On Index Investing

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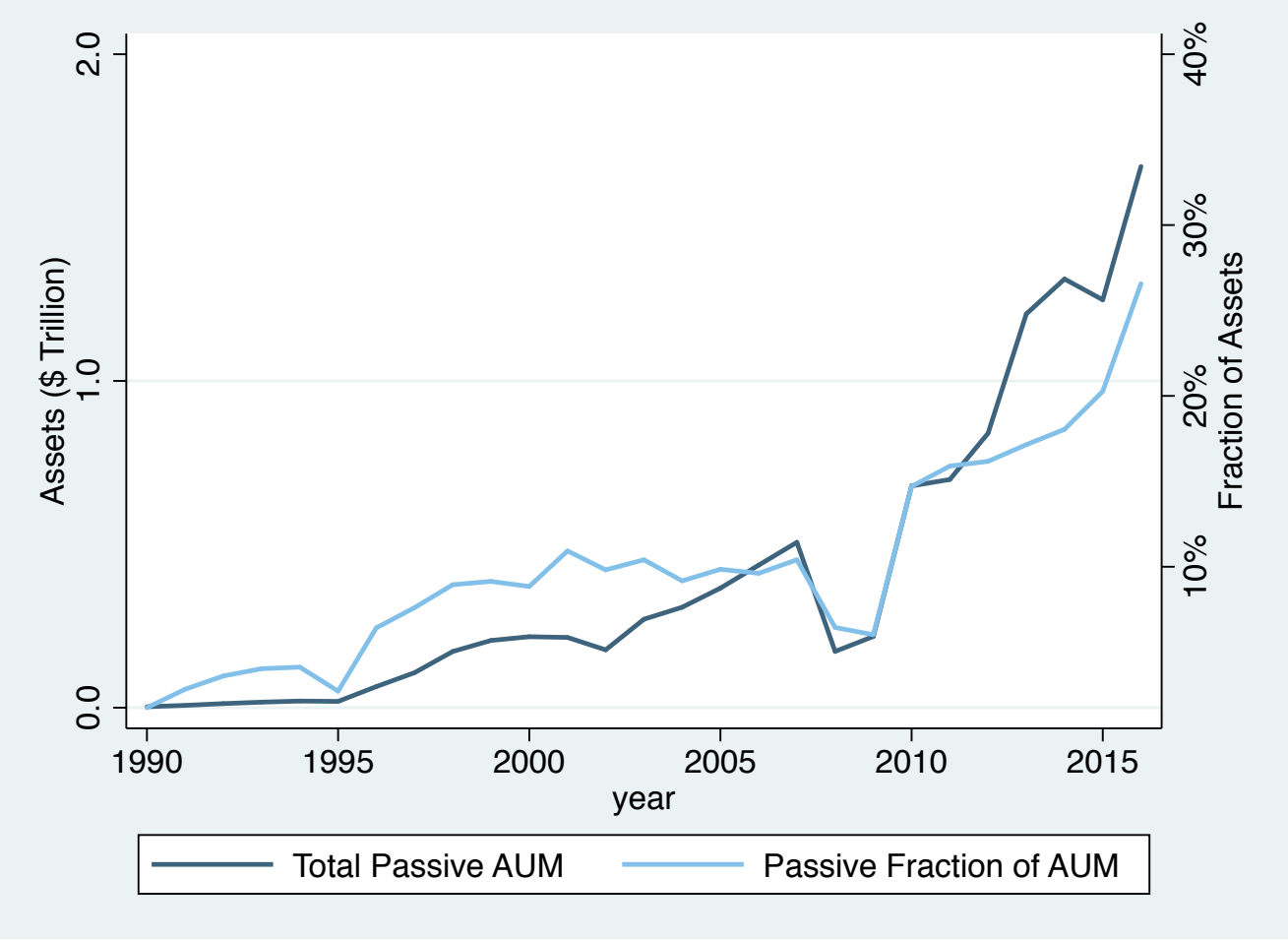
Index investing has dramatically increased

- Capital allocated to passive index funds has increased dramatically over the last 20 years



Index investing has increased, but does it matter?

– Matt Levine, Bloomberg

"Not literally everyone can index! Some people need to build and manage and run businesses, and some other people need to allocate capital to those businesses... If everyone indexed, nothing would get built."

- Active managers, on average, do not outperform
- As a result, index investing has increased dramatically over the last two decades
- What are the implications?

