From Fireside Intentions to Market Reconfiguration: Residential Mobility, Real Estate Frictions, and Tourism Shifts after the 2022 Landes Wildfire

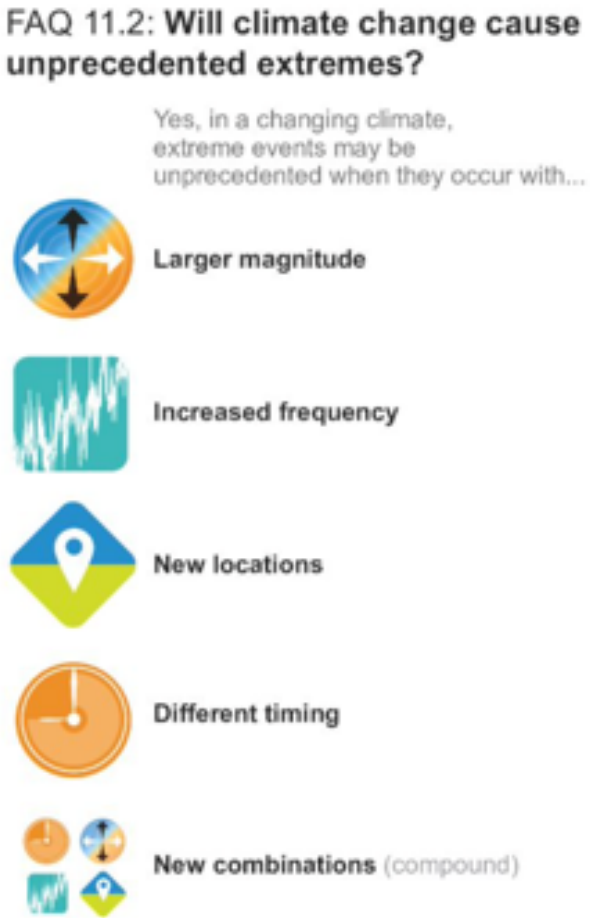
Patrick Bigler[2], *Marie Breuillé*[1], *Camille Grivault*[1], Sébastien Houde[2], *Julie LeGallo*[1] *and Alexandra Verlhiac*[1,3]

[1] *CESAER UMR*1041, *INRAE*, *L'InstitutAgro*, Université de Bourgogne Franche-Comté
[2] *Faculty of Business and Economics* (*HEC*), University of Lausanne, Switzerland
[3] *Aviv Group*

alexandra.verlhiac@aviv-group.com

EEA Congress Bordeaux, August 25 2025

Motivation : Climate change will cause more extreme events



It includes "temperature extremes, heavy precipitation and pluvial floods, river floods, droughts, storms (including tropical cyclones), as well as compound events (multivariate and concurrent extremes)"
According to IPCC[a] Sixth Assessment Report

a. IPCC : Intergovernmental Panel on Climate Change

Case Study: Landes and Gironde Forest Fires 2022

The Forêt des Landes was developed in the late 19th century exclusively with the pin maritime—"*arbre d'or des Landes*" (Alexandre Léon)

Figure – Dune du Pilat, France. *Source: https://www.sudouest.fr/.*

Case Study : Landes and Gironde Forest Fires 2022

The year 2022 was exceptional, with more than 50,000 ha burnt by forest fires between May and September 2022

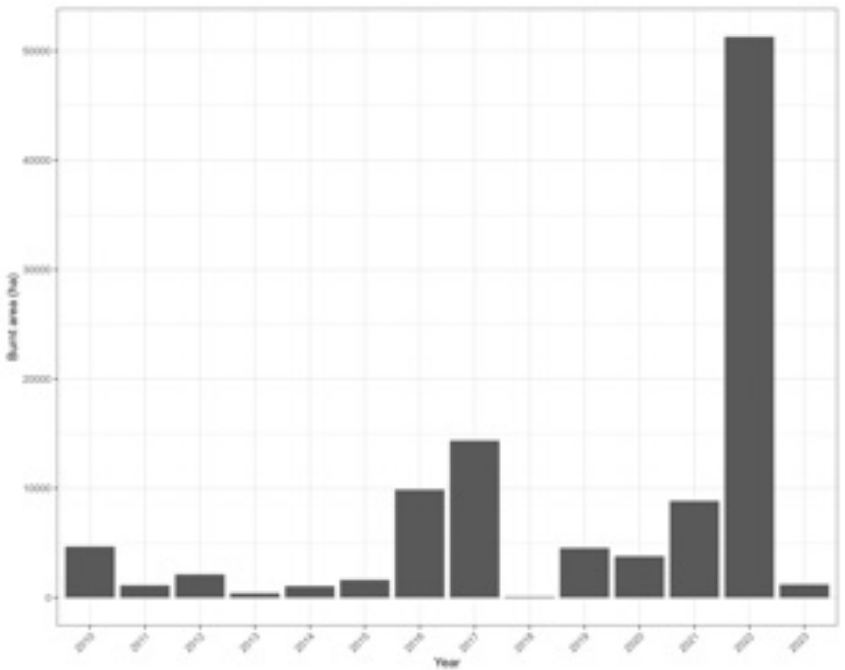


Figure – Yearly burnt areas caused by forest fires (from May to September).
Source: EFFIS database, 2010-2023.

