

The Higher They Fly, The Harder They Fall

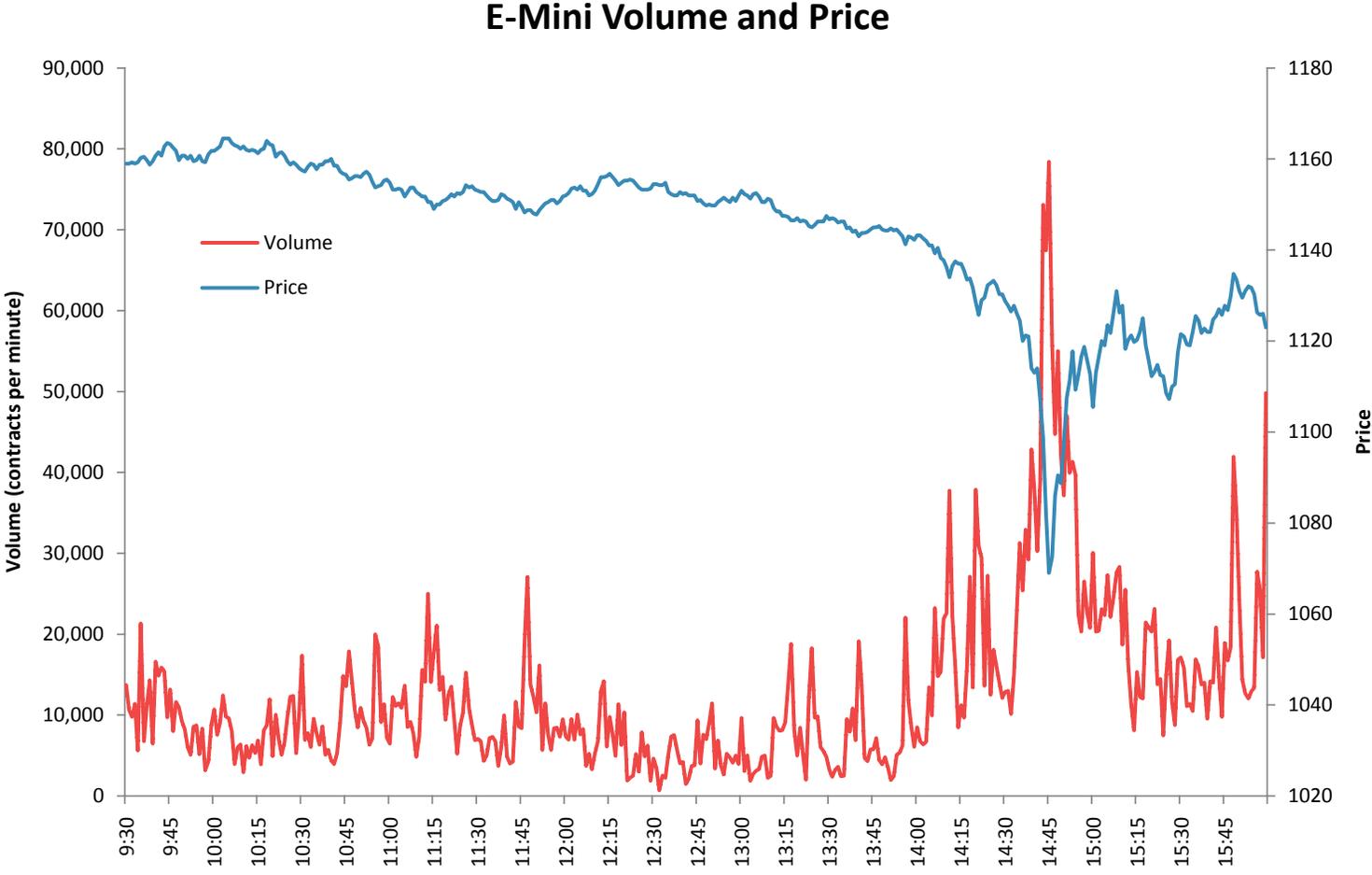
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This paper studies

