Rising Waters, Falling Taxes(?)

The Impact of Natural Disasters on Property Assessments

– Evidence from Hurricane Sandy in New York City

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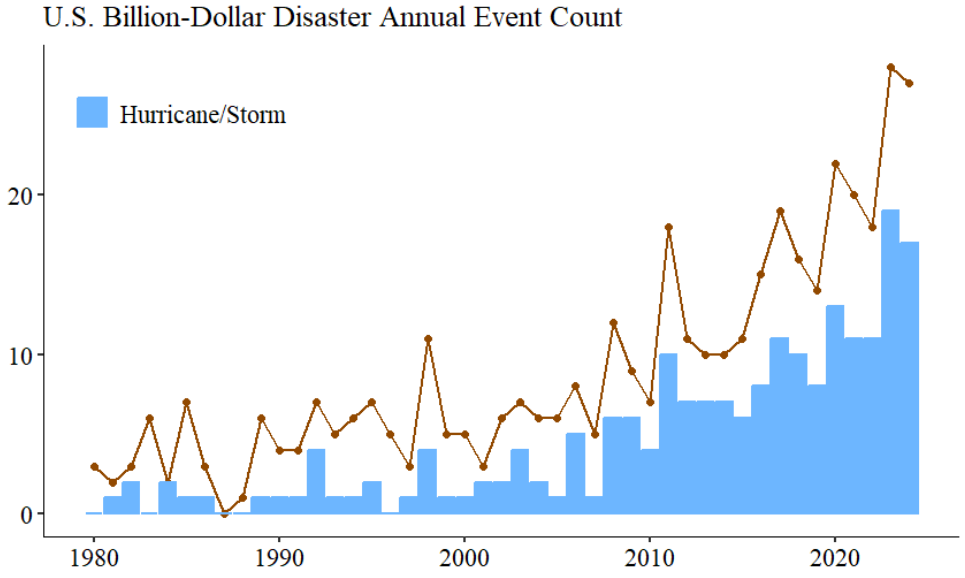
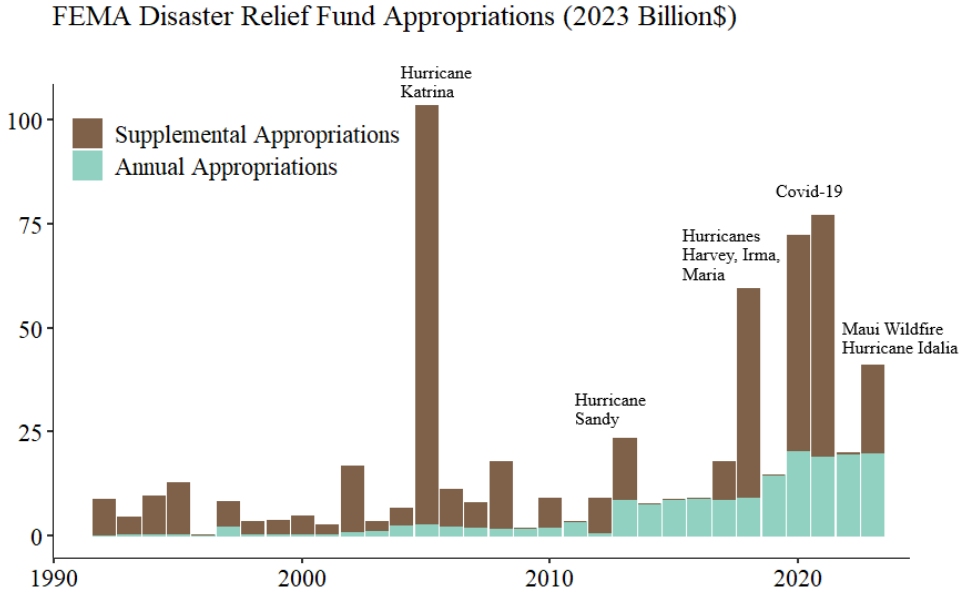
Brookings
July 22, 2025


U.S. Billion-Dollar Disaster Annual Event Count
Hurricane/Storm
20
10
0
1980
1990
2000
2010
2020


FEMA Disaster Relief Fund Appropriations (2023 Billion$)
Supplemental Appropriations
Annual Appropriations
Hurricane Katrina
Hurricane Sandy
Hurricanes Harvey, Irma, Maria
Covid-19
Maui Wildfire Hurricane Idalia
100
75
50
25
0
1990
2000
2010
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Property Tax Prospective – Key Revenue Source

