Optimal Financial Education

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Motivation

- The notion that irrational investors may be prevalent in financial markets has taken on increased impetus in recent years.
- For example, Daniel and Titman (1996, 2007) indicate that the book/market effect is due to behavioral phenomena
- Barber and Odean in several papers indicate that individual investors may not be rational

Motivation, contd.

- It has come to be accepted by financial economists that some investors may indeed be irrational
- What has not been studied is whether there are sufficient economic incentives for other agents to induce these agents to become rational.
- Alluding to learning is not sufficient because due to the self-attribution bias (Gervais and Odean, 2001) learning can take a long time.

Motivation, contd

- Trading successfully in financial markets requires a certain degree of sophistication.
- For example, one must learn about the importance of risk, the potential futility from trading on already-public information, and being aware of possible behavioral biases such as overconfidence and loss aversion.

Motivation, contd.

- One aspect of financial markets is that the agents in the best position to confer financial education to the unsophisticated are themselves traders on their own account.
- What is the equilibrium level of financial education in this scenario?

Model

- We build a model of a financial intermediary who possesses a technology that allows the correction of the biases of individual investors and/or directs them away from useless information sources.

Ideas modeled

- Trading profits earned at the expense of individuals drive a wedge between what is optimal for individual and what is optimal for the intermediary
- The equilibrium expected utility of the overconfident (rational) agents decreases (increases) in the level of overconfidence
- The optimal amount of education partially but not fully corrects the irrationality
- In equilibrium, agents retain some equilibrium degree of overconfidence

A variant of the basic model

- Another form of irrationality accounts for the notion that agents may believe useless sources of information to be valuable.
- Such information may take the form of internet bulletin boards, television shows, and the like.
  - This scenario can be considered as an extreme form of overconfidence, so that even though observe a signal that is noise, they believe that it is a signal that is linked to true value.
- Rationals can educate the irrationals at a profit.
- In equilibrium, a certain proportion of the population remains uneducated.

Results, contd.

- In a dynamic setting with per trade commissions, intermediary may let agent be irrational in earlier rounds to earn commissions as well.
- Individual may rationally choose to maintain relationship with intermediary because the possibility of being educated in later rounds

Volume

- In this model, volume occurs because individuals trade on irrational signals in a dynamic setting, and later get educated to be rational.
- Explains high level of trading volume.

Other literature

- No literature on educating irrationals to be rational
- Some literature on selling and trading on information (Admati and Pfleiderer etc)
- But the above literature does not allow for trading by both the informed and the uninformed
- In our paper, the decision on education needed needed to be sophisticated is made by the sophisticated, not the unsophisticated, unlike in Grossman and Stiglitz and the like.

First model, education as bias reduction

- Consider a security that pays off an amount $\theta + \varepsilon$ at date 2, and is traded at date 1.
- There are two types of agents who trade the security. The first type are rational agents who observe the realization of θ and have a hedgeable endowment of w. The second class are those who do not observe the realization of θ but infer it from market prices.
- These agents are interchangeably termed individual investors or unsophisticated investors.

Model, contd.

- In the first specification, unsophisticated agents are overconfident and underassess the variance of ε.
- We calculate the equilibrium price and ex ante gains from trade.
- Overconfident agents can be educated to reduce their degree of overconfidence through for-profit education provided by the rational agents
- Informed can remove overconfidence to a variable degree using an exogenous profit function

Propositions

- The expected utility of the uninformed (informed) is decreasing (increasing) in the level of overconfidence
- So, the equilibrium preserves the overconfidence of the uninformed to some endogenous degree (they are not fully educated).

Steering irrationals away from useless signals

- Irrationals think they observe useful information, but they observe and trade on noise (internet bulletin boards, television, and the like).
  - This scenario can be considered as an extreme form of overconfidence, so that even though the irrationals observe a signal that is noise, they believe that it is a signal that is linked to true value.
- Rationals, who also are traders, can educate a varying proportion of these agents not to trade on noise in accordance with a profit function

Steering irrationals away from useless signals, contd.

- More specifically, suppose individual investors believe the risky asset's payoff is $\eta + \varepsilon$, but it is actually $\theta + \varepsilon$.
- The fraction of individuals that is educated to discard η is denoted by m, and is controlled by the sophisticated agents by way of an exogenous profit function.

