Getting Dirty Before You Get Clean: Institutional Investment in Fossil Fuels and the Green Transition

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MICHIGAN ROSS

Growing concerns around private equity and greenwashing

Private Equity Funds, Sensing Profit in Tumult, Are Propping Up Oil

These secretive investment companies have pumped billions of dollars into fossil fuel projects, buying up offshore platforms, building new pipelines and extending lifelines to coal power plants.

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According to new research, private equity firms have invested at least $1.1 trillion into the energy sector since 2010. Jim Wilson/The New York Times

New York Times (October 13, 2021)

New York City Pensions to Divest Future Private Equity Holdings from Fossil Fuels

Comptroller Brad Lander is scrutinizing the climate impacts of private equity investments — a topic his counterpart in Albany has yet to address.

BY LILAH BURKE, NEW YORK FOCUS | APR 6, 2023, 6:27PM EDT

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NYC will no longer invest public employees' pension money in polluters that burn fossil fuels. | Bilanol/Shutterstock

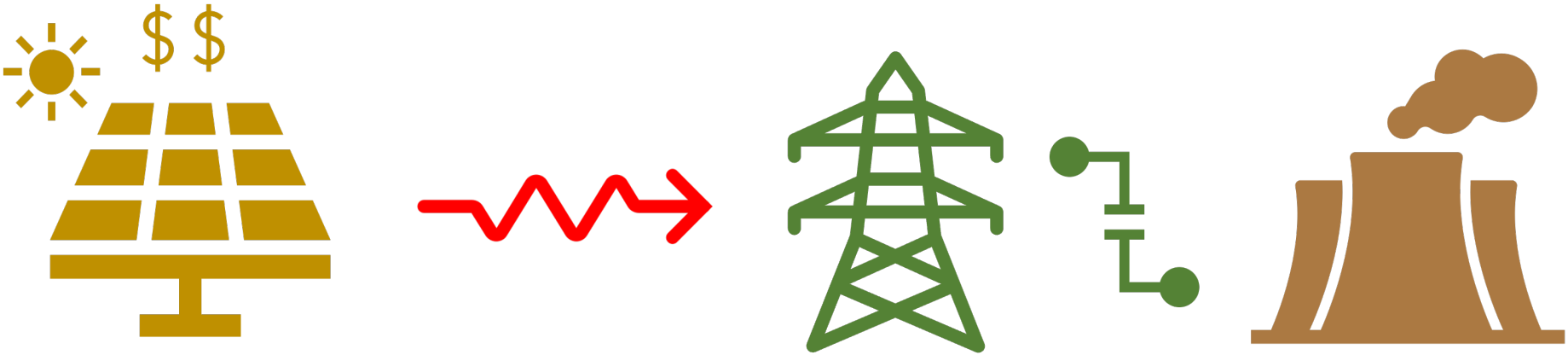
The City (April 6, 2023)

PE investment in fossil fuels can facilitate the green transition

- Old, dirty assets provide **opportunities** for new, clean technologies
  - Coal power plant is already connected to the power grid
  - Financial **frictions** may prevent such opportunities from being realized
- **This paper:** PE firms can alleviate frictions and better realize these investment opportunities
  - PE firms acquire fossil fuel plants that provide more opportunities
  - PE acquisition of fossil plant $\rightarrow$ more solar development in the area

$\Longrightarrow$ Prohibiting fossil fuel financing may reduce clean energy investments

Fossil plants provide opportunities for renewable development



Lack of electrical infrastucture

Connected to the grid, with transmission rights

▸ Interconnection

Fossil plants provide opportunities for renewable development

In a Twist, Old Coal Plants Help Deliver Renewable Power. Here's How.

