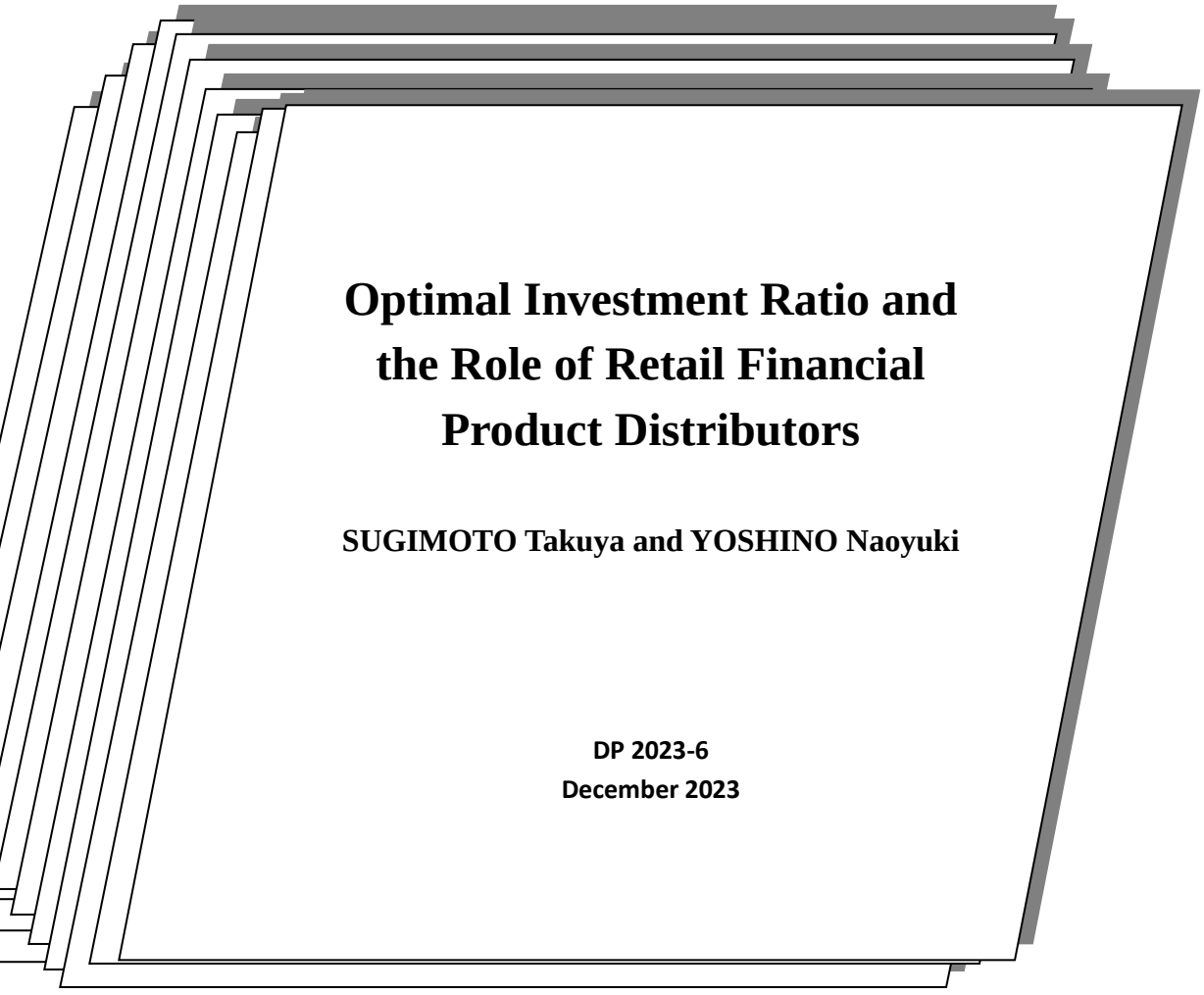

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Optimal Investment Ratio and the Role of Retail Financial Product Distributors

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Summary

The purpose of this paper is to present the role of retail financial product distributors and the importance of individual customers' trust in them in determining individuals' optimal level of investment in risky assets. The following three reasons are often cited for the high savings ratio in Japan in individuals' asset building: (1) Japanese people's inherent tendency to be conservative, (2) low expectations for the profitability of stock investment after the collapse of the bubble economy, and (3) in recent years, low financial literacy. All three reasons suggest, with varying degrees, that individuals are not making rational decisions, as opposed to the assumptions of typical finance models. On the other hand, this paper shows that even when individual customers are rational, if they do not trust distributors, the ratio of investment in risky assets to total investment would decrease. Where distributors try to maximize fee income, if those fees are neither clear nor trustworthy to individuals, the ratio of investment to risky assets will fall below the optimal level as a result of rational decisions by individuals under asymmetric information.

