The Hidden Costs of Urban Renewal

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Check the slides: mateomoglia.github.io/files/JMPMoglia_slides.pdf
Check the paper: mateomoglia.github.io/files/JMPMoglia.pdf

CREST PhD Seminar, mock job market talk — September 2026

Productive cities no longer grow outward

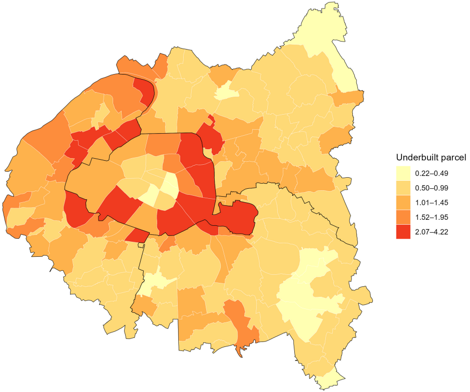
- Paris area, 1999–2021: population **+11%**, land take-up **+0.9%**
- Land at the fringe is exhausted. Growth happens **inside** the built envelope
- Same picture in Tokyo, New York, San Francisco, Seoul, Toronto (Frokling et al., 2025; Rollet, 2026)

The margin of adjustment is no longer vacant land. It is **redevelopment**.

Yet valuable land remains empty where rents are highest

- 8,000+ parcels are empty, vacant, or *infills*
- All of them sit in the **98th percentile** of French rents
- Textbook urban economics says land moves to its highest-valued use

High rents, high returns, **no redevelopment**



The standard answer is regulation: it is incomplete

Regulation as a supply tax (Glaeser & Gyourko, 2003, 2018; Gyourko & Molloy, 2015; Chapelle et al., 2025)

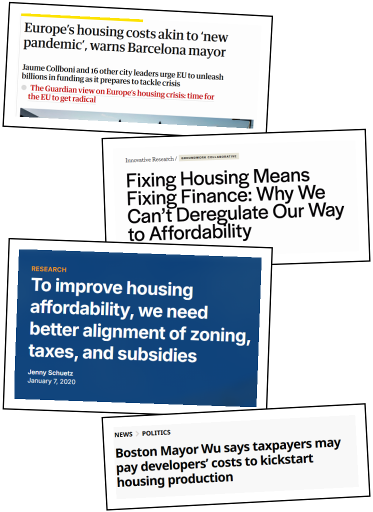
- Density caps, zoning, permitting, local opposition explain low supply elasticities in high-price cities

- But a developer must acquire the land, bargain with the owner, evict, demolish, remediate, wait → high redevelopment fixed costs (Murphy, 2018; Peng, 2023; Rollet, JMP)
- These costs are **sunk**, **irreversible**, and **do not scale** with the building
  - Redevelopment is not only a production decision but also a timing decision
  - Fixed costs act as a barrier to entry

A low redevelopment rate does not, by itself, imply stringent regulation

Why this matters now

- **Zero net land take** (*Zéro Artificialisation Nette*) is a French and EU objective since 2021
  - Halve land take-up by 2031, reach net zero by 2050
  - Greenfield expansion is closed by law. Every additional unit must come from the existing stock
  - *Fonds Friches*: a nationwide brownfield clenaing programme, around **50 €/m^2** of land
- Housing supply crisis is fuelling political discontent and calls for local leader action



Should (local) governments **deregulate** or **subsidise** redevelopment?

This paper quantifies and decomposes redevelopment cost

1. **How large** are the fixed costs of redevelopment?
2. **What are they made of**?
3. **How much of the low supply response** do they explain, relative to land-use regulation?

What I do

1. **Gather** a parcel-level panel of the Paris area, 2014–2025
   - 500,000+ developed parcels. Cadastre, permits, transactions, 3D envelopes, zoning, soil, and a developer cost survey

   → Unique granularity; **developer-reported costs**

2. **Build** an option-value model of redevelopment with two frictions
   - Uncertainty comes from the **price process**, not from idiosyncratic profitability shocks

   → **Time-to-build** and **bargained land** taken to parcel-level data

3. **Invert** the land transaction to recover fixed cost F_i as a determined residual
   - Net of the delay wedge and of the developer's rent, both calibrated outside the price equation

   → Fixed costs are **measured**, not a residual under parametric assumptions

4. **Decompose** F_i against directly measured components, then run counterfactuals
   - Observable at the parcel level. Subsidies against density limit

   → Separate technological for regulation frictions; compare the margins

What I find

- **Fixed costs are large.** The median reachable parcel needs a transfer of 1,839 €$/\mathrm{m}^2$ of land.
  - Same order as the cost of building the replacement, $c_0 = 1{,}186$ €$/\mathrm{m}^2$.
  - Existing programmes (50 €$/\mathrm{m}^2$) reach 1.2% of the reachable set.
- **Regulation does not explain fixed costs alone.** Of the cross-sectional variance of F_i:
  - land-use regulation 21%, demolition 15%, surrounding 12%, and 37% unexplained
- **Fixed costs are the binding friction.**
  - Setting $F_i = 0$ raises supply by 104.1% and cuts rent by 22.7%.
  - Removing height limit closes only 41% of that gap

The binding constraint is not: **can I build?** but **how much does it cost** to build?

Related literature

1. **Structural housing supply and fixed costs**

   Grovenstein, Kau, and Muneke (2011), Murphy (2018), Peng (2023), Baum-Snow & Han (2024), Rollet (2025)

2. **Real options and irreversible investment**

   McDonald & Siegel (1986), Majd & Pindyck (1987), Capozza & Helsley (1990), Dixit & Pindyck (1994), Bar-Ilan & Strange (1996), Womack (2015), Lange & Teulings (2024), Lebret, Liu, and Valentin (2026)

3. **Land-use regulation as a supply tax**

   Glaeser & Gyourko (2003, 2018), Gyourko & Molloy (2015), Diamond, Huang, and McQuade (mimeo), Chapelle, Eyméoud, and Wolf (2023), Chapelle, Paul-Venturine, and Urvoy (2025)

4. **Housing supply elasticities**

   Saiz (2010), Combes, Duranton, and Gobillon (2021), Baum-Snow & Han (2024)

