Build at your own risks.

Integrating disaster risks into land use regulations

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Personal website

Motivation

- Urban areas, that gathers 56% of global population and accounts for 80% of global GDP
- Yet they are exposed to recurring disasters.
- Important material and human losses, expected increase in event frequency and magnitude with climate change

Policy

"Risk prevention plans"

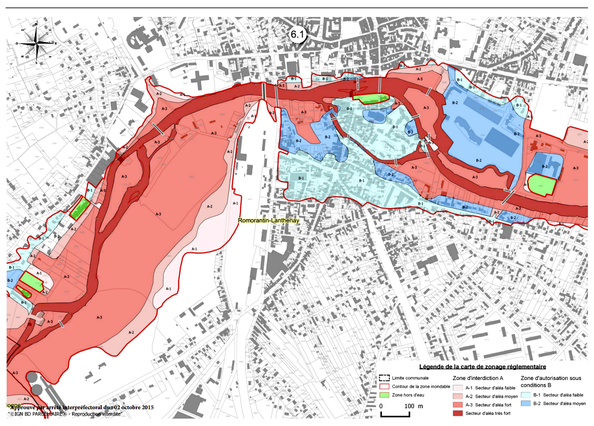
Goal: Promote resilient urban development through the integration of natural and industrial risks into land use regulations

A two-step treatment

- **Information** on levels of hazard exposure
- Adapted land-use **regulation**
- On average, 6 years in between

Two type of zones

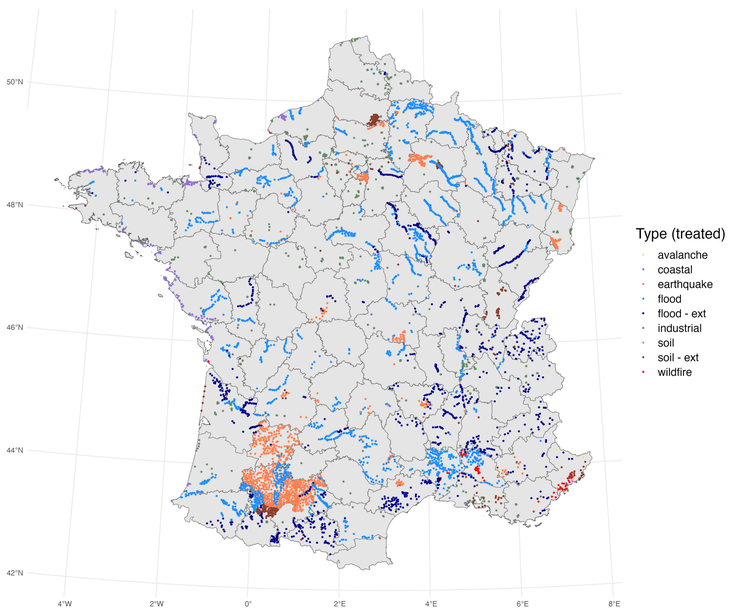
- **Red**: ban on new constructions
- **Blue**: development is allowed, mandatory protective norms ⇒ increase in construction costs



Example of a **flood risk plan** (Romorantin)

Data

- Spatial and temporal variation
- Precise **geolocalized data**
- Long period of time (**1995–2020**)



Empirical strategy

Staggered difference-in-difference.

TWFE estimator

$$Y_{i,t} = \sum_{t=-j}^{-2} \alpha_t \times 1_t + \sum_{t=0}^{k} \alpha_t \times 1_t + \lambda_{p(i)} + \delta_{y(i,t)} + \epsilon_{i,t}$$

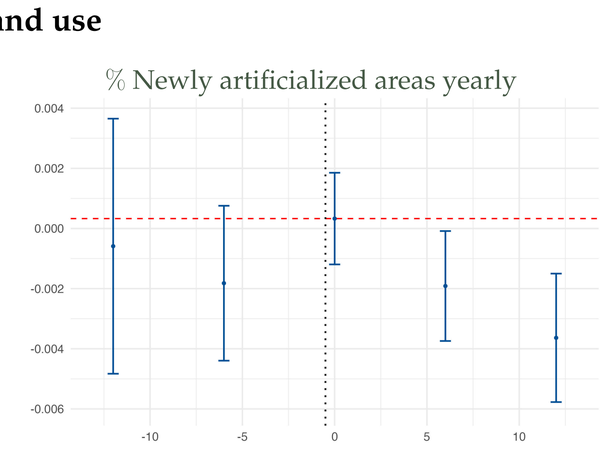
Robustness tested using new DID estimators [1, 5, 2].

