



Full length article

## Rationality of longevity expectations: Evidence from the Korean Longitudinal Study of Aging

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## ABSTRACT

This study utilizes data from the Korean Longitudinal Study of Aging to test the rational expectations hypothesis regarding longevity expectations. The rationality of longevity expectations is tested on two grounds: belief formation and its association with consumption and savings outcomes. Although individuals seem to have little knowledge of lifespan, they revise their survival forecast rationally and systematically in response to new information. The updating process follows a random walk as predicted by a Bayesian learning model. We also show that consumption and savings behaviors vary with this rationally formed expectations as if individuals make deliberate long-range plans. Overall, these findings lend further support to the rational expectations hypothesis and individuals as forward-looking decision makers.

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### 1. Introduction

Theory of intertemporal choice suggests that individuals maximize risk-weighted expected utility when faced with uncertain prospects. Economists explain this concept by postulating a person endowed with quantitative skills of a statistician. When deciding on how much to consume and save, an economic agent is assumed to form some beliefs about uncertain outcomes relevant to the decision. These include, for instance, predicting how much income will be earned, when he/she is most likely to retire, and how long he/she is expected to survive—all of which are reasonably predictable but unknown at the time the decision is made. Because such events have a large stochastic component, belief formation involves identifying all feasible states and assessing their stochastic nature. Individuals then act as if they are maximizing a weighted average of utility where the weights are subjectively held probabilities.

This view of decision-making requires people to have a conscious vision about future outcomes. In a forward-looking economic model, individuals are assumed to have rational

expectations (RE); that is, their subjective beliefs about future states coincide with a true probability distribution, and therefore any deviation from perfect foresight is random (Lucas, 1972; Muth, 1961). The hypothesis requires that the past is quantifiable and that the same probability distributions continue to govern future events (Davidson, 1991; Pesaran, 1987). In many examples, however, future states do not even have well-defined objective distributions and information about the past is hardly observable. Individuals may have little knowledge of the future, or their projections merely involve extrapolating current and past observations. In these circumstances, individuals may deal with unforeseeable changes, or more generally, “true” uncertainty where no information about prospects exists today.

For some domains of decision-making, the assumptions of the RE hypothesis do not seem unrealistic or even necessary because individuals have a considerable amount of private information that may signal their future (Hurd, 2009; Perozek, 2008). A good example is a personal judgment on health. For instance, a habitual smoker who has smoked over the last 20 years would have observed some warning signs such as a chronic cough, chest pain, and headache. If such symptoms increase the risk of lung disease (as they usually do), the assumption that their past governs future seems quite plausible. Even though any changes in health behaviors (e.g., smoking cessation) are expected, belief formation would operate jointly with a learning process

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to update their expectations in an adaptive manner. In turn, subjective projections may be quite accurate and often converge with objective distributions, if private information is observable, credible, and encoded in an unbiased way (Manski, 2004).

Our discussion so far poses a natural question of whether the expectations based on private information is a reliable guide to the future, even in some decision-making areas where uncertainty prevails. Among a number of uncertainties that have implications for economic choices, a particular domain that has drawn renewed interest is longevity expectations. While predicting the end of life is unpleasant and rarely explicitly done, prior studies find that subjective survival probabilities correspond well with life table values and covary with risk factors for chronic conditions. For instance, Hurd and McGarry (2002) discovers that the onset of certain diseases (e.g., cancer, cardiovascular disease, and stroke) substantially lower the subjective chance of survival. Hurd and McGarry (1995) shows that smokers and drinkers report lower survival probability as if they are aware of their risky health behaviors. In Smith et al. (2001), the health risk is signaled in the form of a lower survival probability, much earlier than it becomes severe enough to interfere with daily life. Individuals' forecasts seem to condition on various other private information, such as family health history (Zick et al., 2014), genetic characteristics (Anderson et al., 2015; Perozek, 2008), and health trajectories in the past (Benitez-Silva and Ni, 2008).

Arguably, there is enough evidence that expected survival is associated with consumption and savings decisions. Empirical studies on life-cycle choices find that individuals who expect to be long-lived are more likely to reduce consumption expenditures (Biro, 2013; Salm, 2010), accumulate extra wealth to cope with longer retirement period (Bloom et al., 2006), and hold risky investment portfolio (Spaenjers and Spira, 2015; Yang and Huang, 2009). Other studies find that retirement intention and the timing of Social Security benefits claiming also vary with expected longevity, in a manner similar to the predictions from underlying theory (Hurd et al., 2004; Khan et al., 2014). Especially noteworthy is Gan et al. (2015) where a structural life-cycle model is estimated using both subjective survival and life table mortality rates. Their results show that a model based on subjective probabilities yield more accurate out-of-sample predictions than the one estimated with life table values. This evidence lends support to the hypothesis that people refer to their subjective assessment of mortality risk when adjusting consumption and saving.

