Leveraging Overconfidence

Brad Barber, UC Davis

Xing Huang, Wash U St. Louis

K. Jeremy Ko, NORC at the University of Chicago*

Terry Odean, UC Berkeley

Cherry Blossom Financial Education Institute

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*The views expressed in this paper and presentation are those of the authors and not necessarily those of NORC at the University of Chicago.

Overconfidence and Trading

No problem in judgment and decision making is more prevalent and more potentially catastrophic than overconfidence. --- Plous, 1993

- Theoretical research has shown that overconfident investors:
  - trade excessively | diversify less | perform worse

  [Odean (1998) | Gervais and Odean (2001) | Caballe and Sakovics (2003)]
- Empirical research has shown that retail investors:
  - trade excessively | perform poorly

  [Barber and Odean 2000, 2001 | Grinblatt and Keloharju 2009]

Contribution

We demonstrate that overconfident investors tend to use leverage using three methodologies:

- Theory:
  - Overconfidence increases use of leverage and trading volume
  - Overconfident investors (i.e., retail investors) perform worse when trading against better informed and calibrated investors (i.e., institutional investors)
  - Investors with more precise information use leverage and trade more, but perform better

- Survey Data Analysis:
  - 2015 Investor Survey by FINRA Investor Education Foundation
  - Respondents with higher overconfidence in investment/financial knowledge are more likely to report using margin and having margin accounts

- Brokerage Data Analysis:
  - Trading and Account Data from Large Discount Broker 1991-96
  - Margin account holders and users trade more and perform worse than cash investors

Summary of Empirical Results

		Motivation for Margin Use	
Data Source	Finding	Overconfidence	Information
Survey	Margin investors are more overconfident than other investors	✓	✗
Brokerage	Margin investors trade more and speculate more	✓	✓
Brokerage	Margin Investors perform worse than cash investors	✓	✗

We DO NOT claim

- All investors are overconfident.
- Only the overconfident use margin.

We DO claim

- Overconfidence can increase the use of margin.
- Overconfidence-motivated margin use likely hurts performance

IMPORTANCE

- Leverage and overconfidence:
  - From market participant's perspective: wealth damaging, welfare loss
    - 67% of individual investors aged 18-34 have traded using margin or options during COVID-19 pandemic
  - From aggregate market's perspective: liquidity, bubble and crash, market contagion
    - Use of leverage in asset management and systemic risk: e.g., LTCM
    - Housing Bubble and Overconfidence
      (Cheng, Raina, and Xiong, 2014)
    - 2015 Chinese stock market bubble and crash
      (Hansman, Hong, Jian, Liu and Meng, 2019 | Bian, Da, Lou and Zhou, 2019 | Bian, He, Shue and Zhou, 2018)

Adding Leverage to Models of Overconfidence

- Typical model setup
  - Investor receives a noisy signal regarding asset value
  - Well-calibrated investors (e.g., institutional): know the precision of their signal ["know what they actually do"]
  - Overconfident investors (e.g., retail): overestimate the precision of their signal ["think they know more than they actually do"]

- Add: a budget constraint & the ability to borrow

- Predictions: our model predicts the following associations with overconfidence and precision

	Overconfidence	Info Precision
Margin	+	+
Turnover	+	+
Profit	–	+

Survey Data Analysis

National Financial Capability Study (FINRA Foundation)

- 2015 State-by-State Survey (500 adults/state)
  - Nationally-representative sample of 27,564 American adults
- 2015 Investor Survey (2000 adults with non-retirement investment accounts)
  - A separate follow-up survey
- Our sample
  - 1601 investors from investor survey

Self-assessment, Knowledge, Overconfidence

- Knowledge
  - Investment literacy quiz (10 Q) and financial literacy quiz (6 Q)
  - Convert to percentile ranks [0,1]
- Self-Assessment
  - On a scale from 1 to 7, where 1 means very low and 7 means very high, how would you assess your overall knowledge about investing? (or overall financial knowledge?)
  - Convert to percentile ranks [0,1]
- Overconfidence measures
  - Overconfidence = self-assessment – knowledge
    (based on investment or financial knowledge)