Over the 50,000 ha burnt, 29,585 ha were in Gironde.

Case Study : Landes and Gironde Forest Fires 2022

In Landes and Gironde, 5 distinct fires have burned over 3% of the area of the impacted municipalities.

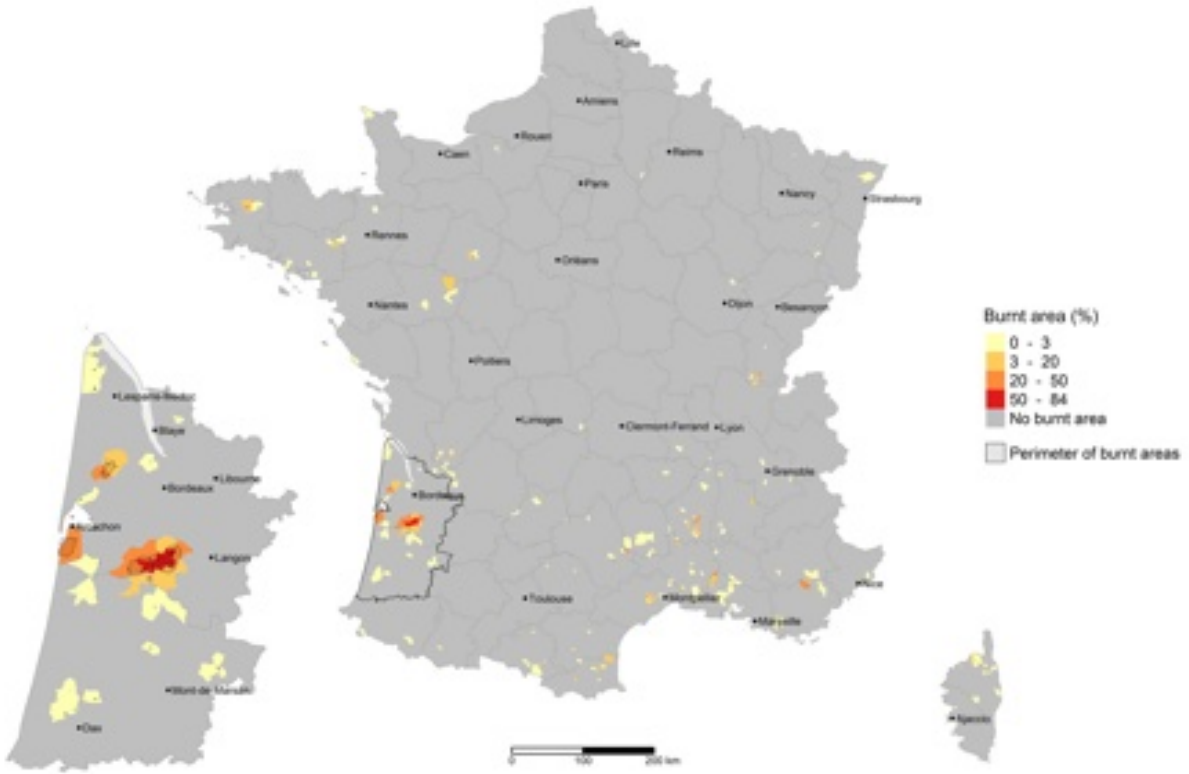


Figure – Percentage of burnt areas caused by forest fires between May and September 2022. *Source: EFFIS database, 2022.*

Case Study : Landes and Gironde Forest Fires 2022

The salience of the event was also exceptional.

