Measuring the Effect of Green Monetary Policy Surprises

40th meeting of the European Economic Association.

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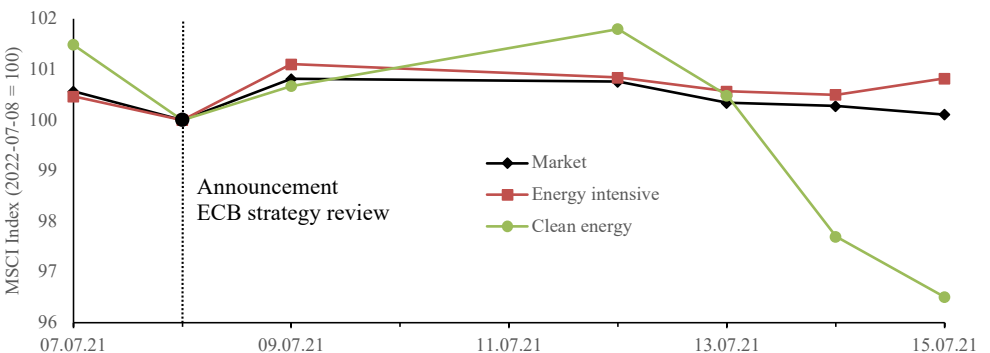
August 2025

Motivation



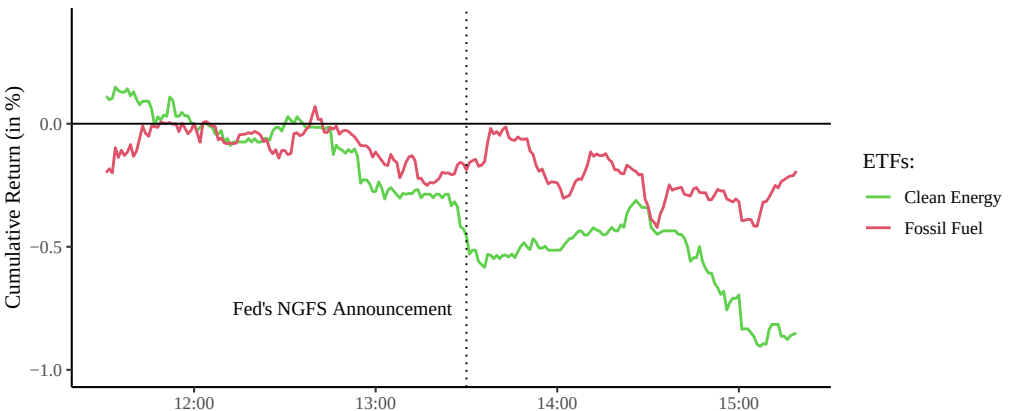
Market response to the ECB's Strategy Review (Jul 8, 2021)

"The ECB's Governing Council is strongly committed to further incorporating climate change considerations into its monetary policy framework."

ECB press release 8. July 2021

back

Motivation



Market response to the Fed exiting the NGFS (Jan 17, 2025)

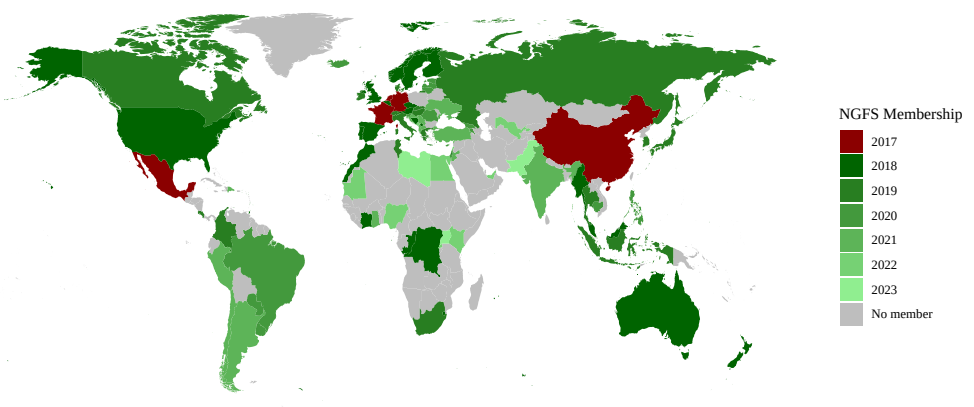
[NGFS's focus to] "mobilize mainstream finance to support the transition toward a sustainable economy" fell "just way beyond any plausible mandate that you could attribute to the Fed [. . .] it's not right for the Fed."

