SURVEY AND APPLICATION: CONSTRUCTING LIFE PLANNING SUPPORT SYSTEM FOR RETIREMENT PLANNING USING SOCIAL SIMULATION

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PROFILE: TAKAMASA KIKUCHI

VISITING RESEARCHER, GRADUATE SCHOOL OF BUSINESS ADMINISTRATION, KEIO UNIVERSITY.

HE RECEIVED HIS B.A. DEGREE IN ENGINEERING IN 2007 FROM YOKOHAMA NATIONAL UNIVERSITY.
HE RECEIVED HIS M.A. DEGREE IN 2009 AND PH.D. DEGREE IN 2017 FROM TOKYO INSTITUTE OF TECHNOLOGY.

HIS RESEARCH INTERESTS INCLUDE FINANCE AND AGENT-BASED MODELING.

PLAN TO TALK

1. **Introduction**

2. **Datasets**

3. **Methodologies**

4. **Analysis and Simulation**
   - ① Feature Analysis of Individual Questionnaire Data
   - ② Asset Formation and Withdrawal Simulation

5. **Concluding Remark**

ONE MINUTE SUMMARY

- **Propose an improvement to the analysis method in policy simulation of asset formation and withdrawal**

- **Our method consists of …**
  - Feature analysis of individual questionnaire data
    - Focusing on the diversity and representativeness of the individual attributes
    - Consider more diverse attributes, e.g., financial assets to be inherited and investment preferences
  - Simulation on the feature analysis
    - Considering asset succession and the price fluctuations of risk assets
    - Examine actions that could be taken to avoid asset depletion for each cluster

1. INTRODUCTION (1/2)

- **Asset formation and withdrawal of generations before and after retirement**
  - In Japan, various measures are discussed
  - ex. increasing retirement age, asset formation from a young age, curbing spending

- **Discussions in the previous study** [Yokoyama et al. 2018] [Kato 2018]
  - Studies using macro-statistical data
    - ex the amount of financial assets and disposable income

    → Expressed some of the attributes of individuals using actual data

  - Studies using individual sample cases

    →There is room to improve the generality and representativeness of the individual attributes set as samples

1. INTRODUCTION (2/2)

- **Purpose**
  - To propose an improvement to the analysis method in policy simulation related to asset formation and withdrawal

- **Requirement**

① Attributes of the assumed person cluster
  - Could be set in a realistic and diverse manner
  - Could be set in a low arbitrariness and representative form

② Simulation framework
  - Could express various attributes and decisions

2. DATASETS

① Asset Class and Cash-in, Cash-out

- Income and expenditure of each individual asset class
- Data from the Ministry of Internal Affairs and Communications[2014]

Table Income and Expenditure of Each Asset Class

Asset Class [m Yen]	(1) Income *	(2) Expenditure *	(3) Net Cash Flow ((1)−(2))*12
Less than 150	18.2	18.6	−5.1
150～300	18.8	20.1	−15.9
300～450	19.8	21.3	−17.7
450～600	20.6	22.5	−22.9
600～750	21.5	23.1	−18.9
750～900	21.9	24.7	−33.8
900～1,200	22.0	24.8	−33.8
1,200～1,500	22.4	25.5	−37.4
1,500～2,000	22.6	27.7	−61.5
2,000～3,000	24.4	29.8	−64.9
3,000～4,000	25.7	31.4	−68.4
Over 4,000	28.6	36.1	−90.8

(*:10 thousand Yen/month)