Keywords: fee structure; financial literacy; risk-free asset/risky asset ratio.

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1. Assumptions about Individual Investors

In this paper, we assume that there are two types of individual investors with different degree of rationality. The first type is individuals who have high financial literacy and are highly rational. This type of investors can identify which risky assets they should or should not invest in and select the most appropriate distributor for themselves. Before 2000 in Japan, even if a person had high financial literacy, the choice of distributors and investment methods were limited. However, with the emergence of online securities companies at around 2000, external constraints on investment decreased significantly, and the number of low-cost distributors and product options increased markedly. As a result, highly literate investors can carry out investment in the way they consider optimal. The second type of individuals, on the other hand, may not have sufficient financial literacy to select a distributor or product on their own, and rely on distributors' advice in selecting which financial products to invest in. However, we assume that such investors are rational to the extent that they can make investment decisions taking into account risk and return of products recommended to them. They have little knowledge of financial products and rely on distributors for product selection, but they can, at least, calculate profits and losses. There is information asymmetry in product selection, and individuals in this group are those that make investment decisions with limited information.

Ideally, it would be better to educate the latter type of individuals to also have high financial literacy and to be able to choose distributors and products themselves, like the former type of individuals. However, it may not be very practical to try to shift elderly people with low financial literacy, for example, to the former type because certain costs are incurred to gain financial literacy. For the discussions in this paper, we assume that there remains the latter type of individuals who are rational only to a limited extent.

The Financial Services Agency (FSA) published "Survey Results of Customer Perception on Sales of Risk Financial Products" (June 30, 2021, available in Japanese only), in which individual responses to questions regarding financial literacy level and personal investment are available. There are four questions on financial literacy, and the level of literacy of respondents can be estimated by the accuracy rates of the four questions. As shown below, it is clear that the higher the percentage of correct answers on the financial literacy questions, the higher the proportion of investors using online securities companies and banks. This supports the assumption about individuals in this paper.

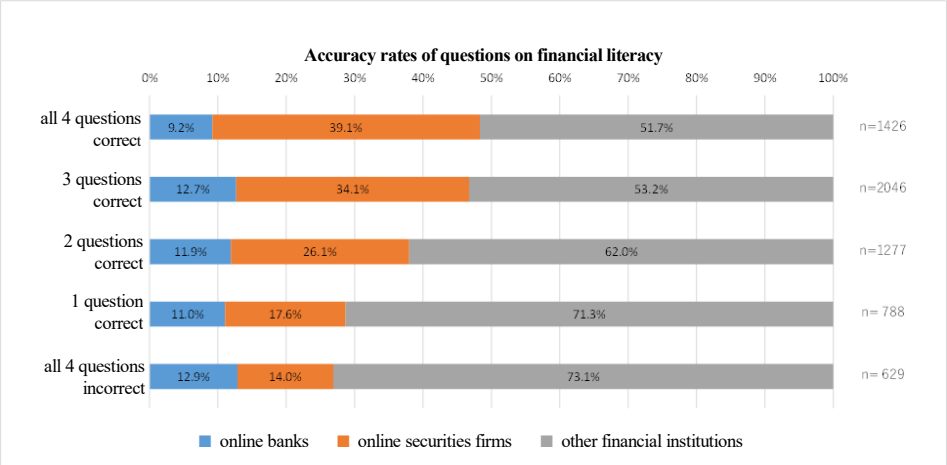


Figure 1: Main financial institutions used for asset management

Source: FSA, "Survey Results of Customer Perception on Sales of Risk Financial Products" (June 30, 2021)

2. Investors' Behavior

We assume an economic model of investor behavior with a simple two period model shown below, for allocation of assets between risk-free assets and risky assets. As risk-free assets, we assume deposits, savings and government bonds, for which returns (r_S) are known with certainty, and we deem that the risk (σ_S) is zero. As for risky assets, returns are r_R and the risk is σ_R. Here, we assume that all purchases of assets are made through distributors, and distributors charge fees when purchase is made, and fees for risk-free assets f_S are assumed to be zero for simplicity, and fees for risky assets is expressed as f_R. For the analysis in this paper, we assume that distributors act only as an intermediary channeling financial products, and that they cannot influence returns on assets (i.e., returns before deducting fees). Assuming that investors allocate a proportion of their total investment to risk-free assets $(1-\theta)$ and a proportion of their total investment (θ) to risky assets, expected returns and expected risks are calculated as follows. We use a utility function that presumes investors' behavior that aims to increase returns (r) from portfolios of risk-free and risky assets after fees, and also reduce risks (σ).

