

# Exchange-traded funds' expansion and their unintended effects over underlying stocks

## Volatility, liquidity and efficiency

Grégoire Pichard

HEC Lausanne (Unil)

June 28, 2019

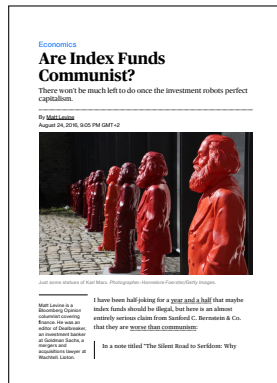
## All evil rooted in one product ?

### The Silent Road to Serfdom : Why Passive Investing is Worst Than Marxism – Note by I. Fraser-Jenkins, *Sanford C. Bernstein & Co.*, 2016

- Abstract : the shift of a growing share of capital markets towards passive, index-based investing prevents the efficient reallocation of capital from overpriced to underpriced companies. Active management and the related research generate positive externalities.
- Are this concern and conclusion justified ?
  - What are the author's interests ? This is from the quantitative research of an asset management company, also running retail mutual funds.
  - In general:

*Everything which is exaggerated is insignificant.*

*Talleyrand*



**Figure 1:** Matt Levine, Bloomberg Opinion, 24.08.2016, available at: <https://www.bloomberg.com/opinion/articles/2016-08-24/are-index-funds-communist#footnote-1472053794479>

## Research field & focus

### General concerns expressed

- What effects are caused through index-tracking securities and **especially ETFs** on underlying securities ?
- Is there a new risk investors and regulators should become aware of ?

### Warning

Focusing on observable indicators of the risk and loss of efficiency is needed: choice based on existing research strategies.

### Research questions

Three aspects are treated over a broad and long sample of stocks:

- 1 Do ETFs increase underlying stocks' volatility over the short term ?
- 2 Do ETFs divert the liquidity and thus decrease it at the individual security level ?
- 3 Are there signs ETFs make prices noisier, hence less efficient ?

# Outline

## 1 Context

- Exponential growth of a new fund type
- Institutional aspects of ETFs
- Evidence-based concerns expressed about ETFs

## 2 Research method and main results

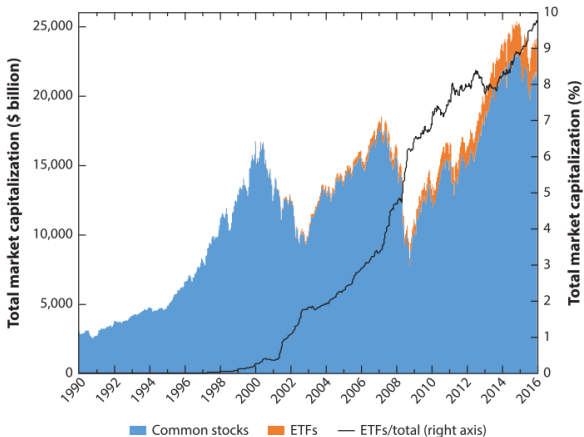
- Data
- ETF ownership and the volatility of underlying stocks
- ETF ownership and the liquidity of underlying stocks
- ETF ownership and the price efficiency of underlying stocks

## 3 Conclusion

- Wrap-up
- Limitations and further directions

# Capitalization worldwide

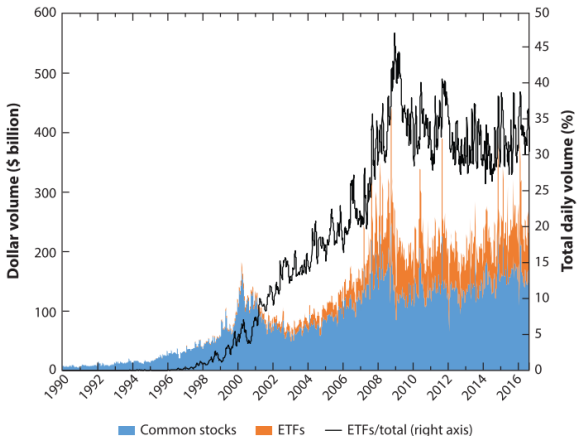
Figure 2: Comparison of total stock market vs. ETF capitalization<sup>1</sup>



<sup>1</sup>Ben-David, F. Franzoni, and Moussawi 2017, p. 172.

# Trading volume, share of total

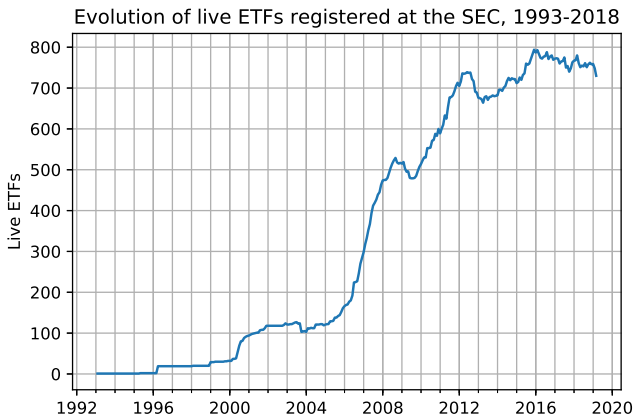
Figure 3: Comparison of total stock market vs. ETF-related daily trading volume<sup>2</sup>



<sup>2</sup>Ben-David, F. Franzoni, and Moussawi 2017, p. 173.

# Entities listed in the U.S.

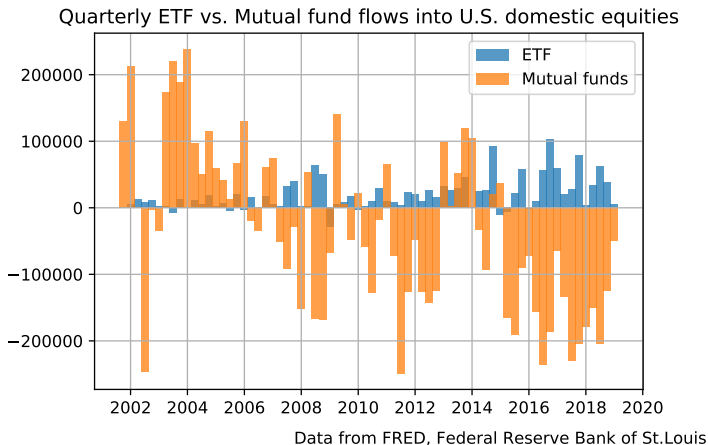
Figure 4: Number of ETFs included over the sample period<sup>3</sup>



<sup>3</sup>Data from *Eikon* fund screener, only physical- and optimized-replication ETFs listed in the U.S.

