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JACOBS LEVY EQUITY MANAGEMENT CENTER
for Quantitative Financial Research

ETF Short Interest and Failures-to-Deliver: Naked Short-selling or Operational Shorting?

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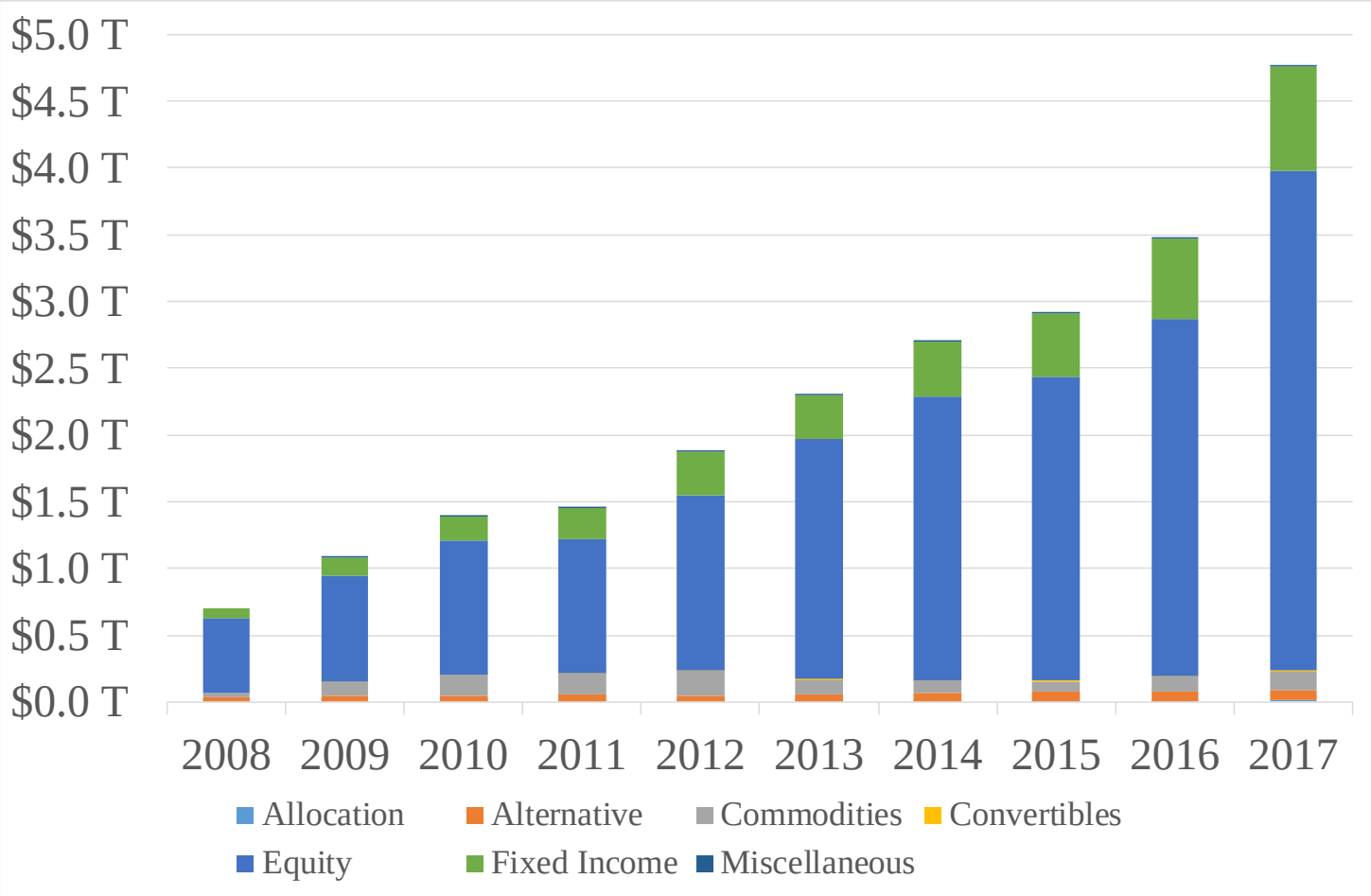
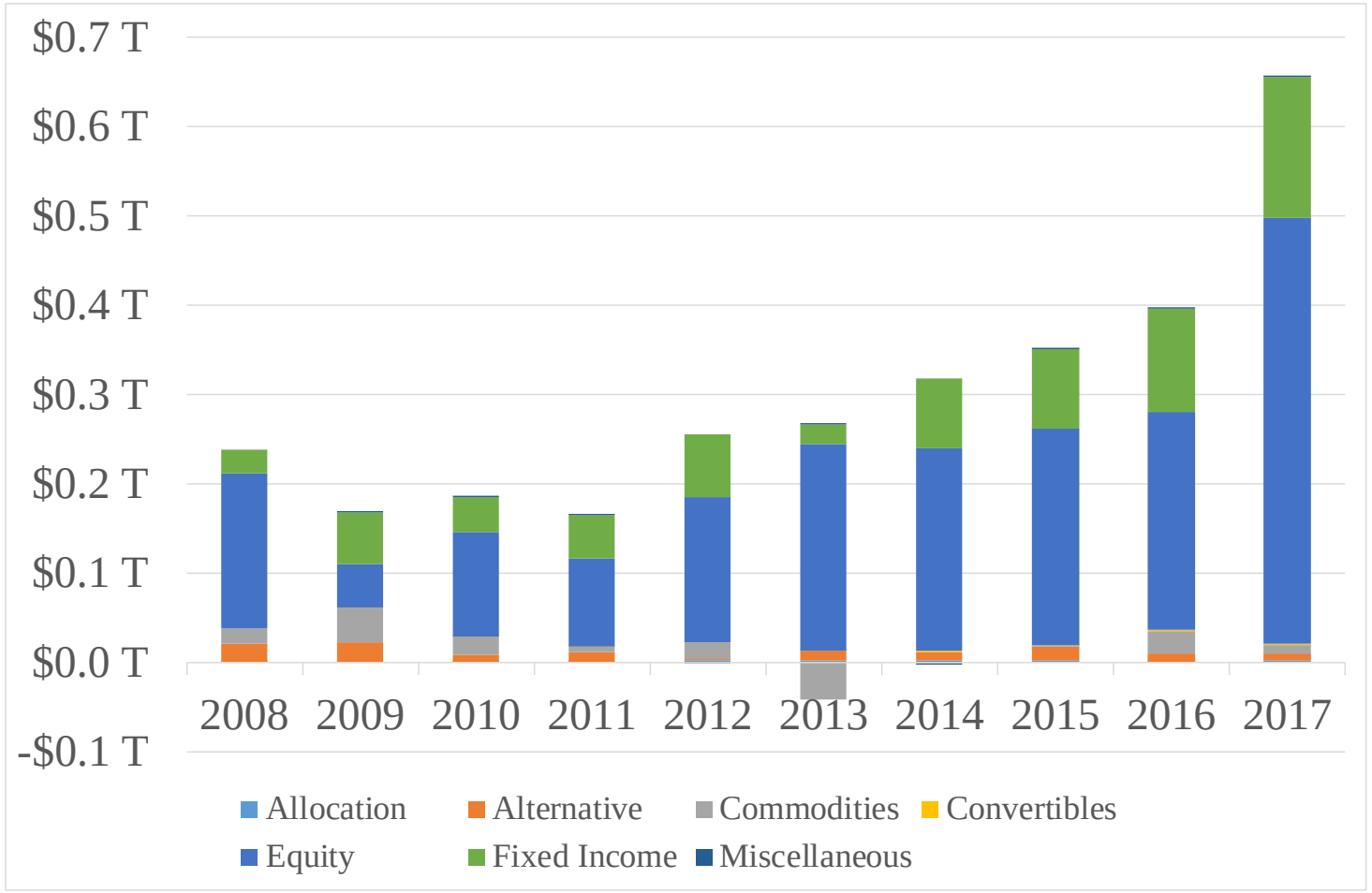
World-Wide ETF Assets



Source: Morningstar Direct

World-Wide ETF Flows



Source: Morningstar Direct

Why might the rise in ETFs be concerning?

