

ECON 8000/9000 Empirical Energy Econ

Topic 11: Nuclear Energy

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March 29, 2026

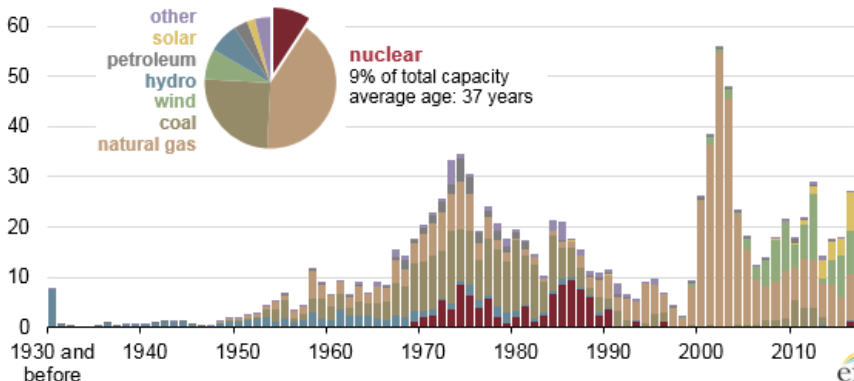
Outline

- ▶ Studies on Nuclear Energy
- ▶ Example 1: Kiso, Chan, & Arino (2022) JEEM
- ▶ Example 2: Neidell, Uchida, & Veronesi (2021) JHE
- ▶ Example 3: Davis & Wolfram (2012) AEJ:AE

Challenges in empirically studying nuclear energy

1. Lack of temporal variation in the US since mid 1990s: capacity investment

U.S. utility-scale electric generating capacity by initial operating year (as of Dec 2016)
gigawatts

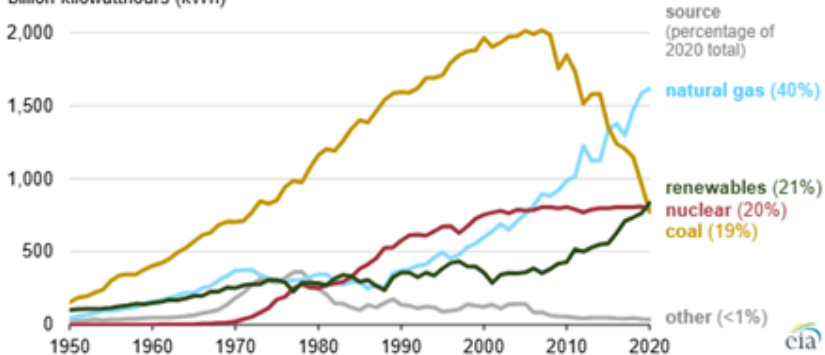


Source: US EIA

Challenges in empirically studying nuclear energy

2. Lack of temporal variation in the US since mid 1990s: generation (kwh)

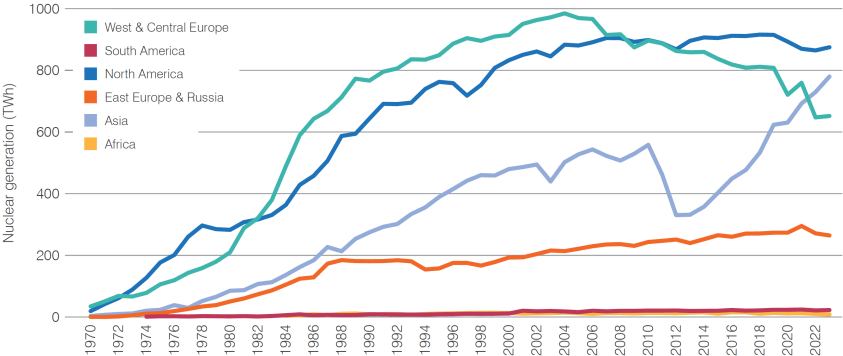
Annual U.S. electricity generation from all sectors (1950–2020)
billion kilowatthours (kWh)



Source: US EIA

Challenges in empirically studying nuclear energy

3. Lack of temporal variation in the world since mid 1990s, except for the Fukushima shock in Japan + some shutdowns in West/Central Europe

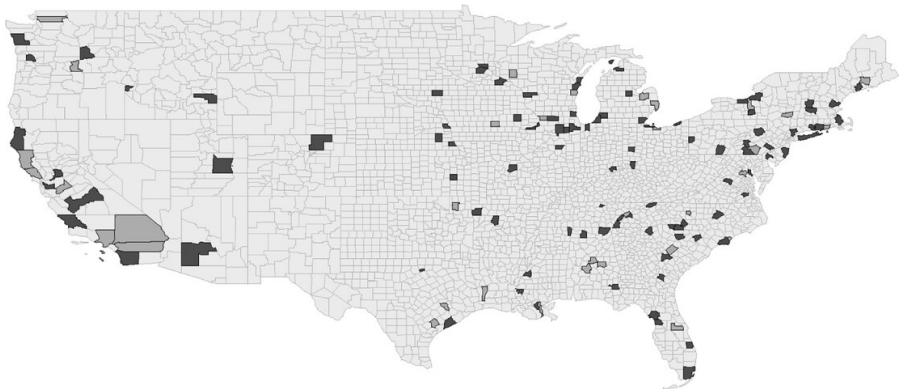


Source: World Nuclear Association, IAEA PRIS

Source: World Nuclear Association (WNA)

