

# Spillovers of Subsidized Housing Programs: Evidence from South Africa

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  - ▶ Weak incentives to invest in housing/public goods
- ▶ **Public Housing Provision** → primary government response

# What do we know?

## ① Direct Recipient Impacts

- ▶ Health, Well-Being:  
Cattaneo et al. [2009], Galiani et al. [2017]
- ▶ Employment, Income:  
Barnhardt et al. [2015], Picarelli [2017], Franklin [2018]

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## ② Indirect Recipient Impacts

- ▶ Amenity value to neighboring residents:  
Diamond & McQuade [2016], Baum-Snow & Marion [2008]
- ▶ Informal housing possibilities / indirect access to provided services.

# Introduction

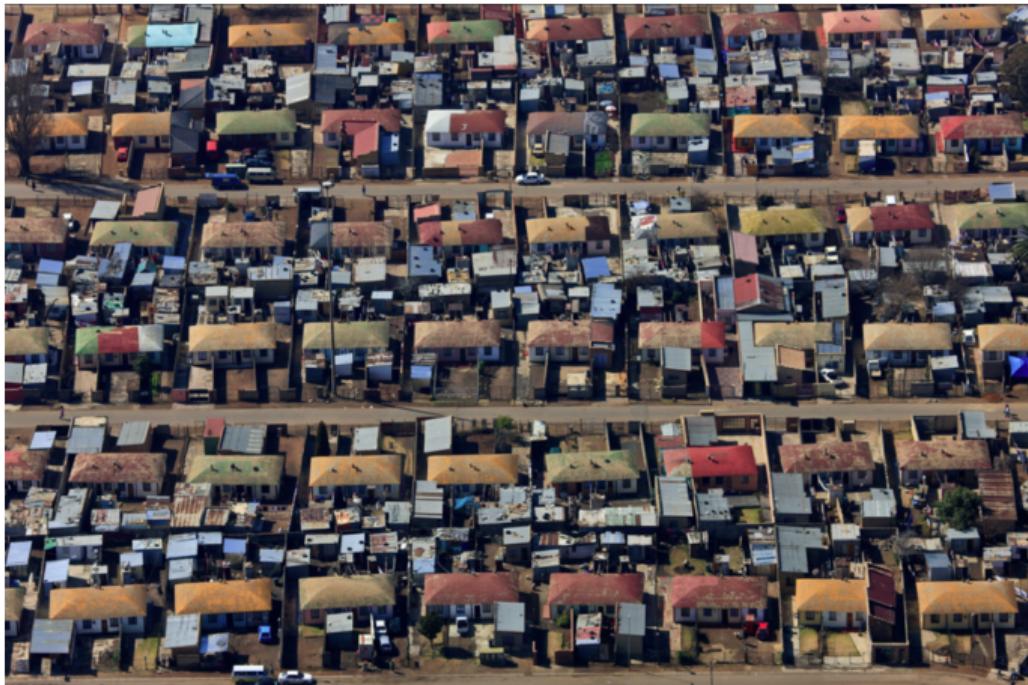


Figure: Public Housing with Backyard Shacks in Soweto

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## ▶ **Data and Setting:**

57 public housing projects in Gauteng province combined with GPS property transactions, building-based land information, and census data.

## Preview of Findings

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- ② Slum growth twice as large inside and in vicinity of projects, compared with more distant locations.
- ③ Share of households with direct access to water and sanitation improves within project areas, but decreases in vicinity.

## Background

# Public Housing in South Africa

- ▶ Large national subsidy scheme providing housing opportunities to eligible households.
- ▶ 3 million houses delivered since program inception in 1994.
  - ▶ free-standing, single-story, two-bedrooms, 30-40m<sup>2</sup> dwellings
- ▶ Annual expenditure of 6bn Rands (US\$500M).
- ▶ Supply planned by municipal and provincial housing agencies, project construction outsourced to private developers.
- ▶ Constraints on costs per unit, services access, and rooms/lot sizes.

# Who gets a house?

## ► **Official Policy:**

- ▶ Must be eligible: South African Citizen, Married or with dependents, Monthly income < R3,500
- ▶ National/provincial waiting lists
- ▶ No resale within 7 years

# Who gets a house?

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- ▶ **In Practice:**

- ▶ Wait-lists and eligibility weakly enforced (corruption).
- ▶ 20% of houses occupied not occupied by initial owners after 5 years.
- ▶ More than a third have backyard shacks after 2 or less years.

# Where are these houses built?

- ① **Greenfield projects** on undeveloped land near slums.
- ② **In-Situ upgrading** replacing existing slums.



- ▶ Projects are fully serviced (roads, water, sanitation, electricity)

# Data

## Data Sources

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- ▶ Four main data sources:
  - ① **Property Transactions**
  - ② **Building-Based Land Use**
  - ③ **Population Census**
  - ④ **Additional Administrative Data**

## Property Transactions

- ▶ Sourced from South African deeds registry.
- ▶ Universe of formal housing transactions recorded during 2001-2011 in affordable areas. (460K transactions)
- ▶ Exact geographic location of traded property, but limited information on characteristics other than price and lot size.
- ▶ Includes buyer and seller name.

## Building Based Land-Use

- ▶ Exhaustive hand-coded building identification from aerial imagery.
- ▶ 2 cross-sections: 2001 and 2012.
- ▶ Building type differentiated by category: residential, commercial, industrial, etc.
- ▶ Within residential, ability to differentiate formal from informal housing, including backyard shacks.
- ▶ High Correlation ( $>80\%$ ) with reported dwelling type from census data at coarser spatial resolution.

# Other Data Sources

## Census Data

- ▶ Full coverage from 2001 and 2011 censuses at the individual and household level.
- ▶ Smallest identifiable geography is *census small area*.
  - ▶ 11,000 small areas in 2001, 17,000 in 2011.
  - ▶ average of 170 household per small area.

## Administrative Data Sources

- ▶ Data on location of government housing initiatives as of 2008.
  - ▶ Includes planned but unconstructed projects.
- ▶ Annual Budget Reports from National Treasury.

# Identifying Housing Projects

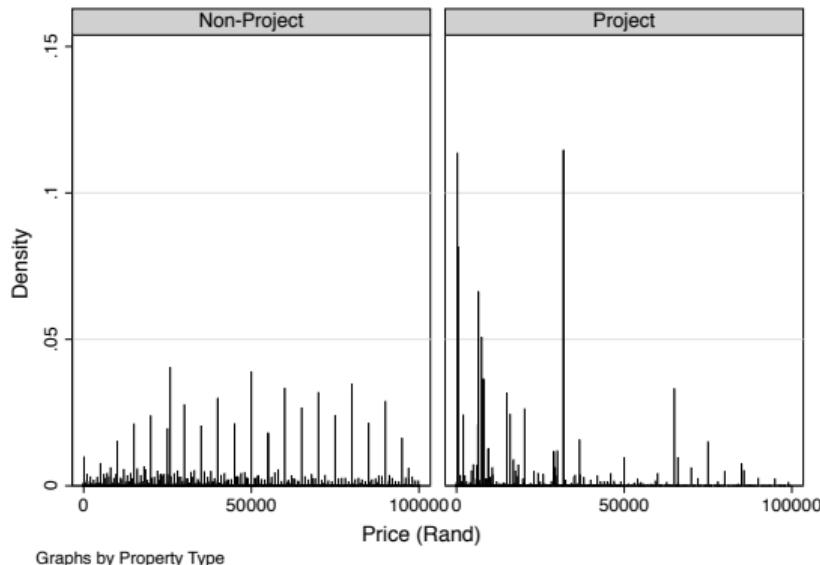
- ① **Filter on Seller Identity:** Match governments and housing authorities from seller-names in transactions.