Investment Literacy Quiz

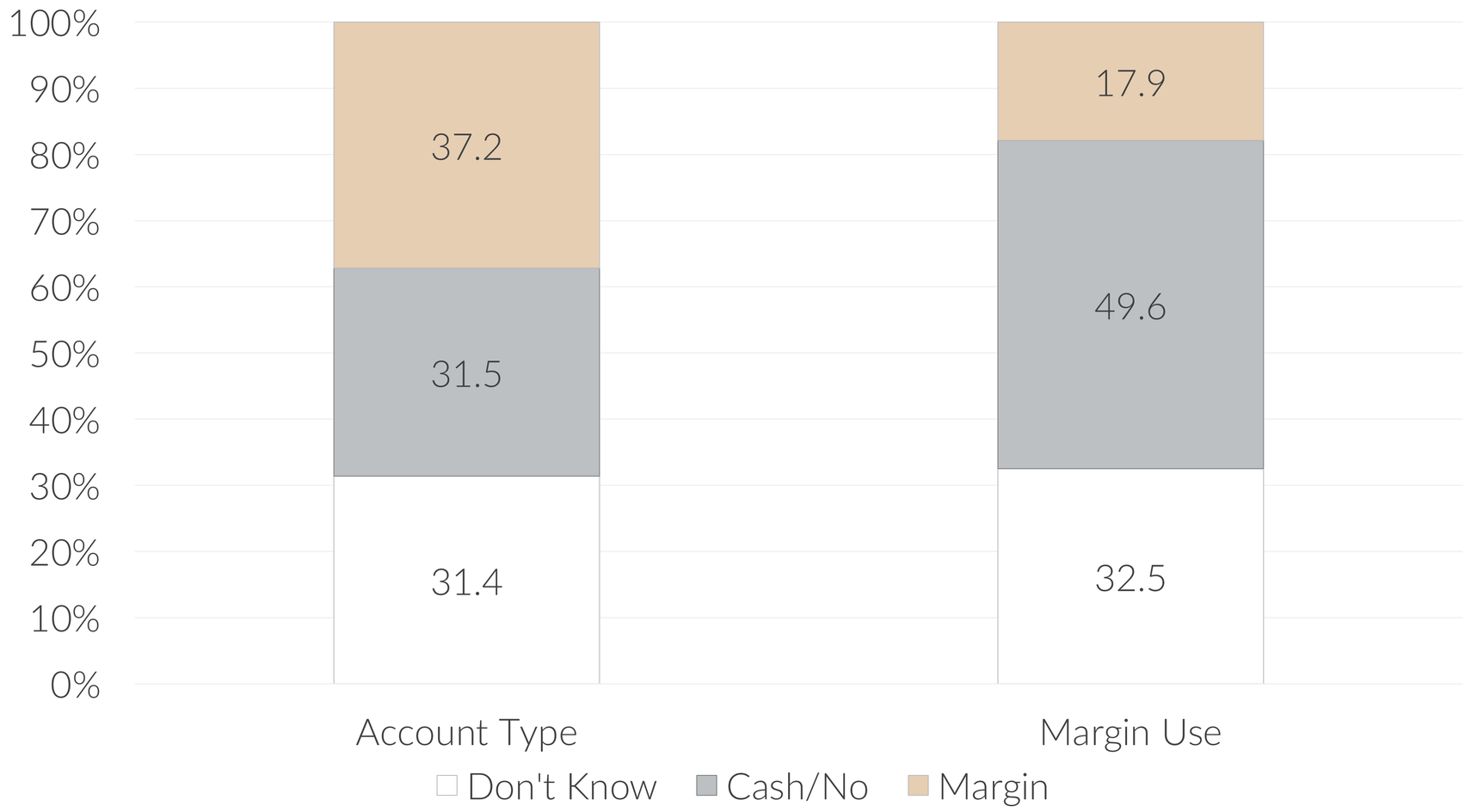
1. If you buy a company's stock…
   - You own a part of the company
   - You have lent money to the company
   - You are liable for the company's debts
   - The company will return your original investment to you with
2. If you buy a company's bond…
   - You own a part of the company
   - You have lent money to the company
   - You are liable for the company's debts
   - You can vote on shareholder resolutions
3. If a company files for bankruptcy, which of the following securities is most at risk of becoming virtually worthless?
   - The company's preferred stock
   - The company's common stock
   - The company's bonds
4. In general, investments that are riskier tend to provide higher returns over time than investments with less risk.
   - True
   - False
5. Over the last 20 years in the US, the best average returns have been generated by:
   - Stocks
   - Bonds
   - CDs
   - Money market accounts
   - Precious metals
6. What has been the approximate average annual return of the S&P 500 stock index over the past 20 years (not adjusted for inflation)?
   - -10%
   - -5%
   - +5%
   - +10%
   - +15%
   - +20%
7. Which of the following best explains the distinction between nominal returns and real returns?
   - Nominal returns are pre-tax returns; real returns are after
   - Nominal returns are what an investment is expected to earn;
   - Nominal returns are not adjusted for inflation; real return
   - Nominal returns are not adjusted for fees and expenses; real
8. Which of the following best explains why many municipal bonds pay lower yields than other government bonds?
   - Municipal bonds are lower risk
   - There is a greater demand for municipal bonds
   - Municipal bonds can be tax-free
9. You invest $500 to buy $1,000 worth of stock on margin. The value of the stock drops by 50%. You sell it. Approximately how much of your original $500 investment are you left with in the end?
   - $500
   - $250
   - $0
10. Which is the best definition of 'selling short?'
    - Selling shares of a stock shortly after buying it
    - Selling shares of a stock before it has reached its peak
    - Selling shares of a stock at a loss
    - Selling borrowed shares of a stock

Margin Question

You invest $500 to buy $1000 worth of stock on margin. The value of the stock drops by 50%. You sell it. Approximately how much of your original $500 investment are you left with in the end?

