JONATHAN BERK AND JULES VAN BINSBERGEN

THE IMPACT OF IMPACT INVESTING

HOW DOES DIVESTMENT AFFECT SOCIAL OUTCOMES?

- Swap one owner/investor for another.
  - Why would this affect social outcomes?
- Two Channels
  - Change in investor preferences leads to governance changes
    - Unlikely to produce the desired effect since a socially conscious investor is replaced by another investor
  - Change in the Cost of Capital

DIVESTMENT AND THE COST OF CAPITAL

- Theory
  - When one investor sells, they need to induce another investor to buy.
  - The inducement comes in the form of a lower price
  - The lower price implies a higher cost of capital
  - A higher cost of capital implies fewer positive NPV opportunities and thus lower growth rates
  - Thus socially undesirable firms shrink at the expense of socially desirable firms
  - Total social and environmental costs in society goes down.
- Thus, for this mechanism to work, it is essential that divestment leads to a change in the cost of capital.

THE PLAN

- I will investigate the impact of divestiture on the cost of capital using two approaches:
  - Theoretically: Build a model and ask the question what would we expect to see?
  - Empirically: Take the predictions of the model and see if they are validated in the data.

MODEL OVERVIEW

- Single period CAPM where all investors have mean-variance preferences
- To study the effect on the cost of capital we solve for 2 equilibria:
  - The equilibrium when all investors are identical
  - The equilibrium in which γ fraction of investors have ESG preferences and refuse to hold stocks that impose social and environmental costs, hereafter, *dirty* stocks.
- Notice that in the ESG investor equilibrium:
  - ESG investors hold a constrained MV efficient portfolio of the clean stocks
  - Other investor hold a MV efficient portfolio that prices all stocks.

EXOGENOUS ASSUMPTIONS

- All investors maximize $E[R_p] - k\sigma_p^2$ where R_p and σ_p is the return and standard deviation of their portfolios
- Two kinds of stocks
  - Clean
  - Dirty
- Two kinds of investors all of whom are endowed with a fraction of total wealth
  - γ fraction of wealth is owned by ESG investors, $1 - \gamma$ owned by the rest
  - Investors then trade to an equilibrium in which ESG investors only hold clean stocks
- Liquidating Dividends
  - D is the combined liquidating dividend of all stocks
  - D_E is the liquidating dividend paid to all investors holding the clean portfolio
  - $D_D = D - D_E$ (the liquidating dividend paid to all investors holding the dirty portfolio)

FORMAL PORTFOLIO DEFINITIONS

- The clean portfolio is defined to be the portfolio of clean stocks ESG investors hold:
  - It is the tangency portfolio on the constrained MV efficient frontier.
- The dirty portfolio is the portfolio that when combined with the clean portfolio gives the market portfolio.
  - Notice that the dirty portfolio can contain clean stocks
    - The dirty portfolio only contains dirty stocks if and only if the clean portfolio is on the *unconstrained* MV efficient frontier of risky stocks.
- b is the total wealth ESG investors choose to invest in the risk free asset
  - So the rest of investors invest $-b$ in the risk free asset.

THE COST OF CAPITAL

- The difference is the cost of capital between the dirty and clean portfolio is

$$\Delta R = R_D - R_E = 2k\sigma^2\left(\beta_D^m - \beta_E^m + \frac{\Gamma}{V_D}\right)$$

$$= 2k\sigma^2\left(\beta_D^m - \beta_E^m + V_D\left(\frac{\gamma}{1-\gamma}\right)(1-\rho^2)\frac{\sigma_{R_D}^2}{\sigma^2}\right)$$

  - Notice that the market portfolio is not mean-variance efficient, so the difference in the cost of capital is not just the difference in the *market* betas

- So the difference is a function of the risk difference measured by the market betas plus a term that captures the effect of impact investing.

EQUILIBRIUM WITHOUT ESG INVESTORS

- This is the initial equilibrium before investors acquire ESG preferences
- It is the standard CAPM equilibrium where the market is MV efficient and because investors are identical, they all hold an unlettered position in the market portfolio. Solving that equilibrium (where asterisks are used to denote equilibrium quantities) gives

$$\Delta R^* = 2k\sigma^2(\beta_D^* - \beta_E^*)$$

  - These are the market betas, but in the equilibrium without test investors.