Challenges in empirically studying the local effect

4. Majority of locations are in control groups



Source: Altindag et al. (2025) JPAM

Challenges in empirically studying nuclear energy

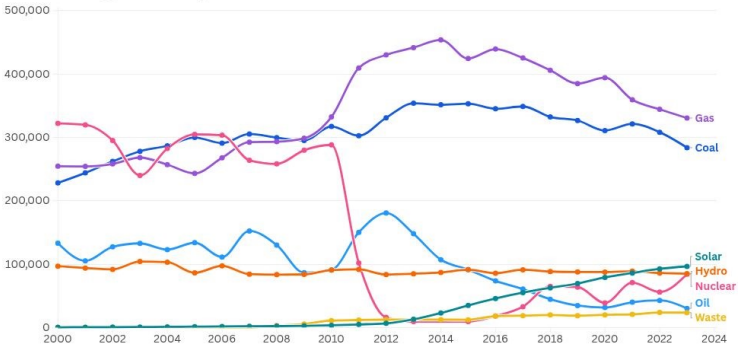
5. Opportunities to study nuclear (sometimes an unfortunate one)

5.1 Japan shifted energy mix since Fukushima

Japan's nuclear drop off

Electricity generation from nuclear power in Japan plummeted after Fukushima

Annual electricity generation in Japan (Gwh)



Source: IEA • Some minor sources - like wind and geothermal - not included

Challenges in empirically studying nuclear energy

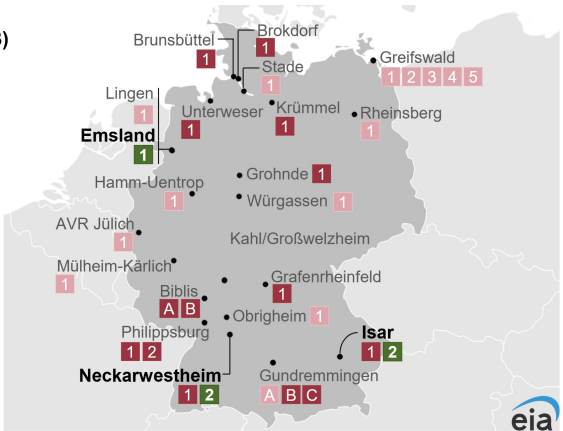
5. Opportunities to study nuclear (sometimes an unfortunate one)

5.2 German shut down their reactors

Germany nuclear power plants, by reactor status (January 2023)



- reactor status
- operational
 - shutdown before 2011
 - shutdown 2011–2022
 - nuclear power plant



Source: EIA

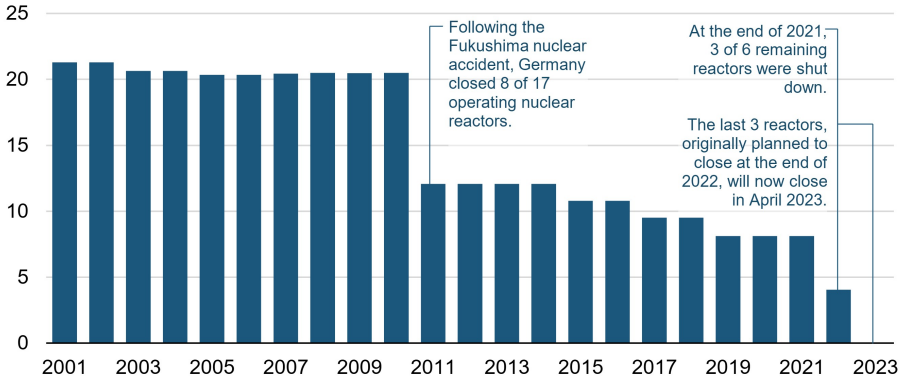
Challenges in empirically studying nuclear energy

5. Opportunities to study nuclear (sometimes an unfortunate one)

5.2 German shut down their reactors & changed energy mix (pipelines on the news)

Germany, nuclear power capacity (2001–2023)