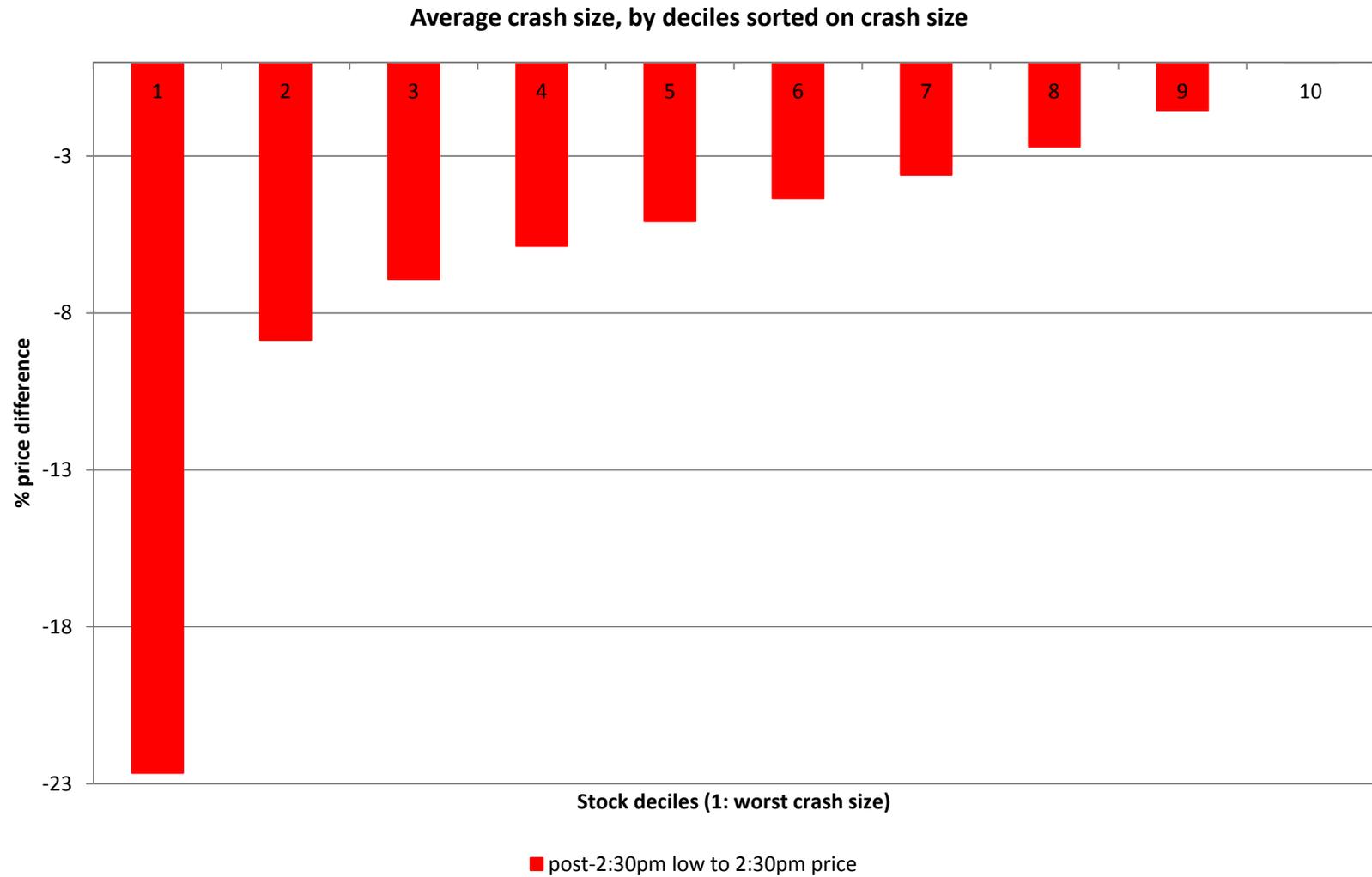
- Is there any pattern in the cross section of crashes?
 - Finding: **winner stocks crash more**
- Test crash theories using micro-level institutional trading data
 - Finding: **Bigger crash is associated with less “support buying”**, which supports crash theories based on *heterogeneous investors* and *information revelation* as opposed to risk aversion.
- Today: focus on flash crash day.
 - In progress: outside flash crash