# Comparing flows in U.S. equity

Figure 5: Shift towards ETF investments and steady outflows from mutual funds





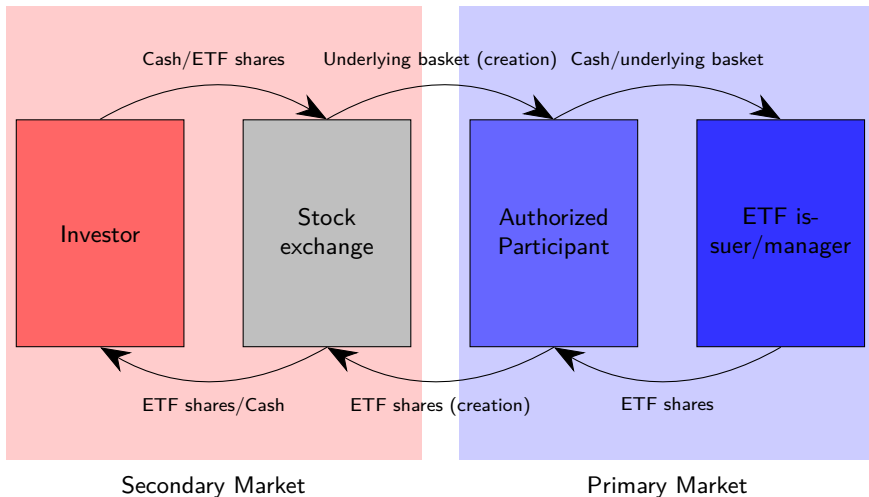
# Concept and history of exchange-traded funds

- Goal at the inception : track a value-weighted equity index using physical replication.
  - First ETF ever listed : Toronto Stock Exchange Index Participation Units, introduced March 1990
  - First ETF listed in the U.S. : State Street SPDR S&P 500 ETF, a.k.a. “SPY”, introduced January 1993.
  - As of June 21, 2019, SPY is the largest ETF by assets under management: USD 266 B.
- A mixture of existing products:
  - As (open-end) mutual funds:
    - release their Net Asset Value and their holdings
    - registered as 1940 Act investment companies → creation/redemption of shares
  - As index-funds : track an index built with underlying securities and/or derivatives and following rules defined in a prospectus
  - As closed-end funds : traded throughout the day on an exchange

## Special features

- the intraday NAV is spread out every 15 seconds, or more often.
- **standardized in-kind or cash creation/redemption process involving authorized participants' arbitrage.**

# ETF pricing mechanism and trading



## Concerns expressed about risks conveyed through ETFs

- Liquidity : apart from idiosyncratic events (e.g. 2010 Flash Crash), ETFs in general are very liquid thanks to the arbitrage mechanism. E.g. Ben-David, F. A. Franzoni, and Moussawi (2018) show their turnover is higher than stocks.
- What about underlying securities' liquidity ?

### Under regulatory scrutiny

This asset category started to worry regulators less than a decade ago, without leading them to clear conclusions nor actions.

*[ETFs] may transmit or amplify financial shocks originating elsewhere.*

*[...]*

*ETFs [...] could also potentially accelerate or amplify movements in markets during market turbulence, thus reducing market liquidity.*

*U.S. Dept. of Treasury, Office of Financial Research, September 2013*

# Selection of academic contributions about ETFs' effects I

## ■ Empirical contributions

- Agarwal et al. (2018) : quasi-natural experiments with (1) trading halts and (2) Russell indices to show an increase of the *commonality* of stock liquidity with respect to a highly ETF-owned basket of other stocks.
- Da and Shive (2018) :
  - ETFs' turnover, but not ownership, is positively linked with the comovement of their component stocks.
  - Stock-level analysis : average turnover of ETF shareholders predicts comovement with the market; mean reversion due to ETF flows and comovement is thus *excessive*
- Leippold, Su, and Ziegler (2015) (including a model) : introduction of equity ETF increases the average correlation among index components as well as non-index components, more than index futures did.
- Krause, Ehsani, and Lien (2014) (idem) : variance spillovers between ETFs and their largest component stocks are positively correlated with liquidity, ETF ownership share, ETF flows and their market capitalization; the relationship strengthens for small stocks.

## ■ Theoretical models

- Bhattacharya and O'Hara (2017) : as ETFs provide access to otherwise illiquid securities, ETF-related information distorts those securities' prices. ("tail wagging the dog" in authors' words)
- Chinco and Fos (2016) : ETF rebalancing cause subsequent rebalancing cascades reaching stocks held together in ETF portfolios; the direction of a stock's move is impossible to predict.

## Selection of academic contributions about ETFs' effects II

### Most relevant

**Part of the methodology** in the following articles has served for this thesis, which replicates and extends their results:

- Ben-David, F. A. Franzoni, and Moussawi (2018)
  - **Monthly volatility impact of ETF ownership** : *liquidity trading hypothesis vs. liquidity buffer hypothesis*
  - Robust IV setting using exogenous index membership changes (Russell 3000)
  - **Reversion of prices after a shock** : *liquidity trading hypothesis vs. price discovery hypothesis*
  - Price impact of ETF flows using trade-level data
  - Correction of mispricing (arbitrage) and intraday volatility
  - Asset pricing consequence : a risk premium for the volatility caused by ETF interest.
- Israeli, Lee, and Sridharan (2017)
  - Testing two hypotheses showing that ETF appeal to noise traders, who migrate from individual securities, while informed traders find less liquidity on underlying stocks.
    - 1 Trading costs increasing with ETF ownership
    - 2 Deterioration of the informational efficiency of stock prices
  - **Proxies for liquidity** : *bid-ask spread estimator and Amihud (2002) illiquidity ratio*
  - Proxies for firm-level informational efficiency : return synchronicity, future earnings response and analyst coverage

# Data coverage

- Period : August 1999 – December 2018
- Frequency:
  - Daily price, volume and VWAP series
  - Monthly ETF and other fund holdings, and controls
  - Quarterly resampling for variance ratios (estimation of efficiency effects)
- Analysis performed at stock-level over separate samples:
  - on a U.S. stocks sample : 4784 companies
  - on an international sample of stocks: 16417 companies from Europe (EU25 + EFTA), Canada, Japan, BRICS and emerging countries (Israel, Turkey, South Korea, Hong Kong, Taiwan)
- Exchange-traded funds :
  - 3601 live funds as of 2019 Q1, from the *Lipper* database
  - Physical or optimized replication only
  - Countries of incorporation not limited to U.S. :
    - Americas (Canada, Mexico, Brazil, Colombia)
    - Europe (France, Germany, Switzerland, Ireland, Spain, Greece, Sweden, Poland, Russia)
    - Asia-Pacific (Japan, South Korea, India, Hong Kong, Mainland China, Taiwan, Vietnam, Indonesia, Malaysia, Australia, New Zealand)
- Source : Thomson Reuters *Eikon* platform and API.

