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A life-cycle model with ambiguous survival beliefs

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Abstract

Based on a cognitive notion of neo-additive capacities reflecting likelihood insensitivity with respect to survival chances, we construct a Choquet Bayesian learning model over the life-cycle that generates a motivational notion of neo-additive survival beliefs expressing ambiguity attitudes. We embed these neo-additive survival beliefs as decision weights in a Choquet expected utility life-cycle consumption model and calibrate it with data on subjective survival beliefs from the Health and Retirement Study. Our quantitative analysis shows that agents with calibrated neo-additive survival beliefs (i) save less than originally planned, (ii) exhibit undersaving at younger ages, and (iii) hold larger amounts of assets in old age than their rational expectations counterparts who correctly assess their survival chances. Our neo-additive life-cycle model can therefore simultaneously accommodate three important empirical findings on household saving behavior.

JEL classification: D91; D83; E21

Keywords: Bayesian learning; Likelihood insensitivity; Ambiguity; Dynamic inconsistency; Subjective survival beliefs; Saving puzzles

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1. Introduction

Recent empirical findings on household saving behavior are puzzling for the standard rational expectations (RE) life-cycle consumption model à la Modigliani and Brumberg (1954) and Ando and Modigliani (1963). For example, Laibson et al. (1998) and Bernheim and Rangel (2007) report large gaps between self-reported behavior and self-reported plans. People save less for retirement than actually planned (Choi et al., 2006; Barsky et al., 1997; Lusardi and Mitchell, 2011). They behave in a dynamically inconsistent manner. Furthermore, people hold large amounts of assets still late in life and dissave less in old age than predicted by the standard RE life-cycle model (see, e.g., Love et al., 2009; De Nardi et al., 2010; Lockwood, 2014). Among many underlying assumptions the standard RE life-cycle model describes survival beliefs as objective survival probabilities. In this paper we ask whether the assumption of ambiguous rather than objective survival beliefs may jointly accommodate the aforementioned saving puzzles. As a novelty of our approach, we derive these ambiguous survival beliefs from a model of Bayesian learning with cognitive limitations.

Our approach comprises of two buildings blocks. As our first building block, we develop a model of Choquet Bayesian learning of survival beliefs which allows for *likelihood insensitivity*. Likelihood insensitivity is a well-documented cognitive limitation according to which people do not properly understand probabilities but rather over- (resp. under-) estimate small (resp. large) probabilities.[1] Our second building block combines Choquet expected utility maximization with respect to learned survival beliefs with a canonical life-cycle model. We calibrate this model with data on survival beliefs taken from the Health and Retirement Study (HRS) and asset data taken from the Survey of Consumer Finances (SCF). Our quantitative analysis investigates in how far our calibrated life-cycle model is able to accommodate the aforementioned saving puzzles.

Central to both building blocks are non-additive probability measures in the form of neo-additive capacities (Chateauneuf et al., 2007). Neo-additive capacities are empirically and theoretically very attractive because they stand for a well-interpreted (and, in some sense, minimal) deviation from the standard concept of additive probability measures to which they add two parameters only.[2] While our point of departure is a cognitive notion of neo-additive capacities reflecting likelihood insensitivity of a representative Bayesian learner, we later employ a motivational notion of neo-additive capacities expressing ambiguity as well as ambiguity attitudes (in the form of *relative optimism*) of a representative decision maker. As a distinctive feature of our modelling approach, these motivational neo-additive capacities are not imposed ad hoc but comprehensively derived from our Choquet Bayesian learning model.

We now describe in detail the steps of our analysis. As a starting point of our first building block we extend earlier work in Ludwig and Zimper (2013) and construct a model of Choquet Bayesian learning which describes the decision maker's uncertainty about the joint distribution of the parameter and sample space of survival chances through a *cognitive* neo-additive capac-

[1] In rank dependent utility theory this cognitive limitation corresponds to an inverse-S shaped mapping from additive probabilities to probability judgments whereby "fifty-fifty" probability judgments represent an extreme form of likelihood insensitivity. For a survey of the according decision-theoretic and psychological literature see Wakker (2010).

[2] Due to their technical convenience neo-additive capacities are often used to approximate the typical inverse S-shape of (cognitive) probability judgments and (motivational) decision weights elicited for rank-dependent utility theories (e.g., Abdellaoui et al., 2011; for a survey on this literature see Wakker, 2010). Moreover, Choquet decision making with respect to neo-additive capacities could be equivalently formalized within the multiple priors framework of Ghirardato et al. (2004).