Identification hypothesis:

- **Quasi-randomness of treatment timing**:
  - No anticipation: large uncertainty about local implementation timing and exact zoning rules [3].
  - No selection into treatment
- **No manipulation of treatment boundaries**: Authoritarian attitude of the central State. [4].

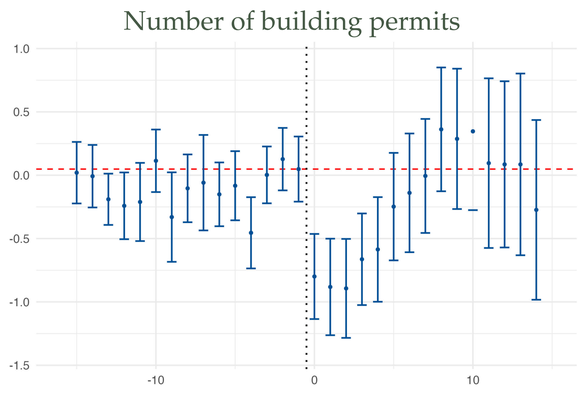
Results

Land use

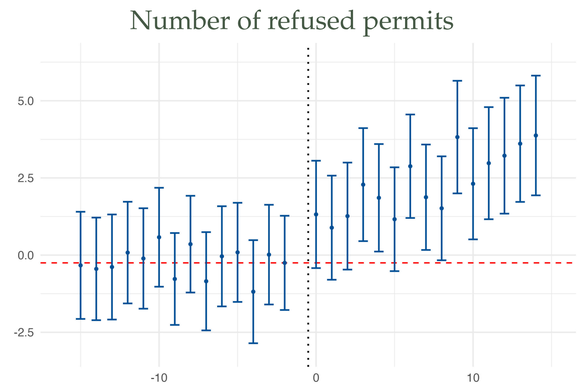


⇒ Driven by **red zones**.

Building permits



⇒ Driven by **blue zones**.



⇒ Driven by **blue zones**.

+ No significant impact on either housing surface, plot size, number of floors, or density.

Main takeaways

- **Temporary permits reduction** during implementation
- Administrative uncertainty and **complexity increase**
- Development in red zones stopped
- But **buildings shapes not affected** in blue zones

It suggests

- **Limited integration** of risk by inhabitants?
- Because of **insurance** liability? The "*CatNat*" system:
  - No price discrimination, households compensated regardless of behavioral decisions
  - Reinsurance guaranteed by the State

Forthcoming research

- **Outcomes**
  - Single and multifamily units
  - Housing and land prices
  - Neighborhood characteristics
- **Heterogeneity**
  - Risk type
  - Housing market characteristics
- **Model:** Residential choice model that integrates **the role of financial incentives**

References

[1] Brantly Callaway and Pedro HC Sant'Anna. Difference-in-differences with multiple time periods. *Journal of Econometrics*, 225(2):200–230, 2021.

[2] Clément De Chaisemartin and Xavier d'Haultfoeuille. Two-way fixed effects estimators with heterogeneous treatment effects. *American Economic Review*, 110(9):2964–2996, 2020.

[3] Eric Pautard. Les français face aux risques environnementaux (eser 2013). *CGDD/SOeS. Études & documents*, 128:82, 2015.

[4] Céline Perherin. *La concertation lors de la cartographie des aléas littoraux dans les Plans de Prévention des Risques: enjeu majeur de prévention*. PhD thesis, Brest, 2017.

[5] Liyang Sun and Sarah Abraham. Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics*, 225(2):175–199, 2021.

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