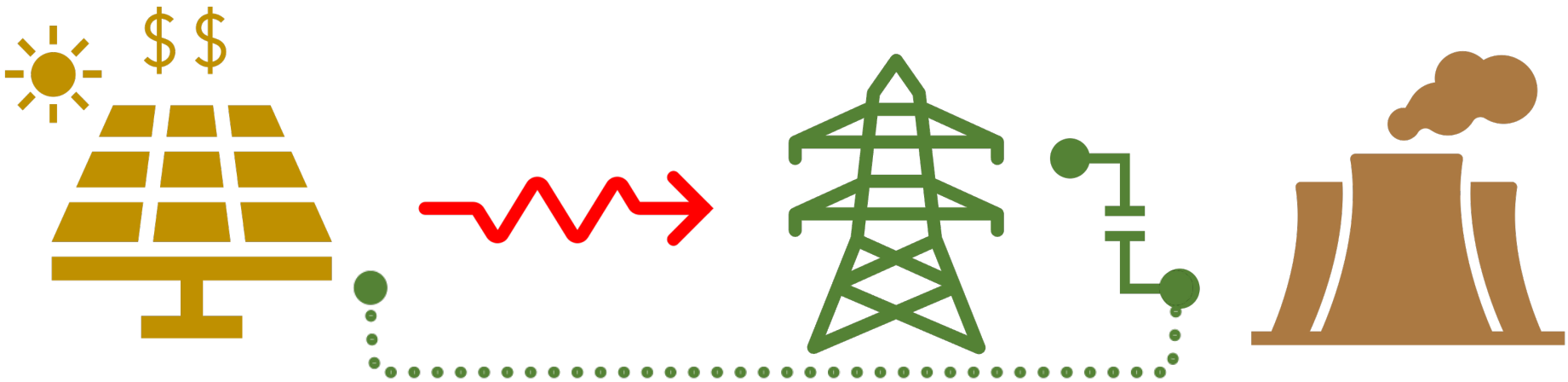
The sites, once a source of greenhouse gases, have a useful feature: They're wired to the electricity grid. For new ventures like solar farms, that can save a lot of time and money.

The coal station in Baldwin, Ill., will retire in 2025 and then be used to connect 190,000 solar panels to the grid. E. Jason Wambsgans/Chicago Tribune, via Alamy Live News

Engie solar panels at the site of the former Mount Tom coal plant in Holyoke, Mass. Simon Simard for The New York Times

New York Times (July 15, 2022)

Frictions prevent such opportunities from being realized



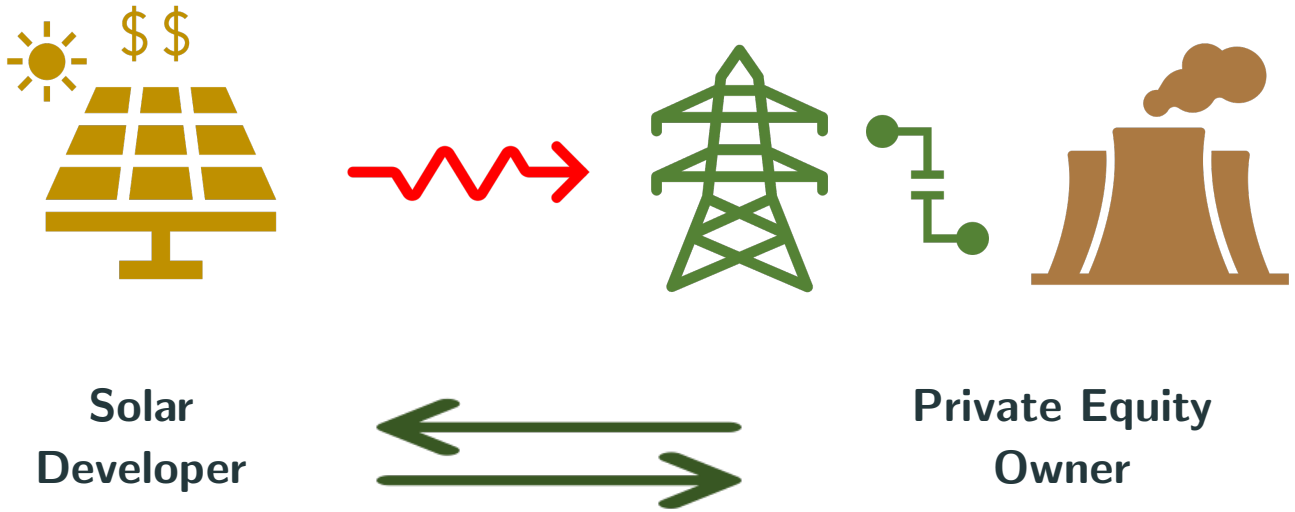
Solar developers should partner with fossil fuel plant owners