- Disasters necessitate **substantial spending** on **rescue, relief**, and **recovery**
  - Home value depreciation; tax base shrinkage

    (Bakkensen & Barrage 2017; Ortega & Taspınar 2018; Gibson & Mullins 2020; Cohen et al. 2021)

Property Tax Prospective – Key Revenue Source

- Disasters necessitate substantial spending on recovery
  - For property owners, home value sunk; for govts, tax base slashed

    (Bakkensen & Barrage 2017; Ortega & Taspınar 2018; Gibson & Mullins 2020; Cohen et al. 2021).

- **Tax relief for affected homeowners**
  - **Property tax administration**: uniformity, cycle/frequency, constraints

    (Bowman & Mikesell 1978; Mikesell 1980; Giertz & Chicoine 1990; Eom 2008; Kim et al. 2023)

Research Question

- **Impact of natural disasters** on **property value** and **tax administration**
- Case: Hurricane Sandy (2012) in NYC

Impact of Hurricane Sandy in NYC

Most costly hurricanes/flood

Hurricane Katrina (2005)	$**193** Billion
Hurricane Harvey (2017)	$155 Billion
South Asian floods (2020)	$128 Billion
Hurricane Ian (2022)	$ 115 Billion
Hurricane Maria (2017)	$ 111 Billion
Hurricane Sandy (2012)	**$ 95** Billion
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Impact of Hurricane Sandy on property tax assessments in NYC

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  - $4.2 billion direct damage in NYC

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- Storm surge, flooding, and strong winds.
- **Widespread socio-economic impacts**
  - Property market; Business
  - Infrastructure; Public health; Social well-being

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- **Mandatory evacuation order**.

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- **Even larger impacts in lower-income neighborhoods** (Ellen & Meltzer, 2024).

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- Larger impacts in lower-income neighborhoods (Ellen and Meltzer, 2024).
- **Decline of commercial property values** (Holtermans et al., 2024; Addoum et al., 2024).

Property Assessment in NYC

Estimated Market Value (EMV)

– Modeling of sale price over previous 3 years

Assessment

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Assessed Value (AV)

– 6% of EMV, constrained by *Assessment Cap* (6% per year or 20% over 5 years)

Assessment

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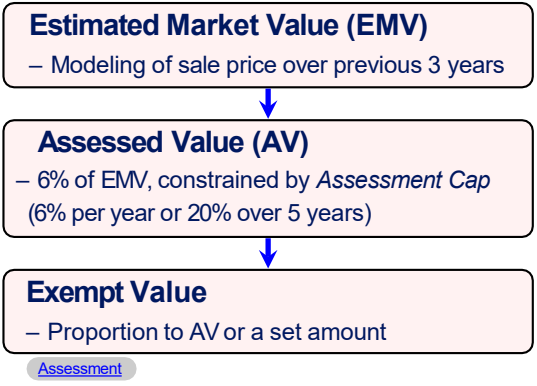

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Taxable Ratio
– Taxable Value / Market Value (Sale Price)
Proportion to effective tax rate (Tax / Value)

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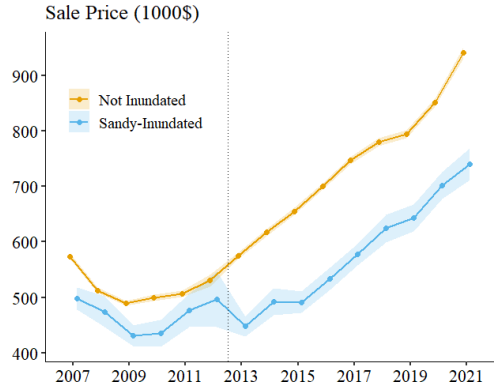
Neighborhood
– Severely impacted neighborhoods
– 15% EMV reduction for qualified properties

Individual
– Owner-reported property damage
– Demolition change (EMV) for structural damage