COMPARING THE COC IN THE TWO EQUILIBRIA

- Without ESG Investors

$$\Delta R^* = \overline{R}_D^* - \overline{R}_E^* = 2k\sigma^2(\beta_D^* - \beta_E^*)$$

- With ESG Investors

$$\Delta R = R_D - R_E$$

$$= 2k\sigma^2\left(\beta_D^m - \beta_E^m + V_D\left(\frac{\gamma}{1-\gamma}\right)(1-\rho^2)\frac{\sigma_{R_D}^2}{\sigma^2}\right)$$

- Although both betas are market betas, because prices are different in the two equilibria, the betas are not the same.

- BUT, we show that the difference is betas is 2nd order so the effect is essentially the difference assuming the betas are the same.

CALIBRATING THE DIFFERENCE

- In a standard CAPM equilibrium $2k = \frac{R-r^*}{\sigma^2} = \frac{MRP}{\sigma^2}$ so we have

$$\Delta R - \Delta R^* \approx MRP \times V_D \times \left(\frac{\gamma}{1-\gamma}\right)(1-\rho^2)$$

- We can therefore use the historical market risk premium (MRP=6%) to calibrate preferences.
- The volatility of the dirty stock portfolio and the market are approximately the same.
- V_D is the fraction of the economy clean stocks comprise
- γ is the fraction of investors that have ESG preferences
- ρ is the correlation between clean and dirty stocks

