping SWB. Finally, two reference groups are adopted in the analysis:

[37] Bookwalter and Dalenberg (2010) make a similar point.

one's spouse and others in the same community. Differentiating the comparison effect between family and non-family members makes it possible to examine whether different reference groups affect SWB differently and to find out which plays a more important role in determining SWB in China. Previous literature on the comparison effect provides little empirical evidence about the differences between family and non-family members.

The rest of the paper is structured as follows. Section 2 discusses the reference group. Section 3 introduces the empirical model, and Section 4 provides data descriptions. The results are then presented in Section 5, followed by the conclusion in Section 6.

5.2 Reference Group

Elder (1998, p.4) wrote, "lives are lived interdependently, and social and historical influences are expressed through this network of shared relationships." Interdependent preference is a long-standing idea in the history of economic thought and is discussed in the works of well-known economists, including Smith, Ricardo, Marx, Mill, and many others, in sympathetic terms (Drakopoulos, 2012). However, it is now seen as relatively unimportant in mainstream economic theory, in which only absolute income or consumption are considered important. Over the last two decades, however, a strong comeback has appeared in the SWB literature in the specific form of income or wage comparison (Drakopoulos, 2011). Obviously, with interdependent preferences, not only do individuals' own achievements matter but also their relative position in a reference group.

The way in which to define a reference group is one of the most discussed issues in the literature related to the comparison effect. There are various ways of defining a reference group, as surveyed by Brown (2015), but two kinds of criteria are mainly used: 1) similarities in characteristics (e.g., age, gender, education, or occupation) and 2) spatial similarities (e.g., individuals who live near one another, such as in the same neighborhood or community). Moreover, because individuals have different identities in different contexts, a single individual may also have more than one reference group (Kingdon and Knight, 2007). Bookwalter and Dalenberg (2010) stated that individuals may compare or evaluate their relative position in comparison to a wide variety of groups and that there is no obvious a priori appropriate reference group; as such, to obtain greater insight into both the appropriate reference group and the determinants of SWB, they suggest including a wider range of feasible reference groups into the analysis. This study follows the spatial criterion and specifies one's spouse and others in the same community as the reference groups.

Studies about the influence of a spouse on an individual's SWB are limited, though a few exceptions show the importance of economic characteristics for married Chinese couples. Qian and Qian (2015) investigated gender differences in the impact of couple-level characteristics on SWB among young and middle-aged married individuals in urban China and found that a husband's employment status is much more strongly related to the SWB of both the husband and the wife than a wife's employment status. Additionally, the husband's share of household income earning has a more positive impact on his own SWB than does that of the wife on her own SWB. They concluded that, in a less individualistic Chinese context, individuals' lives are linked with their significant others. Shang et al. (2018) analyzed the within-household income comparison effect on SWB, with particular attention to the role of gender identity. They found that, in households with traditional views, both the husband's and wife's SWB may be lowered if the wife earns more income than does the husband; however, this is not the case in households that do not hold traditional views. The above results confirm that traditional gender roles within households persist in China: males are expected to be the breadwinners and females bear more of the housework and family care responsibilities.

Two major limitations are involved in previous studies. One is that, because only one individual per household has been surveyed in these studies, the interplay between family members has been neglected. As each respondent's spouse was also interviewed in the China Health and Retirement Longitudinal Survey (CHARLS), it is possible to study the interplay of spousal relationships within households. The other limitation is that almost all the existing studies focus exclusively on material aspects and usually on income rather than actual within-household distributions, due to the difficulty in observing such distributions. From a CA perspective, material aspects merely provide a means by which to pursue well-being;[38] instead focusing on functionings makes it possible to look directly at each family member's achievements and avoid making any assumptions about the allocation of resources within households. Hence, exploring the comparison effect in terms of functionings may provide new insights into the interplay between family members. It is natural to think that family members care about one another's well-being; therefore, the well-being of one's spouse is expected to affect one's SWB in a positive manner. Moreover, according to the traditional gender roles held by much of the Chinese population, females are supposed to take care of their family members. Thus, wives may care more about their husbands' well-being than do husbands about their wives', and therefore, it is

[38] In this study, "well-being" refers to functionings.

expected that a husband's well-being will have a greater impact on a wife's SWB than vice versa.

Meanwhile, examining the relative importance of different reference groups can help us figure out whether individuals have different feelings towards different reference groups, as well as which reference group plays a more important role in determining SWB. For instance, Kingdon and Knight (2007) discovered that, in South Africa, a positive comparison effect changes to a negative one when the reference group is widened. Using the same data, Bookwalter and Dalenberg (2010) found that achievement relative to one's parents is more important than achievement relative to others in the community in relation to SWB. Individuals in the same community share similar social and culture circumstances, which may influence their behavior in pursuing and evaluating lives. Previous studies conducted in China have found that the majority confine their reference group to the village (Knight et al., 2009). Hence, in addition to the influence of one's spouse, the present study also investigates how others in one's community influence SWB.

5.3 Method of Analysis

This study attempted to investigate the influence on SWB of individual well-being in terms of functionings and of the well-being of reference groups, under the assumption that SWB depends not only on absolute achievements but also on one's achievements relative to others. It can be represented in the following form:

$$s_i = \text{SWB}\ (f_i, f_r, X_i) \tag{1}$$

where s_i is the subjective indicator, f_i indicates the individual's functionings index, and f_r stands for the functionings index of the reference group. The vector of X_i represents the demographic and socioeconomic variables that are widely used in the literature.

Four specifications were conducted in the empirical analysis. In the first specification, the absolute achievements were focused on; therefore, only the individual's own functionings index and control variables (f_i and X_i) were included. In the second specification, the individual's spouse's functionings index is defined as f_r to investigate the influence of a spouse's well-being on an individual's SWB. In the third specification, the reference group was defined as others in the same community; therefore, the community's functionings index is taken as f_r to examine the influence of non-family members on SWB. In the last specification, both the spouse's and community's functionings indices were included in the analysis to evaluate which plays a more important role in determining SWB.