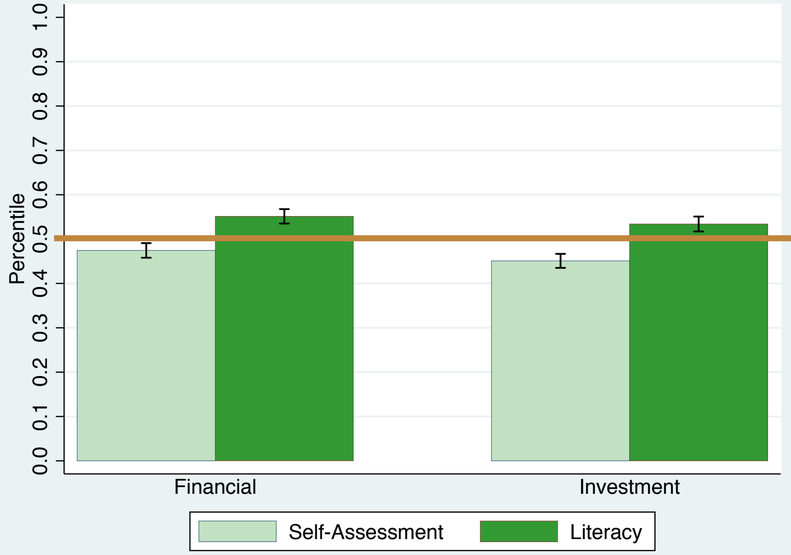
- $500
- $250
- $0

The availability and use of margin

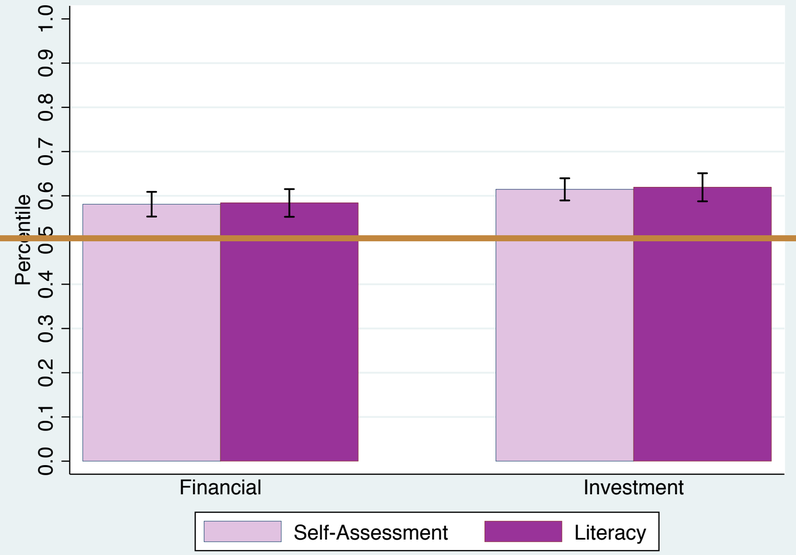


Knowledge vs. Self-assessment

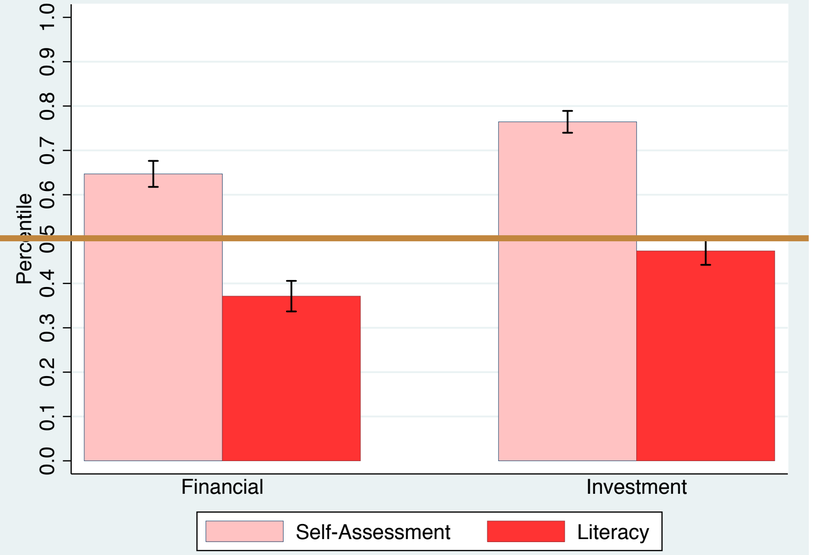
Cash and Margin Investors



cash accounts



margin accounts
but no margin experience



margin trading experience

Does overconfidence affect margin availability?