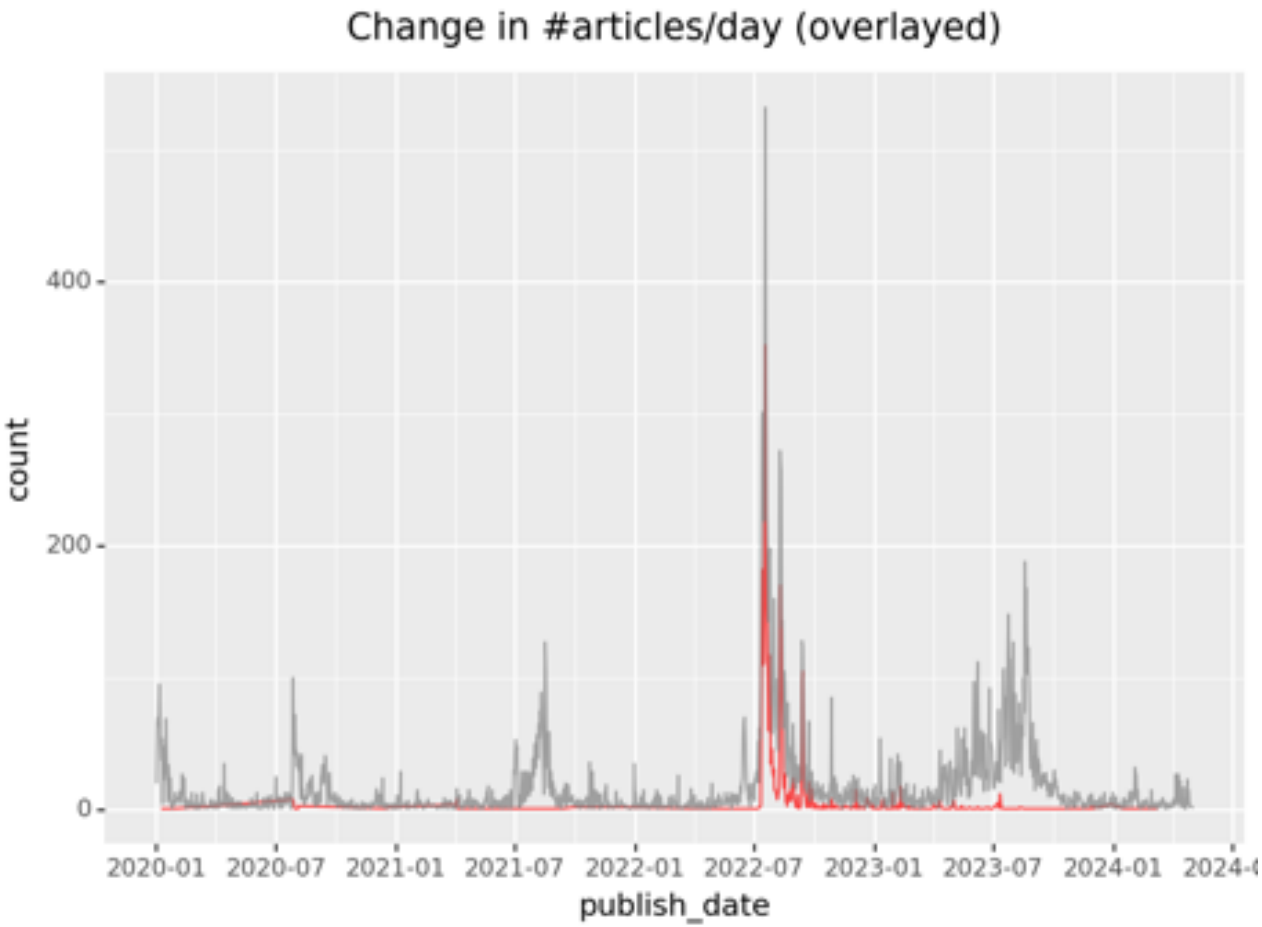


Figure – Number of media articles on Landes and Gironde Forest Fires 2022 (red) vs Forest Fires (gray). *Source: Common Crawl database, 2022.*

Migration is an adaptation strategy

- Migration is an adaptation strategy.
- But important barriers to moving inducing an **intention gap**: a difference between intended and actual migrations.
- A crucial determinant of the adaptation capacity of a local economy comes from the ability of households to migrate
- Understanding the impact of climate risks on households' location decisions is thus of primary importance for territories in order to adapt with consistent policies.

Goal

This paper aims to understand the **impact of an extreme climatic event (ECE)**

on the **intention to move versus actual moving decisions and market outcome consequences** in a developed economy setting.
...

...Thanks to **original data** based on users' behaviour on SeLoger online real estate platform and mail forwarding from La Poste.