This paper: we examine the impact of index investing

- This paper: we examine the impact of index investing on stock prices
- What should we expect?
- Possible that "unskilled" investors move to index funds, so everything is better
- But, index investors are free-riding off the research of active investors
- This suggests a trade-off:
  1. Passively managed index funds allow investors to earn market returns at low fees
  2. Actively managed funds work to make prices correct

Overview of paper: challenging question

Problem

- Why hasn't this been examined already?
- There is research on it, but difficult question
  - Can't just examine stocks with more index investing: they are different than other stocks
  - This makes inference difficult (endogeneity)

Solution

- We use a cohort difference-in-differences design (DiD) to identify the effect of index investing
- Formally, we use DiD around Russell index reconstitutions
  - Not the first to use this setting, but we have new results and a new methodology

Preview of Results: index investing impacts price (a little)

Index investing changes stock returns, but does not change price informativeness, or limit arbitrage

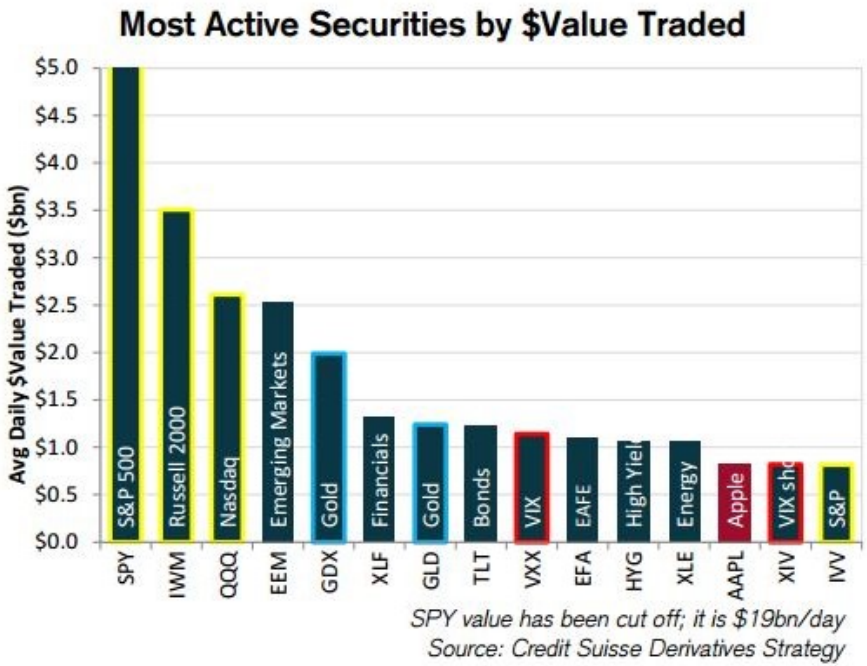
- After a stock is added to the index we find:
  1. Decrease in ownership by active funds
  2. Increase in ownership by passive funds
  3. Increase in correlation with other members of index
  4. No change in trading by informed active investors
  5. Decrease in information production
  6. No change in price efficiency, mispricing, or PEAD
- Consistent with Grossman and Stiglitz (1980)

First, some terminology...

- We are interested in the impact of increased passive (i.e., index) investing
  - Tempting to equate this to ETF trading
- Many ETFs are passively managed, but that does not mean they are passively owned!
  - ETF turnover often higher than stock turnover

Index ETFs are now a huge component of markets

- ETFs now hold over $3 trillion in assets (more than hedge funds)
- Over 1,700 US ETFs tracking over 1,300 indices
- Many ETFs trade more than stocks!



Empirical evidence suggests that ETF trading does matter

- Increasing evidence that index ETFs do impact prices
- Boyer (2011) and Da and Shive (2016): Using OLS, indexing associated with higher correlations
- Ben-David et al. (2016): Using OLS & RDD, ETF trading associated with higher stock volatility
- Israeli et al. (2016): Using OLS, ETF trading associated with worse price efficiency
- Glosten et al. (2016): Using OLS, change in ETF holdings associated with better price efficiency
- Brown, Davies, and Ringgenberg (2017): Using OLS, ETF creation/redemptions push ETF NAV and stock prices away from fundamental value

Many (possible) effects from the rise of index investing

- Models of index investing
- Let's start with a simple verbal model

1. Index investing could improve price efficiency: "unskilled" investors stop actively trading
2. Index investing could reduce price efficiency: flows from index investors act as noise
3. Index investors are free-riding on the research effort of active investors
    - Index investors might deter/reduce efficiency of arbitrageurs

Existing theory discusses many possible results

- New models specifically of index investing:
  - Basak and Pavlova (2013): index investors generate price pressure and increased asset correlations
  - Brown and Davies (2017): more passive investors changes the incentive to acquire info
  - Baruch and Zhang (2017): index investing changes correlations and idio volatility
  - Bond and Garcia (2017): more index investors makes prices more informative but distorts risk sharing
- Models about changes to investor composition:
  - Stein (1987): intro of speculators leads to welfare reduction
  - Subrahmanyam (1991): intro of index investors can increase or decrease price efficiency
  - Goldstein and Yang (2017): index investing in commodities changes risk sharing and price efficiency