2. DATASETS

② Various Attributes of Individuals

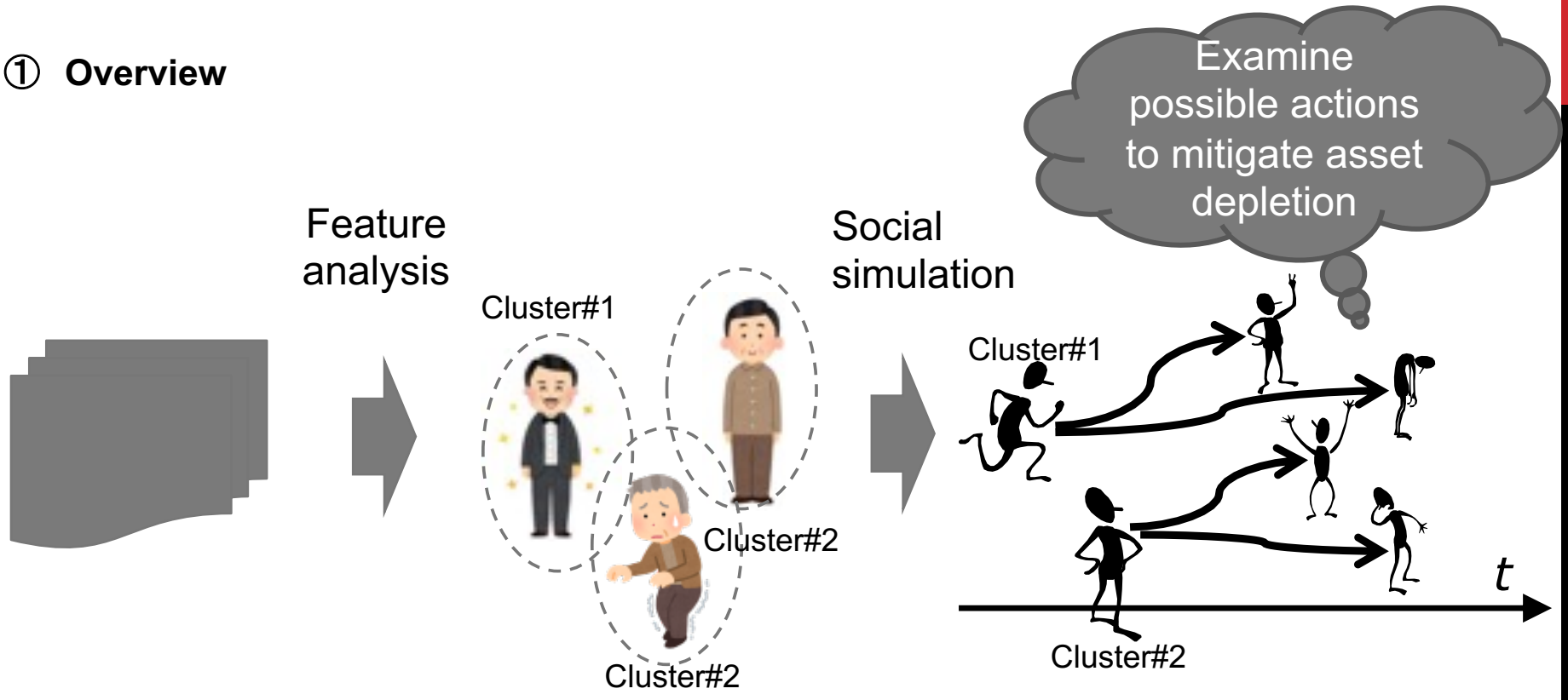
- Survey Name: "Awareness Survey on Life in Old Age for Before and After Retirement Generations" conducted by the MUFG Financial Education Institute
- Method: Online survey
- Period: Jan. 22th, 2019 ~ Jan. 25th, 2019
- Target: Men and women over 50 years old in Japan
- Number of samples: 6,192

Table Questionnaire Items (excerpt)

Item	Question matters
Attributes	Age, Sex, Household composition, etc.
Financial Statue	Stock data: Asset Balance(Current), Asset Balance(to be Inherited), etc.
	Flow data: Regular Cash In/Out Flow, etc.
Risk Preference	Investment Experience, Risk Asset Holding Ratio, etc.