May 6, 2010: Flash crash



Cross section of crashes

Variation in cross sectional crash size



Initial hypotheses on what may affect the cross section of crashes

- Hypothesis A. Market event → **beta** matters
 - Hypothesis B. S&P 500 event → **size** matters
 - Hypothesis C. Chaos → **random** crash
 - Hypothesis D. Liquidity event → **liquidity** matters
 - Hypothesis E. Perhaps **something else** matters, too
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- Data: CRSP, TAQ

Flash crash in the cross section

	5th quantile crash size						Median crash size					
	1	2	3	4	5	"5-1"	1	2	3	4	5	"5-1"
MOM (2-12)	-12.77	-10.63	-12.49	-17.16	-22.3	-9.53	-3.97	-4.61	-4.64	-5.52	-5.49	-1.52
MOM (1-6)	-12.61	-12.49	-11.79	-16.14	-20.84	-8.23	-3.85	-4.58	-5.06	-5.06	-5.51	-1.66
3-yr return	-14.1	-14.39	-11.33	-13.39	-20.84	-6.74	-4.5	-4.89	-4.79	-4.92	-5	-0.5
Market beta	-12.57	-13.78	-13.7	-14.08	-18.93	-6.36	-3.65	-4.31	-5.04	-5.26	-5.76	-2.11
Turnover	-10.4	-15.55	-15.57	-14.51	-15.67	-5.27	-1.97	-3.94	-5	-5.44	-5.6	-3.63
Volatility	-14.8	-11.21	-12.38	-15.08	-16.94	-2.14	-4.57	-4.61	-4.69	-4.83	-5.2	-0.63
Reversal (1-1)	-14.46	-14.83	-14.41	-12.87	-16.34	-1.88	-4.38	-4.45	-4.74	-4.73	-5.25	-0.87
coskewness	-12.61	-13.94	-16.28	-13.29	-14.2	-1.59	-4.45	-4.55	-4.89	-5	-5.18	-0.73
UMD beta	-15.14	-13.78	-13.92	-12.5	-16.58	-1.44	-4.94	-4.92	-4.63	-4.73	-4.74	0.2
Market beta (daily)	-15.78	-13.89	-14.08	-13.45	-16.58	-0.8	-3.7	-4.44	-4.99	-4.97	-5.52	-1.82
Bid-Ask spread	-12.5	-15.8	-23.66	-13.34	-12.73	-0.23	-5.5	-5.45	-4.9	-3.78	-2.11	3.39
B/M	-15.78	-15.04	-12.89	-13.71	-15.57	0.21	-4.93	-4.92	-4.62	-4.65	-4.42	0.51
Reversal (1-1) beta	-16.58	-14.01	-12.49	-12.7	-16.25	0.33	-5.35	-4.78	-4.59	-4.61	-4.66	0.69
SMB beta	-16.25	-12.5	-14.38	-14.87	-14.56	1.69	-4.58	-4.73	-4.5	-4.83	-5.34	-0.76
HML beta	-16.18	-13.61	-13.7	-15.11	-14.44	1.74	-4.91	-4.71	-4.76	-4.33	-5.02	-0.11
Size	-15.55	-15.33	-11.41	-11.71	-12.7	2.85	-3.79	-5.19	-4.93	-5.41	-5.85	-2.06

Robustness

- The finding that winner stocks crash more
 - holds using matched sample of stock pairs, following pairs-trading algorithm in Gatev, Goetzmann and Rouwenhorst (2006)
 - holds in regressions for the mean, as well as quantile regressions from 5th to median crash (stronger for extreme crash size quantiles)
 - holds for past-return horizons from one month to three years.
 - holds when controlling market, size, value, momentum betas, market cap, similarity of pairs, volatility, skewness, kurtosis, co-skewness, removal of trades at stub quotes (\$0.01), nonlinearity

Test crash theories

Representative investor theory

- Representative investor theory
 - Bursting of rational bubbles: Blanchard and Watson (1982)
 - Volatility, leverage effect: Christie (1982) and Campbell and Hentschel (1992)

Hypothesis 1. There is no prediction on the trading behavior of different types of investors during a crash.