5. **Land assembly and developer market power**

   Miceli & Sirmans (2007), Brooks & Lutz (2016), Quintero (2023), Charreire (2025), Lefebvre (2026), Favilukis, Pikulina, and Wu (2026)

Roadmap

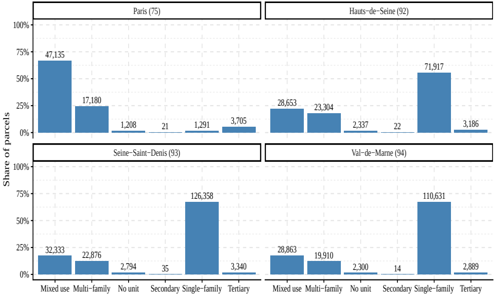
1. Introduction
2. Data and motivating facts
3. A dynamic model of redevelopment
4. Calibration
5. What is in the fixed cost?
6. Counterfactuals

Data and motivating facts

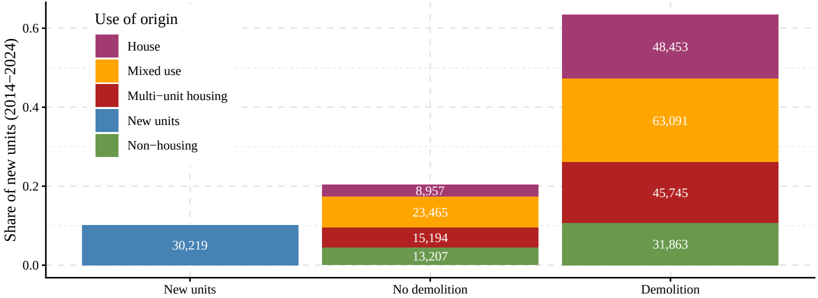
A (constructible) parcel-level dataset of the Paris area

- **Stock**: *Fichiers Fonciers* (fiscal universe of units), destination, floorspace, construction date (2014–2025)
- **Flow**: *Sitadel* (universe of permits), demolished floorspace, developer identifier, start/end dates (2014–2025)
- **Prices**: *DVF* (universe of land/property transactions) + *ODL* (municipal rents)
- **Costs**: *PRLN* (developer survey)

Also: *BD Topo* 3D envelopes, *Apur* zoning, geological and network data, *Fidéli* income.



Housing is supplied by replacing what already stands

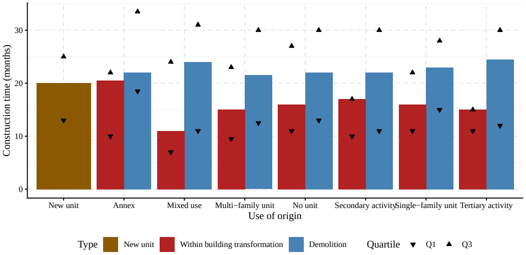


- 18,873 permits, 298,329 new units, 18.0 million m^2 (2014–2024).
- **64%** of new units come from demolition-reconstruction, 20% from transformation within the envelope, 10% from empty parcels.
- A third of new units are supplied on **former non-housing** parcels

Two model frictions are visible in the data

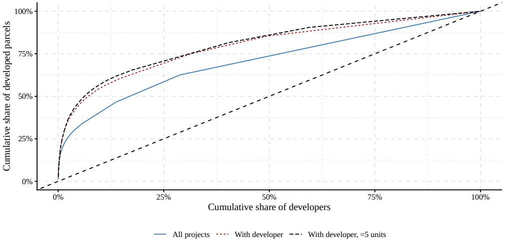
Concentration | Assembly premium

Construction takes time



- Tertiary and secondary are slower ($p < 0.01$ against other category)
- Demolition is slower than within-building transformation

Land is bought in a thin local market



- Median municipal market: an effective **17** developers (low competition on land)
- Largest project: 1.35% of the municipal stock (atomistic on prices)

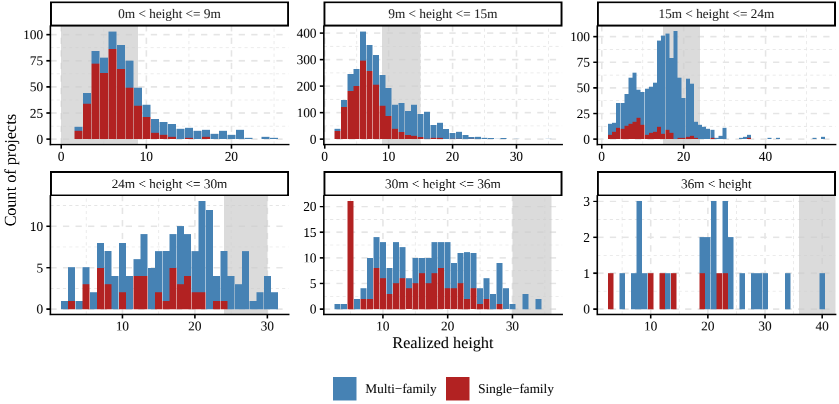
Land-use regulations are three-fold

D: in the data; **M**: in the model; **U**: unobserved

1. **Nationwide regulations**
   - D Historical protections (500m around a building)
   - U Environmental concerns (specific materials)
   - U Accessibility mandates, parking, etc.
2. **Local regulations**
   - M Maximum height
   - D Minimum lot size, floor-to-area ratio
   - U Building composition
   - D Zoning
   - D Discretionnary mayor power
3. **Local political economy**
   - D Building permit appeals
   - U Citizen push-backs, NIMBY