# Methodology

$$\text{Volatility}_{i,t} = \beta_0 + \beta_1 \text{ETF\_ownership}_{i,t} + B_C^T \text{Controls}_{i,t} + \alpha_i + \gamma_t + \epsilon_{i,t} \quad (1)$$

with:

$$\text{Volatility}_{i,t} = \sqrt{\frac{1}{N_{d_{i,t}} - 1} \sum_{d=1}^{N_{d_{i,t}}} (r_{i,d} - \bar{r}_{i,t})^2}$$

$$\text{ETF\_Ownership}_{i,t} = \frac{\sum_{f=1}^{N_f} \#\_AdjShares\_Held_{f,i,t} \cdot B_f}{\#\_Shares\_Out_{i,t}}$$

$\forall i = 1 : N_i$  (stocks),  $t = 1 : T$  (periods) with  $B_f = 1$  if fund  $f$  is an ETF, 0 else.

Controls:

- Size, Value, Momentum
- Liquidity
- Gross profitability
- Volatility lags
- Other institutional ownership : mutual funds, hedge funds, pension funds

## Estimation results : U.S.

**Table 1:** U.S. Sample : Exchange-Traded Fund aggregate ownership share and the volatility of underlying securities' daily returns

	Baseline	Controls +lags	O'ship controls	Standardized
<b>Intercept</b>	0.2964***	0.0488***	0.0494***	-0.0154
<b>PctETF<sub>t-1</sub></b>	0.2470***	0.0385***	0.0395***	0.0081***
<b>(t-stat)</b>	(8.2542)	(5.9800)	(6.2940)	(6.8269)
<b>log(MarketCap<sub>t-1</sub>)</b>	-0.0127***	-0.0018***	-0.0018***	-0.0102***
<b>1/Close<sub>t-1</sub></b>	0.0988***	0.0251***	0.0251***	0.1452***
<b>(BE/ME)<sub>t-1</sub></b>	5.552e-07**	7.393e-07***	1.038e-06***	5.019e-06***
<b>Past12to1Mret.<sub>t-1</sub></b>	-0.0003	-0.0004*	-0.0004*	-0.0024*
<b>AmihudRatio<sub>t-1</sub></b>		3.4590***	3.4611***	19.952***
<b>BidAskSpread<sub>t-1</sub></b>		0.1750***	0.1748***	1.0060***
<b>G. Profitab.<sub>t-1</sub></b>		-0.0005***	-0.0005***	-0.0028***
<b>Volatility lags (t - 4 to t - 1)</b>		Yes	Yes	Yes
<b>Other funds ownership</b>			Yes	Yes
<b>Fixed Effects</b>	Entity, Time	Entity, Time	Entity, Time	Entity, Time
<b>No. Observations</b>	413304	297405	297399	297247
<b>R<sup>2</sup></b>	0.0545	0.1592	0.1593	0.1594
<b>R<sup>2</sup> (Within)</b>	0.0565	0.1353	0.1351	0.1348
<b>R<sup>2</sup> (Between)</b>	0.2009	0.7626	0.7625	0.7616
<b>R<sup>2</sup> (Overall)</b>	0.1515	0.2716	0.2715	0.2710
<b>F-statistic</b>	4717.9	4643.9	3718.4	3718.6
<b>P-value (F-stat)</b>	0.0000	0.0000	0.0000	0.0000



## Estimation results : International

**Table 2:** International Sample : Exchange-Traded Fund aggregate ownership share and the volatility of underlying securities' daily returns

	Baseline	Controls + Vol. lags	Inst. o'ship control	Standardized
<b>Intercept</b>	0.0582***	0.0283***	0.0283***	0.6235***
<b>PctETF<sub>t-1</sub></b>	0.0169*	0.0072	0.0070	0.0028
<b>(t-stat)</b>	(1.8226)	(1.0225)	(0.9781)	(0.9781)
<b>log(MarketCap<sub>t-1</sub>)</b>	-0.0015***	-0.0008***	-0.0008***	-0.0310***
<b>1/Close<sub>t-1</sub></b>	0.0045***	0.0015	0.0015	0.0585
<b>(BE/ME)<sub>t-1</sub></b>	3.446e-05***	2.54e-05***	2.538e-05***	0.0010***
<b>Past12to1Mret.<sub>t-1</sub></b>	0.0005*	0.0001	0.0001	0.0052
<b>AmihudRatio<sub>t-1</sub></b>		0.0250	0.0250	0.9984
<b>BidAskSpread<sub>t-1</sub></b>		0.0262***	0.0262***	1.0496***
<b>G. Profitab.<sub>t-1</sub></b>		-0.0001	-0.0001	-0.0056
<b>Volatility lags (t - 4 to t - 1)</b>		Yes	Yes	Yes
<b>Mutual funds ownership</b>			Yes	Yes
<b>Fixed Effects</b>	Entity, Time	Entity, Time	Entity, Time	Entity, Time
<b>No. Observations</b>	1516791	1319966	1319966	1319966
<b>R-squared</b>	0.0070	0.1729	0.1729	0.1729
<b>R-Squared (Within)</b>	0.0148	0.2100	0.2100	0.2100
<b>R-Squared (Between)</b>	-0.0101	0.7081	0.7079	0.7079
<b>R-Squared (Overall)</b>	-0.0208	0.3261	0.3260	0.3260
<b>F-statistic</b>	2118.7	2.274e+04	2.099e+04	2.099e+04
<b>P-value (F-stat)</b>	0.0000	0.0000	0.0000	0.0000