Literature

- **Migration is a key driver of adaptation**, particularly internal migrations *Hoffmann et al. (2020), Moore and Wesselbaum (2022), Beine and Jeusette (2021)*
- The bulk of the empirical evidence on the influence of ECEs on different economic outcomes, including migrations, comes from **developing economies** *(Kellenberg and Mobarak, 2011)*
- Apart US: some studies have investigated the **impact of forest fires in California on migration** *(Jia et al, 2020,Winkler, 2020, Sarygin, 2021, McConnell et al., 2021, Holloway and Rubin, 2022)*

Contribution

1. **Providing empirical evidence for a region that has received little attention so far** but is expected to be heavily impacted by different types of physical and transition climate risks
2. Use of **original daily disaggregated data** from behaviour on online real estate platform and from mail forwarding

Various Data Sources

Realized and Predicted Fire Risk

$\rightarrow$ *Construction of treatment and control groups*

Outcome of interest:

1. **Intentions: Supply and Demand** from listing data and contact requests on online SeLoger real estate platform
2. **Effective moves** from La Poste mail forwarding Data
3. **Real Estate Market**: DV3F database from CEREMA
4. **Short-Term Rentals** from AirDNA database based on scraped Airbnb data

Forest Fire Data: Sources and Construction

Realized and Predicted Fire Risk

- **Realized Fires – EFFIS database**
  - Satellite-based + validated with ground data
  - Measures share of municipality area burned
  - Treatment definition: >3% area burned in summer 2022
  - 5 distinct fires in Gironde and Landes from July to September 2022
- **Predicted Risk – Firelihood model (Pimont et al., 2023)**
  - Predicts seasonal fires (>20ha) using weather, vegetation, and spatial controls
  - Used for matching control municipalities based on similar risk exposure

Goal: Combine observed damage and underlying risk to define treatment and construct a valid comparison group.

Mobility intentions: users behaviour on SeLoger

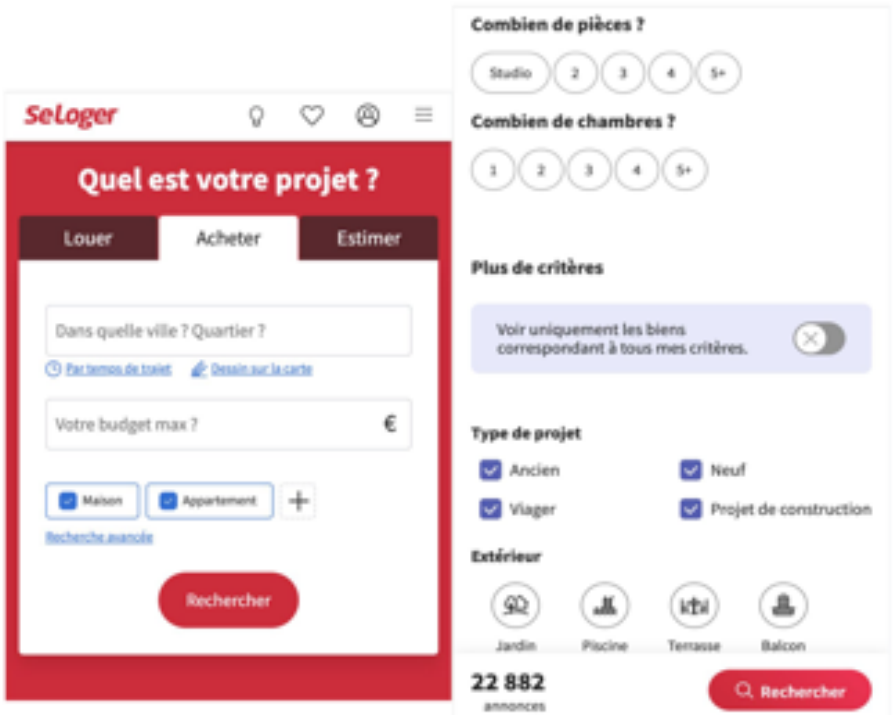
SeLoger is an online real estate platform with 1.26 million visits per day.

User
Location from IP address
Proxi of Origin City

$\longleftrightarrow$

Listings clicked
Searched residence
Destination City

- **Contact Request**
- Property's status: Sell or Rent listings
- Visit date
- Housing location
- Housing characteristics
- Publication dates