3. METHODOLOGIES

① Overview



Individual questionnaire data [MUFG 2019]

Classify the survey respondents into several clusters K-means method [MacQueen 1967]

Simulation Model of asset formation and withdrawal [Kikuchi & Takahashi 2020]

3. METHODOLOGIES

② Simulation Model of Asset Formation and Withdrawal

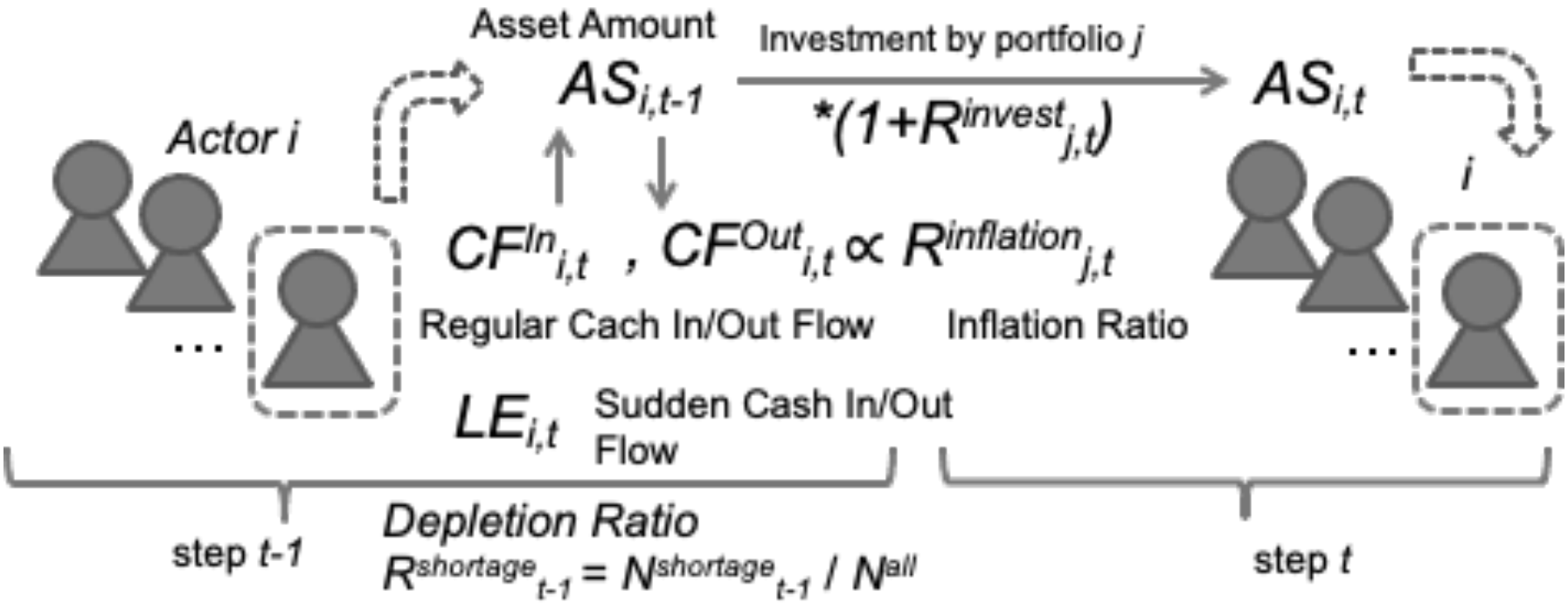
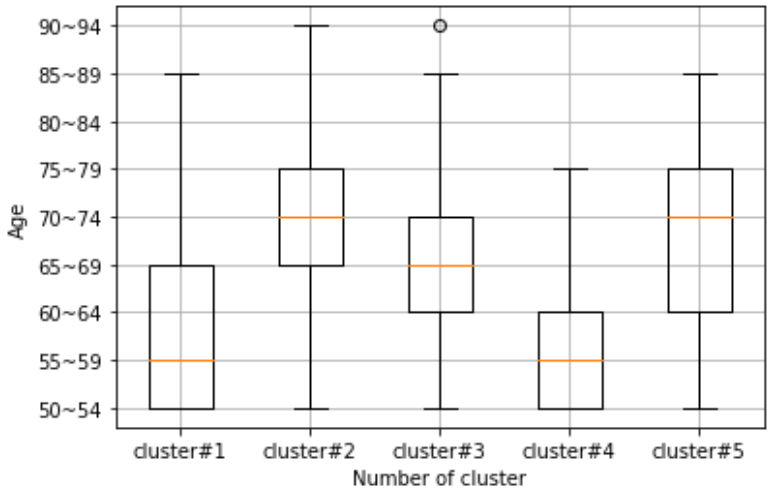