New constructions do not all reach the regulatory cap

Comparison with regulatory maximum height



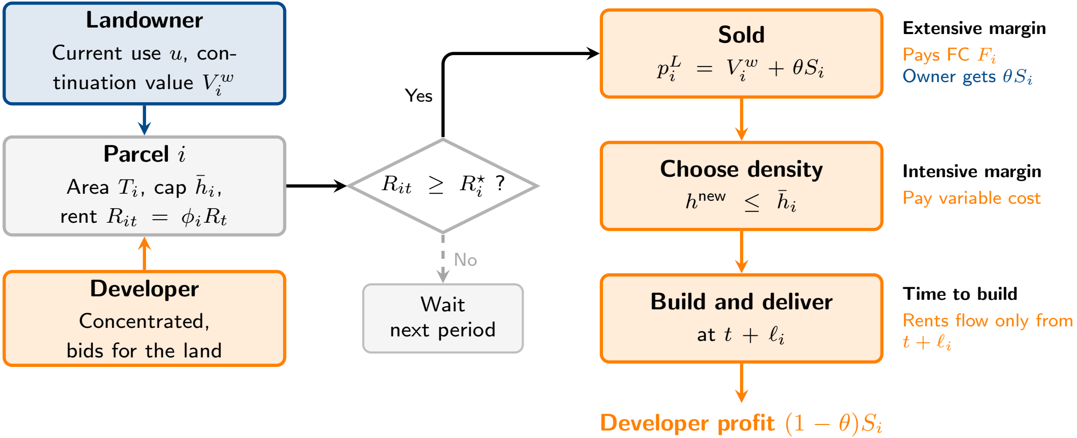
Comparison with 90th percentile building envelope around

A dynamic model of redevelopment

Main objectives

1. Recover **a redevelopment threshold** $R_i^\star$, the rent above which parcel i is redeveloped
   - The incumbent landowner earns a rental income that depends on the current use (housing, non-housing, vacant)
   - She sells once the price offered exceeds the value of holding on
   - That indifference point defines $R_i^\star$
2. Extract the **redevelopment fixed cost** F_i
   - Conditional on buying, the developer chooses $h^\star \leq \bar{h}_i$ to maximise profit
   - F_i is what separates the profit she can make from the price she pays

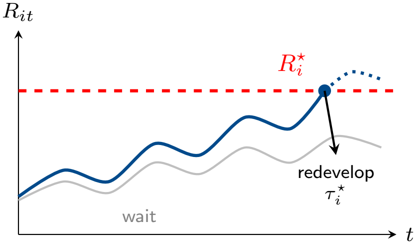
The redevelopment decision



Surplus $S_i(R_t) = \pi_i(R_{it}) - F_i - V_i^w$, split θ. Trade occurs whenever $S_i \geq 0$.

Why does anyone wait?

- **Waiting is valuable** Waiting is valuable
  - **Irreversible**: demolition cannot be undone, F_i is sunk
  - **Uncertain**: nobody knows the rent in ten years
  - **No deadline**: the parcel does not expire
- **Rents follow a geometric Brownian motion** Rents follow a geometric Brownian motion
  - Drift up at δ per year
  - Hit by proportional shocks of scale σ
- **Building today locks** in today's rent forever Building today locks in today's rent forever
- **Waiting keeps** the upside and **discards** the downside Waiting keeps the upside and discards the downside
  - Landowner: keeps V_i^w and the right to sell later



The trigger is a **markup** over break-even: $R_i^\star = \frac{\beta}{\beta-1} R_i^{\text{naive}}$, with $\frac{\beta}{\beta-1} = 1.50$

Intensive margin: how much to build?

A developer on parcel i chooses density to maximise value created, net of convex construction cost:

$$\pi_i(R_{it}) = \max_{h^{\text{new}} \le \bar{h}_i} \underbrace{\lambda_i^R \frac{R_{it}\ h^{\text{new}}}{\rho - \delta}}_{\text{Delayed revenue}} - \lambda_i^C \text{ Convex variable cost}$$

- Two wedges summarise the lag: $\lambda_i^R = e^{-(\rho-\delta)\ell_i}$ and $\lambda_i^C = (1 - e^{-\rho\ell_i})/(\rho\ell_i)$. Only their ratio κ_i matters
- Optimal density is linear in parcel area and increasing in rent:

$$h_i^{\text{new}} = \left[\frac{\zeta\, \kappa_i R_{it}}{c_0(\zeta+1)(\rho-\delta)}\right]^{\zeta} T_i \quad \text{if } R_{it} < \bar{R}_i, \qquad \bar{h}_i \text{ otherwise}$$

- Delay makes **projects smaller** (by κ_i^{ζ}) and **widens** the interior regime (saturation rent rises by κ_i^{-1}).

Time-to-build wedges

Extensive margin I: land is bargained, not auctioned

- The landowner's outside option is the value of the **current use** V_i^w

$$\text{Housing: } V_i^w = \frac{R_{it} h_i^{\text{old}}}{\rho - \delta}, \quad \text{Non-housing: } \frac{v_i^C}{\rho - \delta^C}, \quad \text{Vacant: } 0$$

- The **surplus** created by the transaction is $S_i(R_t) = \pi_i(R_{it}) - F_i - V_i^w$
- Generalised Nash with landowner weight θ gives the price and the developer's rent

$$p_i^L = V_i^w + \theta S_i, \qquad \Pi_i^D = (1-\theta) S_i$$

- $\theta = 1$ recovers the **competitive benchmark**: zero developer profit, full capitalisation into land
- $\partial p_i^L / \partial F_i = -\theta$: landowners bear only a **fraction** of transition costs
- Density is unaffected. Both parties take a constant share of the maximised surplus

Extensive margin II: the stopping rule

- The landowner solves an optimal stopping problem, $\tau_i^\star = \inf\{t : R_t \geq R_i^\star\}$, with

$$R_i^\star = \underbrace{\frac{\beta}{\beta-1}}_{\text{Option multiplier}} \cdot \underbrace{\frac{1}{\kappa_i}\frac{(\zeta+1)(\rho-\delta)}{\zeta}\left[\frac{\zeta(F_i+V_i^w)}{\lambda_i^C c_0^{-\zeta} T_i}\right]^{\frac{1}{\zeta+1}}}_{\text{Naive break-even rent}}$$

- $\beta > 1$ solves $\frac{1}{2}\sigma^2\beta(\beta-1)+\delta\beta-\rho=0$: it depends on σ, δ and ρ **only**
  - More volatility σ or a higher discount rate ρ raises the trigger. Faster rent growth δ lowers it
  - The parcel enters through F_i, V_i^w, T_i and $\bar{h}_i$, never through the multiplier

Proposition 1. The construction lag does not touch the multiplier. It rescales the payoff multiplicatively, so β is unchanged and $R_i^\star(\ell)/R_i^\star(0) = [\kappa_i(\lambda_i^C)^{1/(\zeta+1)}]^{-1} > 1$.