To date, a vast majority of evidence is based on several developed countries such as the US, UK, and other European countries. Relative to under-developed or developing countries, respondents of these countries are predominantly well-educated and cognitively capable individuals who might have the characteristics of Bayesian decision-makers. If educated and cognitively capable people better deal with probabilities (Binswanger and Salm, 2013; Chater and Oaksford, 2008), past evidence might not be generalizable to other countries with less social capital. Uneducated and cognitively unskilled individuals may elect mental shortcuts that give an intuitive and satisfiable estimate or rely on a non-probabilistic method based on cues and feelings (Bruine de Bruin and Carman, 2012; Peters, 2008; Peters and Levin, 2008). If rough guess about future outcomes is perceived less reliable, their expectations would not be taken into account when making intertemporal choices.

The aim of this study is to re-evaluate the RE hypothesis by analyzing a sample in which the subjects are predominantly boundedly rational agents. Among a number of surveys including information on longevity expectations, Korean sample gives us the perfect setting in which Bayesian reasoning is unlikely. For instance, educational attainment of the elderly population in South Korea is one of the lowest among OECD member countries (OECD,

2014). In 2014, the proportion of the population aged between 55 and 64 with a postsecondary degree was only 17%, which is considerably lower than OECD average of 41%. Furthermore, as a result of double-digit economic growth in the 80s and 90s, their life expectancy has increased dramatically reaching nearly 82.4 years in 2016 (Central Intelligence Agency, 2016). This rapid extension of lifespan should have added additional complexity to forecasting the end of life and financial planning horizon. In other words, our sample of Korean population should form expectations about the event which is likely to occur in 20 or 30 years using limited cognitive resources. Considering a lack of education and long lifespan, rejection of the RE hypothesis would not be surprising.

Our empirical analysis is divided into two parts. In the first phase, we test whether or not longevity expectations are formed rationally. We first present a theoretical and econometric framework of Bernheim (1990), which describes the evolution of expectations to informational events over time. A key prediction from the model is that longevity expectations, if formed rationally, evolve as a random walk and therefore unrelated to the information from the previous period. This conceptual model leads to a testable hypothesis of rational expectations in a regression context. As in the literature, we pay particular attention to handling measurement error in probabilistic assessment – gross rounding and a high frequency of probability 50 – using an instrumental variable (IV) technique. Our identification strategy is to use retirement expectations as an exclusion restriction, given that predicting when to retire and when to die is based on the same information, and thus they are internally consistent. In the second phase, we estimate the standard life-cycle models linking subjective survival probability to saving and consumption growth. Results from these models are expected to be consistent with the life-cycle hypothesis in that saving increases and consumption growth declines with subjective lifespan.

Our estimation results provide several interesting findings. First, the formation of survival beliefs among Koreans follows a random walk as predicted by the framework. While the baseline models find no evidence of random updating, using retirement expectations to purge measurement error leads to a consistent non-rejection of the RE hypothesis. Second, we find that about 1% increase in subjective survival probability corresponds with 0.9% increase in direct saving, 1.3% greater financial wealth, and 0.13% decrease in annual consumption growth. Adding expectations on other domains such as expected living standards during retirement, expected pension benefits, and projection on economic growth leaves the point estimates quite similar and inferences unchanged. These robustness checks suggest that the estimates on subjective survival probability are not picking up the impact of optimistic outlook or attitudes towards future. Overall, our findings point to a strong rationality in expectations formation and economic decision-making at the end of life.

The remainder of this article is structured as follows. In Section 2, we briefly introduce the conceptual model of expectations formation and testable hypotheses. In Section 3, we describe data and sample selection with a particular focus on the survey procedure eliciting subjective survival probability. Section 4 provides the test results of the RE hypothesis and the estimates for the life-cycle models. Section 5 concludes.

## 2. Conceptual and econometric framework

### 2.1. Expectation formation and a test of rational expectation

Suppose  $X$  represents the event individuals want to predict, and  $X_t^e$  is the corresponding expectation formed at time

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