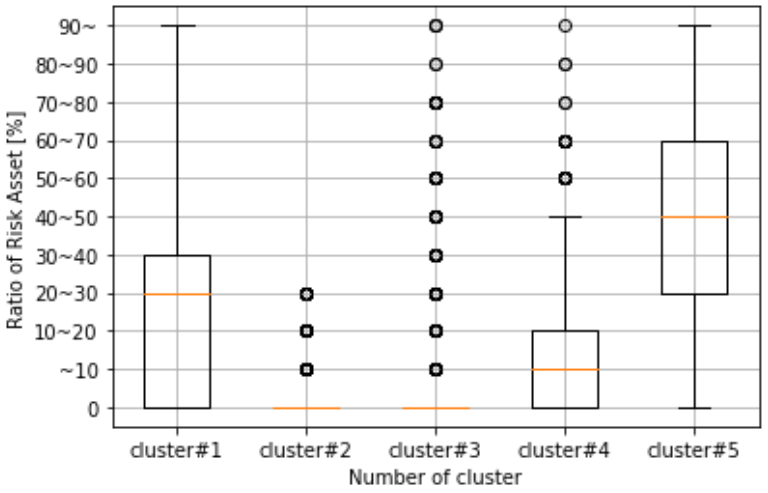
Fig. Conceptual Diagram of Simulation Model [Kikuchi & Takahashi 2020]

4. ANALYSIS AND SIMULATION

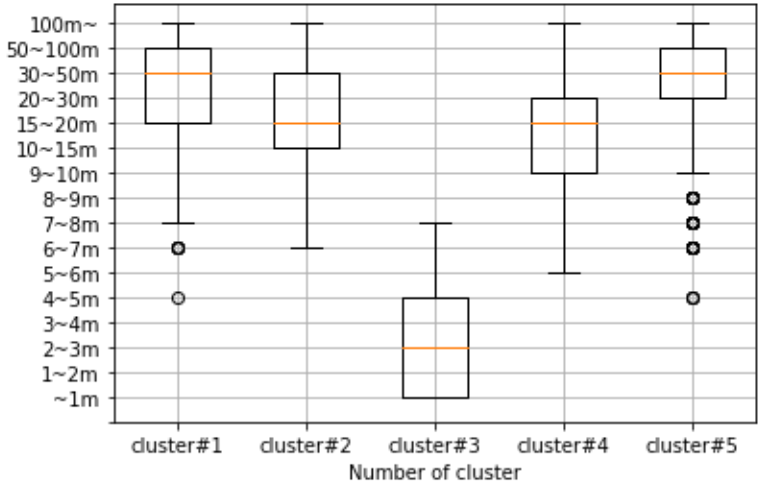
① Feature Analysis of Individual Questionnaire Data



