Should Passive Investors Actively Manage Their Trades?

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Passively Investing in an Index, but How?

- Efficient market hypothesis supports passive investing
  - In the past decades, investors shifted toward passive investment funds for lower management fees
  - Passive mutual funds and ETFs managed 7 trillion dollars, or 14% of U.S. stock market as of 2020
- Passive funds also need to trade
  - The indexes often adjust their constituents due to market cap changes, IPOs, M&A and delists.
  - The funds need to rebalance accordingly, which generate predictable patterns of trading
- This paper: How do passive funds trade? How should they trade?
  - Use a daily holding dataset to analysis index ETFs
  - Transaction costs generate NAV return heterogeneity of ~30 bps per trade or 9.6 bps per year
    - For a $2 million retirement account accrued over 30 years, fail to save 9.6 bps per year translates to $29 thousand less assets at retirement
  - How to lower the trading costs?

Publicity of Trades

- Should uninformed traders pre-announce their trades?

- Sunshine trading (Admati and Pfleiderer 1991):
  - Uninformed traders pre-announce their trades to lower their price impact
  - Liquidity providers can estimate the informed flow better, so the market becomes more liquid

- Other factors affect the trading costs of uninformed traders
  - Predatory trading (Brunnermeier and Pedersen 2005): Predictable order flow attracts "front-runners"
    - They sell before uninformed traders sell, push price to a temporarily lower level
  - Slice-and-dice a large order can lower its market impact

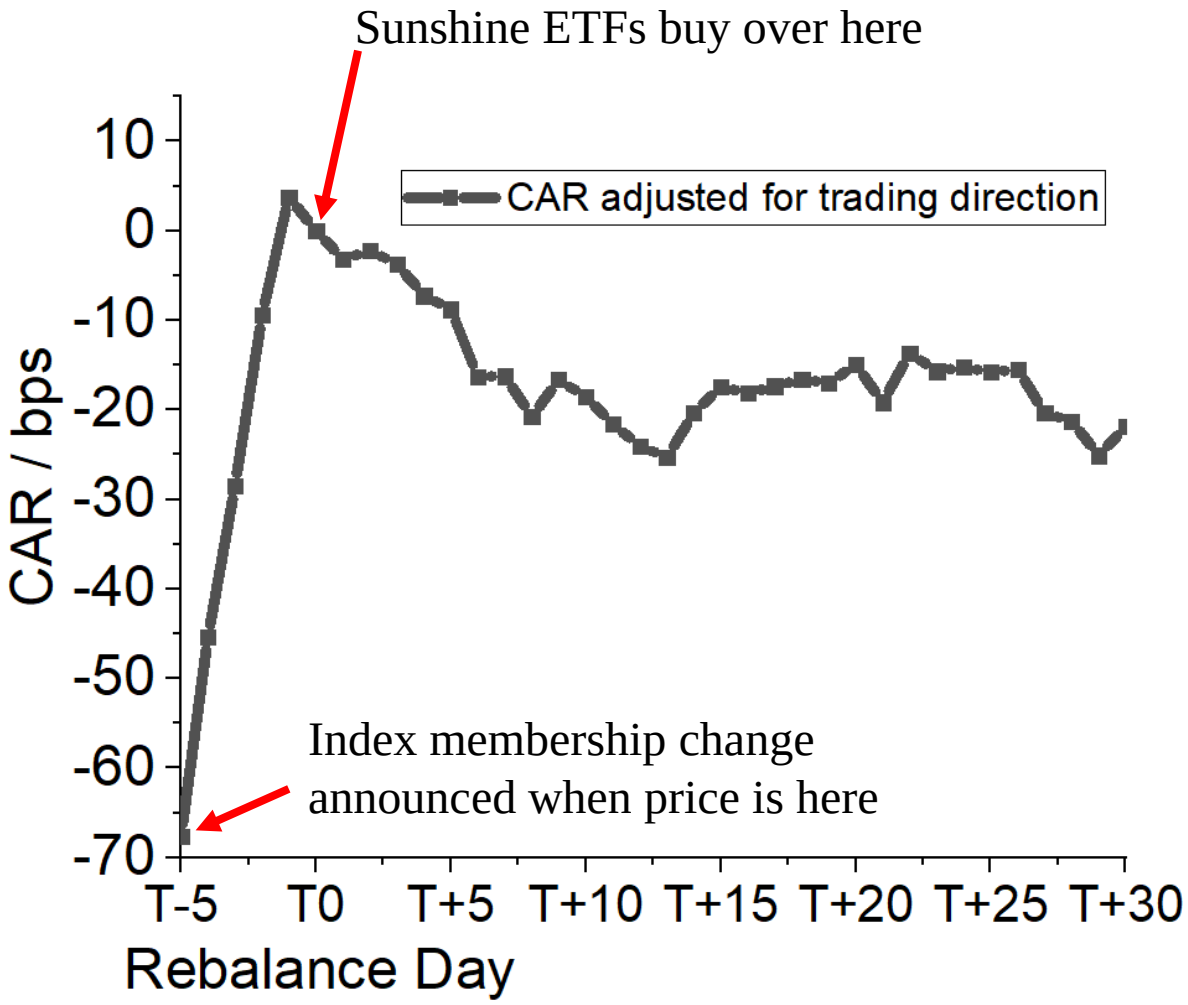
- Identification challenge: given a sunshine trade, it is hard to answer "what if" the trader had conducted the trade in a camouflaged way
  - This paper compares the execution costs of sunshine trading ETFs and two types of camouflagers
    - The ETFs face exogenous rebalancing problems but take different approach in trading

Three Types of ETFs

	Daily Portfolio Disclosure	Monthly Portfolio Disclosure
Track a public index (from S&P, MSCI, Russell, etc.)	56% of ETFs use public indexes from index companies, and mechanically follow the index reconstitution ("Sunshine ETFs") • Fully rebalance on the reconstitution date at the closing auction price • The index reconstitution is pre-announced at least 5 business days in advance • Highly transparent & predictable order flow	7% of ETFs use public indexes, but they do not follow the rebalance schedule of the index ("Opaque ETFs") • Less transparent on *when* do they trade • I match them with sunshine ETFs that track the same indices • The fund pairs have NAV correlation of 0.9999 in non-rebalancing periods • Opaque ETFs outperform in rebalance periods
Track a private index (from an affiliated firm)	37% of ETFs follow private indexes ("Self-indexers") • Do not pre-announce reconstitutions • Less transparent on *what* will they trade • Example: Schwab 1000 ETF	Forbidden • SEC requires all self-indexers to disclose daily holdings • Otherwise, they are not considered passive

Sunshine ETFs Pay Largest Transaction Costs

- Predictable large trades are associated with high transaction costs
- For sunshine ETFs that mechanically follow public indexes:
  - Execution shortfall between T-5 and T0: 67 bps [t=14.49] per trade
  - Price reversal in 20 days : 19 bps [t=3.56]
- Is there any way to lower the costs?