Grossman and Stiglitz Provides Testable Predictions

- We provide one of the first ever direct tests of Grossman and Stiglitz (1980)
  - Single risky asset with payoff $\tilde{\theta} + \tilde{\epsilon}$ one period from today
  - Price insensitive noise traders
  - M price sensitive active traders
  - Fraction λ of M pay to become informed
  - Grossman and Stiglitz show that in equilibrium investors are indifferent between becoming informed or not
  - The correlation ρ_θ between price and fundamental value equals:

$$\rho_\theta = \sqrt{1 - \frac{\sigma_\epsilon^2}{\sigma_\theta^2}(e^{2\psi c} - 1)}. \quad (1)$$

Grossman and Stiglitz Provides Testable Predictions

- Price informativeness does not depend on M!
- An exogenous change in M prompts an equilibrium response
- As M falls, the fraction of active investors who choose to become informed, λ, does not change – that is, λ is independent of M.
- Side result: this results in a reduction in total information production (since less investors are buying costly information)

1. Background
   - Overview of Index ETFs
   - Theory
2. Results
   - Empirical Methodology
   - First Stage Results
   - Effect of Index Investing
3. Discussion
4. Conclusion

Sample and Data Sources

We test the predictions of Grossman and Stiglitz (relative to other models) using standard databases:

1. CRSP common stocks (10,11) from 2003-2016
2. Compustat data on firm characteristics
3. Thomson-Reuters + CRSP fund ownership data
4. Data on index membership from Russell

Identifying the impact of index investing

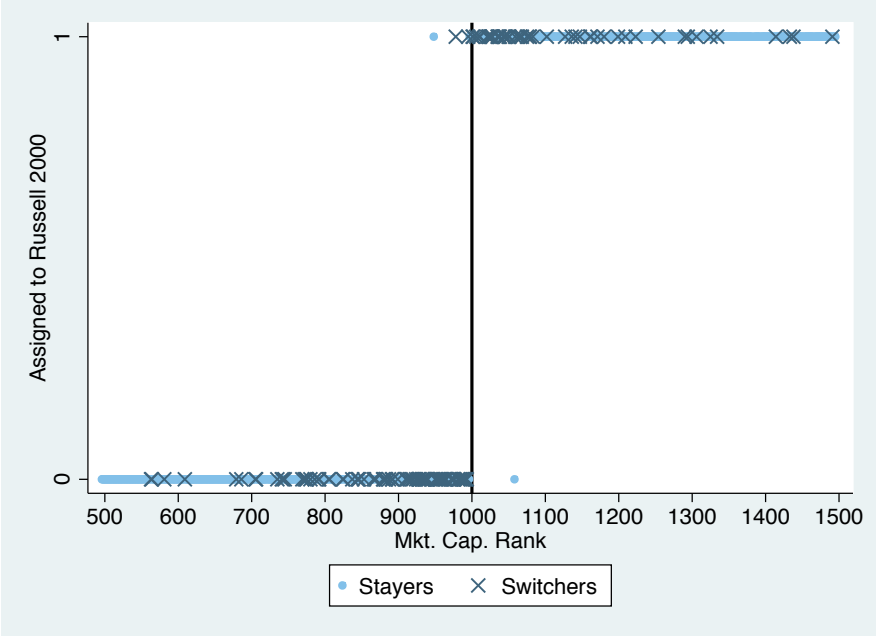
- We can't simply look at trading volume in ETFs
  - Stocks in an index are different than stocks not in an index
- Instead, we use a diff-in-diff design
  - Mullins (2014), Chang, Hong, and Liskovich (2015), Appel, Gormley, and Keim (2016). See also Wei and Young (2017)
- New methodology and new sample period (2007–today)
  - Basically, we compare stocks on either side of the cutoffs to *switch* between the Russell 1000 and 2000

Russell RDD: pre-banding

- Each May, Russell ranks all stocks by market cap
- Top 1000 stocks in Russell 1000, next 2000 in Russell 2000
- Ideally, we'd know the exact market cap used by Russell
- Then, we could perfectly estimate a sharp RDD
- But, Russell float-adjusts the market caps (this is proprietary)
- Cannot "control" for these adjustments, because they are endogenous (Wei and Young (2017))
- Proxy market cap ranking using CRSP/Compustat