Figure: Top 5 Seller Names

Seller Name	Observations
City Of Johannesburg Metropolitan Municipality	29,087
City Of Johannesburg	27,672
City Of Tshwane Metropolitan Municipality	24,780
Ekurhuleni Metropolitan Municipality	21,758
Gauteng Provincial Housing Advisory Board	13,058
Total Observations	549,704

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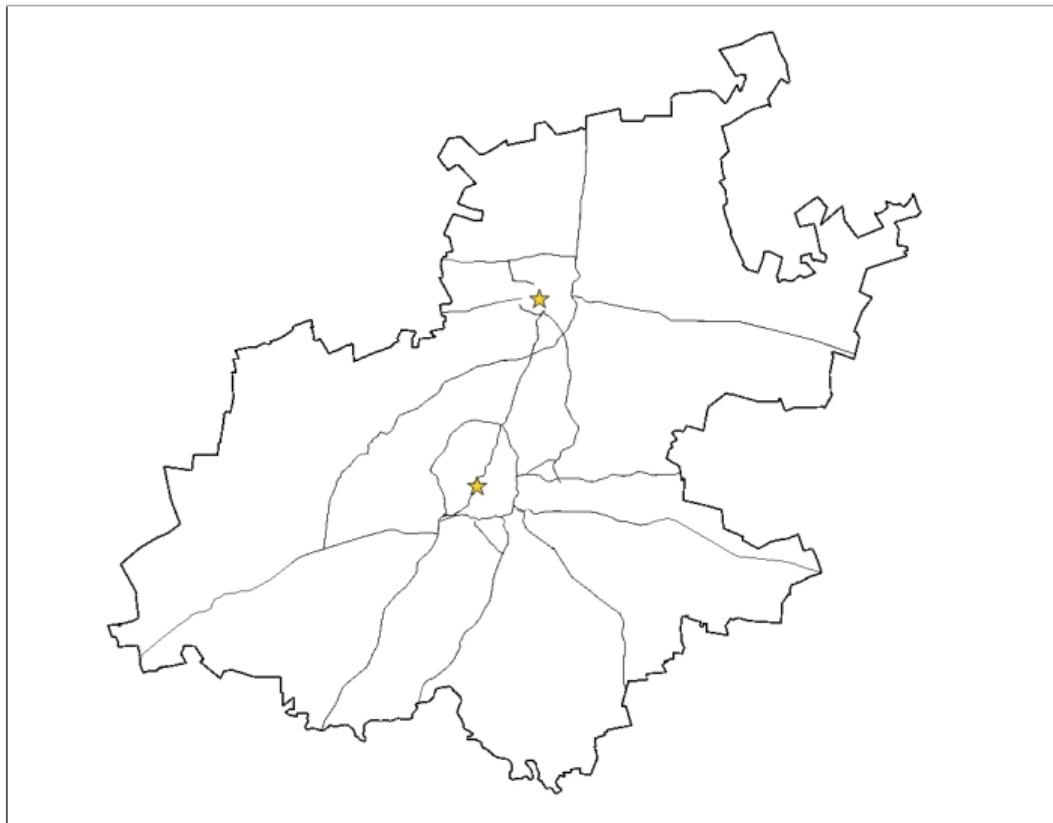
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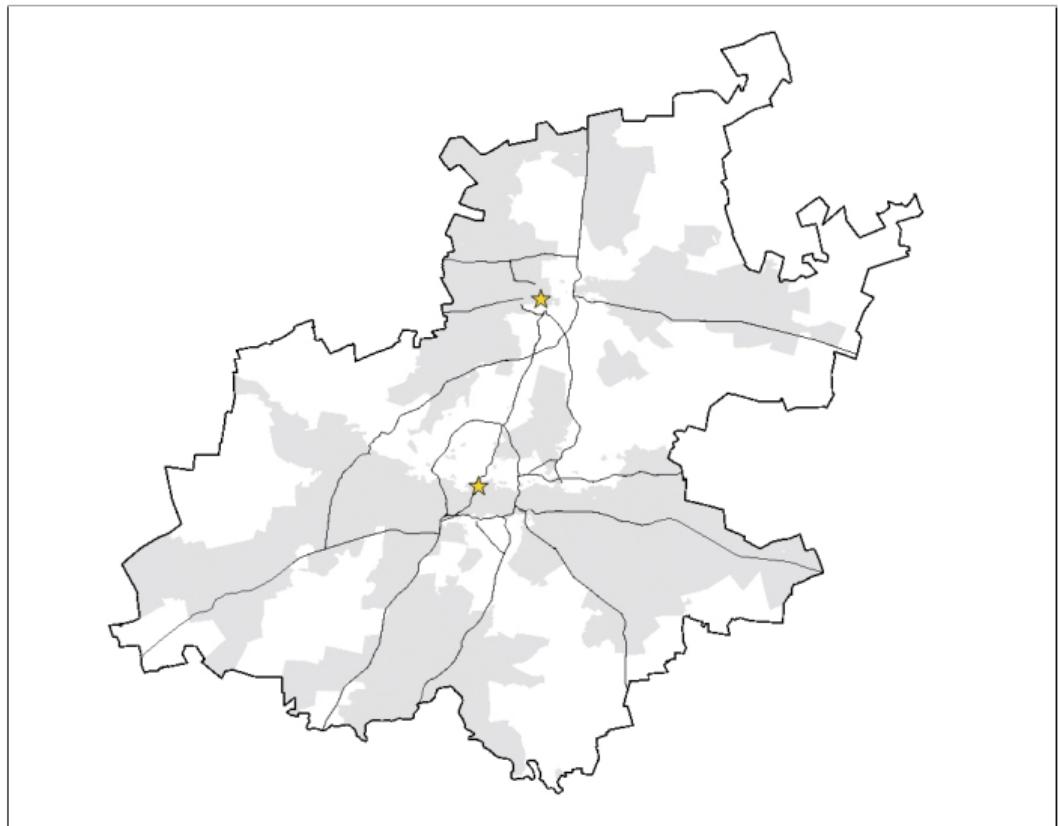
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  - ▶ Overlaps well with completed projects from admin. data