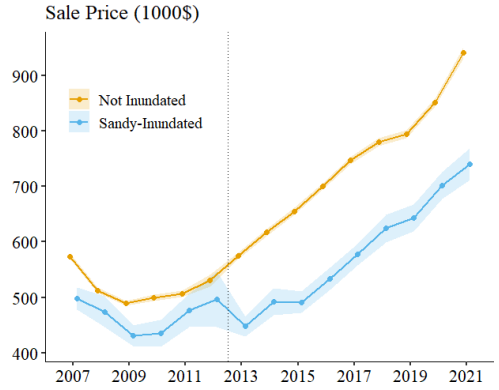
Timeline

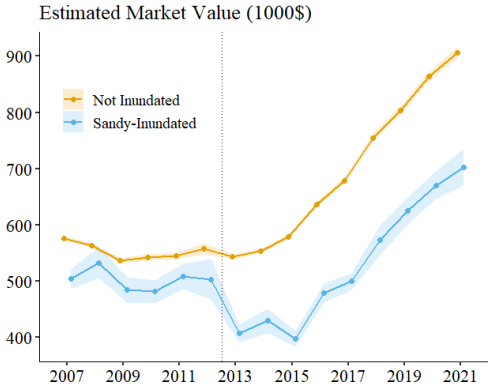
Tax Relief and **EMV Over-adjustment**



Transactions

Tax Relief and **EMV Overadjustment**





Transactions

Property-level Data 2007-2021

- **Housing transactions** (Unbalanced)
  - Sale date, price, type, property characteristics

summ Pre-Sandy Diff

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summ | Pre-Sandy Diff

Property-level Data of 2007-2021

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- Hurricane Sandy-Induced Damage.
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- **Hurricane Evacuation Zones**
  - Historical zones active during Sandy (revamped in June 2014)
  - Zone A is a proxy for high-risk flood areas HEZ

summ Pre-Sandy Diff

Difference-in-Differences Model

$$\ln(Y_{it}) = \boldsymbol{\beta_1}\ \mathbf{Post}_t \cdot \mathbf{Sandy}_i + \beta_2\ \text{Sandy}_i + \alpha X_i + \alpha_{ym} + \alpha_{fy} + \alpha_b + \alpha_A + \epsilon_{it}$$

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- Y_{it}: outcome variables (price, assessment) for property i at time t
- $\textbf{Post}_t = 1$ if after Sandy (excluding 2012/10–2013/06)
- $\textbf{Sandy}_i = 1$ if property experienced inundation
- X_i: property features (e.g., # units, stories, living area, lot size, age)
- α_{ym}: sale-year-month FE (macroeconomic trends, seasonality)
- α_{fy}: fiscal-year FE (fiscal trends, policy changes)
- α_b: census-block FE (local differences)
- α_A: evacuation-zone-A FE (preparedness, resilience, recovery)

◦ **Identification**: precise property location relative to Sandy's impact zone

Results – **Higher Tax Burdens for Inundated Properties**

$N = 295{,}178$	**Price**
Post × Sandy	**−0.10*** **
	(0.010)
Adj. R^2	0.49

Controls: property char., sale-year-month FE, fiscal-year FE, block FE, Zone A FE. SE clustered at the block level.

Exemption | Damage | Repeated | Asmt Roll | Levy

Higher Tax Burdens for Inundated Properties

$N = 295{,}178$	Price	**EMV**
Post × Sandy	-0.10^{***}	$\mathbf{-0.17^{***}}$
	(0.010)	(0.010)
Adj. R^2	0.49	0.80

Controls: property char., sale-year-month FE, fiscal-year FE, block FE, Zone A FE. SE clustered at the block level.

Exemption Damage Repeated Asmt Roll Levy

Higher Tax Burdens for Inundated Properties

$N = 295{,}178$	Price	EMV	**AV**
Post × Sandy	-0.10^{***}	-0.17^{***}	$\mathbf{-0.10}^{***}$
	(0.010)	(0.010)	(0.013)
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Adj. R^2	0.49	0.80	0.77	0.14

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Higher Tax Burdens for Inundated Properties

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Post × Sandy	-0.10^{***}	-0.17^{***}	-0.10^{***}	-0.18^{*}	$\mathbf{-0.065}^{***}$
	(0.010)	(0.010)	(0.013)	(0.010)	(0.015)
Adj. R^2	0.49	0.80	0.77	0.14	0.56

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Exemption Damage Repeated Asmt Roll Levy

Results: **Higher Tax Burdens for Inundated Properties**

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Post × Sandy	-0.10^{***}	-0.17^{***}	-0.10^{***}	$\mathbf{-0.18^{*}}$	-0.065^{***}	$\mathbf{0.039^{**}}$
	(0.010)	(0.010)	(0.013)	(0.010)	(0.015)	(0.019)
Adj. R^2	0.49	0.80	0.77	0.14	0.56	0.23

Controls: property char., sale-year-month FE, fiscal-year FE, block FE, Zone A FE. SE clustered at the block level.