# Methodology

$$\text{PctBidAskSpread}_{i,t} = \beta_0 + \beta_1 \text{ETF\_ownership}_{i,t-1} + B_C^T \text{Controls}_{i,t-1} + \alpha_i + \gamma_t + \epsilon_{i,t} \quad (2)$$

with:

$$\text{Pct\_BidAskSpread}_{i,t} = \frac{\text{Ask}_{i,t} - \text{Bid}_{i,t}}{\frac{\text{Ask}_{i,t} + \text{Bid}_{i,t}}{2}}$$

$$\text{Illiq}^{\text{Num}}_{i,t} = \beta_0 + \beta_1 \text{ETF\_ownership}_{i,t-1} + \beta_2 \text{Illiq}^{\text{Denom}}_{i,t} + B_C^T \text{Controls}_{i,t-1} + \alpha_i + \gamma_t + \epsilon_{i,t} \quad (3)$$

Amihud (2002) illiquidity ratio:

$$\text{Illiq}_{i,t} = \frac{1}{N_{d,i,t}} \sum_{d=1}^{N_{d,i,t}} \frac{|r_{i,d}|}{\text{Volume\_}\$_{i,d}} = \frac{1}{N_{d,i,t}} \sum_{d=1}^{N_{d,i,t}} \frac{|r_{i,d}|}{\text{Volume}_{i,d} \cdot \text{VWAP}_{i,d}}$$

Modified version following Israeli, Lee, and Sridharan (2017):

$$\text{Illiq}^{\text{Num}}_{i,t} = \frac{1}{N_{d,i,t}} \sum_{d=1}^{N_{d,i,t}} |r_{i,d}| \quad \text{Illiq}^{\text{Denom}}_{i,t} = \frac{1}{N_{d,i,t}} \sum_{d=1}^{N_{d,i,t}} \text{Volume\_}\$_{i,d}$$

# Estimation results : U.S.

**Table 3:** U.S. Sample : Exchange-Traded Funds' aggregate ownership share and underlying securities' liquidity

	Amihud ratio		Bid-Ask spread	
	Baseline	w/inst. o'ship	Baseline	w/inst. o'ship
Intercept	0.3424***	0.3425***	0.1055***	0.1057***
PctETF <sub>t-1</sub>	0.1809***	0.1810***	0.0074	0.0073
(t-stat)	(7.5170)	(7.5198)	(0.8731)	(0.8642)
log(MarketCap <sub>t-1</sub> )	-0.0153***	-0.0153***	-0.0049***	-0.0049***
(BE/ME) <sub>t-1</sub>	2.812e-07	2.925e-07	-4.261e-08	-4.149e-08
Amihud Denominator	1.335e-11***	1.335e-11***		
Other funds ownership				Yes
Volatility <sub>t-1</sub>			0.0498***	0.0498***
Other funds ownership				Yes
Fixed Effects	Entity, Time	Entity, Time	Entity, Time	Entity, Time
Dep. Variable	Amihud Numerator	Amihud Numerator	Bid-Ask Spread	Bid-Ask Spread
No. Observations	436359	436352	335170	335164
R-squared	0.0326	0.0326	0.0510	0.0510
R-Squared (Within)	0.0448	0.0448	0.0659	0.0660
R-Squared (Between)	0.1897	0.1898	0.5568	0.5572
R-Squared (Overall)	0.1291	0.1291	0.1879	0.1881
F-statistic	3643.1	2914.2	4445.9	2543.2
P-value (F-stat)	0.0000	0.0000	0.0000	0.0000

## Estimation results : International

**Table 4:** International Sample : Exchange-Traded Funds' aggregate ownership share and underlying securities' liquidity

	Amihud ratio		Bid-Ask spread	
	Baseline	w/inst. o'ship	Baseline	w/inst. o'ship
Intercept	0.0776***	0.0776***	0.1446***	0.1446***
PctETF <sub>t-1</sub>	0.0038	0.0038	0.0613***	0.0610***
(t-stat)	(0.5715)	(0.5817)	(4.9367)	(4.9518)
log(MarketCap <sub>t-1</sub> )	-0.0058***	-0.0058***	-0.0061***	-0.0061***
(BE/ME) <sub>t-1</sub>	0.0012	0.0012	1.107e-05	1.108e-05
log(AmihudDenominator <sub>t</sub> )	0.0042***	0.0042***		
Volatility <sub>t-1</sub>			0.1772***	0.1772***
Other funds ownership		Yes		Yes
Fixed Effects	Entity, Time	Entity, Time	Entity, Time	Entity, Time
Dep. Variable	AmihudNumerator	AmihudNumerator	PctBidAskSpread	PctBidAskSpread
No. Observations	1465561	1465555	1124265	1124260
R-squared	0.0285	0.0285	0.0227	0.0227
R-Squared (Within)	0.0287	0.0287	0.0375	0.0375
R-Squared (Between)	-0.3627	-0.3626	0.1785	0.1785
R-Squared (Overall)	-0.0089	-0.0089	0.0956	0.0956
F-statistic	1.064e+04	8514.8	6433.1	4289.0
P-value (F-stat)	0.0000	0.0000	0.0000	0.0000

# Methodology

$$VR_{iq} = \beta_0 + \beta_1 \text{ETF\_ownership}_{i,q-1} + B_C^T \text{Controls}_{i,q-1} + \alpha_i + \gamma_q + \epsilon_{i,q} \quad (4)$$

with:

$$VR_{i,t} = \frac{\text{Var}(r_{5,i,t})}{5 \cdot \text{Var}(r_{1,i,t})}$$

$$\text{abs}VR_{iq} = \beta_0 + \beta_1 \text{ETF\_ownership}_{i,q-1} + B_C^T \text{Controls}_{i,q-1} + \alpha_i + \gamma_q + \epsilon_{i,q} \quad (5)$$

with:

$$\text{abs}VR_{i,t} = |VR_{i,t} - 1|$$

## Estimation results : U.S.

**Table 5:** U.S. Sample : Exchange-Traded Funds' aggregate ownership share and weekly mean reversion of underlying securities

	absVR		VR	
	Baseline	w/inst. o'ship	Baseline	w/inst. o'ship
Intercept	0.8523***	0.8532***	0.8735***	0.8579***
PctETF <sub>t-1</sub>	0.0096	0.0218	-0.1205	-0.1005
(t-stat)	(0.1484)	(0.3373)	(-1.4081)	(-1.1660)
log(MarketCap <sub>t-1</sub> )	-0.0248***	-0.0248***	0.0044	0.0052
1/Close <sub>t-1</sub>	0.1276***	0.1277***	-0.2002***	-0.1986***
AmihudRatio <sub>t-1</sub>	9.9267***	9.9488***	-15.135***	-15.117***
BidAskSpread <sub>t-1</sub>	0.9314***	0.9286***	-1.2190***	-1.2179***
(BE/ME) <sub>t-1</sub>	-3.498e-06	4.433e-05***	-1.257e-05	6.777e-05***
Past12to7Mret. <sub>t-1</sub>	0.0003	-9.153e-05	-0.0006	-0.0013**
G. Profitab. <sub>t-1</sub>	0.0011	0.0012	0.0064	0.0062
Other funds ownership		Yes		Yes
Fixed Effects	Entity, Time	Entity, Time	Entity, Time	Entity, Time
No. Observations	126851	126847	126851	126847
R-squared	0.0079	0.0081	0.0040	0.0041
R-Squared (Within)	0.0106	0.0106	0.0040	0.0042
R-Squared (Between)	0.2814	0.2820	0.1376	0.1385
R-Squared (Overall)	0.0318	0.0320	0.0163	0.0165
F-statistic	123.79	91.734	61.843	46.323
P-value (F-stat)	0.0000	0.0000	0.0000	0.0000

