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Setting self-discipline saving rates for Thai income earners in a risk-management framework

Anya Khanthavit

Faculty of Commerce and Accountancy, Thammasat University, Bangkok 10200, Thailand

A R T I C L E I N F O

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A B S T R A C T

This study proposed a model for setting self-discipline saving rates in a risk-management framework and applied it to Thai income earners. The model involved financial planning, incorporating stochastic lifetime incomes, expenses, savings, and investment returns, together with mortality and morbidity data. The self-discipline saving rate was set so the probability that the bequest was less than the funeral expenses was at a pre-determined, low, acceptable level. The resulting rate was higher for females than for males, and it increased with age. When the rate was possible, the median net bequest of funeral expenses was positive for both females and males of all ages. Therefore, if earners follow the self-discipline saving rule, they are likely to have sufficient funds to cover the expenses of their own funeral.

Introduction

It is important for income earners to set a self-discipline saving rate in their financial plan so that the long-term objective is not compromised by myopic consumption and immediate utility (Thaler & Shefrin, 1981). Alternative saving rates have been advised. For example, Berger (2013) advised a 10-percent rule-of-thumb rate, and the Bank of Thailand (2014) suggested a 25 percent rate. Henna, Fan, and Chang (1995) noted that the advice has no basis in economic theory and proposes that the rate is set based on a rigorous prescriptive model of life cycle savings. However, Henna et al.'s prescribed rates are not very useful because the assumptions are not realistic. The model does not consider the stochastic nature of incomes and expenses, as well as the longevity and health of income earners.

More realistic models for setting saving rates have been proposed. For example, Scholz, Seshadri, and Khitatrakun (2006) solved a life-cycle model backward from death to starting age for optimal saving paths of US households, and this model incorporated uncertain lifetimes, uninsurable earnings, and medical expenses. Despite being more realistic, these models, which are based on the expected discounted utility of consumption and bequest, are difficult, since their implementation requires the estimation of a subjective utility function. With respect to Bayraktar and Young (2007), analyzing the problem in a risk-management framework, e.g. to minimize the probability of lifetime ruin, is much easier and more practical.

In this study, I propose a realistic and practical model for setting a self-discipline saving rate in a risk-management framework and apply it to Thai income earners. The model is modified from Khanthavit (2015). While Khanthavit fixes the financial plan for an income earner and measures the benefits of choosing exercise over a sedentary lifestyle, I fix the lifestyle and determine the self-discipline saving rate for a desirable financial plan.

The model proposed here involves financial planning and it incorporates stochastic lifetime incomes, expenses, savings, and investment returns together with mortality and morbidity data. It sets the self-discipline saving rate such that the probability that the bequest is less than the

E-mail address: akhantha@tu.ac.th.

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funeral expenses is at a pre-determined, acceptable level. I do not consider the minimization problem of ruin probability as in Bayraktar and Young (2007) because ruin is not the absorbing state. Earners continue to live whether they experience financial ruin or not. Instead, I consider the probability of meeting a bequest target because a person anticipates it (Hurd & Smith, 2001). A zero net bequest of funeral expenses is chosen as the target. This target ensures that a person is not in financial ruin at death and has enough savings to pay terminal funeral expenses. It is important to note that most people die in old age during their retirement years, during which their income is low or nonexistent. Thus, if they do not leave a negative bequest, then it is not likely that these people are in financial ruin during their retirement years either.

The contribution of this study is at least two-fold. First, the model is new and can address the weaknesses of the previous models in the literature. As opposed to Berger (2013) and the Bank of Thailand (2014), the model is based on rigorous economic theory. Unlike those in Henna et al. (1995), the assumptions are realistic in that income, expenses, and investment returns are stochastic and that morbidity and mortality are incorporated. The model is practical. In the risk management framework, the saving rate is independent of utility. Hence, the utility function, as in Scholz et al. (2006), for example, does not need to be estimated or assumed. Moreover, the analysis is simple. It can be conducted using Microsoft Excel. Second, the model is applied to estimate the self-discipline saving rates for Thai income earners. These estimates are Thailand's first from a rigorous model and the actual data set. The estimates are useful. Thai earners may adopt them, and government agencies, such as the National Saving Fund, may recommend them to savers.

Materials and Methods

The Model

The study analyzed the stochastic behavior of saving over the lifetime of an income earner and assessed the probability that the bequest, i.e. saving at death, was less than the funeral expenses. Because saving largely depends on the saving rate to income, the self-discipline saving rate is the rate to equate that probability with a pre-determined, low, acceptable threshold.