In order to maximize this utility function, the optimal proportion of allocation between risk-free assets and risky assets derived using a single-period model is as follows. The coefficient of investors' degree of risk aversion is expressed as A:

$$U = r - \frac{1}{2}A\sigma^2 \quad (1)$$

$$r = (1-\theta)(r_S - f_S) + \theta(r_R - f_R) \quad (2)$$

$$\sigma^2 = \theta^2(\sigma_R)^2 \quad (3)$$

$$\frac{\partial U}{\partial \theta} = \{(r_R - f_R) - (r_S - f_S)\} - A\theta(\sigma_R)^2 = 0 \quad (4)$$

$$\theta^* = \frac{\{(r_R - f_R) - (r_S - f_S)\}}{A(\sigma_R)^2} \quad (5)$$

The ratio of risk-free assets and risky assets (θ^*) that maximizes investors' utility would be as follows.

(i) The higher the fees for risky assets f_R, the lower the net return on risky assets and hence the smaller the value of θ^*; consequently, greater utility would be realized by allocating more funds to risk-free assets.

(ii) The higher the risk of risky assets σ_R, the smaller the value of $\theta^*$and hence it would be ideal to allocate more funds to risk-free assets.

3. Distributors' Behavior

From distributors' side, their fee income (F) can be expressed by an equation as the sum of fees from risk-free assets and risky assets. As noted above, assuming that no fees are charged on investment in risk-free assets (S), distributors' income will only be fees from risky assets. Distributors would act so as to maximize F.

$$F = (1 - \theta)f_S + \theta f_R = \theta f_R \ \rightarrow \max \quad (6)$$

In what follows, we explain that the behavior of distributors to maximize fee income results in different equilibrium for investment by (i) individuals who have high financial literacy and (ii) those with low financial literacy.

4. Differing Optimal Behavior Due to the Level of Financial Literacy

4.1 Case of rational individual investors with sufficient financial literacy

In the case of rational investors, investors have the ability to select the most appropriate distributors by themselves and this means a relatively competitive environment for distributors. There is no pricing power on the part of distributors and fees are reduced to the marginal cost. Given the current rise of online securities companies, we assume that fees will be reduced to as close to zero as possible ($f_R \cong 0$) and that θ^* at the equilibrium would be somewhere close to P^* in the figure below.

$$\theta^* = \frac{\{(r_R - f_R) - (r_S - f_S)\}}{A(\sigma_R)^2} = \frac{r_R - r_S}{A(\sigma_R)^2} = P^* \ \text{where} f_S = f_R = 0 \quad (7)$$

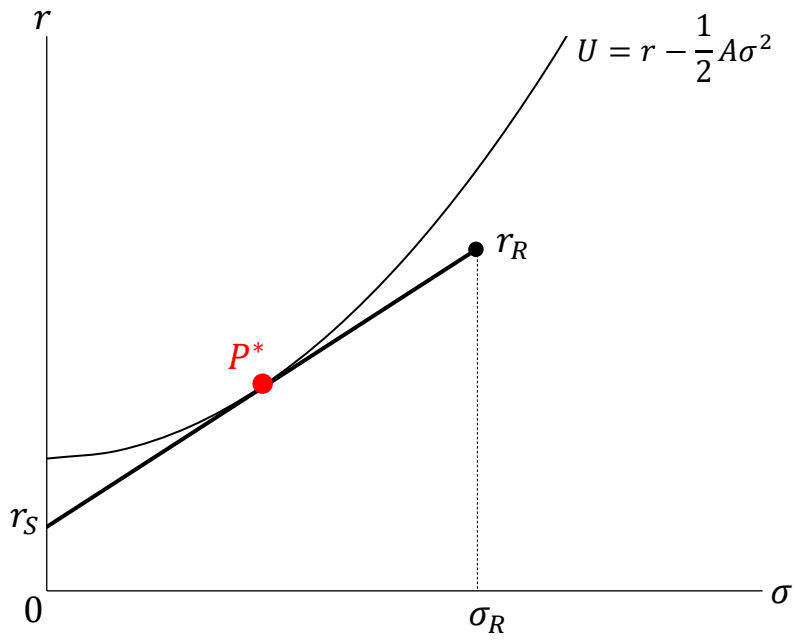


Figure 2: Case of a rational investor with sufficient financial literacy

4.2 Case of individual investors with insufficient financial literacy

Individual investors who have little financial literacy and are rational only in a limited way do not choose financial products or distributors by themselves, and make investment decisions only based on products offered by distributors. This creates an oligopolistic market structure, where distributors having price control power can set fees, and investors try to maximize utility taking as given that f_R is deducted from return on risky assets. Therefore, θ^* is a function of f_R, and distributors set $f_R{}^*$ to maximize the formulae below. Here, the key point to note is that distributors have pricing power.