Proposition 2. Bargaining is neutral for timing. The developer maximises $(1-\theta)S_i$ and $(1-\theta)$ is a constant, so $R_i^\star$ is invariant to θ.

A fixed cost that is really a fixed cost

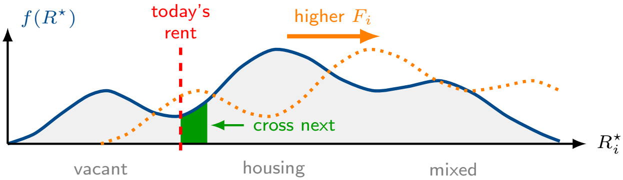
A structural residual is only as interpretable as the things it has been **purged of**

- Standard practice recovers F_i from an aggregate development rate. It then absorbs everything the model omits
- Here F_i is recovered by **inverting one observed price** at one observed rent
- Two "contaminants" are removed **by construction**
  - the **delay wedge**: a project costs now and earns only from $t + \ell_u$
  - the **developer's rent**: land does not trade at its full redevelopment value
- Option value is **not** netted out, and should not be
  - It is not a cost. It is what makes waiting optimal *at a given cost*

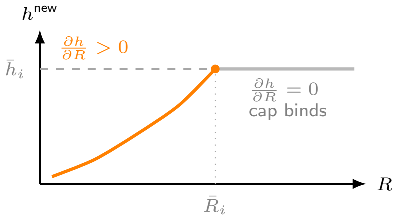
What remains is euros that must be spent before the first square metre is built

What governs the supply elasticity

$$\frac{dQ_t}{dR_t} = \underbrace{E\left[\frac{\partial h_i^{\text{new}}}{\partial R} \,\middle|\, R_i^\star = R_t\right]}_{\text{How much more each builds}} \cdot f(R_t) + \underbrace{E[h_i^{\text{new}}(R_t) \mid R_i^\star = R_t]}_{\text{How much each builds}} \cdot \underbrace{f(R_t)}_{\text{How many cross}}$$



Extensive: how much mass sits at today's rent



Intensive: shut where the cap binds

- **Fixed costs** push the whole curve right
- **The cap** shuts the orange term

Fixed costs and regulation act on **different margins**

Calibration

Every parameter is fixed outside the price equation

Par.	Name	Source	Value
μ	Demand growth	Obs. Loyers, FF	0.01
σ	Demand volatility	Obs. Loyers, FF	0.04
α	Inverse demand elast.	Chapelle et al. (2023)	0.35
δ	Perceived rent growth	$\rho-$ net yield (IDF)	0.02
ρ	Discount rate	Banque de France	0.065
β	Option root	Computed	2.98
ζ	Cost convexity	Combes et al. (2021)	1.17
c_0	Construction cost	PRLN, EPTB	1,186
ℓ_{hous}	Lag, housing	Sitadel	2.0
ℓ_{nonhous}	Lag, non-housing	Sitadel	2.2
θ	Landowner weight	$1-$HHI, floor $F_i \geq 0$	1.00
F_i	Fixed cost	**Structural residual**	–
$\bar{h}_i$	Density cap	90th pct. envelope	–

- The option multiplier is $\beta/(\beta-1) = 1.50$
- **Demolition is measured**, not assumed
  - 35–56 €/m^2 by destination, plus a 25,269 € mobilisation cost.
  - Uncorrelated with authorised floorspace (fixed in exactly the model's sense)

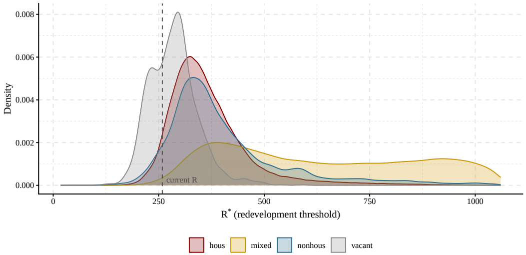
Demolition costs

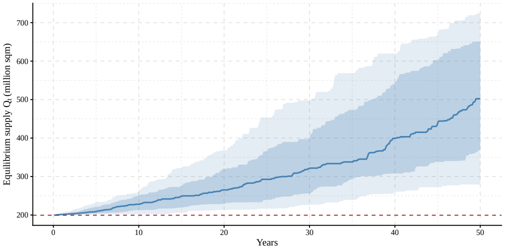
Four over-identification checks

1. **Supply elasticity**. The model delivers 0.6 against an external estimate of 0.35 (Chapelle et al., 2023)
2. **The μ–δ wedge has the right sign**. Demand grows at 0.01, perceived rents at 0.02.
   - The gap is exactly the rate at which supply expansion erodes the clearing rent. It is imposed nowhere
3. **$F_i \geq 0$ almost everywhere**. Negative for 1125 parcels out of 543,974.
   - Under a correctly specified model this is zero, so it bounds specification + hedonic error
4. **The sign restriction disciplines θ**. The share of negative F_i is monotone in θ, which delivers a floor of 0.38

θ floor (ℓ, θ) grid

Taking stock: where the parcels sit





- Vacant parcels sit below the 2023 rent: some **should already have redeveloped**
- Mixed-use parcels sit far above. A doubling of rents would not move a substantial share

- Supply grows slowly along the demand gradient over 50 years.
- At the 2023 rent, the elasticity of 0.63 is **almost entirely extensive** in Paris. The cap binds for most parcels.

Maps Regime split

What is in the fixed cost?