## Estimation results : International

**Table 6:** International Sample : Exchange-Traded Funds' aggregate ownership share and weekly mean reversion of underlying securities

	absVR		VR	
	Baseline	w/inst. o'ship	Baseline	w/inst. o'ship
Intercept	0.9251***	0.9250***	0.5297***	0.5304***
PctETF <sub>t-1</sub>	0.2529***	0.2539***	-0.6122***	-0.6199***
(t-stat)	(2.7216)	(2.6854)	(-3.6541)	(-3.6808)
log(MarketCap <sub>t-1</sub> )	-0.0248***	-0.0248***	0.0106***	0.0106***
1/Close <sub>t-1</sub>	0.0015	0.0015	-0.0146	-0.0146
AmihudRatio <sub>t-1</sub>	0.2138***	0.2138***	-0.2476***	-0.2475***
BidAskSpread <sub>t-1</sub>	0.2117***	0.2117***	-0.2938***	-0.2937***
(BE/ME) <sub>t-1</sub>	0.0001*	0.0001*	-0.0001	-0.0001
Past12to7Mret. <sub>t-1</sub>	-6.928e-05***	-6.928e-05***	-7.459e-05*	-7.461e-05*
G. Profitab. <sub>t-1</sub>	-0.0041***	-0.0041***	0.0036	0.0036
Mutual funds ownership		-0.0004		0.0026
Fixed Effects	Entity, Time	Entity, Time	Entity, Time	Entity, Time
No. Observations	592054	592054	591848	591848
R-squared	0.0049	0.0049	0.0014	0.0014
R-Squared (Within)	0.0055	0.0055	0.0017	0.0017
R-Squared (Between)	0.0991	0.0992	0.0757	0.0758
R-Squared (Overall)	0.0099	0.0099	0.0104	0.0104
F-statistic	354.08	314.75	98.569	87.752
P-value (F-stat)	0.0000	0.0000	0.0000	0.0000

## Key findings

### U.S.

- On average, the volatility of U.S. stocks rises with ETF ownership : + 0.8% of a std. dev. following a 1 std. dev. ETF ownership increase (3.5%)
- If the mean reversion also increased because of ETFs, this volatility would be non-fundamental and the *liquidity trading hypothesis* would hold.
- But no significant effect on variance ratios : *price discovery hypothesis* ?
- Still an effect on liquidity: only price impact rises

### International

- No volatility increase correlated with ETF ownership (with controls)
- But likely increase in mean reversion over 1 to 5 days
- Positive effect on bid-ask spread
- Significance of the sample ? 0.4% of a company's equity held through ETFs on average



# Limitations and further directions

## Quality concerns

- Dropping up to  $\frac{2}{3}$  of the observations because of missing data
- Reporting delays in institutional holdings addressed through extrapolation

## Robustness checks to try

- Subsamples over time, matching regime changes
- International : developed and emerging countries apart
- Keep securities with a minimum available number of observations

## Research avenues

- Discriminate by funds' strategies : passive, smart beta, active
- Focus on liquidity effects around ETF trading halts
- Intraday effects

## Likely trends in the ETF universe

- Rise of alternative weighting schemes (smart beta)
- More active bets, nicknamed *passive-aggressive*
- Opaque holdings structures are at an advanced stage in the regulatory approval process in the U.S. (late spring 2019)

### The Precidian model

**An ETF That Hides Its Secret Sauce Is Poised for Regulator's Nod –**  
Bloomberg News, April 8, 2019.<sup>a</sup>

- Positive signs that the Securities and Exchange Commission will allow the design.
- Trading permission is the next decision needed before the product is issued.
- Disagreement at the SEC and skepticism from some analysts regarding appeal to investors; reality check needed and *evidence so far has shown that awareness about ETFs can take time.*

<sup>a</sup>Available at <https://www.bloomberg.com/news/articles/2019-04-08/an-etf-that-hides-its-secret-sauce-is-poised-for-regulator-s-nod>

# Bibliography

- Agarwal, Vikas et al. (2018). "Do ETFs Increase the Commonality in Liquidity of Underlying Stocks?". In: *SSRN Electronic Journal*. ISSN: 1556-5068. DOI: 10.2139/ssrn.3070550. URL: <https://www.ssrn.com/abstract=3070550>.
- Amihud, Yakov (2002). "Illiquidity and stock returns: Cross-section and time-series effects". In: *Journal of Financial Markets* 5.1, pp. 31–56. ISSN: 13864181. DOI: 10.1016/S1386-4181(01)00024-6. URL: <http://linkinghub.elsevier.com/retrieve/pii/S1386418101000246>.
- Ben-David, Itzhak, Francesco A. Franzoni, and Rabih Moussawi (2018). "Do ETFs Increase Volatility?". In: *The Journal of Finance* 73.6, pp. 2471–2535. ISSN: 00221082. DOI: r. URL: <http://doi.wiley.com/10.1111/jofi.12727>.
- Ben-David, Itzhak, Francesco Franzoni, and Rabih Moussawi (2017). "Exchange-Traded Funds". In: *Annual Review of Financial Economics* 9.1, pp. 169–189. ISSN: 1941-1367. DOI: 10.1146/annurev-financial-110716-032538. URL: <https://doi.org/10.1146/annurev-financial-110716-032538>.
- Bhattacharya, Ayan and Maureen O'Hara (2017). "Can ETFs Increase Market Fragility? Effect of Information Linkages in ETF Markets". In: *SSRN Electronic Journal* April, pp. 1–55. ISSN: 1556-5068. DOI: 10.2139/ssrn.2740699. URL: <https://www.ssrn.com/abstract=2740699>.
- Chinco, Alexander and Vyacheslav Fos (2016). "The Sound of Many Funds Rebalancing". In: *SSRN Electronic Journal*, pp. 1–56. ISSN: 1556-5068. DOI: 10.2139/ssrn.2764941. URL: <https://www.ssrn.com/abstract=2764941>.
- Da, Zhi and Sophie Shive (2018). "Exchange traded funds and asset return correlations". In: *European Financial Management* 24.1, pp. 136–168. ISSN: 1468036X. DOI: 10.1111/eufm.12137.
- Israeli, Doron, Charles M.C. Lee, and Suhas A. Sridharan (2017). "Is there a dark side to exchange traded funds? An information perspective". In: *Review of Accounting Studies* 22.3, pp. 1048–1083. ISSN: 13806653. DOI: 10.1007/s11142-017-9400-8.
- Krause, Timothy, Sina Ehsani, and Donald Lien (2014). "Exchange-traded funds, liquidity and volatility". In: *Applied Financial Economics* 24.24, pp. 1617–1630. ISSN: 0960-3107. DOI: 10.1080/09603107.2014.941530. URL: <http://www.tandfonline.com/doi/abs/10.1080/09603107.2014.941530>.
- Leippold, Markus, Lujing Su, and Alexandre Ziegler (2015). "Do Index Futures and ETFs Affect Stock Return Correlations?". In: *SSRN Electronic Journal* 41.44. ISSN: 1556-5068. DOI: 10.2139/ssrn.2620955. URL: <http://www.ssrn.com/abstract=2620955>.