gigawatts

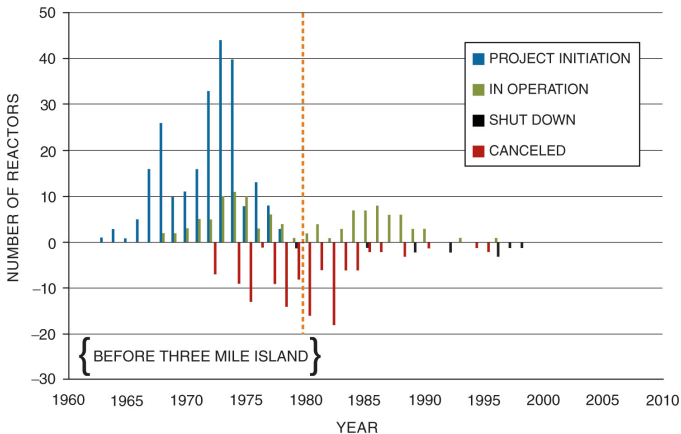


Source: EIA

Challenges in empirically studying nuclear energy

5. Opportunities to study nuclear (sometimes an unfortunate one)

5.3 Historical cancellation of approved projects since TMI



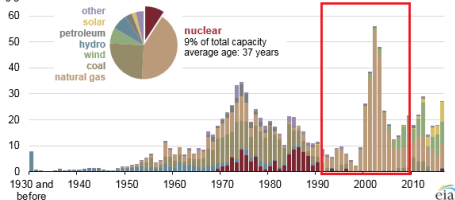
Source: SAGE and NRC

Challenges in empirically studying nuclear energy

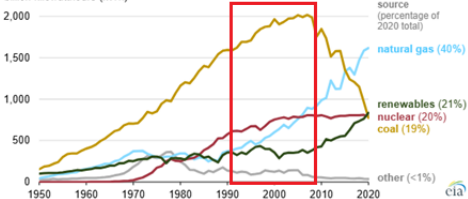
5. Opportunities to study nuclear

5.4 Deregulation in 1990s since Energy Policy Act of 1992

U.S. utility-scale electric generating capacity by initial operating year (as of Dec 2016)
gigawatts



Annual U.S. electricity generation from all sectors (1950–2020)
billion kilowatthours (kWh)

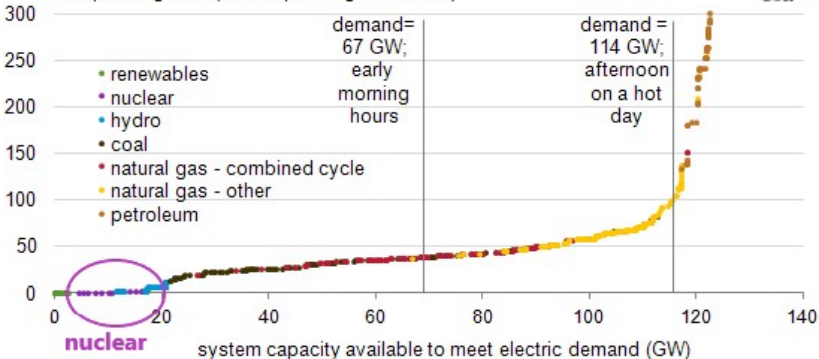


Feature of Nuclear Energy:

1. In terms of MC

Hypothetical dispatch curve for summer 2011

variable operating cost (dollars per megawatthours)



► Low MC to run

→ implication on electricity price from nuclear shutdown (a merit-order effect)

Feature of Nuclear Energy:

2. In terms of emissions

Emissions from Generating Electricity

(pounds per million kilowatt hours)

| Type | CO ₂ | Methane (CO ₂ e) | SO ₂ | NO _x |
|-------------|-----------------|-----------------------------|-----------------|-----------------|
| Coal | 2,100,000 | 350,000 | 3,900 | 1,600 |
| Natural gas | 900,000 | 540,000 | 5 | 2,100 |
| Biomass | 270,000 | na | 540 | 3,300 |
| Nuclear | 0 | 0 | 0 | 0 |
| Solar | 0 | 0 | 0 | 0 |
| Wind | 0 | 0 | 0 | 0 |
| Geothermal | 0 | 0 | 0 | 0 |
| Hydro | 0 | 0 | 0 | 0 |

- ▶ Low pollution emissions (SO₂, NO_x, PM, etc) compared to fossil fuel sources
→ potential health implications
- ▶ Low greenhouse gas emissions (CO₂, etc) compared to fossil fuel sources
→ potential climate implications

Feature of Nuclear Energy:

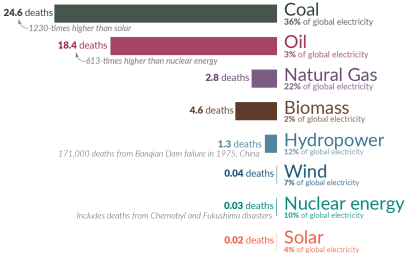
2. In terms of emissions: Health impact

What are the **safest** and **cleanest** sources of energy?

**Our World
in Data**

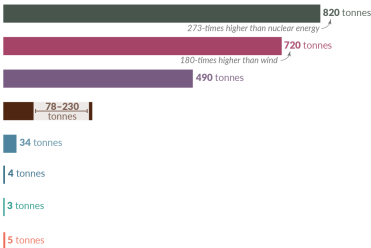
Death rate from accidents and air pollution

Measured as deaths per terawatt-hour of electricity production.
1 terawatt-hour is the annual electricity consumption of 150,000 people in the EU.



Greenhouse gas emissions

Measured in emissions of CO₂-equivalents per gigawatt-hour of electricity over the lifecycle of the power plant.
1 gigawatt-hour is the annual electricity consumption of 150 people in the EU.



Death rates from fossil fuels and biomass are based on state-of-the-art plants with pollution controls in Europe, and are based on older models of the impacts of air pollution on health. This means these death rates are likely to be very conservative. For further discussion, see our article: [OurWorldinData.org/safest-sources-of-energy](https://ourworldindata.org/safest-sources-of-energy). Electricity shares are given for 2021. Data sources: Markandya & Wilkinson (2007); UNSCEAR (2008; 2018); Sovacool et al. (2016); IPCC AR5 (2014); Pehl et al. (2017); Ember Energy (2021).

[OurWorldinData.org](https://ourworldindata.org) - Research and data to make progress against the world's largest problems.