Contracting frictions prevent such partnerships:

- Solar projects require large **up-front investments** that rely on **long-term contracts** with fossil plant owners

  → **Hold-up** problems

PE firms can alleviate frictions and realize opportunities



- Long-term relationships with financial investors of solar projects
  - Repeated interactions make **information** flow and **contracting** easier
  - Incentivized to maintain relationships for future fundraising, which relieves **hold-up** concerns

Hypotheses

H1 **Ex-ante selection:** PE firms should own fossil fuel power plants that offer more investment opportunities for solar generation

H2 **Ex-post effects:** Solar development should increase in areas where PE firms own fossil fuel power plants

Results preview

- **Ex-ante selection:** PE more likely to acquire plants that provide higher solar investment opportunities
  - In sunnier areas, but only after solar generation becomes attractive
  - Effect stronger for smaller and older plants

- **Ex-post effects:** PE ownership of fossil plant $\rightarrow$ more solar development in the same county
  - Increase comes from institutional investments in solar
  - Especially from investors related to the owners of fossil fuel plants

Data

Power plant characteristics: Energy Information Administration (EIA)

- Installation year, fuel type, technology type, capacity, age, total generation, location

Ownership: S&P CapitalIQ

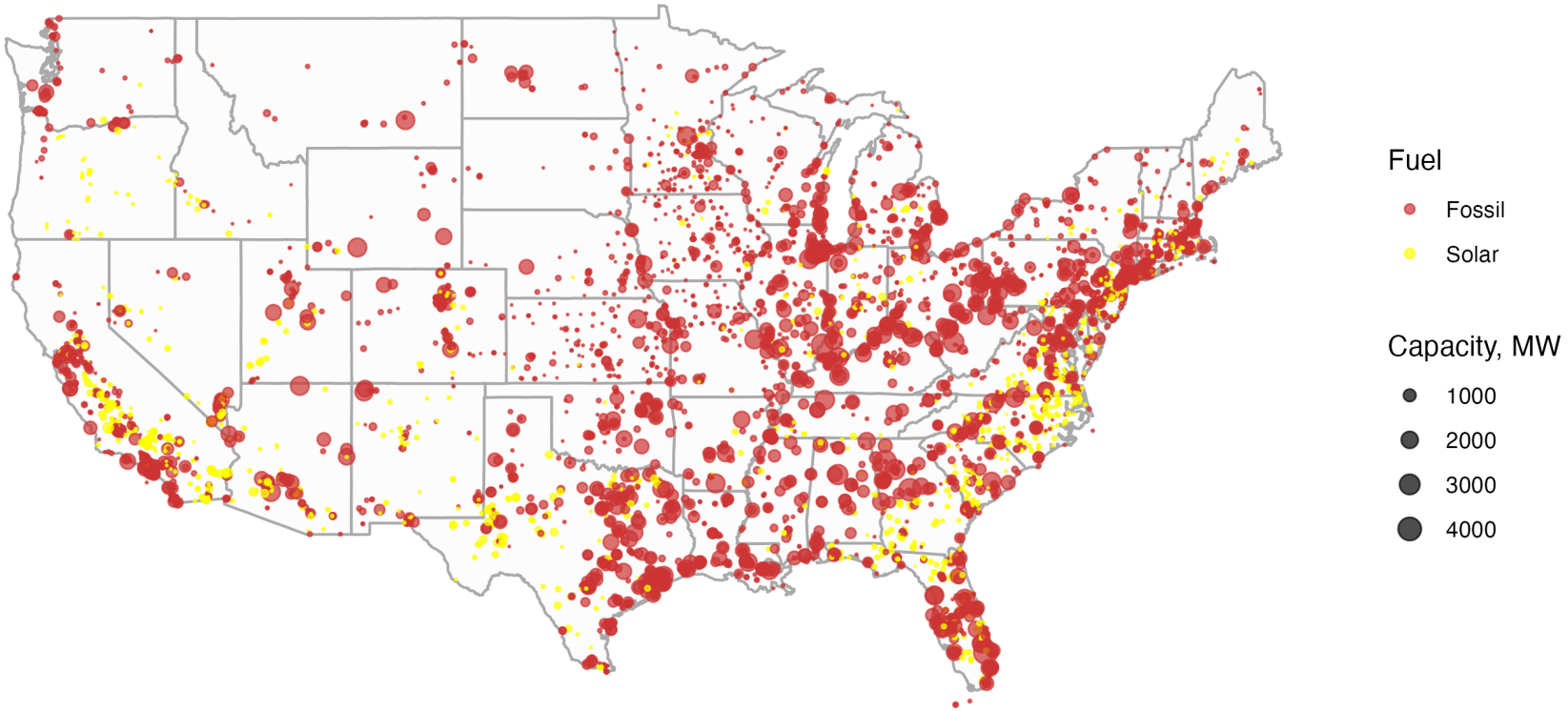
- Supplement with hand-collected data from SEC filings, PR Newswire, and other news articles