Russell RDD: pre-banding

- Result: there is noise in $CAPrank_{it}$



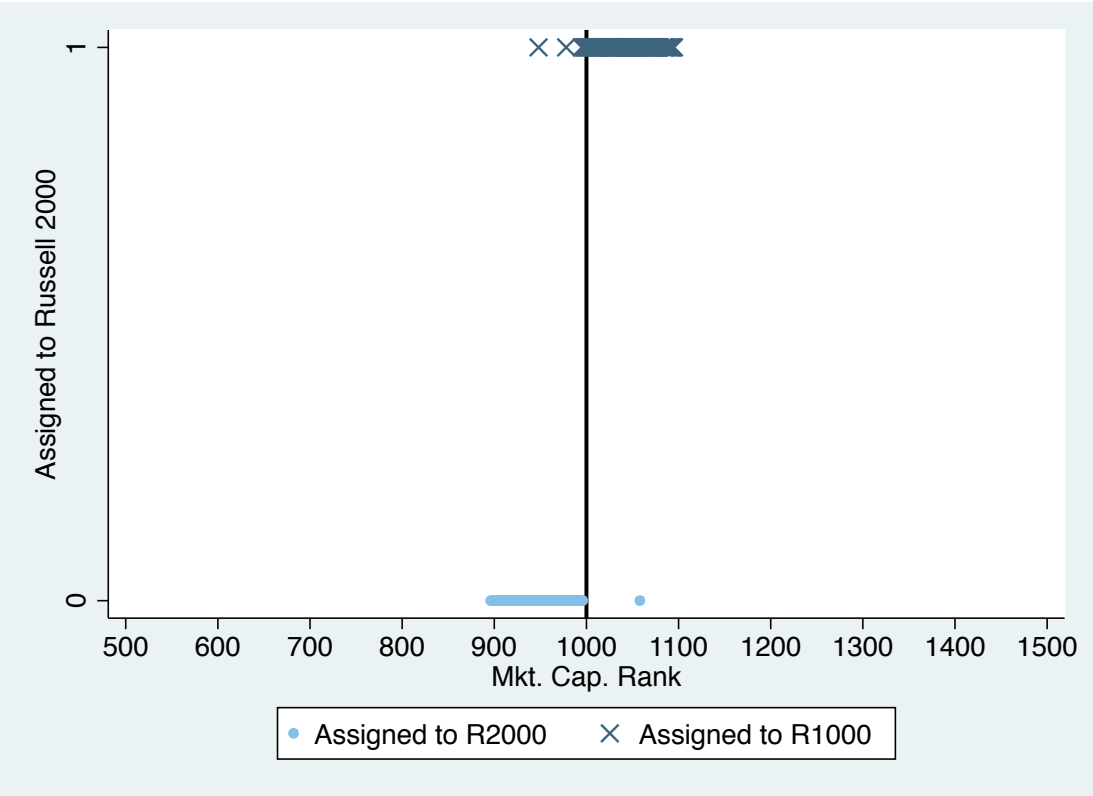
- Fuzzy RDD *does not* fix this
- Pei & Shen (2017) - RDD biased if noise in forcing variable!
- Huge problem for existing Russell literature

Our Russell DiD Methodology

- Starting in 2007, Russell changed their methodology
  - Wanted to make index more stable, less susceptible to manipulation
- Added a band of 2.5% of market cap; if in that band around threshold, no change in status
- This breaks the discontinuity at 2000 threshold, but creates two *new* discontinuities at threshold $+/-$ 2.5%

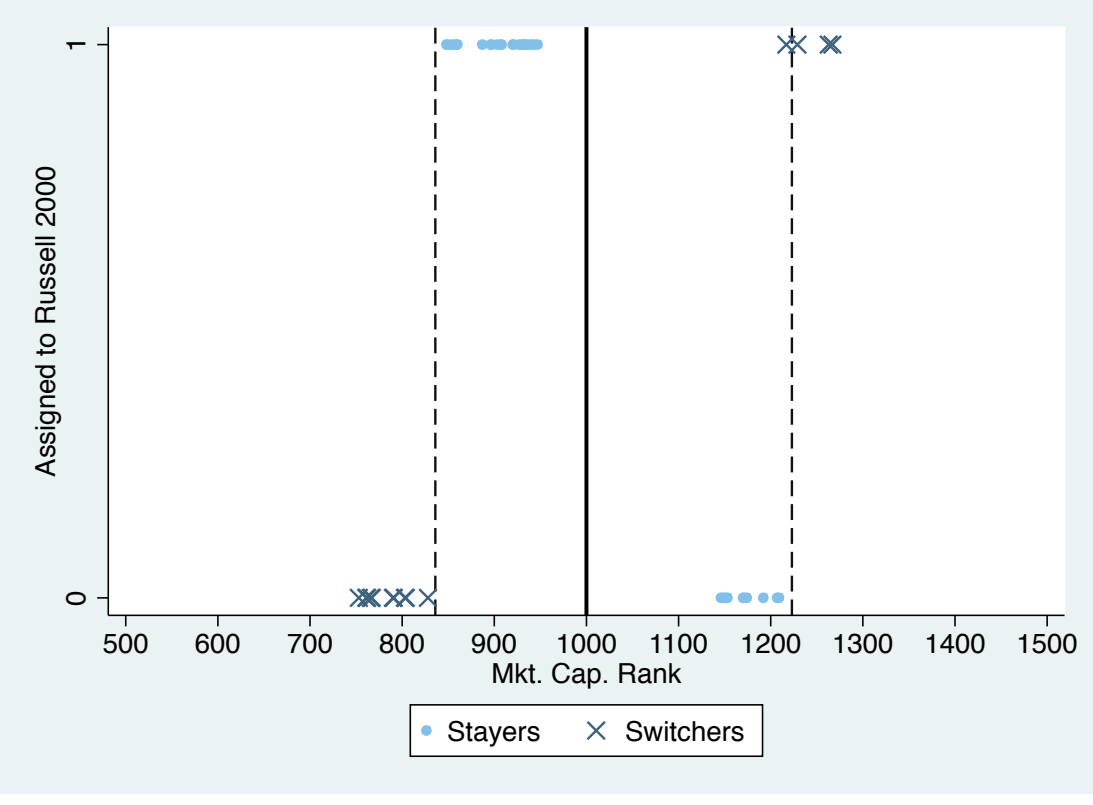
Russell assignment pre-banding

- Before banding, index assignment looks like this:



Our Russell DiD Methodology: post-banding

- After banding (post-2006), our setup looks at these firms:



Russell DiD Methodology

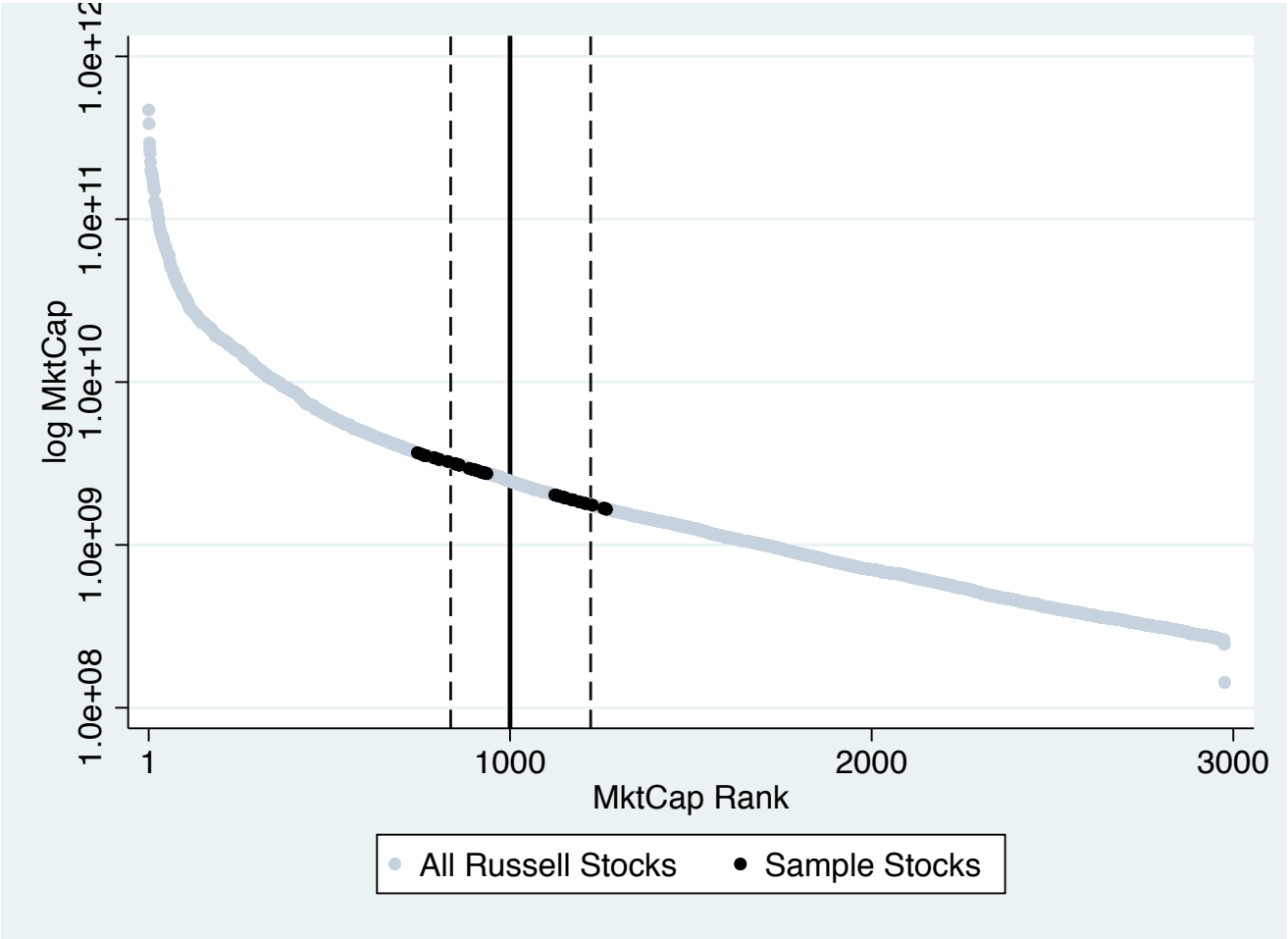
- Each year, select cohort as all stocks that were potential switchers, based on their lagged index membership, in windows of +/-100 ranks around the upper and lower band
- For upper band we estimate:

$$Y_{jt} = \beta \times I\{R2000 \rightarrow R1000_{jc}\} \times PostAssignment_{ct} + \phi_{jc} + \lambda_t + \epsilon_{jct},$$