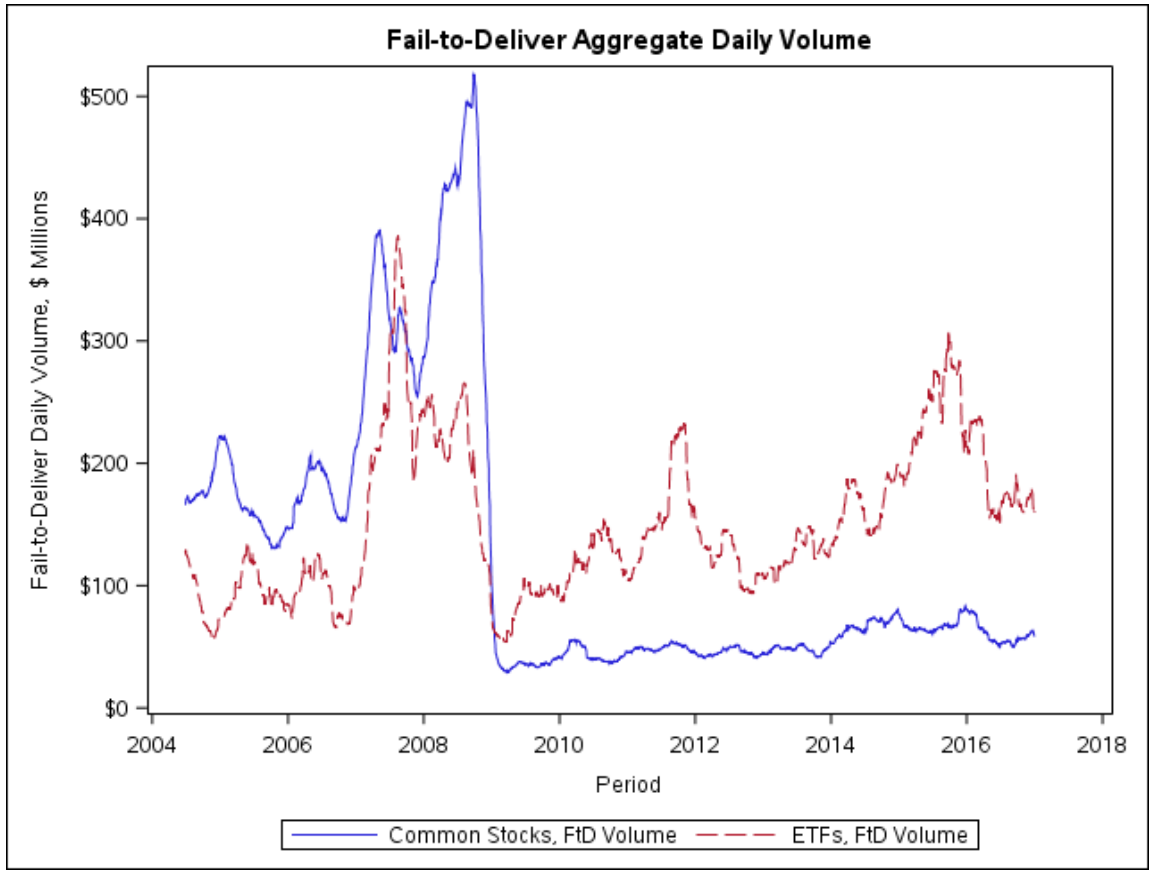
- ETFs are a growing force in financial markets (~$5 Trillion AUM)
- ETFs constitute almost 25% of US equity trading volume
- ETFs are a hybrid: a mutual fund that trades like a stock
- ETFs and their Authorized Participants/Market Makers are at the nexus of many markets (spot, futures, options, securities lending)

- Does the increased investment in/trading of ETFs pose a risk for markets?

Failure to Deliver (FTD)

FTD - a condition where two investors agree to the purchase/sale of a security at a given price but the seller **fails to deliver** the security in a timely manner.

Stock sale (T) → Deliver shares (T+3) → If not, FTD (T+3) → Must cover (T+4 or T+7)