– Jerome Powell on January 29, 2025

Motivation

Green MP Surprise

- Network for Greening the Financial System (NGFS): Global alliance of central banks dedicated to promoting the green transition.
- Announcement of participation in the NGFS
- Green monetary policy surprises: Unexpected policy actions that signal a central bank's commitment to environmental objectives.



Source: NGFS Data (2023)

Motivation

Green MP Surprise

Advantage of our green monetary policy surprises:

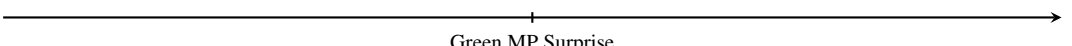
1. NGFS entry announcements are unexpected. ▸ ECB Strategy Review ▸ NGFS communication
2. NGFS membership signals the cb's commitment to green objectives
3. NGFS participation is purely informative (lacks policy implications)
4. NGFS announcements convey information that is unrelated to cb's conventional objective ▸ example[1]

$$L_t = \beta_1 \Delta\pi_t^2 + \beta_2 \Delta x_t^2 + \beta_3 \Delta c_t^2$$ Chen et al. (2021, EE)

[1] $\beta_3 = 0$ in Abiry et al. (2022) Darracq Paries et al. (2023), Dietrich et al. (2021), Diluiso et al. (2021), Masciandaro, Russo (2024), Kara, Thakoor (2023).

Motivation

This Paper



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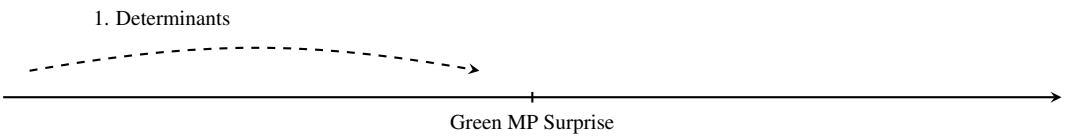

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   - *Income, green national preferences and strong national institutions.* ▸ reg results
   - *The fulfillment of primary objectives* ▸ reg results

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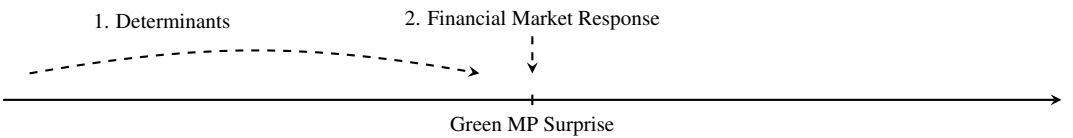

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2. What is the effect of a green monetary policy surprise?
   - Event Study 1: *Green Stocks* ↑, *brown stocks* ↓
   - Event Study 2 on industry level: *E(SG)* ↑, *Emmision Score* ↑, *Emission intensity* ↓

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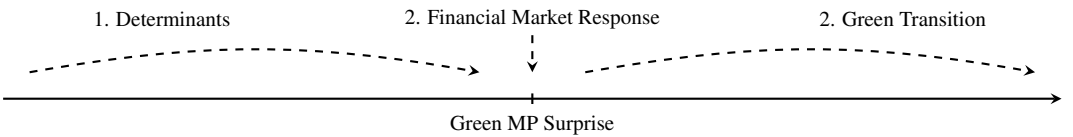

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3. Does green monetary policy support the green transition?
   - *Yes! Green bond issuance rises.*

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What is the effect of a green monetary surprise?