Private equity relationships: Pitchbook

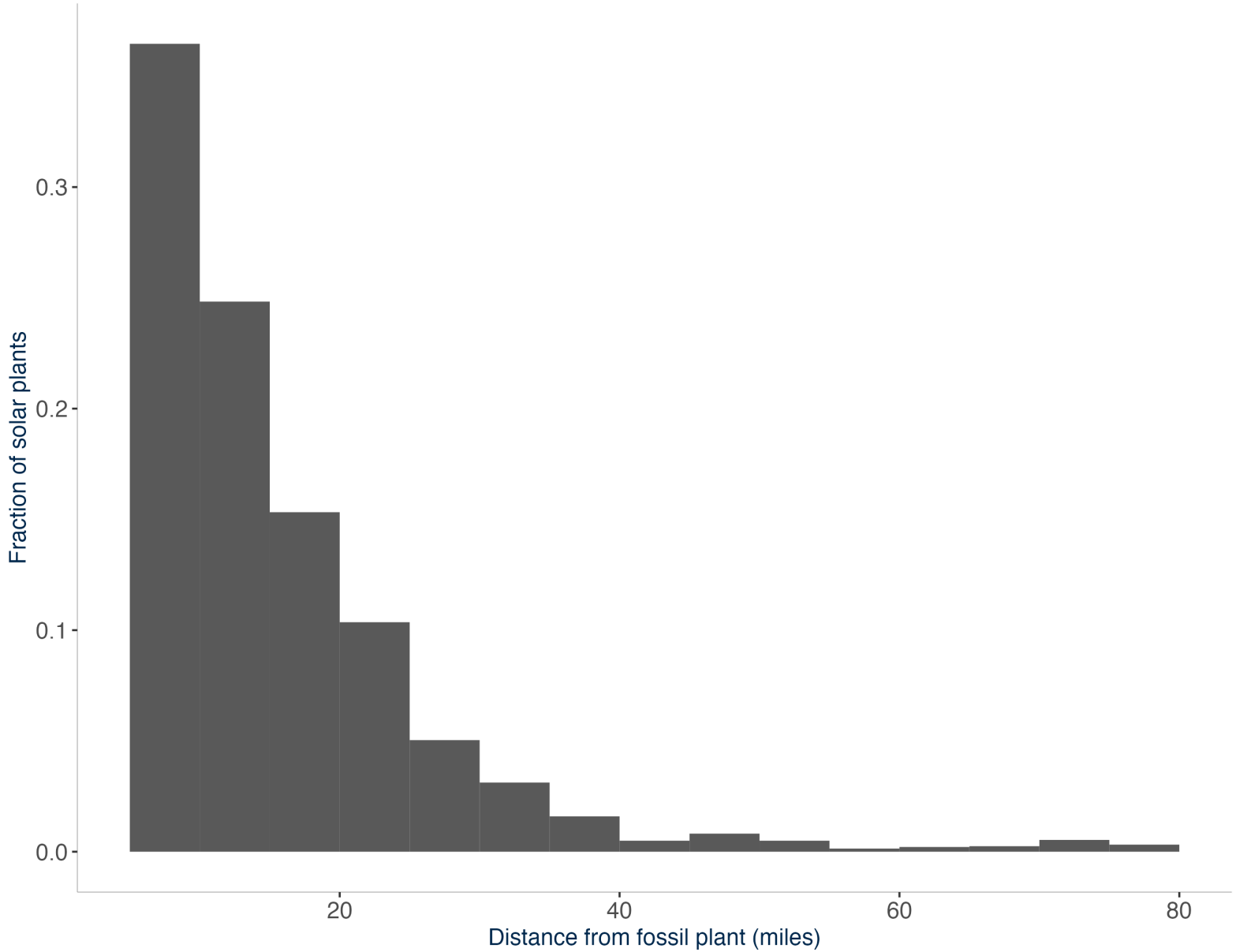
- Limited partnership and co-investment relations