## Census Areas Exposure Measures

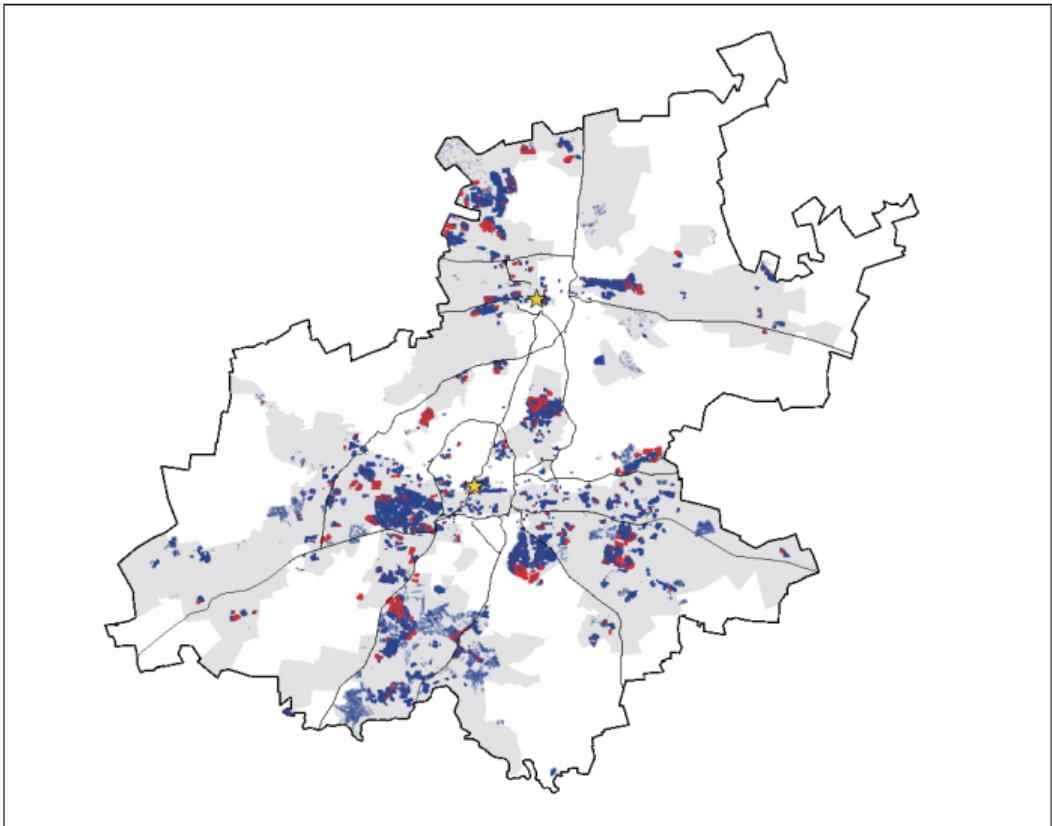


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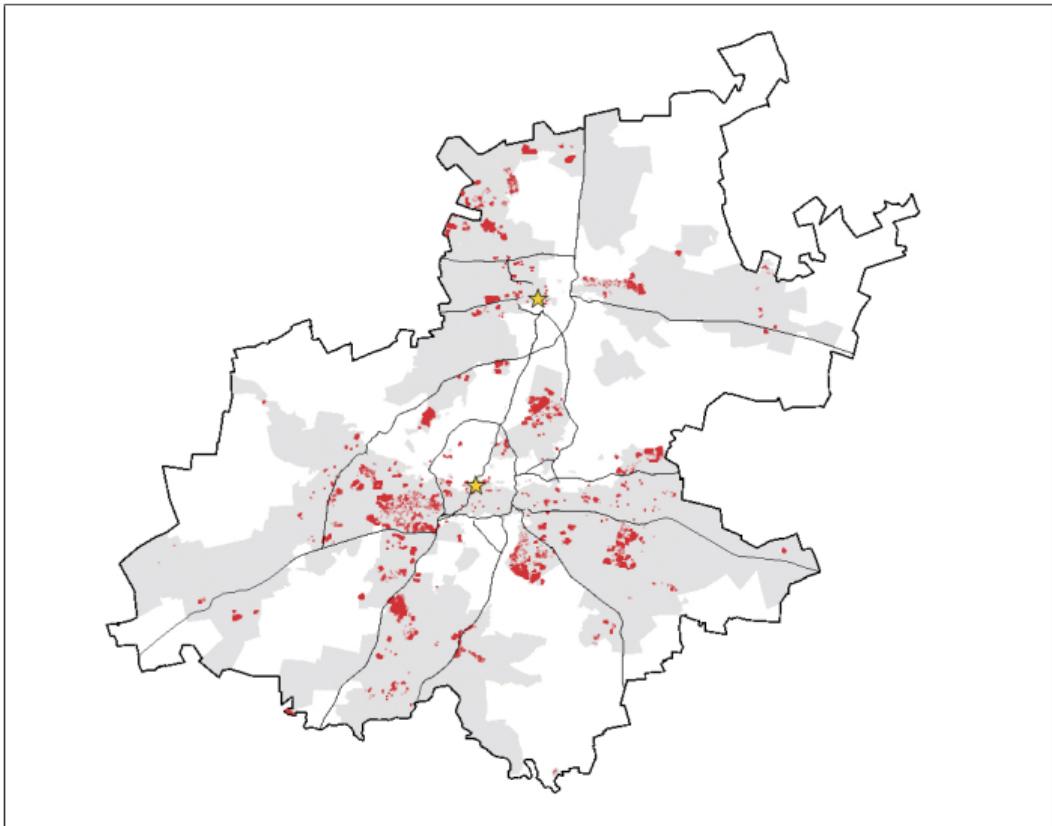
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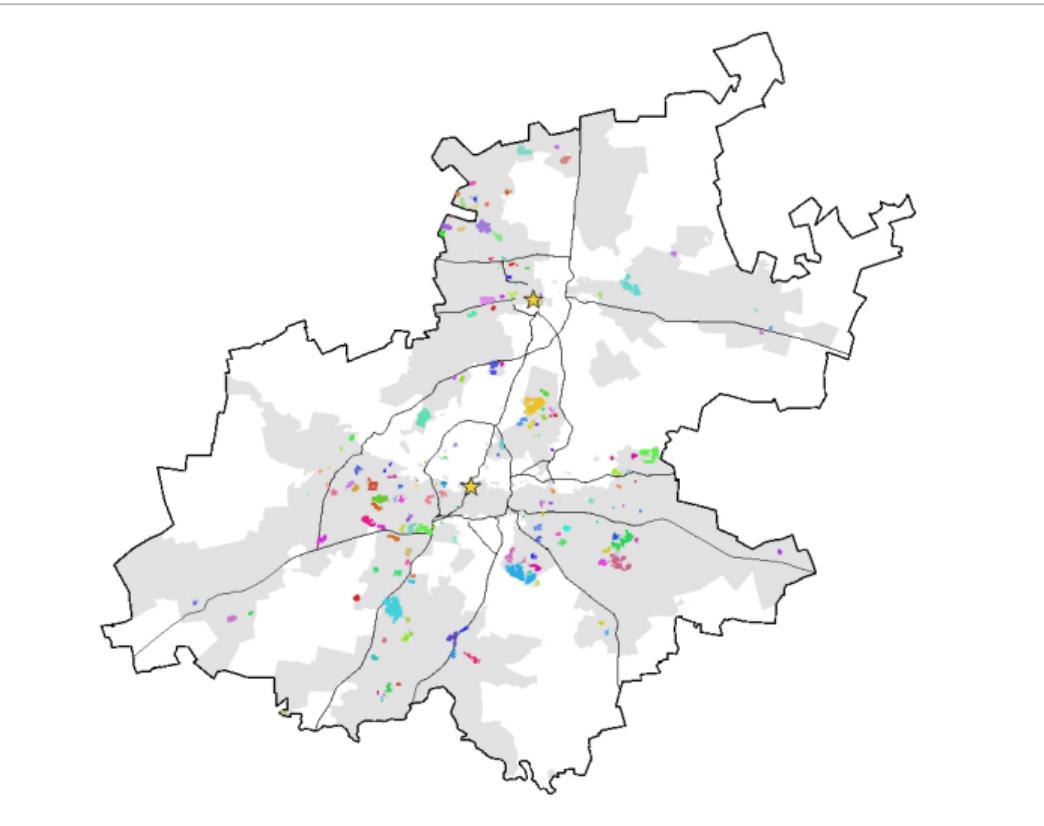
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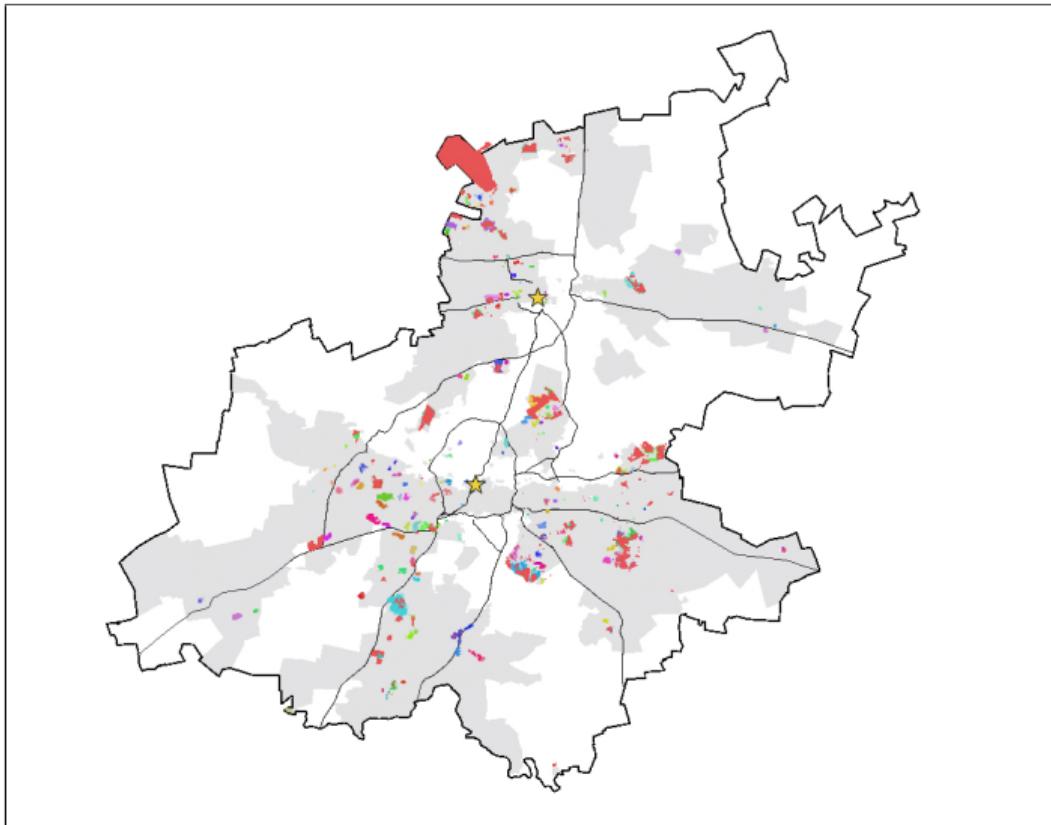
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# Identifying Planned but Unconstructed Projects