The underlying latent variable model can be written as follows:

$$s_{it}^{*} = \alpha f_{it} + \beta f_{r,it} + \gamma X_{it} + \lambda T_t + v_i + \varepsilon_{it} \quad (2)$$

$$\Pr(s_{it} = h) = \Pr\left(\mu_{(h-1)} < \alpha f_{it} + \beta f_{r,it} + \gamma X_{it} + \lambda T_t + v_i < \mu_h\right), \text{ where } h=1, \cdots, 5$$

$$s_{it} = 1, \text{ if } s_{it}^{*} < \mu_1; =2, \text{ if } \mu_1 < s_{it}^{*} < \mu_2; \cdots; = 5, \text{ if } \mu_4 < s_{it}^{*}$$

where s_{it} is the subjective indicator of individual *i* in period *t*; s_{it}^{*} is the corresponding unobserved latent variable; f_{it} represents the individual's own functionings index; and $f_{r,it}$ is the reference group's functionings index. Further, X_{it} is a set of control variables; T_t are year dummies; v_i is the individual specific time invariant component; α, β, γ, and λ are the coefficients; $\mu_1, \cdots, \mu_4$ are the threshold parameters; and ε_{it} is the error term.

A correlated random effects ordered probit model was employed to estimate SWB. In a usual random effects model, the unobserved individual specific effect v_i is assumed to be not correlated with the observed explanatory variables, which is a very strong assumption. In order to relax this assumption, the solution proposed by Mundlak (1978) is employed to address the issue. The unobserved individual specific effect was assumed to have the following structure:

$$v_i = \delta \overline{Z}_i + u_i \quad (3)$$

where $\overline{Z}_i$ is the average of the selected observed explanatory variables across time, which is supposed to pick up the correlation between the individual specific effect and the observed explanatory variables. The per capita household assets and ownership of residence were included in Z_i in all analyses, while u_i is the error term, which is not correlated with the observed explanatory variables.

5.4 Data

In this study, the data was drawn from the CHARLS, which is conducted by Peking University every two years and covers the representative regions in China. Its survey subjects are individuals aged 45 and above. The baseline national wave conducted in 2012 includes about 10,000 households and 17,500 individuals in 150 counties/districts and 450 villages/residential committees. Information such as demographic and family characteristics, health status and physical function, employment status, and income and assets is covered by the survey. In this study, a balanced panel dataset was constructed using three waves of CHARLS (CHARLS 2011,

2013, 2015). Married couples were focused on, but those for whom key variables are missing were excluded. As a result, the full sample included 4,998 individuals.

As Chinese society is characterized by a remarkable rural–urban divide, to account for the gap, the full sample was first classified using the *hukou* status.[39] Furthermore, the study attempts to explore the interplay between husband and wife within each household, and therefore, the sample was further differentiated by gender. Hence, four subsamples were constructed—namely, rural male, rural female, urban male, and urban female groups. Estimations were carried out for each subsample to capture possible differences.

As the dependent variable, self-reported life satisfaction was used as the SWB indicator. The CHARLS asks respondents to think about their life as a whole and rate it on a five-point scale, with 1 being "completely satisfied" and 5 being "not at all satisfied." The order of choices was reversed so that a higher value indicates more satisfaction with life.

The key independent variable was the functionings index. In the CA framework, functionings serve as an important indicator of individual well-being, as achieving more functionings means a higher level of well-being has been gained. The definition of valuable functionings is, by essence, subjective and individual. Hence, SWB was used in the selection of functionings to examine how individuals evaluate various dimensions of their lives. The selection procedure was as follows. First, nine specific functionings were drawn from the survey. Considering the fact that different groups may evaluate functionings differently, a regression of SWB in relation to these nine functionings and the control variables[40] was conducted for each subsample.[41] In order to get a commonly valued functionings set, only functionings that were positively but not necessarily significantly[42] related to SWB for all four subsamples were selected. Six functionings among the nine met the above condition: playing Mahjong, getting enough sleep, having a good memory, not feeling lonely, having no chronic disease, and not suffering body pain. All these functionings

[39] Since 1958, Chinese society has been segmented according to the *hukou* registration system. Economic development level, health care, public education, and social security all differ within the *hukou* system.

[40] The control variables used were the same as those used in Section 5.

[41] The estimation results are presented in Table 6 in the Appendix.

[42] Along with improving well-being, the importance of basic functionings (e.g., being well-nourished) may decrease in the subjective evaluation of lives and, hence, may become statistically insignificant. However, these functionings have intrinsic values in themselves and were therefore included in the analysis in this study.

were defined as binary variables, being 1 if the individual achieved the functioning and 0 otherwise. Therefore, a new variable—number of achieved functionings (NAF)—was constructed as the index of functionings by summing up the above six binary variables to measure how many functionings the individual achieved. The NAF, rather than income, was taken as the relative indicator in the present study.

Table 1 The mean NAF by quintile of per capita household assets and by the level of life satisfaction

Quintile of per capita household assets	Life satisfaction					
	1	2	3	4	5	Diff 5-1
1st	2.08	2.49	3.30	3.43	3.53	1.45
2nd	2.08	2.67	3.41	3.52	3.66	1.58
3rd	2.05	2.83	3.47	3.67	3.66	1.61
4th	2.41	2.82	3.58	3.73	3.65	1.24
5th	2.30	3.38	3.86	3.87	4.03	1.73
Diff 5-1	0.22	0.89	0.56	0.44	0.50	
Percentage of respondents	1.55%	8.73%	59.07%	27.03%	3.63%	

Note: (i) Pooled data of CHARLS2011, 2013, 2015. (ii) Life satisfaction, 1 not at all satisfied; 2 not very satisfied; 3 somewhat satisfied; 4 very satisfied; 5 completely satisfied.