$$F = (1-\theta)f_S + \theta f_R = \theta f_R \quad \text{where } f_S = 0 \tag{8}$$

$$\frac{\partial F}{\partial f_R} = \frac{\partial \theta}{\partial f_R} f_R + \theta = 0 \tag{9}$$

$$\frac{\partial \theta}{\partial f_R} = -\frac{1}{A(\sigma_R)^2} \qquad where\ \theta = \frac{\{(r_R - f_R) - r_S\}}{A(\sigma_R)^2} \tag{10}$$

Thus, $f_R{}^*$ that maximizes distributors' fee income F is expressed as follows:

$$\frac{\partial F}{\partial f_R} = -\frac{1}{A(\sigma_R)^2} f_R + \frac{\{(r_R - f_R) - r_S\}}{A(\sigma_R)^2} = 0 \tag{11}$$

$$f_R{}^* = \frac{r_R - r_S}{2} \tag{12}$$

In other words, distributors' optimal behavior is to charge half of the excess return on risky assets relative to risk-free assets. In this case, the allocation ratio to risky assets (P^{**}) is calculated as follows by substituting $f_R{}^*$ into the equation on θ.

$$\theta = \frac{\{(r_R - f_R{}^*) - r_S\}}{A(\sigma^R)^2} = \frac{r_R - r_S}{2A(\sigma_R)^2} = P^{**} \quad < P^* \tag{13}$$

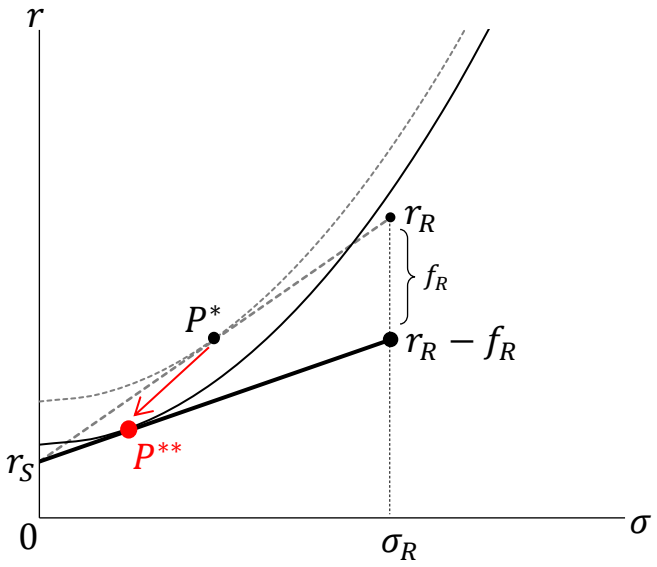


Figure 3: Retail investors with insufficient financial literacy

From investors' perspective, portfolio allocation to risky assets at point P^{**} will be cut in half compared to P^* because net return from risky assets will be reduced by fees. Equation 10 shows the relationship between the size of θ (allocation ratio to risky assets) and the size of f_R (fee ratio). The larger the fee ratio on risky assets, the lower the net return for investors. Therefore, θ decreases according to the risk tolerance in the denominator.

Total fee income F is calculated by multiplying the fee rate f_R by the allocation ratio to risky assets, as shown below.

$$F = \theta f_R = \frac{f_R\{(r_R - f_R) - r_S\}}{A(\sigma_R)^2} = \frac{\{f_R(r_R - r_S) - (f_R)^2\}}{A(\sigma_R)^2} \tag{14}$$

This equation shows how fee income F changes depending on the level of fee rate f_R. As shown in the figure below, fee income initially increases in accordance with an increase in the fee rate. However, as the rate of investment in risky assets decreases, this effect grows gradually, and an increase in the fee rate leads to a decrease in income when f_R exceeds a certain value. Thus, we expect a bell-shaped curve

where there is the "optimal commission" (f_R in below figure) that maximizes fee income of a distributor. Here, we express the optimal fee income as F^*.

