
FinTech Brings a Bias from Psychology Labs to a Two-trillion-dollar Market

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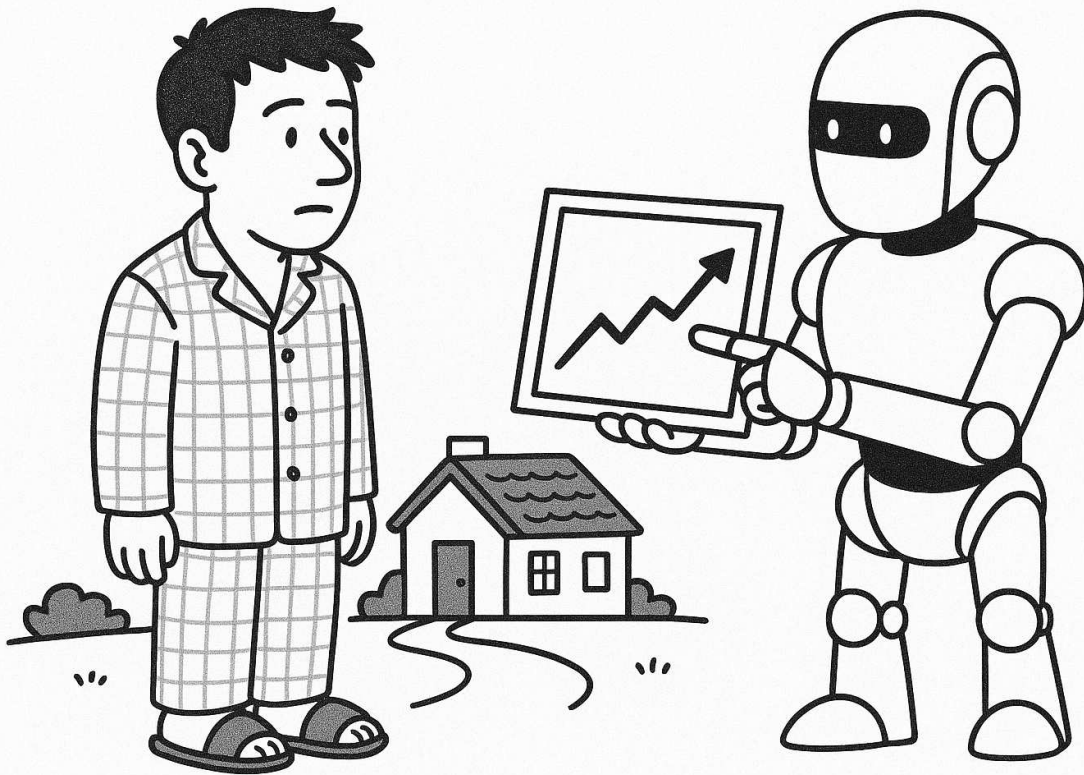
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Personalized services tend to be expensive