Table 1 presents the mean NAF by quintiles of per capita household assets and by SWB. For the most part, there was a monotonic increase in the NAF across quintiles and SWB. A clear monotonic relationship between NAF and SWB was observed in each quintile except for those who reported completely satisfied in the third and fourth quintiles. For those who reported they were somewhat or very satisfied, the NAF increased strictly in line with the increase in household assets.[43] Easterlin (2001) argued that it is because individuals' aspirations grow along with income that the relationship between SWB and income becomes puzzling. Such shifts in aspiration are observed in Table 1. As is the case for increases in household assets, for individuals report the same level of SWB, more functionings have to be achieved. For instance, for individuals in the top quintile, having 3.86 functionings only corresponded to "somewhat satisfied." However, for other quintiles, 3.86 was high enough to report the highest level of SWB.

[43] The other three categories of SWB did not show a clear monotonic relationship. This may be caused by too few respondents in some cells. In total, the percentage of respondents reported the three categories was lower than 14%.

This reflects the fact that rich individuals do have higher aspirations for their lives. Meanwhile, when well-being is judged by functionings, individual well-being does improve along with rising wealth in the context of Chinese older people.

In addition, it is observed that the difference of NAF between the highest and lowest categories of SWB in each quintile is much larger than the corresponding difference of NAF in each category of SWB. In other words, the gap of achieved functionings between someone who reported completely satisfied and not at all satisfied with lives is large. In contrast, in each category of SWB, the gap of achieved functionings between poorest and richest individuals is much smaller. It is possible that factors other than resources play a role in achieving functionings, therefore, more resources do not lead a significant improvement in functioning achievements for Chinese older people.

In line with previous studies on the comparison effect, socioeconomic and demographic variables were included. Variables such as per capita household assets, educational attainment, and basic activities of daily living (BADL) were correlated with functionings;[44] including these variables was important for studying the relationship between functionings and SWB. In addition, age, employment status, ownership of residence, and district—which were confirmed to be determinants of SWB in previous studies—were included. Variable definitions and descriptive statistics are presented in Table 2 for the full sample and four subsamples. The mean SWB over the six-year period was 3.225. Older people in urban reported a higher level of SWB than those in rural. Females' SWB was shown to be slightly higher than that of males in urban, while the opposite was true in rural. With respect to NAF, males achieved more functionings than did females, both in rural and urban areas; moreover, the gender gap relating to NAF was larger in rural than in urban areas. The same pattern was also observed for educational attainment. For health status, as older people included in the CHARLS are still relatively young, very few respondents reported limitations in physical activities. On average, the female respondents were younger than males in both rural and urban areas, but only urban females' health statuses were better than those of males. Not surprisingly, a huge gap in material aspects between those in rural and urban areas was observed, with the per capita household assets of older people in urban areas being close to three times of that of older people in rural areas; in addition, far more older people were involved in work in rural areas for both genders.

[44] For information about the determinants of functionings, readers can refer to Robeyns (2005) for a theoretical discussion, and Wang and Ma (2019) for empirical research.

Table 2 Descriptive statistics

	Full sample		Rural				Urban			
			Male		Female		Male		Female	
Variables	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Life satisfaction	3.225	0.717	3.227	0.701	3.204	0.752	3.266	0.669	3.267	0.666
NAF	3.475	1.316	3.653	1.271	3.152	1.341	3.992	1.113	3.584	1.252
Age	59.61	7.884	60.00	7.778	58.40	7.472	62.73	8.769	59.65	7.813
Education	3.496	1.903	3.816	1.589	2.563	1.679	5.204	1.753	4.474	1.964
household assets	12,691	37,421	9,300	30,644	9,918	31,228	24,519	53,211	27,391	58,315
Ownership	0.875	0.331	0.880	0.325	0.878	0.327	0.857	0.350	0.859	0.348
BADL	3.937	0.212	3.944	0.202	3.926	0.212	3.939	0.272	3.956	0.146
Work_no	0.264	0.441	0.137	0.344	0.239	0.426	0.500	0.500	0.685	0.465
Work_agricultral	0.505	0.500	0.559	0.497	0.624	0.484	0.162	0.368	0.0898	0.286
Work_non-agricultral	0.112	0.315	0.103	0.304	0.0588	0.235	0.270	0.444	0.209	0.407
Work_both	0.120	0.325	0.200	0.400	0.0786	0.269	0.0687	0.253	0.0158	0.125
East	0.345	0.475	0.355	0.479	0.354	0.478	0.311	0.463	0.299	0.458
Central	0.351	0.477	0.332	0.471	0.335	0.472	0.416	0.493	0.436	0.496
West	0.304	0.460	0.313	0.464	0.311	0.463	0.274	0.446	0.264	0.441
Hukou	0.809	0.393	1	0	1	0	0	0	0	0
Gender	0.500	0.500	1	0	0	0	1	0	0	0
No. of individuals	5054		1964		2126		563		401	
No. of observations	15,162		5,892		6,378		1,689		1,203	

Note: Data is derived from CHARLS2011, 2013, 2015.

5.5 Estimation Results

The results of the first specification, which focused on the influence of an individual's own achievements on SWB, are presented in Table 3. The estimated panel-level variance components were all significantly different from 0, suggesting that the random effects ordered probit model should be preferred over a standard ordered probit model. The results showed that an individual's achievements were significantly and positively associated with SWB for all subsamples, indicating that achieving more functionings leads to a higher SWB. This result is not surprising due to only valuable functionings being selected.