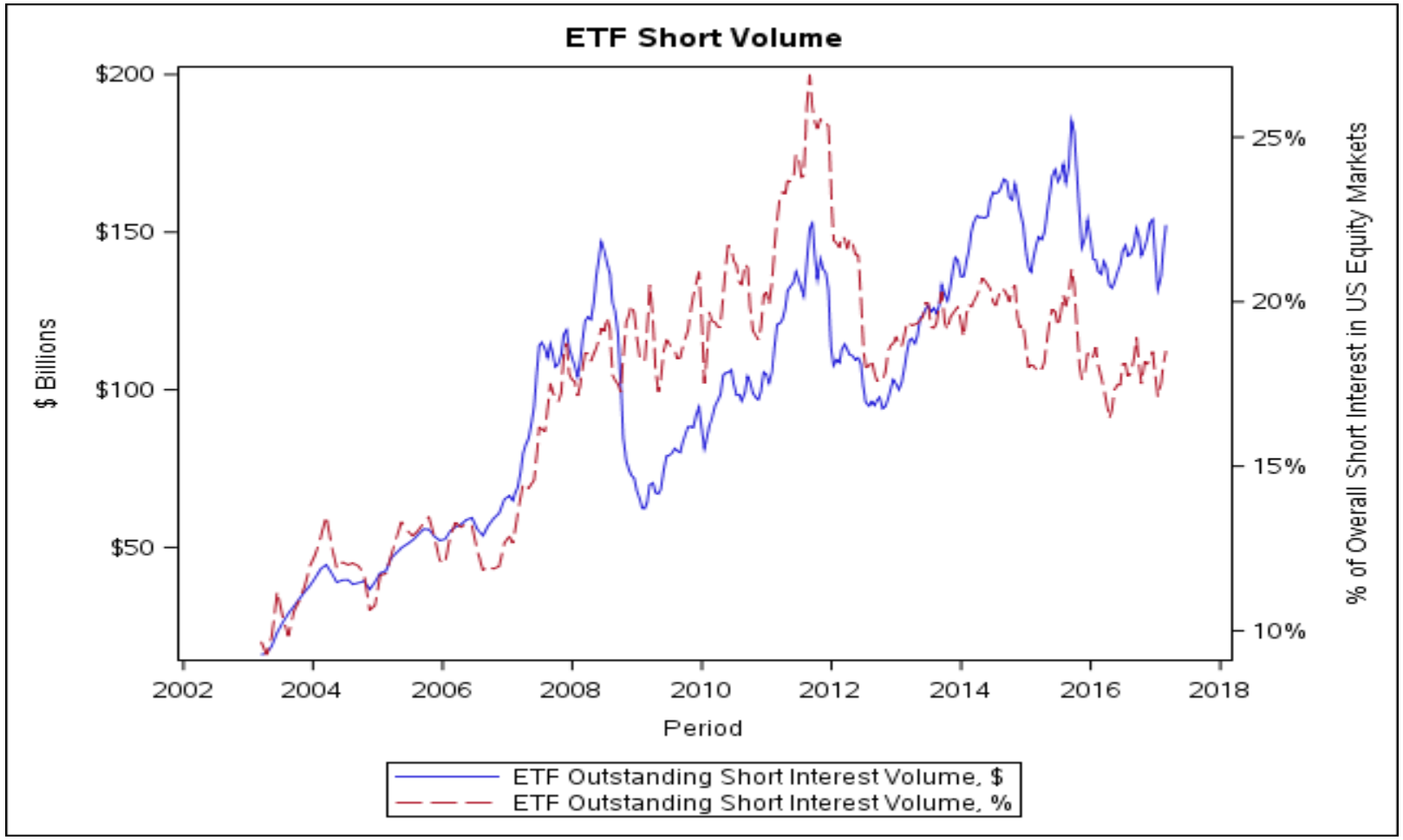


ETF FTDs have been growing since 2009

Year	Total Dollar FTD	ETF	Common Stock	OTC Stocks	Corporate Bond	ADR	Structured Products	Units and Trusts	Other Securities	# of Securities with Positive FTD
2004	$3,439.9	$936.0	$2,103.8	$36.7	$35.9	$212.7	$21.2	$102.6	$2.8	2,739
2005	$3,011.3	$974.4	$1,691.4	$43.2	$25.5	$201.1	$14.6	$65.4	$0.3	2,488
2006	$3,443.6	$994.1	$2,040.2	$42.6	$88.7	$211.1	$19.7	$50.7	$1.2	2,639
2007	$7,129.6	$2,540.9	$3,520.4	$50.5	$451.3	$359.4	$40.9	$57.5	$117.1	2,937
2008	$6,401.6	$1,887.7	$3,931.2	$47.2	$45.8	$342.6	$66.1	$46.7	$44.2	4,545
2009	$1,430.0	$866.4	$402.0	$10.3	$15.9	$91.7	$25.4	$13.0	$10.6	6,465
2010	$1,953.3	$1,272.4	$495.0	$14.9	$13.9	$114.1	$20.2	$15.7	$12.4	6,265
2011	$2,479.4	$1,705.2	$543.1	$16.9	$15.5	$142.3	$30.8	$15.5	$19.2	6,109
2012	$1,877.0	$1,183.7	$509.0	$11.3	$20.5	$99.3	$23.8	$20.8	$18.3	5,731
2013	$2,065.3	$1,313.6	$552.4	$10.4	$20.1	$106.7	$29.2	$24.4	$17.6	5,588
2014	$2,704.9	$1,734.0	$746.4	$11.8	$20.0	$137.3	$36.3	$14.7	$12.0	6,074
2015	$3,460.1	$2,506.3	$734.2	$9.1	$15.1	$137.6	$37.4	$11.2	$15.9	6,190
2016	$3,304.1	$2,592.5	$522.1	$8.2	$10.3	$122.0	$32.1	$14.5	$7.0	5,951

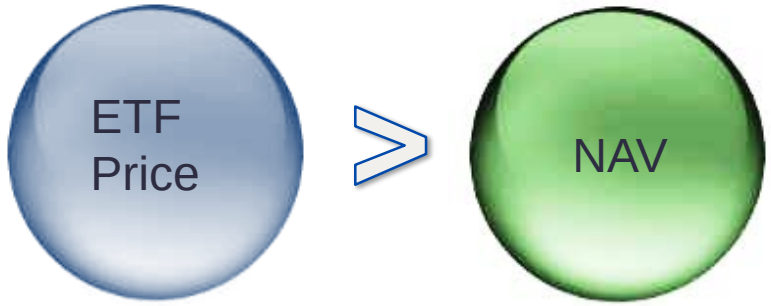
Year	Total FTD, % of Shares Outstanding	ETF	Common Stock	OTC Stock	Corporate Bond	ADR	Structured Products	Units and Trusts	Other Securities	# of Securities with Positive FTD
2004	0.83%	3.94%	0.63%	1.12%	1.29%	1.01%	1.49%	0.47%	1.57%	1,943
2005	0.57%	2.40%	0.39%	1.02%	0.78%	0.63%	0.65%	0.27%	0.58%	1,756
2006	0.73%	3.35%	0.33%	1.72%	1.05%	0.49%	0.48%	0.20%	1.42%	1,834
2007	0.99%	5.24%	0.37%	2.01%	1.01%	0.46%	0.55%	0.22%	0.82%	2,124
2008	0.82%	4.05%	0.31%	1.66%	0.32%	0.23%	0.97%	0.14%	0.45%	3,507
2009	0.22%	0.85%	0.03%	1.20%	0.05%	0.03%	0.21%	0.02%	0.03%	5,400
2010	0.18%	1.02%	0.03%	0.61%	0.09%	0.02%	0.17%	0.02%	0.00%	5,373
2011	0.23%	1.15%	0.04%	0.53%	0.07%	0.04%	0.33%	0.02%	0.00%	5,216
2012	0.17%	0.87%	0.03%	0.28%	0.07%	0.03%	0.24%	0.02%	0.00%	5,185
2013	0.23%	1.10%	0.03%	0.14%	0.05%	0.11%	0.27%	0.02%	0.00%	5,061
2014	0.17%	0.80%	0.03%	0.18%	0.04%	0.06%	0.31%	0.01%	0.00%	5,553
2015	0.17%	0.68%	0.02%	0.34%	0.03%	0.08%	0.31%	0.01%	0.00%	5,664
2016	0.18%	0.83%	0.02%	0.31%	0.02%	0.02%	0.14%	0.01%	0.00%	5,504

Are FTDs Symptomatic of Growing Short Interest in ETFs?



