



# Precautionary saving demand and consumption dynamics with the spirit of capitalism and regime switching



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## ARTICLE INFO

### Article history:

Received 6 November 2014

Received in revised form

4 February 2016

Accepted 21 March 2016

Available online 30 March 2016

### Keywords:

Precautionary saving demand

Consumption dynamics

The spirit of capitalism

Regime switching

Learning

## ABSTRACT

This paper explores how the spirit of capitalism and regime switching affect the precautionary saving demand and consumption dynamics for two settings in which labor income growth depends on observable and unobservable economic regimes, which are defined as continuous-time Markov chains. I show that the spirit of capitalism reduces the precautionary saving demand, while regime switching increases the precautionary saving demand. With the spirit of capitalism and regime switching, the excess sensitivity puzzle can be resolved to some extent. Unlike Luo et al. (2009), I show that the spirit of capitalism can interpret the excess smoothness puzzle when labor income follows a unit root process or an Ornstein–Uhlenbeck process which is widely used in the literature of consumption and saving. I find that regime switching would worsen the excess smoothness puzzle under complete information, while the excess smoothness puzzle can be resolved by regime switching under incomplete information. Finally, I discuss the effects of the spirit of capitalism and regime switching on the welfare gain of information.

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## 1. Introduction

The spirit of capitalism, the desire to accumulate wealth as an end in itself, was first proposed by Weber (1958), and has been used to address a range of issues, including the economic growth theory (Zou, 1994; Smith, 1999; Gong and Zou, 2002; Clemens, 2004; Chang, 2006; Gong et al., 2010) and the asset pricing theory (Bakshi and Chen, 1996; Yang, 1999; Smith, 2001; Kenc and Dibooğlu, 2007; Roussanov, 2010). But in the field of consumption and saving, these are not so luxuriant. Zou (1995) presents the effects of the spirit of capitalism on households' savings behavior and shows that the capitalist-spirit approach can effectively understand savings by the rich and savings across countries and over time. Carroll (2000) uses the spirit of capitalism to interpret the fact the rich has higher lifetime saving rates. Fisher and Hof (2005) investigate the effects of the spirit of capitalism on consumers' long-run consumption and show that the effects of improvements in productivity on long-run consumption are magnified by the spirit of capitalism. Luo et al. (2009) explore how the spirit of capitalism affects saving and consumption behavior. They demonstrate

that the spirit of capitalism may reduce the importance of precautionary savings and cause the consumption process to deviate from a random walk. They also offer a partial explanation of the excess smoothness puzzle when the labor income process is non-stationary.

However, Luo et al. (2009) assume that the long-run labor income growth rate is constant. I relax this assumption and introduce regime switching because of the discontinuous and recurrent regime switching of economic environments, such as significant events including innovations in technique, introduction of new products, adjustment of interest or tax rate and other changes in laws or government policies. The relationship among numerous events and labor income is complex. Similar to David (1997), Veronesi (1999), Honda (2003), Wang (2009) and Liu (2011), for simplicity I assume that labor income growth depends on a switching regime that has two possible states: good and bad states.

Furthermore, almost all of the exiting research on consumption and saving assumes that the consumer has complete information about the parameters of his income process, such as the growth rate and volatility. Baker (1997), Guvenen (2007), and Huggett et al. (2007) provide convincing empirical evidence to support that the labor income process has an important individual-specific growth rate. If labor income growth is individual specific, the consumer may enter labor market with a prior belief about his future income growth and updates his belief over time based

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on the realized labor income process. Under the individual-specific labor income growth assumption, Wang (2004) proposes an intertemporal precautionary saving model in which the consumer has incomplete information about his labor income process. He shows that incomplete information gives rise to an additional amount of precautionary saving and the additional precautionary saving is higher when the estimation risk is higher. Wang (2009) studies an individual's optimal consumption-saving and portfolio choice problem when he does not observe his labor income growth. He indicates that learning affects the consumer's consumption-saving and portfolio allocation decisions through two channels: the expected labor income growth and the precautionary saving demand induced by the consumer's learning of his labor income growth. Similar to Wang (2004), the learning-induced precautionary saving demand is greater when his belief is more uncertain. Then I extend the previous switching regime which is observable to an unobservable case and assume that the consumer estimates the current economic regime by using current and past observations on labor income.

In summary, I study the effects of the spirit of capitalism and regime switching on the precautionary saving demand and consumption dynamics for two settings in which labor income growth depends on observable and unobservable economic regimes. Comparing with Luo et al. (2009), I introduce regime switching and examine how regime switching affects the precautionary saving demand and consumption dynamics for observable and unobservable economic regimes. Comparing with Wang (2009), I introduce the spirit of capitalism and emphasize the effects of the spirit of capitalism on the precautionary saving demand and consumption dynamics. It is noteworthy that Wang (2009) considers four models with known and unknown labor income growth: constant and known labor income growth, constant and unknown labor income growth, stochastic and known labor income growth, and stochastic and unknown labor income growth. Since the first two models have not consider regime switching and can be viewed as the special cases of the last two models, I only consider the last two models in this paper.