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- ▶ Lower pollution emissions (SO₂, NO_x, PM, etc) → potential health implications
- ▶ Lower greenhouse gas emissions (CO₂, etc) → potential climate implications

Outline

- ▶ Topics and Studies on Nuclear Energy ✓
- ▶ Example 1: Kiso, Chan, & Arino (2022) JEEM
- ▶ Example 2: Neidell, Uchida, & Veronesi (2021) JHE
- ▶ Example 3: Davis & Wolfram (2012) AEJ:AE

Kiso, Chan, & Arino (2022) JEEM

"Contrasting effect of electricity price on retrofit and new-built installation of solar PV: Fukushima as a natural experiment"

Research Question:

- ▶ How does a higher electricity price driven by nuclear reactor shutdowns affect residential solar PV adoption?
- ▶ How does the above effect differ between (i) new buildings vs (ii) existing buildings?

Data

- ▶ Prefecture-by-quarter level data from Japan over 2009 Q1 - 2014 Q1
(Unfortunately, Japan PV Energy Associate no longer collects this data)

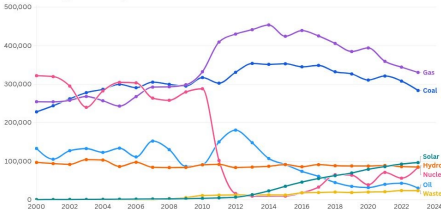
Temporal Variation after March 2011

Energy production

Japan's nuclear drop off

Electricity generation from nuclear power in Japan plummeted after Fukushima

Annual electricity generation in Japan (Gwh)



Source: IEA - Some minor sources - like wind and geothermal - not included

Figure by IEA

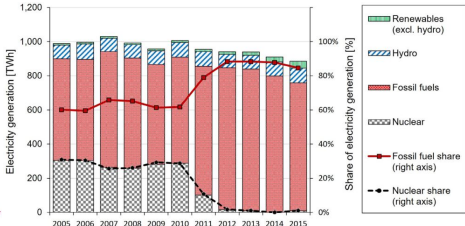


Fig. 3. Japan's electricity generation by energy source. Source: Agency for Natural Resources and Energy (2017, Fig. 214-1-8).

Kiso et al. (2022) Fig 3

Temporal Variation after March 2011

Electricity price driven by energy production variation

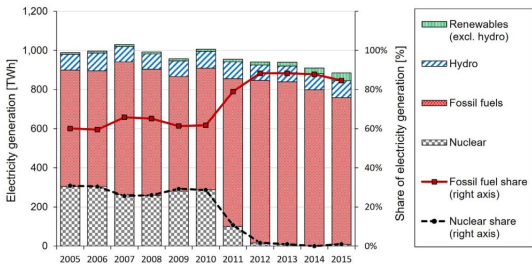


Fig. 3. Japan's electricity generation by energy source.
Source: Agency for Natural Resources and Energy (2017, Fig. 214-1-8).

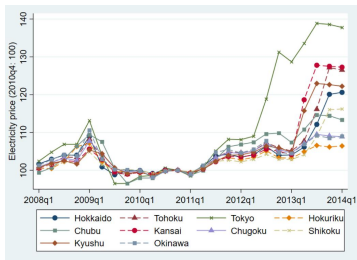


Fig. 4. Marginal electricity price by region (relative to 2010 Q4).
Source: Statistics Bureau of Japan (Retail Price Survey).

- ▶ There was a brief electricity rationing Mar-Sept 2011, attenuating the price shock

Empirical Strategy

For prefecture i in quarter t , estimate Eq(1) separately for new-buildings and existing ones:

$$\ln y_{it} = \beta p_{i,t-1} + \gamma \mathbf{X}_{it} + \eta_t + \mu_i + \varepsilon_{it} \quad (1)$$

- ▶ y : New solar PV installation
- ▶ p : lagged electricity price (average or marginal)
- ▶ \mathbf{X} : solar PV subsidies, lagged cumulative PV installation, lagged detached homes w/o solar PV, waste collection rate & volume, housing starts, population, wage, worker age, etc.
- ▶ FEs: Prefecture FE and quarter FE
- ▶ Philosophically, this is like a (cross-product) demand estimation
 - ▶ Similar to all demand estimation, there is an endogeneity issue related to price
 - ▶ E.g., PV installation and prices are both correlated with unobserved adoption of energy-efficiency investment for homes and buildings
- ▶ IVs: Cost shifters
 - ▶ Lagged fuel cost (e.g., coal, LNG)
 - ▶ Lagged energy mix measured by the share of fossil fuels (3 lags)
 - ▶ If authors multiply them: They would be shift-share IVs

IVs and Variation

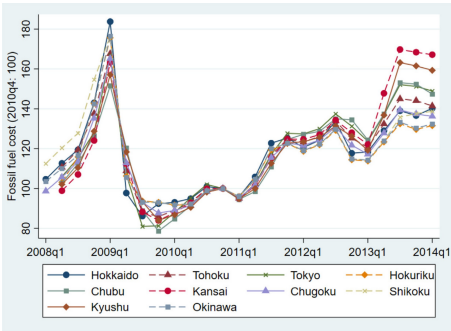


Fig. 8. Fossil fuel cost by region (relative to 2010 Q4).
Sources: Electricity companies' press releases.