First, what F_i does not contain

		Median, EUR per sqm of parcel			Share of aggregate gap		
Use	N	Delay	Developer rent	Fixed cost	Delay	Developer rent	Fixed cost
Housing	104,760	608	0	3,282	16.0%	0.0%	84.0%
Mixed	16,339	1,020	0	4,457	17.5%	0.0%	82.5%
Non-housing	4,950	891	0	4,279	17.4%	0.0%	82.6%
Vacant	1,577	529	0	3,372	13.4%	0.0%	86.6%

- Across the sample the construction lag takes 16.8% of the gap and the developer's rent 0.0%
- The fixed cost is the remaining 83.2%, and that is the object I decompose
- The delay wedge is largest for non-housing origins: longest lags, largest redevelopment values

The magnitudes are shares of a **smaller total** than a competitive, instantaneous construction benchmark would give

Decomposing the fixed cost

$$\log \frac{F_i}{T_i} = a + \underbrace{\mathbf{Dem}_i}_{\text{Demolition}} + \underbrace{\mathbf{Soil}_i + \mathbf{Conn}_i + \mathbf{Surr}_i + b \log T_i}_{\text{Parcel situation}} + \underbrace{\mathbf{Reg}_i}_{\text{Regulation}} + \mathbf{Mun}_i + e_i$$

- **Demolition**: demolition cost (predicted oos from PRLN survey), height, construction date
- **Regulation is out-of-model**: refusal rates, architectural protection, zoning type
  - $\bar{h}_i$ is excluded. It already enters π_i, so including it would recover a mechanical link
- **Shapley** apportions the R^2 by averaging marginal contributions over all orderings of entry
  - Order-invariant. Splits shared variance symmetrically between correlated blocks
- Estimated on 530,436 non-vacant parcels with $F_i > 0$, trimmed at 1% and 99%
- Cluster bootstrap on municipalities, 500 replications

Demolition costs | Coefficients | Pre-conditions

Regulation makes fixed costs *differ*. It does not make them *large*

	Share of total variance (%)		
Component	With controls	Without controls	Within commune
Demolition	11.4 (1.0)	14.8 (1.3)	2.0 (0.2)
Ground condition	9.2 (1.5)	14.1 (2.1)	3.3 (1.0)
Grid connectivity	0.3 (0.6)	0.4 (0.8)	0.2 (0.3)
Built surroundings	9.7 (1.1)	12.5 (1.3)	1.0 (0.1)
Parcel size	0.4 (0.1)	0.6 (0.1)	0.0 (0.0)
Land-use regulation	14.9 (1.1)	20.6 (1.6)	9.8 (0.9)
Municipal (location)	24.4 (1.4)	–	–
Unexplained	29.7 (3.5)	37.0 (3.8)	83.6 (1.2)

- **Regulation** leads ahead of demolition alone
  - Ranking holds across the whole parameter band and every price specification
- **Parcel situation** is second and connectivity indistinguishable from zero
- **37.0%** is explained by nothing observable
  - Local political economy

Robustness

Counterfactuals

Two families of instruments, two margins

Acting on F_i

- $F_i = 0$: a **bound**, not a policy
- Subsidise **under-built** parcels within 1 km of Paris (38k parcels, 7% of stock)
- Subsidise **vacant and non-housing** parcels (10k parcels, 1.8%)
  - $s \in \{50, 100, 500, 1{,}000\}$ €/m^2, capped at F_i. The floor is the *Fonds Friches* rate.

Acting on $\bar{h}_i$

- **Remove the cap** entirely ($\bar{h}_i \to \infty$): a bound on any relaxation
- **Raise every** below-median municipality to the **metropolitan median FAR** of 1.9
  - The only implementable one of the three

All equilibria re-solved under the **same draws** of A_t. I report the partial-equilibrium shift and the general-equilibrium response separately.

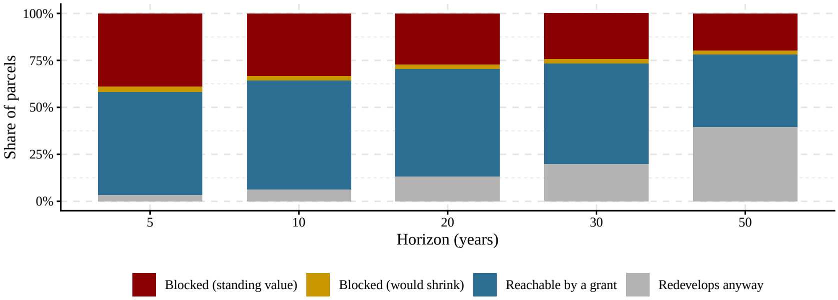
Fixed costs are the binding friction

Family	Scenario	ΔQ (GE)	ΔQ (PE)	ΔR	Projects	Net floor	Outlay
Fiscal	No fixed cost	104.1%	148.1%	-22.7%	193,331	282.59	–
	Underused, near Paris	2.3%	5.2%	-0.8%	-2,215	6.35	6,515
	Non-housing and vacant	2.3%	5.0%	-0.7%	-3,327	6.13	10,719
Regulatory	Density cap lifted	21.6%	61.3%	-6.5%	-35,478	58.74	–
	Below-median to median	9.9%	21.1%	-3.1%	-19,638	26.79	–

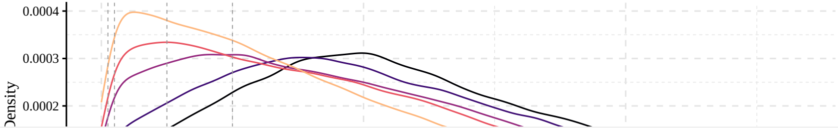
- Removing F_i raises supply by 104.1% and lowers rent by 22.7%
  The PE shift is 148.1%: about 30% is clawed back once the market re-clears
- Removing the density cap **entirely** closes only 41% of that gap
  - Equivalent to a uniform subsidy of 1,343 €/m^2
- The cap binds for 76.6% of parcels, so raising it leaves the rest untouched

282m square meters (/ 60 sqm) : 67 years of Région Île de France target of 70,000 new

How large a transfer would tip the median parcel?



- At twenty years: 13.4% redevelop anyway, 57.1% are **reachable**, 27.3% blocked by standing value, 2.2% by the cap.