- ① Admin. data have “planned,” “proposed,” “implementing” projects
  - ▶ Exclude projects with identified project transactions
- ② Assign projects an expected completion date
  - ▶ Fuzzy-string match budget data (with start-dates) on project names
  - ▶ Add avg. diff. between transaction-date and start-date for completed projects
- ▶ Why are projects canceled/delayed?
  - ▶ Legal disputes, service delivery backlogs, funding complications
  - ▶ Delays often exceed 12 years

# Housing Projects

Table: Housing Projects and Building Growth

	Completed	Uncompleted
Formal Density: 2001	338.3	238.9
Formal Density: 2011	1,718.4	691.6
Informal Density: 2001	435.2	2,125.8
Informal Density: 2011	1,022.9	2,950.4
Median Year (est.)	2005	2007
Distance to CBD (km)	29.7	29.8
Total Projects	57	64

Density is building number per square kilometer.

# Housing Price Descriptives

Table: Price Descriptives

	Completed	Uncompleted	Other
Purchase Price (Rand)	249,739.8 [1436396.3]	195,237.4 [605,346.6]	249,334.9 [304,547.1]
Plot Size (m3)	863.3 [34,095.1]	743.1 [5,112.2]	1,972.1 [57,208.8]
Sold At Least Once	0.327	0.328	0.336
Median Purchase Year	2006	2006	2006
Observations	29,104	30,552	157,692

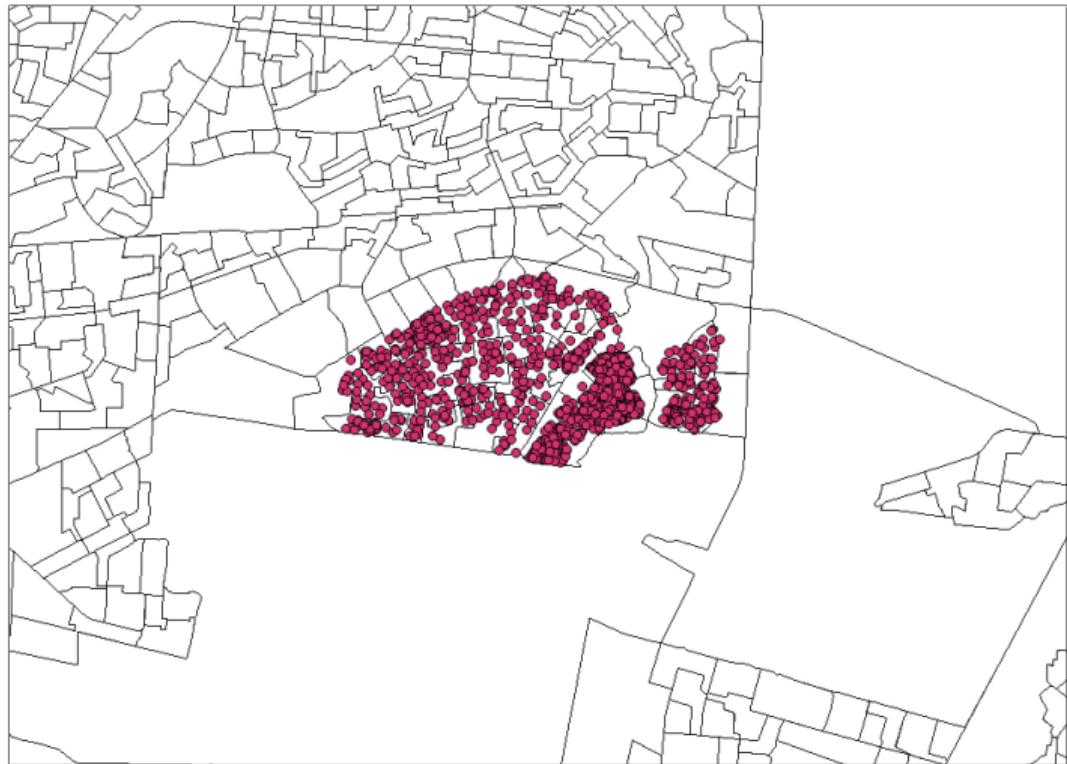
# Census Descriptives

	In Buffer but No Overlap		0% < Overlap ≤ 50%		50% < Overlap	
	Completed	Uncompleted	Completed	Uncompleted	Completed	Uncompleted
Flush Toilet: 2001	0.78	0.84	0.74	0.66	0.69	0.16
Flush Toilet: 2011	0.79	0.90	0.86	0.74	0.93	0.23
Piped Water: 2001	0.39	0.36	0.38	0.31	0.23	0.09
Piped Water: 2011	0.52	0.54	0.57	0.47	0.52	0.17
Owner: 2001	0.48	0.52	0.51	0.41	0.44	0.39
Owner: 2011	0.73	0.78	0.76	0.63	0.73	0.56
House: 2001	0.50	0.56	0.52	0.41	0.35	0.32
House: 2011	0.52	0.63	0.61	0.54	0.64	0.32
Rooms: 2001	3.30	3.39	3.16	3.14	2.85	3.01
Rooms: 2011	3.44	3.57	3.49	3.49	3.32	3.12
Observations	1,196,080	996,443	356,975	131,708	567,633	225,675

