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Life cycle saving: Insights from the perspective of bounded rationality

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ABSTRACT

This paper provides a new life cycle model that takes into account key elements of bounded rationality. The paper shows that the model can account for patterns in the data that are hard to explain by the standard life cycle model. Among other patterns, the model predicts that, typically, the young either hold no equity or their equity portfolio share is rather low and then increases over working life. The analytical solution of the model demonstrates its high degree of tractability.

1. Introduction

Many studies of savings and asset allocation behavior are based on the modern life cycle model (Carroll, 1997; Cocco et al., 2005; Hubbard et al., 1995; Scholz et al., 2006, among others). This model is quite successful in explaining how savings vary over the life cycle (Carroll, 1997; Gourinchas and Parker, 2002). However, it is less successful in explaining a variety of other empirical patterns. For instance, it faces difficulties explaining how the share of savings invested in stocks varies with age and (permanent) income (Binswanger, 2010a; Carroll, 2002; Gomes and Michaelides, 2005).

Another important property of the standard life cycle model is that it relies on the assumption of unbounded rationality. This is an important benchmark for any economic analysis indeed. However, life cycle saving and asset allocation are rather complex economic decisions and bounded rationality may be a relevant concern (Laibson et al., 1998; Pemberton, 1993; Thaler, 1994). It is therefore interesting to explore predictions of models of bounded rationality about life cycle saving and asset allocation. In particular, it is interesting to investigate whether models of bounded rationality are able to explain the empirical patterns mentioned above that the standard model has difficulties to account for.

Suggestive evidence for the fact that decision making according to the standard life cycle model may indeed be very complex and thus beyond the abilities of boundedly rational agents comes from Allen and Carroll (2001) and Lettau and Uhlig (1999). Allen and Carroll investigate how long it would take a boundedly rational agent to learn a pattern of behavior

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as predicted by the life cycle model. Their staggering finding is that, under plausible learning rules, it would take about one million years to learn a reasonably good approximation to optimal behavior. Lettau and Uhlig provide arguments that boundedly rational agents may never converge to the behavior as predicted by the standard life cycle model.

In this paper, I provide a new life cycle model, dubbed hierarchical feasibility goals (HFG) model, that takes into account two essential features of bounded rationality. The first feature is that a decision maker aims to achieve a list of hierarchically ordered goals, a key pattern of bounded rationality decision making in complex environments (Payne et al., 1993). The second feature is procedural rationality in planning (Simon, 1976, 1978). The HFG model bridges two recent existing models of choice under bounded rationality: the static so-called hierarchical goal model of Binswanger (2010a); and the dynamic feasibility goals model developed by Binswanger (2011).

From a methodological point of view, the analysis takes as primitives certain important empirical patterns and builds a model based on these primitives. In other words, the primitives are not theoretical axioms, such as the axioms of rational choice, but stylized facts about choice behavior. Specifically, the relevant primitives are stylized facts about decision making in complex environments, as well as observations about the hierarchy of certain goals, as will be discussed. These facts have been established in the psychological literature. We may never be able to fully rationalize them, i.e. derive them from an underlying set of axioms that can be viewed as rational, in one or the other way. The aim of this paper is to show how certain empirical characteristics of choice behavior in complex environments help us to understand phenomena of life-cycle saving and asset allocation.

The approach of starting with empirical observations as primitives is very common in the field of Behavioral Economics (see, e.g. Rabin, 1998). For instance, assumptions such as loss aversion, fairness preferences or biases in judgment derive from empirical data. Proceeding in this manner, the theorist has to be very careful that the empirical observations that serve as primitives do not already essentially contain the empirical observations that a model is intended to explain. In other words, there should be a sufficiently large “intellectual distance” between what is assumed and what is explained. While there is no formal way to measure this distance, I believe that the relationship between assumptions and results in this paper is sufficiently distant, such that the analysis provides some true insights into how typical patterns of choice behavior under bounded rationality translate into patterns of life-cycle saving and asset allocation.

Combining the models of Binswanger (2010a) and Binswanger (2011), this paper provides a fully-fledged life cycle model to analyze life cycle savings and asset allocation choices. I solve the model analytically for the case of three periods and for an infinite-horizon setup. The analytical solution is particularly helpful for getting insights into the mechanisms of the model. It also demonstrates the high tractability of the model, in particular in comparison to existing life cycle models. Beyond this, I also provide simulations that allow for insights into the quantitative predictions of the model. I show that the model can explain better than existing models how the proportion of savings invested in stocks varies over the life cycle. Furthermore, the model is consistent with other patterns in the data that are difficult to explain with existing models. In particular, the HFG model predicts that both savings and equity shares increase with current and permanent income. In particular, the model helps to shed light on why richer people save substantially more and hold substantially riskier portfolios (Carroll, 2000, 2002). Finally, the model also provides insight on why some wealthy individuals may not invest in stocks at all.

A closely related paper is Pemberton (1993). In his model of life cycle saving, an agent avoids contingent planning by simply deciding about how much to consume now and how many resources to transfer into the future in general. In contrast to the HFG model, there are no scenario-related opportunity goals. Furthermore, Pemberton (1993) does not analyze asset allocation. There are several other behavioral economics models of saving and asset allocation, such as the mental accounting model of Shefrin and Thaler (1988), models of hyperbolic discounting (Laibson, 1997), and models of loss aversion such as Barberis et al. (2001), Benartzi and Thaler (1995), and Bowman et al. (1999). None of these models address bounded rationality and planning.

The rest of this paper is organized as follows. Section 2 introduces the model. In Section 3, I solve the model for the case of three periods. In Section 4, I discuss how savings and asset allocation behavior varies over the life cycle and across income groups. In Section 5, I compare the predictions of the model to the data and the existing literature. Section 6 concludes. The Appendix contains an analytical solution of the model for an infinite horizon setup.

2. The model

2.1. Building blocks of the HFG model

In this section, I introduce the hierarchical feasibility goals (HFG) model, a life cycle model of bounded rationality. The model combines two existing frameworks of bounded rationality: the (static) hierarchical goal model (Binswanger, 2010a); and the (dynamic) feasibility goals framework (Binswanger, 2011). Before presenting the HFG model, I briefly describe these two building blocks.

2.1.1. First building block: hierarchical choice

The hierarchical goal model is a two-period model of life cycle saving and asset allocation under bounded rationality. In this model, a decision maker has a set of goals that she seeks to achieve. Crucially, these goals are ordered by a *hierarchy*. This notwithstanding, the model fits the general definition of preferences, e.g. as spelled out in Mas Colell et al. (1995).