Survey and Application: Constructing Life Planning Support System for Retirement Planning Using Social Simulation

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***Abstract*—This extended abstract focus on a life planning support system built based on data and social simulation. We present an overview of the simulation model and its applications.**

Keywords- life planning; finance; computational simulation

I. INTRODUCTION

Asset formation for the retirement generation is a common issue around the world and has been widely discussed in various countries. In the U.S., the empirical benchmark is a fixed withdrawal rate of 4% of initial assets [1]. On the contrary, there are critics who argue that a fixed withdrawal rate is inefficient [2] and that "rules" should be set to vary the withdrawal rate and amount [3] [4].

On the other hand, there have been reports of research using social simulation to solve problems in social science. For example, Yamada et al. [5] have proposed a method that utilizes both real data and agent simulation to solve problems faced by real businesses and industries. Such a level of elaborate analysis that is able to withstand decision-making in the field is expected to make a significant contribution to efficient decision-making in social and economic activities. In addition, there have been many reports of analysis through modeling based on real corporate behavior and finance theory [6][7].

In this study, we focus on a life planning support system built based on data and social simulation. In Sections II and III, we present an overview of the model and its application.

II. METHODOLOGY

In this Section, we present an overview of the simulation model used in this paper.

A. Outline

This system is designed to run simulations based on data of customer attributes, and to evaluate and validate measures for customers' retirement assets based on the data and simulation results (Fig. 1). The social simulation is constructed based on finance theory. And machine learning is used for the evaluation and verification of the policy measures [8].

Through these models, it will be possible to effectively discuss measures to avoid the depletion of retirement assets [9][10]. The proposed methodology is intended to be used by financial planners and others who develop life plans for their clients.

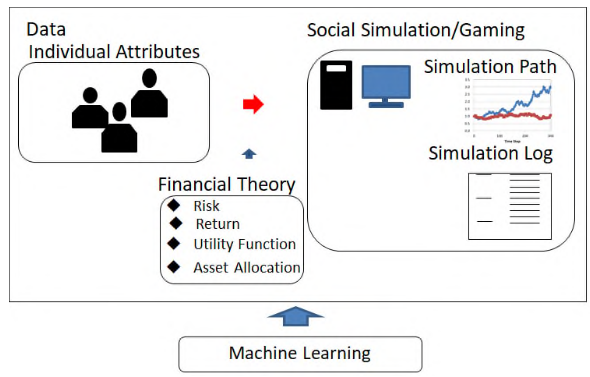

Figure 1. Basic Architecture of Life Planning Support System

B. Simulation model

We construct a computer simulation model that expresses asset formation and withdrawal before and after retirement (Fig. 1). This model is based on a model previously proposed by the authors [9][10].

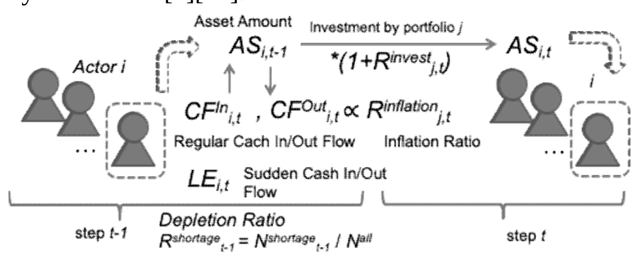

Figure 2. Conceptual Diagram of Simulation Model

The actors in the model have a specific asset balance at a certain age. Actors also have regular income and expenditure (cash inflow and outflow) and sudden income and expenditure (depending on life events) according to actor's own status (before and after retirement). The attributes of the actors can be grounded to statistical data. In addition, by manipulating the attributes of the actors, what-if analysis can be performed when a policy is implemented.

Next, the assets held by actors include cash, deposits, and risk assets. Risk assets are fully invested in a portfolio of traditional assets and provide returns according to the risk of

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the portfolio. In addition, the regular income and expenditure fluctuates according to the inflation rate. Here, the risk-return of the portfolio, inflation rate, and their variances are given as the external environment.

C. Usefulness and limitation of the proposed system

Conventional analysis has often focused on people with specific attributes to simulate asset depletion situations [11] [12]. In those studies, ad hoc analysis was required for each person in order to examine possible measures to be taken.

On the other hand, the proposed system is capable of comprehensively and semi-automatically specifying possible life planning measures for each person.

One of the limitations of this analysis is that there is arbitrariness on the part of the modeler as to which attributes of the targeted individuals are reflected in the simulation model.

III. APPLICATION

In this Section, we show an application of our methodology.

A. Dataset: Individual attributes

We use the individual questionnaire data from the "Awareness Survey on Life in Old Age for Before and After Retirement Generations" conducted by the MUFG Financial Education Institute [13]. The survey target was men and women aged 50 and over. The survey area was Japan, and the number of valid responses was 6,192 samples. This questionnaire comprehensively investigated the asset status of each individual (current asset balance and expected income/expenditure in old age), the planned asset succession amount, stance on investment, and outlook for old age, etc.

B. Sample of Simulation Results

Based on the above individual questionnaire data, we established several patterns of "possible person attributes" through segmentation by feature analysis. Based on these attributes, the simulation model described in the Section II was used to simulate measures for asset formation and withdrawal. Then, we estimated the asset depletion status of representative people who were typified by the individual questionnaire data (TABLE I) [9].

TABLE I. SIMULATION RESULT (SAMPLE): DEPLETION RATES

# of cluster	Depletion rates by inflation scenario					
	(1) No inflation		(2) Moderate inflation		(3) 2% inflation	
	Age: 90 (%)	Age: 100 (%)	Age: 90 (%)	Age: 100 (%)	Age: 90 (%)	Age: 100 (%)
#4	34	75	60	86	93	98
#1	0	0	0	0	0	0
#3	100	100	100	100	100	100
#2	0	34	0	94	0	100
#5	0	0	0	1	0	5

In addition, we conducted a hypothetical simulation in which the actors made various decisions to control asset depletion. By calculating feature importance using machine learning methods, we examined the effectiveness of these decisions (TABLE II) [9].

TABLE II. ASSUMED COUNTERMEASURES FOR EACH CLUSTER

# of cluster	Countermeasures (example)
#4	Appropriate risk taking for inflation hedging, increase retirement age
#1	Appropriate and steady asset succession
#3	Curbing expenditure, expanding social security
#2	Curbing expenditure
#5	Avoid excessive risk to prevent price fluctuations

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