$$\text{Fuel cost}_{it}$$

Mostly temporal variation over t

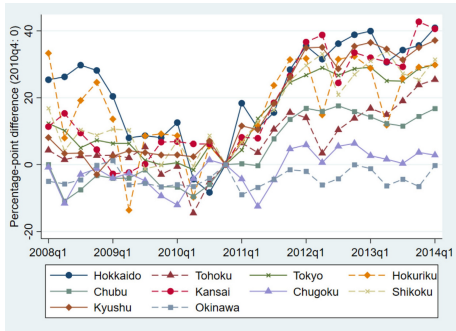


Fig. 9. Fossil fuel share by region (difference from 2010 Q4).
Source: Federation of Electric Power Companies of Japan.

$$\text{Fossil fuel share}_{it}$$

Varying both by i and t

The cross-sectional part is more exogenous

First-stage Results

Table 4
First-stage results.

| | (1) | (2) | (3) |
|--|--------------------|--------------------|--------------------|
| Fossil fuel cost _{<i>t-1</i>} | 0.35*** (0.026) | 0.32*** (0.023) | 0.32*** (0.025) |
| Fossil fuel share _{<i>t-1</i>} | -0.032 (0.42) | 0.054 (0.42) | 0.27 (0.68) |
| Fossil fuel share _{<i>t-2</i>} | 0.40* (0.22) | 0.54** (0.22) | 0.00013 (0.28) |
| Fossil fuel share _{<i>t-3</i>} | 1.36*** (0.34) | 1.63*** (0.40) | 1.84*** (0.53) |
| Fossil fuel share _{<i>t-4</i>} | -0.69* (0.36) | -0.73** (0.36) | -0.58 (0.44) |
| Covariates | No | Yes | Yes |
| Prefecture-by-quarter fixed effects | No | No | Yes |
| <i>F</i> -statistic for excluded instruments | 168.5 | 58.0 | 58.1 |
| Adjusted <i>R</i> ² | 0.842 | 0.857 | 0.838 |

Notes: Columns (1), (2), and (3) show the first-stage results for the IV estimations reported in columns (2), (4), and (5), respectively, of [Table 2](#). The dependent variable (i.e., the endogenous regressor in the second stage) is the marginal electricity price in period $t - 1$. The *F*-statistic for excluded instruments is for testing the joint significance of the excluded instruments. Cluster-robust standard errors are in parentheses, where the observations are clustered at the prefecture level. The superscripts *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Main Results

Table 2

Regression results: retrofit installations.

| | (1) | (2) | (3) | (4) | (5) |
|--------------------------------------|-------------------------------|---------------------------------|------------------------------------|------------------------------------|------------------------------------|
| Marginal electricity price $_{t-1}$ | 0.036 [*] (0.018) | 0.073 ^{***} (0.019) | 0.029 [*] (0.015) | 0.069 ^{***} (0.018) | 0.062 ^{***} (0.019) |
| Prefectural subsidy dummy (retrofit) | | | 0.025 (0.056) | 0.018 (0.055) | 0.0056 (0.055) |
| Prefectural subsidy rate (retrofit) | | | 0.00080 ^{**} (0.00040) | 0.00079 ^{**} (0.00040) | 0.00082 ^{**} (0.00038) |
| Implied electricity price elasticity | 0.90 | 1.85 | 0.74 | 1.73 | 1.56 |
| Prefecture-by-quarter fixed effects | No | No | No | No | Yes |
| Instruments | No | Yes | No | Yes | Yes |
| p -value of Hansen's J test | | 0.24 | | 0.48 | 0.68 |
| Within R^2 | 0.77 | 0.77 | 0.79 | 0.79 | 0.79 |

Note: Refer to the notes below Table 3.

Table 3

Regression results: new-build installations.

| | (1) | (2) | (3) | (4) | (5) |
|---------------------------------------|--------------------|------------------|-------------------------|------------------------|------------------------|
| Marginal electricity price $_{t-1}$ | 0.0055 (0.0072) | 0.014 (0.014) | 0.012 (0.0085) | 0.019 (0.015) | 0.021 (0.015) |
| Prefectural subsidy dummy (new-build) | | | -0.00058 (0.028) | 0.00035 (0.027) | 0.0022 (0.028) |
| Prefectural subsidy rate (new-build) | | | -0.0000087 (0.00023) | -0.000029 (0.00023) | -0.000086 (0.00023) |
| Implied electricity price elasticity | 0.14 | 0.35 | 0.29 | 0.49 | 0.54 |
| Prefecture-by-quarter fixed effects | No | No | No | No | Yes |
| Instruments | No | Yes | No | Yes | Yes |
| p -value of Hansen's J test | | 0.31 | | 0.69 | 0.09 |
| Within R^2 | 0.92 | 0.92 | 0.93 | 0.93 | 0.93 |

Notes: In Table 2 (Table 3), the dependent variable is the logarithm of the number of retrofit (new-build) residential solar PV installations. All specifications have 987 observations (47 prefectures over 21 quarters) and include prefecture fixed effects and time (year-quarter) fixed effects. Column (5) also includes prefecture-by-quarter fixed effects (i.e., four quarterly fixed effects for each prefecture). Variables with the subscript $t-1$ are lagged by one quarter. In columns (2), (4) and (5), the electricity price is instrumented with the fossil fuel cost and lagged fossil fuel shares. Cluster-robust standard errors are in parentheses, where the observations are clustered at the prefecture level. The implied electricity price elasticity of solar PV installations is calculated at the sample mean electricity price. The superscripts *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Student Questions

- ▶ Marginal price construction
- ▶ Discussions on possible explanations

Outline

- ▶ Topics and Studies on Nuclear Energy ✓
- ▶ Example 1: Kiso, Chan, & Arino (2022) JEEM ✓
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Neidell, Uchida, & Veronesi (2021) JHE

"The unintended effect from halting nuclear power production: Evidence from Fukushima Daiichi accident"

Research Question:

- ▶ How does a higher electricity price driven by nuclear reactor shutdowns affect energy consumption?
- ▶ How does this further affect mortality during cold(er) locations and time?