Results

- There is an interior optimum for the proportion of uneducated agents.
- This proportion is increasing in the variance of information (profitability concerns of the informed).
- As it becomes more profitable to disseminate educational materials (internet), proportion of educated agents will rise

Dynamic setting

- Two rounds of trade.
- Informed intermediary disseminates education and also charges a per round commission
- Unsophisticated agents observe two noise variables, one in each round, that they mistake for valid information (if they are uneducated)

Results

- Intermediary will delay education to obtain commission in first round.
- Individual may rationally choose to maintain relationship with intermediary because the possibility of being educated in later rounds
- Informational efficiency of price is decreasing in the proportion of uneducated
  - Education not just a matter of fairness, but lack thereof can potentially hurt corporate resource allocation

Results, contd.

- Endogenous lack of sophistication creates trading volume, which decreases in the profitability of financial education
- With price-inelastic liquidity trading, unsophisticated agents can survive

Contrasting comparative statics

- In a monopolistic market for education, increasing the variance of information increases the proportion of uneducated agents
- In a competitive market for education, we get the opposite result
- With competition, increasing informational advantage increases profitability from trading and hence increases financial educations as rents are competed to zero
- With monopoly, the derivative of the gains to trade function dictates what happens.

Conclusion

- No-one has previously considered the incentives for the unsophisticated financial market agents to be educated not to be unsophisticated
- The agents who profit from the unsophisticated are in the best position to educate them.
  - Thus, agents are not fully educated in equilibrium

Conclusion, contd.

- Agents remain biased, and some agents are not told to avoid useless signals.
- In a dynamic setting, agents are educated only in later rounds to maximize commission revenue
- This activity creates volume
- With price-inelastic agents, irrationals may also survive in financial markets

Sentiment and the Stock Market

- If investors remain uneducated, stock markets may be affected by investor sentiment
- How does investor sentiment affect the profitability of investment strategies (e.g., momentum)?

Investor Sentiment and Momentum

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What makes the overall stock market move?

Macroeconomic conditions:

- GDP, unemployment
- interest rates
- inflation rate

Changes in risk perceptions:

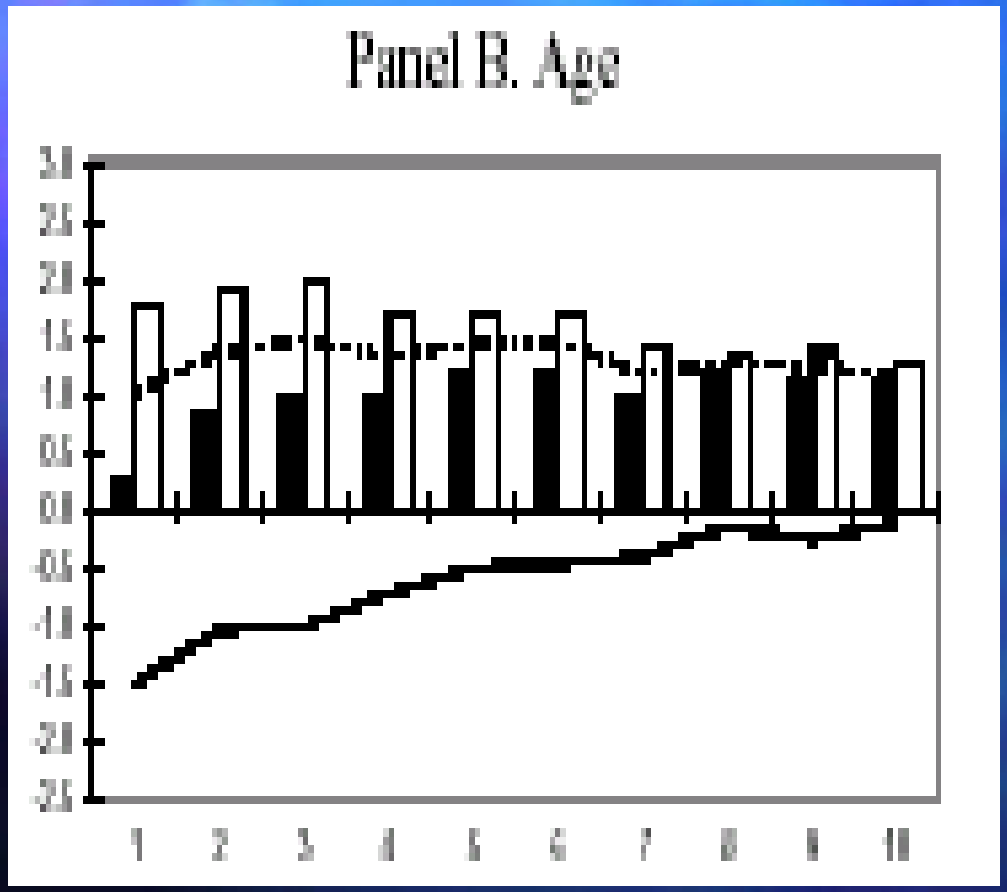
- increased uncertainty about oil prices
- impending change of political regime