Effective moves: mail forwarding from La Poste

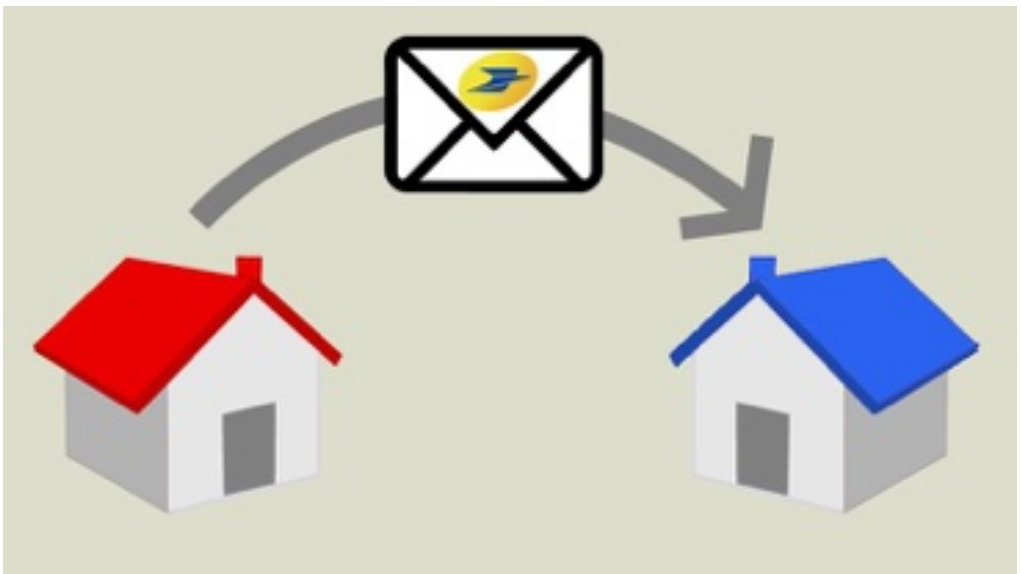
La Poste is the near-monopoly leader in charge of mail distribution.

Previous housing
Address

$\longleftrightarrow$

New housing
Address

- Around 2/3 of French movers take out a mail forwarding contract
- Proxy for the date of the decision to relocate : three months before the starting date of the contract



DV3F Dataset: Real Estate Market

Source: DV3F database from CEREMA (2010–2023)

- Geolocated data at the address level
- Covers all property transactions in France (except Bas-Rhin, Haut-Rhin, Moselle)
- Key variables:
  - Sale date, price, surface area, number of rooms
- Study period: January 2010 – June 2023
- Proxy for decision date: *sale date - 5 months*
- Constructed variables at municipality-month level:
  - Number of transactions
  - Median price per m^2

AirDNA Dataset: Short-Term Rentals

Source : AirDNA, based on scraped Airbnb data (2016–2023)

- Municipality-month level data (Jan. 2021 – Dec. 2023)
- Focus on full-home listings only
- Key outcome variables:
  - Number of active listings
  - Number of bookings
  - Number of booked nights
  - Average daily rate
  - Monthly host revenue
- Used to evaluate tourism activity and secondary home market post-fire

Empirical Strategy

- **Different outcome (10+) variables** at the municipality$_i$-month$_t$ level: y_{it}.
  - Supply
  - Mobility intentions (Demand)
  - Actual moves
  - Market outcomes
  - Short-Term Rentals

- **Aggregate inter or intra-municipality flows** (search from municipality i to municipality j):
  - at the municipality of origin level (**outgoing** flows from i)
  - at the municipality of destination level (**incoming** flows to j)
  - **internal** flows inside municipality i

Empirical Strategy: Synthetic DiD

Using a **Synthetic Difference-in-Differences** method. The estimation of the Average Treatment Effect $\hat{\tau}^{sdid}$ is done as follows:

$$\left(\hat{\tau}^{sdid}, \hat{\mu}, \hat{\alpha}, \hat{\beta}\right) =$$

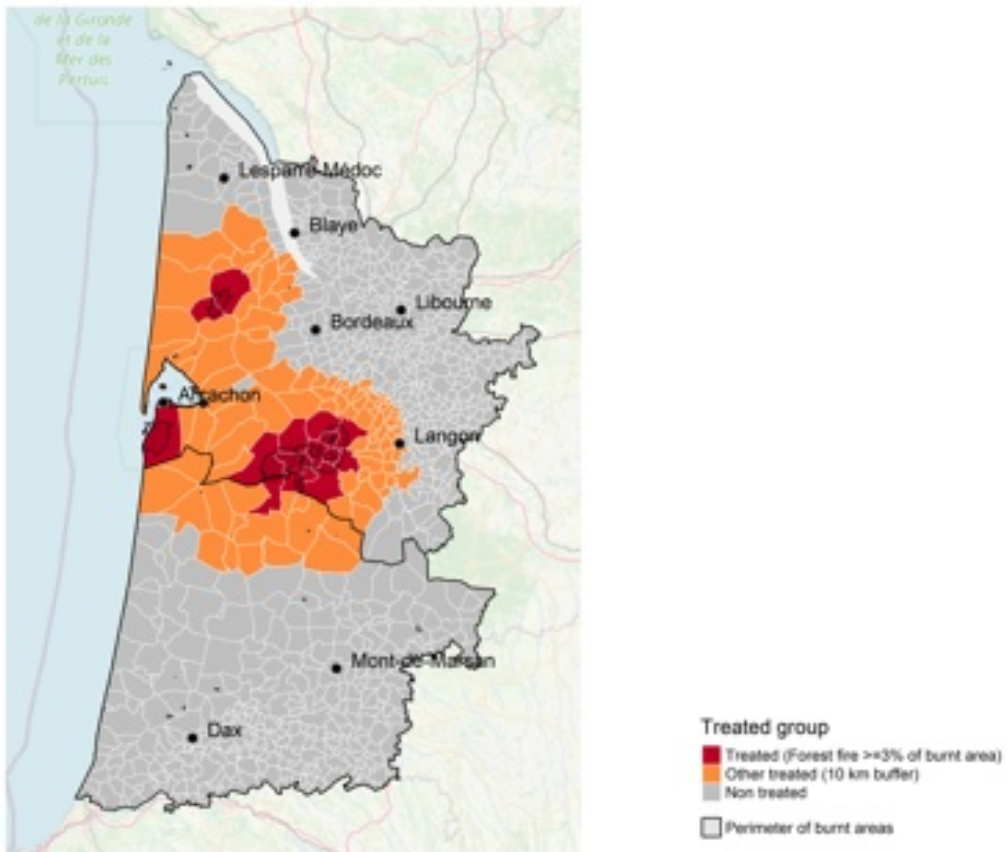
$$\arg\min_{\tau,\mu,\alpha,\beta} \left\{ \sum_{i=1}^{N} \sum_{t=1}^{T} \left(ihs(Y_{it}) - \mu - \alpha_i - \beta_t - W_{it}\tau \right)^2 \hat{\omega}_i^{sdid} \hat{\lambda}_t^{sdid} \right\}$$

where

- Y_{it} refers alternately to each of our dependent variables
- $W_{it} = Fire_t \times Treatment_i$ is the treatment variable
- $Fire_t$ is a binary variable equal to 1 from the start of severe forest fires in July 2022
- $Treatment_i$ is a binary variable equal to 1 if the municipality is in the treated group.
- Inverse Hyperbolic Sine transformation: $ihs(y) = ln(y + (y^2 + 1)^{(1/2)}$
- Two-way fixed effect regression with α_i the individual fixed effect and β_t is the time fixed effect
- SDID procedure chooses optimal individual weight $\hat{\omega}_i^{sdid}$ and time weight $\hat{\lambda}_t^{sdid}$

Treated group

Municipalities belonging to a 10 km buffer around municipalities with a burnt area $>3\%$ between July and October 2022