- Importantly: Firm fixed effects *absorb* noisy forcing variable
- Estimate similar equation for lower bound $\Longrightarrow$ two separate estimates each year

Russell DiD Methodology

- Basic idea: we want to compare firms that are similar in every way EXCEPT changes in index membership



Caution: Much controversy with Russell Setup

- Wei and Young (2017) show that most Russell setups lead to biased estimates
- We have extensive evidence that our setup is not biased
  - See appendix for balance tests, placebo tests, etc.
- Moreover, setup has been used dozens of times
  - See "Reusing Natural Experiments" – Heath, Ringgenberg, Samadi, and Werner (2019)
- Our setting is **out-of-sample** to existing literature

Measuring the impact of index membership

- What happens to stock ownership after a change in index assignment?
- Expect that "passive" ownership will increase
- But if index funds are buying, who is selling?
  1. Active investors?
  2. Retail traders?
  3. Other ETF managers?

First-Stage DiD Estimates: Institutional Ownership

Panel A: Lower Band

	(1) $FundOwn_{it}^{R2000}$	(2) $FundOwn_{it}^{R1000}$	(3) $FundOwn_{it}^{Passive}$	(4) $FundOwn_{it}^{Active}$	(5) $FundOwn_{it}$
$R1000 \rightarrow R2000_i \times$	1.72***	-0.23***	2.09***	-1.26*	0.84
$PostAssignment_t$	(0.072)	(0.010)	(0.299)	(0.717)	(0.838)
Observations	2,552	2,552	2,552	2,552	2,552
Adjusted R-squared	0.696	0.710	0.817	0.803	0.797
Stock x Cohort FE	Yes	Yes	Yes	Yes	Yes
Year x Quarter FE	Yes	Yes	Yes	Yes	Yes

First-Stage DiD Estimates: Institutional Ownership

Panel B: Upper Band

	(1) $FundOwn_{it}^{R2000}$	(2) $FundOwn_{it}^{R1000}$	(3) $FundOwn_{it}^{Passive}$	(4) $FundOwn_{it}^{Active}$	(5) $FundOwn_{it}$
$R2000 \rightarrow R1000_i \times$	-1.58***	0.22***	-0.96***	1.56***	0.61
$PostAssignment_t$	(0.053)	(0.007)	(0.179)	(0.562)	(0.672)
Observations	4,512	4,512	4,512	4,512	4,512
Adjusted R-squared	0.749	0.733	0.846	0.813	0.799
Stock x Cohort FE	Yes	Yes	Yes	Yes	Yes
Year x Quarter FE	Yes	Yes	Yes	Yes	Yes

Index additions change composition of investors. So what?

- Index additions cause "active" managers to sell to "passive" managers
- Does this matter?
- Basak and Pavlova (2013): index investors generate price pressure and increased asset correlations
- Baruch and Zhang (2017): index investing changes correlations and idio volatility
- We next examine volatility, correlations, and liquidity

Test of Basak-Pavlova and Baruch-Zhang

Panel A: Lower Band

	(1) $Turnover_{it}$	(2) $logVolatility_{it}$	(3) ρ_{it}^{R1000}	(4) ρ_{it}^{R2000}	(5) $MarketBeta_{it}$
$R1000 \rightarrow R2000_i \times$	0.067**	0.064*	0.046***	0.069***	0.300***
$PostAssignment_t$	(2.1)	(1.7)	(2.9)	(4.5)	(4.5)
MDES	±0.091	±0.105	±0.045	±0.044	±0.190
Sample St.Dev.	0.559	0.612	0.237	0.233	0.986
Observations	6,130	6,642	6,450	6,450	6,642
Adjusted R-squared	0.812	0.687	0.394	0.388	0.278
Stock x Cohort FE	Yes	Yes	Yes	Yes	Yes
Year x Month FE	Yes	Yes	Yes	Yes	Yes

Test of Basak-Pavlova and Baruch-Zhang

Panel B: Upper Band

	(1) $Turnover_{it}$	(2) $logVolatility_{it}$	(3) ρ_{it}^{R1000}	(4) ρ_{it}^{R2000}	(5) $MarketBeta_{it}$
$R1000 \rightarrow R2000_i \times$ $PostAssignment_t$	-0.020	-0.049**	-0.035***	-0.053***	-0.175***
	(-1.2)	(-2.1)	(-3.9)	(-5.7)	(-4.5)
MDES	±0.049	±0.066	±0.025	±0.026	±0.109
Sample St.Dev.	0.453	0.568	0.226	0.224	0.748
Observations	11,540	11,669	11,302	11,302	11,669
Adjusted R-squared	0.751	0.665	0.398	0.390	0.289
Stock x Cohort FE	Yes	Yes	Yes	Yes	Yes
Year x Month FE	Yes	Yes	Yes	Yes	Yes

Index investing has some significant effects

- Results partially consistent with models
- Results show increase in asset correlations
- However, no change in volatility or liquidity
- Note: non-results are informative here
  - We show the minimum detectable effect size
  - We could detect small changes, just aren't any
- What about predictions from Grossman and Stiglitz?