Exemption Damage Repeated Asmt Roll Levy

Undamaged but Risk-Prone Properties

- At-risk properties experience depreciation due to perceptions of heightened risk after disasters (Ortega & Taspınar 2018; Gibson & Mullins 2020; Cohen et al. 2021)

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Post × Sandy	**−0.11*****	−0.17***	−0.10***	−0.18*	−0.063***	**0.043****
	(0.010)	(0.010)	(0.013)	(0.11)	(0.015)	(0.019)
Post × ZoneA	**−0.11*****	0.0294	0.081	0.083	0.14	**0.24****
	(0.013)	(0.010)	(0.12)	(0.34)	(0.12)	(0.12)
Adj. R^2	0.49	0.80	0.77	0.14	0.56	0.23

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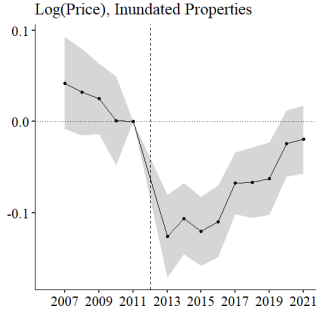
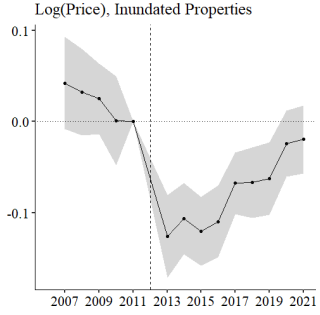
Repeated Tri-DiD

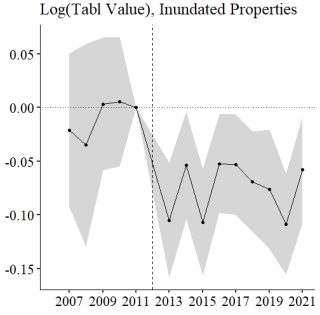
Gradual Recovery of Inundated Properties



Event Study

Gradual Recovery for Inundated Properties





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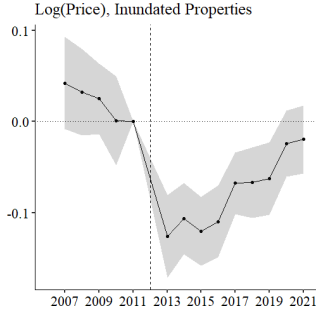

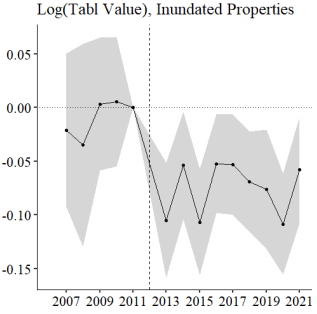

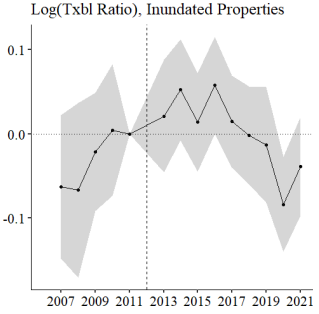

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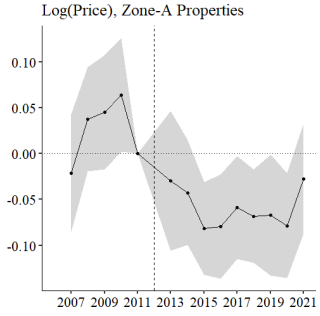
Persistent Devaluation and Increased Burdens for At-Risk Properties



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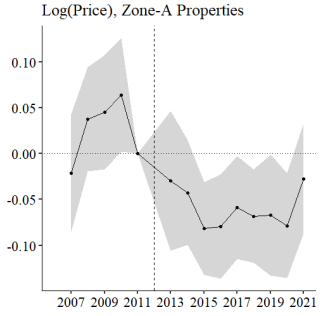

