

Stock Ownership and Learning from Financial Information

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- the majority of people in the U.S. and Europe do not invest in the stock market (Campbell (2006), Calvet et al. (2007)), which results in lower wealth accumulation and consumption over the life span (Mankiw and Zeldes (1991))
- perhaps due to insufficient provision of financial services to those willing to invest
- perhaps due to a lack of understanding of financial markets (Grinblatt et al. (2011), Van Rooij et al. (2011), Haushofer and Fehr (2014))

- we test a specific mechanism that could lead people to have incorrect beliefs about the outcomes of stock investments, which in turn could change their willingness to participate in equity markets
- using behavioral and brain imaging data, we test whether people's ability to learn from new financial information may mistakenly depend on their prior investment choices, in a manner that would make those not currently holding stocks to be more pessimistic about the potential outcomes of these risky assets, and thus less willing to invest

Connection to the prior literature

- implicit assumption in finance: market participants are able to learn the same way from new information about available investments, irrespective of the composition of their portfolio
- while theoretical work has shown that previous portfolio choices may influence investors' *utility function* (Barberis, Huang & Santos (2001), Barberis & Xiong (2012)), it is possible that these prior choices might also change investors' *beliefs* or the learning rules they use to incorporate financial market news
- recent evidence (Kuhnen & Knutson (2011)) suggests that people may update beliefs such that they are consistent with their prior investment choices

Do prior investment choices influence people's ability to learn from new financial information?

If so, what are the brain mechanisms underlying this effect?

- brain imaging experiment
- 46 male participants
- age: 40.08 ± 6.53 years, range 29-49 years
- recruited in Bonn, Germany

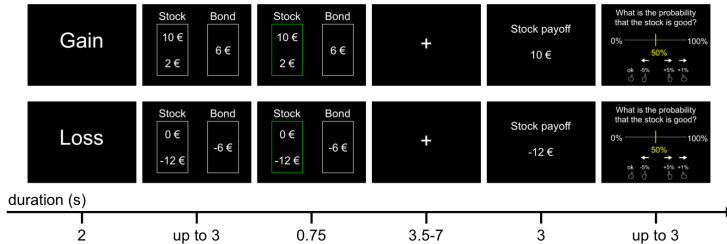
Investment Task: based on Kuhnen (2014)

- subjects made 96 decisions to invest in one of two securities: a stock with risky payoffs coming from one of two distributions, one better than the other, and a bond with a known payoff
- after each choice subjects provided an estimate of the probability that the risky security was paying from the better distribution
- subjects paid based on their investment payoffs and the accuracy of the probability estimates provided

Condition		Stock Payoffs	Bond Payoff	#Blocks
Gain	Low variance	+ €10 or + €2	+ €6	4
Gain	High variance	+ €12 or + €0	+ €6	4
Loss	Low variance	- €10 or - €2	- €6	4
Loss	High variance	- €12 or - €0	- €6	4

- 16 blocks of 6 trials each. Learning problem changed at the beginning of each new block of 6 trials.
- in each condition, the stock was either Good or Bad. If Good, it paid the high dividend with 70% probability each trial. If Bad, it paid the high dividend with 30% probability each trial
- in the beginning of each block of 6 trials, it was equally likely that the stock will be Good or Bad

Trial examples

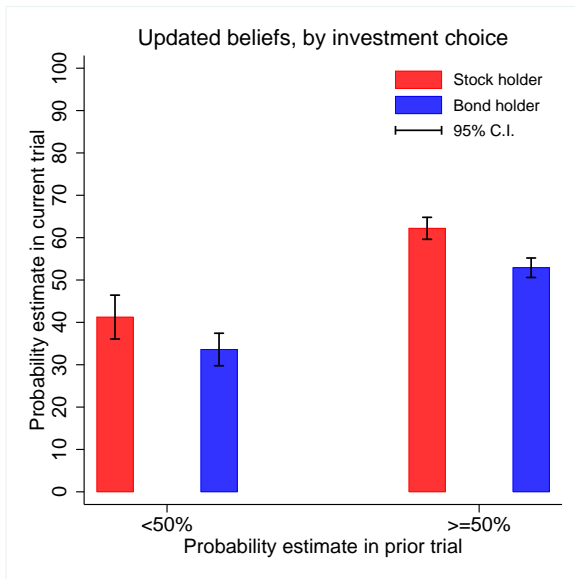


It is optimal for subjects to learn objectively from all new outcomes.