Quantifying the impact of index investing: Grossman and Stiglitz

- Results show that index membership changes investor composition
- Grossman and Stiglitz predict this will change information production
  - Rise in passive investing reduces the mass of active traders (M)
  - In equilibrium, the fraction (λ) of informed to uninformed does not change!
- Simple example:
  - Before shock: M=1, λ =0.5: mass of informed actives = 0.5, mass of uninformed actives = 0.5
  - After shock increases index investing: M=0.4 (since 0.6 actives become indexers), λ =0.5 : mass of informed actives = 0.2, mass of uninformed actives = 0.2

Test of Grossman and Stiglitz on info production

Panel A: Lower Band

- Reduction in total size of active investors means less are paying for information
- As a result, information production in the economy falls!

	(1) $log(SVI)_{it}$	(2) $log(EDGAR)_{it}$	(3) $log(AnalystReports)_{it}$
$R1000 \rightarrow R2000_i \times$	-0.038	-0.141	-0.108*
$PostAssignment_t$	(-1.0)	(-1.1)	(-1.8)
MDES	$\pm$0.107	$\pm$0.374	$\pm$0.166
Sample St.Dev.	0.822	1.882	0.853
Observations	6,699	6,699	1,914
Adjusted R-squared	0.836	0.790	0.717
Stock x Cohort FE	Yes	Yes	Yes
Year x Month FE	Yes	Yes	No
Year x Quarter FE	No	No	Yes

Test of Grossman and Stiglitz on info production

Panel B: Upper Band

- Reduction in total size of active investors means less are paying for information
- As a result, information production in the economy falls!

	(1) $log(SVI)_{it}$	(2) $log(EDGAR)_{it}$	(3) $log(AnalystReports)_{it}$
$R2000 \rightarrow R1000_i \times$	0.044	0.140*	0.143***
$PostAssignment_t$	(1.5)	(1.7)	(2.8)
MDES	±0.085	±0.227	±0.144
Sample St.Dev.	0.897	1.964	0.826
Observations	11,844	11,844	3,384
Adjusted R-squared	0.830	0.810	0.598
Stock x Cohort FE	Yes	Yes	Yes
Year x Month FE	Yes	Yes	No
Year x Quarter FE	No	No	Yes

What about price informativeness?

Panel A: Lower Band

- Several models predict this will change price informativeness (Brown and Davies (2017), Bond and Garcia (2017))
- Grossman and Stiglitz predict that fraction of informed to uninformed (λ) is unchanged so no effect on price efficiency

	(1) $AbsVarRatio^4_{it}$	(2) $AbsVarRatio^8_{it}$	(3) $Misprice_{it}$	(4) β^{PEAD}_{it}
$R1000 \rightarrow R2000_i \times$	-0.017	-0.027	0.001	-0.034
$PostAssignment_t$	(-0.7)	(-0.4)	(0.0)	(-1.0)
MDES	±0.068	±0.221	±0.048	±0.099
Sample St.Dev.	0.413	1.353	0.137	0.102
Observations	6,800	6,800	5,601	434
Adjusted R-squared	0.067	0.102	0.734	0.235
Stock x Cohort FE	Yes	Yes	Yes	Yes
Year x Month FE	Yes	Yes	Yes	No
Year FE	No	No	No	Yes

What about price informativeness?

Panel B: Upper Band

- Several models predict this will change price informativeness (Brown and Davies (2017), Bond and Garcia (2017))
- Grossman and Stiglitz predict that fraction of informed to uninformed (λ) is unchanged so no effect on price efficiency

	(1) $AbsVarRatio^4_{it}$	(2) $AbsVarRatio^8_{it}$	(3) $Misprice_{it}$	(4) β^{PEAD}_{it}
$R2000 \rightarrow R1000_i \times$	0.011	0.004	0.005	-0.014
$PostAssignment_t$	(0.7)	(0.1)	(1.1)	(-0.5)
MDES	±0.041	±0.132	±0.026	±0.079
Sample St.Dev.	0.385	1.246	0.126	0.185
Observations	11,928	11,927	9,905	845
Adjusted R-squared	0.062	0.095	0.739	0.223
Stock x Cohort FE	Yes	Yes	Yes	Yes
Year x Month FE	Yes	Yes	Yes	No
Year FE	No	No	No	Yes

Finally, what happens with informed investors?