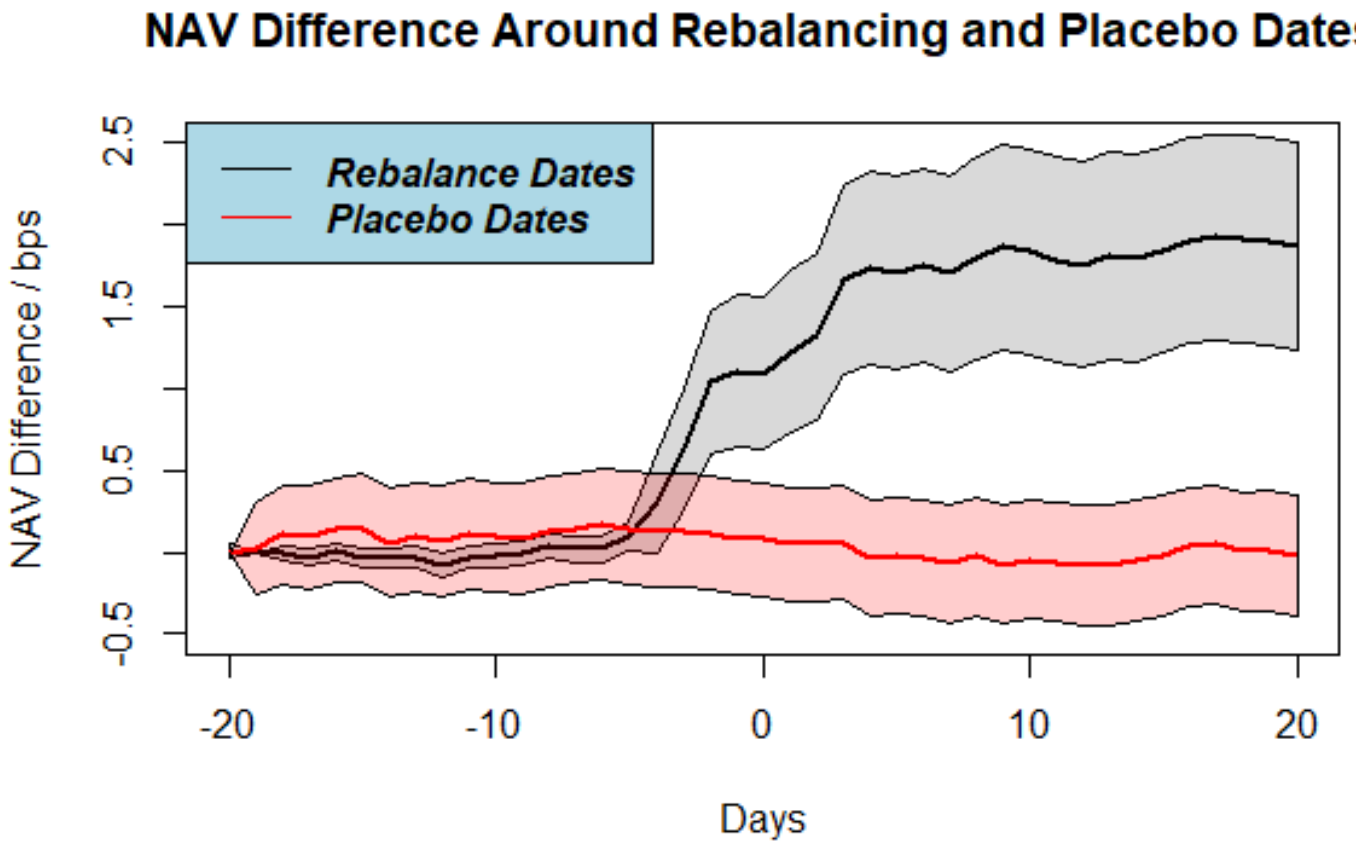
Vanguard: Opaque in the Rebalance Schedule

- "*Daily reporting can encourage so-called front-running and free-riding by opportunistic traders, [which] reduce the investment performance earned by shareholders.*" -- Doug Yones, head of Vanguard's domestic equity indexing
  - Unlike other major ETF providers, Vanguard doesn't divulge the daily holdings of its stock ETFs. Instead, Vanguard reports month-end portfolio data with a 15-day lag.

- "*We're not afraid of the transparency. Our daily holdings disclosure does not necessarily provide actionable information.*" -- Paul Lohrey, head of U.S. iShares product design and quality.

- I identify 16 pairs of funds that track the same index, managed by Vanguard and Blackrock
  - Correlation of their NAVs are at least 0.9999 during non-rebalancing periods
  - Do they have return differences?

Opaque (Vanguard) vs. Sunshine (Blackrock)

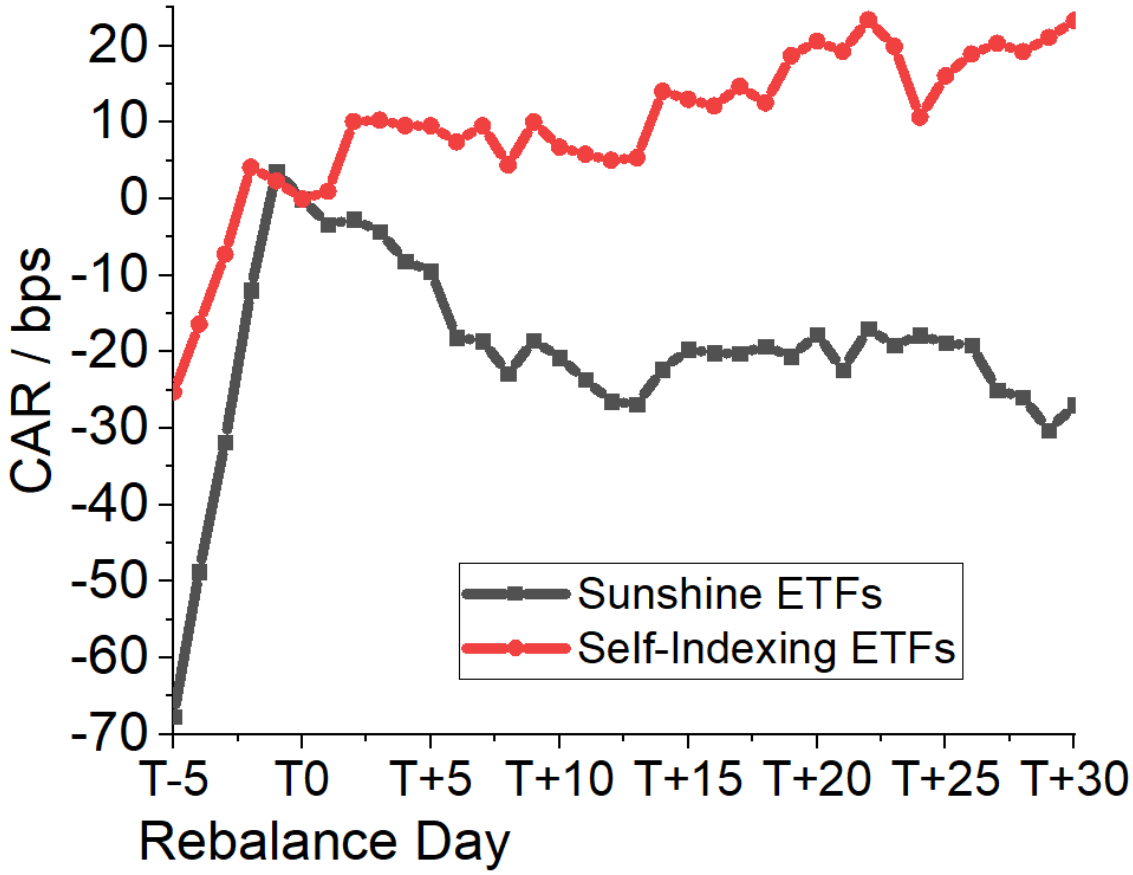


- Opaque ETFs' NAV outperforms 1.8 bps around the quarterly rebalancing dates
  - 0 around placebo dates
- Translates to a 7.3 bps execution cost saving per year, or 34 bps per trade