Summary statistics ▸ Plant-Level ▸ County-Level

Power plant locations



Distance of solar plants from fossil fuel plants



H1 (Ex-ante selection): Does PE acquire fossil plants that offer more opportunities for solar power?

Empirical challenges

Difficult to isolate PE firm's **incentives** behind acquiring an asset for future **investment opportunities**:

1. **Measurement**: Hard to measure investment opportunity set of a new technology

2. **Endogeneity:** Hard to find exogenous variation in investment opportunities that leaves other factors unchanged

    - A renewable policy increases solar investment opportunity, but also affects prospects of existing fossil plants

This paper addresses the challenges

1. Intensity of sunlight that falls on fossil plants as a **measure** of future solar opportunities
    - Measured as Global Horizontal Irradiance (GHI)
    - Relevant for future solar generation ▸ Relevance
    - Plausibly exogenous to the value of fossil fuel plants
2. Tax credits as a **temporal variation** in costs of solar development
    - Energy Policy Act, 2005 offered a 30% investment tax credit (ITC)
    - Made solar generation commercially viable *(Stokes and Breetz, 2018)*

Empirical strategy: difference-in-differences

$$PE\ Owned_{i,t} = \beta \times Solar\ Radiance_i \times Post\ 2005_t + Plant\ FEs + State \times Year\ FEs\ + Controls + \epsilon_{i,t}$$

- $PEOwned_{i,t} = 1$ if a fossil power plant, i, is owned by a PE in year t
- $Solar\ Radiance_i$: Standardized average solar radiance, measured in GHI, at the power plant location
- $Post\ 2005_t = 1$ for years after 2005
- *Controls* : Net generation, Efficiency, County population

Sample: All utility-scale power plant in the US (2000 – 2019)

PE owns fossil plants in areas with higher solar prospects

	PE Owned		
	(1)	(2)	(3)
Solar Radiance × Post 2005	0.0311**	0.0332**	0.0328**
	(2.534)	(2.531)	(2.495)
Plant FEs	✓	✓	✓
State-Year FEs	✓	✓	✓
Plant-level Controls		✓	✓
County-level Controls			✓
Observations	53,488	48,002	47,288
R^2	0.61	0.61	0.61
Outcome mean	0.0754	0.0754	0.0754

Clustered (Plant ID) co-variance matrix, t-stats in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Interpretation: A 1 s.d. increase in radiance increases PE ownership by 40%, relative to unconditional likelihood

▸ Dynamic effect ▸ Relevance

H2 (Ex-post effects): Does solar power increase in areas with PE-owned fossil plants?

Empirical strategy: Staggered difference-in-differences

Two-way fixed effects (TWFE):