Targeting on observables is expensive

- At 50 €/m^2 the under-built scheme converts 0.38% of targeted parcels; the non-residential scheme 0.67%.
  - Twentyfold escalation to 1,000 €/m^2 reaches 8.6% and 19.6%.
- **The inframarginal share is invariant to the subsidy**. Lowering $R_i^\star$ cannot stop a parcel from crossing.
  - At 50 €/m^2, 95.7% of the outlay goes to parcels that would have redeveloped anyway.
- **Targetting** the parcels **most likely to redevelop** is not efficient
  - It maximises the transfer and minimises the causal effect
  - The model helps screening the relevant parcels

Conclusion

Conclusion

- Where cities grow inward, the binding constraint is the **cost of clearing the site**, not the permitted envelope
  - Removing F_i: $+104.1\%$ supply. Removing the cap entirely: 41% of that
- Regulation still matters explains only 21% of variance
- Calls for policy actions on fixed costs!
- **Next steps**:
  - **Fiscal incidence**: optimal subsidy under budget constraint and tax revenues
  - Counterfactuals on the **option value** itself: preferred-rate credit, uncertainty reduction
  - Rent control and social housing mandates
  - Estimate ζ directly on multi-family projects

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Appendix

Demolition costs, measured

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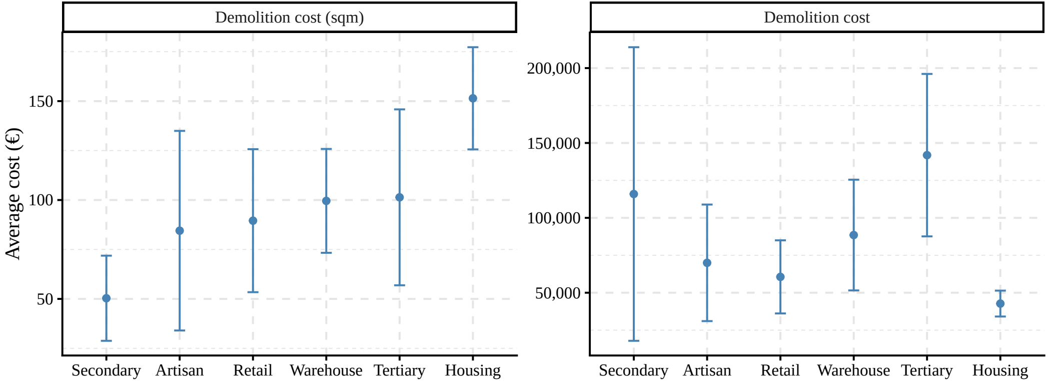

Demolition costs by project size

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	Demolition cost
	(1)
Authorised floorspace	31.3*
	(16.3)
Number of dwellings	-1,081.5
	(1,005.1)
Observations	341
R^2	0.330
Year fixed effects	✓
Region fixed effects	✓

Developer concentration in land acquisition

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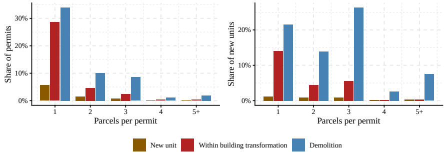
Statistic	Sample: All	Sample: With dev.	Sample: Dev. & large (≥5)
Municipal			
Active developers	101	35	25
HHI	2.00	5.79	7.44
CR4	18.6%	35.9%	42.3%
Effective devs.	50.0	17.3	13.4
Department			
Active developers	4,784	1,360	916
HHI	0.15	0.60	0.85
CR4	5.5%	11.4%	13.8%
Effective devs.	661.2	171.5	120.5
Regional			
Active developers	16,810	4,249	2,789
HHI	0.07	0.30	0.43
CR4	3.4%	7.2%	8.7%
Effective devs.	1452.2	332.8	233.4

Level	Share of aggregate stock: Median	P99	Max	Share of aggregate flow: Median	P99	Max
Municipal	1.35%	6.19%	11.83%	14.60%	74.91%	76.91%
Department	0.10%	0.12%	0.12%	0.98%	2.09%	2.12%
Regional	0.02%	0.02%	0.02%	0.29%	0.29%	0.29%



- Concentration is local and dissolves with aggregation: CR4 falls from 35.9% to 7.2%.
- Atomistic on the stock, not on a given parcel.

Land assembly: a bundling premium, no hold-out escalation

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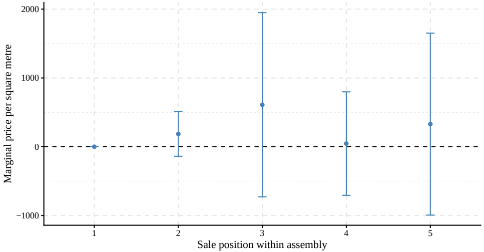
	(1)	(2)	(3)	(4)	(5)
Naive assembly	235.787**	234.827**	219.760**	229.435**	204.484**
	(98.821)	(98.988)	(90.048)	(88.396)	(87.811)
Sequential assembly	-3.618	2.601	83.677	102.256	73.244
	(114.670)	(114.537)	(98.702)	(96.897)	(101.757)
Year FE	✓	✓	✓	✓	✓
Municipality FE	✓	✓	✓	✓	✓
Built area		✓	✓	✓	✓
Seller			✓	✓	✓
Buyer				✓	✓
Parcel count					✓
Mean Dep. Var	1,984€	1,984€	1,984€	1,984€	1,984€
Observations	9,482	9,482	9,482	9,482	9,482
R^2	0.533	0.534	0.547	0.554	0.554



Time-to-build wedges

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					Effect on		
Use of origin	ℓ_u	λ_u^C	λ_u^R	κ_u	$\Delta\pi$	Δh^*	ΔR^*
Housing	2.00	0.9377	0.9139	0.9746	-11.3%	-3.0%	5.7%
Mixed	2.25	0.9303	0.9037	0.9714	-12.6%	-3.3%	6.4%
Non-housing	2.25	0.9303	0.9037	0.9714	-12.6%	-3.3%	6.4%
Vacant	1.75	0.9452	0.9243	0.9778	-10.0%	-2.6%	5.0%

- κ_u is far closer to one than λ_u^R: spreading the spend offsets most of the delay.
- Housing parcels: payoff -11.3%, density -3.0%, trigger $+5.7\%$.
- Second-order at parcel level. First-order in the aggregate, through the delivery lag.

The bargaining weight and its floor

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Use of origin	N	θ_i Median	p75	p95
Housing	344,803	-0.261	0.068	0.370
Mixed	47,898	-0.319	0.135	0.389
Non-housing	6,873	0.201	0.321	0.508
Vacant	1,600	0.372	0.464	0.624

- $\theta_i = (p_i^L - V_i^w)/(\pi_i - V_i^w)$ is computable without knowing F_i.
- Any θ below the 95th percentile implies more than 5% of parcels with a negative fixed cost.
- The floor is $\theta \geq 0.38$. Adopted value: 1.00.