Self-Indexing: Avoid Pre-Announcing the Trade

- Public index companies include S&P Dow Jones, FTSE Russell, MSCI, NYSE, and NASDAQ
  - These companies simultaneously sell the index to ETFs and other users
  - Hard for the ETF to eliminate order flow predictability

- 37% of ETFs track proprietary indexes
  - For example, Schwab 1000 ETF tracks the proprietary Schwab 1000 Index
  - The index is not available for subscription, much harder for outsiders to predict the reconstitution
  - I find the execution shortfall for these ETFs is only 24 bps from by T-5 to T0
  - No price reversals after the rebalancing day



Contribution: Institutional Traders' Execution Costs

- Index reconstitutions are not driven by private information
  - A clean laboratory to separate the managers' trade skills and stock-picking skills
  - ETFs should have been able to get better execution costs than potentially informed traders
- I document 67 bps of execution shortfall for ETF rebalance trades
  - Anand et al. (2012) uses the Ancerno data estimates the execution shortfall of 24 bps for orders sized 2.4% Average Daily Volume (ADV)
  - Di Maggio et al. (2017): 0.5% ADV, costs 10.5 bps
  - Frazzini, Israel, and Moskowitz (2012): 1.2% ADV, costs 13 bps
- The average ETF rebalance size is 1.14% ADV, so 67 bps is huge!
  - Indicates a lot of room for optimization
- Uninformed traders pay higher cost than potentially informed traders, why?

Uninformed Traders Pay Higher Cost Than Potentially Informed Traders, Why?

- ETFs pay *higher* execution costs because they concentrate the trade, mechanically follow the index rebalance timing, and pre-announce their trades

- Collin-Dufresne and Fos (2015) identify activists as large informed traders
  - They find informed traders pay *lower* execution costs because they spread out the trades, time the liquidity, and rush to trade before announcing their trades (13D filings)

- This paper identifies ETF rebalance flows as large uninformed traders
  - Clean identification because
    1. The trading decisions are exogenous, not affected by the underlying investment decisions
    2. Answers “what if” the trader had conducted the trade in a camouflaged way

Contribution: Impact of the Rise of ETFs

- With detailed *daily* holding data of ETFs, I reverse-engineer the *intraday* trading pattern of ETFs and show that most ETFs trade *at* the closing prices

- Ben-David et al. (2018): Higher ETF ownership leads to higher return volatility
  - Their conjecture: short-horizon liquidity traders on ETFs propagate to the underlying stocks
  - A higher ETF ownership increase the nonfundamental volatility of the stocks

- Bogousslavsky and Muravyev (2021), Jiang and Yao (2021): Stocks with higher ETF ownership has larger distortion in closing prices

- My paper provides a micro foundation: ETFs indeed dump the portfolio at the close
  - Large orders from ETFs distort prices (which push the price worse for themselves)
  - The abnormal trading volume is much larger than ETFs' own rebalance size

Roadmap

- Rebalancing pace for daily-reporting ETFs
- Sunshine vs. Self-indexers (hide *what* to trade)
- Sunshine vs. Opaque ETFs (hide *when* to trade)
- Implications

Data

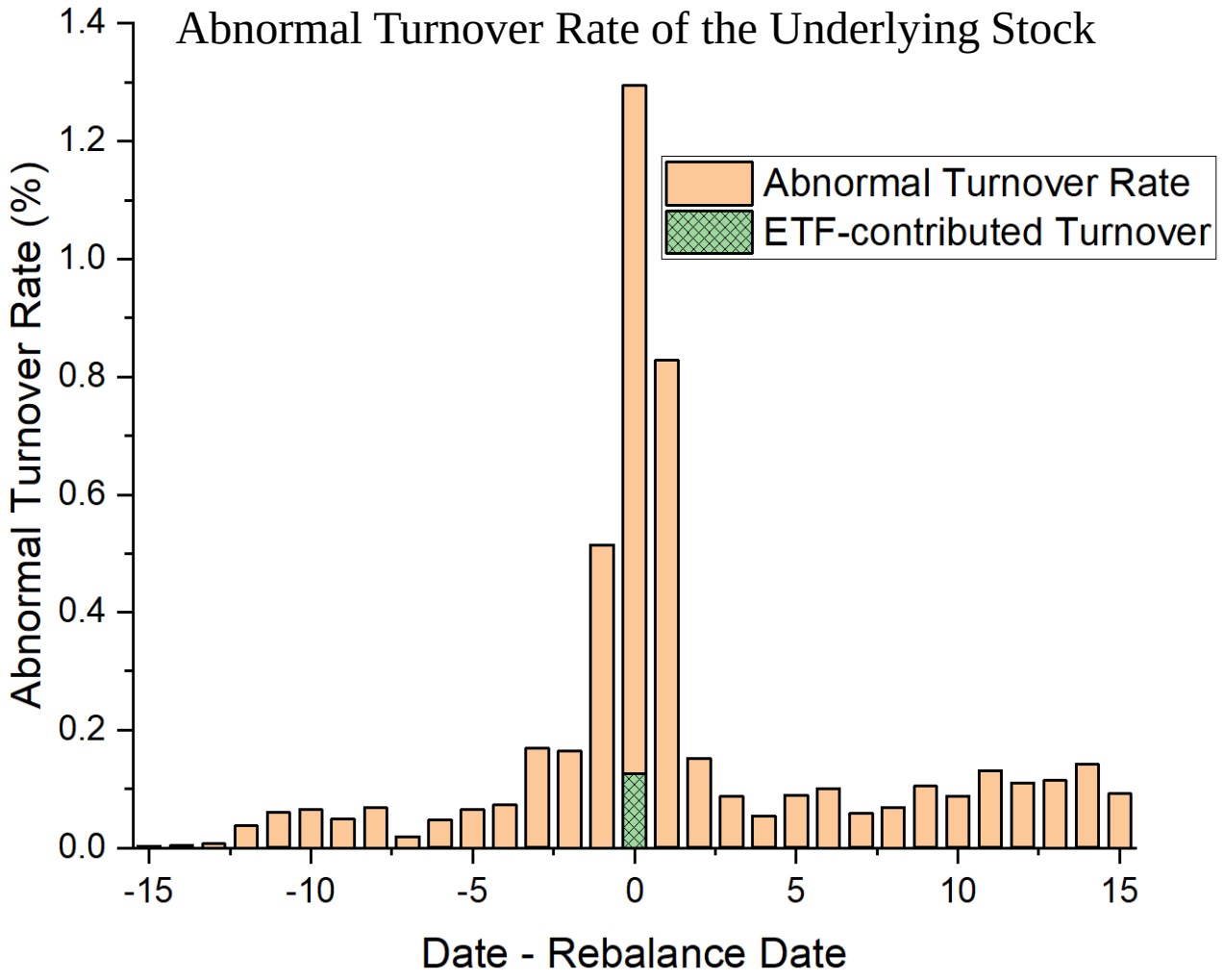
- ETF Global data with daily holdings of all U.S. listed ETFs (monthly for Vanguard), 2012 – 2020
  - Other information: full name, issuer, inception date, *benchmark index*, AUM, leverage ratio, listing exchange, sector exposures, put and call options volume, short interest, management fee, and total/net expenses