FTSE 4 GOOD GROUND RULES

Section 4

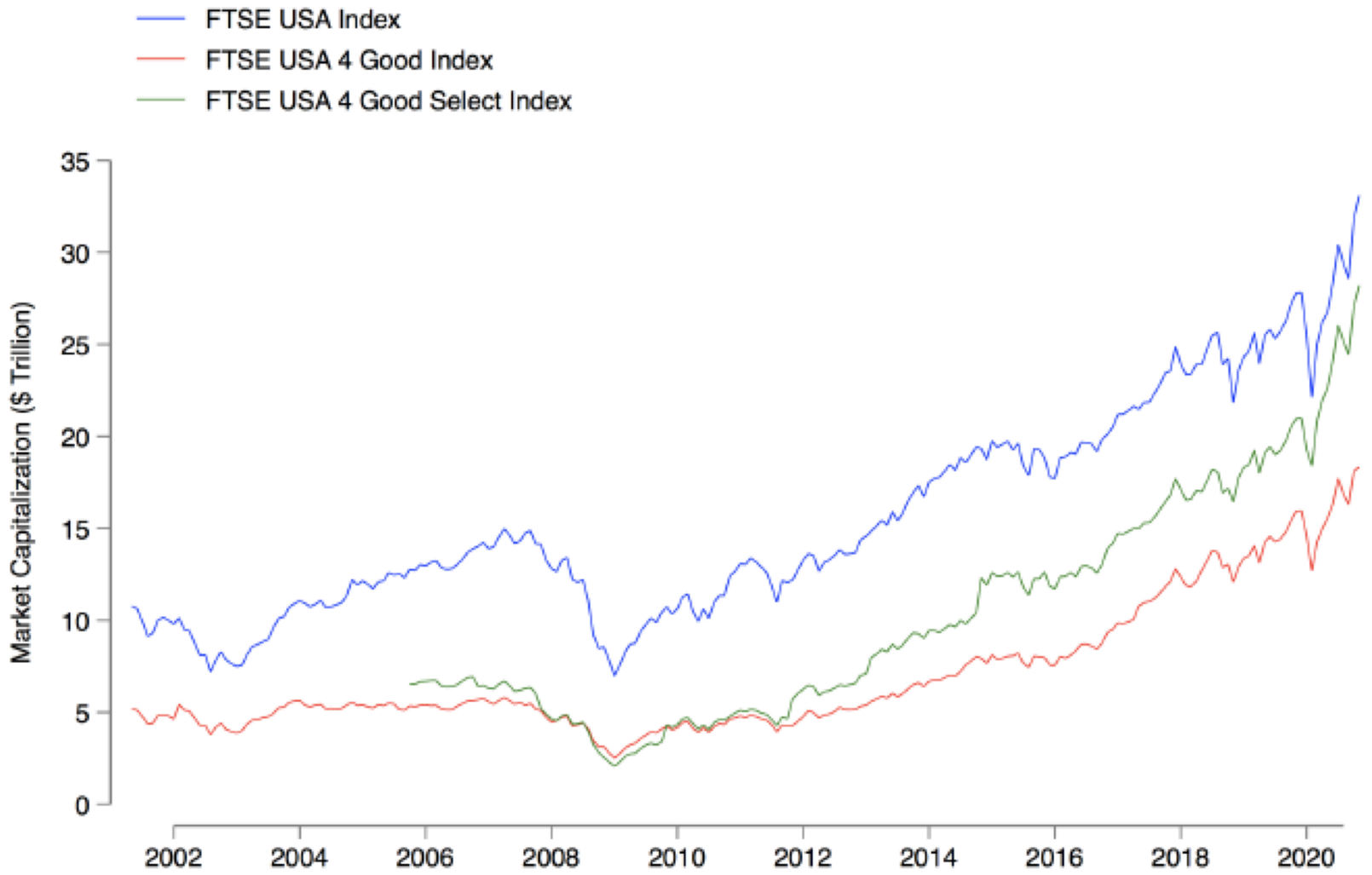
Eligible Securities

4.0 Eligible Securities

4.1 Companies are eligible for inclusion in the FTSE4Good US Select Index if they are current constituents of FTSE USA All-World Index.