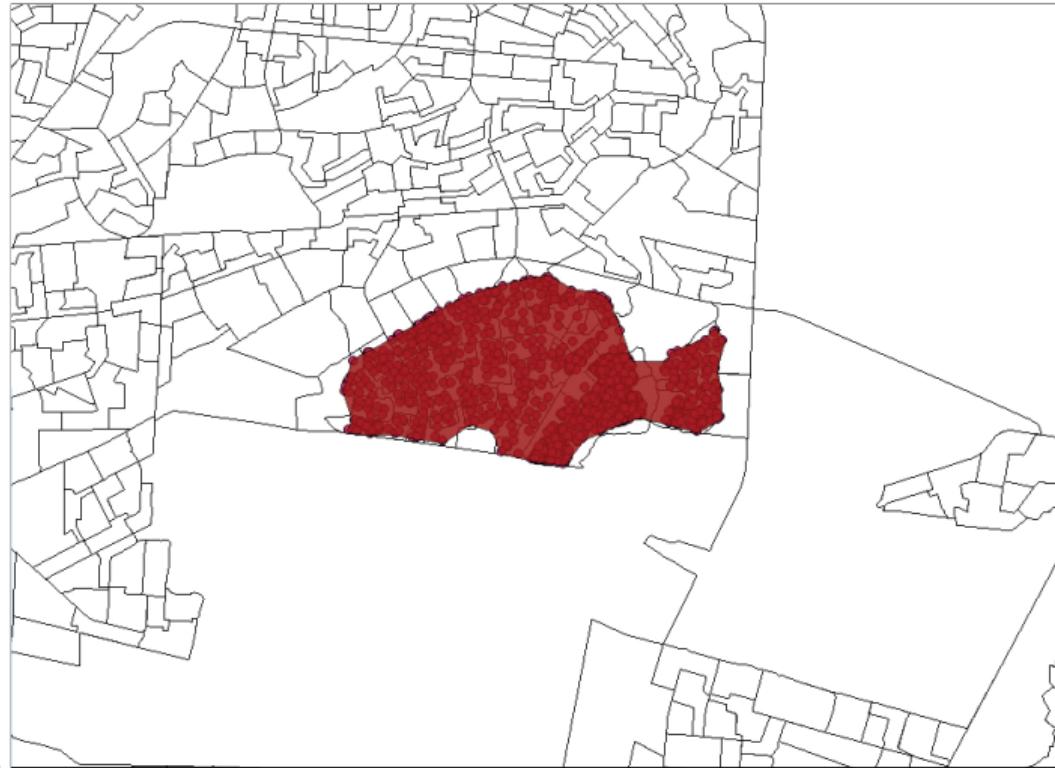
## Census Descriptives

	Within Project (>30% Overlap)		Outside Project (<30% Overlap)	
	Completed	Uncompleted	Completed	Uncompleted
Flush Toilet	0.56	0.14	0.77	0.81
Piped Water	0.21	0.06	0.42	0.36
Elec. Cooking	0.58	0.19	0.68	0.67
Elec. Light	0.79	0.33	0.74	0.82
Single House	0.51	0.48	0.53	0.59
Observations	59,460	48,065	213,809	205,744

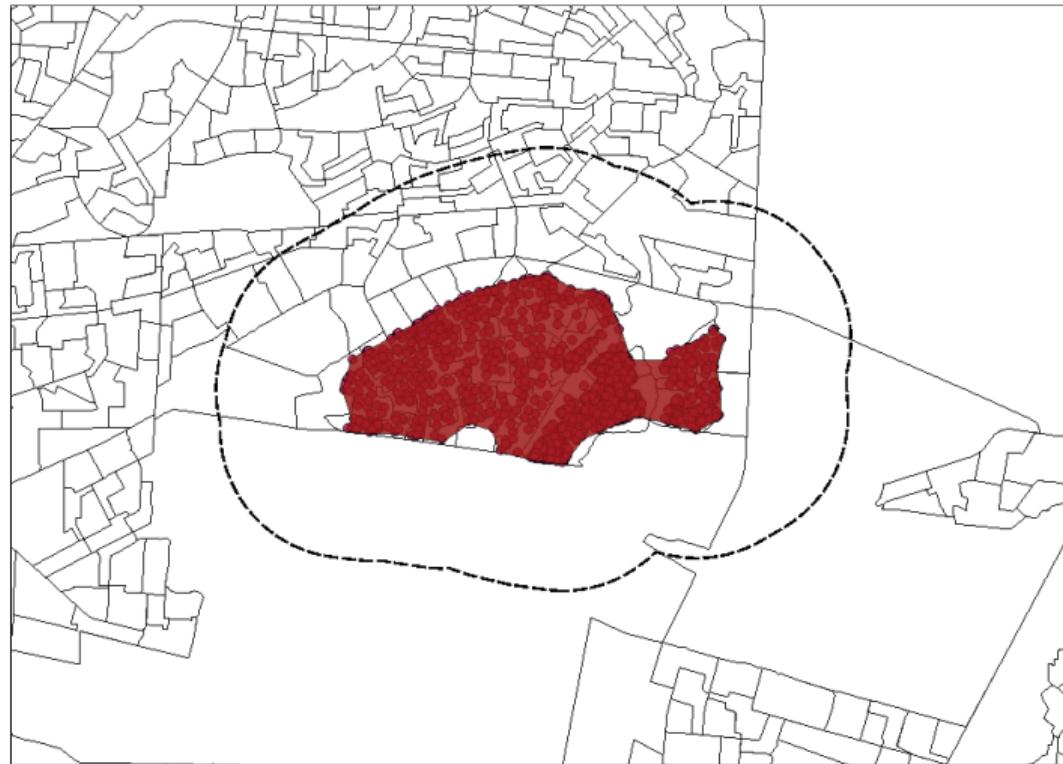
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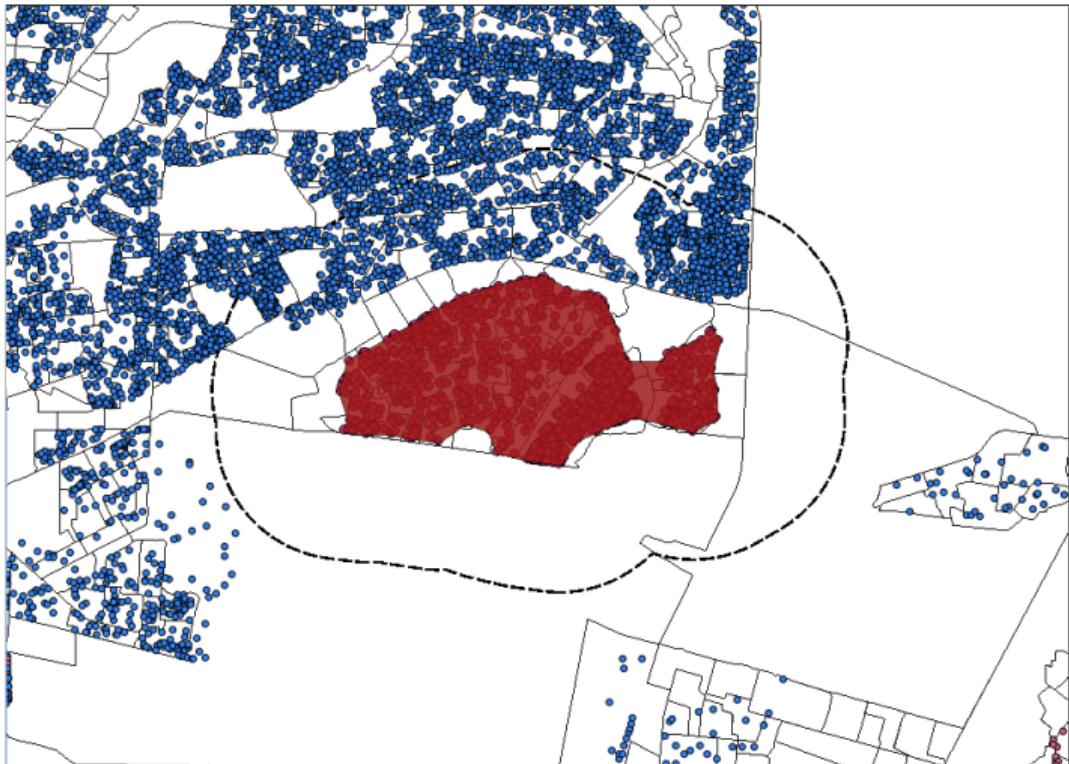
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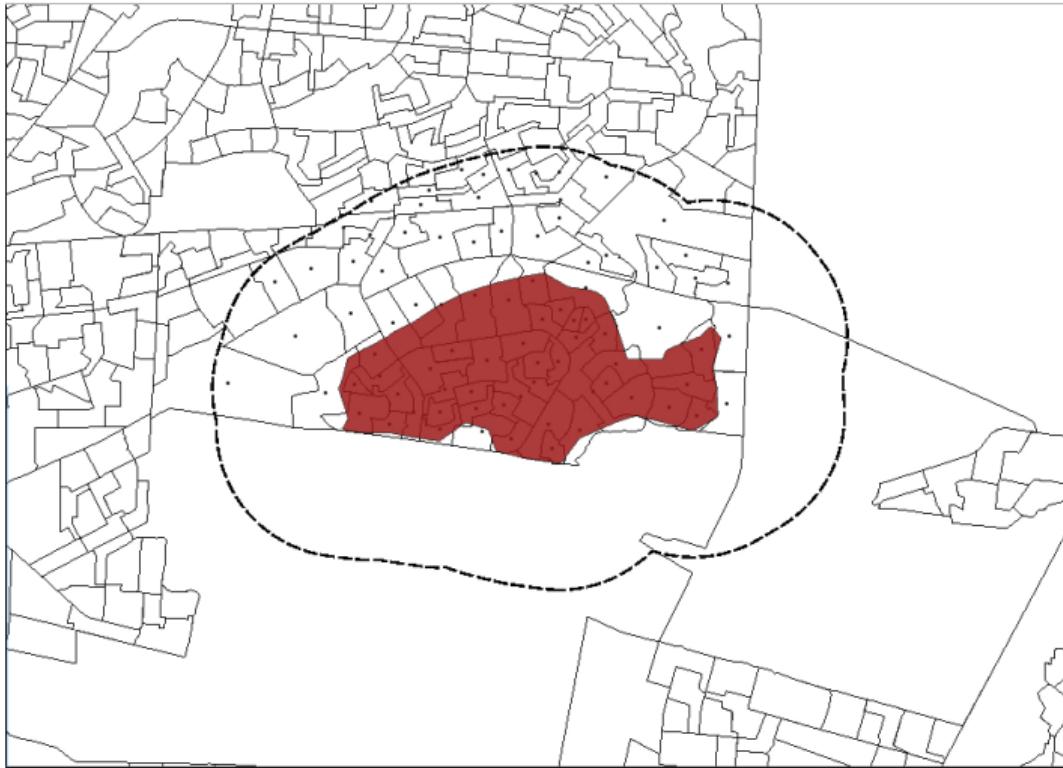
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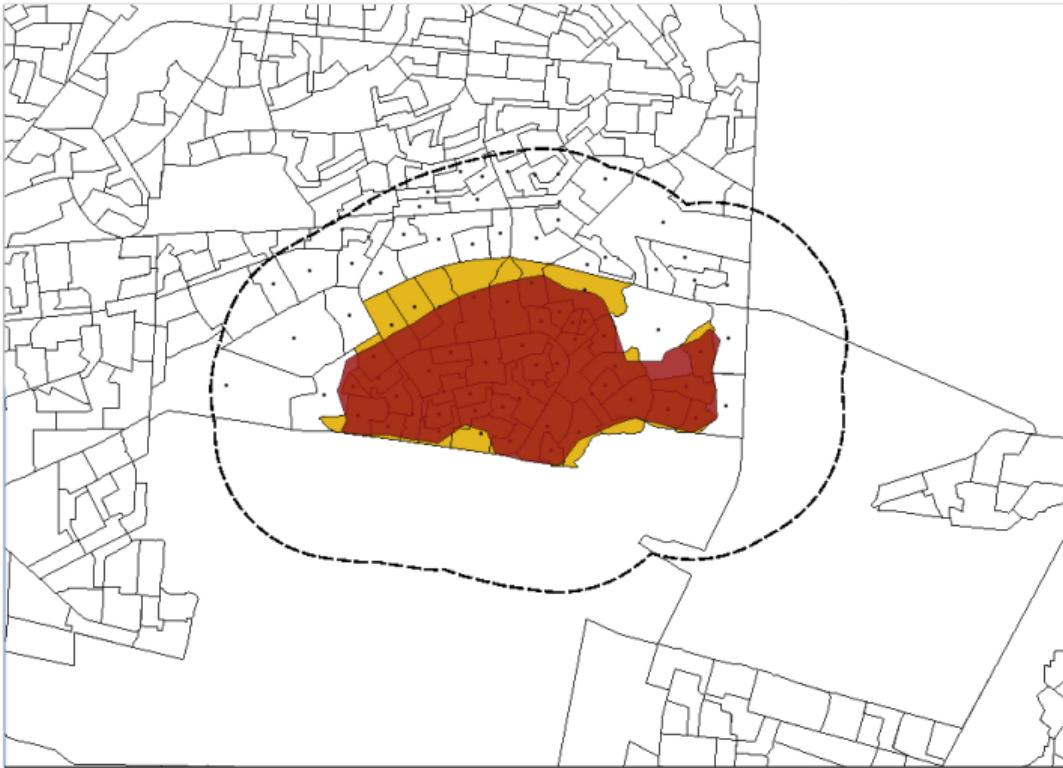
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# Empirical Methodology