Robustness to the two frictions

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Regime split: where the density cap binds

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		Share of parcels		
Use	Dept.	N	Interior share	$\Pr(\pi < 0)$
Housing	75	10,140	98.9%	0.19%
	92	95,953	26.6%	0.02%
	93	157,056	17.4%	0.01%
	94	136,295	16.2%	0.02%
Mixed	75	55,189	99.6%	0.05%
	92	28,575	66.8%	0.12%
	93	26,182	54.0%	0.32%
	94	24,582	48.4%	0.07%
Non-housing	75	1,472	86.0%	9.71%
	92	2,209	63.2%	3.67%
	93	2,613	48.2%	2.95%
	94	2,094	41.5%	1.77%
Vacant	75	42	85.7%	11.90%
	92	541	28.8%	1.11%
	93	672	22.8%	0.15%
	94	359	21.2%	0.56%

Elasticities and fixed costs in space

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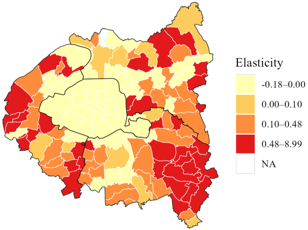
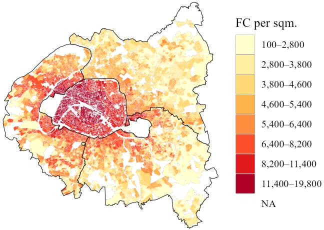
Municipal supply elasticity



Fixed cost per m^2, cadastral section



Fixed cost decomposition: coefficients

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	log(Fixed cost per sqm)					
	Disaggregated			Predicted cost		+ FE
	(1)	(2)	(3)	(4)	(5)	(6)
notationCE	0.046	0.045	0.019	0.051	0.020	-0.117**
	(0.080)	(0.077)	(0.068)	(0.078)	(0.068)	(0.056)
notatione2Cr-BE	0.271***	0.251***	0.224***	0.265***	0.229***	0.171
	(0.080)	(0.076)	(0.080)	(0.080)	(0.081)	(0.146)
notatione4AM	0.282***	0.278***	0.244***	0.272***	0.238***	0.108
	(0.100)	(0.097)	(0.084)	(0.101)	(0.085)	(0.104)
notatione4AP	0.058	0.060	0.047	0.064	0.050	-0.083
	(0.114)	(0.106)	(0.093)	(0.110)	(0.095)	(0.060)
notatione4GS	0.322***	0.304***	0.249***	0.313***	0.250***	0.004
	(0.082)	(0.079)	(0.073)	(0.081)	(0.073)	(0.063)
notatione4SC-AH	0.304***	0.286***	0.232**	0.289***	0.231**	-0.008
	(0.084)	(0.092)	(0.099)	(0.082)	(0.092)	(0.058)
notatione5CG	0.086	0.090	0.078	0.090	0.077	-0.017
	(0.077)	(0.075)	(0.062)	(0.075)	(0.061)	(0.052)
notatione5MC	0.104	0.095	0.071	0.107	0.076	-0.068
	(0.087)	(0.083)	(0.071)	(0.085)	(0.071)	(0.057)
notatione6-7MGC	0.017	0.016	0.024	0.022	0.027	-0.084
	(0.076)	(0.074)	(0.067)	(0.075)	(0.066)	(0.056)
notatione6CSO	0.004	0.010	0.011	0.011	0.012	-0.089
	(0.079)	(0.077)	(0.067)	(0.077)	(0.066)	(0.058)
notatione6SB-A	0.064	0.057	0.054	0.066	0.059	-0.069
	(0.078)	(0.075)	(0.064)	(0.077)	(0.064)	(0.054)
notatione6SM	0.129	0.121	0.105	0.131	0.109	-0.027
	(0.084)	(0.081)	(0.070)	(0.083)	(0.070)	(0.063)
notatione7C	0.118	0.106	0.056	0.134	0.068	-0.193
	(0.274)	(0.272)	(0.284)	(0.274)	(0.286)	(0.186)
notatione7CCh-MP	-0.082	-0.078	-0.073	-0.073	-0.070	-0.082
	(0.110)	(0.109)	(0.109)	(0.110)	(0.109)	(0.064)
notatione7G	-0.001	-0.001	-0.002	0.005	0.001	-0.122**

Pre-conditions: orthogonality and separability

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- **Orthogonality**. Regressing F_i/T_i on parcel area and the density cap gives an adjusted R^2 of 2%.
  - Correlation with area is essentially zero; with the cap, 0.098.
- **Separability**. The demolition-by-regulation interaction is rejected ($p = 0.003$), as is the omnibus test ($p = 0.001$).
  - It fails by a negligible margin: interactions raise R^2 by 0.0046 on half a million observations.
- **Normalisation**. F_i is taken per m^2 so the decomposition recovers economic content, not parcel size. Scale ends up at 0.6%.

Shapley shares: parameter band and price specification

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Component	Share of total variance (%), [min, max] With controls	Without controls
Demolition	[8.8, 10.4]	[11.3, 13.8]
Parcel characteristics	[14.2, 17.6]	[19.7, 26.2]
Land-use regulation	[11.8, 17.2]	[17.5, 24.3]
Municipal (location)	[19.4, 26.8]	–
Unexplained	[28.0, 45.9]	[35.7, 51.5]

Component	Share of total variance (%), [min, max] With controls	Without controls
Demolition	[10.3, 13.6]	[13.7, 17.6]
Parcel characteristics	[16.8, 17.5]	[24.6, 25.8]
Land-use regulation	[14.5, 16.3]	[20.7, 23.3]
Municipal (location)	[24.4, 26.2]	–
Unexplained	[29.5, 30.7]	[37.0, 37.5]

- Regulation 18–24 %, demolition 11–14 %. The intervals never meet.
- Unexplained share moves 36 –51 % across parameters but only 37–37 % across price specifications.