Panel A: Lower Band

- Results suggest equilibrium response by active investors (consistent with Grossman and Stiglitz)
- Finally, we verify that nothing changes with active informed behavior (using Ancerno data)

	(1) $Slippage_{it}$	(2) $NumberofInst_{it}$	(3) $OrdersperTrade_{it}$	(4) $TradesperInst_{it}$
$R1000 \rightarrow R2000_i \times$	-0.015	-0.42	-0.08	-0.19
$PostAssignment_t$	(-0.6)	(-0.3)	(-0.4)	(-0.8)
MDES	±0.068	±3.97	±0.69	±0.68
Sample St.Dev.	0.396	19.19	3.01	3.54
Observations	3,521	3,522	3,522	3,522
Adjusted R-squared	0.116	0.098	0.253	0.493
Stock x Cohort FE	Yes	Yes	Yes	Yes
Year x Month FE	Yes	Yes	Yes	Yes

Finally, what happens with informed investors?

Panel B: Upper Band

- Results suggest equilibrium response by active investors (consistent with Grossman and Stiglitz)
- Finally, we verify that nothing changes with active informed behavior (using Ancerno data)

	(1) $Slippage_{it}$	(2) $NumberofInst_{it}$	(3) $OrdersperTrade_{it}$	(4) $TradesperInst_{it}$
$R2000 \rightarrow R1000_i \times$	0.173	0.69	-0.07	-2.43
	(1.1)	(0.4)	(-0.4)	(-1.5)
MDES	±0.455	±5.25	±0.48	±4.53
Sample St.Dev.	3.25	30.58	2.32	37.72
Observations	6,618	6,618	6,618	6,618
Adjusted R-squared	0.024	0.112	0.130	0.020
Stock x Cohort FE	Yes	Yes	Yes	Yes
Year x Month FE	Yes	Yes	Yes	Yes

Related Project: Index Investing and Control Rights

- This paper examines index investing and cash flow rights
- In a companion paper (*"Do Index Funds Monitor"*) we examine index investing and control rights
- We find that index funds cede control to corporate managers
  - Index funds much more likely to vote with management (relative to active funds)
  - Index funds rarely exit, and never do so for governance reasons
  - No evidence index funds affect change with "engagement"
- Index funds have a legal obligation to monitor, but no economic incentive to do so
- Thus, they monitor less than active funds

We are NOT making welfare claims

- We are (trying to be) careful with our results
  - Our estimates are local average treatment effect (LATE)
- This paper does not provide welfare implications BUT
- Limited evidence of bad effects from indexing:
  - Higher correlations
  - Reduction in aggregate information production
  - More trading (noise?)
- In general, many good things:
  - Lower fees for investors
  - No change in liquidity
  - No apparent change in price informativeness
  - No change in informed trading
- Our results echo the predictions of Grossman and Stiglitz (1980)

Conclusion: Index Membership has (Some) Consequences

We make several contributions:

- Index membership changes investor composition, correlations, noise trading
- However, most findings confirm predictions in Grossman and Stiglitz
  - Change in investor composition leads to reduction in aggregate information production
  - But *fraction* of informed to uninformed active investors does not change
  - As a result, no change in price informativeness
- Results suggest some concerns are overblown: active investors are still doing their job

Appendix

Balance Tests Support Identifying Assumptions

Panel A: Lower Band

	Stayers		Switchers		
	Mean	St.Dev.	Mean	St.Dev.	p-value
$FundOwn^{Passive}$	7.41	3.36	7.01	3.24	0.47
$Turnover$	1.38	0.53	1.52	0.60	0.17
$Volatility$	0.03	0.02	0.03	0.02	0.85
$AbsVarRatio^{4}$	0.37	0.29	0.48	0.45	0.13
$AbsVarRatio^{8}$	0.83	0.91	1.05	1.31	0.29
$Misprice$	0.55	0.14	0.54	0.13	0.60
β^{PEAD}	0.02	0.13	0.06	0.17	0.17
$Slippage$	-0.01	0.20	-0.05	0.28	0.43
$NumberofInst$	11.53	9.64	9.40	5.16	0.07*
$OrdersPerTrade$	1.47	1.58	1.45	1.35	0.96
$TradesPerInst$	2.72	3.15	2.32	2.36	0.36

Balance Tests Support Identifying Assumptions

Panel B: Upper Band

	Stayers		Switchers		
	Mean	St.Dev.	Mean	St.Dev.	*p*-value
$FundOwn^{Passive}$	7.52	3.81	8.07	3.45	0.19
Turnover	1.34	0.52	1.38	0.40	0.39
Volatility	0.03	0.01	0.03	0.01	0.67
$AbsVarRatio^{4}$	0.37	0.35	0.37	0.38	0.92
$AbsVarRatio^{8}$	0.86	1.11	0.91	1.16	0.68
Misprice	0.48	0.12	0.49	0.14	0.57
β^{PEAD}	0.04	0.16	0.04	0.18	0.97
Slippage	0.21	6.08	-0.04	0.87	0.59
NumberofInst	19.13	76.91	17.27	21.38	0.75
OrdersPerTrade	1.47	0.91	1.80	3.31	0.26
TradesPerInst	3.38	4.21	4.53	7.14	0.11