DID model:

$$P_{itp} = \alpha D_{tp} T_{ip} + \theta_1 D_{tp} + \theta_2 T_{ip} + X_i' \beta + \lambda_p + \eta_t + \varepsilon_{itp},$$

with:

- ▶  $P_{itp}$ : log-price of property  $i$  sold at time  $t$ , in vicinity of project  $p$ .
- ▶  $D_{tp} = 1$  if date  $t$  is after modal construction month.
- ▶  $T_{ip} = 1$  if property  $i$  within 400m of project border.
- ▶  $X_i$ : quadratic in lot size of property  $i$ .
- ▶  $\lambda_p$ : project fixed-effect.
- ▶  $\eta_t$ : time (year  $\times$  month) fixed-effect.
- ▶  $\varepsilon_{itp}$ : error term

# Empirical Methodology

Identification:

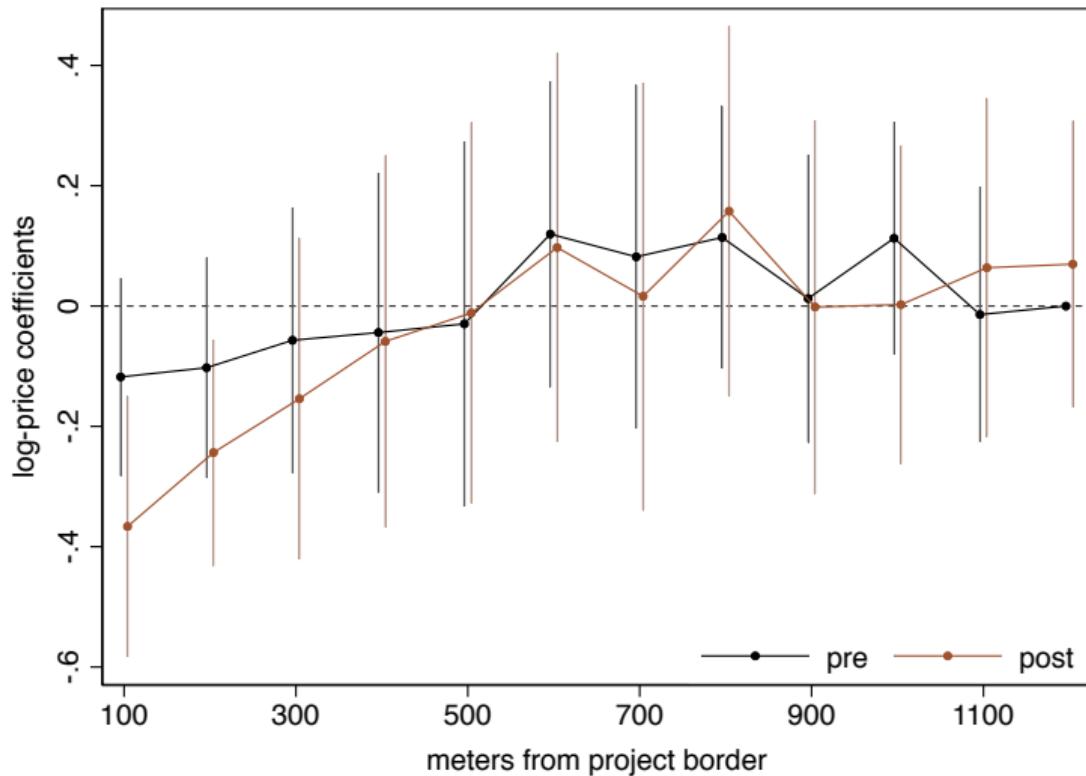
$$E[\varepsilon_{itp}|X_i, T_{ip}, D_{tp}, \lambda_p, \eta_t] = 0$$

- ▶ Identify off “sharp” amenity changes created by calming projects
- ▶ Use within group variation to limit OVB - assuming that control and treatment houses are exposed to same unobservable shocks.