Data

- ▶ City-by-month level data from Japan over 2007-2014

Empirical Strategy

Regression 1: Electricity expenditure for city c and month t

$$\ln EXP_{ct} = \delta \ln P_{c,t-k} + \beta \mathbf{X}_{ct} + \varepsilon_{ct} \quad (1)$$

- ▶ P : residential electricity price, with k denote lags
- ▶ Exp : electricity expenditure (not consumption)
- ▶ $\delta - 1$: demand elasticity
- ▶ \mathbf{X} : numbers of hours in different temperature bins, other socioeconomic controls, city-by-month FE, year-by-month FE

Regression 2: Correlation between mortality and temperature

$$\ln M_{ct} = \sum_i \alpha_i \ln T_{cti} + \theta \mathbf{X}_{ct} + \gamma_{ct} + \mu_{ct}, \text{ with temperature bins } i \quad (2)$$

- ▶ M : age-adjusted mortality rate (per 100k people)
- ▶ T : electricity expenditure (not consumption)

Regression 3: Continuous treatment by incorporating both regressions

$$\ln M_{ct} = \sum_i \lambda_i T_{cti} \cdot \ln P_{c,t-k} + \sum_i \alpha_i \ln T_{cti} + \delta \ln P_{c,t-k} + \theta \mathbf{X}_{ct} + \gamma_{ct} + \nu_{ct} \quad (3)$$

- ▶ Test if $\lambda > 0$

Results

Regression 1:

Elasticity onelectricity expenditure

$$\ln \text{Exp}_{ct} = \delta \ln P_{c,t-k} + \text{controls} + \varepsilon_{ct}$$

Table 3

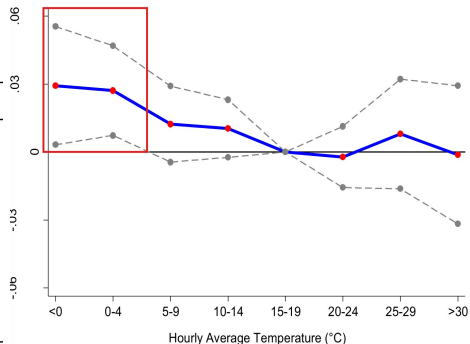
Price elasticity of residential electricity demand.

| Log(price) | Second lag of price |
|-----------------------------|---------------------|
| | (1) |
| <i>Panel A. Baseline</i> | -0.303** (0.108) |
| <i>Panel B. Seasonality</i> | |
| Winter | -0.249** (0.110) |
| Summer | -0.180 (0.184) |

Regression 2:

Temperature and mortality correlation

$$\ln M_{ct} = \sum_i \alpha_i \ln T_{cti} + \text{controls} + \mu_{ct}$$



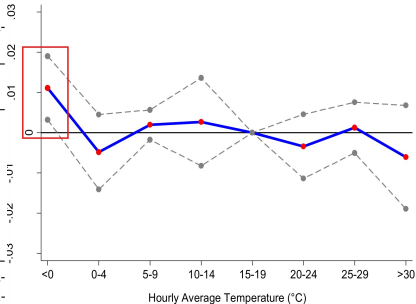
Main Results

Elevated mortality in colder locations and time

Table 6
The impact of residential electricity prices on the temperature-mortality relationship with electricity prices at different times.

| | Second lag of price (1) | First lag of price (2) | Current price (3) |
|-----------------------|----------------------------|---------------------------|----------------------|
| Number of hours < 0°C | 0.108** (0.038) | 0.099** (0.042) | 0.044 (0.034) |
| 0-4°C | -0.049 (0.045) | -0.059 (0.047) | -0.065 (0.051) |
| 25-29°C | 0.011 (0.029) | -0.001 (0.022) | -0.015 (0.029) |
| ≥ 30°C | -0.060 (0.059) | -0.075 (0.062) | -0.094 (0.055) |

Notes: Coefficients estimates are multiplied by 100 for readability. The dependent variable is the logarithm of the monthly mortality rate. The reported esti-



Main Results

Cause of mortality

Table 7
The impact of residential electricity prices on the temperature-mortality relationship: robustness checks and cause of death.