In terms of the control variables, per capita household assets, BADL, and age were all positively related to SWB, while educational attainment was negatively related to SWB in all subsamples. This is possibly because educated individuals may have higher aspirations for their lives, but high aspirations tend not to be achieved by older people in China. Gender differences in the impact of ownership were also observed, indicating that financial burden may significantly decrease males' SWB, while this is not the case for females. Furthermore, work status exerted different levels of impact on SWB between the subsamples. For males, the same pattern was observed both in rural and urban areas. More precisely, compared with those who are not working, those who do agricultural work may have a lower SWB, while those doing non-agricultural work or both kinds of work may have a higher SWB. However, only the coefficients of doing both kinds of work were significant, which may imply that both rural and urban males prefer doing a variety of work, rather than doing the same kind of work day in, day out. For females, different patterns were observed between rural and urban areas. For rural females, compared with those not working, doing only non-agricultural work may increase SWB, while for urban females, doing agricultural work or both kinds of work may increase SWB. However, only doing agricultural work had a significantly positive impact on urban females' SWB. China has rapidly urbanized in recent decades, more rural residents are engaging in non-agricultural work; therefore, it is interesting to find that urban females are enjoying doing agricultural work.

Table 3 Estimation results of own functioning achievements on SWB

	Rural		Urban	
Variables	Male	Female	Male	Female
NAF	0.180***	0.163***	0.183***	0.152***
	(0.016)	(0.014)	(0.035)	(0.037)
lnhousehold_assets	0.026***	0.026***	0.035*	0.060***
	(0.010)	(0.009)	(0.018)	(0.022)
Ownership	-0.127*	0.061	-0.284**	-0.153
	(0.068)	(0.062)	(0.129)	(0.155)
Education	-0.051***	-0.040***	-0.027	-0.059**
	(0.015)	(0.013)	(0.026)	(0.029)
BADL	0.337***	0.325***	0.501***	0.455
	(0.095)	(0.085)	(0.150)	(0.291)
Age	0.017***	0.020***	0.022***	0.023***
	(0.003)	(0.003)	(0.006)	(0.007)
Work_agricultural	-0.037	-0.002	-0.111	0.315*
	(0.059)	(0.043)	(0.109)	(0.162)
Work_non-agricultural	0.079	0.053	0.068	-0.039
	(0.080)	(0.079)	(0.100)	(0.115)
Work_both	0.148**	-0.022	0.272*	0.256
	(0.070)	(0.070)	(0.153)	(0.336)
East	0.002	0.017	-0.157	-0.180
	(0.057)	(0.051)	(0.112)	(0.137)
Central	0.093*	0.036	-0.113	-0.245*
	(0.056)	(0.050)	(0.105)	(0.125)
Year2013	0.086**	0.025	0.004	0.044
	(0.041)	(0.038)	(0.079)	(0.093)
Year2015	0.678***	0.525***	0.540***	0.546***
	(0.045)	(0.041)	(0.084)	(0.100)
lnhousehold_assetsm	0.049***	0.055***	-0.045	-0.014
	(0.017)	(0.015)	(0.030)	(0.035)
Ownershipm	0.204*	0.030	0.856***	0.610**
	(0.122)	(0.109)	(0.212)	(0.248)
Sigma2_u	0.506***	0.414***	0.512***	0.530***
	(0.041)	(0.034)	(0.080)	(0.096)
No. of observations	5,892	6,378	1,689	1,203
No. of individuals	1,964	2,126	563	401

Notes: (i) Within mean of explanatory variables, year dummies, thresholds are not reported. (ii) Standard errors in parentheses. (iii) *** p<0.01, ** p<0.05, * p<0.1.

Table 4 summarizes the results of the other three specifications that investigated the influence of individuals' achievements relative to others on SWB. In specification 2, the within-household comparison effect was focused on. It was observed that after including a spouse's achievements, the significance of an individual's own achievements did not change in any of the subsamples. In addition, a spouse's achievements had a significantly positive impact on SWB for both genders in rural areas, while only for females in urban areas. This indicates that females may care more about their spouse's well-being than do males in urban China.

Table 4 Summary of results for different reference groups.

	Rural		Urban	
Variables	Male	Female	Male	Female
Specification 2				
NAF	0.170***	0.150***	0.177***	0.143***
	(0.017)	(0.014)	(0.035)	(0.037)
Spouse NAF	0.049***	0.065***	0.040	0.085**
	(0.015)	(0.015)	(0.030)	(0.042)
Specification 3				
NAF	0.179***	0.157***	0.202***	0.158***
	(0.017)	(0.015)	(0.037)	(0.039)
Community mean NAF	0.010	0.041	-0.144*	-0.054
	(0.045)	(0.041)	(0.087)	(0.110)
Specification 4				
NAF	0.174***	0.152***	0.200***	0.156***
	(0.017)	(0.015)	(0.037)	(0.039)
Spouse NAF	0.052***	0.067***	0.064**	0.096**
	(0.016)	(0.015)	(0.032)	(0.043)
Community mean NAF	-0.035	-0.014	-0.207**	-0.117
	(0.047)	(0.043)	(0.092)	(0.113)

Notes: (i) Control variables are the same as those used in specification 1 showed in Table 3. (ii) Standard errors in parentheses. (iii) *** p<0.01, ** p<0.05, * p<0.1.

This result supports the argument that, besides socioeconomic factors, family roles and the characteristics of a spouse play important roles in determining SWB (e.g., Qian and Qian, 2015). According to traditional gender roles in China, the husband is the breadwinner, while the wife is the homemaker. Previous empirical literature confirmed that gender roles remain strictly defined in China, but the literature mainly focused on male-dominated factors (e.g., Qian and Qian, 2015; Shang et al., 2018). By contrast, this study moves the focus to family members' well-being, which is supposed to fall within the wife's realm of responsibility. The result shows that a spouse's well-

being matters more for females than it does for males in the more developed urban areas, which adds new empirical evidence to the literature reporting that the division of labor based on gender roles continues to exist within households in China.