Authorized Participants

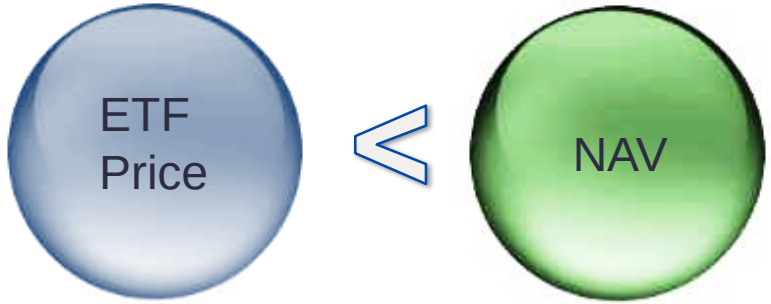
ETF Premium:



Authorized Participants:

- Buy underlying securities
- Create ETF shares in kind
- Sell ETF shares
- Profit = ETF price – NAV – transaction costs

ETF Discount:



Authorized Participants:

- Buy ETF shares in the market
- Redeem ETF shares in kind
- Sell underlying securities
- Profit = NAV – ETF price – transaction costs

Authorized Participant Arbitrage Option: Operational Shorting

When faced with **"excess buying"** pressure for ETF shares, the AP/MM has two choices:

- **Sell shares from its inventory or locate the shares** in the secondary market (and deliver at T+3).

OR

- **Sell shares "naked" and then locate or create the shares** at a later time (up to T+6 for "bona fide" market making)…
  …but delay past T+3 results in an FTD

The first choice locks in a market-making profit but requires higher upfront capital outlays (safer but *lower* return).

The second choice can also lock in a profit (if a futures/options hedge is used) but with less capital outlay (safe and *higher* return).

What is Operational Shorting?

- **The AP/Market Maker sells ETF shares that they don't own:**

"Market makers, often commercial banks or hedge funds, create ETFs for their issuers by buying the securities that the funds are supposed to represent. But they've discovered that they can make a predictable return by **delaying the purchases and selling you nonexistent exchange-traded fund shares that they will create later**. These transactions— **a form of shorting** —eventually may involve 50,000 shares—the amount typically in a 'creation unit'…"

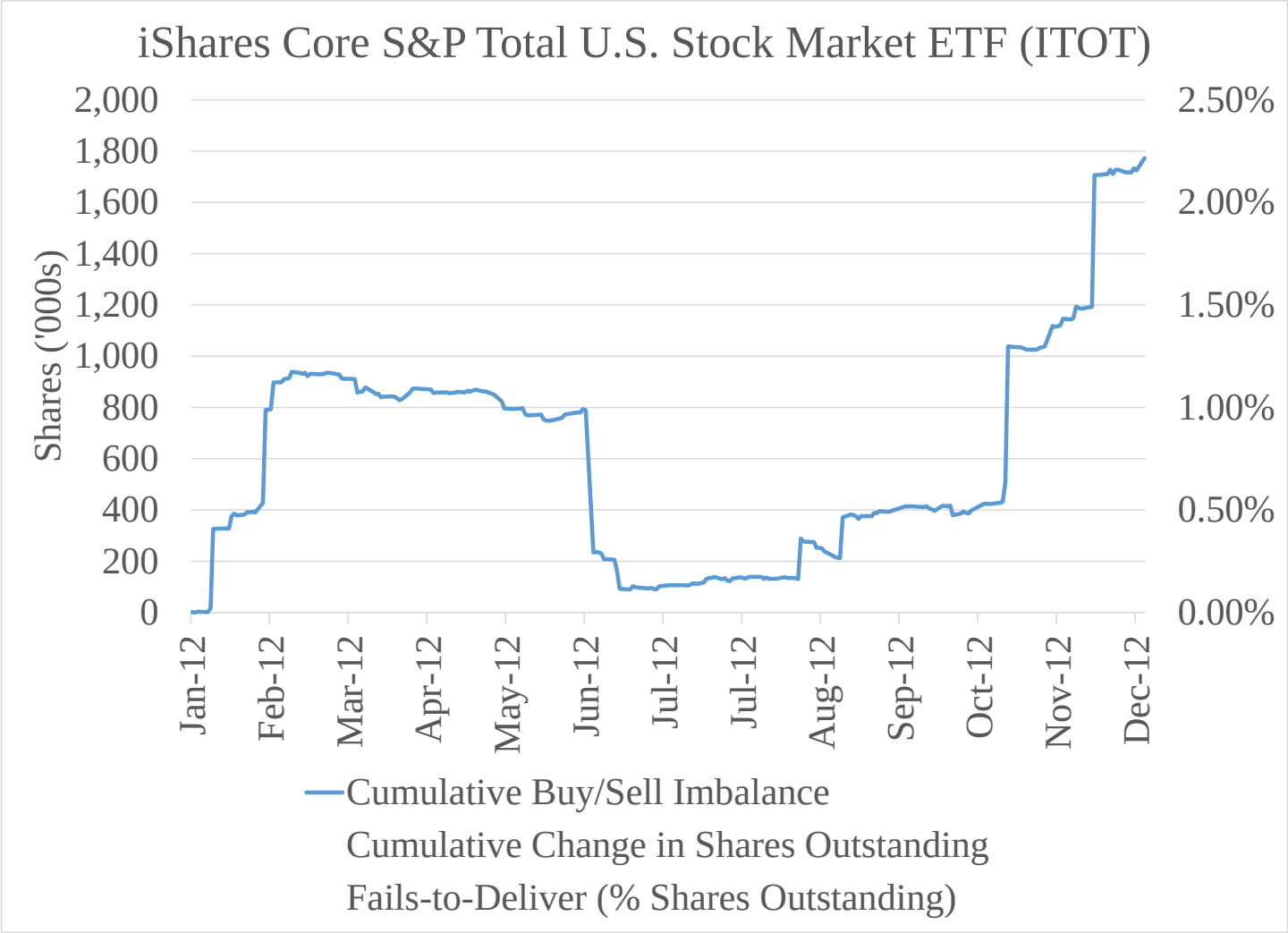
- Jim McTague (2011), Barron's

- **AP/Market Makers are allowed to fail because they are 'making markets':**

"…sometimes the settlement of primary market ETF shares may be delayed past T+3….these transactions are reported as "failures to deliver"….**Market makers**, which can include APs acting as market makers or agents to market makers, **have up to three additional days to settle trades** (a total of **T+6**) if their failure to deliver is the result of bona fide market making."