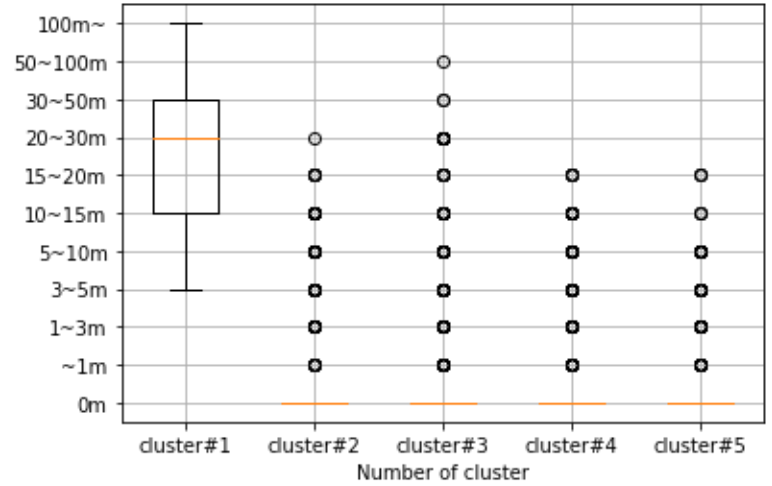
(a) Age Groups



(b) Assets Holding Ratio



(c) Current Financial Asset Balances



(d) Financial Assets to be Inherited

Fig. Distribution of each attribute for Each Cluster

4. ANALYSIS AND SIMULATION

① Feature Analysis of Individual Questionnaire Data

Table Summary of Clustering Results

# of Cluster	Attributes			
	age	FA^{now}	FA^{future}	R^{risk}
#4	57	17.5 m yen	none	5%
#1	57	40.0 m yen	25.0 m yen	25%
#3	67	2.5 m yen	none	0%
#2	72	17.5 m yen	none	0%
#5	72	40.0 m yen	none	45%

4. ANALYSIS AND SIMULATION

② **Asset Formation and Withdrawal Simulation**

(Case1) Depletion rate based on individual questionnaire data

Table Simulation Parameter Settings: Case of Making Basic Decisions

Item	Value
Curbing of Expenditure	Without
$age^{retired}$	60
R^{future}	100%
μ_j, σj	(6.37%, 18.0%)
$\mu_{inflation}$	{ 0.0%, 0.53%, 2.0%}
$\sigma_{inflation}$	1.26%
K	10,000

4. ANALYSIS AND SIMULATION

② Asset Formation and Withdrawal Simulation

(Case1) Depletion rate based on individual questionnaire data

Table Depletion Rates by Cluster and Inflation Scenario

# of Cluster	Depletion Rates by Inflation Scenario					
	(1) No Inflation		(2) Modarate 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%

4. ANALYSIS AND SIMULATION

② Asset Formation and Withdrawal Simulation

(Case2) Analysis of Impact of Various Decisions on Depletion Rates

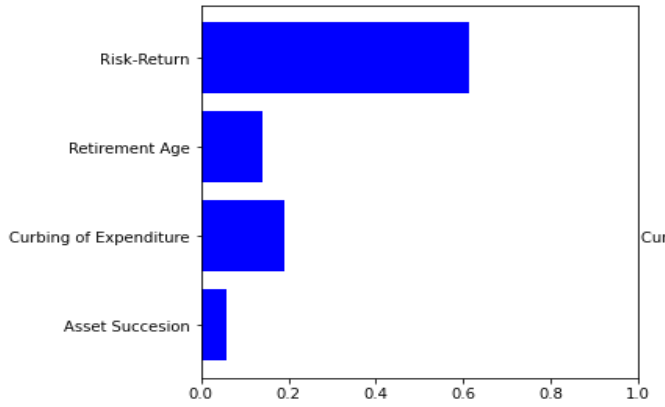
Table Simulation Parameter Settings: Case of Making Various Decisions

Item	Value
Curbing of Expenditure	{Without, With}
$age^{retired}$	{60, 65, 70}
R^{future}	{100%, 50%, 0%}
μ_j, σj	{(6.37%, 18.0%), (4.68%, 12.0%), (2.87%, 6.0%), (0.01%, 0.0%)}
$\mu_{inflation}$	{ 0.0%, 0.53%, 2.0%}
$\sigma_{inflation}$	1.26%
K	10,000

