

What Doesn't Kill You Slows Your Green Stride:  
Technological Change After Hurricane Katrina

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# Climate Change and Natural Disasters

**Climate change has led to the increased frequency and/or intensity of natural disasters, particularly the destructiveness of hurricanes** (Emanuel 2005;

Nordhaus 2006; IPCC 2023)



Damage Done by Hurricane Katrina

# Motivation

- Technological progress and innovation, specifically **green technologies**, are important for
  1. the combat against climate change
  2. the transition to sustainable growth
- **Individual inventors** play a crucial role in producing innovation, thus contributing significantly to technological change
- Prior research mainly focuses on **endogenous** market incentives,
  - ▶ i.e., how prices affect the allocation of scientific activities between **green** and non-green innovation (e.g., Acemoglu et al. 2012; Aghion et al. 2016)

⇒

- However, we know little about **causal effects** of **exogenous** shocks, like **natural disasters**, on changes in **inventors'** innovation activities:
  1. Green
  2. Non-green

## Empirical Design – Hurricane Katrina and Patents

- Hurricane Katrina is one of the most deadly and costliest storms in US history – \$186.3 billion estimated cost and 1392 fatalities (National Oceanic and Atmospheric Administration(NOAA) Tropical Cyclone Report)
  - ▶ **SHELDUS** (Spatial Hazard Events and Losses Database for the US): a unique **county-level** database including **county location**, **property losses** associated with natural hazard events in the US
- Patent data provides a well-documented and widely-used measure of innovation, even though their use involves some limitations
  - ▶ **PatentsView**, a patent data platform supported by the USPTO (United States Patent and Trademark Office), offers a wealth of information, based on patent applications, about
    1. **disambiguated data** on inventors' **identities**
    2. **geocoded data** on inventors' **locations**
    3. technological classifications for patents, i.e., Cooperative Patent Classification (CPC) ⇒ **to identify green patents, i.e., with the Y02 class** – technologies or applications for mitigation or adaption against climate change (Aghion et al. 2023; Nanda et al. 2023)

# Sample Construction

## Treatment Group

- Patent inventors who filed patents
  1. in 2004 or in 2005 before 25 Aug (first landfall and hurricane status on 25 Aug)
  2. with a recorded address in one of the South counties **with** property damage from Katrina (mainly south counties affected)

## Potential Control Inventors

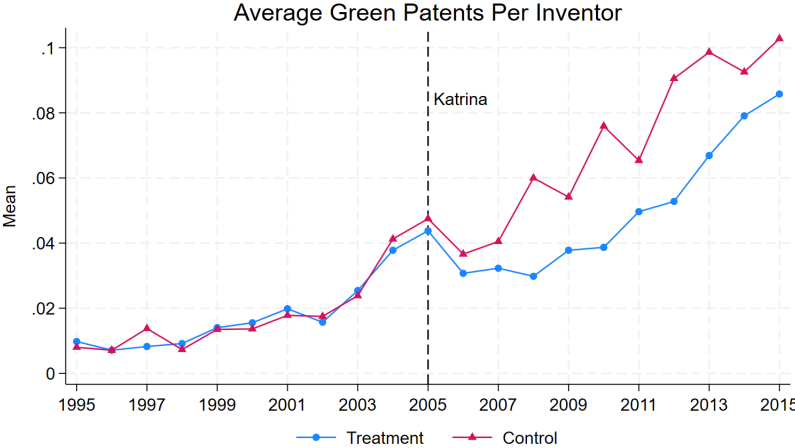
- Patent inventors who filed patents
  1. in 2004 or in 2005 before 25 Aug
  2. with recorded addresses in South counties **without** property damage from Katrina