Event Study 1: Aggregate Level

- Event study approach → high frequency participation unpredictable
- Compare global stock market performance of climate-sensitive industries around NGFS announcement (green MP surprise):

$$CAR_{t-1,t+3} = \alpha + \beta_1 \times \Delta\text{Network size}_t + \epsilon_t$$

  - *CAR*: Cumulative abnormal returns of green vs brown stocks ▸ Data ▸ CAR explained
  - ΔNetwork size: Change in NGFS size measured in % of World GDP

What is the effect of a green monetary surprise?

Event Study 1: Aggregate Level

	Dependent variable:				
	Clean energy - Fossil fuel				Clean energy
	(1)	(2)	(3)	(4)	(5)
Constant	-1.00	-0.48	-1.04	-1.28	-0.98
	(-1.08)	(-0.34)	(-1.10)	(-1.61)	(-0.92)
ΔNetwork	34.10***	37.00**	35.23***	26.75***	26.13***
	(4.18)	(2.17)	(3.44)	(4.60)	(3.79)
Abn. network size			-1.913	-1.05	-1.75
			(-0.89)	(-0.69)	(-1.01)
Observations	17	17	17	17	17
R-squared	0.30	0.30	0.33	0.32	0.24
Method	OLS	Median	OLS	OLS	OLS
Event window	$[-1;+3]$	$[-1;+3]$	$[-1;+3]$	$[-1;+1]$	$[-1;+3]$

- Paris Agreement $\Rightarrow$ $CAR_{\text{Clean}} \uparrow$ *(4%)*
- ΔNetwork $\uparrow$ *(1sd)* $\Rightarrow$ $CAR_{\text{Clean}} \uparrow$*(2.25%)*
- Federal Reserve (23% of World GDP) $\Rightarrow$ $CAR_{\text{Clean}} \uparrow$*(8.4%)*

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Event Study 2: Firm Level

US firm-level evidence level following the Federal Reserve's NGFS entry (Bauer et al., 2024):

- Dependent Variable: Market return of 2,771 listed US firms
- Independent variables: Firms "green" measures
  - E (of ESG) score
  - Emission score
  - CO2 equivalent emissions
- Firm-specific controls: firm size, sales growth, book leverage, profitability, effective tax rate, ...

What is the effect of a green monetary surprise?

Event Study 2: Firm Level

	Dependent variable:		
	Return (Dec 14-15, 2020)		
	(1)	(2)	(3)
E (of ESG)	1.245**		
	[2.70]		
Emission score		0.801**	
		[2.64]	
Emission intensity			-0.210**
			[-2.40]
N	2,128	2,128	808
Adjusted R^2	0.029	0.026	0.11
Firm controls	Yes	Yes	Yes
Industry fixed effects	No	No	Yes

Interpretation of effect size: ~ 50-60% of 1t$ 2022 Inflation Reduction Act (Bauer et al., 2024)

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How does a green monetary policy affect the green transition?

- Hypothesis: Joining NGFS → green bond issuance ↑
  Xiao et al. (2024), Diluiso et al. (2021), Känzig (2023), Guter-Sandu et al. (2024)
- DiD TWFE from 2015-2022:

$$Green\ Bond_{i,t} = \alpha + \beta_1(Post \times NGFS_{i,t}) + \beta_2 X_{i,t} + \epsilon_{i,t}$$

  - $Green\ Bond_{i,t}$: Annual green bond issuance in b$ of 75 countries across 2010-2022 through IMF's Climate Change Green Bonds database Mertzanis (2024, EE)
  - $Post \times NGFS = 1$ if central bank has joined the NGFS by time t and 0 otherwise
  - $X_{i,t}$: Country FE, Time FE, ...

How does a green monetary policy affect the green transition?