3 heterogeneous investor theories

- Heterogeneous belief and short-sales constraint
 - Hong and Stein (RFS, 2003)
- Trading-generated news
 - Cao, Coval and Hirshleifer (RFS, 2002)
 - Also, Romer (AER 1993)
- Heterogeneity in liquidity
 - Huang and Wang (RFS, 2009)

Discuss them in turn.

Hong and Stein (RFS, 2003)

- Heterogeneous belief and short-sales constraint
 - short-sales constraints → pessimists' view hidden → when price declines → pessimists may become the marginal “support buyers” → lack of buying from support buyers is additional bad news (likely due to their views being worse than anticipated)

Proposition 1. The biggest one-period crash in the model in Hong and Stein (2003) occurs when the formerly bearish investor does not buy even in light of the crash.

Hong and Stein (RFS, 2003), continued

Hypothesis 2. A stock's return during crash is positively related to the potential support buyers' total purchase of that stock (i.e., less purchase is associated with lower return).

Cao, Coval and Hirshleifer (RFS, 2002)

- Trading-generated news
 - fixed trading cost → investors delay trading → which implies investors may delay trading until signal is strong enough (until price changes validate their private signals) → rich path-dependent implications → investors with optimistic signals participate less when a stock falls than when the same stock rises
- Also implies Hypothesis 2 in previous slide

Huang and Wang (RFS, 2009)

- Heterogeneity in liquidity
 - Trading cost → idiosyncratic trading needs no longer synchronized → such endogenous order imbalance tends to manifest as selling (due to risk aversion) → selling translates to crash because market makers are assumed risk averse
 - Can capture anecdotes of capitulations by leveraged investors, exit of liquidity providers (did high frequency funds stop trading?)

Hypothesis 3. A stock's return during crash is negatively related to the market makers' total purchase of that stock (i.e., more purchase is associated with lower return).

Comparison of theories: Information revelation vs risk aversion

	Hong and Stein (2003)	Cao, Coval and Hirshleifer (2002)	Huang and Wang (2009)
Trading cost	Short-sales constraint	Symmetric (same for long and short)	Symmetric (same for long and short)
Information revelation	Yes	Yes	No
Risk aversion	No (risk-neutral arbitrageur)	No (risk-neutral investors)	Yes (risk-averse market maker)

Comparison of Hypotheses 2 & 3

- More purchase by support buyers is associated with
 - Smaller crash in hypothesis 2 (information revelation hypothesis)
 - Bigger crash in hypothesis 3 (risk aversion hypothesis)

Data

- Ancerno (formerly Abel Noser)
 - Daily institutional trades (largely mutual funds)
 - Covers about 8% of CRSP volume on average

Who are the support buyers

- We tried two hypotheses on who are the support buyers, and get consistent results
 - By stock style

	Loser stocks	Winner stocks
Contrarian funds	1 st support buyer	3 rd support buyer
Other funds	2 nd support buyer	2 nd support buyer
Momentum funds	3 rd support buyer	1 st support buyer

- Sort stocks into deciles by past 6m return. Momentum, contrarian, other funds: the average return decile of stocks they bought in the previous month are in the top 30%, bottom 30%, and middle 40%.
 - All Ancerno funds if their total net buy of a stock > 0

Discussions on support buyers

- In Hong and Stein (2003), the pessimists are support buyers.
 - Momentum funds aren't exactly "pessimistic" in winners.
 - Hong and Stein (2003) have 2 types of agents in their model, optimistic and pessimistic agents.
 - We interpret their "pessimists" as those next in line to buy, and not necessarily the most pessimistic agents
 - The momentum funds category likely includes those funds who are inclined to "buy on dips" for momentum stocks and maps well to the support buyers in Hong and Stein (2003).
 - Similarly the support buyers for loser stocks are likely those institutions who tend to buy loser stocks in the past (we call them contrarian funds).

