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Retirement with risk aversion change and borrowing constraints

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ABSTRACT

We quantify how an economic agent's risk aversion change at retirement and borrowing constraints affect her optimal consumption, portfolio, and retirement decision. Numerical results with a reasonable parameter set imply that increase in an economic agent's relative risk aversion at retirement, strong pre-retirement borrowing constraints, alone or together, can reduce the amount of wealth that must be accumulated to allow retirement. The numerical results also say that increase in an economic agent's relative risk aversion at retirement, decrease in pre-retirement borrowing constraints, or both, can increase the consumption drop at retirement. We also display analytical results for some extreme cases.

1. Introduction

Numerous papers have considered flexibility of the retirement decision in the context of the utility maximization problem. An endogenous retirement decision is closely related to the labor supply flexibility. In Bodie et al. (1992), an economic agent is allowed to adjust labor and leisure continuously, but

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the authors admitted that the assumption of continuous labor supply without cost is unrealistic. By introducing an option to retire from the labor and taking into consideration the irreversibility of retirement decision, Farhi and Panageas (2007) cast an alternative realistic model which incorporates labor supply flexibility. In Farhi and Panageas (2007), the optimal retirement problem is formulated as an optimal stopping problem: retirement time is determined by the trade-off between pre-retirement labor income and a large consumption of post-retirement leisure. Choi and Shim (2006) dealt with the trade-off between labor income and disutility against labor. Other studies in this literature imposed realistic restrictions or derived early retirement incentives from pension plans or annuities other than leisure or disutility. For example, Dybvig and Liu (2010) considered optimal consumption, investment, and retirement problem under borrowing constraints. Sundaresan and Zapatero (1997) and Chai et al. (2011) investigated incentives to retire induced by defined benefits plans and annuities, respectively. Lopes and Michaelides (2007) used the Epstein–Zin utility function to examine an optimal portfolio selection problem, and tried to clarify the relationship between the annuity puzzle and insurer's default risks. Most existing studies, including all of the above literature, on optimal retirement assume that the risk aversion is constant during the lifetime of the economic agent.

An economic agent's lifetime risk aversion is, however, not flat but rather has time-varying feature. The correlation between risk aversion and age has been well documented in literature. Morin and Suarez (1983), and Rees and Shah (1986) addressed positive correlation between risk aversion and age. Empirical studies by Yoo (1994) that investigated portfolio risk exposure with age suggests households increase risk exposure before retirement and decrease it after retirement. Riley and Chow (1992) found that relative risk aversion decreases with age until 65, which is the traditional retirement age, then increases substantially. Based on life insurance survey data, Halek and Eisenhauer (2001) estimated empirically the relative risk aversion and unearth significant increase in relative risk aversion at the age of 65. Steffensen (2011) solved a consumption and portfolio selection problem for an economic agent with an exogenously-given and time-deterministic risk aversion; the proposed model stimulates us to include the age effect when considering an economic agent's optimal consumption and portfolio behaviors.

In this paper, we solve an optimal consumption and portfolio selection problem in which an economic agent can voluntarily choose an optimal retirement time. We permit the coefficient of relative risk aversion to change at retirement by assuming that the coefficient has a constant value during pre-retirement days and can jump once at retirement. The assumption of a one-time jump may seem less realistic than modifying the model of Steffensen (2011) to provide the agent with a voluntary retirement option, but such an optimal stopping problem with time-deterministic parameters is hardly solved. Our model provides tractability in calculation without loss of economic implications, and in fact, yields an analytic form of the economic agent's optimal consumption, portfolio selection, and retirement behaviors. We show that the jump of the relative risk aversion has a significant influence on the wealth level at the time of optimal voluntary retirement. Increase in the magnitude of the economic agent's jump in relative risk aversion at retirement tends to reduce the amount of wealth that she accumulates for retirement and to increase her tendency to invest in the risky asset, while reducing her consumption.

One of the most relevant work with ours is Kwak et al. (2009), who solved a problem similar to ours for an economic agent with disutility against labor, but did not consider borrowing constraints, whereas we do. Our model is different from that of Kwak et al. (2009) in that we take a Cobb–Douglas utility function to model economic agent's preference to consumption and leisure. Our model assumptions allow us to observe a sudden drop in consumption at retirement, which has been empirically examined by Hurd and Rohwedder (2003), Haider and Stephens (2007), and Aguila et al. (2011) and named the *retirement-consumption puzzle*. Moreover, we use our model to investigate the relationship between the sudden change in the relative risk aversion and the depth of retirement-consumption puzzle: the magnitude of consumption drop at retirement increases with the jump size of the relative risk aversion.

To increase the realism of our model, we assume that the economic agent faces different borrowing constraints after retirement than while working. In our model the economic agent is not allowed to borrow against the whole (expected) future labor income; i.e., we impose the so-called *negative*