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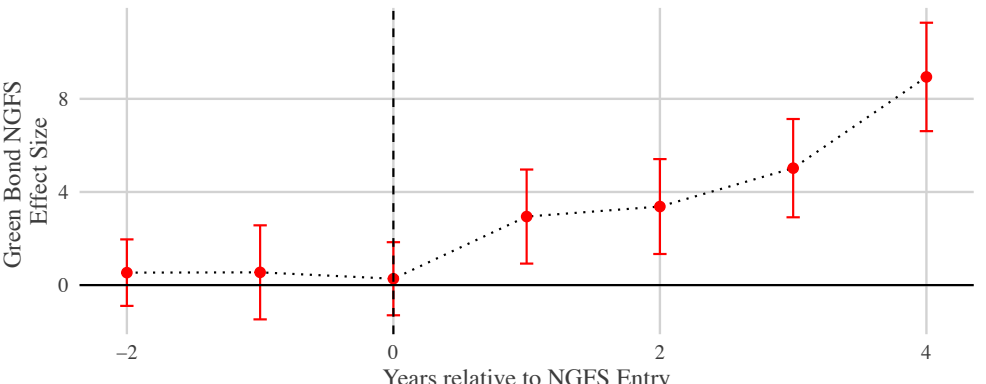

▸ Reg Results

Interpretation of effect size: $\sigma(\textit{Green Bond}) = 7.7$
→ cb can permanently stimulate capital flows towards environmentally sustainable projects

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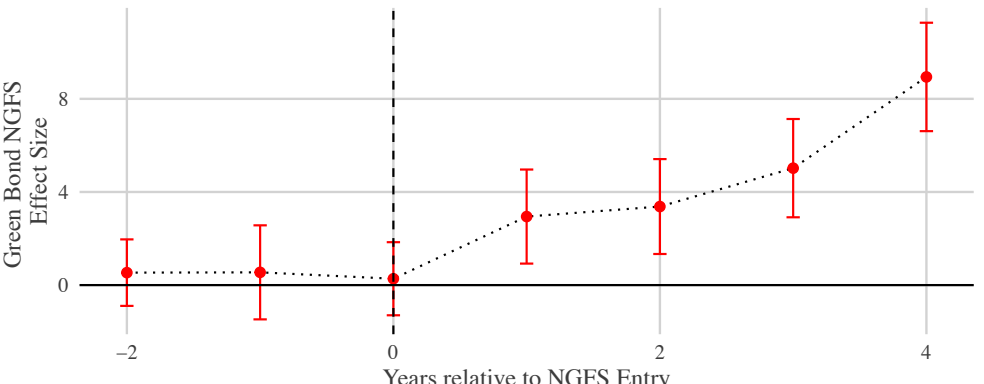

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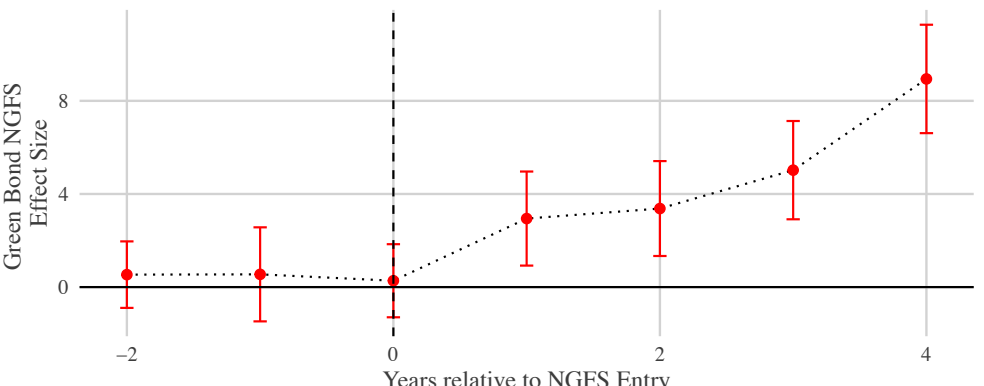

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Summary

What we do:

- Treat the decision to join the NGFS as a quasi-natural experiment
- Unexpected announcement of NGFS memberships → green monetary policy surprises.

