

Exploited by Complexity

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July 17, 2020

NBER Summer Institute Household Finance

Motivation

- ▶ More than a trillion dollars of structured financial products have been sold to households over the last decade or so
- ▶ Motives for issuing structured financial products
 - traditional: risk-sharing (Allen et al. 1994; Duffie and Rahi 1995)
 - recent: exploit naive investors via *complexity* (Bordalo et al. 2016)
- ▶ Growing evidence for the exploitation-based view
 - salient headline rates, with risks shrouded (Célérier and Vallée 2017)
 - low or negative returns (Henderson and Pearson 2011; Vokata 2018)
- ▶ **This paper**
 - ① heterogeneous effects on investment performance
 - ② redistributive consequences

- ▶ Example of the hotel industry (Gabaix and Laibson 2006)
 - stay cost: basic room rate + various add-ons (e.g., parking)
 - ▶ hotels lower basic room rates by upcharging add-ons
 - **asymmetry**:
 - ▶ *naive*: pay for over-priced add-ons
 - ▶ *sophisticated*: avoid them and take advantage of the cheap rate
 - a cross-subsidization

- ▶ Analogy for complex financial products
 - a new product with an upside and a downside is introduced
 - ▶ downside: e.g., crash risk
 - issuers make the upside salient and shroud the downside
 - ▶ only the sophisticates know about the downside
 - crash risk goes up: smart ones get out and naive ones suffer
 - ▶ a similar cross-subsidization

► Challenges

- ① many structured products are sold directly by brokers to households
 - brokers misguide their clients into dominated products (Egan 2019)
 - hard to disentangle the effect of product design from broker activities
- ② detailed transaction data of structured products are lacking
 - even harder to make comparisons with *simple* products
- ③ complex products may also have other features
 - difficult to isolate the effect of complexity

► Strategy

- ① **setting:** exchange-traded structured funds in China
 - leveraged funds with *time-varying* leverage and *hidden* clauses
 - exchange-traded setting: little space for aggressive sales tactics
- ② **data:** all exchange-traded products for 3M retail investors
 - compare structured funds against non-structured funds such as ETFs
- ③ **event study:** 2015 market crash triggered a *hidden* feature
 - for 52 funds, their value would shrink by half over a two-day window
 - differential responses to quantify the effect of complexity

Preview of Results

① Performance asymmetry

- on average, an investor broke even from 2014 to 2015
- **asymmetry:**
 - ▶ the largest 1% gained 500 million; the remaining 99% lost 500 million
 - ▶ similar transfers from the naive to the sophisticated
- **population:** a total wealth transfer of 8 to 20 billion RMB

② Comparison with simple ETFs

- little evidence of any ETFs-induced wealth transfer
- the scaling effect of leverage cannot explain the difference

Preview of Results, cont'd

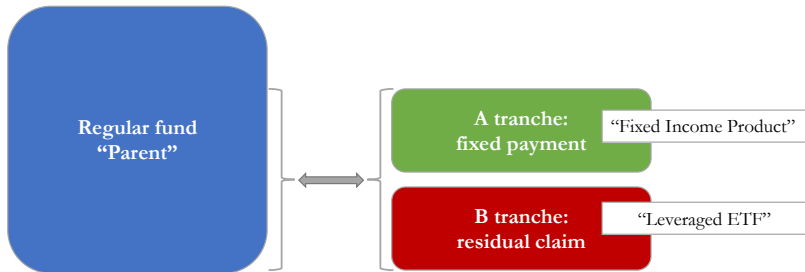
③ Direct evidence (on the effects of complexity)

- rely on the trigger of a hidden feature: **leverage reset**
 - ▶ high leverage → large premium
 - ▶ *too high* → resets to one
 - ▶ after reset, premium disappears, and fund value shrinks by half
- many investors completely ignored these events
 - ▶ differential responses: 25% to 45% of the total wealth transfer
 - ▶ poor, naive investors were left holding the funds when resets hit
- issuers were aware of the risk but chose to shroud it in prospectuses

④ Entry decisions (if time permits)

- participants: extrapolators entered after positive market returns
- attracted by the high “headline” returns, but ignored the risks shrouded by complex features (Bordalo et al. 2016)

Structured Funds: AB Funds



Parent Fund

- Created/redeemed at the broker
- **Not** traded on the exchange
- Pay the net-asset-value (NAV)
- Can be split into A and B shares

A and B Funds

- **Cannot** be created or redeemed
- Traded on the exchange
- Pay market prices, which can deviate from NAV
- Can be merged into parent shares