Let $S^*_{t_0}$ be the initial saving level of the representative t_0-year-old income earner. The saving level $\tilde{S}_{t_0+1}$ in the following year when the income earner turns t_0+1 must equal the starting level $S^*_{t_0}$ plus $\tilde{r}_{t_0+1}$-percent investment return and income $\tilde{I}_{t_0+1}$ net of personal expenses $\tilde{P}_{t_0+1}$. That is Equation (1),

$$\tilde{S}_{t_0+1} = S^*_{t_0} e^{\{\tilde{r}_{t_0+1}\}} + \tilde{I}_{t_0+1} - \tilde{P}_{t_0+1}, \tag{1}$$

so that Equation (2),

$$\tilde{S}_{t_0+j} = \tilde{S}_{t_0+j-1} e^{\{\tilde{r}_{t_0+j}\}} + \tilde{I}_{t_0+j} - \tilde{P}_{t_0+j}. \tag{2}$$

The symbol "~" labels stochastic variables. I assumed that the investment return $\tilde{r}_{t_0+j}$ is age-specific in order to reflect the fact that earners may adjust investment strategies along their glide path (Budsaratrakul, 2014). It is assumed that the return is normally distributed with a μ_{t_0+j} mean and a σ_{t_0+j} standard deviation when $\tilde{S}_{t_0+j-1} \geq 0$. I assumed a fixed negative return of the lending rate if $\tilde{S}_{t_0+j-1} < 0$, i.e. the earner is in debt.

In Equations (3) and (4), because income $\tilde{I}_{t_0+j}$ is age-specific and rises with inflation for j years from its initial level $I^*_{t_0}$, the income must be inflation-adjusted. In addition, it must be scaled to reflect the actual working days in the year. Finally, it must be adjusted downward for decreasing productivity from sickness.

$$\tilde{I}_{t_0+j} = I^*_{t_0} e^{\left\{\sum_{h=1}^{j} \tilde{\pi}^I_h\right\}} \times \left(1 - \frac{\sum_{d=1}^{4} L_d \tilde{\gamma}_{d,t_0+j}}{252}\right) \times \left(1 - \tilde{F}_{t_0+j}\right), \tag{3}$$

where $\tilde{\pi}^I_h$ is the stochastic inflation rate for income in year h. Because nominal income grows with inflation, I assumed the income inflation follows a mean-reversion process, as does the country's inflation rate under the Bank of Thailand's inflation targeting policy (Goncalves & Salles, 2008).

$$\tilde{\pi}^I_h = \theta(\overline{\pi} - \pi^I_{h-1}) + \tilde{\varepsilon}^I_h, \tag{4}$$

where θ is the convergence rate, $\overline{\pi}$ is the long-run mean, and $\tilde{\varepsilon}^I_h$ is the normally distributed error of $\tilde{\pi}^I_h$.

L_d is the number of lost working days resulting from disease d. $\tilde{\gamma}_{d,t_0+j}$ is the disease d indicator variable. $\tilde{\gamma}_{d,t_0+j} = 1$ if the earner experiences disease d at age $t_0 + j$. Otherwise, it is zero. I followed Khanthavit (2015) to limit the interest to only four important, non-communicable diseases (NCDs), namely, (1) diabetes, (2) heart disease, (3) stroke and (4) cancer, because these four NCDs are chronic and are leading causes of death worldwide (World Health Organization, 2009). Chronic NCDs imply $\tilde{\gamma}_{d,t_0+j} = 1$ if $\tilde{\gamma}_{d,t_0+j-1} = 1$. However, if $\tilde{\gamma}_{d,t_0+j-1} = 0$, $\tilde{\gamma}_{d,t_0+j}$ is a (1, 0) Bernoulli with probability of the disease-d incidence rate. The incidence rate corresponds with age and sex. The term $1 - \frac{\sum_{d=1}^{4} L_d \tilde{\gamma}_{d,t_0+j}}{252}$ scales the income proportionately with actual working days in the year. $\tilde{F}_{t_0+j}$ is the productivity adjustment variable. $\tilde{F}_{t_0+j}$ necessarily equals the NCD-induced productivity loss rate if $\tilde{\gamma}_{d,t_0+j} = 1$.

I assumed the personal expense $\tilde{P}_{t_0+j}$ depends on the subsistence level and income level as in Equations (5) and (6). The expenses exclude medical costs because the costs are absorbed by the universal health coverage scheme of the Thai government.

$$\tilde{P}_{t_0+j} = Max\left[P^*_{t_0} e^{\left\{\sum_{h=1}^{j} \tilde{\pi}^P_h\right\}}, (1-\Omega)\tilde{I}_{t_0+j+1}\right], \tag{5}$$

$$\tilde{\pi}^P_h = \theta(\overline{\pi} - \pi^P_{h-1}) + \tilde{\varepsilon}^P_h. \tag{6}$$

$P^*_{t_0}$ is the present time's subsistence personal expenses for the t_0-year-old earner. It must rise with inflation, constituting a level of $P^*_{t_0} e^{\{\sum_{h=1}^{j} \tilde{\pi}^P_h\}}$ when the earner turns