In addition, this finding may provide an alternative explanation to the puzzling report of a number of studies that females in China have a higher level of SWB than do males, even though females are usually at a disadvantage (e.g., Knight and Gunatilaka, 2010; Wang and VanderWeele, 2011; Asadullah et al., 2015). Asadullah et al. (2015) suggested that this is due to absolute income having a larger impact on females' SWB than it does on that of males. Based on the above result, it may instead be attributable to the within-household positive impact on females' SWB leading to a high level of SWB. As females bear more responsibilities in taking care of family members, the statistics in Table 2 show that, on average, males achieve more functionings than do females; this indicates that it is in fulfilling their responsibilities well that females tend to gain satisfaction.

Table 5 Summary of average partial effects on SWB

	Rural		Urban	
Variables	Male	Female	Male	Female
Specification 1				
NAF	0.035	0.036	0.034	0.030
	(0.003)	(0.003)	(0.006)	(0.007)
Specification 2				
NAF	0.033	0.034	0.033	0.028
	(0.003)	(0.003)	(0.006)	(0.007)
Spouse NAF	0.010	0.015	0.007	0.017
	(0.003)	(0.003)	(0.006)	(0.008)
Specification 3				
NAF	0.035	0.035	0.037	0.031
	(0.003)	(0.003)	(0.007)	(0.008)
Community mean NAF	0.002	0.009	-0.027	-0.011
	(0.009)	(0.009)	(0.016)	(0.022)
Specification 4				
NAF	0.034	0.034	0.037	0.031
	(0.003)	(0.003)	(0.007)	(0.008)
Spouse NAF	0.010	0.015	0.012	0.019
	(0.003)	(0.003)	(0.006)	(0.009)
Community mean NAF	-0.007	-0.003	-0.038	-0.023
	(0.009)	(0.009)	(0.017)	(0.022)

Note: (i) The probability of reporting the second highest category of SWB (very satisfied) is reported. (ii) Standard errors in parentheses.

Furthermore, to provide an indication of the quantitative results on the association between SWB and NAF, the average partial effects (APE) of all specifications are presented in Table 5. The probability of reporting the second highest category (i.e., "very satisfied") was calculated for an individual's own achievements and for those of the reference group. In specification 2, when a spouse's achievements were included in analysis, the impact of an individual's own achievements on SWB became slightly smaller compared to that in specification 1 for all subsamples. Within households, a husband's achievements had a larger impact on his wife's SWB—for both rural and urban areas—than did a wife's achievements on her husband's. For urban females, the importance of a spouse's achievements was more than half of the individuals' own achievements in determining SWB. In contrast, the impact of wife's achievements on husband's SWB was much smaller, however, none of these differences were significant.

With respect to the third specification, instead of a spouse's achievements, the mean achievements of others in the same community were included in the analysis. There remained no change in the significance of one's own achievements in any of the subsamples. The comparison effect was found to be the opposite between rural and urban areas, with the mean level of community achievements found to be positively associated with SWB in rural areas but negatively associated with SWB in urban areas. However, only the coefficient for urban males was significant. In addition, the APE presented in Table 5 shows that the comparison effect was very small for older people in rural areas but much larger for those in urban areas; particularly for urban males, the negative impact from others in the community was so large that it almost offset the positive impact of one's own achievements on SWB.

In specification 4, both the spouse and community's achievements were included to explore whether family and non-family members influence an individual's SWB differently. It was found that both one's own achievements and one's spouse's achievements had a significant and positive impact on SWB. Compared with the results in specification 2, when community achievements were controlled, the impact of spouse's achievements on urban males' SWB became significant. Meanwhile, the mean community achievements had a negative impact on SWB for all subsamples, still only the coefficient for urban males was significant. Therefore, individuals do have different feelings towards family and non-family members in relation to SWB.

A notable finding is that, when spouse's achievements were controlled, the influence of mean community achievements on SWB changed from positive to negative for older people in rural areas, and the negative impact became much larger for older people in urban. The changes indicate

the importance of discussing multiple reference groups, as neglecting potential reference groups can lead to imprecise results. In addition, this draws attention to the fact that, when the reference group is defined spatially, distance matters, as individuals may feel differently about those who are physically closer (Charness et al., 2007). Kingdon and Knight (2007) discovered that households derived SWB from the income success of others within their own area, but within a wider area, they tended to compete with others. The cluster defined in their study was a geographically small unit within which households were likely to know each other—an area size that would, on average, contain 580 households. Furthermore, in order to examine whether distance matters, they defined clusters containing fewer than 200 households as "small clusters" and found that the positive effect was stronger for small clusters than it was for large clusters in South Africa. By contrast, even though the size of community used in the present study corresponded to a "small cluster" (as defined in Kingdon and Knight's study), a negative comparison effect was found in China.

With respect to the APE presented in Table 5, two points are worth mentioning. First, it is interesting to note that both one's own achievements and one's achievements relative to others had a larger impact on SWB for urban males than they did for rural males. This is inconsistent with the results found in the context of income. Easterlin (1995) argued that absolute income matters up to a certain level, after which point relative income increasingly matters. In other words, relative income is more important to SWB at higher levels of absolute income. By contrast, both absolute and relative achievements matter more for urban than for rural males in the context of functionings. While the results for females are consistent with those found in the context of income. Second, the reference group that plays the most important role in determining SWB differs between rural and urban areas. In rural areas, the negative impact of the community was smaller than the positive impact of the spouse, while the opposite was true in urban areas. In particular, urban males were strongly affected by the negative impact of the community, which was large enough to cancel out the positive impact of one's own achievements. The latter may explain why urban males reported a lower SWB even though they achieved the highest level of functionings among all the four subsamples.