Overconfidence and margin accounts

	(1)	(2)
Panel A: Overconfidence in Investment Literacy (Overconfidence = self-assessment – knowledge)		
Overconfidence	0.217***	0.444***
	(0.036)	(0.046)
Knowledge		0.431***
		(0.058)
Observations	1,601	1,601
R-squared	0.251	0.276
Panel D: Control Variables		
Demographic	YES	YES
Risk and Trust	YES	YES

Respondents with the highest levels of overconfidence had a 69% or greater chance of having a margin account (versus 37% of respondents in the sample who had margin accounts).

Does overconfidence affect margin use?

Overconfidence and margin experience

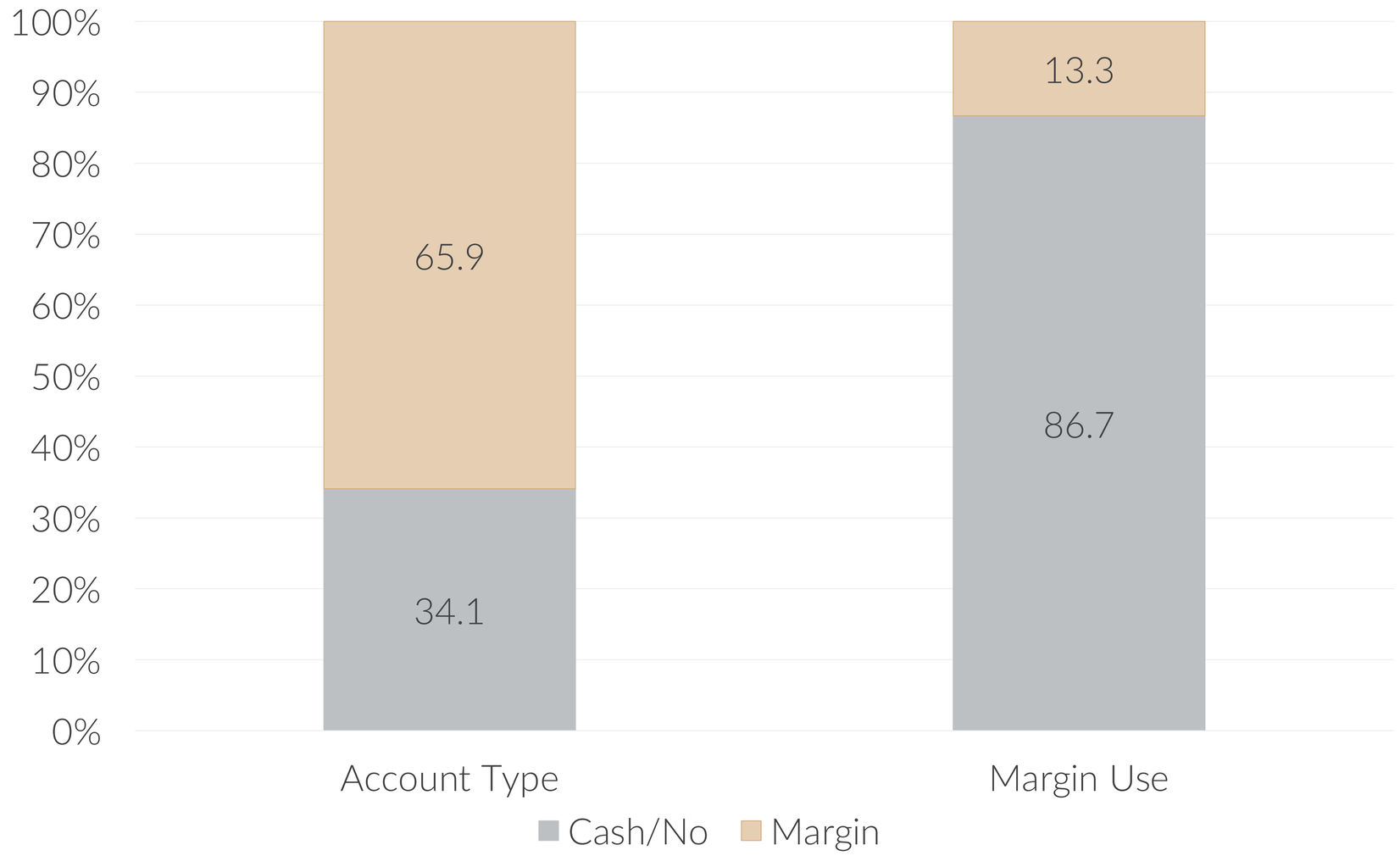
	(1)	(2)
Panel A: Overconfidence in Investment Literacy (Overconfidence = self-assessment – knowledge)		
Overconfidence	0.257***	0.322***
	(0.062)	(0.091)
Knowledge		0.115
		(0.121)
Observations	595	595
R-squared	0.296	0.297
Panel D: Control Variables		
Demographic	YES	YES
Risk and Trust	YES	YES

Respondents with the highest levels of overconfidence had a 71% or greater chance of using margin (versus 48% of respondents in this sample who used margin).