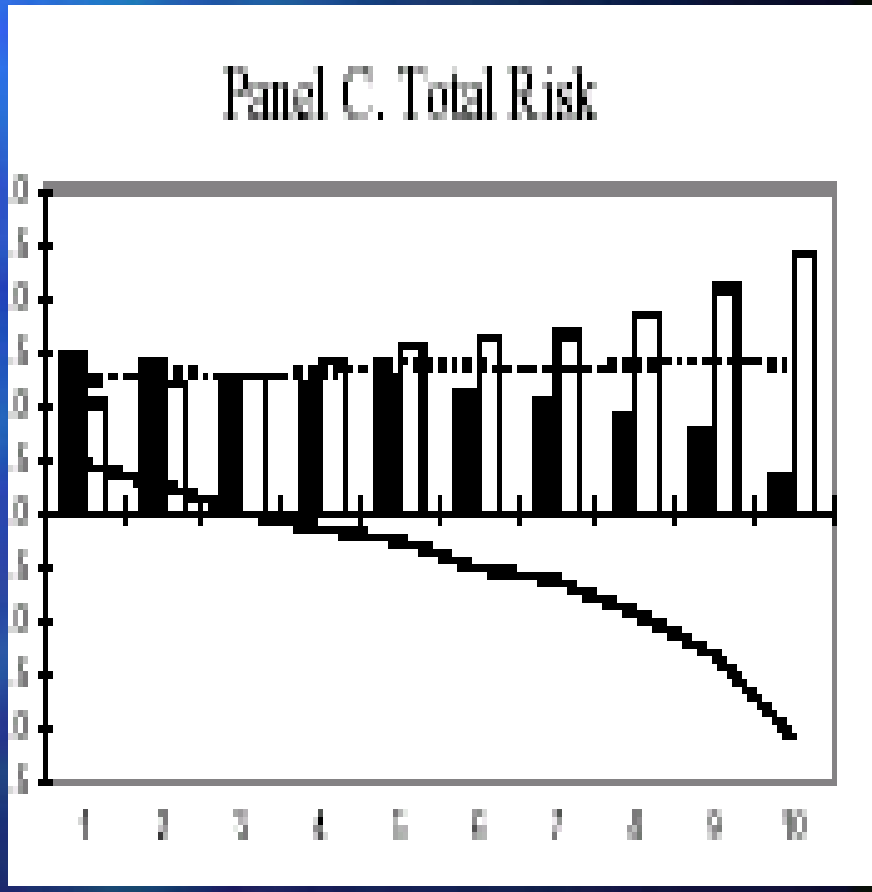
Investor sentiment and mood

Investor sentiment and stock returns (Baker and Wurgler)

- Construct a sentiment index comprised of principal components extracted from:
  - IPO activity
  - Trading volume
  - Volume of equity issued, etc
- Show that stocks that are difficult to arbitrage (young, volatile companies) are mispriced in that their future returns are low when current sentiment is high, and vice versa

Solid (clear) bars - returns when sentiment is high (low). Solid line is difference between two bars and dotted line is average across the bars