Baumol (1967): hard to automate → high costs

Modern Technologies

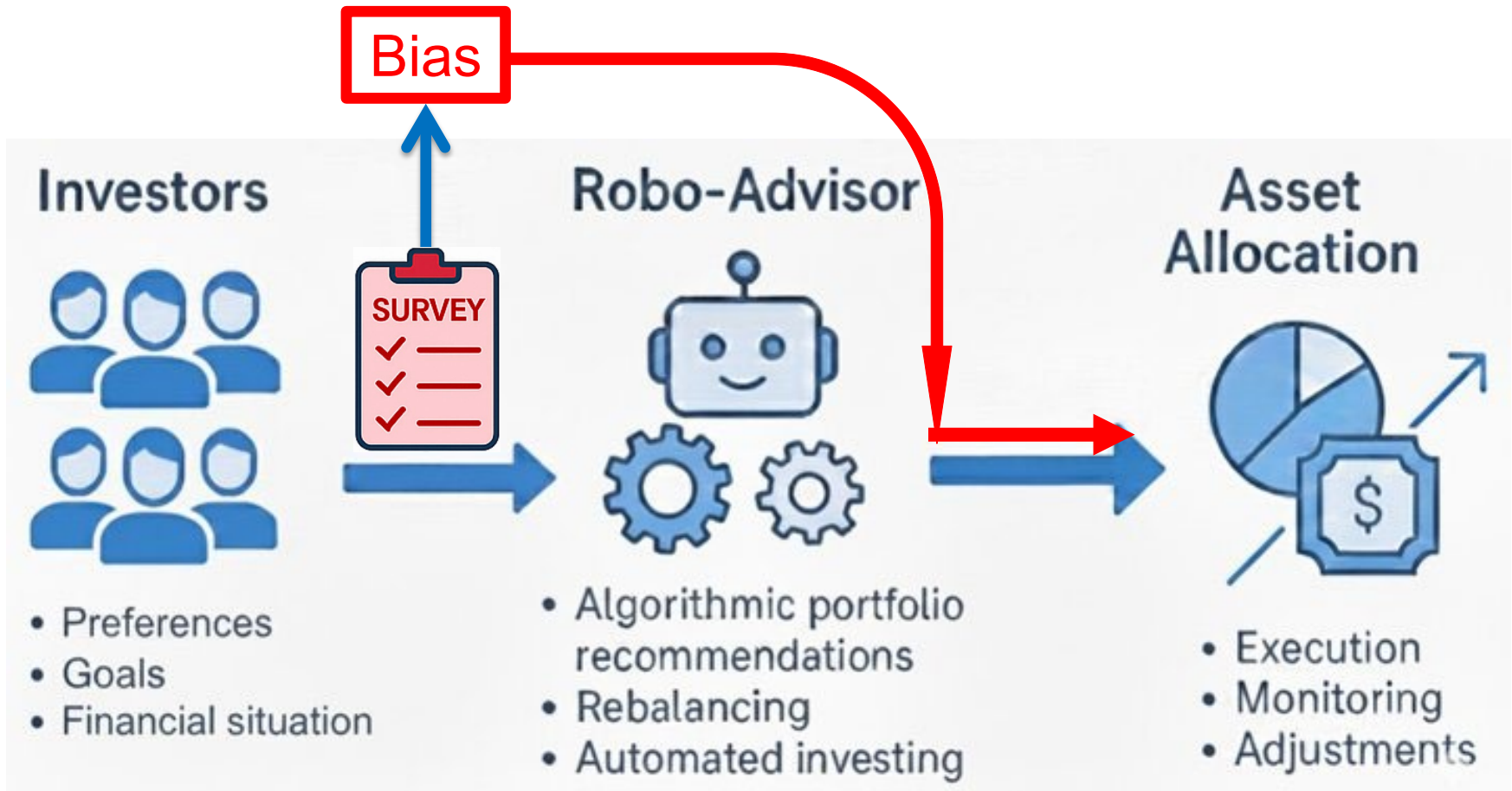


- Financial investments
- Insurance
- Retirement planning
- Housing (rent or buy)
- Career guidance
- Personalized nutrition
- Mattresses

This paper

- Automation may create new challenges
- This paper provides **one example**

\$2 Trillion Robo-advisory Market



Response-order bias

- What is the largest loss you could tolerate in a year?

<i>Original order</i>	<i>Reverse order</i>
-10%	-40%
-20%	-30%
-30%	-20%
-40%	-10%

439 out of 1,550 611 out of 1,576

p -value: 6.29×10^{-10}

Research Questions

1. Does it hold for **robo-advisory questions** and **real investors**?
 2. Does it affect **real investment decisions**?
- **Yes, to both**

Main Results

- **AAll survey (2020):** ~3k affluent experienced US investors
 - Significant effect on **subjective** Qs (**preference, goals**, expectations)
 - No effect on **objective** Qs (age, gender)

- **Pre-registered RCT (2025):** with a robo-advisor in China
 - 10k investors, **RMB150M** purchase during the trial (\$1 = RMB7)
 - Response order affects “risk scores”
 - Affect investment decisions

 - **Implies even stronger effects in the US**

Implications

- Ethical concerns
 - Implications for decision theory
 - Preference parameters are indeterminate
 - Even based on the revealed-preference approach
 - Applicable to other survey-based personalized services
 - The role of FinTech in this setting
 - standardizes bias in large scale
 - similar results in settings with manual surveys
 - Solutions
-

A Preregistered RCT

- A leading robo-advisor in China (Advisor)
 - RMB20 billion AUM; 150k investors in 2024
- Risk assessment survey
 - 11 questions: risk tolerance, income, financial literacy, experience...
 - **Risk score**: 18 to 89
 - **Risk category**: C1, ..., C5
 - New users: must take
 - Existing users: occasionally
- Two types of investment products
 - **Robo-advised**
 - **Self-directed**

RCT Procedure

- Randomization: **Even #, Original; Odd #, Reverse**

- New users:



- Existing users



- **RCT sample**: 7,141 users (5,818 existing + 1,323 new)
- **Placebo sample**: 3,142 users

What is your investment preference?