- All shares are normalized to a per-share NAV of one

Feature I: Time-Varying Leverage

- ▶ B funds → leveraged closed-end funds
 - however, two additional features that make them more *complex*
- ▶ **Example:**
 - with NAV of 200 USD, 100 shares of A and 100 shares of B
 - A tranche annual dividend rate = 8%

Feature I: Time-Varying Leverage

Time	NAV_P	NAV_A	NAV_B	Leverage (NAV_B/NAV_A)
Month 3	1.1	1.02	1.18	0.86
Month 6	1.3	1.04	1.56	0.66
Month 9	0.8	1.06	0.54	1.96
Month 12	0.65	1.08	0.22	4.91

- ▶ when the underlying assets go up (down) in value, leverage goes down (up)

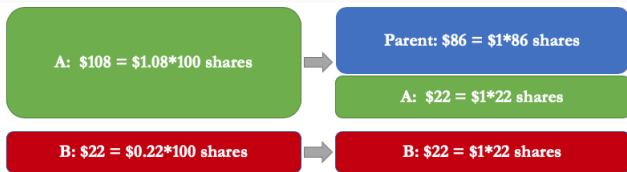
Feature II: Restructuring Clause

Feature II: Restructuring Clause

- ▶ In theory, A is not risk-free
 - if the parent drops by more than 50%, it eats into the A tranche
- ▶ To ensure that A is risk-free
 - if the per-share NAV of B drops below 0.25, funds are restructured
 - NAVs are reset to one for A, B, and the Parent

▶ Example

Time	NAV_P	NAV_A	NAV_B	Leverage
Month 12	0.65	1.08	0.22	4.91

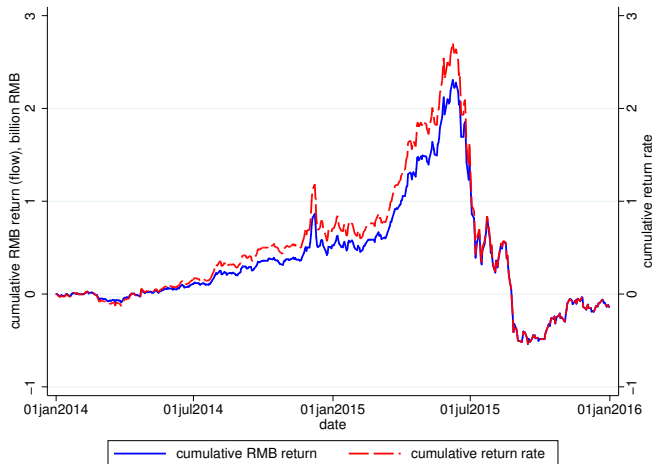


Popularity of B Funds

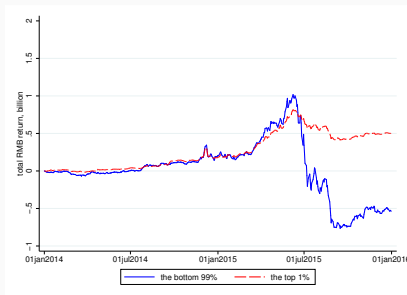
- ▶ In 2015, the Chinese stock market had a dramatic bubble and crash episode
 - rose 100% in six months and crashed
- ▶ B funds became exceedingly popular in the run-up
 - traded by 10% of the active investor population
 - market size comparable to ETFs
- ▶ **Popularity**: embedded leverage
 - Chinese retail investors were (are) leverage-constrained
 - ▶ e.g., minimum 500K for a margin account
 - B funds filled this gap
- ▶ B funds were trading at a large **premium**
 - exceeded 100% in some cases
 - variation mostly explained by leverage (in both TS and CS)

- ▶ **Transaction data:** from a large national brokerage firm in China
 - wide geographic coverage
 - all exchange-listed securities
 - ▶ stocks, ETFs, and structured funds
 - 5% of the entire Chinese investor population
- ▶ **Survey data:** survey responses when opening an account
 - self-reported wealth and sophistication
 - control variables such as risk attitudes and investment horizons