Findings:

1. What are drivers of green central bank preferences?
   → *traditional objectives + income + national institutions*
2. What is the effect of a green monetary surprise?
   → *Green stocks rise!*
3. What is the medium term response?
   → *Green bond issuance rises.*

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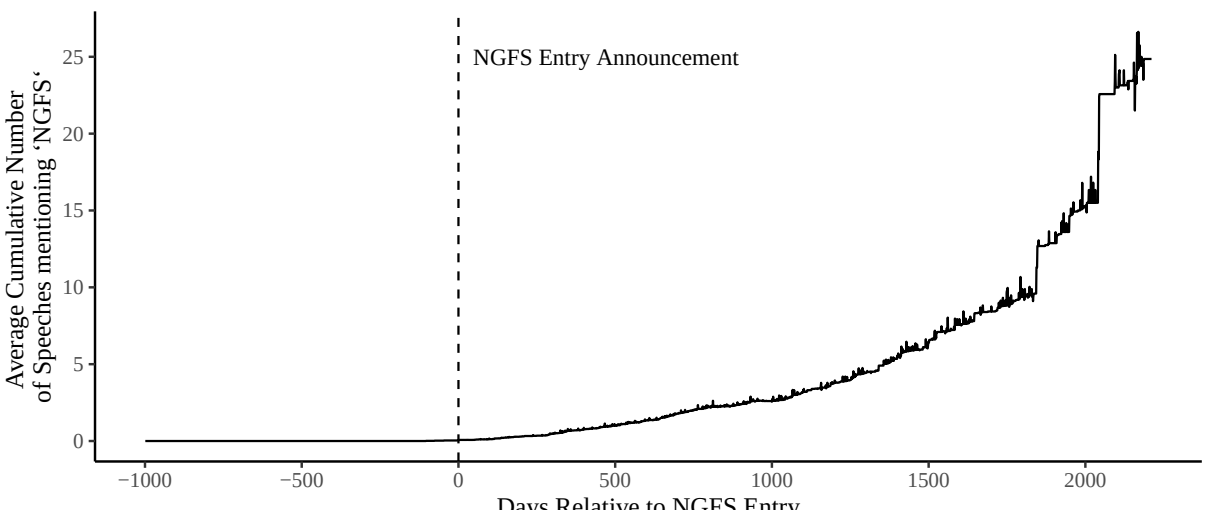
Public 'NGFS' Communication

back

Based on Baumgärtner, Zahner (2025) and Campiglio et al. (2025):



Participation at NGFS

BACK

National Preferences

	Dependent variable:				
	Membership in 2021				
	(1)	(2)	(3)	(4)	(4)
Renewable Production		-0.20			
		(-0.75)			
Energy use		0.65			
		(1.02)			
CO2 emissions		-2.55***			-1.46***
		(-3.14)			(-3.29)
Urban population in coastal zone			-0.30		
			(-1.31)		
Agriculture, forestry, and fishing			-0.65*		-1.00**
			(-1.80)		(-2.54)
Central bank independence index				0.69***	0.58**
				(3.09)	(2.23)
GDP per capita	1.51***	4.39***	1.20***	1.62***	2.84***
	(4.50)	(4.01)	(2.88)	(4.24)	(3.38)
NGFS Border	1.13***	0.82	1.04**	0.83*	0.91*
	(2.81)	(1.64)	(2.36)	(1.93)	(1.89)
Observations	151	123	143	144	148
Log Likelihood	-79.03	-56.40	-70.40	-71.84	-61.32
Akaike Inf. Crit.	164.06	124.79	150.79	153.68	134.63
Note:			*p<0.1; **p<0.05; ***p<0.01		

Participation at NGFS back

Primary Objectives

- Relationship between central banks' primary (price stability) and secondary (economic slack) objectives and their decisions to join the NGFS
- Logistic panel regression from 2015-2022:

$$NGFS : join_{i,t} = \beta_1 \cdot \Delta\pi_t + \beta_2 \cdot \Delta x_t + FE_{it}$$

  - $\Delta\pi_t$: absolute deviation from long-run inflation in *sd*
  - Δx_t: output gap in *sd* and/or unemployment rate in %
  - Country FE, Time FE, ...