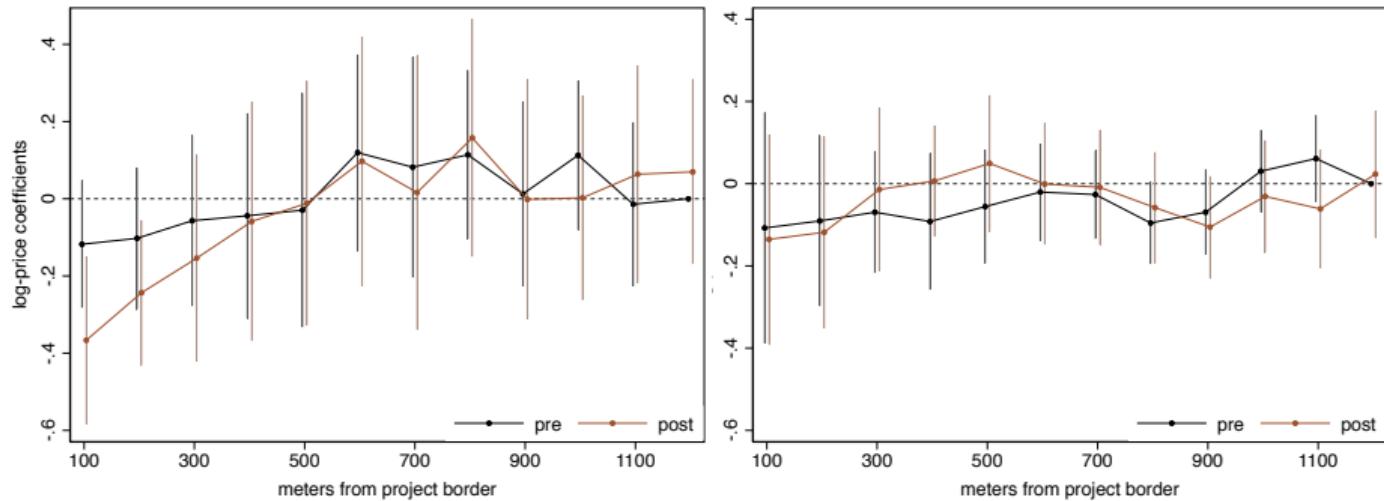
Concerns:

- ▶ negative/positive spillovers - not clear that control transactions are not affected.
- ▶ sorting.

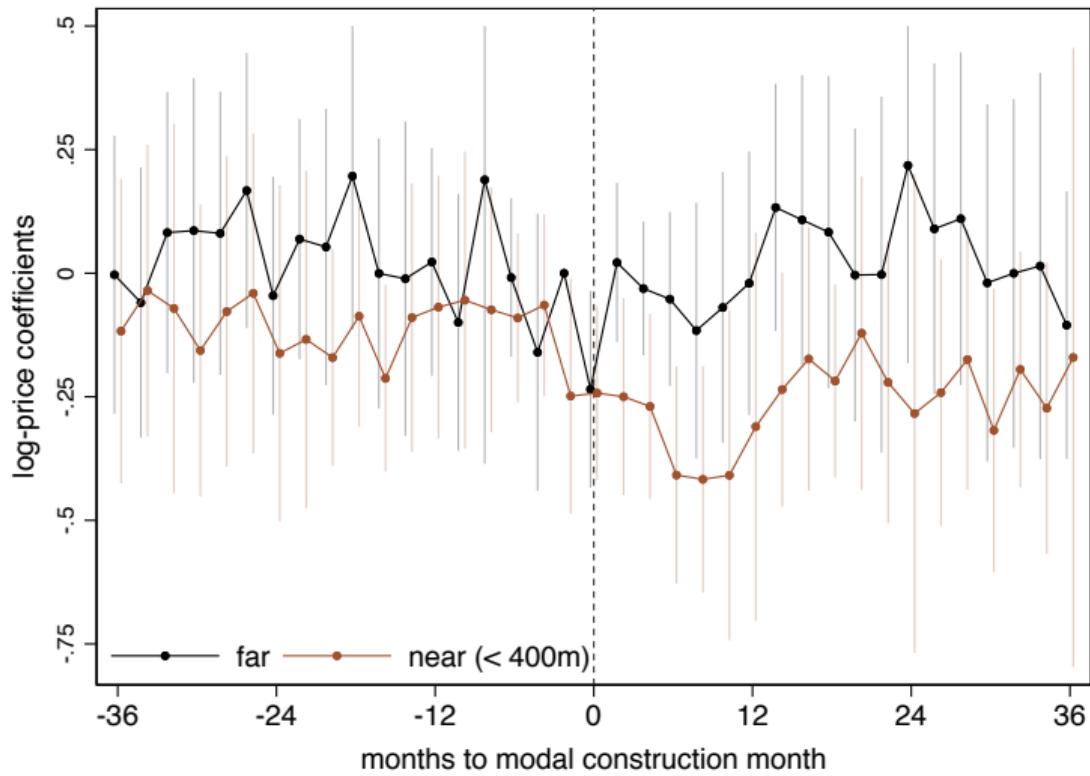
# Distance Plot



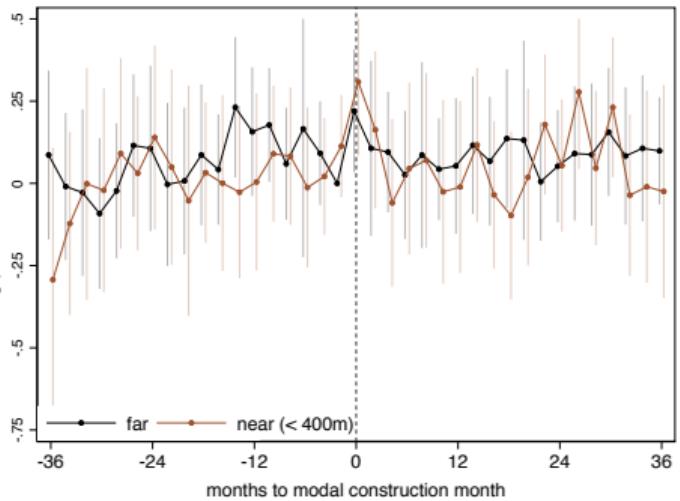
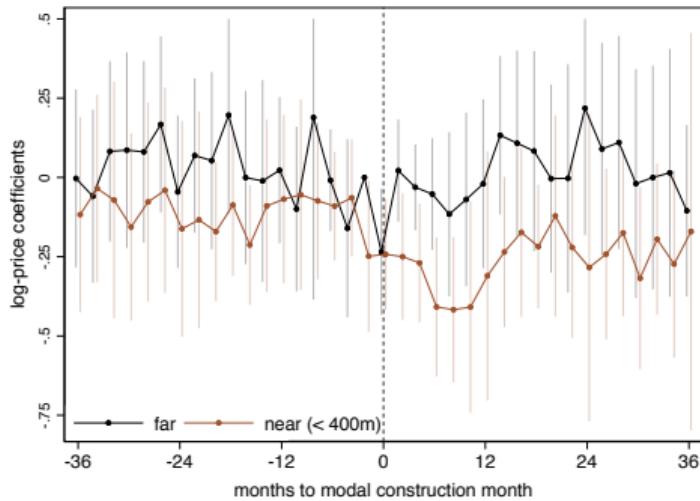
# Placebo Distance Plot