5.6 Conclusion

This study investigated the influence of functioning achievements and achievements relative to others on SWB, focusing on married couples aged 45 and above in China. In order to examine whether family and non-family members influence SWB differently, one's spouse and others in

one's community were taken as separate reference groups. Through this analysis, several important findings emerged. First, an individual's SWB was positively associated with the individual's own and spouse's achievements, but it was negatively associated with the mean community achievements. This indicates that individuals have different feelings towards family and non-family members in China. In addition, within households, a husband's achievements have a larger impact on his wife's SWB than do a wife's achievements on her husband's, but the difference is not significant. Second, the mean level of community achievements is found to be negatively associated with urban males' SWB, and the negative impact is large enough to cancel out the positive impact of urban males' own achievements. Third, both an individual's achievements and achievements relative to others had a larger impact on SWB for urban males than for rural males, but in different patterns. For rural males, the positive impact of the spouse was larger than the negative impact of the community, while the opposite was the case for urban males.

Based on the findings above, there are three points worth noting. First, it is important to distinguish comparison effects from different reference groups. In the case of China, it is particularly interesting to evaluate the effects of family versus non-family members; the current study showed that, after including spouses' achievements in the analysis, the comparison effect from the community changed from positive to negative in rural areas, while the negative effect became much larger in urban areas. Therefore, without such differentiation, the results are likely to be imprecise or underestimated.

Second, the negative comparison effect is relatively easy to observe in urban areas but may be hard to find in rural areas. One astonishing result was that achievements relative to others in the community were hugely important to urban males; in other words, the significant negative impact of achieving less than others in the community outweighs the benefit of urban males' own achievements. In such cases, a direct policy implication is that, compared to policies aiming to improve individual well-being, policies that reduce the level of inequality between individuals play a more important role in raising SWB. Additionally, in rural areas, even though one's own achievements matter most, a negative comparison effect from the community appears in the early stages of economic development and cancels out more than half of the positive impact of a spouse's achievements for males. Therefore, inequalities in well-being require serious attention from policymakers not only in urban but also in rural areas in China.

Third, for females, a spouse's achievements are likely to be a key determinant of SWB in addition to one's own achievements. For rural females, a spouse's achievements make up close to half the impact of one's own achievements, while this impact is more than half for urban

females. While this provides an alternative explanation of why females tend to report a high SWB, it further reveals the potential problem involved in using subjective indicators—a problem that requires special attention. The high self-reported SWB of females may be attributable to feelings about their spouses, hence covering the reality of their own low levels of achievement. This provides empirical evidence supporting Sen's (1985) argument that relying on subjective indicators to make judgements about individual well-being has major drawbacks and, hence, that functionings serve as better indicators in the measurement of well-being.

In sum, our findings extend previous research on SWB and on the application of CA, at the same time, they also have substantial implications for future research. First, compared to older generations, younger generations in China are more exposed to Western values and shifts towards individualism; therefore, it would be interesting to investigate whether similar results hold for younger generations in future research. Second, only a small number of functionings were discussed in the present study. Using a broader set of functionings or different sets of functionings to examine the issue may add new insight to the current understanding of the impact of non-material aspects on SWB.

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Appendix

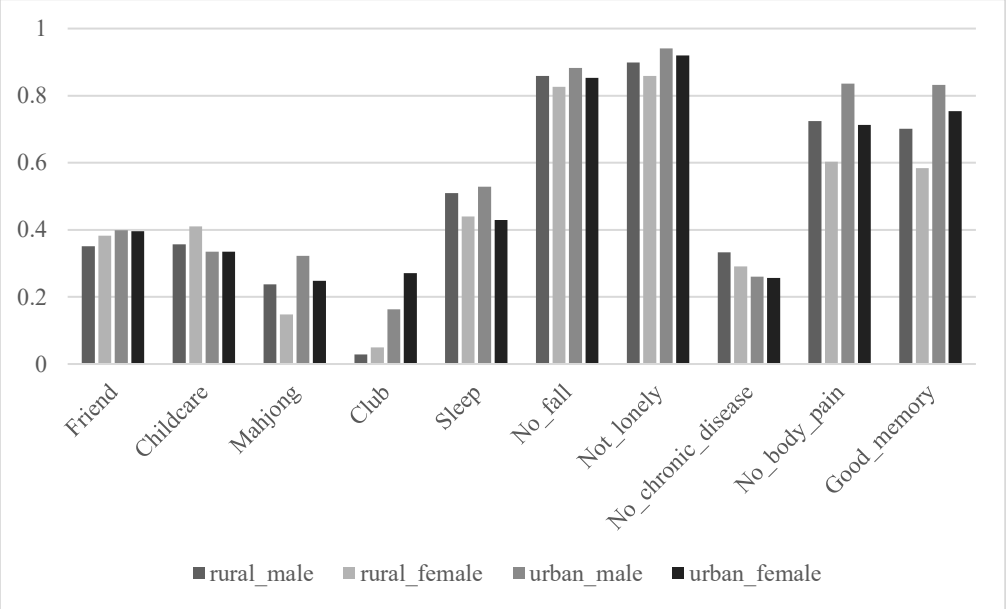

Figure 1. Mean achievement level for each functioning by subsample.