- I focus on the unlevered ETFs that invest in the U.S. equity market
  - Merge with CRSP, CRSP mutual fund, TAQ

	Mean	Min	Q1	Median	Q3	Max	Std.Dev	N
AUM ($bn)	4.6408	0.0003	0.0246	0.2344	1.3246	327.7875	21.5146	732
Daily Trading Volume (Million)	0.8894	0.0000	0.0084	0.0372	0.2138	76.6160	5.1118	732
Inception Date		19930100	20060900	20131000	20170600	20201100		732
Net Expenses (bps)	38.2575	3.0000	20.0000	35.0000	57.5000	106.1000	21.9935	732

- I categorize the benchmark indexes by S&P, FTSE, Russell, Dow Jones, MSCI, NYSE, NASDAQ as public, and those by the ETF issuer (e.g. Schwab) as private ("self-indexer")

Rebalance Paces for Sunshine ETFs



Green bar(s) are the trades conducted by the rebalancing ETF

- Green bar(s) are not visible except on date T
- All daily reporting ETFs trade abruptly in 1 day

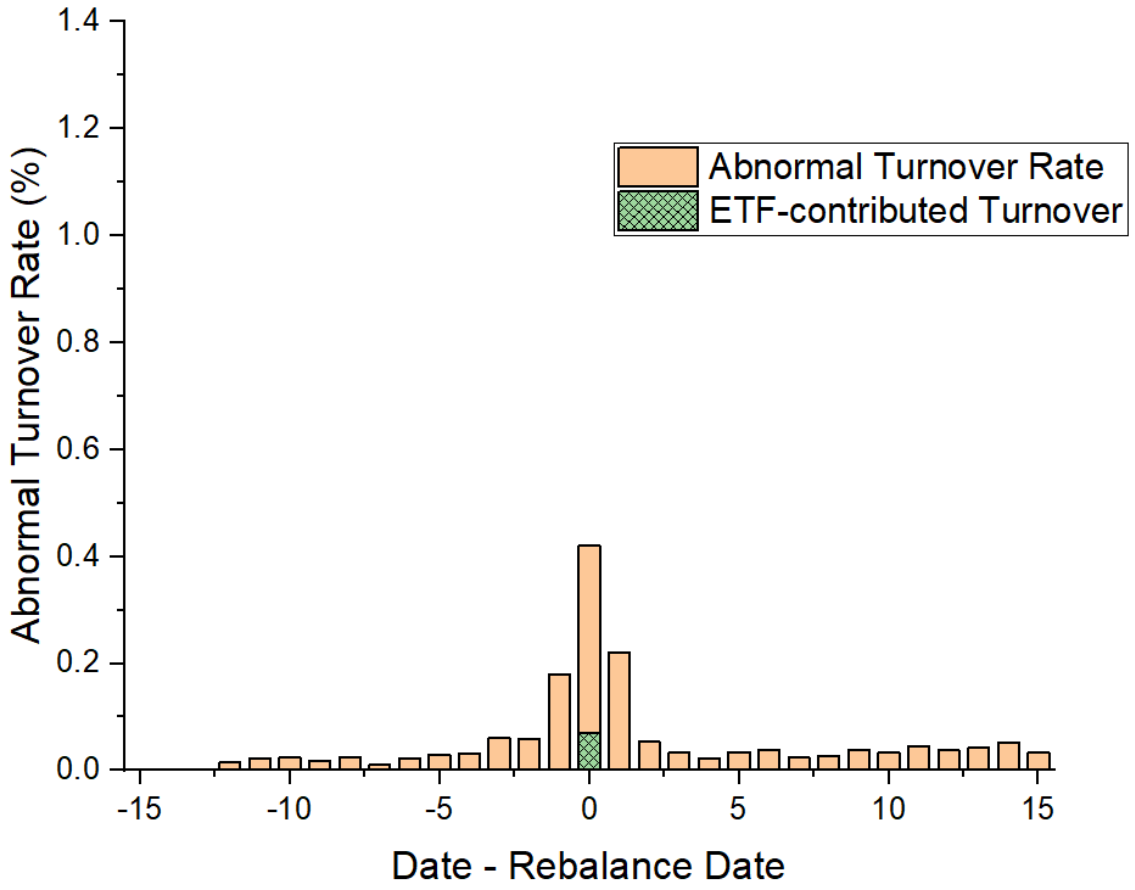
Yellow bars are the abnormal trading volume relative to $[T-30, T-60]$

- *Much* larger than the ETF's direct trade size

Who can be in these yellow bars?

- Opaque ETFs/similar index mutual funds
- Closet indexers (active-funds-in-name-only, Cremers and Petajisto 2009)
- ETF rebalance arbitragers?

Rebalance Paces for Self-Indexing ETFs



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- *Much* larger than the ETF's direct trade size

Self-indexing ETFs also trade within 1 day

The trades are much less crowded for self-indexing ETFs

Trade within 1 Day, but When?

- The ETF holding data is in daily granularity, which provides a unique opportunity to reverse-engineer the ETFs' intraday trading pattern

- Trade in the open auction/continuous trading (9:30 AM – 3:59 PM)/close auction ⇒ different end-of-day NAVs for the ETF

- Given the portfolios of the ETFs, I construct their hypothetical returns if they:
  - Rebalanced at OPEN auction prices
  - Rebalanced at VWAP (Volume Weighted Average Price in 9:30 AM – 3:59 PM)
  - Rebalanced at CLOSE auction prices

- Compare with the realized NAV returns gross of management fees charged
  - Null hypothesis: 100% of the non-Vanguard ETFs traded at the CLOSE auction prices
  - Regress the realized return on three hypothetical returns, the best hypothesis should prevail

Both Sunshine and Self-Indexing ETFs Trade at the Closing Auction

$$GrossRet_{i,t} = \alpha \cdot HypRet_{i,t,OPEN} + \beta \cdot HypRet_{i,t,VWAP} + \gamma \cdot HypRet_{i,t,CLOSE} + \varepsilon$$