Partial and general equilibrium paths

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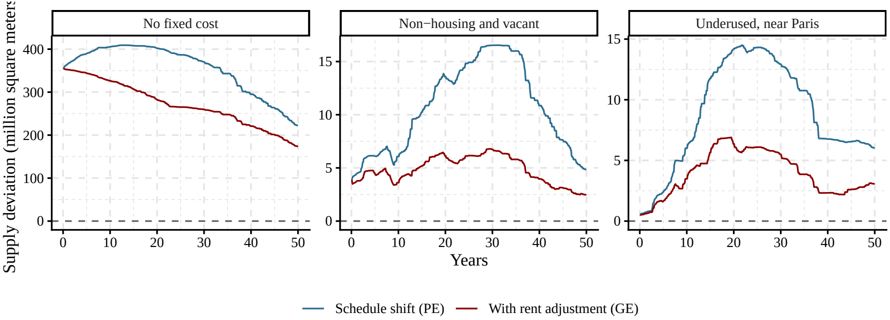

- The schedule shift peaks early and declines: the baseline rent eventually does the work by itself
- Argues for a **front-loaded** rather than a permanent instrument

Take-up, conversion, and the inframarginal outlay

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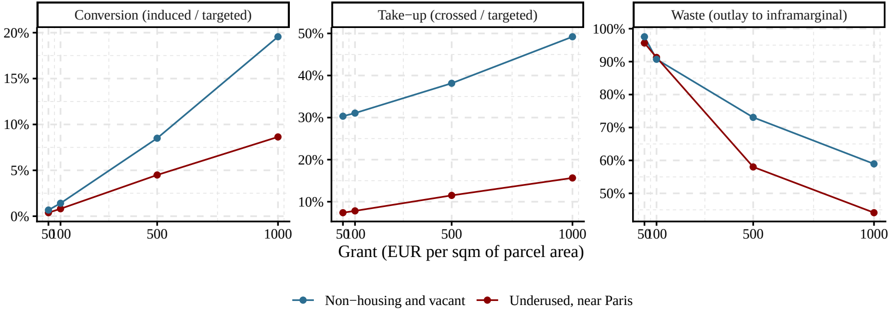

The infeasible budget frontier

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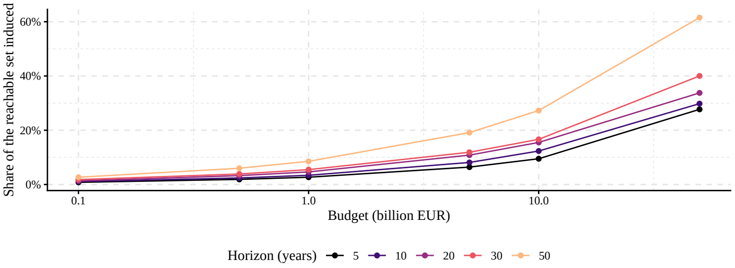

	Reachable set					1bn EUR budget	
Horizon	Reachable	Share	Median $s_{\min}$	$\leq$ 500/sqm	$\leq c_0$	Induced (1bn)	Cost/induced (k)
5	297,469	54.7%	2,309	5.5%	18.7%	7,981	123
10	315,016	57.9%	2,104	8.0%	24.3%	10,697	93
20	310,701	57.1%	1,839	12.7%	32.7%	14,403	68
30	289,833	53.3%	1,714	15.4%	36.1%	15,884	63
50	208,923	38.4%	1,482	19.0%	41.7%	17,826	56

Relaxing the density cap barely moves the stock

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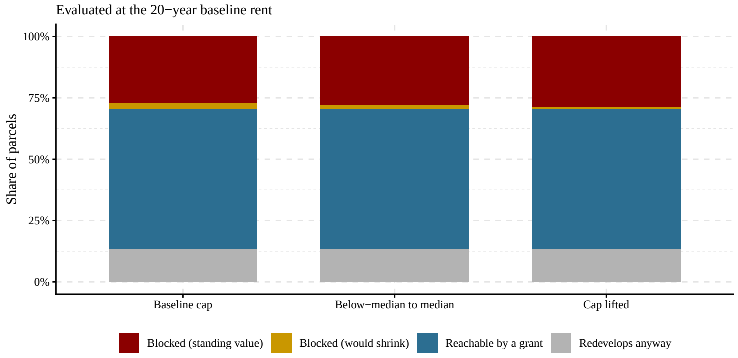

- Lifting the cap entirely removes two-thirds of cap-blocked parcels, from 12,032to 3,681
- For 93 % of those remaining, the unconstrained optimum is *smaller* than the standing structure

Construction time: formal tests

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	Annex	Mixed	Multi	New unit	No unit	Secondary	Single
Mixed	0.383						
Multi	0.620	0.058*					
New unit	0.258	<0.001***	0.602				
No unit	0.804	0.089*	0.316	0.003***			
Secondary	0.038**	0.051*	0.010**	<0.001***	0.020**		
Single	0.634	<0.001***	0.804	0.089*	0.049**	0.003***	
Tertiary	<0.001***	<0.001***	<0.001***	<0.001***	<0.001***	0.708	<0.001***
Kruskal–Wallis: $\chi^2 = 118.7$, df $= 7$, $p < 2.2 \times 10^{-16}$							

- Kruskal–Wallis rejects equal durations across uses of origin ($\chi^2 = 118.7$, df $= 7$, $p < 2.2 \times 10^{-16}$)

Permits creating housing versus non-housing

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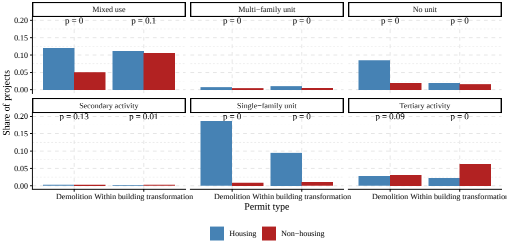

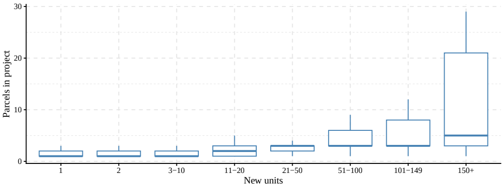

- 79% of permits involving a demolition supply housing, against 56% of permits without
- The median project above 150 units requires 5 parcels

Price prediction: hold-out fit and rent validation

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