Table 6 Estimation results of own functioning achievements on SWB

	Rural		Urban	
Variables	Male	Female	Male	Female
Friend	0.007	0.005	-0.045	-0.023
	(0.038)	(0.034)	(0.072)	(0.086)
Mahjong	0.074	0.034	0.036	0.239**
	(0.046)	(0.051)	(0.081)	(0.106)
Club	0.102	0.202***	0.145	-0.041
	(0.107)	(0.077)	(0.097)	(0.098)
Childcare	0.087**	0.090***	-0.114	0.114
	(0.038)	(0.035)	(0.077)	(0.092)
Sleep_d	0.034	0.095***	0.101	0.093
	(0.043)	(0.036)	(0.090)	(0.093)
Notlonely	0.495***	0.385***	0.764***	0.475***
	(0.062)	(0.048)	(0.149)	(0.153)
Nochronic_disease	0.155***	0.075*	0.011	0.099
	(0.043)	(0.041)	(0.089)	(0.106)
Nopain	0.214***	0.177***	0.178*	0.143
	(0.043)	(0.036)	(0.097)	(0.096)
Goodmemory	0.194***	0.189***	0.349***	0.066
	(0.041)	(0.035)	(0.096)	(0.103)
age	0.017***	0.020***	0.021***	0.023***
	(0.003)	(0.003)	(0.006)	(0.007)
edu	-0.050***	-0.041***	-0.035	-0.055*
	(0.015)	(0.013)	(0.025)	(0.029)
lnhh_ass	0.025**	0.026***	0.033*	0.060***
	(0.010)	(0.009)	(0.019)	(0.022)
ownership	-0.125*	0.052	-0.264**	-0.146
	(0.068)	(0.063)	(0.129)	(0.155)
BADL	0.276***	0.304***	0.507***	0.433
	(0.095)	(0.085)	(0.148)	(0.293)
Work_agricultral	-0.036	0.006	-0.076	0.271*
	(0.059)	(0.043)	(0.109)	(0.163)
Work_non-agricultral	0.077	0.062	0.063	-0.015
	(0.080)	(0.079)	(0.100)	(0.116)
Work_both	0.147**	-0.010	0.297*	0.224
	(0.070)	(0.070)	(0.152)	(0.337)
East	0.005	0.021	-0.182	-0.169
	(0.056)	(0.051)	(0.111)	(0.137)
Central	0.092*	0.042	-0.119	-0.246**
	(0.056)	(0.050)	(0.103)	(0.125)
Year2013	0.074*	-0.002	0.021	0.038
	(0.041)	(0.038)	(0.080)	(0.093)
Year2015	0.668***	0.494***	0.566***	0.540***
	(0.045)	(0.042)	(0.085)	(0.101)
lnhh_assm	0.050***	0.055***	-0.041	-0.013

	(0.017)	(0.015)	(0.030)	(0.035)
Ownershipm	0.200*	0.049	0.852***	0.594**
	(0.120)	(0.108)	(0.210)	(0.248)
No. of observations	5,892	6,378	1,689	1,203
No. of individuals	1,964	2,126	563	401

Notes: (i) Standard errors in parentheses. (ii) *** p<0.01, ** p<0.05, * p<0.1.

Chapter 6 General Conclusion

This thesis contributes to the formulation and operationalization of the capability approach. In Chapter 2, we discussed relevant issues related to the key concept in the capability approach. We formulate the capability concept based on production theory and show the conditions that are needed to reach optimal points in both goods space and functionings space. We specifically focus on the case in which at least one good can be used to pursue multiple functionings. Then we show that doubt about the usefulness of the capability concept is invalid in such a situation. In Chapter 3 and Chapter 4, using the China Health and Retirement Longitudinal Survey data, we estimated the determinants of utilization ability, functioning achievements, and subjective well-being empirically in the context of older Chinese people. The results indicate that utilization ability is determined by various personal, social, and environmental factors. Besides resources, individual utilization ability plays an unneglectable role in achieving functionings. These investigations provide empirical evidence for the arguments of the capability approach and give insights into well-being in later life. In Chapter 5, we explored the determinants of subjective well-being from a capability approach perspective with a particular focus on distinguishing the comparison effects between family and non-family members. The results indicate that one's achievements and those of one's spouse have a positive impact on subjective well-being, while community achievements may have a negative impact. The results also indicate the importance of distinguishing comparison effects between family and non-family members in China, which provides new insights into individuals' feelings on inequality in well-being from the capability approach perspective.

Four policy implications emerge from the empirical results in this thesis. First, in China, pensions for retirees have been raised 16 years in a row since 2005. Although a stable long-term financial status is important for older people, its impact on well-being enhancement is smaller compared to utilization ability, according to the results of this study. The decline in utilization ability along with age increasing needs sustained attention of policymakers. It is shown that regional GDP growth did not contribute to the improvement of older people's utilization ability (Basic Activities of Daily Living (BADL) and Instrumental Activities of Daily Living (IADL)). However, health insurance coverage rates and community health centers play a role in improving older people's BADL, and community health centers also help in improving urban older people's IADL. Health insurance coverage continues to increase in recent years. In the future, in order to cope with a rapidly ageing society, policymakers should consider increasing the number of community health centers. In rural areas, where current services are not as effective as in urban

areas, providing effective support should also be considered in addition to increasing the number of community health centers. Furthermore, community health centers should also provide more support to older residents with disabilities, chronic diseases, and body pains.

Second, it was found that long-lasting loneliness is the biggest reason for older people's low subjective well-being. Older people who participate in social activities more often tend to be more satisfied with life. Most of the government's current programs and initiatives for older people are geared towards poverty alleviation. Concern about the emotional needs of older people from government and family members is deeply insufficient. To solve this problem, neighborhood committees can organize more social activities for older people so that they may live a more colorful life.

Third, urban males achieved the highest level of objective well-being in terms of functionings compared to other groups. However, their subjective well-being is still lower than that of urban females. It was observed that inequality in terms of functioning achievements in the community has a huge negative impact on urban males' subjective well-being. Therefore, growing inequality in objective well-being needs serious attention from policymakers.

Fourth, many previous studies have shown that females tend to report higher levels of subjective well-being than males in China. However, the mechanism of why females are more satisfied with their lives is unclear. Most previous empirical studies focused on examining how one factor influences individuals' subjective well-being. Correspondingly, these studies can only tell if the factor positively or negatively influences subjective well-being. Under the capability approach framework, we can understand the issue in more detail. For married couples, as intrahousehold resource division is unobservable, it is impossible to make judgments about females' well-being based on resources. With respect to utilization ability in terms of BADL, IADL and education attainment, females are generally at a disadvantage compared to males. In addition, females not only achieve less valuable functionings compared to males but also are more vulnerable in some important functionings, such as getting enough sleep, feeling lonely, and falling down. It was also discovered that within households, a husband's functioning achievements have an exceptionally large impact on his wife's subjective well-being. At the same time, the negative impact of community inequality in functioning achievements is insignificant on females' subjective well-being. Therefore, it is possible that females' high subjective well-being is generated by caring for family and their high tolerance for inequality rather than from their own objective well-being. Hence, policymakers should be careful when making judgements about females' wellbeing.