Original Order

- 4% return with no principal loss
- 6% return with a max 2% loss
- 10% return with a max 7% loss
- 15% return with a max 15% loss
- 30% return with a max 40% loss

Reverse Order

- 30% return with a max 40% loss
- 15% return with a max 15% loss
- 10% return with a max 7% loss
- 6% return with a max 2% loss
- 4% return with no principal loss

Reverse-order users → higher risk scores/categories

Summary Stats

	Original Order		Reverse Order		Difference	<i>s.e.</i>
	Mean	N	Mean	N		
<i>Male*100</i>	58.86	3189	60.47	3251	1.62	1.22
<i>Age (year)</i>	45.68	3189	45.65	3251	-0.04	0.26
<i>NewUser</i>	0.18	3542	0.19	3599	0.01	0.01
<i>InitialScore</i>	49.89	2903	49.47	2915	-0.43	0.54
<i>InitialCategory</i>	3.68	2903	3.65	2915	0.03	0.03
<i>InitialAll (1000 RMB)</i>	308.69	2903	322.94	2915	14.25	17.27
<i>InitialRobo (1000 RMB)</i>	155.16	2903	160.85	2915	5.69	10.87
<i>InitialDirect (1000 RMB)</i>	83.14	2903	92.15	2915	9.01	7.69
<i>Score (post-treatment)</i>	65.19	3542	68.53	3599	3.35	0.31
<i>Category (post-treatment)</i>	4.34	3542	4.50	3599	0.16	0.02
<i>BuyRobo (1000 RMB)</i>	25.70	910	30.14	836	4.44	3.08
<i>BuyDirect (1000 RMB)</i>	49.32	715	58.76	704	9.44	7.54

Order effect: RCT Sample

	Risk Score		Risk Category	
	(1)	(2)	(3)	(4)
<i>Reverse</i>	3.35*** (0.31)	3.12*** (0.28)	0.16*** (0.02)	0.14*** (0.02)
Male		5.00*** (0.30)		0.23*** (0.02)
Age		-0.06*** (0.02)		-0.00*** (0.00)
<i>LnInitialAll</i>		1.91*** (0.11)		0.10*** (0.01)
<i>NewUser</i>		7.34*** (0.74)		0.48*** (0.04)
Constant	65.19*** (0.24)	56.92*** (0.88)	4.34*** (0.01)	3.95*** (0.05)
N	7,141	6,440	7,141	6,440
R-squared	0.02	0.11	0.01	0.08

Distribution by risk levels

	C1	C2	C3	C4	C5	Total
RCT Sample	239	3	18	3149	3732	7141
Original-order	161	1	10	1673	1697	3542
Reverse-order	78	2	8	1476	2035	3599
Placebo Sample	256	0	28	1653	1205	3142

Falsification test: Placebo Sample

	Risk Score		Risk Category	
	(1)	(2)	(3)	(4)
<i>Reverse</i>	0.41 (0.59)	-0.27 (0.62)	0.02 (0.04)	-0.03 (0.04)
Male		3.52*** (0.63)		0.13*** (0.04)
Age		0.17*** (0.03)		0.01*** (0.00)
Constant	61.05*** (0.42)	56.32*** (1.28)	4.12*** (0.03)	4.09*** (0.07)
N	3,142	1,640	3,142	1,640
R-squared	0.00	0.04	0.00	0.01

Two types of investments

■ Self-directed

- ❑ Mutual funds, money market funds, wealth management products...
- ❑ 5 risk categories, R1,...,R5
- ❑ Users invest directly

■ Robo-advised

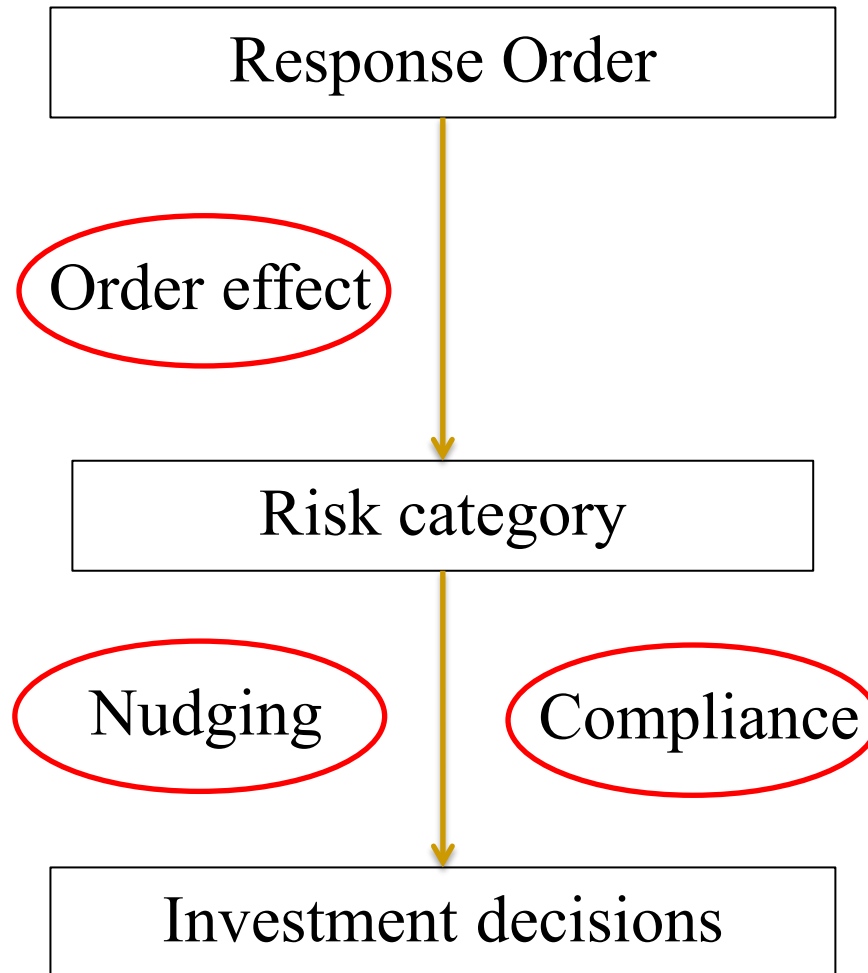
- ❑ “*Aggressive*,” “*Balanced*,” “*Stable*” strategies
- ❑ Target portfolio
- ❑ Special purpose account
- ❑ User authorization for each transaction