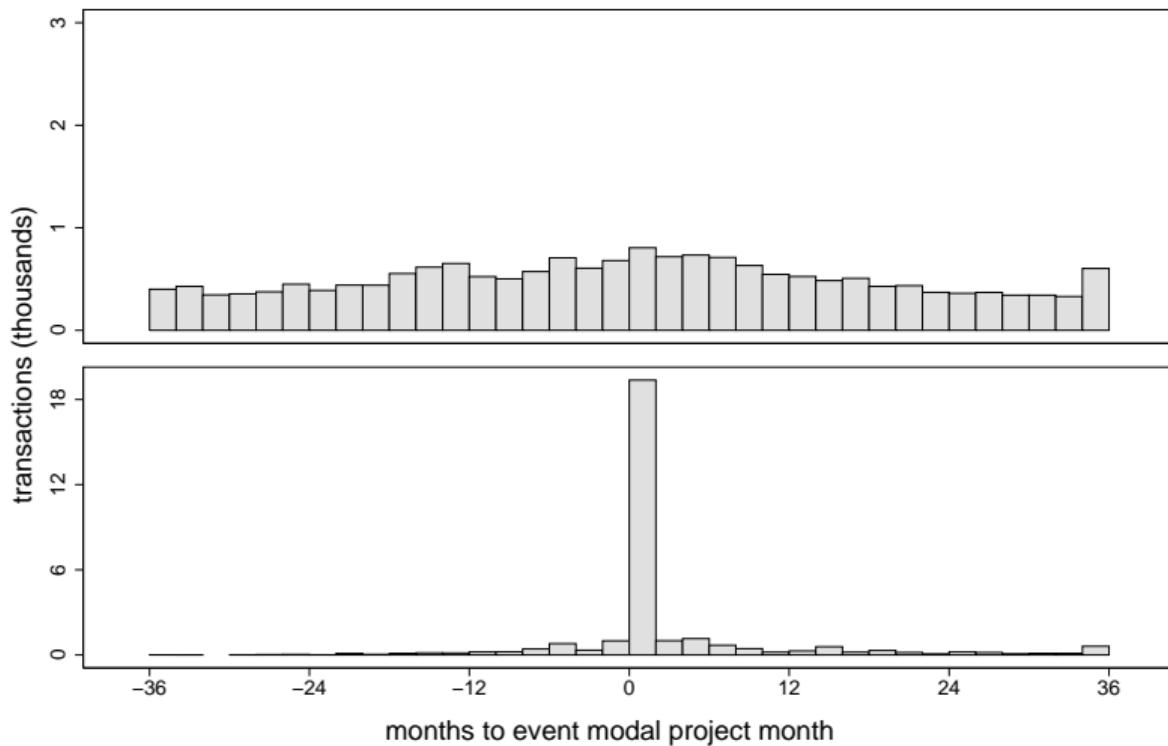
# Time Plot



# Placebo Time Plot



# Transaction Densities



# Housing Projects

Effects:	(1)	(2)	(3)	(4)
3 yrs 0-400m	-0.235** (0.106)	-0.157* (0.083)		
1 <sup>st</sup> yr 0-400m			-0.138* (0.075)	
2 <sup>nd</sup> yr 0-400m			-0.170 (0.115)	
3 <sup>rd</sup> yr 0-400m			-0.109 (0.096)	
3 yrs 0-200m				-0.212** (0.095)
3 yrs 200-400m				-0.061 (0.067)
Project FE	no	yes	yes	yes
N	28,856	28,856	28,856	28,856
R <sup>2</sup>	0.228	0.489	0.490	0.491

Standard errors clustered at the project level.

All specifications control for year-month FE and cubic in plot size.

# Housing Projects

Effects:	(1)	(2)	(3)	(4)
3 yrs 0-400m	0.044 (0.082)	0.010 (0.070)		
1 <sup>st</sup> yr 0-400m			0.027 (0.081)	
2 <sup>nd</sup> yr 0-400m			-0.012 (0.080)	
3 <sup>rd</sup> yr 0-400m			0.004 (0.081)	
3 yrs 0-200m				-0.064 (0.093)
3 yrs 200-400m				0.067 (0.060)
Project FE	no	yes	yes	yes
N	35,096	35,096	35,096	35,096
R <sup>2</sup>	0.276	0.430	0.430	0.430

Standard errors clustered at the project level.

All specifications control for year-month FE and cubic in plot size.

# Housing Projects

	(1)	(2)	(3)	(4)	(5)
	flush toilet	water tap	elec. cooking	elec. light	house
DD >30% overlap	0.265** (0.101)	0.241*** (0.060)	0.034 (0.107)	-0.029 (0.134)	0.207*** (0.051)
DD $\leq$ 30% overlap	-0.027 (0.037)	-0.070** (0.033)	-0.106** (0.042)	-0.016 (0.033)	-0.069** (0.032)
N	1,382,550	1,382,550	1,382,550	1,382,550	1,329,296
R <sup>2</sup>	0.352	0.212	0.249	0.244	0.157

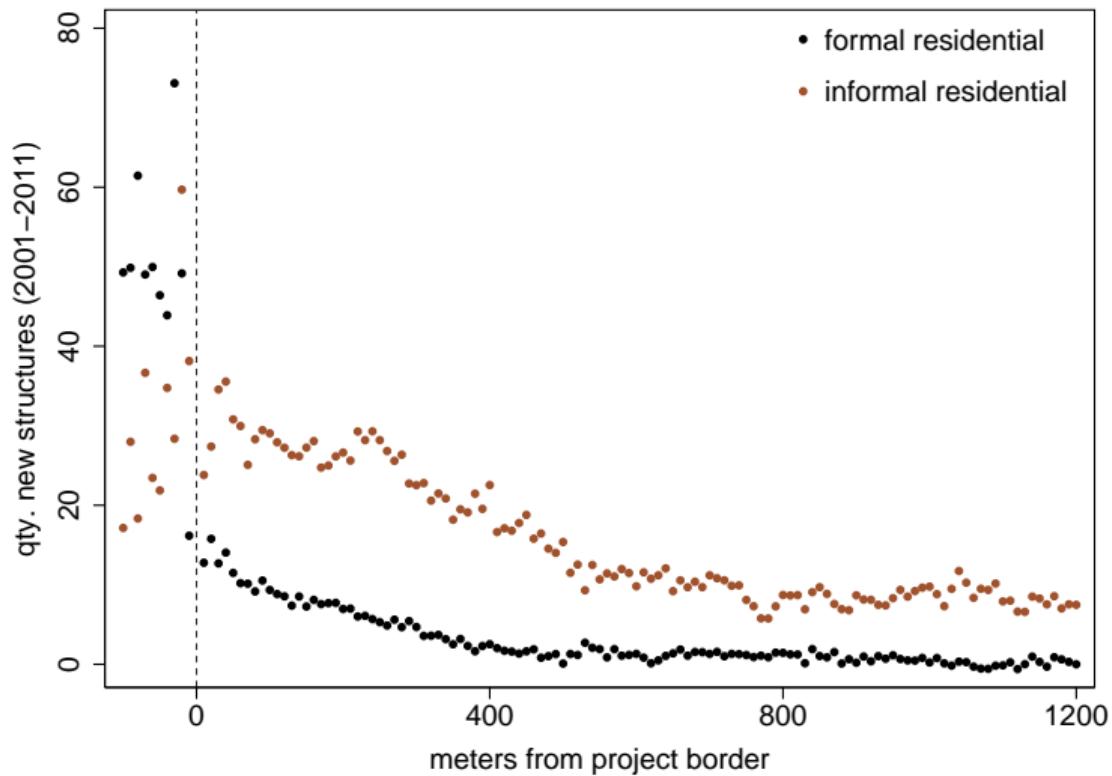
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# Housing Projects

	(1)	(2)	(3)
	high-school	monthly income	unemployed
DD >30% overlap	-0.053*** (0.013)	226.330 (372.469)	-0.008 (0.023)
DD $\leq$ 30% overlap	-0.008 (0.012)	77.967 (428.078)	0.024 (0.016)
$N$	2,055,289	909,466	1,069,857
$R^2$	0.024	0.050	0.049

Standard errors clustered at the project level. All specifications control for project FE

# BBLU plot



# BBLU plot placebo