4.2 Ground Rules for the FTSE Global Equity Index Series are available at www.ftserussell.com.

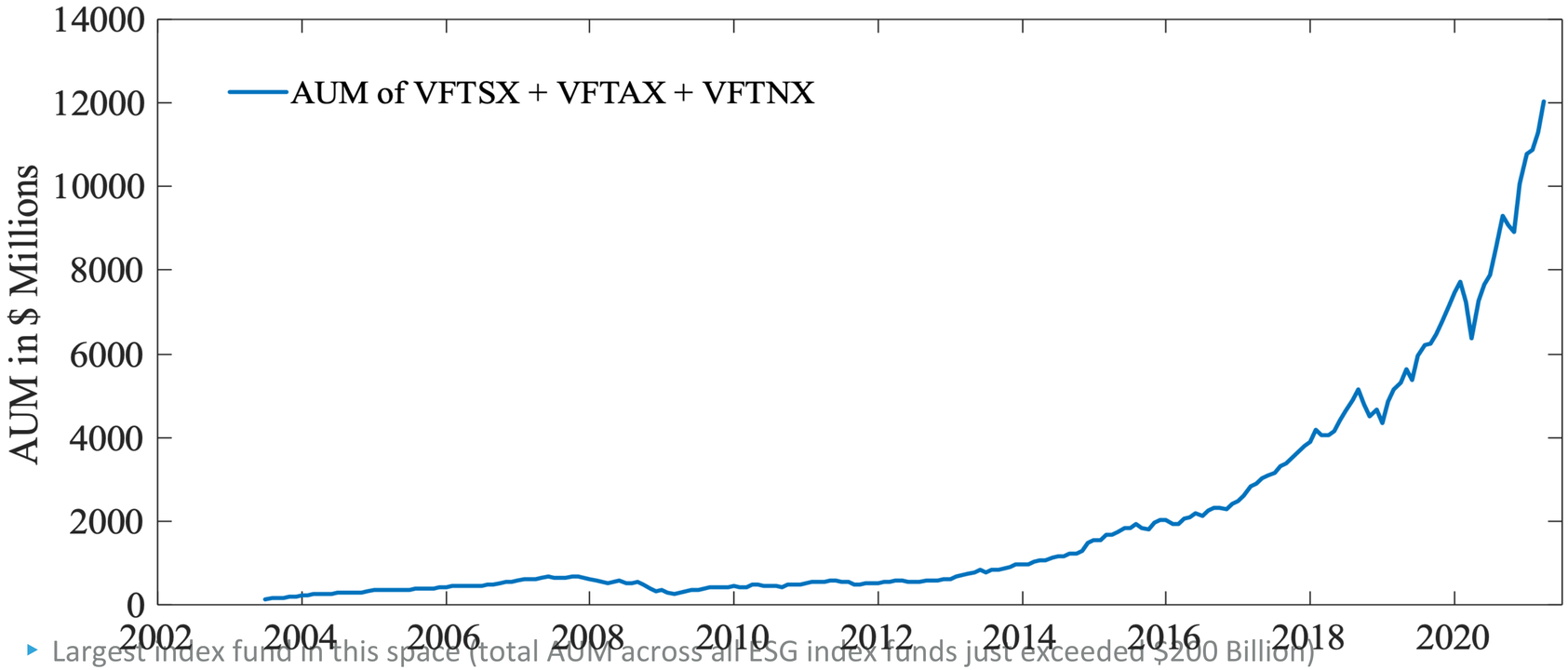
TOTAL MARKET CAPITALIZATION OF FTSE



ASSETS-UNDER-MANAGEMENT VANGUARD SOCIAL INDEX FUND

Between 2015 and 2021 AUM increased from $2 Billion to $12 Billion (x6)

Equity market total market cap increased from $25 Trillion to $50 Trillion (x2)



- Largest index fund in this space (total AUM across all ESG index funds just exceeded $200 Billion)
- Over this time period the AUM in all index funds + ETFs grew from $500 Billion to $12 Trillion.

CALIBRATING USING FTSE UNIVERSE

- Define the set of cleans stocks as the set of stocks held in the FTSE 4 Good US Domestic Index and the set of dirty stocks as the set of stocks in the FTSE US Domestic Index not in FTSE 4 Good
  - $\rho = 0.93$
    - The measured correlation between clean and dirty stocks in the last 5 years as defined by FTSE
  - $V_D = 27\%$
    - Market value fraction dirty stocks as defined by FTSE make up
  - $\gamma = 2\%$:
    - Fraction of mutual fund AUM held in ESG funds.
- This gives $\Delta R - \Delta R^* \approx 6\% \times 27\% \left(\frac{0.02}{1-0.02}\right)(1 - 0.93^2) = 0.44$ b.p.

SENSITIVITY

- γ estimates vary widely, the highest are around 33% (by industry groups representing impact investing). Using that number we get $\Delta R - \Delta R^* = 6\% \times 27\% \left(\frac{0.33}{1-0.33}\right)(1 - 0.93^2) = 10.6$ b.p.
- Use the complement of the union of all stocks held by socially conscious mutual funds to measure the set of dirty stocks
  - V_D=18% and ρ = 0.8

$$\Delta R - \Delta R^* = 6\% \times 18\% \left(\frac{0.02}{1-0.02}\right)(1 - 0.8^2) = 0.79 \text{ b.p.}$$