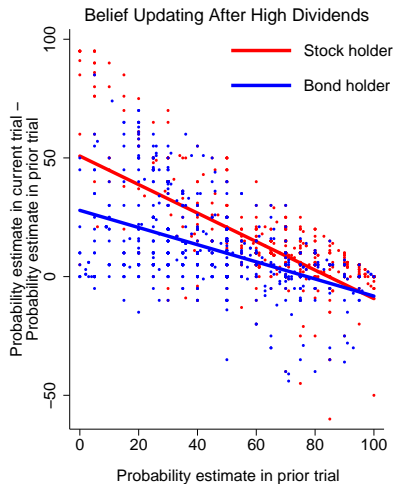
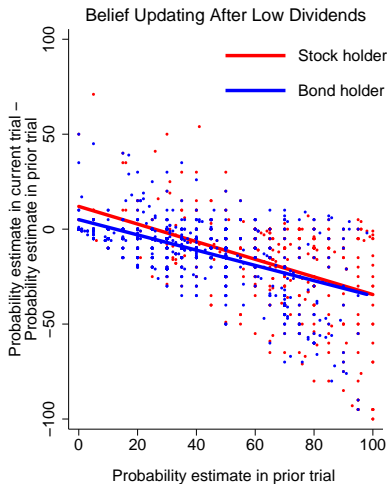
Subjects' prior choices do not constrain them from changing their portfolio going forward.

Investors learn more from new information which ex-post justifies their prior investment choice.

Prior choices influence posterior beliefs



Prior choices influence the updating process



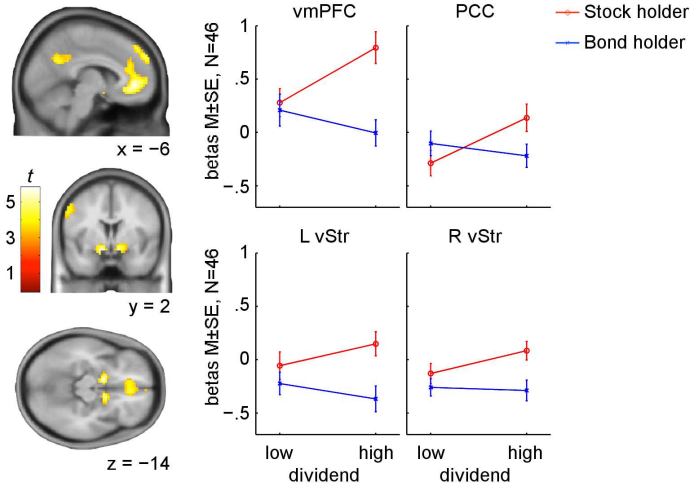
Prior choices change belief updating

Dependent variable	<i>ProbabilityEstimate_{it}</i>
<i>HighDividend_{it}</i> X <i>StockHolder_{it}</i>	5.15 (2.31)**
<i>HighDividend_{it}</i>	25.15 (11.98)***
<i>StockHolder_{it}</i>	5.04 (3.53)***
<i>ProbabilityEstimate_{it-1}</i>	0.52 (7.39)***
<i>GainCondition_{it}</i>	1.74 (1.92)*
<i>LowVarianceCondition_{it}</i>	0.11 (0.21)
Subject Fixed Effects	Yes
R^2	0.687
Observations	3663

Main result: Brain activation

Prior investment choices bias the brain response to new information.

Prior choices change brain reaction to new outcomes



vmPFC and vSTR activation at payoff time influences belief errors when faced with information contradicting prior choice, e.g., when Bond holders observe High dividends.

Dependent variable	<i>Probability Estimation Error_{it}</i>		
<i>vmPFC_{it}</i> at dividend presentation	-1.03		
	(-1.96)*		
<i>vSTR_{it}</i> at dividend presentation		-1.28	
		(-1.97)*	
1 st principal component of <i>vmPFC_{it}</i> and <i>vSTR_{it}</i> at dividend presentation			-0.84
			(-2.39)**
Condition Fixed Effects	Yes	Yes	Yes
Objective Probability Fixed Effects	Yes	Yes	Yes
Subject Fixed Effects	Yes	Yes	Yes
R^2	0.38	0.38	0.38
Observations	1014	1014	1014

- non-participation puzzle (Campbell (2006)): majority of households do not invest in stock market
 - non-stock holders may not update their beliefs if the stock market performs well, will be too pessimistic about market outcomes and less inclined to invest in stocks
- disposition effect (Odean (1998)): investors are reluctant to sell stocks that have not performed well
 - investors may not update beliefs sufficiently after observing low outcomes of stocks they have previously chosen

- prior investment choices influence people's ability to correctly update their beliefs about the quality of financial assets
 - if most recent choice is a stock, people update their beliefs more after observing a high dividend, rather than a low one
 - if most recent choice is a bond, people update their beliefs more after observing a low dividend, rather than a high one
- valuation-related brain areas preferentially encode new information that matches prior choice, and this predicts learning performance
- effect may explain non-participation puzzle, disposition effect