## Control Group

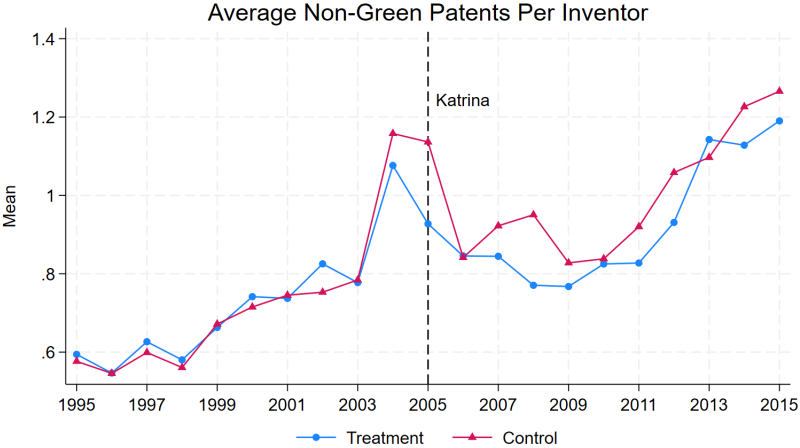
- **One-to-one exact matching** based on observables at patent inventor level (Jaravel et al. 2018):
  1. year of first patent filing
  2. the accumulative patent count by 2005
  3. the accumulative number of **green** patents by 2005

**In total 4993 pair (9986 inventors) of matched treatment and control patent inventors**

# Green Patents – Treatment VS Control



# Non-Green Patents – Treatment VS Control

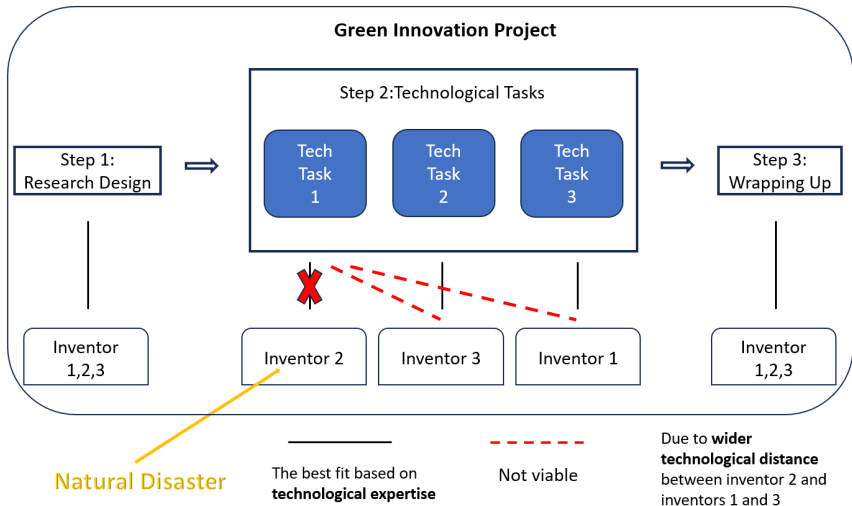


## Differential Effects of Katrina on Green and Non-Green

- Difference-in-differences regressions compare changes in patenting of treatment and control inventors who were on similar patent trajectories before Katrina, and the results show that
  - ▶ Hurricane Katrina **negatively** impacted **inventors'** **green** patent production:
    - Treatment inventors could have produced 372 percent more green patents, had Hurricane Katrina not occurred.
  - ▶ Non-green patent production remained unaffected
- Why differential effects between green and non-green?
  1. **Difference regarding the distance in technological expertise** among inventors **within a research team**
    - this **technological distance** may be **wider** in a **green** innovation team
  2. Difference in profitability
  3. ....



# Theoretical Argument of Technological Distance



# Findings and Implications

## Findings:

1. **Technological distance** (Azoulay et al. 2010; Akcigit et al. 2022) is **greater** within a **green** patent team compared to a non-green one
2. The effect on patent production of Katrina is **more negative** for inventors who worked with **more technologically distant** collaborators before Katrina

## Implications:

1. The **differential effects** of Katrina may arise from the **greater technological distance** within **green** innovation teams compared to non-green ones
2. Development of new technology, such as **green** innovation, which requires a **broader** range of **technological expertise**, may be **more vulnerable** to external shocks, such as natural disasters related to climate change.

# Thank You!

Please come to my poster stand, if you are interested in more details.

Should you have any questions or wish to discuss further, please feel free to email me.

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