## Volatility – U.S. sample I

Table 7: U.S. Sample : Exchange-Traded Fund aggregate ownership share and the volatility of underlying securities' daily returns

	Baseline	Controls +lags	O'ship controls	Standardized
Intercept	0.2964 (22.268)	0.0488 (7.1942)	0.0494 (7.2977)	-0.0154 (-0.4273)
<b>PctETF<sub>t-1</sub></b>	<b>0.2470***</b> (8.2542)	<b>0.0385***</b> (5.9800)	<b>0.0395***</b> (6.2940)	<b>0.0081***</b> (6.8269)
log(MarketCap <sub>t-1</sub> )	-0.0127 (-20.751)	-0.0018 (-5.8479)	-0.0018 (-5.9701)	-0.0102 (-6.1991)
1/Close <sub>t-1</sub>	0.0988 (10.972)	0.0251 (7.7261)	0.0251 (7.7792)	0.1452 (7.9151)
(BE/ME) <sub>t-1</sub>	5.552e-07 (2.3023)	7.393e-07 (4.1534)	1.038e-06 (8.5166)	5.019e-06 (5.3019)
Past12to1Mret. <sub>t-1</sub>	-0.0003 (-0.6844)	-0.0004 (-1.8758)	-0.0004 (-1.8564)	-0.0024 (-1.8927)
AmihudRatio <sub>t-1</sub>		3.4590 (2.7034)	3.4611 (2.7029)	19.952 (2.7038)
BidAskSpread <sub>t-1</sub>		0.1750 (4.5505)	0.1748 (4.5446)	1.0060 (4.5471)
G.Profit. <sub>t-1</sub>		-0.0005 (-2.6218)	-0.0005 (-2.6334)	-0.0028 (-2.6197)
Volatility <sub>t-1</sub>		0.1377 (6.7584)	0.1378 (6.7701)	0.1376 (6.7630)

## Volatility – U.S. sample II

<b>Volatility<sub>t-2</sub></b>	0.1605 (16.002)	0.1604 (15.972)	0.1603 (15.949)
<b>Volatility<sub>t-3</sub></b>	0.1230 (13.390)	0.1229 (13.402)	0.1229 (13.403)
<b>Volatility<sub>t-4</sub></b>	0.0819 (9.8851)	0.0818 (9.8688)	0.0817 (9.8756)
<b>PctOtherMutual<sub>t-1</sub></b>		-0.0003 (-2.5676)	-0.0016 (-1.1497)
<b>PctPension<sub>t-1</sub></b>		1.0330 (3.4034)	0.0015 (3.6451)
<b>PctHedge<sub>t-1</sub></b>		-0.0284 (-3.2527)	9.023e-05 (0.4613)
<b>Effects</b>	<b>Entity Time</b>	<b>Entity Time</b>	<b>Entity Time</b>

	<b>Baseline</b>	<b>Controls +lags</b>	<b>O'ship controls</b>	<b>Standardized</b>
<b>Dep. Variable</b>	Volatility	Volatility	Volatility	Volatility
<b>Estimator</b>	PanelOLS	PanelOLS	PanelOLS	PanelOLS
<b>No. Observations</b>	413304	297405	297399	297247
<b>Cov. Est.</b>	Driscoll-Kraay	Driscoll-Kraay	Driscoll-Kraay	Driscoll-Kraay
<b>R<sup>2</sup></b>	0.0545	0.1592	0.1593	0.1594
<b>R<sup>2</sup> (Within)</b>	0.0565	0.1353	0.1351	0.1348
<b>R<sup>2</sup> (Between)</b>	0.2009	0.7626	0.7625	0.7616
<b>R<sup>2</sup> (Overall)</b>	0.1515	0.2716	0.2715	0.2710

## Volatility – U.S. sample III

<b>F-statistic</b>	4717.9	4643.9	3718.4	3718.6
<b>P-value (F-stat)</b>	0.0000	0.0000	0.0000	0.0000

---

# Volatility – International sample I

**Table 8:** International Sample : Exchange-Traded Fund aggregate ownership share and the volatility of underlying securities' daily returns

	Baseline	Controls + Vol. lags	Inst. o'ship control	Standardized
Intercept	0.0582 (10.611)	0.0283 (7.7563)	0.0283 (7.7708)	0.6235 (4.4628)
PctSharesHeldETF_1lag	0.0169 (1.8226)	0.0072 (1.0225)	0.0070 (0.9781)	0.0028 (0.9781)
np.log(CompanyMarketCap_1lag)	-0.0015 (-6.1428)	-0.0008 (-4.9380)	-0.0008 (-4.9511)	-0.0310 (-4.9511)
InvClose_1lag	0.0045 (2.5792)	0.0015 (1.1485)	0.0015 (1.1484)	0.0585 (1.1484)
BookToMarketRatio_1lag	3.446e-05 (3.6160)	2.54e-05 (3.3179)	2.538e-05 (3.3206)	0.0010 (3.3206)
RetPast12to1M_1lag	0.0005 (1.8965)	0.0001 (1.5202)	0.0001 (1.5203)	0.0052 (1.5203)
AmihudRatio_1lag		0.0250 (0.8272)	0.0250 (0.8272)	0.9984 (0.8272)
PctBidAskSpread_1lag		0.0262 (6.9533)	0.0262 (6.9532)	1.0496 (6.9532)
GrossProfitability_1lag		-0.0001 (-0.6729)	-0.0001 (-0.6731)	-0.0056 (-0.6731)
Volatility_1lag		0.2541 (21.616)	0.2541 (21.615)	0.2541 (21.615)