Broker data analysis

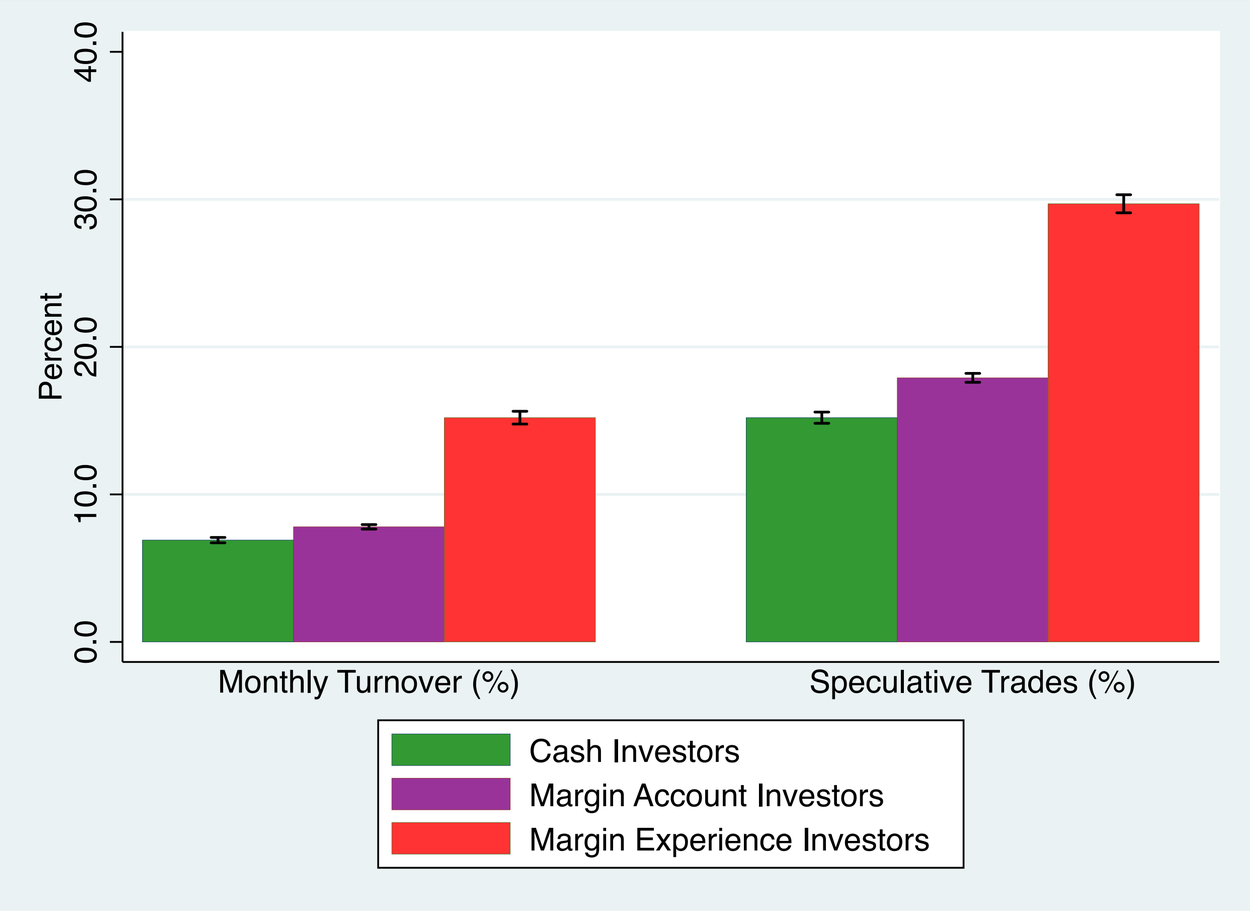
- 1991-1996 Discount Broker Data
  - 68,000 households and 158,000 accounts
  - Trades & monthly position data
  - Demographic (household) data for a subset of investors
- Our Sample: 43,000 households that
  - Have a non-retirement account
  - Have only one type of account, cash or margin
  - Make at least one trade during the sample period
- Margin Experience
  - We cannot identify the use of margin directly.
  - Margin experience are households who short or use options.