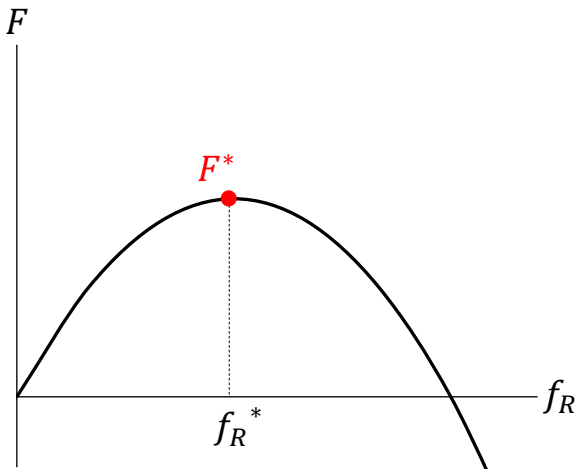


Figure 4: Relationship between fee income F and fee rate f_R

4.3 Where distributors' fees are not disclosed

In some cases, distributors do not disclose their fees, or disclose only partially in an attempt to make them look small. Because disclosure regulations narrowly define "fees," there are some items that distributors deduct from investment performance and record as their revenues, but that are not disclosed to investors. In this paper, they are collectively referred to as "fees" regardless of whether or not they are disclosed.

According to the FSA's "Quantitative data on distributors of investment trusts and other assets" (available in Japanese only) published on June 30, 2022, products for which distributors' fees are not sufficiently disclosed accounted for approximately 30-50%[1] of risky financial products[2] sold by domestic banks and securities companies between fiscal years 2017 and 2021. Such products are mainly structured bonds and lump-sum insurance policies. Even for standard investment trusts, while its investment management fees are disclosed in advance, there are some expense items for which investors can see its actual amount only after investment is made.

Although investors may reasonably estimate such undisclosed costs, their estimates are subject to uncertainty as fees set by distributors are not disclosed in advance. In this case, fee is a random variable from the viewpoint of investors.

In developing a model on investor behavior, we assume that investors anticipate expected value ($\mathrm{E}[f_R]$) and variance ($(\sigma_f)^2$) for f_R, the random variable fee. For simplicity, we assume that expected fee f_R is uncorrelated with returns on risky assets r_R. Various factors can affect investors' process of

[1] See P.2 of the Data Book.
[2] Risk financial products include single-premium policies, investment funds, fund wrap programs and bonds.

expectation formation of fees, but to compare with 4.2 above, we assume that the expected value is equal to equilibrium at which distributors maximize their fee revenues, as shown below:

$$\mathrm{E}[f_R] = f_R{}^* = \frac{r_R - r_S}{2} \tag{15}$$

On the investor side, the uncertainty of fees is a risk, which is added to the risk of underlying risky asset itself, so the ratio of investment in risky assets would decrease. The equilibrium point in this case is point P^{***} in the figure below, where the investment ratio in risky assets is even lower than at P^{**} in 4.2.

$$P^{***} = \frac{r_R - r_S}{2A\left\{(\sigma_R)^2 + (\sigma_f)^2\right\}} \quad < \quad P^{**} \tag{16}$$

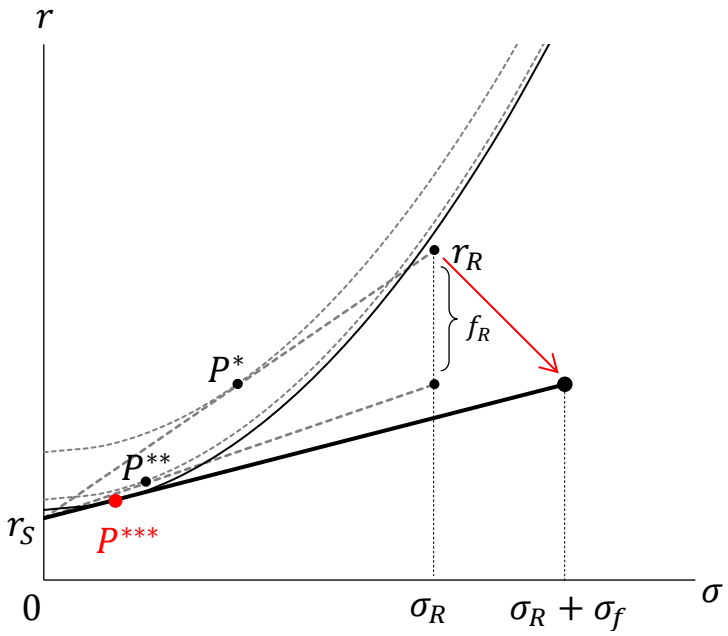


Figure 5: Case where fees are not disclosed by distributors

Compared to the case of 4.2 in which investors do not have uncertainty about fees, this is not an optimal balance point for neither investors nor distributors. For investors, asset allocation is not optimal (i.e., not maximizing utility), and for distributors profit maximization is not achieved ($F^{**} < F^*$) as indicated by the following equation.