## Volatility – International sample II

Volatility_2lag		0.1226 (18.960)	0.1226 (18.960)	0.1226 (18.960)
Volatility_3lag		0.0968 (11.790)	0.0968 (11.790)	0.0968 (11.790)
Volatility_4lag		0.0607 (13.274)	0.0607 (13.271)	0.0607 (13.271)
PctSharesHeldOtherMutual_1lag			9.061e-05 (0.6096)	0.0008 (0.6096)
Effects	Entity Time	Entity Time	Entity Time	Entity Time

	Baseline	Controls + Vol. lags	Inst. o'ship control	Standardized
Dep. Variable	Volatility	Volatility	Volatility	Volatility
Estimator	PanelOLS	PanelOLS	PanelOLS	PanelOLS
No. Observations	1516791	1319966	1319966	1319966
Cov. Est.	Driscoll-Kraay	Driscoll-Kraay	Driscoll-Kraay	Driscoll-Kraay
R-squared	0.0070	0.1729	0.1729	0.1729
R-Squared (Within)	0.0148	0.2100	0.2100	0.2100
R-Squared (Between)	-0.0101	0.7081	0.7079	0.7079
R-Squared (Overall)	-0.0208	0.3261	0.3260	0.3260
F-statistic	2118.7	2.274e+04	2.099e+04	2.099e+04
P-value (F-stat)	0.0000	0.0000	0.0000	0.0000



## Liquidity – U.S. sample I

**Table 9:** U.S. Sample : Exchange-Traded Funds' aggregate ownership share and underlying securities' liquidity

	Amihud ratio		Bid-Ask spread	
	Baseline	w/inst. o'ship	Baseline	w/inst. o'ship
<b>Intercept</b>	0.3424 (30.114)	0.3425 (30.084)	0.1055 (15.863)	0.1057 (15.819)
<b>PctSharesHeldETF_1lag</b>	0.1809 (7.5170)	0.1810 (7.5198)	0.0074 (0.8731)	0.0073 (0.8642)
<b>np.log(CompanyMarketCap_1lag)</b>	-0.0153 (-26.856)	-0.0153 (-26.830)	-0.0049 (-14.666)	-0.0049 (-14.622)
<b>BookToMarketRatio_1lag</b>	2.812e-07 (1.1005)	2.925e-07 (1.1141)	-4.261e-08 (-0.9060)	-4.149e-08 (-0.8901)
<b>AmihudDenominator</b>	1.335e-11 (4.3898)	1.335e-11 (4.3890)		
<b>PctSharesHeldOtherMutual_1lag</b>		-1.157e-05 (-5.2639)		-2.123e-06 (-6.0853)
<b>Volatility_1lag</b>			0.0498 (10.156)	0.0498 (10.161)
<b>PctSharesHeldPension_1lag</b>				0.2846 (1.1997)
<b>PctSharesHeldHedge_1lag</b>				0.0053 (1.1511)

## Liquidity – U.S. sample II

Effects	Entity, Time		Entity, Time	
	Amihud ratio		Bid-Ask spread	
	Baseline	w/inst. o'ship	Baseline	w/inst. o'ship
Dep. Variable	AmihudNumerator	AmihudNumerator	PctBidAskSpread	PctBidAskSpread
Estimator	PanelOLS	PanelOLS	PanelOLS	PanelOLS
No. Observations	436359	436352	335170	335164
Cov. Est.	Driscoll-Kraay	Driscoll-Kraay	Driscoll-Kraay	Driscoll-Kraay
R-squared	0.0326	0.0326	0.0510	0.0510
R-Squared (Within)	0.0448	0.0448	0.0659	0.0660
R-Squared (Between)	0.1897	0.1898	0.5568	0.5572
R-Squared (Overall)	0.1291	0.1291	0.1879	0.1881
F-statistic	3643.1	2914.2	4445.9	2543.2
P-value (F-stat)	0.0000	0.0000	0.0000	0.0000

# Liquidity – International sample I

**Table 10:** International Sample : Exchange-Traded Funds' aggregate ownership share and underlying securities' liquidity

	Amihud ratio		Bid-Ask spread	
	Baseline	w/inst. o'ship	Baseline	w/inst. o'ship
<b>Intercept</b>	0.0776 (12.831)	0.0776 (12.829)	0.1446 (25.012)	0.1446 (25.021)
<b>PctSharesHeldETF_1lag</b>	0.0038 (0.5715)	0.0038 (0.5817)	0.0613 (4.9367)	0.0610 (4.9518)
<b>np.log(CompanyMarketCap_1lag)</b>	-0.0058 (-21.501)	-0.0058 (-21.502)	-0.0061 (-23.176)	-0.0061 (-23.183)
<b>BookToMarketRatio_1lag</b>	0.0012 (1.0328)	0.0012 (1.0328)	1.107e-05 (0.6876)	1.108e-05 (0.6887)
<b>np.log(AmihudDenominator)</b>	0.0042 (16.998)	0.0042 (16.998)		
<b>PctSharesHeldOtherMutual_1lag</b>		-1.341e-05 (-0.9416)		-1.92e-06 (-0.2806)
<b>Volatility_1lag</b>			0.1772 (13.426)	0.1772 (13.426)
<b>PctSharesHeldPension_1lag</b>				0.0314 (1.1500)
<b>Effects</b>	Entity Time	Entity Time	Entity Time	Entity Time