The availability and use of margin



Trading activities

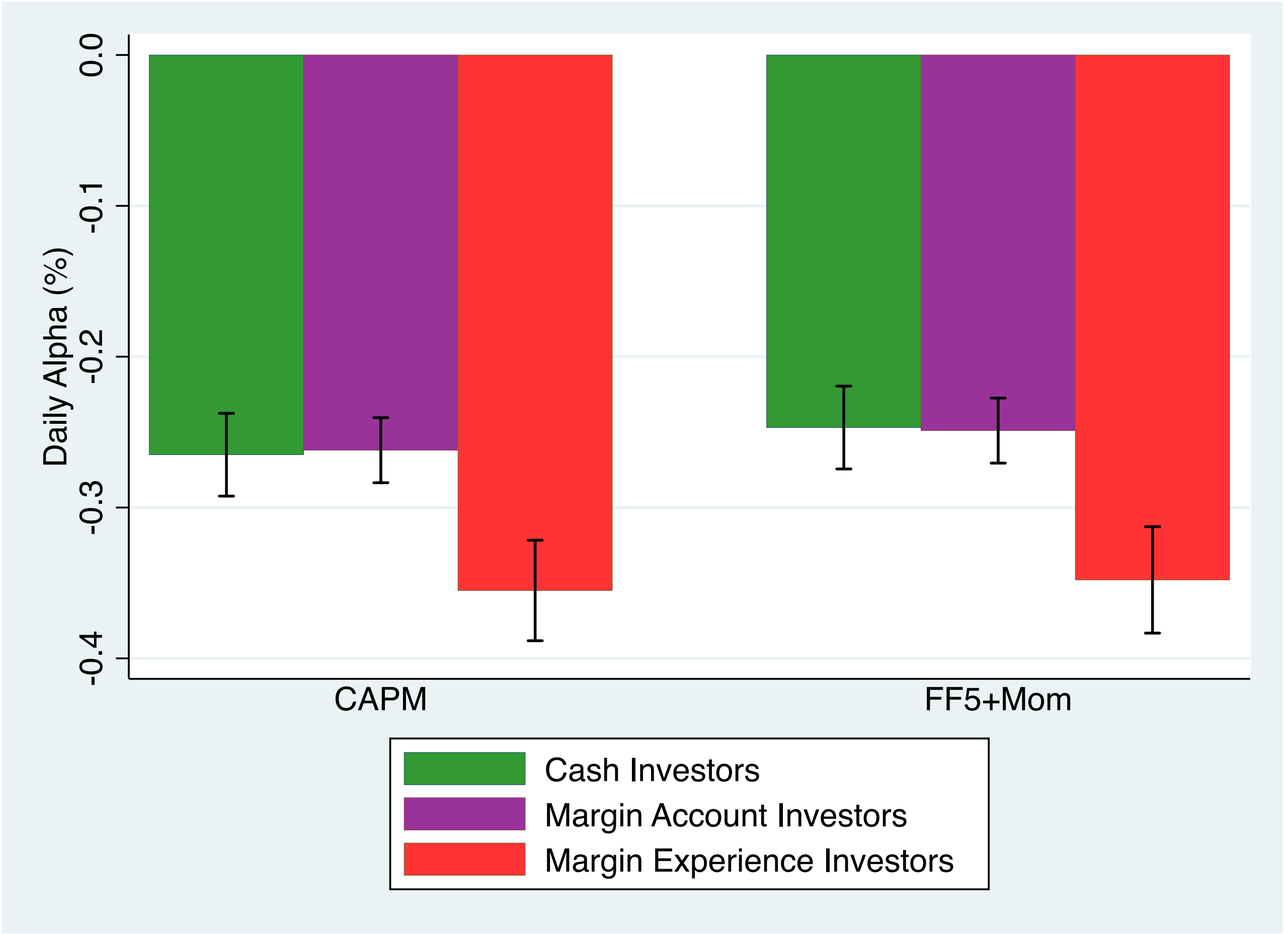
Cash vs. Margin Investors



- Cash accounts turn over 6.9% per month (82.9% per year) while margin users turn over their portfolios 15.2% per month (182.9% per year).
- 15.2% of trades in cash accounts are speculative, while 29.6% of trades in the accounts of margin users are speculative.