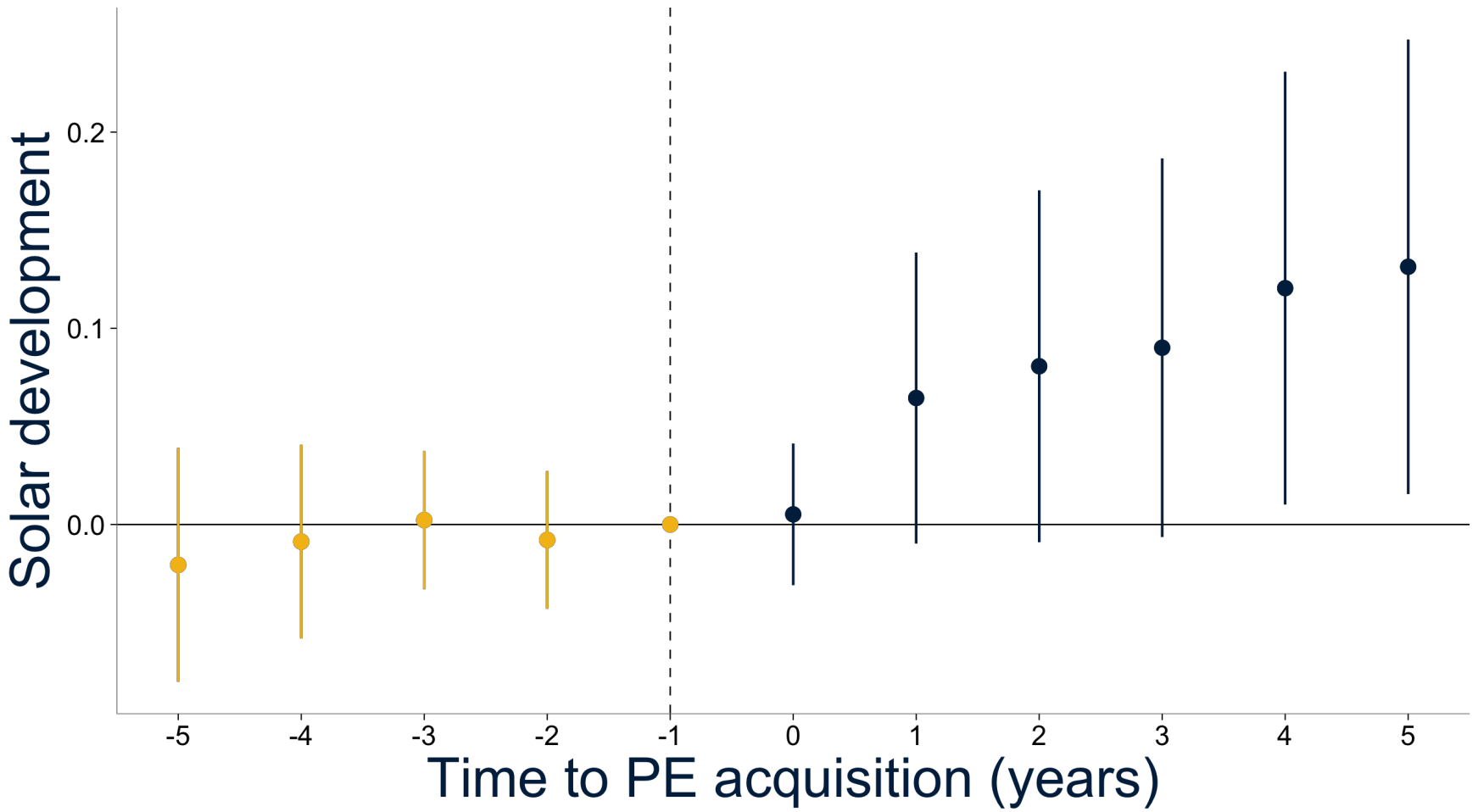
$$solar_{c,t} = \beta \times Post\ PE_{c,t} + County\ FEs + Year\ FEs + \epsilon_{c,t}$$

- $solar_{c,t} = 1$ if there is a solar development in county c and year t
- $Post\ PE_{c,t} = 1$ if the county c has PE-acquired fossil plant in year t
- Treated counties to $t = -5, -4, ..., 4, 5$

Sun & Abraham, 2021: ▸ SA 2021

- Restrict control group to *'never-treated'* counties
- Estimate effects using saturated cohort $\times$ relative time FEs

Solar power increases in counties with PE-acquired fossil plants



Solar power increases in counties with PE-acquired fossil plants

Extensive margin: Likelihood of solar generation

Model:	TWFE		Sun and Abraham (2021)	
Dependent variable:	Solar Dummy			
	(1)	(2)	(3)	(4)
Post PE	0.1009**	0.0993**	0.0803**	0.0820**
	(2.136)	(2.057)	(2.095)	(2.129)
Controls		✓	✓	✓
County FEs	✓	✓	✓	✓
Year FEs	✓	✓	✓	
Regulated State-Year FEs				✓
Observations	20,712	20,367	20,367	20,367
R^2	0.54	0.55	0.55	0.55