Another Sentiment Measure and its Relation to Momentum

- Conference Board's Consumer Sentiment
- Momentum is the effect that winners tend to win and losers tend to lose for at three- to six-month horizons
- Momentum profits obtain only during periods of high sentiment

Sentiment

- Sentiment, broadly defined, refers to whether an individual, for whatever *extraneous* reason, feels excessively optimistic or pessimistic about a situation.
- Peoples' *current* sentiment affects their judgment of future events.
- For example, Johnson and Tversky (1983) show that people that read sad newspaper articles view various causes of death, such as disease etc., as more likely

The hypothesis

- Optimism is associated with high overconfidence and thus extremely miscalibrated positive signals, and short-selling constraints prevent arbitrage from correcting prices.
- Prices tend to be pushed above fundamental values, amplifying the momentum effect, and ultimately lead to long run reversals.
- A symmetric effect may not obtain in the case where investors are pessimistic, because of short-sale constraints faced by retail investors

Another hypothesis

- Losers in optimistic periods continue to lose because agents face cognitive dissonance when they receive bad news in optimistic periods, and do not act in a timely way on such information
- Good news is disclosed promptly by managers themselves so a symmetric effect need not obtain in pessimistic periods (Hong, Lim, and Stein (2000))

The sample

- In each month *t*, we form deciles on the basis of returns for the past *J* months.
- In each month *t*, the strategy takes a long position in the winner portfolio and a short position in the loser portfolio, held for *K* months.
- We construct overlapping portfolios to increase the power of our tests. Specifically, we close the position initiated in month *t-K* in both the winner and loser portfolios, and take a new position using the winners and losers of month *t*.

The sample, contd.

- In order to avoid microstructure biases, we allow one month between the end of the formation period and the beginning of the holding period, and delete all stocks that are priced less than one dollar at the beginning of the holding period.

CB index survey questions

- 1) How would you rate present general business conditions in your area? 2) What would you say about available jobs in your area right now? 3) Six months from now, do you think that the business conditions in your area will be better, same or worse? 4) Six months from now, do you think there will be more, same, or fewer jobs available in your area? 5) Would you guess your total family income to be higher, same, or lower 6 months from now?

Sentiment measure

- In order to purge the effects of macroeconomic conditions on the CB Index, we orthogonalize it with respect to growth in industrial production, real growth in durable consumption, non-durable consumption, services consumption, growth in employment, and an NBER recession indicator

Optimistic and pessimistic periods

- We calculate a rolling average of the sentiment level for the three months prior to the beginning of the holding period.
- If this average belongs in the top 30% of the three-month rolling average sentiment time series, we classify it as an optimistic period; if it is in the bottom 30%, it is classified as pessimistic.

Optimistic and pessimistic periods, contd.

- In order to calculate the average sentiment in the *K* formation periods, we first calculate whether each of these *K* formation periods was optimistic or pessimistic as explained above, and then tally how many were optimistic or pessimistic. If, from those *K* formation periods, at least 66% were identified as high (low) sentiment, the returns from the particular holding period month are classified as optimistic (pessimistic).

Momentum Profits in high and low sentiment periods

		Momentum Portfolio											
		1=Sell	2	3	4	5	6	7	8	9	10=Buy	Buy-Sell	t-stat.
Panel A:													
J=6,K=3													
Optimistic	(n=354)	-0.43	0.25	0.59	0.72	0.83	0.86	0.94	0.94	1.08	1.27	1.71	[7.51]
Pessimistic	(n=146)	1.44	1.89	2.01	1.95	1.91	1.87	1.84	1.75	1.77	1.90	0.46	[1.04]
											Opt.-Pes	1.46	[2.49]

Momentum and sentiment across market states

		Momentum Portfolio											
Panel A:													
DOWN market		1=Sell	2	3	4	5	6	7	8	9	10=Buy	Buy-Sell	t-stat.
Optimistic	(n=29)	1.95	1.29	1.23	1.23	1.08	1.07	1.13	1.58	1.33	1.35	-0.61	[-0.63]
Pessimistic	(n=33)	3.18	3.28	3.45	3.38	3.21	3.12	3.05	3.03	3.05	3.08	-0.10	[-0.11]
											Opt.-Pes.	-0.51	[-0.36]
Panel B:													
UP market													
Optimistic	(n=348)	-0.32	0.35	0.66	0.79	0.94	1.01	1.11	1.16	1.29	1.49	1.81	[8.64]
Pessimistic	(n=90)	0.27	0.84	1.02	1.04	1.08	1.08	1.01	1.05	0.99	0.99	0.72	[1.31]
											Opt.-Pes.	1.09	[1.86]