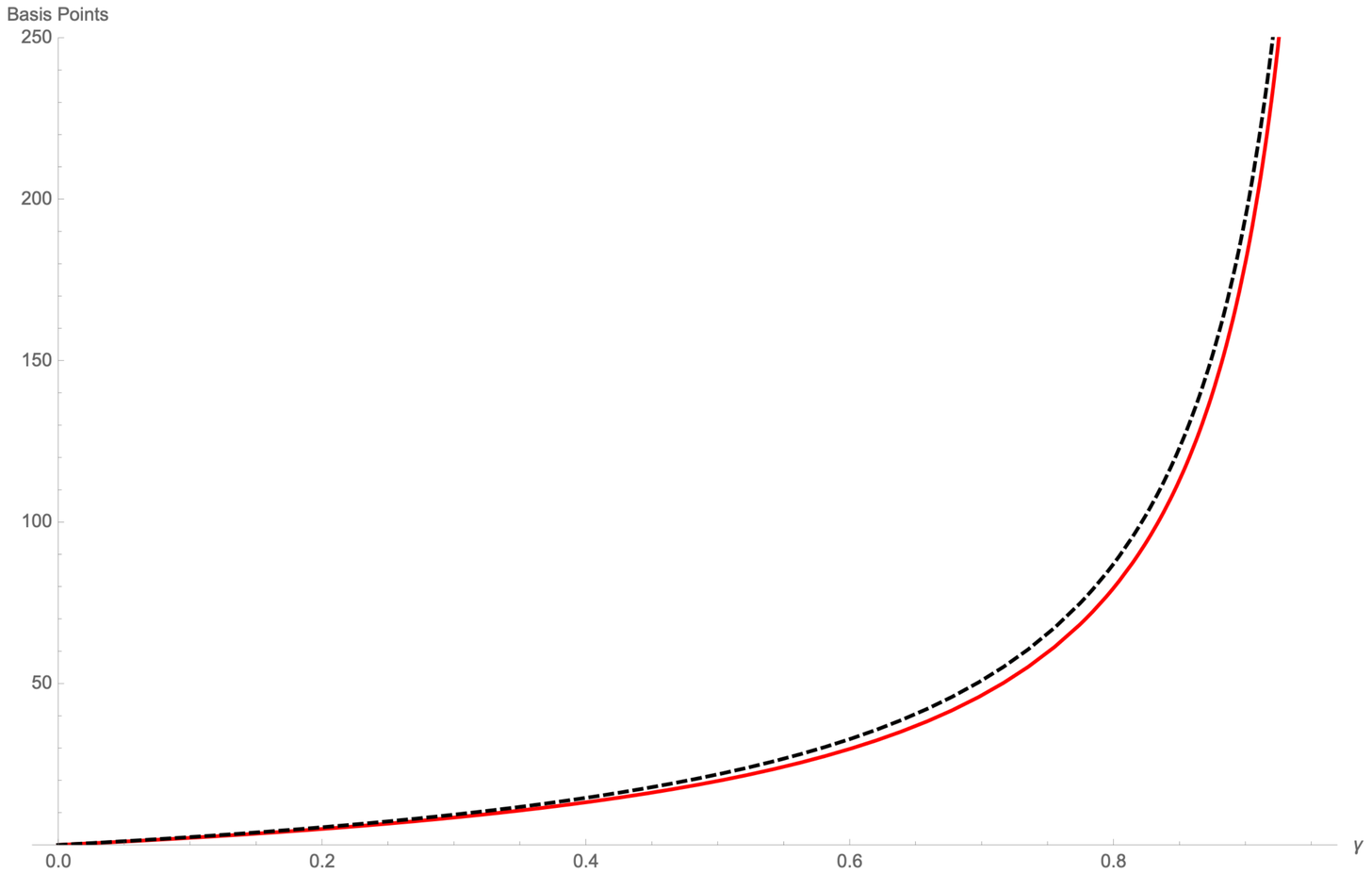
WHAT WOULD IT TAKE?

- How many ESG investors would it take to make a difference? We calibrate the model with the following additional moments:

MRP=6% r=2% $\sigma_{R_E} = 15\%$ (vol of VFTSX) $\sigma_{R_D} = 15\%$ (vol of the other stocks).