	(1)	(2)	(3)
Sample	Full non-Vanguard sample	Public indexers	Self-indexers
$HypRet_{i,t,OPEN}$	0.016	0.110*	0.004
	(0.013)	(0.061)	(0.004)
$HypRet_{i,t,VWAP}$	-0.039	-0.271*	0.003
	(0.033)	(0.150)	(0.009)
$HypRet_{i,t,CLOSE}$	1.028	1.167*	0.996
	(0.020)	(0.089)	(0.009)
Obs.	748,039	555,197	192,842
Adj. R^2	0.9992	0.9993	0.9992

- Null hypothesis: $\alpha = \beta = 0$, and $\gamma = 1$ is not rejected
  - On average, 100% of rebalance trades happen at the closing prices
- Collinearity is modest because we have abundant observations
  - Estimated standard errors in brackets are much smaller than 1 (the effect size)

Two Measures of Execution Cost of ETFs at Stock-Level

- Define P_t as the closing auction price at date t
  - Most (if not all) rebalances happen at close

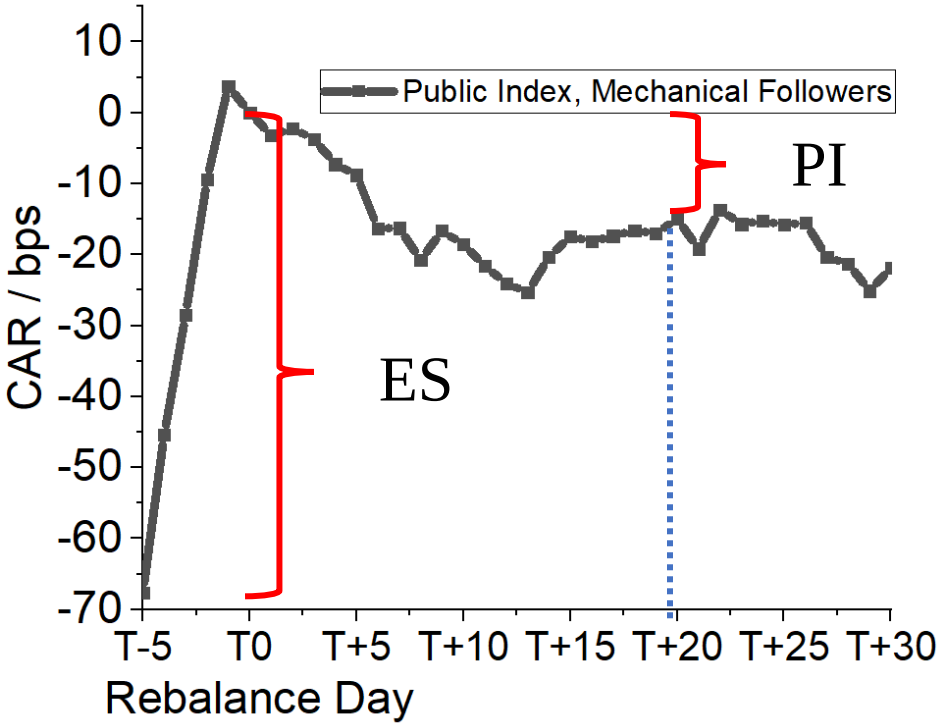
- Execution shortfall: the price difference between the execution and the initial rebalance decision was made

$$ES = (P_0 - P_{-5}) * Direction$$

- Price impact: price difference between the execution and the subsequent prices

$$PI = (P_{20} - P_0) * Direction$$

- A negative price impact means price reversal



Roadmap

- Rebalancing pace for daily-reporting ETFs
- Sunshine vs. Self-indexers (hide *what* to trade)
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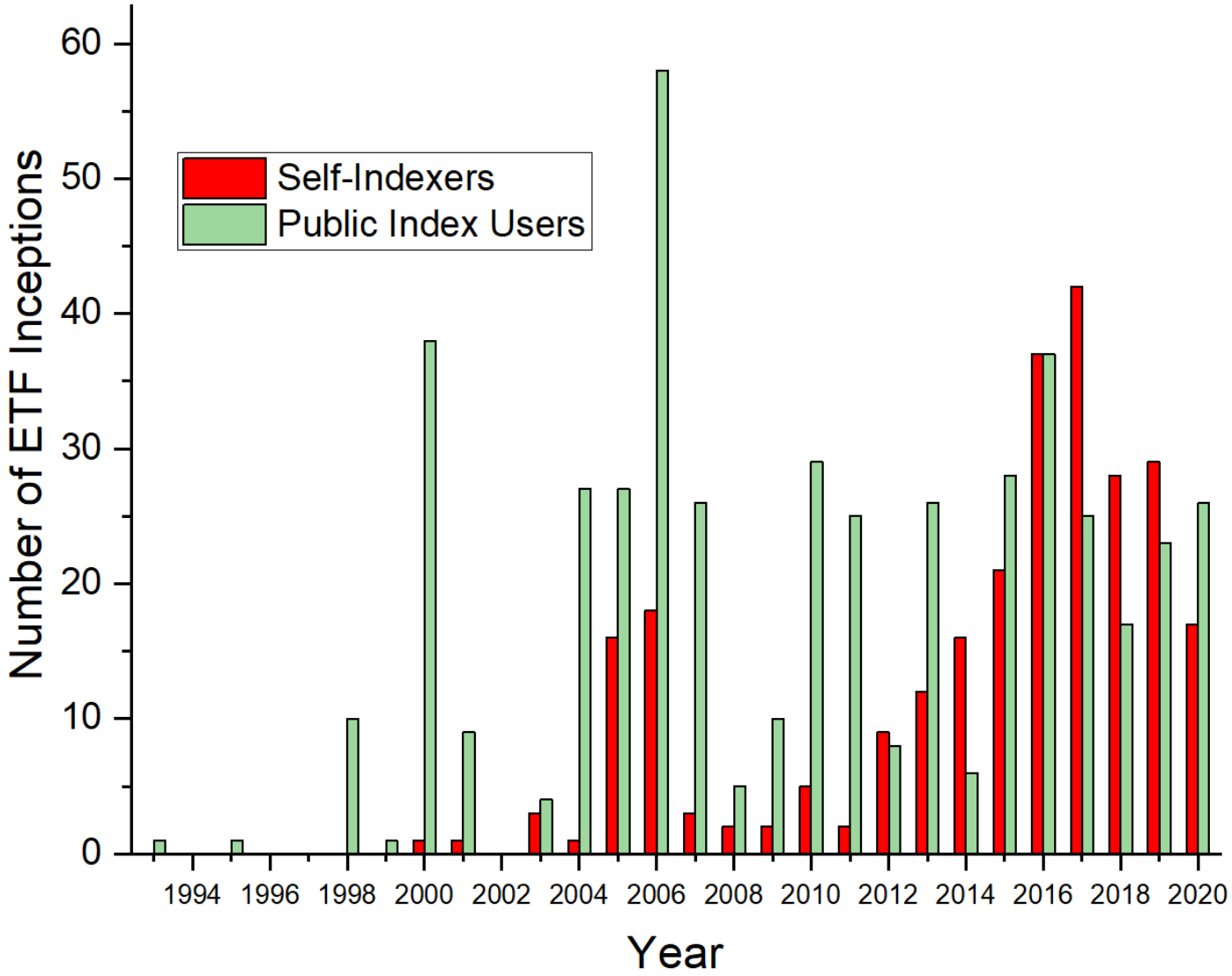
Public Index Users vs. Self-Indexers