Momentum and sentiment across volume terciles

		Momentum Portfolio											
Panel A: High Vol.		1=Sell	2	3	4	5	6	7	8	9	10=Buy	Buy-Sell	t-stat.
Optimistic	(n=377)	-0.41	0.25	0.49	0.57	0.69	0.80	0.92	0.96	1.11	1.35	1.76	[6.54]
Pessimistic	(n=123)	0.47	1.15	1.30	1.25	1.19	1.20	1.12	1.13	1.18	1.24	0.77	[1.49]
											Opt.-Pes.	0.99	[1.69]
Panel B: Mid. Vol.													
Optimistic	(n=377)	-0.05	0.54	0.80	0.86	0.97	1.03	1.09	1.16	1.30	1.65	1.71	[7.26]
Pessimistic	(n=123)	1.01	1.46	1.64	1.69	1.71	1.60	1.55	1.59	1.59	1.78	0.77	[1.88]
											Opt.-Pes.	0.94	[1.97]
Panel C: Low Vol.													
Optimistic	(n=377)	0.20	0.60	0.84	0.97	1.10	1.15	1.22	1.33	1.46	1.65	1.45	[6.41]
Pessimistic	(n=123)	1.71	1.82	1.90	1.88	1.82	1.78	1.79	1.95	1.95	1.99	0.28	[0.60]
											Opt.-Pes.	1.17	[2.25]

Company size, sentiment and momentum

	Momentum Portfolio											
	1=Sell	2	3	4	5	6	7	8	9	10=Buy	Buy-Sell	[t-stat.]
Panel A: 30%-30% Sentiment states												
Panel A1:Small Cap.												
Optimistic (n=378)	-0.33	0.37	0.65	0.84	0.99	1.07	1.20	1.26	1.39	1.49	1.83	[7.80]
Pessimistic (n=122)	0.85	1.31	1.64	1.74	1.79	1.81	1.72	1.81	1.76	1.69	0.84	[1.92]
										Opt.-Pes.	0.99	[1.92]
Panel A2:Large Cap.												
Optimistic (n=378)	0.42	0.69	0.82	0.90	0.88	0.92	0.98	0.98	1.14	1.35	0.92	[3.98]
Pessimistic (n=122)	0.90	1.15	1.23	1.27	1.27	1.07	1.10	1.08	1.08	1.02	0.11	[0.23]
										Opt.-Pes.	0.81	[1.46]
Panel B: 20%-20% Sentiment states												
Panel B1:Small Cap.												
Optimistic (n=428)	-0.41	0.28	0.58	0.79	0.93	1.00	1.13	1.21	1.31	1.41	1.82	[8.58]
Pessimistic (n=72)	2.14	2.48	2.75	2.68	2.72	2.70	2.50	2.50	2.48	2.32	0.18	[0.29]
										Opt.-Pes.	1.64	[2.38]
Panel B2:Large Cap.												
Optimistic (n=428)	0.32	0.61	0.74	0.83	0.82	0.84	0.90	0.90	1.04	1.23	0.90	[4.29]
Pessimistic (n=72)	1.87	1.99	1.94	1.95	1.94	1.61	1.67	1.63	1.62	1.50	-0.37	[-0.60]
										Opt.-Pes.	1.27	[1.90]