$$F^{**} = P^{***}\mathrm{E}[f_R] = \frac{f_R{}^*(r_R - r_S)}{2A\left\{(\sigma_R)^2 + (\sigma_f)^2\right\}} = \frac{(r_R - r_S)^2}{4A\left\{(\sigma_R)^2 + (\sigma_f)^2\right\}} \quad < \quad F^* \tag{17}$$

5. How to Motivate Distributors to the Same Direction as Investors?

If distributors' fees are set in a way that they depend on the utility function of investors, distributors and investors will share the same objective. In this case, distributors will charge fees according to the level of utility. At the time distributors sell risky assets to investors, distributors will learn about investors' degree of risk aversion (β), and will charge γ^{**}, which is fees dependent on the equation below. γ^{**} shall be an exogenous value, which is a constant that cannot be manipulated by distributors for their own revenue maximization.

Commission revenues for distributors: $F = (\gamma^{**})\phi[E(r_t) - \beta(\sigma_{Rt})^2]$ (18)

If such a fee structure is taken, distributors will also aim to maximize the utility function as investors do.

6. Numerical Examples

Using actual data for Japan, we estimate risk-aversion coefficient of retail investors in Japan and examine possible impact of parameter changes on the risky asset allocation ratio.

According to Family Income and Expenditure Survey (savings and liabilities) by the Ministry of Internal Affairs and Communications, the average amount outstanding of savings and assets by type of assets for families (households with two or more members) in 2020 and 2021 was as follows.

Table 1: Outstanding amount of households' financial holdings by type of assets

Amount (thousand yen)	Savings (amount outstanding)	Securities	Stocks	Mutual funds	Bonds
2020	1,791	240	123	80	29
2021	1,880	295	152	102	33

Composition	Savings (amount outstanding)	Securities	Stocks	Mutual funds	Bonds	Stocks and mutual funs
2020	100.0%	13.4%	6.9%	4.5%	1.6%	11.3%
2021	100.0%	15.7%	8.1%	5.4%	1.8%	13.5%

Source: "Family Income and Expenditure Survey Results" (2020 and 2021), Statistics Bureau, Ministry of Internal Affairs and Communications

We set the ratio of risky asset allocation (θ) at 12%, which is around the mid-point of the percentage of stocks and mutual funds held by households in 2020 and 2021.

Expected return and risk of risky assets are calculated by substituting the actual return and volatility of the Tokyo Stock Price Index (TOPIX, including dividends) over the past 20 years.

Table 2: Monthly data from October 2002 to September 2022

	TOPIX (including dividends)
Average annual return: r_R	6.9%
Volatility (annual rate): σ_R	17.0%
Variance (annual): $(\sigma_R)^2$	2.9%

Source: Bloomberg

Note: Risk-free interest rate (r_S) is assumed to be 0% for simplicity.

The annual rate of fees (f_R) for distributors is calculated by referring to fees for investment trusts. Fees are composed of two parts: investment management fee and sales commission. First, for the management fee part, we use an annual rate of 1.54%, which is the average expense ratio for active funds according to "Progress Report on Enhancing Asset Management Business 2022" published by the FSA. As for sales commission, we use data in "Quantitative data on distributors of investment trusts and other assets" (June 30, 2022), also published by the FSA, in which sales commission and average investment period by type of financial institutions (major banks, regional banks, major securities firms) are provided. Based on these data, we calculate annual rate for commission as shown in the table below, and add up with trust fees to obtain annualized rate of distributors' fees.

Table 3: Annual Rates of Distributor Fees

	Sales commission (fiscal 2021) (A)	Average holding period (fiscal 2021) (B)	Annual Sales Commission (A/B)	Trust fees	Total annualized fees
Major banks	1.47%	4.6 years	0.32%	1.54%	1.86%
Regional banks	1.96%	3.4 years	0.58%		2.12%
Major securities firms, etc.	2.37%	3.8 years	0.62%		2.16%

Source: FSA, "Progress Report on Enhancing Asset Management Business 2022" (May 27, 2022), "Survey Results of Customer Perception on Sales of Risk Financial Products" (June 30, 2021).

For f_R, we use "2.1%" because major banks and major securities firms account for three quarter of the total outstanding balance of investment trusts, as indicated in "Quantitative data on distributors of investment trusts and other assets" (June 30, 2022, available in Japanese only).