- ETF benchmarks with larger index brands are able to attract more capital from investors. (Kostovetsky and Warner 2021)

- Yet there's a drawback: everyone can subscribe to a large branded index, and their rebalances are public information

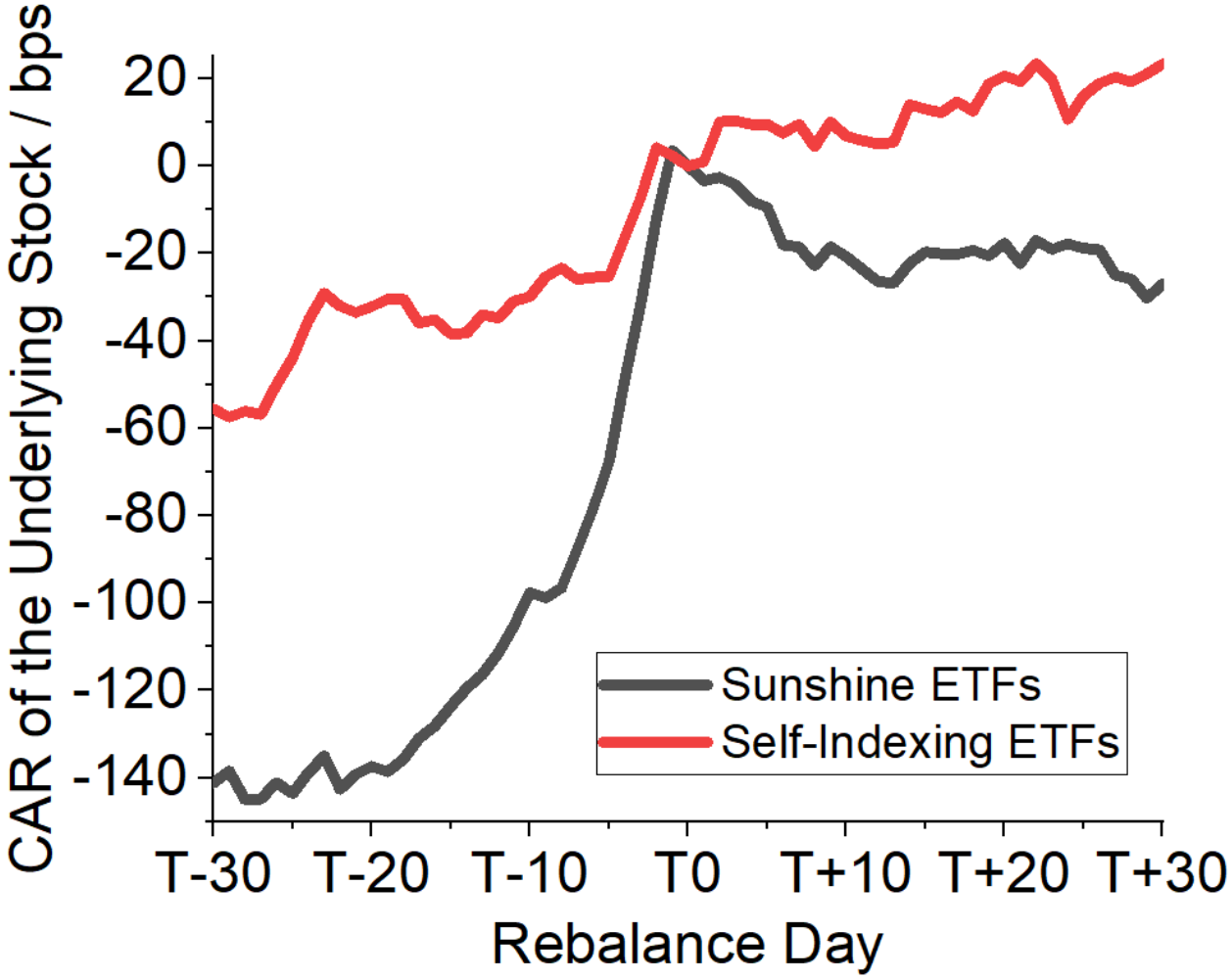
- In July 2013, SEC eases self-indexing rules
  - No longer requires the underlying index methodology and index components to be made publicly available
  - No longer requires that changes to the index methodology be disclosed at least 60 days prior to implementation
  - Only requires daily holding disclosures (i.e., post-trade transparency)
    - Probably that's why self-indexers still chooses to rebalance abruptly (within 1 day)
    - Impossible to simultaneously hide *when* and *what* to trade

Proliferation of Self-indexing ETFs



Execution Costs

- Execution shortfall between T-5 and T0: 67 bps [t=14.49] per trade
  - I use T-5 as the rebalance decision date to provide a conservative estimation
  - Yet some index compilers pre-announce the rebalance even earlier, e.g., FTSE Russell publishes preliminary revisions 3 weeks before the rebalance day (Chang, Hong, and Liskovich 2015).
  - Smart traders can further pre-position to trade the index membership change
- Price reversal in 20 days: 19 bps [t=3.56]



Public Index Users vs. Self-Indexers

$$Rebalance\ Cost_{i,j,t} = \beta Public_{i,j} + Controls_{i,j,t} + \eta_i + \xi_t + \varepsilon_{i,j,t}$$

- i is the index of the stock and j is the index of the ETF, η_i is the stock fixed effect. ξ_t is the year fixed effect. Standard errors are clustered at the stock level and year level.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	Execution Shortfall (T-5 to T)		Negative Price Impact (T to T+20)		Negative Price Impact (T to T+60)	
Public	**25.72*** **	**14.69*** **	**30.59*** **	**19.03****	**37.58*** **	**29.82****
	(5.30)	(5.17)	(7.95)	(8.40)	(12.16)	(14.97)
Log(Trade Size)		**1.75****		**7.54*** **		**8.43*** **
		(0.75)		(1.28)		(2.42)
Log(MKTCAP)		**-91.8*** **		17.07		56.85
		(34.45)		(37.96)		(70.05)
Log(Price)		-43.84		10.78		143.66*
		(33.79)		(41.69)		(79.38)
Stock FE	N	Y	N	Y	N	Y
Year FE	N	Y	N	Y	N	Y
Obs.	122,492	122,492	115,659	115,441	111,815	111,603
Adj. R^2	0.0004	0.1355	0.0002	0.0890	0.0001	0.1072

Explain the Proliferations of Self-Indexing

- Kostovetsky and Warner (2021): ETF benchmarks with larger index brands are able to attract more capital from investors.