Clustered (County) co-variance matrix, t-stats in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Interpretation: PE acquisition leads to $\sim 25\%$ increase, relative to unconditional likelihood of solar generation (37%)

Solar power increases in counties with PE-acquired fossil plants

Intensive margin: No. of solar plants, capacity, and generation

Model:	Sun and Abraham (2021)		
Dependent variable:	Log (plants)	Log (cap)	Log (gen)
	(1)	(2)	(3)
Post PE	0.1128***	0.4034***	0.7989***
	(2.714)	(2.777)	(2.726)
Controls	✓	✓	✓
County FEs	✓	✓	✓
Regulated State-Year FEs	✓	✓	✓
Observations	20,367	20,367	20,367
R^2	0.51	0.54	0.48

Clustered (County) co-variance matrix, t-stats in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

▸ Chen Roth 2022

PE firms alleviate frictions for institutional investors

- Solar generation: an attractive asset class for institutional investors
  - Informational and contracting frictions related to infrastructure usage
- PE firms have strong relationships with other institutional investors
  - Repeated interactions makes the flow of information and contracting easier *(Ivashina and Kovner, 2011; Malenko and Malenko, 2015)*
  - Incentivized to maintain relationships for future fundraising purposes, which alleviates hold-up concerns *(Chung et al., 2012)*

▸ Interconnection

Solar development comes from institutional investment

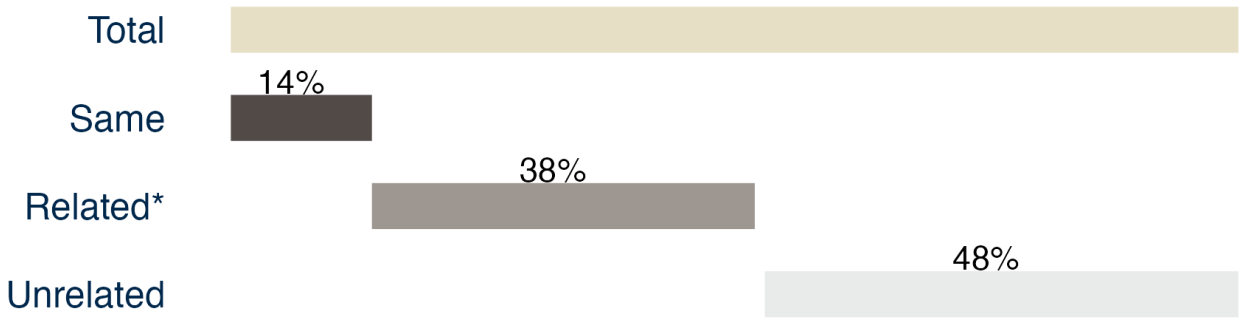
	Institutional Solar		Non-Institutional Solar	
Model:	TWFE	SA2021	TWFE	SA2021
	(1)	(2)	(3)	(4)
Post PE	0.0759**	0.0665**	0.0249	0.0145
	(2.041)	(2.326)	(0.7355)	(0.5733)
County FEs	✓	✓	✓	✓
Year FEs	✓	✓	✓	✓
Observations	20,712	20,712	20,712	20,712
R^2	0.54	0.54	0.49	0.49

Clustered (County) co-variance matrix, t-stats in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Solar development comes especially from related investors

- Fraction of treated counties with related institutional investors



⋆ Relationships through prior limited partnerships

▸ Bar plots

Key takeaways

1. Old, dirty assets provide opportunities for new, clean technologies

   - Ownership of dirty assets relevant for clean investments

   $\rightarrow$ Debate on divestment/investment should consider the spillover effects

2. PE firms can be efficient owners of such assets

   - Better able to realize investment opportunities and facilitate transition

   $\rightarrow$ Prohibiting PE investment in fossil fuels may be counterproductive

Thank you