Based on these data, we estimate risk aversion coefficient (A) in Equation 5 and obtain 13.8 as shown below.

$$A = \frac{[(r_R - f_R) - r_S]}{\theta(\sigma_R)^2} = \frac{[(6.9\% - 2.1\%) - 0\%]}{12\% \cdot 2.9\%} = 13.8 \qquad (19)$$

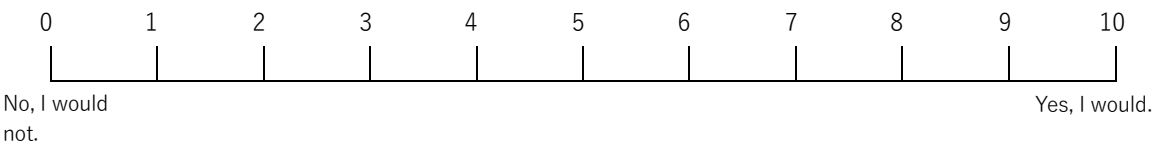
Based on the estimated value of the risk-aversion coefficient, the allocation ratio θ to risky assets according to various combinations of r_R and f_R is shown below.

Table 4: Allocation ratio to risky assets

Change in θ		f_R						
		0.5%	1.0%	1.5%	2.0%	2.1%	2.5%	3.0%
r_R	5.0%	**11.1%**	**9.9%**	**8.7%**	**7.4%**	**7.2%**	**6.2%**	**5.0%**
	5.5%	**12.4%**	**11.1%**	**9.9%**	**8.7%**	**8.4%**	**7.4%**	**6.2%**
	6.0%	**13.6%**	**12.4%**	**11.1%**	**9.9%**	**9.7%**	**8.7%**	**7.4%**
	6.5%	**14.9%**	**13.6%**	**12.4%**	**11.1%**	**10.9%**	**9.9%**	**8.7%**
	6.9%	**15.9%**	**14.6%**	**13.4%**	**12.1%**	**11.9%**	**10.9%**	**9.7%**
	7.0%	**16.1%**	**14.9%**	**13.6%**	**12.4%**	**12.1%**	**11.1%**	**9.9%**
	7.5%	**17.3%**	**16.1%**	**14.9%**	**13.6%**	**13.4%**	**12.4%**	**11.1%**
	8.0%	**18.6%**	**17.3%**	**16.1%**	**14.9%**	**14.6%**	**13.6%**	**12.4%**
	8.5%	**19.8%**	**18.6%**	**17.3%**	**16.1%**	**15.9%**	**14.9%**	**13.6%**

6.1 Validation through data

We examine difference in the level of investors' reliance on distributors depending on investor attributes, using questionnaire data of the "Survey Results of Customer Perception on Sales of Risk Financial Products," (June 30, 2021). This survey asks respondents the question "If you are going to purchase risky financial products more in the future, would you like to purchase them from the financial institution you are currently using? Please answer on a scale of 0 to 10, where 0 is 'no, I would not' and 10 is 'yes, I would'." This question was asked to respondents with investment experience.



As we can obtain data on the type of distributors that respondents use, we assume that those using online financial institutions to be "highly literate individuals" and others as "less literate individuals," and analyzed the influence of product recommendation by financial institutions on their willingness to purchase risky financial products by regression analysis that introduced an interaction term as a dummy variable indicating whether online institutions are used or not. We tested the hypothesis that "willingness of individual investors using online distributors to buy risky financial products is not affected by the quality of distributors' product recommendation, while willingness of individuals who are not using online financial institutions to buy risky products depends on the quality of product recommendation." The dependent variable is the answer to Question 50 of the survey (0-10), and the explanatory variables are as follows:

(i) D: Dummy variable for the use of online financial institutions

The dummy variable takes the value one when investors use online financial institutions, and zero otherwise.

(ii) A: Total financial assets

In Question 3 of the survey, respondents answered the value of their financial assets, including deposits, but not including risky financial products. A numerical value was allocated to each answer as follows:

0: No assets (JPY 0)
1: JPY 1 to less than JPY 3 million
2: JPY 3 million to less than JPY 5 million
3: JPY 5 million to less than JPY 10 million
4: JPY 10 million to less than JPY 20 million
5: JPY 20 million to less than JPY 30 million
6: JPY 30 million to less than JPY 50 million
7: JPY 50 million to less than JPY 100 million
8: JPY 100 million or more

The larger the assets held, the greater the purchasing power of risky financial products. Therefore, we assume a positive value for this coefficient. Respondents had the option to choose "not willing to answer," but samples that chose this response are excluded.