- Industry reports usually cite the hefty fees charged by large index compilers as the reason of the proliferation of self-indexing
  - Index licensing revenue of S&P Dow Jones Indices LLC: $647 million or 3.2 bps per year for the $2 Trillion passive funds tracking the S&P indices

- I find the transaction cost saving is much larger than the licensing fees
  - Saving in transaction costs is about 30 bps per trade or 9.6 bps per year
  - The average turnover rate of self-indexing ETFs is approximately the same to sunshine ETFs

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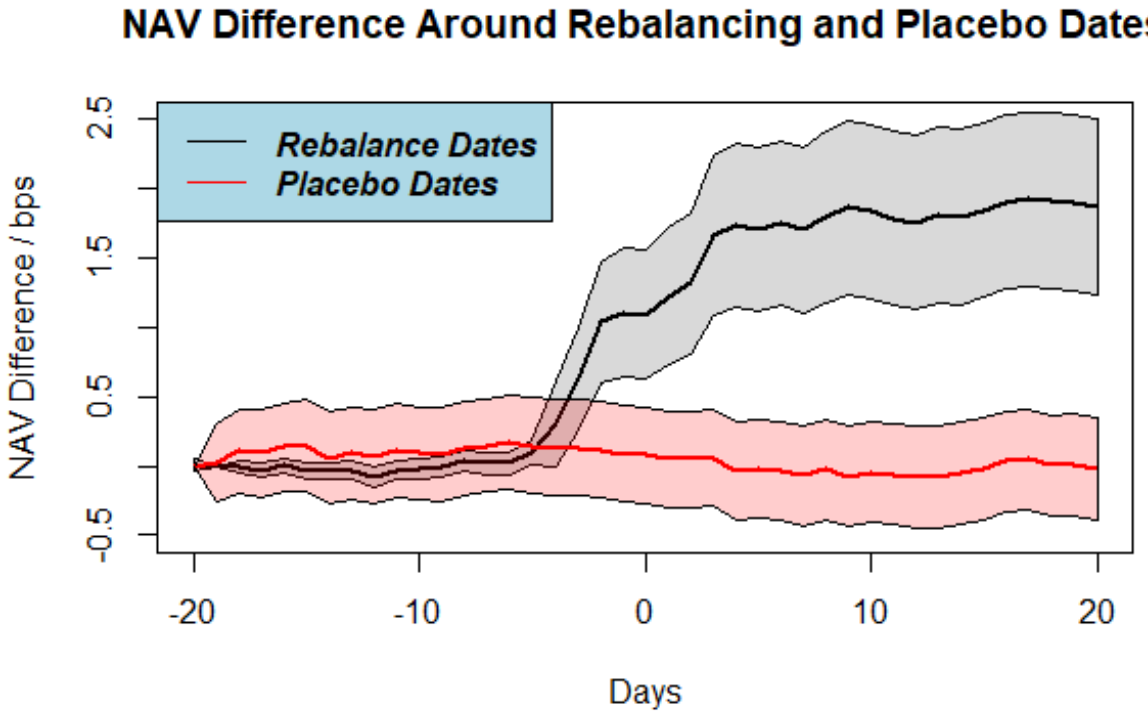
16 Pairs of ETFs that Track the Same Index

	Ticker	Name	Benchmark Index		Ticker	Name	Benchmark Index
1	IJS	iShares S&P Small-Cap 600 Value ETF	S&P Smallcap 600 Value Index	9	IVW	iShares S&P 500 Growth ETF	S&P 500 Growth Index
	VIOV	Vanguard S&P Small-Cap 600 Value ETF	S&P Smallcap 600 Value Index		VOOG	Vanguard S&P 500 Growth ETF	S&P 500 Growth Index
2	IJR	iShares S&P SmallCap 600 ETF	S&P SmallCap 600 Index	10	IWV	iShares Russell 3000 ETF	Russell 3000 Index
	VIOO	Vanguard S&P Small-Cap 600 ETF	S&P SmallCap 600 Index		VTHR	Vanguard Russell 3000 ETF	Russell 3000 Index
3	IJT	iShares S&P Small-Cap 600 Growth ETF	S&P Smallcap 600 Growth Index	11	IWN	iShares Russell 2000 Value ETF	Russell 2000 Pure Value Index
	VIOG	Vanguard S&P Small-Cap 600 Growth ETF	S&P Smallcap 600 Growth Index		VTWV	Vanguard Russell 2000 Value ETF	Russell 2000 Pure Value Index
4	IJJ	iShares S&P Mid-Cap 400 Value ETF	S&P Midcap 400 Pure Value Index	12	IWM	iShares Russell 2000 ETF	Russell 2000 Index
	IVOV	Vanguard S&P Mid-Cap 400 Value ETF	S&P Midcap 400 Pure Value Index		VTWO	Vanguard Russell 2000 ETF	Russell 2000 Index
5	IJK	iShares S&P Mid-Cap 400 Growth ETF	S&P Midcap 400 Pure Growth Index	13	IWO	iShares Russell 2000 Growth ETF	Russell 2000 Growth Index
	IVOG	Vanguard S&P Mid-Cap 400 Growth ETF	S&P Midcap 400 Pure Growth Index		VTWG	Vanguard Russell 2000 Growth ETF	Russell 2000 Growth Index
6	IJH	iShares S&P 400 MidCap ETF	S&P Midcap 400 Index	14	IWD	iShares Russell 1000 Value ETF	Russell 1000 Value Index
	IVOO	Vanguard S&P Mid-Cap 400 ETF	S&P Midcap 400 Index		VONV	Vanguard Russell 1000 Value	Russell 1000 Value Index
7	IVE	iShares S&P 500 Value ETF	S&P 500 Value Index	15	IWB	iShares Russell 1000 ETF	Russell 1000 Index
	VOOV	Vanguard S&P 500 Value ETF	S&P 500 Value Index		VONE	Vanguard Russell 1000	Russell 1000 Index
8	IVV	iShares S&P 500 ETF	S&P 500 Index	16	IWF	iShares Russell 1000 Growth ETF	Russell 1000 Growth Index
	VOO	Vanguard S&P 500 ETF	S&P 500 Index		VONG	Vanguard Russell 1000 Growth ETF	Russell 1000 Growth Index

- Their NAV correlations on non-rebalancing periods are more than 0.9999
  - Identical holdings: They are full replicators of indexes
  - During rebalancing periods: correlation is only 0.97

NAV Divergence of Opaque and Sunshine ETFs

- Opaque ETFs disclose monthly holdings, so I can't analysis they at stock-day level
  - Compare fund-level NAVs
- I calculate the pairwise gross-fee NAV return differences between the funds
  - $ReturnDiff_{i,t} = GrossRetOpaque_{i,t} - GrossRetSunshine_{i,t}$
- Then, I accumulate $Return\_diff$ around:
  - Quarterly rebalance dates of the underlying indexes
  - Placebo dates (rebalance dates + 1 month)