Ancerno funds bought on average

- Net buy (buy-sell, relative to total trading volume, in %)
- Total buy (buy+sell)/2, relative to total trading volume, in %)

	Loser stocks	Winner stocks
Contrarian funds	0.68***	0.66***
Other funds	0.98***	1.36***
Momentum funds	0.04	0.79***
Sum	1.70***	2.81***

	Loser stocks	Winner stocks
Contrarian funds	0.94***	0.89***
Other funds	3.28***	4.00***
Momentum funds	0.58***	0.95***

Support buyers by style

- Net buy relative to $(\text{buy} + \text{sell})/2$, in %
- % of stocks with net buy > 0

	Loser stocks	Winner stocks
Contrarian funds	72	75
Other funds	30	34
Momentum funds	7	83

	Loser stocks	Winner stocks
Contrarian funds	41	37
Other funds	42	40
Momentum funds	17	23

Relation between net buy and crash

Net buy	Loser stocks				Winner stocks			
	Big crash	Small crash	diff	t	Big crash	Small crash	diff	t
Contrarian funds	1.10%	2.27%	-1.17%	-2.59	1.62%	1.92%	-0.30%	-0.55
Other funds	4.80%	5.57%	-0.77%	-1.07	5.37%	7.38%	-2.02%	-2.19
Momentum funds	0.87%	0.96%	-0.09%	-0.26	1.75%	2.50%	-0.75%	-1.45
Sum	6.76%	8.74%	-2.03%	-2.43	8.79%	11.81%	-3.06%	-2.58

- Finding: *Big* crash is associated with *less* net buy, consistent with the **information revelation hypothesis**.
- Works for both definitions of support buyers
 - All Ancerno funds
 - By style. Evidence suggests that contrarian funds are the support buyers of loser stocks, while other funds (instead of momentum funds) are support buyers of momentum stocks.
 - Table uses stocks with total net buy > 0. Result similar but somewhat weaker t-stat for all stocks.

Which crash theories

- Information revelation
 - Heterogeneous belief and short-sales constraint, Hong and Stein (RFS, 2003)
 - Trading-generated news, Cao, Coval and Hirshleifer (RFS, 2002)
- This suggests the following thought is going through the minds of some investors during crash: the price is down, but why don't other people buy? Perhaps they know something very bad that I don't know yet. May be I shouldn't buy unless price drops further.
- Rejection of liquidity story suggests margin call or other non-informational capitulations do not explain flash crash

Potential implication for risk premium

- (co-)skewness is related to winner stock returns, as documented in Harvey and Siddique (JF, 2000)
 - That momentum funds avoiding winner stocks is associated with bigger crash of winner stocks likely has implication for the risk premium of winner stocks (co-)skewness itself may be priced, Kraus and Litzenberger (JF, 1976)
 - Potential implication of our finding that less total net buy from Ancerno institutions is associated with bigger crash of a stock
- work in progress

Intuition (of work in progress)

- Example: you and I get a signal on the value of a stock
 - 1, -1 with prob $\frac{1}{2}$, $\frac{1}{2}$
 - Market price = Avg of our signals
- Return skewness (return asymmetry) \leftrightarrow information release skewness
 - Symmetric information release example: both signal released to the market. Market price: -1, 0, 1 with prob $\frac{1}{4}$, $\frac{1}{2}$, $\frac{1}{4}$. NO skewness.
 - Asymmetric information release example: Your signal is NOT released when mine is 1 (so I guess yours using expected value 0), but released when mine is -1. Market price: -1, 0, $\frac{1}{2}$ with prob $\frac{1}{4}$, $\frac{1}{4}$, $\frac{1}{2}$. Negative skewness when more information is released in bad state.
 - This is the intuition behind Hong and Stein (RFS, 2003) and Cao, Coval and Hirshleifer (RFS, 2002)
- How does this relate to winner stock returns?

Conclusion

- Stocks with high past returns crash more during flash crash
- Micro-level institutional trading data supports
 - Heterogeneous investor theories of crash
 - In particular, crash theories based on information revelation as opposed to risk aversion
- Potential risk premia implications (in progress)