Overview: B Returns



B Returns by Account Size

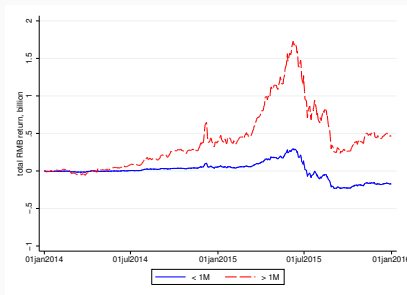


(a) RMB return

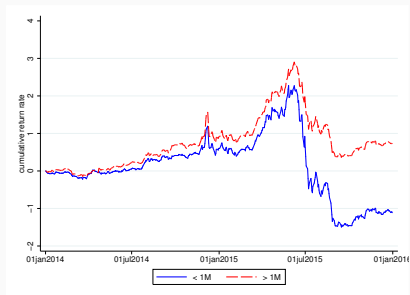


(b) Return rate $\left(\frac{\text{RMB Return}}{\text{Avg Balance}}\right)$

B Returns by Self-Reported Wealth

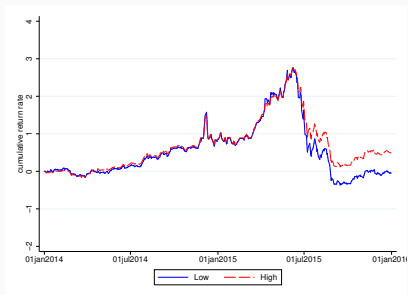


(a) RMB return

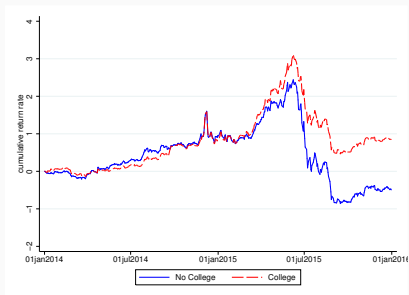


(b) Return rate $\left(\frac{\text{RMB Return}}{\text{Avg Balance}}\right)$

B Return Rates by Sophistication



(a) Self-reported financial literacy

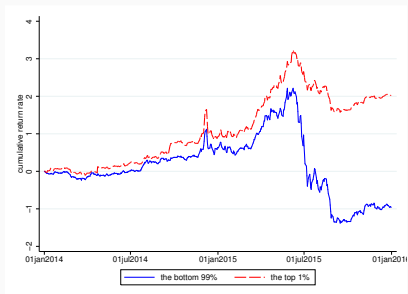


(b) Education

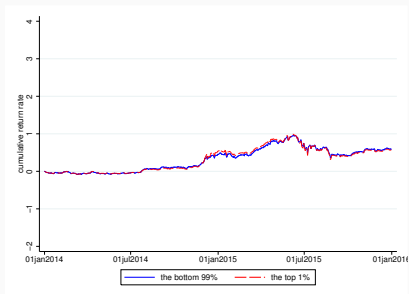
ETFs as Simple Products

- ▶ Ex-ante, it is perhaps not surprising that rich and sophisticated investors do better
- ▶ Our goal is to show that adding *complexity* to simple products widens the return gap
 - **complexity tax**: subsidizes the rich (sophisticated) and taxes the poor (naive)
- ▶ A natural benchmark *without* complexity: simple ETFs
 - virtually hold the same underlying assets
 - both are exchange-traded with ample liquidity
 - market size is also similar around the bubble