Control groups - Main specification - Restriction to coastal areas

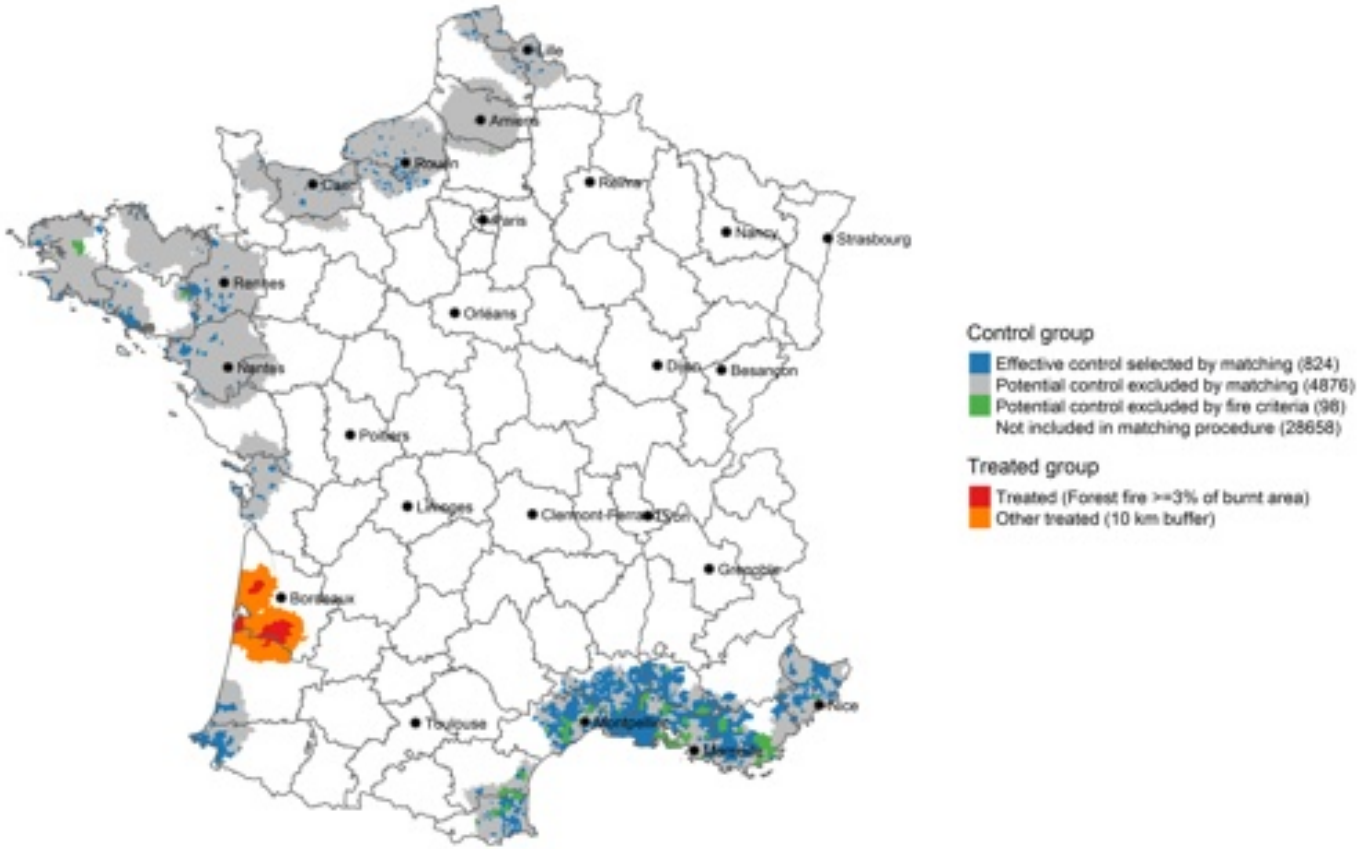


Figure – Ratio 1/7

Supply - Number of Listings

Estimated treatment effects from synthetic DiD model

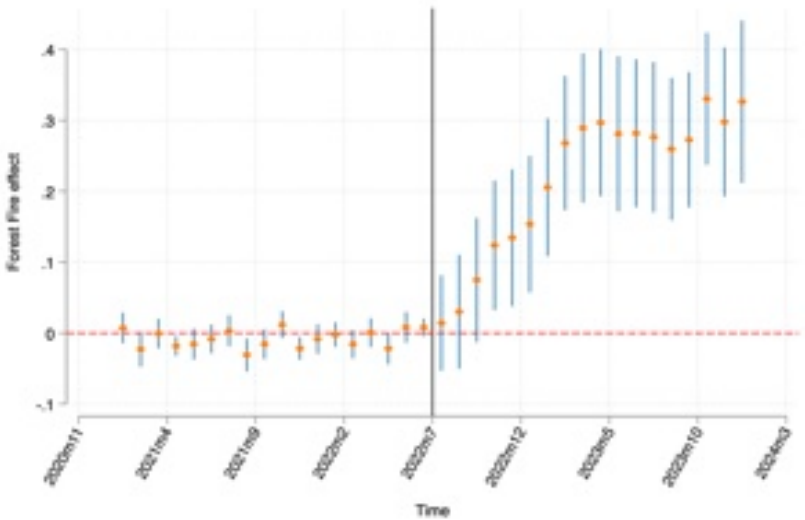
Table – Housing supply-side effects - Stock & Flows

Dependent variable:	Supply - Stock			Supply - Flow		
	All	Sell	Rent	All	Sell	Rent
Fire effect	0.2134***	0.2070***	0.1460***	0.0880**	0.0825**	0.0877***
	(0.037)	(0.037)	(0.037)	(0.027)	(0.029)	(0.024)
N	33,984	33,984	33,984	33,984	33,984	33,984

Notes: Standard errors clustered at a municipality level and estimated via bootstrap with 100 replications. + p<0.1, * p<0.05, ** p<0.01, *** p<0.001.

Supply - Number of Listings - Event Study

Panel (A): Stock (All listings)



Panel (B): Flow (All listings)