– Antoniewicz and Heinrichs (2014), ICI

Example of Operational Shorting: ITOT



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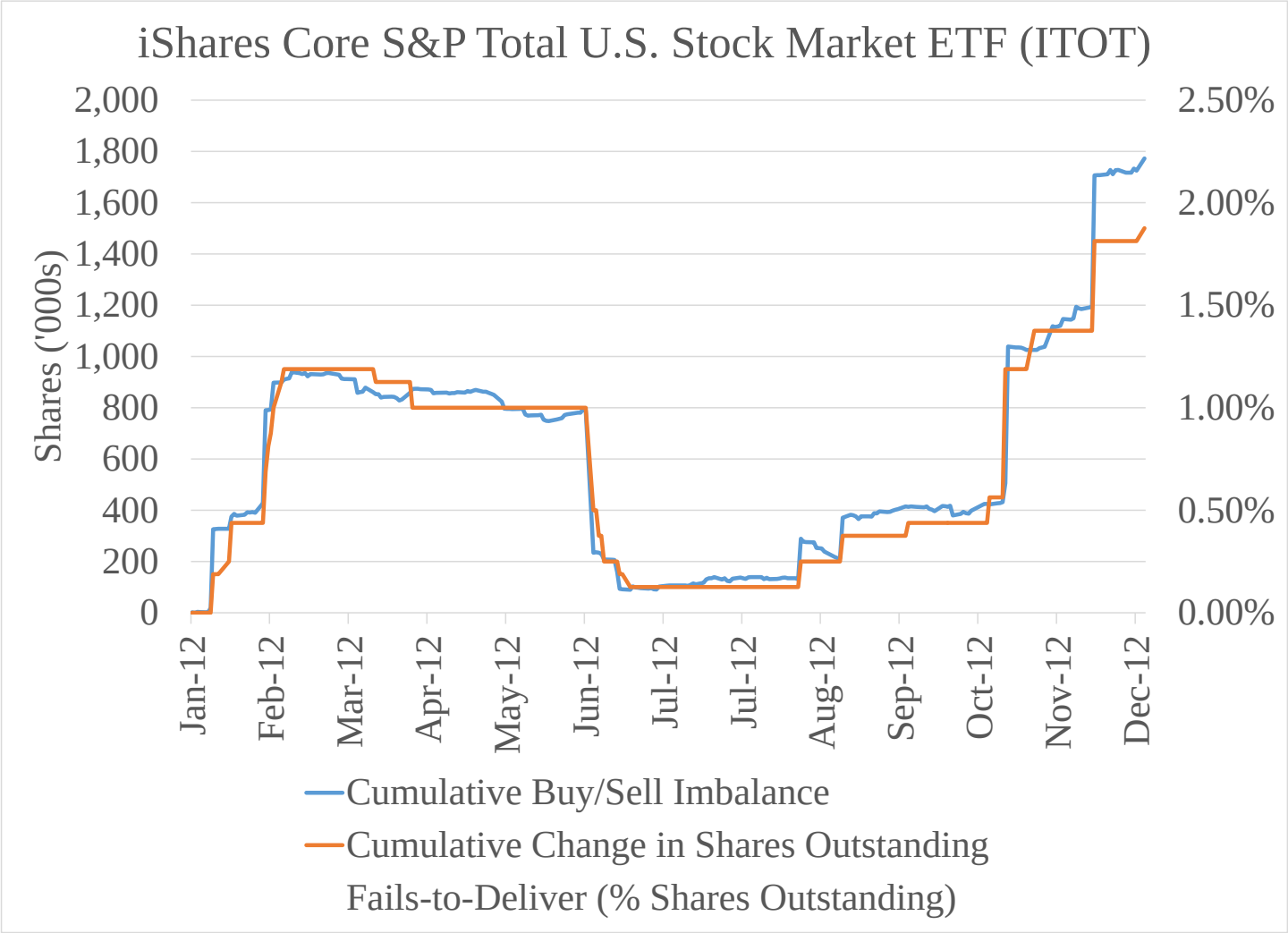
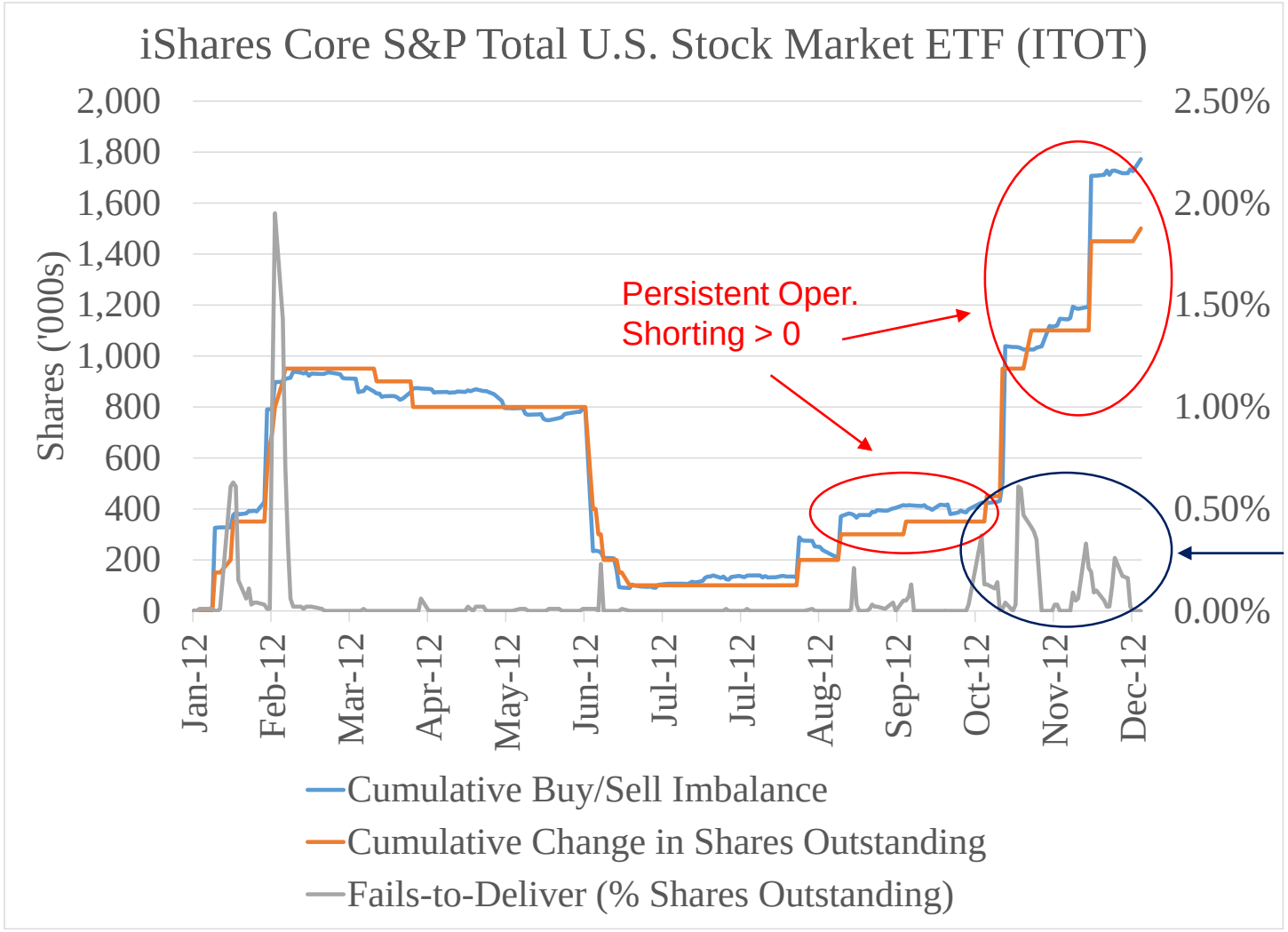


Example of Operational Shorting: ITOT

Why doesn't ETF share creation respond perfectly to excess buying/selling?

- Creation unit size
- Creation fee
- Trading costs
- Trading environment or market liquidity



Measuring Operational Shorting

Our daily measure of operational shorting imbalance and the change in shares outstanding over a 3-day rolling window:

$$Operational\ Shorting = \frac{\max[0, \left(\text{Cumulative Buy/Sell Imbalance}(t-3, t-1) - \Delta\text{Shares Outstanding}(t-1, t)\right)]}{\text{Shares Outstanding}(t\text{ - }3)}$$

Uses Lee and Ready's (1991) algorithm, modified with Ellis, Michaely, and O'Hara (2000) method to sign *all trades* on a millisecond basis and then sums all signed trades at 4:00 pm for each day.