Participation at NGFS

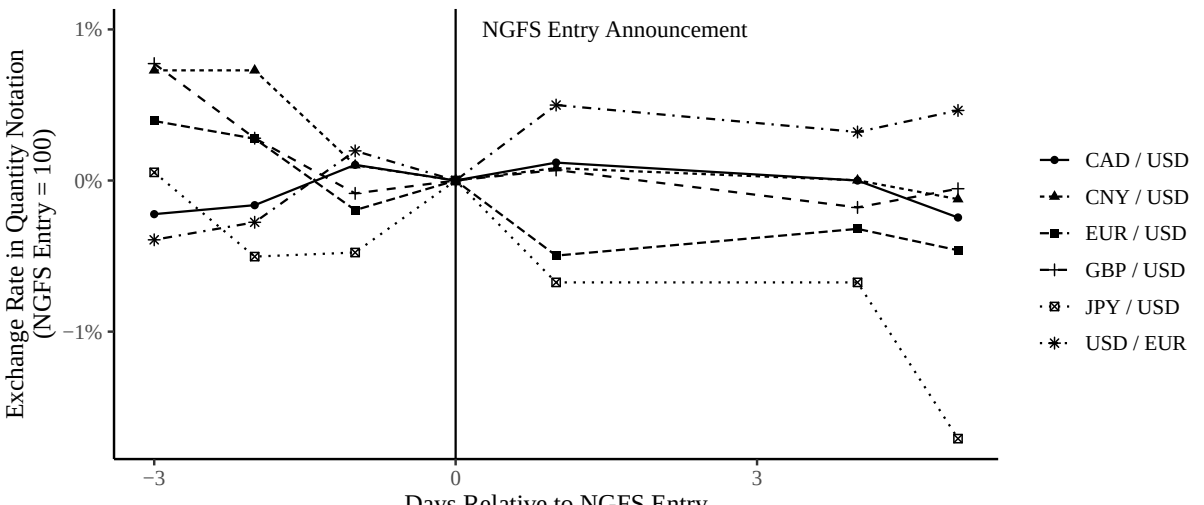
back

Primary Objectives

	Dependent variable:				
	Joining NGFS				
	(1)	(2)	(3)	(4)	(5)
Inflation Gap	-1.5^{***}			-1.4^{***}	-1.1^{*}
	(0.5)			(0.5)	(0.6)
Output Gap		0.6^{***}		0.5^{***}	0.6^{**}
		(0.2)		(0.2)	(0.3)
Unemployment Rate			0.02	0.1	0.2
			(0.1)	(0.2)	(0.2)
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Countries > 10k$	No	No	No	No	Yes
Observations	476	476	476	476	308

Interpretation: $\Delta\pi_t \uparrow$ *(1sd)* $\Rightarrow$ *Pr(NGFS)* $\downarrow$ *(75%)*

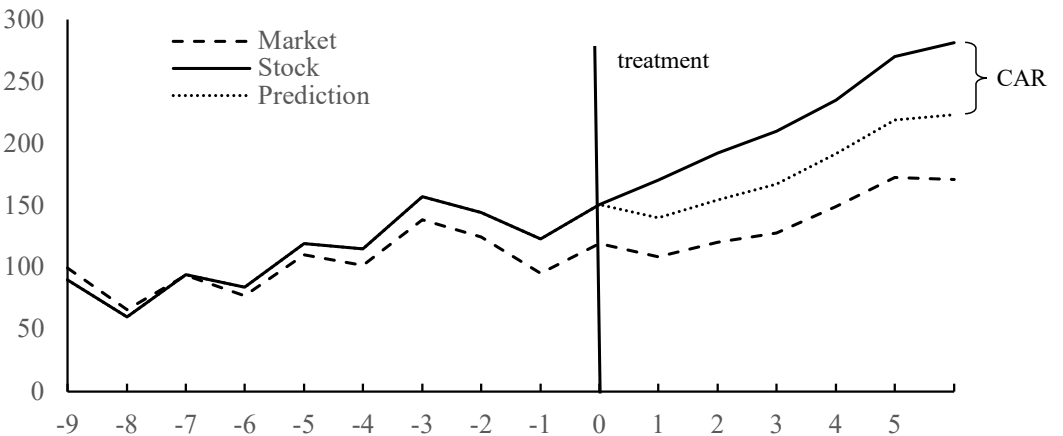
Exchange rates around NGFS entries



Cumulative Abnormal Returns

BACK

An illustrative example:



- Here: The actual return was higher than the expected (predicted) return, so we say that the stock *outperformed* expectations (due to the treatment).