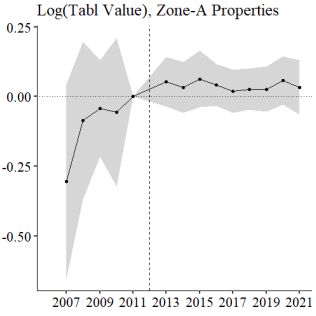

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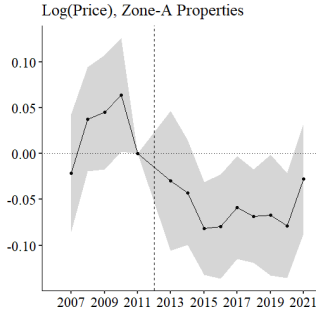

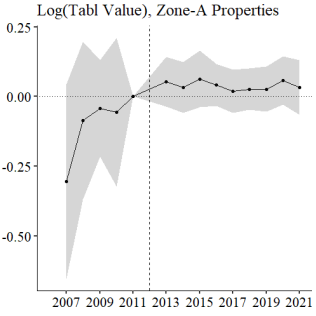

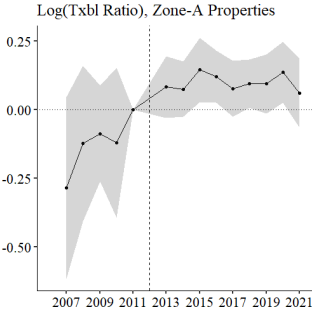

Event Study

Heterogeneous Effects by Property Value

- **Resilience and recovery vary across properties**.
  - Wealthier communities are better prepared for disasters (Cutter et al. 2012; Van Zandt et al. 2012; Bakkensen & Barrage 2017).

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- **Vertical Equity/Progressivity**: higher-value properties bear higher tax rates.

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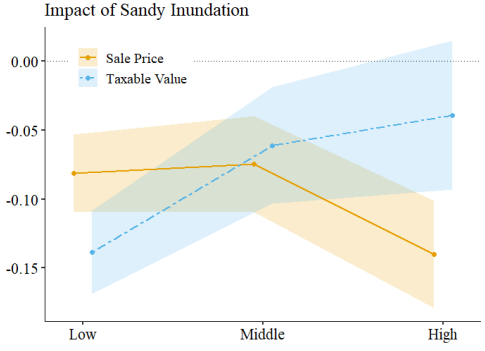
- *Horizontal Equity*: similar-valued properties taxed equitably.
- *Vertical Equity/Regressivity*: higher-value properties bearing higher tax rates.
- Properties grouped into three tiers based on pre-Sandy market value (FY2012).

Heightened Tax Burdens on High-Value Properties



Model At-risk

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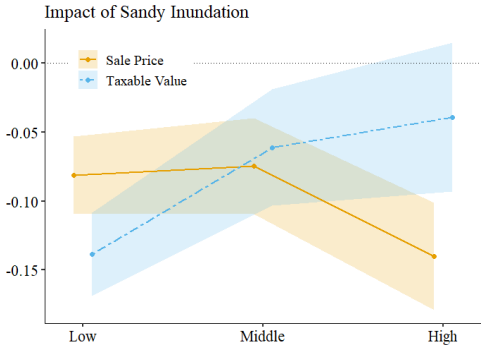

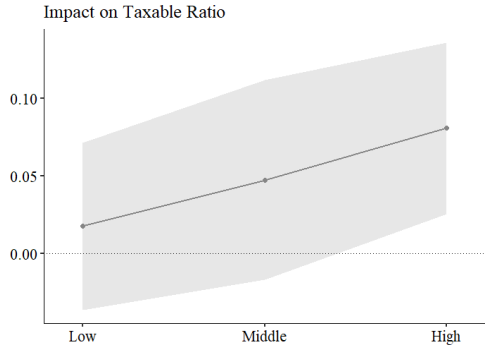

Model At-risk

Enhanced Progressivity but Compromised Horizontal Equity

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- Assessment caps on high-value properties:
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- **Limited tax relief for high-value properties**:
  - Greater resilience to storm damage Damage Evidence

Policy Implications

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  - Distributed relief may address tax regressivity.

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- **Direct adjustment in assessed value or exemption**.

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  - Texas – tax relief on exemption.

Thank you!

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