In this paper, I show that the spirit of capitalism reduces the precautionary saving demand, while regime switching increases the precautionary saving demand. With the spirit of capitalism and regime switching, the anticipated growth of labor income can be used to predict changes in consumption, then the excess sensitivity puzzle may be resolved to some extent. Unlike Luo et al. (2009), I show that with regime switching the spirit of capitalism can interpret the excess smoothness puzzle when labor income follows a unit root process or an Ornstein–Uhlenbeck process. For regime switching, I find that regime switching would worsen the excess smoothness puzzle under complete information. However, the excess smoothness puzzle can be resolved by regime switching under incomplete information. Using the estimated labor income process of Luo et al. (2015), the excess smoothness puzzle is resolved by incorporating the spirit of capitalism and regime switching. In addition, the spirit of capitalism reduces the welfare gain of information, while the effects of regime switching on the welfare gain of information are uncertain. For the risk-neutral consumer, information is worthless.

The framework of the paper is organized as follows. Section 2 describes a regime-switching economy and constructs a continuous-time parameterized-preference model with the spirit of capitalism. Sections 3 and 4 describe the consumer's decision problems in two cases of observable and unobservable economic regimes, derive the explicit solutions to these two problems, and study how the spirit of capitalism and regime switching affect the precautionary saving demand and consumption dynamics. Section 5 studies the welfare gain of information. Section 6 concludes.

## 2. The model

Let  $(\Omega, \mathcal{F}_t, P)$  be a probability space on which a standard Brownian motion  $B_t$  and a two-state continuous-time Markov chain  $Z_t$  are defined, where  $B_t$  and  $Z_t$  are mutually independent, and the information filtration  $\{\mathcal{F}_t, t \geq 0\}$  is an augmented filtration generated by  $B_t$  and  $Z_t$ , i.e.  $\mathcal{F}_t = \sigma(B_s, Z_s; s \leq t)$ . The Markov chain  $Z_t$  is right-continuous with values in  $\{L, H\}$  and represents the bad and good states of the regime-switching economy, respectively. For a small time period  $\Delta t$ , the good state  $H$  jumps to the bad state  $L$  with the transition probability  $\lambda_H \Delta t$  and the bad state  $L$  jumps to the good state  $H$  with the transition probability  $\lambda_L \Delta t$ . The transition densities  $\lambda_H$  and  $\lambda_L$  determine how persistent each state of the Markov chain is. For convenience, I denote that

$$\lambda(Z_t) = \begin{cases} \lambda_H, & Z_t = H, \\ \lambda_L, & Z_t = L. \end{cases}$$

For a long time, the Markov chain has a stationary distribution, and the long-run probabilities of bad and good states are  $\frac{\lambda_H}{\lambda_H + \lambda_L}$  and  $\frac{\lambda_L}{\lambda_H + \lambda_L}$ .

An infinitely lived consumer receives an exogenous perpetual stream of stochastic labor income. Suppose the consumer's labor income process  $Y_t$  follows

$$dY_t = [\mu(Z_t) - \kappa Y_t] dt + \sigma dB_t, \tag{1}$$

where  $\sigma$  measures the conditional volatility of the labor income change over an incremental unit of time. The labor income growth parameter  $\mu(Z_t)$  has the following definition:

$$\mu : \{L, H\} \rightarrow R, \quad \mu(L) = \mu_L \text{ and } \mu(H) = \mu_H.$$

It is assumed that  $\mu_H > \mu_L$ , which means that the consumer has low income in the bad economic regime and high income in the good economic regime. The difference between the two possible values,  $\eta = \mu_H - \mu_L$ , denotes labor income growth changes over economic regimes. When  $\kappa < 0$ , labor income is non-stationary, which reflects the view argued by Campbell and Deaton (1989). When  $\kappa = 0$ , labor income is a unit root process and also non-stationary, which corresponds to the discrete-time unit-root process (Hall, 1988; Caballero, 1991). When  $\kappa > 0$ , labor income is stationary and known as an Ornstein–Uhlenbeck process which has been widely used to model labor income in discrete-time cases (Caballero, 1990; Deaton, 1992). In this case,  $\kappa$  measures the degree of mean reversion.

The consumer can borrow or lend at a constant positive risk-free interest rate  $r$ . There exist no other financial assets, hence markets are incomplete with respect to the labor-income uncertainty. For convergence, I assume  $r + \kappa > 0$ , i.e. labor income cannot grow too fast. Let  $W_t$  denote the consumer's financial wealth process, then the consumer's wealth dynamics is given by

$$dW_t = (rW_t + Y_t - C_t) dt, \tag{2}$$

where  $C_t$  is the consumption flow of the consumer.

The consumer derives utility from consumption  $C_t$  and wealth  $W_t$  according to the following time-separable expected utility:

$$E_0 \left[ \int_0^\infty u(C_t, W_t) e^{-\rho t} dt \right], \tag{3}$$

where  $\rho > 0$  is the consumer's subjective discount rate. Instantaneous utility function  $u(C, W)$  is twice continuously differentiable in  $C$  and  $W$ , and satisfies  $U_C > 0, U_W > 0, U_{CC} < 0$  and  $U_{WW} < 0$ . Similar to Luo et al. (2009) and Wang (2009), I use the constant absolute risk aversion (CARA) utility which allows me to deliver the precautionary saving demand in an analytically tractable way, i.e.

$$u(C, W) = -\frac{1}{\gamma} e^{-\gamma(C+\theta W)}, \tag{4}$$

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