| | Baseline (1) | No city-by-year fixed effects (2) | Air pollution and windchill (3) | Wild cluster bootstrap city level (4) | Wild cluster bootstrap region level (5) | No Hokkaido (6) | No Tohoku (7) | Cardiovascular disease (8) | Respiratory disease (9) | Other Causes (10) |
|-----------------------|--------------------|-----------------------------------|---------------------------------|---------------------------------------|---|--------------------|--------------------|----------------------------|-------------------------|-------------------|
| Number of hours < 0°C | 0.108** (0.038) | 0.181*** (0.028) | 0.106** (0.039) | 0.108*** [0.002] | 0.108*** [0.000] | 0.148** (0.072) | 0.101** (0.040) | 0.133* (0.077) | 0.039 (0.073) | 0.066 (0.055) |
| 0-4°C | -0.049 (0.045) | -0.020 (0.028) | -0.052 (0.045) | -0.049 [0.240] | -0.049 [0.170] | -0.054 (0.053) | -0.040 (0.056) | -0.048 (0.064) | -0.01 (0.116) | -0.025 (0.065) |
| 25-29°C | 0.011 (0.029) | -0.004 (0.025) | 0.006 (0.030) | 0.011 [0.698] | 0.011 [0.716] | -0.001 (0.003) | 0.002 (0.003) | 0.021 (0.051) | -0.088 (0.065) | 0.055 (0.042) |
| ≥ 30°C | -0.060 (0.059) | -0.144 (0.073) | -0.063 (0.059) | -0.060 [0.250] | -0.060 [0.478] | -0.089 (0.059) | -0.039 (0.061) | 0.019 (0.112) | 0.153 (0.110) | -0.062 (0.074) |
| SPM | | | 34.753 (55.899) | | | | | | | |
| Ox | | | 72.280 (58.817) | | | | | | | |
| Windchill | | | 0.147 (0.204) | | | | | | | |
| Fixed effects | | | | | | | | | | |
| City-by-month | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| City-by-year | Yes | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year-by-month | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Notes: Coefficients estimates are multiplied by 100 for readability. The dependent variable is the logarithm of the monthly mortality rate. Column 1 reports our baseline estimates computed as the sum of the coefficient estimates for each temperature bin in the current and previous months by fitting Eq. (3). Column 2 excludes city-by-year fixed effects. In column 3, we report estimates where in Eq. (3) we control also for air pollution (Suspended Particulate Matter, SPM; Photochemical Oxidant, Ox) and windchill. Columns 4 and 5 present in square brackets p-values obtained by wild cluster bootstrap-t procedure as described by Cameron et al. (2008) with 1,000 replications to account for the small number of clusters. Column 6 excludes Hokkaido and column 7 excludes Tohoku. Column 8 refers to mortality due to cardiovascular disease, column 9 due to respiratory disease, and column 10 due to other causes (neoplasm, diabetes, suicide, motor vehicle accidents, and infectious diseases). The excluded category is the hourly average temperature in the 15°C-19°C range. Regressions are weighted by city population. Standard errors clustered at the city level are presented in parentheses except in column 5 where standard errors are clustered at the region level. Data refer to the period 2007-2014. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Outline

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- ▶ Example 1: Kiso, Chan, & Arino (2022) JEEM ✓
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Davis & Wolfram (2012) AEJ:AE

"Regulation, consolidation, and efficiency: Evidence from US nuclear power"

Research Question:

- ▶ How has the electricity market deregulation in the 90s affected US nuclear power plants?

Key info:

- ▶ Data: 40-year long panel over 1970-2009
- ▶ Potential gains: efficient nuclear reactors may replace less efficient nuclear reactors + fossil-fuel higher on the merit-order curve
 - ▶ Potential for greater power generation from nuclear
 - ▶ Potential lower electricity price
 - ▶ Ambiguous if operating nuclear reactors themselves get more efficient if most gains come from cross-fuel improvement. Also nuclear is already regarded as "baseload"

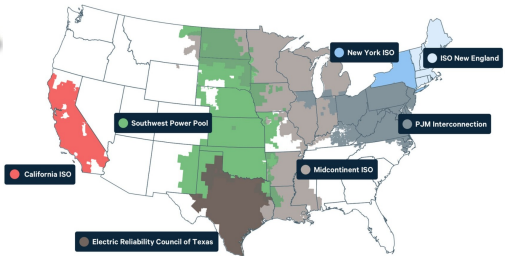
Electricity Market Deregulation History

Deregulation: Timing

- ▶ 1992 Energy Policy Act: It legalized the creation of a wholesale electricity market and allowed entities to participate in this market.
- ▶ Individual states started to deregulate
 - ▶ Peak deregulation time: late 1990s to early 2000s
 - ▶ 1996-1997: CA, OH, PA, RI, NY, IL, OR
 - ▶ 1998-1999: CT, MA, MI, NH, DL, MD, NJ
 - ▶ 2000-later: ME, DC, TX, VA, etc

Electricity Market Deregulation History

Deregulation: Broke down the vertical integration



- ▶ Before 90s deregulation:
 - ▶ Power plants (generation), transmission, and utility companies (serving consumers) are all vertically integrated
 - ▶ Rate-of-return (ROR) style of regulation creates little incentive for cost minimization
- ▶ Since deregulation:
 - ▶ power plants (supply side) and utility companies (demand side) bid on wholesale electricity markets
 - ▶ The remaining vertically integrated locations: northwest, southwest, and southeast

Electricity Market Deregulation History

Deregulation: Recent development in retail consumer choice

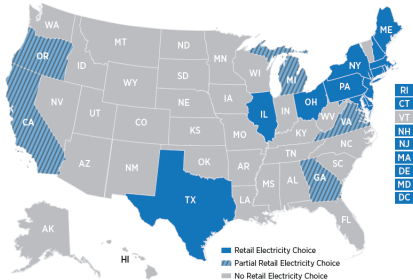


Figure 1. States with retail electricity choice
Source: State public utility commissions (2017)