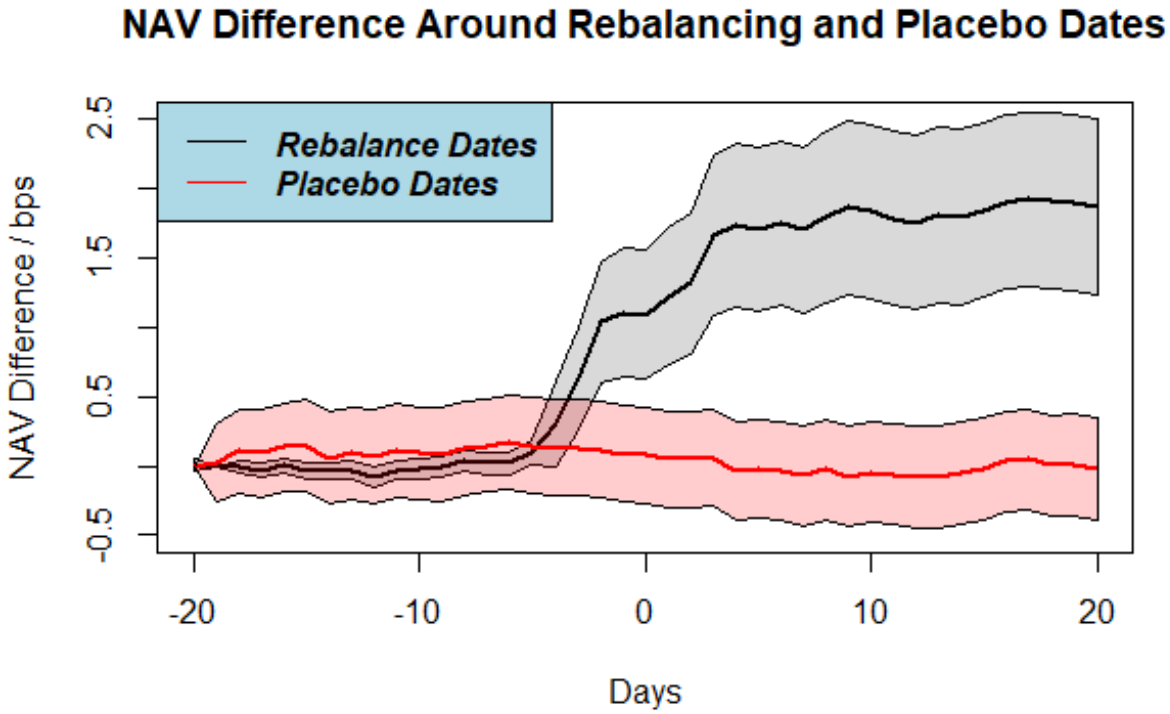


NAV divergence appears only during rebalance dates ± 5 days, indicating alternative rebalance schedules

NAV Divergence of Opaque and Sunshine ETFs

- Vanguard funds outperform BlackRock funds by 1.8 bps per quarter
  - 7.3 bps annually

- Risk-return tradeoff
  - The annualized standard deviation of Vanguard funds' excess return is 10.6 bps
  - Information ratio: $IR = \frac{Portfolio\ Return - Benchmark\ Return}{\sigma_{Tracking\ Error}} = \frac{7.3}{10.6} = 0.69$
  - Represent a very good return-risk trade-off (the lifetime information ratio for Warren Buffett is 0.64)



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Why do Most ETFs Still Follow the Index Mechanically?

- Risk-return tradeoff
  - Yet the information ratio of 0.69 seems too high – a typical ETF investor shouldn't refuse it
- Agency Issue #1: A high tracking error may indicate low ability of managers
  - Some ETF managers are even explicitly compensated for low tracking errors
  - Therefore, ETF managers have high execution risk aversion, while their investors do not
  - A false signal: when it comes to rebalance, opaque ETFs has higher tracking error and higher ability
- Agency Issue #2: No incentive for the ETF manager to beat the benchmark
  - When active funds beat the benchmark, managers are awarded
  - Also, the passive manager has limited attention because they manage multiple ETFs
    - A passive ETF manager, on average, overlooks ~7 ETFs (Active ETF managers: 1.4 ETFs)

Rebalance Costs Substantially Affect the Performance of ETFs

- Predictable rebalancing strategies cost ETFs about 30 bps per trade
  - A 30 bps of one-way saving combined with 16% average turnover rate of passive funds translate to 9.6 bps of round-trip savings per year
  - For the $7 Trillion passive investment business, assuming 56% of them are not rebalancing optimally, $3.9 billions of rebalancing cost can be saved with smarter rebalancing strategies

- Comparable numbers:
  - AUM weighted average expense ratio of ETFs: 15.1 bps per year
  - Index licensing revenue of S&P Dow Jones Indices LLC: $647 million or 3.2 bps per year for the $2 Trillion passive funds tracking the S&P indices
    - Cost of developing the indices is only 1 bps per year
    - *We don't require them [ETFs] to trade in a certain way, that's their business not ours."* -- David Blitzer, chairman of the index committee, S&P Dow Jones Indices

Long-Short Portfolio Betting Against ETF Rebalances

- I construct the long-short portfolio that rides the returns in $[T-5, T]$
  - Enters at the $T-4$ market open price and exits at the date T market close price
  - "Provides liquidity" to the ETFs on date T

- At each day's opening, check the rebalance schedule of the public-indexing ETFs that are trading in the future 4 days

- $Rebalance\_pct = \frac{\sum Signed\ Rebalance\ Trades}{Market\ Cap}$
  - Allows ETF flows to cancel out on some stocks
  - Requires at least 100 stocks in the cross-section (with a non-zero $Rebalance\_pct$)

- Long the top 20% stocks with large anticipated ETF flow to buy, and short the bottom 20%

Portfolio Returns Controlling for FF3/Carhart4

	(1)	(2)	(3)
Dependent Variable	Betting Against ETF Rebalance Daily Returns (bps)		
Alpha	**1.37*** **	**1.38*** **	**1.38*** **
	[3.35]	[3.36]	[3.36]
MKT		-0.01	-0.01
		[-1.37]	[-1.41]
SMB		0.02	0.02
		[1.07]	[1.26]
HML		-0.02	-0.01
		[-1.70]	[-0.87]
MOM			0.01
			[0.98]
Obs.	1886	1886	1886
Adj. R^2	-	0.13%	0.13%

- The portfolio yields 3.45% per year
  - Can survive transaction costs because it trades only ~10 times per year

- No significant SMB and MOM loadings

Conclusion

- Index rebalances create predictable order flows from passive investing funds
  - 56% of ETFs pre-announce the rebalance ("sunshine ETFs")
    - Predictability leads to higher transaction costs
    - As uninformed traders, they pay much more than potentially informed traders!
  - Abnormal trading volume around the rebalance day is 10x larger than the ETF's own rebalance size

- Hiding *when* or *what* to trade can help lower the execution cost
  - 7% of ETFs ("opaque ETFs") make rebalances less predictable
    - Outperform sunshine ETFs by 7.3 bps per year
  - 37% of self-indexing ETFs track indexes that do not pre-announce rebalances
    - Saves 30 bps per trade or 9.6 bps per year
  - Estimated total saving for passive investors: $3.9 billion, or ~60% of the management fees charged

- When it comes to trading, don't be passive!