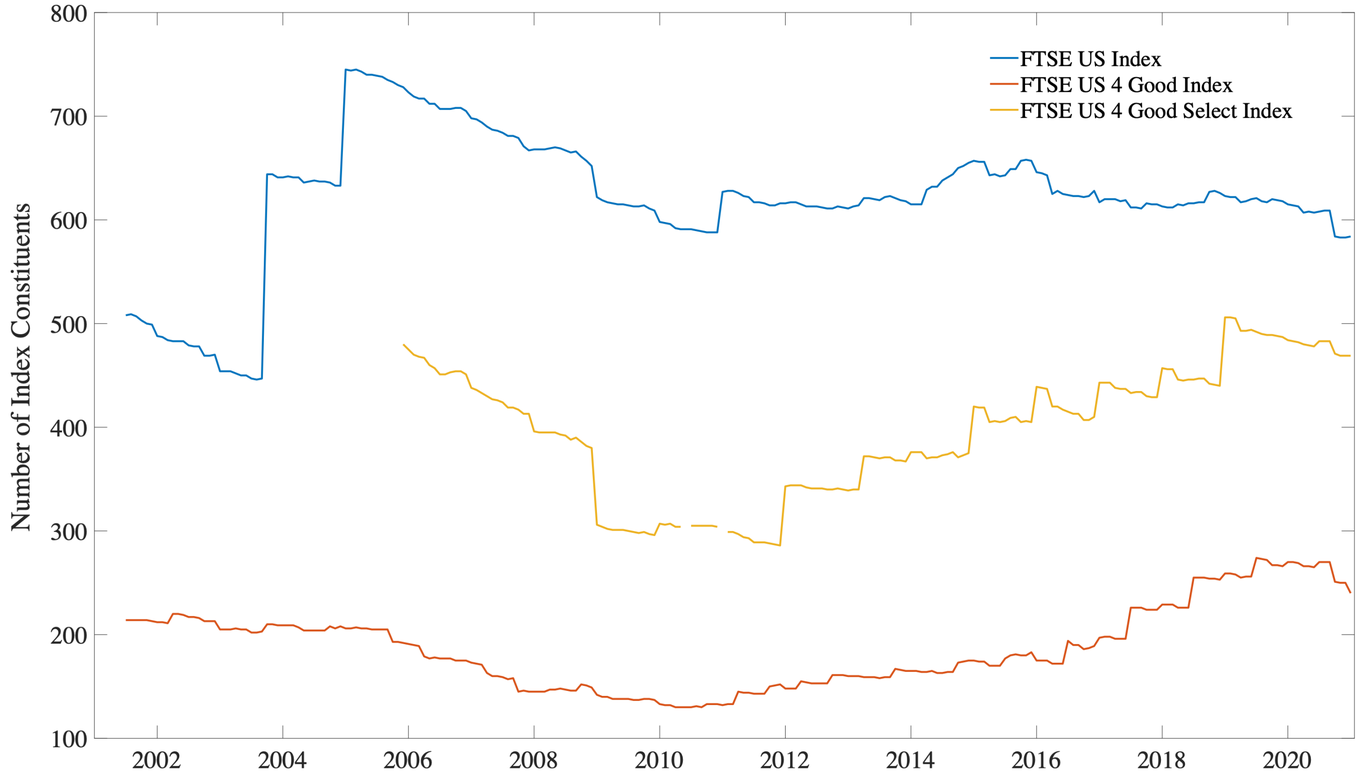
IMPACT ON THE COC OF THE FRACTION OF IMPACT INVESTORS

- Black curve is the approximation. Red curve is actual.