# Liquidity – International sample II

	Amihud ratio		Bid-Ask spread	
	Baseline	w/inst. o'ship	Baseline	w/inst. o'ship
<b>Dep. Variable</b>	AmihudNumerator	AmihudNumerator	PctBidAskSpread	PctBidAskSpread
<b>Estimator</b>	PanelOLS	PanelOLS	PanelOLS	PanelOLS
<b>No. Observations</b>	1465561	1465555	1124265	1124260
<b>Cov. Est.</b>	Driscoll-Kraay	Driscoll-Kraay	Driscoll-Kraay	Driscoll-Kraay
<b>R-squared</b>	0.0285	0.0285	0.0227	0.0227
<b>R-Squared (Within)</b>	0.0287	0.0287	0.0375	0.0375
<b>R-Squared (Between)</b>	-0.3627	-0.3626	0.1785	0.1785
<b>R-Squared (Overall)</b>	-0.0089	-0.0089	0.0956	0.0956
<b>F-statistic</b>	1.064e+04	8514.8	6433.1	4289.0
<b>P-value (F-stat)</b>	0.0000	0.0000	0.0000	0.0000

## Efficiency – U.S. sample I

Table 11: U.S. Sample : Exchange-Traded Funds' aggregate ownership share and weekly mean reversion of underlying securities

	absVR		VR	
	Baseline	w/inst. o'ship	Baseline	w/inst. o'ship
Intercept	0.8523 (12.280)	0.8532 (12.208)	0.8735 (7.6512)	0.8579 (7.4328)
PctSharesHeldETF_1lag	0.0096 (0.1484)	0.0218 (0.3373)	-0.1205 (-1.4081)	-0.1005 (-1.1660)
np.log(CompanyMarketCap_1lag)	-0.0248 (-7.5202)	-0.0248 (-7.4640)	0.0044 (0.8038)	0.0052 (0.9458)
InvClose_1lag	0.1276 (5.5223)	0.1277 (5.5778)	-0.2002 (-6.0619)	-0.1986 (-5.9225)
AmihudRatio_1lag	9.9267 (3.1431)	9.9488 (3.1455)	-15.135 (-3.0288)	-15.117 (-3.0279)
PctBidAskSpread_1lag	0.9314 (5.5878)	0.9286 (5.6027)	-1.2190 (-3.5732)	-1.2179 (-3.5633)
BookToMarketRatio_1lag	-3.498e-06 (-0.5195)	4.433e-05 (3.9695)	-1.257e-05 (-1.4303)	6.777e-05 (3.2826)
RetPast12to7M_1lag	0.0003 (0.5981)	-9.153e-05 (-0.2511)	-0.0006 (-0.9013)	-0.0013 (-2.2311)
GrossProfitability_1lag	0.0011 (0.2252)	0.0012 (0.2454)	0.0064 (1.2767)	0.0062 (1.2635)
PctSharesHeldOtherMutual_1lag		-0.0053		-0.0086

## Efficiency – U.S. sample II

	(-3.9260)	(-3.6908)
PctSharesHeldPension_1lag	11.292	-3.7029
	(4.1468)	(-0.5362)
PctSharesHeldHedge_1lag	-0.1294	-0.1145
	(-0.8927)	(-0.6268)

Effects	Entity Time	Entity Time	Entity Time	Entity Time
	absVR		VR	
	Baseline	w/inst. o'ship	Baseline	w/inst. o'ship
Dep. Variable	absVR	absVR	VR	VR
Estimator	PanelOLS	PanelOLS	PanelOLS	PanelOLS
No. Observations	126851	126847	126851	126847
Cov. Est.	Driscoll-Kraay	Driscoll-Kraay	Driscoll-Kraay	Driscoll-Kraay
R-squared	0.0079	0.0081	0.0040	0.0041
R-Squared (Within)	0.0106	0.0106	0.0040	0.0042
R-Squared (Between)	0.2814	0.2820	0.1376	0.1385
R-Squared (Overall)	0.0318	0.0320	0.0163	0.0165
F-statistic	123.79	91.734	61.843	46.323
P-value (F-stat)	0.0000	0.0000	0.0000	0.0000

# Efficiency – International sample I

**Table 12:** International Sample : Exchange-Traded Funds' aggregate ownership share and weekly mean reversion of underlying securities

	absVR		VR	
	Baseline	w/inst. o'ship	Baseline	w/inst. o'ship
<b>Intercept</b>	0.9251 (22.527)	0.9250 (22.576)	0.5297 (6.1864)	0.5304 (6.1821)
<b>PctSharesHeldETF_1lag</b>	0.2529 (2.7216)	0.2539 (2.6854)	-0.6122 (-3.6541)	-0.6199 (-3.6808)
<b>np.log(CompanyMarketCap_1lag)</b>	-0.0248 (-13.525)	-0.0248 (-13.558)	0.0106 (2.7762)	0.0106 (2.7598)
<b>InvClose_1lag</b>	0.0015 (0.1169)	0.0015 (0.1168)	-0.0146 (-0.6261)	-0.0146 (-0.6257)
<b>AmihudRatio_1lag</b>	0.2138 (3.3927)	0.2138 (3.3923)	-0.2476 (-4.5128)	-0.2475 (-4.5122)
<b>PctBidAskSpread_1lag</b>	0.2117 (5.8326)	0.2117 (5.8319)	-0.2938 (-5.4872)	-0.2937 (-5.4834)
<b>BookToMarketRatio_1lag</b>	0.0001 (1.6458)	0.0001 (1.6464)	-0.0001 (-0.5935)	-0.0001 (-0.5995)
<b>RetPast12to7M_1lag</b>	-6.928e-05 (-2.6264)	-6.928e-05 (-2.6265)	-7.459e-05 (-1.7080)	-7.461e-05 (-1.7081)
<b>GrossProfitability_1lag</b>	-0.0041 (-3.2319)	-0.0041 (-3.2325)	0.0036 (1.5214)	0.0036 (1.5183)
<b>PctSharesHeldOtherMutual_1lag</b>		-0.0004		0.0026

## Efficiency – International sample II

	(-0.2369)		(0.7347)	
Effects	Entity Time	Entity Time	Entity Time	Entity Time
	absVR		VR	
	Baseline	w/inst. o'ship	Baseline	w/inst. o'ship
Dep. Variable	absVR	absVR	VR	VR
Estimator	PanelOLS	PanelOLS	PanelOLS	PanelOLS
No. Observations	592054	592054	591848	591848
Cov. Est.	Driscoll-Kraay	Driscoll-Kraay	Driscoll-Kraay	Driscoll-Kraay
R-squared	0.0049	0.0049	0.0014	0.0014
R-Squared (Within)	0.0055	0.0055	0.0017	0.0017
R-Squared (Between)	0.0991	0.0992	0.0757	0.0758
R-Squared (Overall)	0.0099	0.0099	0.0104	0.0104
F-statistic	354.08	314.75	98.569	87.752
P-value (F-stat)	0.0000	0.0000	0.0000	0.0000