Analysis of Performance

Calendar-time analysis



Worse performance in margin experience group

→ trades of margin users do 10 bps worse per day than cash/non-users, losing 35 bps per day

→ inconsistent with information-based story

Analysis of Performance

Event-time analysis

	(1)	(2)	(3)	(4)
	Returns following buys		Returns following sells	
Dep. Var.:	$R^b(0,3)$		$R^s(0,3)$	
cash (Intercept)	-0.424***	n.a.	0.722***	n.a.
	(0.047)		(0.047)	
marginacc	0.0526*	0.0621**	0.0747**	0.0758**
	(0.030)	(0.030)	(0.033)	(0.033)
marginexp	-0.0249	-0.0326	0.359***	0.361***
	(0.033)	(0.032)	(0.067)	(0.065)
Investor Controls	No	Yes	No	Yes
Observations	675,490	675,490	578,714	578,714

Conclusion

- In theory, overconfidence:
  - increases the use of margin | increases trading | hurts performance
- In survey data, overconfidence:
  - increases the probability of having a margin account and using margin.
- In broker data, margin users:
  - trade more and speculate more
  - perform worse
- Leverage :
  - can improve market efficiency when used by the informed and well-calibrated
  - might hinder market efficiency when investors leverage their mistaken beliefs
  - might damage investors' wealth and welfare

Issues: Regulation & Practice

- Would margin investors benefit from greater protections or education?

- NFCS Investor Survey:
  - 15% of margin traders answered margin question correctly, compared to 31% of non-margin traders.
  - 4.3% of margin traders responded either “do not know” or “prefer not to answer”, while 18.3% of non-margin traders did.

- Standard margin disclosures (FINRA Rule 2264):
  - You can lose more funds than you deposit in the margin account.
  - The firm can force the sale of securities or other assets in your account(s) (without contacting you).
  - The firm can increase its "house" maintenance margin requirements at any time and is not required to provide you advance written notice.

Possible Remedies

Can any of the following interventions improve outcomes for retail margin traders?

- Educational Interventions
- Gates and warnings
- Account eligibility standards

These issues and interventions might also apply to other leveraged or risky investments.

Table 5, Cash v. Margin Acct v. Margin Exp

	Margin Account Status, Full Sample						Margin Experience, Margin Account Holders					
	Cash Account		Margin Account		Difference		No Margin Exp.		Margin Exp.		Difference	
	Mean	N	Mean	N	Mean	t-stat	Mean	N	Mean	N	Mean	t-stat
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel B: Demographic Variables												
college	0.620	1006	0.671	595	0.050	2.03	0.686	309	0.654	286	-0.032	-0.84
nonwhite	0.145	1006	0.303	595	0.157	7.69	0.278	309	0.329	286	0.050	1.34
man	0.530	1006	0.666	595	0.136	5.36	0.686	309	0.643	286	-0.043	-1.10
married	0.687	1006	0.704	595	0.017	0.73	0.699	309	0.710	286	0.011	0.29
child_dum	0.299	1006	0.534	595	0.235	9.60	0.392	309	0.689	286	0.297	7.59
Age_35-54	0.298	1006	0.382	595	0.083	3.44	0.350	309	0.416	286	0.067	1.67
Age_55+	0.580	1006	0.353	595	-0.227	-8.98	0.492	309	0.203	286	-0.289	-7.72
Port_50-250	0.359	1006	0.343	595	-0.016	-0.65	0.282	309	0.409	286	0.128	3.30
Port_250+	0.325	1006	0.415	595	0.090	3.64	0.463	309	0.364	286	-0.099	-2.46
Panel C: Risk and Trust Variables												
Willingness to Take Risk:												
High	0.051	1006	0.222	595	0.171	10.76	0.081	309	0.374	286	0.293	9.18
Above Ave.	0.263	1006	0.447	595	0.184	7.67	0.430	309	0.465	286	0.035	0.85
Average	0.586	1006	0.309	595	-0.277	-11.13	0.456	309	0.150	286	-0.306	-8.53
No Risk	0.586	1006	0.309	595	-0.277	-11.13	0.456	309	0.150	286	-0.306	-8.53
Stock Allocation:												
>50% Stock	0.569	1006	0.706	595	0.137	5.52	0.654	309	0.762	286	0.109	2.92
<50% Stock	0.377	1006	0.284	595	-0.093	-3.79	0.327	309	0.238	286	-0.089	-2.42
No Stock	0.055	1006	0.010	595	-0.045	-4.53	0.019	309	0.000	286	-0.019	-2.38
TrustMkt	6.888	1006	7.775	595	0.887	8.88	7.476	309	8.098	286	0.622	4.06
TrustReg	5.263	1006	6.361	595	1.099	9.33	5.548	309	7.240	286	1.692	8.68

Trading and Margin Users

	(1)	(2)	(3)	(4)
Dep var:	Turnover		Speculative Trade	
Cash Account	0.0691***	n.a.	0.152***	n.a.
(Intercept)	(0.001)		(0.002)	
Margin Account	0.00910***	0.00787***	0.0269***	0.0271***
	(0.001)	(0.001)	(0.002)	(0.002)
Margin Experience	0.0742***	0.0724***	0.118***	0.117***
	(0.002)	(0.002)	(0.003)	(0.004)
Investor Controls	No	Yes	No	Yes
Observations	43143	43143	43143	43143
R-squared	0.044	0.052	0.036	0.041

- Cash accounts turn over 6.9% per month (82.9% per year) while margin users turn over their portfolios 15.2% per month (182.9% per year).
- 15.2% of trades in cash accounts are speculative, while 29.6% of trades in the accounts of margin users are speculative.