(iii) R: responses to Question 22 concerning risk appetite

Question 22 is "What are your basic view about risk and return in relation to asset management?" A numerical value was allocated to each answer as follows:

0: No specific view

1: Prefer an investment approach where expected return is small and possibility of loss is low
2: Prefer an investment approach where both expected return and possibility of loss are moderate
3: Prefer an investment approach where expected return is high and possibility of loss is also high

We assume a positive value for this coefficient.

(iv) DxR: interaction term of R above and the dummy variable on the use of online institutions

If the risk appetite of online investors and non-online investors are different, they inherently take different purchase behaviors, so the coefficient of this interaction term would become significant.

(v) E: Investor evaluation of the quality of product recommendation by financial institutions in Question 35.

A numerical value from the response to Question 35 (on a scale of four) is used.

1: "Very useful"
2: "Fairly useful"
3: "Not really useful"
4: "Not useful at all"

We assume that the quality of financial institutions' product recommendation affects investors' willingness to invest, and so we assume a negative value for this coefficient.

(vi) DxE: Interaction term of E above and the dummy variable on the use of online financial institutions

We test the hypothesis that online investors are less likely to be affected by their evaluation of financial institutions, in terms of their willingness to buy. If the hypothesis is correct, the coefficient of this interaction term will be positive so as to cancel the negative coefficient of E, and the sum of the coefficient of E and the coefficient of this interaction term would be close to zero.

We conduct estimates based on the following equation using 5,115 individual responses with no missing data in neither the dependent variable nor the independent variable.

$$Y = \beta_0 + \beta_1 D + \beta_2 A + \beta_3 R + \beta_4 (D \times R) + \beta_5 E + \beta_6 (D \times E) + \varepsilon \qquad (20)$$

Online investors are:

$$Y = (\beta_0 + \beta_1) + \beta_2 A + (\beta_3 + \beta_4) R + (\beta_5 + \beta_6) E + \varepsilon \qquad (21)$$

Others are:

$$Y = \beta_0 + \beta_2 A + \beta_3 R + \beta_5 E + \varepsilon \quad (22)$$

The result of the estimates is as follows:

Table 5: Regression results

Regression statistics	
Multiple correlation R	0.441
Coefficient of determination R2	0.194
Adjusted R2	0.193
Standard error	2.540
Number of observations	5,115

	Factor	Standard error	t	P-Value
β_0	7.28	0.18	40.1**	0.000
$\beta_1 D$	-0.14	0.27	-0.5	0.617
$\beta_2 A$	0.11	0.02	6.1**	0.000
$\beta_3 R$	0.49	0.05	9.0**	0.000
$\beta_4 (D \times R)$	-0.07	0.08	-0.8	0.396
$\beta_5 E$	-1.09	0.06	-17.6**	0.000
$\beta_6 (D \times E)$	0.96	0.09	10.4	0.000

First, the dummy variable (D) on online investors is not statistically significant. Since the dummy variable is also used for the interaction terms, we believe that it is not possible to identify the contribution of this factor alone.

As for asset holdings value (A) and risk appetite (R), they are statistically significant as signs to the coefficients were as we expected for both. The interaction term for R is not statistically significant, and it seems that risk appetite does not differ by the use of online financial institutions or not.

The evaluation (E) of financial institutions' product recommendation has a minus sign, as expected, and is statistically significant. Since the absolute value of the coefficient is so large, it seems to have a strong impact. On the other hand, the interaction term of E has a plus sign and is statistically significant, and the sum of both coefficients is close to zero. This supports the hypothesis that investor evaluation of financial institutions' product recommendation has little impact on investors using online

financial institutions, while investor evaluation of product recommendation greatly affects willingness of investors not using online financial institutions to purchase financial products.

7. Conclusion

This paper explains that distributors' fee structures are not necessarily consistent with the utility maximization behavior of investors, and that when distributors try to maximize fee income, investors' portfolio allocation to risky assets may be understated compared to the level at which utility is maximized. If distributors' fees are set taking into account the utility function of investors $\{E(r) - \beta(\sigma_R)^2\}$, the portfolio allocation ratio $(\theta^{**},\ 1-\theta^{**})$ that maximizes distributors' fees is the same as one that maximizes investors' utility, and maximization of investors' utility and distributors' behavior would be aligned. Therefore, if the utility function of investors can be reflected in the fee structure, it would be possible to align the viewpoints of distributors and investors, and to further increase the allocation ratio to risky assets.

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