Comparing Return Rates by Account Size

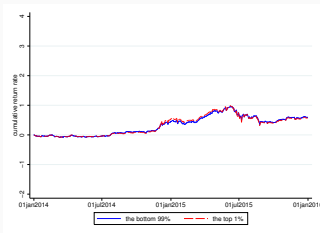


(a) B return rates

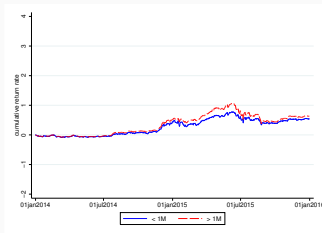


(b) ETF return rates

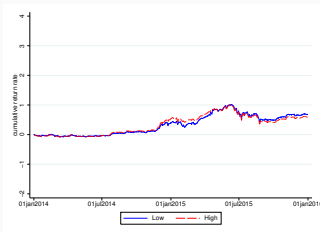
ETF Return Rates by Investor Groups



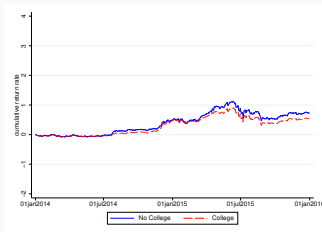
(a) Size



(b) Wealth



(c) Literacy



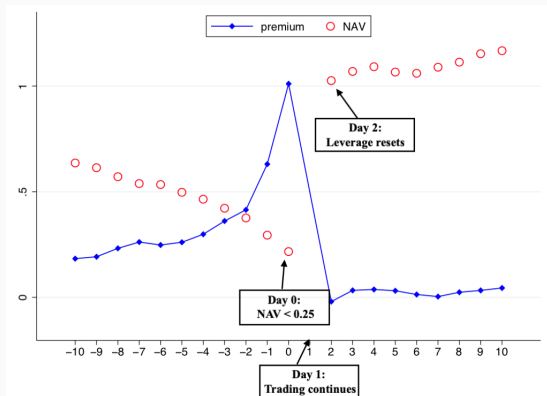
(d) Education

Summary of Findings

- ▶ A sharp contrast between B funds and ETFs
 - cannot be explained by the scaling effect of leverage
 - average leverage was around 1:1
- ▶ However, the effects of leverage may go beyond scaling
 - e.g., leverage could exacerbate behavioral biases (Heimer and Simsek 2019; Heimer and Imas 2020)
 - a more ideal comparison: B funds vs. leveraged ETFs (with a constant leverage)
 - ▶ non-existent in the Chinese market
- ▶ How do we isolate the effects of complexity from leverage?
 - *Feature II: leverage resets* during restructuring events

Overview of Restructuring Events

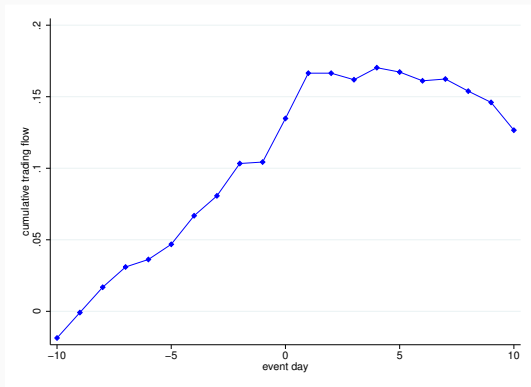
- ▶ **2015 market crash:** out of the 115 funds, 52 had to reset leverage



- ▶ **Example**

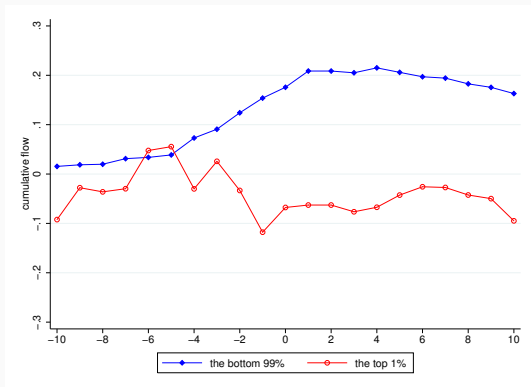
Time	NAV_B	$Price_B$	Shares	Total value
Month 12	0.22	0.44	100	\$44
Post-restructuring	1.00	1.00	22	\$22

Retail Flows During Restructuring Events



- ▶ Investors *increased* their holdings by 13% prior to the trigger
 - another 3% on day 1
 - 400 million RMB wealth vanished when resets hit

Retail Flows by Size Groups



- ▶ Differences in retail flows explain differences in returns
 - leverage resets: 250 million; 21-day window: 450 million
 - 25% to 45% of the total wealth transfer
- ▶ Similar results for groups sorted on wealth, literacy, and education
 - albeit with a similar magnitude

Behaviors of Other Participants

▶ **Brokers (issuers)**

- discussion about risk is buried in lengthy prospectuses
 - ▶ average prospectus length: 130-pages
 - ▶ discussion about risk starts on page 86
- issuers were aware of the risk associated with restructuring
 - ▶ based on their discussion about leverage-induced premium
- however, they chose not to disclose it explicitly
 - ▶ out of 115 funds, only **three** explicitly disclose this risk

▶ **Institutional investors**

- they almost completely liquidated prior to leverage resets
 - ▶ only a few dozen institutional investors in our data
 - ▶ but their behavior is sufficiently telling

▶ **Alternative explanations**

- rational gambling
- liquidity provision
- liquidity shocks
- reluctance to realize losses (the disposition effect)
- inattention
- ...