Research Questions

- What are the determinants of an AP's decision to operationally short?
- Does operational shorting contribute to the observed high rates of ETF short interest/FTDs?
- What are the consequences of operational shorting on AP liquidity provision? (e.g. volatility, liquidity, and price efficiency)
- How does operational shorting activity relate to future returns on both the ETF and the underlying assets?
- Does operational shorting manifest spillover effects/financial linkages:
  - Across different ETFs for a single AP (i.e. within AP effects)
  - Across different APs (i.e. between AP effects)
  - When the AP has leverage constraints

Sample and Summary Statistics

- Daily data from March 2004 to December 2016
- US Exchange-Traded Funds (no levered ETFs)
  - Subset of tests focusing on US Equity ETFs (ETF vs. underlying bid-ask spread)
  - All regressions include ETF/Date fixed effects and clustered standard errors

	Variable	Obs	Mean	Std.Dev.	p1	p25	p50	p75	p99
Entire ETF Sample	Fail-to-Deliver Shares / Shares Outstanding	3,007,239	0.42%	1.53%	0.00%	0.00%	0.00%	0.11%	11.45%
	Operational Shorting, as % of Shares Outstanding	3,006,555	1.01%	2.89%	0.00%	0.00%	0.00%	0.65%	20.83%
	Net Create/Redeem Activity: log (1 + % change in Shares Outstanding)	3,006,045	0.11%	1.37%	-5.72%	0.00%	0.00%	0.00%	8.82%
	ETF Order Imbalance: (Buys - Sells) / Average Shares Outstanding	2,772,648	0.15%	1.81%	-7.15%	-0.15%	0.03%	0.29%	10.63%
	Market Capitalization, $ million	3,007,054	$867.19	$2,600.87	$1.38	$16.81	$86.20	$427.69	$18,523.09
	Daily Share Turnover, % of Shares Outstanding	2,950,760	4.0%	8.6%	0.1%	0.6%	1.2%	2.8%	55.5%
	Amihud Illiquidity Measure	2,756,643	0.11	0.37	0.00	0.00	0.00	0.04	2.59
	% Mispricing: % difference between ETF price and NAV	2,912,330	0.029%	0.572%	-2.332%	-0.118%	0.016%	0.184%	2.115%
	Maximum Rolling R-Squared with Available Futures Contracts	2,673,729	53%	29%	0%	30%	59%	77%	96%
	Available Options Dummy	3,007,239	0.31	0.46	0.00	0.00	0.00	1.00	1.00
	Creation Unit Size	931,999	69,602	35,005	25,000	50,000	50,000	100,000	250,000
	Creation Unit Fee	931,999	$1,577.56	$2,664.75	$100.00	$500.00	$500.00	$1,400.00	$15,000.00
	Bid-Ask Spread, at Close	2,956,434	0.330%	0.542%	0.011%	0.067%	0.147%	0.339%	3.544%
	Intraday NBBO Bid-Ask Spread, Trade Size Weighted	2,772,053	0.269%	0.395%	0.012%	0.064%	0.135%	0.288%	2.470%
	Intraday Volatility, using second-by-second intraday returns	2,703,755	0.0083%	0.0083%	0.0000%	0.0037%	0.0061%	0.0100%	0.0511%
	Daily Cost of Borrow Score	1,768,565	3.19	1.47	1.00	2.00	3.00	4.00	7.00
	Indicative Fee	1,588,220	4.37%	3.44%	0.38%	1.75%	3.50%	6.00%	18.00%
	Short Interest Ratio	2,946,535	4.66%	11.84%	0.00%	0.28%	0.90%	3.20%	83.76%

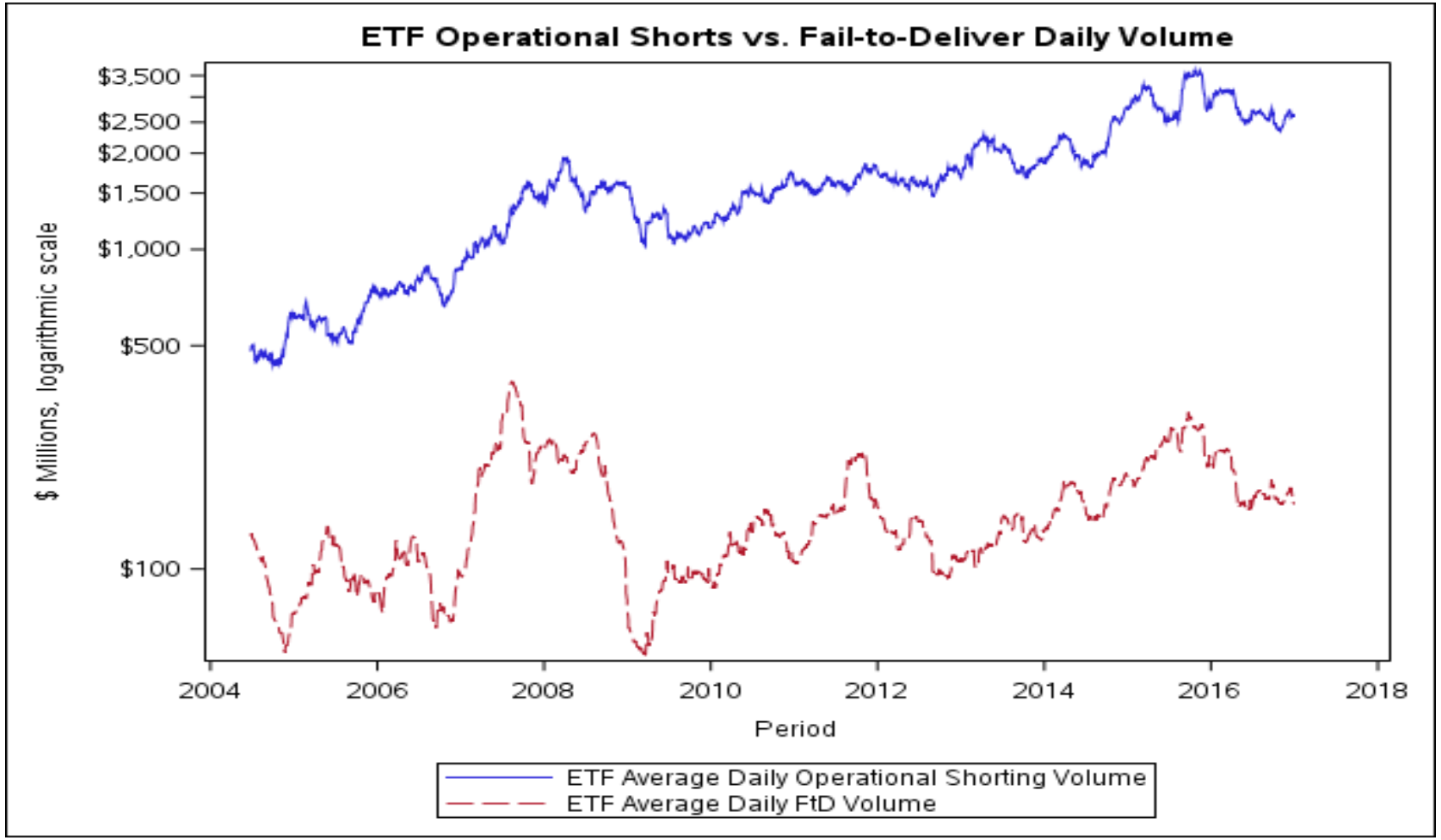
Determinants of Operational Shorting

Increased operational shorting associated with

- Larger creation unit size (sample median 50,000 shares) and creation unit fee (sample median $500)
- Access to hedge for underlying (futures and options)
- Less liquid underlying asset relative to the ETF
- Higher ETF premium relative to NAV (opposite for discount)
- Higher share turnover in the ETF