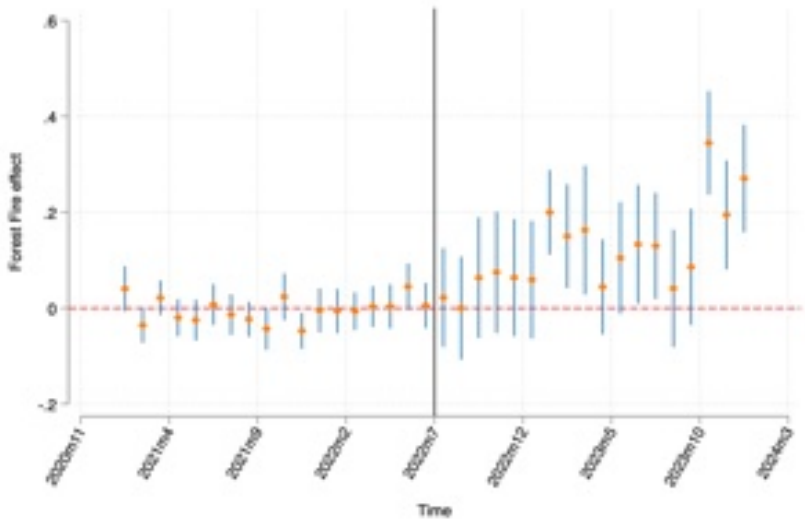


Figure – Dynamic effects of the forest fires on the number of active listings

Note: Average estimated treatment effect for each month separately based on synthetic difference in differences estimates using an event study specification (Ciccia, 2024). Whiskers denote 95% confidence intervals estimated using bootstrapping and 100 replications. Standard errors clustered at the community level.

Time On Market

Estimated treatment effects from synthetic DiD model

Table – Market absorption capacity Effects - Time on market

	Sell	Rent
Fire effect	0.1853**	0.2124+
	(0.058)	(0.119)
N	8,964	2,520

Notes: Standard errors clustered at a municipality level and estimated via bootstrap with 100 replications. + p<0.1, * p<0.05, ** p<0.01, *** p<0.001.

Mobility intentions - Demand - Number of Contact Requests

Estimated treatment effects from synthetic DiD model

Table – Housing demand-side effects - Contact Requests

Dependent variable:	Requests - In			Requests - Out			Requests - Int		
	All	Sell	Rent	All	Sell	Rent	All	Sell	Rent
Fire effect	-0.0771+	-0.1492***	-0.0083	-0.0619+	-0.0601+	-0.0495+	-0.0308+	-0.0208	-0.0121
	(0.042)	(0.038)	(0.042)	(0.033)	(0.031)	(0.028)	(0.018)	(0.018)	(0.017)
N	33,984	33,984	33,984	33,984	33,984	33,984	33,984	33,984	33,984

Notes: Standard errors clustered at a municipality level and estimated via bootstrap with 100 replications. + p<0.1, * p<0.05, ** p<0.01, *** p<0.001.

Effective Migrations

Estimated treatment effects from synthetic DiD model

Table – Effects on Migration

Dependent variable:	Residential migration		
	In	Out	Int
Fire effect	-0.0347	-0.0218	-0.0363+
	(0.025)	(0.021)	(0.020)
N	30,208	30,208	30,208

Notes: Standard errors clustered at a municipality level and estimated via bootstrap with 100 replications. + p<0.1, * p<0.05, ** p<0.01, *** p<0.001.

Real Estate and Airbnb Markets

Estimated treatment effects from synthetic DiD model

Table – Effects on Markets - Real Estate & AirBnB

Dependent variable:	Transactions		Offer Prices		AirBnB				
	Nb.	Price	Sell	Rent	List.	Res.	Days	Rev.	Rate
Fire effect	0.0742*	-0.0024	-0.0081	0.0564*	0.0783*	0.0853+	0.0220	0.1753	-0.0148
	(0.031)	(0.020)	(0.011)	(0.025)	(0.031)	(0.048)	(0.055)	(0.135)	(0.052)
N	23,600	20,625	8,856	2,520	33,984	33,984	33,984	33,984	28,944

Notes: Standard errors clustered at a municipality level and estimated via bootstrap with 100 replications. + p<0.1, * p<0.05, ** p<0.01, *** p<0.001.

Robustness Checks

- Decision dates: different lags: 1 month, 3 months and 5 months (principal estimation)
- Inference via jackknife
- Bigger number of replications with bootstrapped inference
- Reduced treatment radii of 5Km around the affected area or 0Km (i.e. only directly affected municipalities)
- Quarterly level
- Other control-group built in the same way but without filtering on coastal areas

Results remain stable

Takeaway

2022 Landes forest fire Effects: Evidence of early-stage behavioral adaptation to climate risk in the housing market

→ Supply shock: significant increase in property listings
→ due to less demand (incoming intention flows), more new listings (flows)
→ Listings stay longer on the market
→ No significant effect on migrations
→ More transactions without any effect on the price
→ More listings on the Short-Term Rental market
→ Role of secondary homes of investment market ?

Further Research Directions

- Investigate longer-term adjustments
- Explore heterogeneous effects by income, age,...
- Explore institutional responses such as insurance schemes, urban planning regulations, or land-use restrictions...

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