▶ None of them can explain our results

Entry Decisions: Regression Specification

- ▶ For individuals i that have *not* purchased B funds as of month $m - 1$

$$\text{Dummy}_{i,m}^B \times 100 = \alpha + \Theta \times \text{Determinants}_{i,m-1} + \epsilon_{i,m}$$

- $\text{Dummy}_{i,m}^B$: 1 if i trades B in month m and 0 otherwise
- $\text{Determinants}_{i,m-1}$: account characteristics up to month $m - 1$, constructed from transactions of individual stocks
 - ▶ extrapolation
 - ▶ trading experience
 - ▶ gambling preference
 - ▶ prior returns
 - ▶ ...
- ▶ In other words, we examine what factors triggered people to start investing in B funds

Entry Decisions: Regression Results

	(1)	(2)	(3)
Market return, in %	0.091*** (0.018)	0.044*** (0.013)	0.057*** (0.015)
Extrapolation		-0.000 (0.008)	-0.003 (0.006)
Market return, in % × Extrapolation		0.344*** (0.067)	0.301*** (0.062)
Have a margin account, dummy			0.001** (0.001)
Experience in stocks			-0.001*** (0.000)
Account size, log			0.001*** (0.000)
Traded warrants before			0.004*** (0.001)
Return rate, in %			0.021*** (0.006)
Volatility			0.008 (0.012)
Skewness			0.000 (0.000)
Turnover			0.000 (0.000)
Survey responses	NO	NO	YES
Observations	4,541,691	4,541,691	2,520,409
R-squared	0.002	0.004	0.006

Discussion: Policy Implications

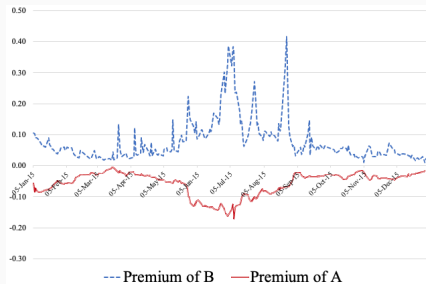
- ▶ **Prior literature:** interaction between brokers and households
 - implications about the regulation of broker conduct
- ▶ **This paper:** exchange-traded setting
 - naive investors may self-select into these products
 - implications about product design and investor education
- ▶ In the U.S.,
 - the pool of exchange-traded assets has expanded dramatically
 - ▶ leveraged ETNs, inverse ETFs, etc.
 - apps like Robinhood make them more accessible to retail investors
 - no clear evidence that they help investor welfare
 - ▶ contributed to personal bankruptcies in the pandemic (“Individual Investors Get Burned by Collapse of Complex Securities”, *WSJ*)
- ▶ Our evidence presents a cautionary tale for policy makers
- ▶ Post-events, the China Securities Regulatory Commission
 - halted the issuance of new structured funds
 - placed a higher barrier to entry for new investors

Conclusion

- ▶ There is a growing literature that examines the welfare implications of structured financial products, and we contribute to this literature in two ways
 - ① existing work focuses on the *average* effect
 - we document a heterogeneous effect and redistributive consequences
 - ② existing work shows that naive investors are tricked by brokers
 - we show they can also be exploited by the design of the product itself
- ▶ Implications of complexity
 - a form of tax (subsidy)
 - a contributor of cross-subsidization
 - ▶ and, perhaps, wealth inequality
 - a source of retail sub-optimal performance

Why Was the B Premium Not Corrected?

- ▶ Failure of the main arbitrage mechanism
 - B shares *cannot* be redeemed or created directly
- ▶ Arbitrageurs would have to create parent shares, split them into A and B shares, and sell them on the exchange
 - the entire process could take up to 2-3 days to complete
- ▶ A shares were substantially underpriced
 - they could hold on to them, but prices could drop even more



Comparison with ETF Returns: Regressions

	Return Rate $e_i = \beta_0 + \beta \cdot \text{Dummies}_i + \epsilon_i$		
	B Fund Return	ETF Return	B Fund Return
	(1)	(2)	(3)
Wealth (>1M)	0.010** (0.004)	0.005 (0.005)	0.010** (0.004)
Size (top 1%)	0.035*** (0.011)	0.013 (0.011)	0.035*** (0.011)
Financial literacy (good)	0.019*** (0.004)	-0.008 (0.005)	0.019*** (0.004)
College	0.015*** (0.004)	-0.000 (0.004)	0.015*** (0.004)
Female	0.003 (0.004)	0.018*** (0.004)	0.003 (0.004)
Experienced with B	0.097*** (0.004)	0.009* (0.005)	0.097*** (0.004)
ETF return			0.041 (0.033)
Observations	17,567	3,341	17,567
R-squared	0.032	0.007	0.032