Trading by Margin Account Status (Table 8, Panel A)

	Cash		Margin		Diff	
Variable	Mean	N	Mean	N	Diff	t-stat
turnover	0.069	14,716	0.093	28,427	0.024	19.72
spec_trade	0.152	14,716	0.202	28,427	0.051	21.15
PGRtoPLR	1.733	4,947	1.967	14,355	0.234	8.37
portsize ($000)	35.158	14,716	54.932	28,427	19.774	10.88

Trading by Margin Experience (Table 8, Panel A)

	No Margin Exp.		Margin Exp.		Diff	
Variable	Mean	N	Mean	N	Diff	t-stat
turnover	0.078	22,691	0.152	5,736	0.074	31.76
spec_trade	0.179	22,691	0.297	5,736	0.118	33.83
PGRtoPLR	1.87	10,334	2.215	4,021	0.345	8.84
portsize ($000)	49.028	22,691	78.288	5,736	29.26	4.00

Demographics by Margin Account Status (Table 8, Panel C)

	Cash		Margin		Diff	
Variable	Mean	N	Mean	N	Diff	t-stat
man	0.867	9,708	0.894	17,481	0.027	6.41
age	51.066	9,308	49.447	16,697	-1.62	-9.19
married	0.744	8,613	0.703	15,443	-0.041	-6.88
child_dum	0.235	11,085	0.222	20,513	-0.013	-2.71
knowledge	2.492	4,539	2.635	10,717	0.143	10.23
experience	2.566	4,422	2.780	10,293	0.214	16.55
income ($000)	73.039	9,739	74.69	17,584	1.651	3.81
wealth ($000)	238.17	4,439	256.75	10,769	18.586	2.23

Demographics by Margin Experience (Table 8, Panel C)

	No Margin Exp.		Margin Exp.		Diff	
Variable	Mean	N	Mean	N	Diff	t-stat
man	0.888	14,107	0.918	3,374	0.03	5.64
age	49.616	13,466	48.74	3,231	-0.876	-3.42
married	0.706	12,464	0.691	2,979	-0.016	-1.66
child_dum	0.223	16,513	0.217	4,000	-0.006	-0.79
knowledge	2.592	8,343	2.787	2,374	0.196	9.39
experience	2.709	8,033	3.030	2,260	0.321	17.58
income ($000)	74.671	14,179	74.768	3,405	0.097	0.15
wealth ($000)	244.11	8,368	300.81	2,401	56.707	4.30

Analysis of performance

Overconfidence-motivated vs. Information-based

- Event-time analysis
  - For each trade, calculate mean market-adjusted return

$$R^b(0,h) = \prod_{t=0}^{h}(1+r_{it}) - \prod_{t=0}^{h}(1+r_{mt})$$

- Calendar-time analysis
  - Construct long-short portfolio that mimics trades of investors

Analysis of Performance

Calendar-time analysis

	(1)	(2)	(3)	(4)	(5)	(6)
	Buy		Sell		Buy - Sell	
	CAPM alpha	FF5+Mom alpha	CAPM alpha	FF5+Mom alpha	CAPM alpha	FF5+Mom alpha
Panel A: Follow trades and hold to day t+3: (0,3)						
(1) Cash investors	-0.0905***	-0.0610***	0.175***	0.186***	-0.265***	-0.247***
	(0.015)	(0.014)	(0.011)	(0.010)	(0.014)	(0.014)
(2) Margin account without exp.	-0.0785***	-0.0465***	0.184***	0.202***	-0.262***	-0.249***
	(0.016)	(0.015)	(0.012)	(0.010)	(0.011)	(0.011)
(3) Margin account with exp.	-0.0940***	-0.0586***	0.261***	0.289***	-0.355***	-0.348***
	(0.018)	(0.016)	(0.019)	(0.018)	(0.017)	(0.018)
(2) - (1)	0.0120	0.0144*	0.00901	0.0165*	0.00302	-0.00206
	(0.009)	(0.009)	(0.009)	(0.009)	(0.012)	(0.012)
(3) - (2)	-0.0155*	-0.0121	0.0773***	0.0872***	-0.0928***	-0.0993***
	(0.009)	(0.009)	(0.014)	(0.015)	(0.017)	(0.018)
(3) - (1)	-0.00345	0.00238	0.0863***	0.104***	-0.0898***	-0.101***
	(0.011)	(0.011)	(0.017)	(0.017)	(0.020)	(0.020)