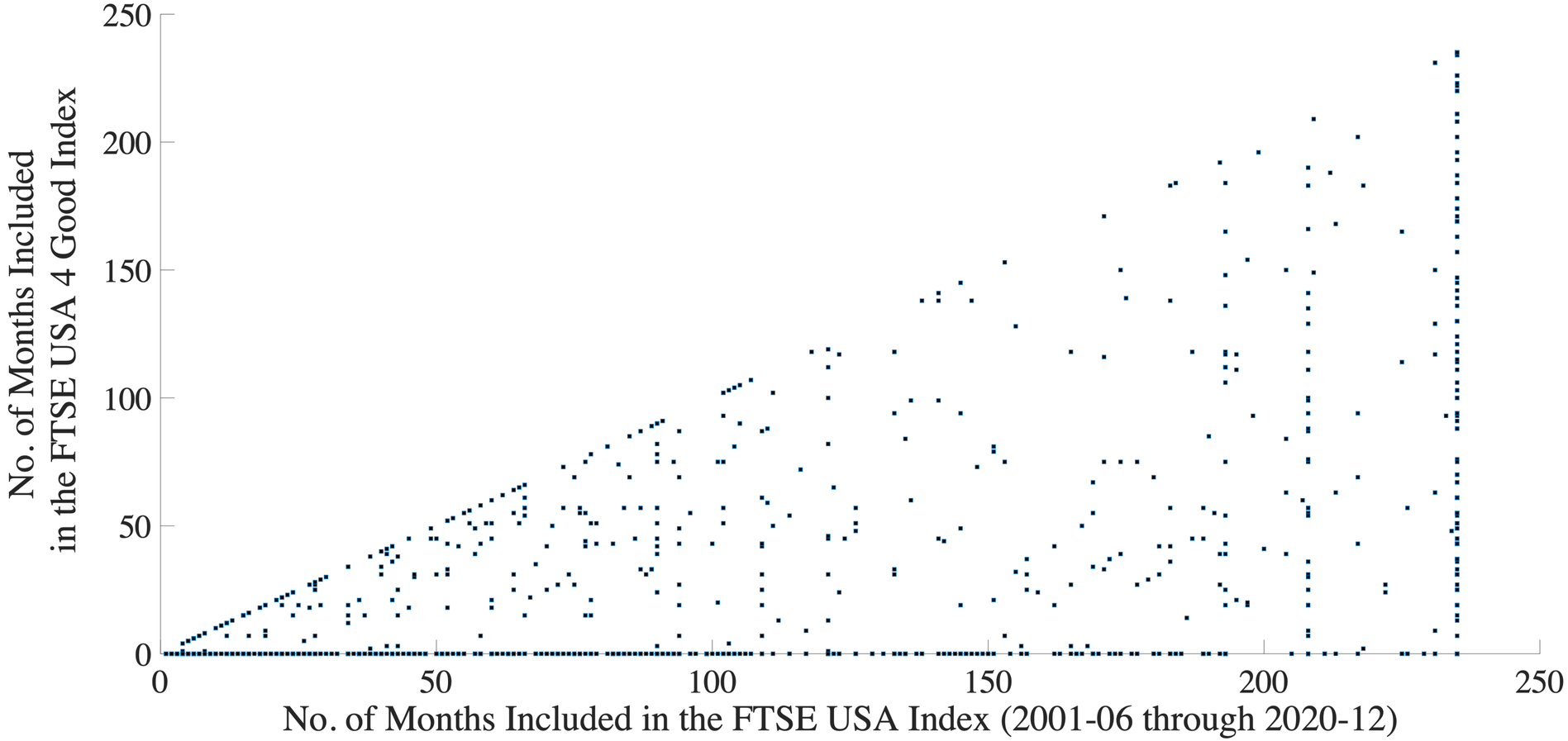


INCLUSION EFFECTS

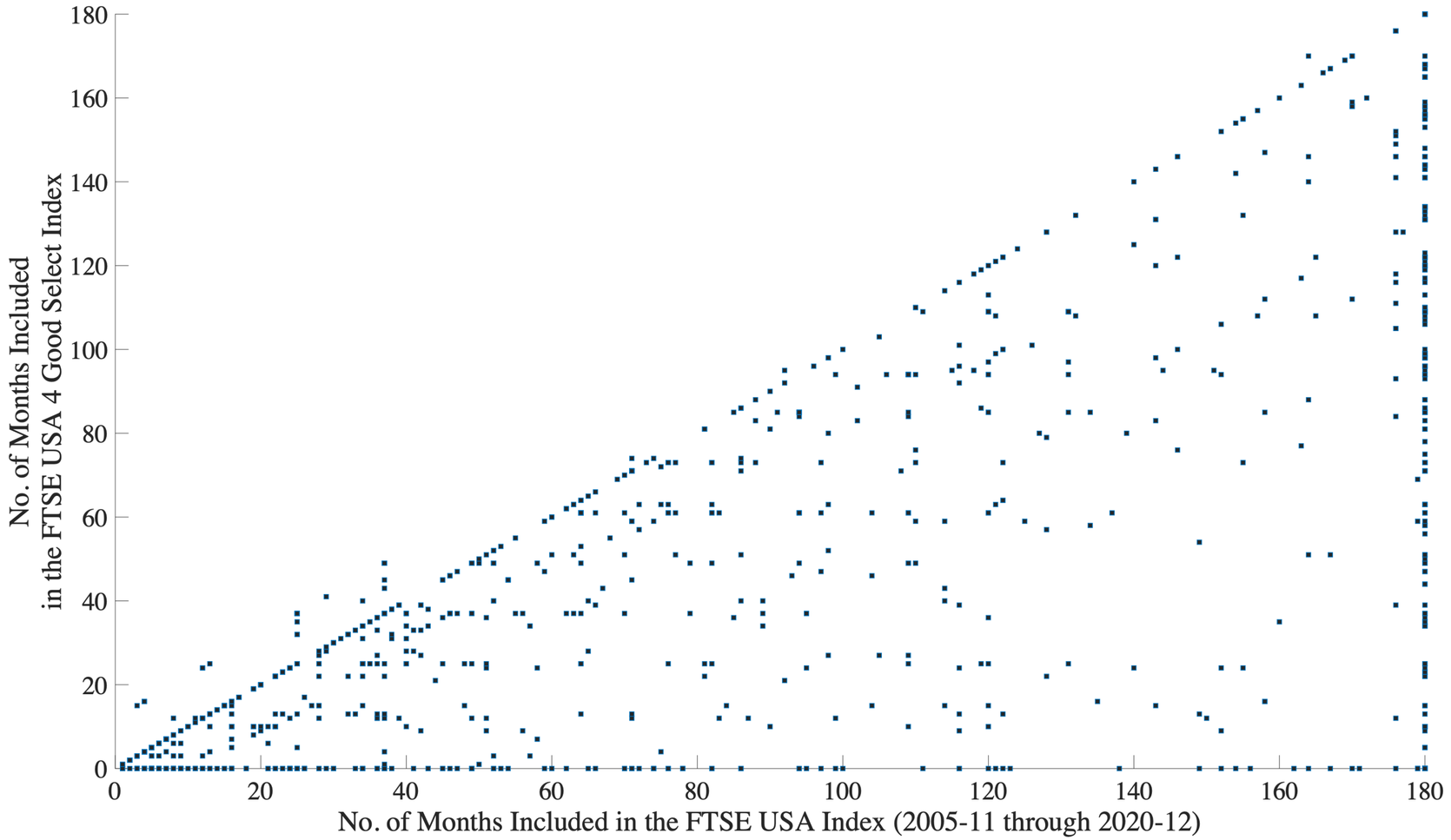
- We have detailed holdings data provided by FTSE/Russell on the FTSE4Good US/FTSE4Good Select and the FTSE US index between 2002-2021.