ETFs underlying the industry proxies

back

Following Antoniuk & Leirvik (2024, JSFI), Wallace & McIver (2019, EMFT):

Industry	ETF	ISIN
Clean energy	VanEck Vectors Environmental Svcs ETF	US92189F3047
	First Trust ISE Global Wind Energy Index Fund	US33736G1067
	VanEck Low Carbon Energy ETF	US92189F5026
	iShares Global Clean Energy ETF	US4642882249
	Invesco Global Clean Energy ETF	US46138G8472
	Invesco Wilderhill Clean Energy ETF	US46137V1347
	First Trust NASDAQ Clean Edge Green Energy Index Fund	US33733E5006
	Invesco Solar ETF	US46138G7060
Energy intensive	First Trust Energy AlphaDEX ETF	US33734X1274
	iShares US Oil & Gas Explor&Prodtn	US4642888519
	iShares Global Energy	US4642873412
	iShares United States Energy	US4642877967
	VanEck Vectors Oil Services ETF	US92189H6071
	Invesco S&P 500 Equal Wt Energy ETF	US46137V3657
	United States Oil ETF	US91232N2071
	Vanguard Energy ETF	US92204A3068
	SPDR S&P Oil & Gas Equipment & Svcs ETF	US78468R5494
	Energy Select Sector SPDR ETF	US81369Y5069
	SPDR S&P Oil & Gas Explor & Prodtn ETF	US78468R5569

Example: Greece Announcement

BACK

The Bank of Greece becomes a member of the NGFS (Network of Central Banks and Supervisors for Greening the Financial System)

31/01/2019 - Press Releases

The Bank of Greece became a member of the Network of Central Banks and Supervisors for Greening the Financial System (NGFS) on 25 January 2019.

The NGFS is a network of central banks and supervisors comprising 28 members and six observers. The Network's objective is to help strengthen the global response required to meet the goals of the Paris agreement and to enhance the role of the financial system in managing risks and mobilising capital for green and low-carbon investments in the broader context of environmentally sustainable development. Members aspire to exchange experiences, share best practices, contribute to the development of environment and climate risk management in the financial sector, and mobilise mainstream finance to support the transition towards a sustainable economy.

Source: www.bankofgreece.gr

Green Bond Issuance: Regression Results

BACK

	Green Bond Issuance				
	(1)	(2)	(3)	(4)	(5)
NGFS	6.94***	3.42***	2.65***	4.05***	
	[12.82]	[4.48]	[4.06]	[3.04]	
NGFS-1				0.55	-0.07
				[0.53]	[-0.11]
NGFS0				0.27	0.41
				[0.34]	[0.59]
NGFS1				2.94***	1.67**
				[2.86]	[2.28]
NGFS2				3.37***	1.46*
				[3.25]	[1.83]
NGFS3				5.02***	2.97***
				[4.66]	[3.34]
NGFS4				8.94***	6.46***
				[7.53]	[6.31]
GDP			5.58***		4.66***
			[18.37]		[8.91]
Constant	0.48*	-0.83	-2.13	-2.76	-2.08
	[1.82]	[-0.46]	[-1.38]	[-0.62]	[-1.44]
Observations	975	975	975	593	593
R-squared [adj.]	0.14	0.40	0.57	0.15	0.68
Regression Type	Panel	Panel	Panel	DiD	DiD
Year effects	No	Yes	Yes	No	Yes
Country effects	No	Yes	Yes	No	Yes