- ❑ **More passive** than self-directed investment
- ❑ **US users are even more passive**

Target Portfolio

	<i>Aggressive</i>	<i>Balanced</i>	<i>Stable</i>
<i>Chinese Stocks (%)</i>	35	25	20
<i>U.S. Stocks (%)</i>	12	8	4
<i>Alternative Investments (%)</i>	25	20	10
<i>Money Market Funds (%)</i>	18	12	6
<i>Government Bonds (%)</i>	10	35	60

Mechanism



Nudging Channel

- *“Your risk profile is **“Aggressive.”** Aggressive investors typically seek to achieve above-average returns and have a strong tolerance for market volatility and potential capital losses.”*
 - “Aggressive” is also the name of the strategy.
- If a C4 tries to open an account for the Aggressive strategy
 - Warning
- Can ignore the warning
 - **Can’t** follow all recommendations
- Stronger effect on robo-advised than on self-directed
 - Should be even stronger in the U.S.

Compliance Channel

- Can only buy products at or below one's risk category
 - E.g., A C4 user can buy products R1,..., R4.
 - Cannot buy an R5 product
 - Compliance rules make it easier to fully implement the Aggressive strategy for the reverse-order users.
- **C1 users cannot invest in stocks**
 - 4.5% of original-order users (161 of 3542)
 - 2.2% of reverse-order users (78 of 3599)
 - Survey design changes equity-market access for about 2.3% of users.
 - Once a user is pushed into a higher risk category, the platform literally allows them to buy products they previously could not buy at all.

Robo-Advised Investments: Intensive Margin

	<i>Aggressive</i>	<i>C5</i>	<i>Aggressive</i>
	(1)	(2)	(3)
<i>Reverse</i>	3.28** (1.66)	0.07*** (0.02)	
<i>Male</i>	3.36* (1.80)	0.18*** (0.02)	-4.82 (4.41)
<i>Age</i>	0.11 (0.09)	-0.00 (0.00)	0.14 (0.09)
<i>InitialRobo</i>	0.02*** (0.00)	0.00*** (0.00)	0.01** (0.00)
<i>NewUser</i>	8.92 (8.22)	-0.18 (0.15)	17.02** (8.30)
$\widehat{C5}$			44.26** (22.28)
<i>Residual</i>			8.90*** (1.35)
<i>Constant</i>	-0.26 (4.68)	0.52*** (0.06)	-23.42* (12.39)
Observations	1,746	1,746	1,746
R-squared	0.05	0.05	0.06

Robo-Advised Investments: Extensive Margin

	$DRobo_i$	C5	$DRobo_i$
	(1)	(2)	(3)
<i>Reverse</i>	-0.0254** (0.0105)	0.09*** (0.01)	
<i>Male</i>	0.01 (0.01)	0.17*** (0.01)	0.06** (0.02)
<i>Age</i>	-0.00*** (0.00)	-0.00* (0.00)	-0.00*** (0.00)
<i>LnInitial</i>	0.06*** (0.00)	0.03*** (0.00)	0.07*** (0.00)
<i>NewUser</i>	-0.09*** (0.01)	0.06*** (0.02)	-0.08*** (0.01)
$\widehat{C5}$			-0.30** (0.12)
<i>Residual</i>			0.10*** (0.01)
<i>Constant</i>	0.19*** (0.03)	0.36*** (0.03)	0.29*** (0.06)
Observations	6,440	6,440	6,440
R-squared	0.11	0.05	0.12

Conclusion

- Automation brings order effect to the robo-advisory market
- AAll survey
 - Strong order effect on preferences and expectations
 - Experienced investors
- RCT
 - Risk assessments
 - Real investments
 - Should be stronger in the U.S.
- Ethical concerns, decision theory, solution