The formulation and operationalization of the capability approach is still in its infancy. This thesis is only a beginning. Due to the relative complexity of the framework, various kinds of difficulties and ambiguities are involved in the empirical application. Several limitations to this thesis suggest avenues for future research.

First, the approach stresses the importance of considering individual heterogeneity in transforming resources into functionings. However, both utilization ability (conversion rates) and conversion factors exist in the literature, and the relationship between these different concepts is not discussed clearly. It is pointed out that even conceptual differences are seldom noticed (Chiappero-Martinetti and Salardi, 2008; Chiappero-Martinetti et al., 2019). In Chiappero-Martinetti et al. (2019), the estimated coefficients of explanatory variables are explained as an individual's conversion rates. In contrast, we take the view that individual utilization ability is determined by conversion factors and apply a proxy variable approach in the empirical study in Chapter 3. This provides an alternative way of understanding the relationship between utilization ability and conversion factors. It is like the concept of total factor productivity, which captures the portion of outputs not explained by the number of inputs used in production and is usually thought to be influenced by a variety of factors, such as technology and culture. We are aware that the difficulty involved here is how to find and justify appropriate proxy variables of individual utilization ability. We chose Activities of Daily Living as the proxy variable of utilization ability in the context of older people, as it is often used as a measurement of functional status to judge if older people can perform activities independently. In turn, independence can affect every aspect of older people's lives.

Second, due to the multidimensional nature of the approach, individual well-being is captured by a bundle of functionings. Most existing literature attempts to simplify the problem by focusing on a limited set of functionings and assuming that there is no interaction between different functionings. However, interaction between functionings is ubiquitous. Some functionings even have a dual role of acting as both ends and instruments, which leads to difficulties in specifying what constitutes an individual's resources, conversion factors, and valuable functionings in practical application. Several studies have shed light on the relationships between functionings. For instance, Gandjour (2008) points out that the achieved functioning bundle in the current period may depend on the functioning bundle achieved by the individual in the past. Binder and Coad (2011) address the interdependency between functionings via the econometrical method. They suggest a panel vector autoregression approach to deal with the intertemporal interaction of functionings and confirm that some functionings are indeed means for many other functionings, while other functionings are independent. Unlike the above mutual dependent relationship, the

fractal structure in Gotoh (2014, 2017) captures a one-way relationship between functionings. “Communicating in public” (named sub-functioning) is valuable by themselves, but they are also important for pursuing “moving by transportation” (named main-functioning). This kind of one-way relationship can continue. For instance, “moving by transportation” is a means to pursue functionings such as “going shopping” or “participating in social activities”.

Different functionings are considered separately in the present thesis, which is widespread in the field. However, mutual dependency between functionings is not rare. For instance, older people may face the choice between going out to work and providing care to family members, or older people who are moving freely may participate in outdoor social activities more often. Recent studies show interest in exploring this aspect. For instance, Anand et al. (2020) show that substitution effects exist between functionings. Exploring the relationship between functionings is especially important for a multidimensional approach because mutually dependent relationships cause great divergences in specifying variables as functionings, resources, or conversion factors. To mitigate the arbitrariness of specifying variables in the empirical application, we need to further investigate the issue in future studies.

Third, when estimating functionings in Chapter 3, both BADL and IADL were included as explanatory variables. Also, when estimating subjective well-being in Chapter 5, both functionings and utilization ability were included as explanatory variables. This means that a multicollinearity problem may exist in these studies. Alleviating the multicollinearity problem should be considered in future studies.

Finally, the broader framework of the capability approach shows advantages. For instance, the empirical results in this thesis provide a more comprehensive understanding of the role of education. On one hand, education has a significant and positive impact on the utilization ability and the majority of functionings in later life that were investigated in this thesis. On the other hand, education has significant and negative impacts on subjective well-being. This suggests that highly educated older people may have higher aspirations for their lives; however, their aspirations cannot be satisfied in Chinese society.

A broad framework could be a two-edged sword. It is easy to share similarities with other theories or approaches, which encounters challenges in making comparisons and remarking what the capability approach can contribute. For instance, the equivalent income approach (EIA) has been gaining popularity in recent years (e.g., Fleurbaey and Blanchet 2013; Decancq et al., 2015; Decancq and Schokkaert 2016; Decancq and Michiels, 2019). Both the capability approach and the EIA have the same purpose of providing alternative tools to measure well-being. The two

approaches share features such as utilizing multidimensional information and taking individual heterogeneity into consideration. The EIA attempts to include various life dimensions in well-being evaluation by adjusting income based on individual preferences. It should be noted that it is a unidimensional measure. Maybe it is unavoidable when we try to make measurements comparable between individuals. However, a more fundamental problem of the EIA is that it only focuses on an individual's subjective heterogeneity. Objective heterogeneity is completely ignored. Even so, the EIA may provide a workable method to apply the capability approach in practice. On the other hand, some previous studies (e.g., Kuklys, 2005; Lelli, 2005) have used the equivalent scale approach (ESA) to deal with the objective heterogeneity in the capability approach literature. Despite the inadequacies of both perspectives, EIA and ESA can be combined to capture both the objective and subjective heterogeneity. This may not be easy to do as a broad range of information is demanded and the analysis becomes more complex when we try to incorporate more information. However, this provides an opportunity for further study.

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