OVERLAP OF THE FTSE AND FTSE4GOOD INDEXES



OVERLAP OF THE FTSE AND FTSE4GOOD SELECT INDEXES



INCLUSION EFFECTS

- Quarterly return data on all stocks in CRSP universe
  - FTSE_US dummy: 1 if in FTSE US index, 0 otherwise
  - FTSE4GOOD_US: 1 if in FTSE4Good index, 0 otherwise
  - Delta_FTSE_US:
    - 1 in quarter when stock is added
    - -1 in quarter when stock is deleted
    - 0 otherwise
  - Delta_FTSE_US4Good
    - 1 in quarter when stock is added
    - -1 in quarter when stock is deleted
    - 0 otherwise

INCLUSIONS AND EXCLUSIONS

	No. of events	
	4 Good (2001-2020)	4 Good Select (2005-2020)
$\Delta I_{it} = 1$	872	508
$\Delta I_{it} = -1$	795	653
$\Delta I^{4G}_{it} = 1$	411	812
$\Delta I^{4G}_{it} = -1$	385	824
$\Delta I_{it} = 1$ & $\Delta I^{4G}_{it} = 1$	54	118
$\Delta I_{it} = -1$ & $\Delta I^{4G}_{it} = -1$	200	386

MAIN REGRESSION SPECIFICATION

$$R_{it} = c + \gamma I_{it} + \delta \Delta I_{it} + \gamma_{4G} I_{it}^{4G} + \delta_{4G} \Delta I_{it}^{4G} + \varepsilon_{it}$$

- γ_{4G} measures the average return difference between clean and dirty FTSE USA stocks and is therefore an estimate of the effect of ESG investors on the cost of capital of the average stock in the FTSE USA Index.

- δ_{4G} measures the instantaneous price reaction of an inclusion or exclusion event and thus measures the capitalized value of the implied change in the cost of capital (the associated percentage price change).

INCLUSION EFFECTS

- Inclusion into FTSE4Good US indices results in a very small price increase (24 b.p.) and is not significantly different from zero.
  - Divide by the stock's duration to get the effect on the cost of capital
- γ_{4G} is very close to zero, and has an inconsistent sign likely due to the imprecision

	(1) 4Good	(2) 4Good Select
I_{it}	-0.0010	-0.0009
	(-0.64)	(-0.50)
$I_{it}^{4G(Select)}$	0.0004	0.0001
	(0.27)	(0.02)
ΔI_{it}	0.0131	0.0117
	(1.55)	(1.34)
$\Delta I_{it}^{4G(Select)}$	0.0021	0.0048
	(0.38)	(0.43)
Constant	0.0098***	0.0101***
	(2.60)	(2.65)
Observations	1376792	1365666
R^2	0.00	0.00