- Regressions control for ETF & date fixed effects, liquidity and size

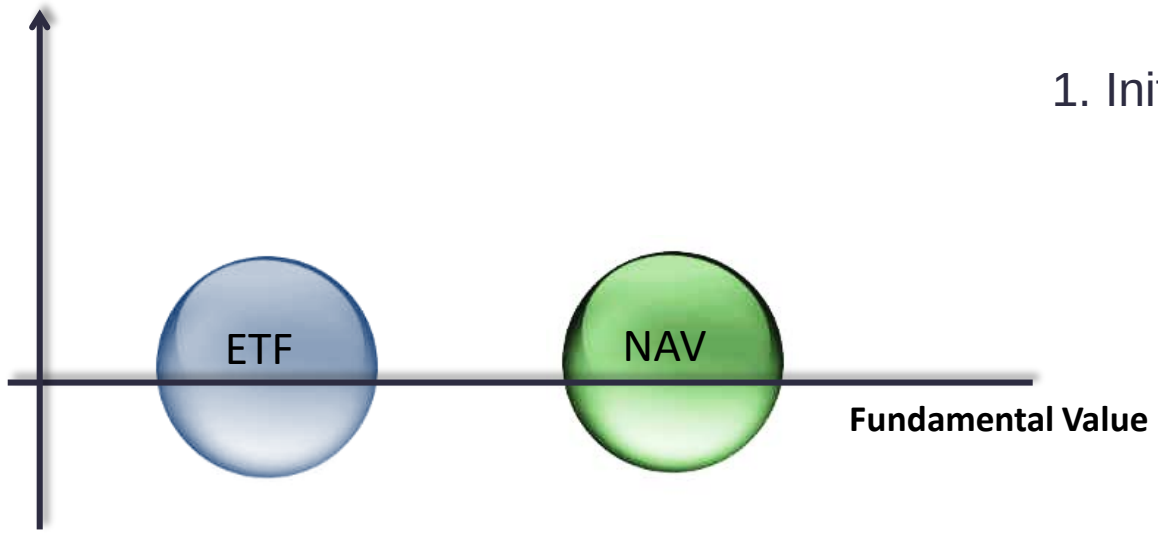
Operational Shorting, Short Interest and FTDs



- Operational shorting strongest determinant of Short Interest & FTDs
- Controlling for contemporaneous borrowing cost and lagged SI/FTDs

Do ETFs Increase Volatility?

Ben-David, Franzoni and Moussawi (2017) examine the impact of ETF ownership on the volatility of the underlying security:



1. Initial Equilibrium

Do ETFs Increase Volatility? (2)

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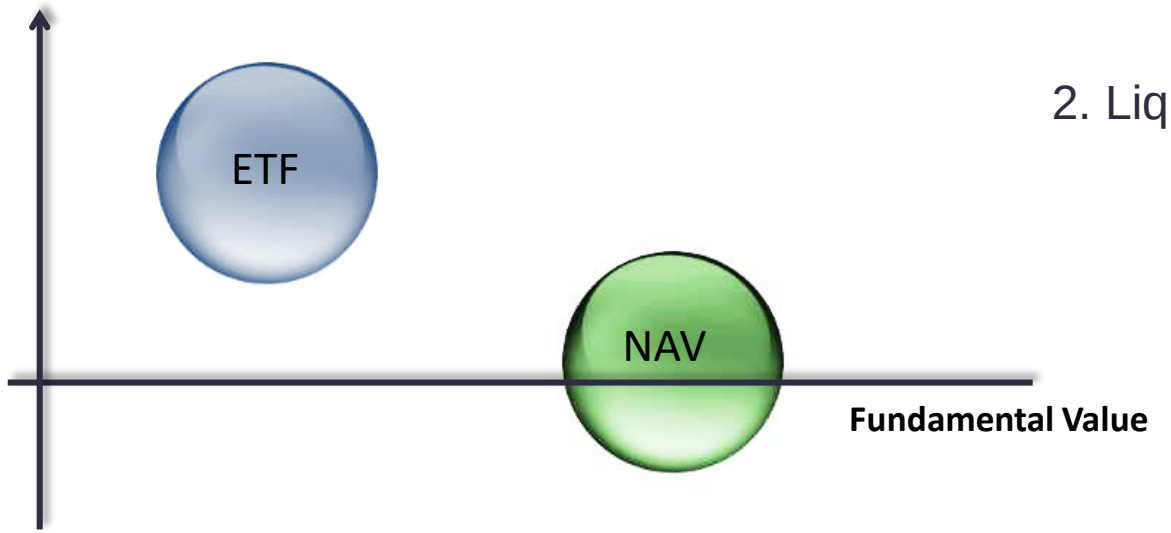

2. Liquidity Shock to ETF

Do ETFs Increase Volatility? (3)

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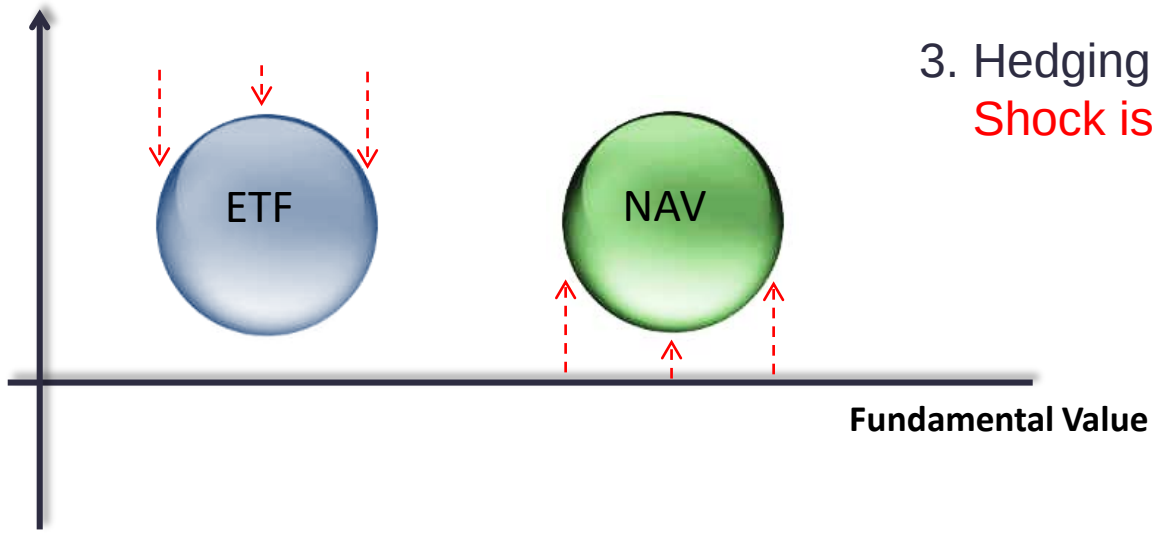