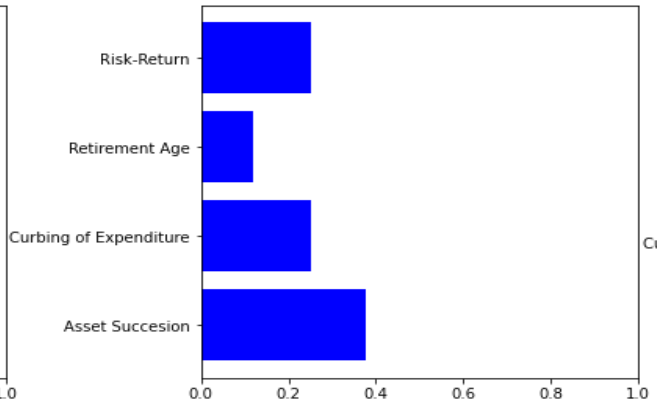
4. ANALYSIS AND SIMULATION

② Asset Formation and Withdrawal Simulation

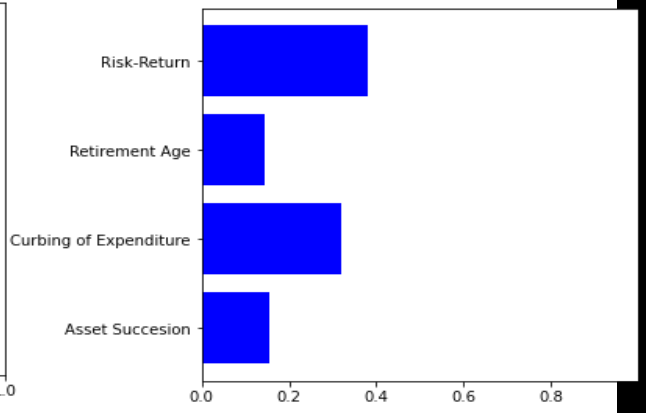
(Case2) Analysis of Impact of Various Decisions on Depletion Rates



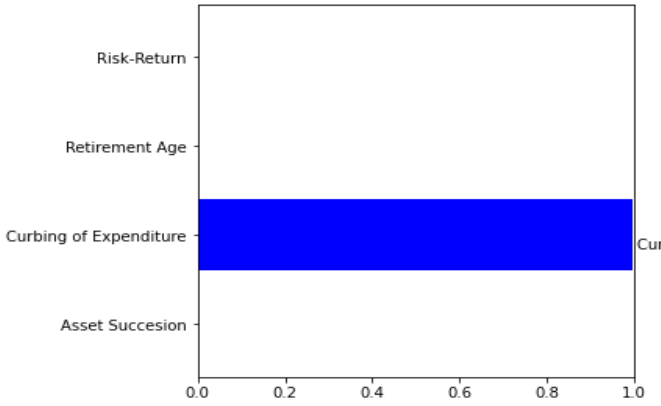
Cluster #4



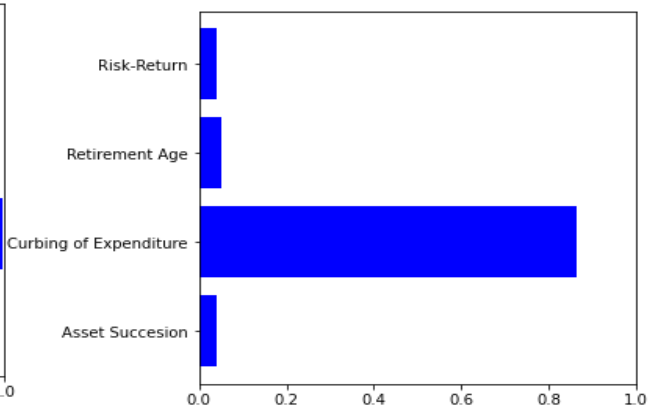
Cluster #1



Cluster #5



Cluster #3



Cluster #2

Fig. Variable Importance for Each Cluster

4. ANALYSIS AND SIMULATION

② Possible Actions for Each Cluster

Table Assumed Countermeasures for Each Cluster

# of Cluster	Countermeasures (Example)
#4	Appropriate risk taking for inflation hedging, Increasing 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

5. CONCLUDING REMARK

- **Propose an improvement to the analysis method in policy simulation of asset formation and withdrawal**
- **Our method consists of …**
  - Feature analysis of individual questionnaire data
    - Focusing on the diversity and representativeness of the individual attributes
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- **Future Work**
  - ① Survey of other attributes that affect asset depletion by questionnaire analysis
  - ② To diversify the decision making of actors in simulation

Thank you.

We will welcome your feedback.

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