- ▶ In selected states, consumers started to have options for multiple retail electricity choices
- ▶ Most of them are already in a deregulated market with wholesale electricity trading
- ▶ GA and OR are examples in a vertically integrated market: They mostly give options for industrial users (not residential users)

Empirical Strategy + Main Results

For reactor i and month t

$$Y_{it} = \beta_0 + \beta_1 \mathbf{1}[\text{Divested}]_{it} + \beta_2 \mathbf{X}_{it} + \delta_i + \omega_t + \varepsilon_{it} \quad (1)$$

- ▶ Y : net generation relative to nameplate capacity
- ▶ $\mathbf{1}[\text{Divested}]$: if a reactor is sold, or reclassified a non-utilities
- ▶ \mathbf{X} : reactor vintage cubic
- ▶ Read column 1: 6.3 pp increase in netgen, from 87 to 93 pp, strong intensive margin

TABLE 2—THE EFFECT OF DIVESTITURE ON NUCLEAR OPERATING PERFORMANCE

| | (1) | (2) | (3) | (4) | (5) |
|--|-----------------|------------------|------------------|------------------|-----------------|
| $\mathbf{1}[\text{Divested}]_{it}$ | 6.3*** (1.2) | 10.2*** (2.1) | 10.0*** (2.1) | 10.1*** (2.1) | 9.5*** (2.0) |
| Month-of-sample fixed effects (480 months) | Yes | Yes | Yes | Yes | Yes |
| Reactor fixed effects (103 reactors) | No | Yes | Yes | Yes | Yes |
| Reactor age (cubic) | No | No | Yes | Yes | Yes |
| Observations weighted by reactor capacity | No | No | No | Yes | No |
| Dataset collapsed to plant level | No | No | No | No | Yes |
| Number of cross sectional units | 103 | 103 | 103 | 103 | 65 |
| Observations | 36,667 | 36,667 | 36,667 | 36,667 | 23,796 |
| R^2 | 0.18 | 0.22 | 0.22 | 0.22 | 0.26 |

Mechanism Discussions

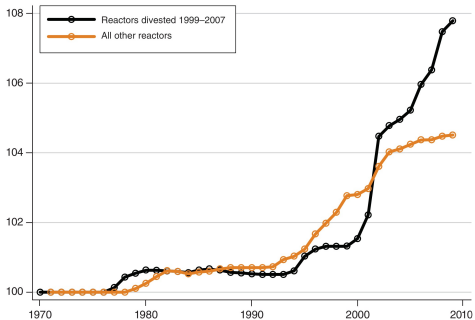


FIGURE 4: LICENSED THERMAL CAPACITY AS A PERCENT OF ORIGINAL LICENSE

TABLE 7—UNDERSTANDING THE MECHANISMS BEHIND POST-DIVESTITURE GAINS

| | (1) | (2) | (3) |
|--|------------------|-----------------|-----------------|
| <i>A. Maximum generating capacity</i> | | | |
| Maximum generation over last 12 operating months [Sample mean: 100.4] | 2.4*** (0.9) | 1.5 (1.5) | 1.6 (1.4) |
| Maximum licensed thermal capacity (MWt) [Sample mean: 102.0] | 1.8 (1.1) | 2.0* (1.1) | 1.9* (1.1) |
| <i>B1. Operating days</i> | | | |
| $1[Operating]_it \times 100$ [Sample mean: 91.0] | 3.9*** (0.7) | 3.5* (2.0) | 3.8** (1.9) |
| <i>B2. Length versus number of outages</i> | | | |
| Number of outages per year [Sample mean: 1.7] | -0.17 (0.11) | -0.13 (0.16) | -0.13 (0.16) |
| Mean outage length in days [Sample mean: 19.1] | -6.4*** (1.3) | -6.2 (5.4) | -6.9 (5.3) |
| <i>C. Capacity factor when operating</i> | | | |
| Capacity factor in percent excluding zeros [Sample mean: 97.7] | -0.3 (0.3) | 0.5 (0.3) | 0.4 (0.3) |
| Time effects (4,017 days/11 years) | Yes | Yes | Yes |
| Reactor fixed effects (103 reactors) | No | Yes | Yes |
| Reactor age (cubic) | No | No | Yes |

Notes: This table reports coefficient estimates and standard errors corresponding to an indicator variable for reactors that have been divested from 18 separate regressions. The row head-

Other evidence of allocative efficiency gains

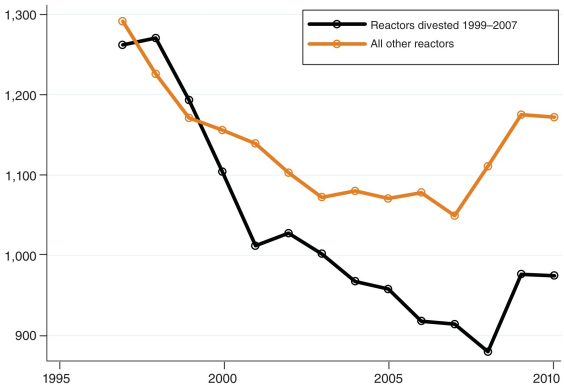


FIGURE 7. AVERAGE NUMBER OF WORKERS PER PLANT