Order imbalances-new results

		Formation period month						Hold period month					
		-6	-5	-4	-3	-2	-1	1	2	3	4	5	6
Panel A: OPTIMISTIC sentiment													
A1: Small investors	Losers	2.78	3.19	2.85	2.48	1.79	0.54	0.66	-1.34	-2.22	-2.53	-3.20	-4.30
	t-stat	[2.76]	[3.47]	[3.07]	[2.81]	[2.08]	[0.63]	[0.6]	[-1.22]	[-1.95]	[-2.04]	[-2.76]	[-3.94]
	Winners	-2.28	-1.65	-1.23	-0.97	-0.92	0.16	-0.58	0.83	1.48	2.15	2.43	2.78
	t-stat	[-3.12]	[-2.04]	[-1.49]	[-1.18]	[-1.11]	[0.20]	[-0.83]	[1.21]	[2.07]	[3.31]	[3.81]	[4.61]
A2: Large Investors	Losers	-7.34	-7.02	-6.58	-6.51	-6.11	-5.25	-3.32	-3.31	-2.96	-2.45	-2.25	-1.95
	t-stat	[-7.62]	[-7.59]	[-7.12]	[-7.29]	[-6.87]	[-6.16]	[-3.27]	[-3.11]	[-2.71]	[-2.12]	[-1.88]	[-1.62]
	Winners	2.63	2.65	2.99	3.14	3.02	2.74	-1.06	-1.35	-1.60	-1.34	-0.78	-0.56
	t-stat	[3.48]	[3.47]	[3.83]	[3.99]	[3.78]	[3.4]	[-1.38]	[-1.75]	[-2.11]	[-1.71]	[-0.99]	[-0.70]

Momentum and the Baker and Wurgler sentiment index

	Momentum Portfolio											
	1=Sell	2	3	4	5	6	7	8	9	10=Buy	Buy-Sell	t-stat.
Optimistic (n=346)	-0.13	0.46	0.73	0.86	0.96	1.02	1.08	1.12	1.20	1.32	1.45	[6.64]
Pessimistic (n=124)	1.87	2.05	2.10	2.07	1.99	1.97	1.99	2.04	2.20	2.44	0.57	[1.38]
										Opt.-Pes.	0.88	[1.91]

Long-run (six year) returns and sentiment

		Momentum Portfolio											
Panel A: Raw		1=Sell	2	3	4	5	6	7	8	9	10=Buy	Buy-Sell	t-stat.
Optimistic	(n=304)	1.22	1.17	1.14	1.12	1.11	1.09	1.07	1.04	0.98	0.86	-0.36	[-5.92]
Pessimistic	(n=117)	1.27	1.38	1.38	1.38	1.38	1.35	1.35	1.33	1.35	1.27	-0.00	[-0.00]
											Opt.-Pes.	-0.36	[-3.50]
Panel B: CAPM													
Optimistic	(n=304)	0.83	0.81	0.79	0.78	0.77	0.76	0.73	0.70	0.63	0.49	-0.35	[-5.81]
Pessimistic	(n=117)	0.81	0.95	0.97	0.98	0.98	0.95	0.95	0.92	0.92	0.81	-0.00	[-0.03]
											Opt.-Pes.	-0.35	[-3.42]
Panel C: FF													
Optimistic	(n=304)	0.42	0.40	0.39	0.39	0.40	0.39	0.39	0.37	0.31	0.21	-0.22	[-3.84]
Pessimistic	(n=117)	0.25	0.43	0.48	0.51	0.54	0.53	0.55	0.53	0.54	0.45	0.20	[2.73]
											Opt.-Pes.	-0.40	[-4.51]

Summary

- Short-run momentum and long-run reversals occur only after periods of high sentiment
- Supports the notion that overconfidence during optimistic periods leads to momentum and prices eventually revert to fundamentals

Concluding remarks

- Price momentum is an anomaly not captured by the Fama and French (1996) three-factor model and is likely the most robust "anomaly" in financial markets.
- Our results indicate that price momentum is significant *only* when investors are optimistic.
- This result is robust to firm size, trading volume, market states, risk adjustments, and alternative specifications for investor sentiment.
- In addition, we show that price reversals occur *only* after optimistic periods.

Explanation

- When investors are very optimistic, they are more miscalibrated, especially for losing stocks. This leads to stronger short-run momentum and larger long-run price reversal during periods of optimism.

Final remarks

- Results are supportive of the notion that short-run momentum and long-run price reversal jointly arise from investors' behavioral biases.
- Chui, Titman and Wei (2010), show that momentum is more pronounced in individualistic cultures such as the US.
- Does the asymmetric momentum pattern in the US also obtain in countries characterized by less individualism? This is an important issue for future research.