3. Hedging Demand by Arbitrageurs:
   Shock is propagated to NAV

Do ETFs Increase Volatility? (4)

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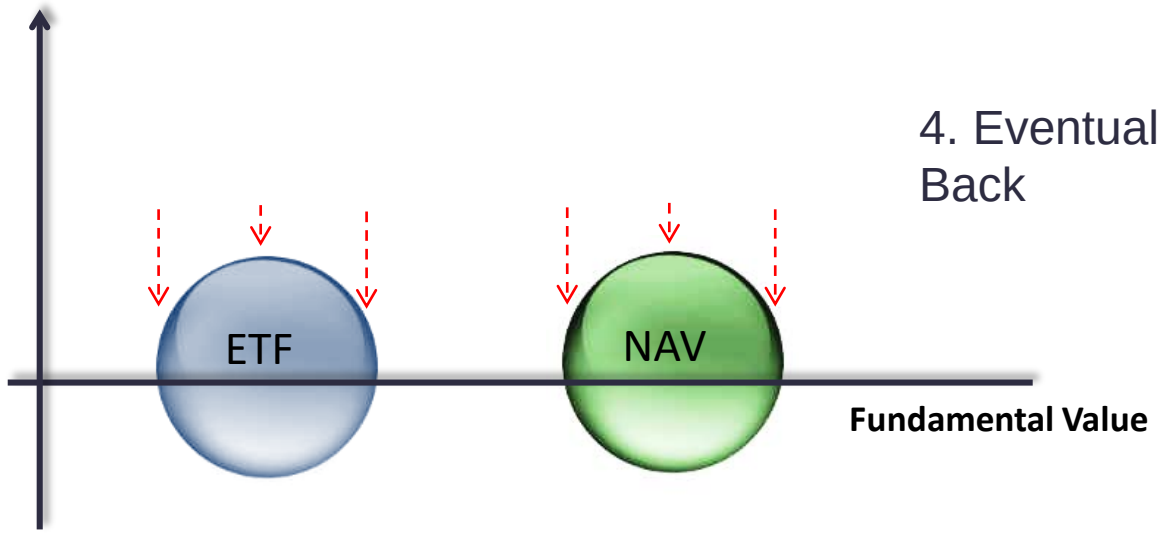

4. Eventually Liquidity Flows Back

Compelling evidence that ETFs do increase volatility

Consequences of Operational Shorting

Purpose of ETF T+6 exemption is to enhance liquidity…does it?

Operational Shorting acts as a **buffer** with the underlying basket of securities:

- Reduces negative effect of ETFs on the volatility of the basket
- Reduces negative effect of ETFs on intraday spreads of the basket
- Improves the price discovery process of the underlying basket, by absorbing noise related to liquidity traders

Return effects consistent with liquidity trader explanation

Operational Shorting and Future Returns

	Weekly Return						
	ETF FF4 α (t) (1)	ETF FF4 α (t+1) (2)	NAV FF4 α (t+1) (3)	ETF FF4 α (t+1) (4)	ETF FF4 α (t+1) (5)	ETF FF4 α (t+1) (6)	ETF FF4 α (t+1) (7)
Operational Shorting - Weekly % (t)	1.331***	-0.232***	-0.027	-0.341***	-0.250***	-0.031	-0.265***
	(11.70)	(-3.03)	(-0.35)	(-3.81)	(-2.75)	(-0.13)	(-2.78)
Create Orders - Weekly % (t)	-0.076	-0.140*	0.004	-0.105	-0.091	-0.154	-0.028
	(-0.77)	(-1.87)	(0.06)	(-1.17)	(-1.08)	(-0.79)	(-0.29)
log (Market Cap), at (t-1)	-0.022**	-0.039***	-0.033***	-0.040***	-0.032***	-0.045***	-0.044***
	(-2.57)	(-4.08)	(-4.02)	(-3.82)	(-3.78)	(-3.82)	(-3.72)
Average Share Turnover (t-1)	-0.097	-0.188**	-0.018	0.013	0.194	0.090	0.058
	(-1.05)	(-2.00)	(-0.19)	(0.13)	(1.02)	(0.39)	(0.28)
Amihud Illiquidity Measure (t-1)	0.024	0.040	0.013	0.012	-0.001	-0.043	0.025
	(0.99)	(1.49)	(0.87)	(0.59)	(-0.05)	(-0.95)	(0.78)
Observations	551,252	550,664	550,664	249,579	222,161	60,958	158,914
R-squared	0.077	0.082	0.086	0.197	0.073	0.085	0.089
ETF & Date Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ETF & Date Clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ETF Sample	All	All	All	Non US-Equity	US-Equity	US-Equity	US-Equity
Liquidity Mismatch (ETF vs Underlying)						Low	High

Excerpt from August 2015 ETF-FTD SEC Comment Letter

Table 16 – XRT Shares Held by Institutions above Shares Outstanding, Short Interest and NSCC Fails

	December 31, 2011	March 31, 2012	June 30, 2012
Shares Outstanding	***11,700,113***	***12,950,113***	***9,450,113***
Number of Reporting Institutional Holders	97	95	99
Total Shares Owned by Institutions	**77,808,884**	**75,085,005**	**64,319,206**
Difference between Shares Outstanding and Shares Owned by Institutions	66,108,771	62,134,892	54,869,093
Reported Short Interest	51,645,632	44,635,529	38,032,800
Shares Outstanding plus Short Interest	63,345,745	57,585,642	47,482,913
Shares Owned by Institutions Above Shares Outstanding plus Reported Short Interest	**14,463,139**	**17,499,363**	**16,836,293**
NSCC Reported Fails	728,413	242	292,383

Operational Shorting and Financial Linkages

Looking at the intra-AP and inter-AP linkages for ETFs, we find:

- APs who are operationally short in one ETF, are more likely to be operationally short in other ETFs for which they serve as an AP (intra-AP linkage)
- A given AP has higher operational shorting when other APs have higher levels of operational shorting (inter-AP linkage)

Looking at regulatory constraints on AP leverage, we also find that the closer a firm is to its regulatory leverage limit, the higher

Conclusions

- We identify a previously unrecognized source of ETF short sales and FTDs by APs, which we term '**Operational Shorting**'
- We propose a novel measure of operational shorting and show that it is a strong determinant of short interest and FTDs
- Operational shorting can act as a **buffer** and improve the basket's liquidity and price efficiency
- Operational shorting by the AP predicts an ETF return reversal, but has no predictive power for the return of the underlying securities
- We show **"spillovers"** within and between APs and leverage constrained APs are more likely to operationally short