Land Use Regulation, the Redevelopment Premium and House Prices

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Brief Overview

- Do *land use regulations* (LURs) affect the *redevelopment premium* (RP) in house prices?
  - *Redevelopment option*: The right to augment or teardown and replace

- We study the effects of the Auckland Unitary Plan on house prices
  - LURS relaxed in target areas to permit more density ("upzoning")
  - Rich dataset of individual residential property transactions
  - Method: embed difference-in-differences in a hedonic regression

- Main findings:
  - Upzoning increases the redevelopment premium
  - Overall effect on (relative) prices depends on extent of site development
    - Under-developed sites appreciate in value
    - Intensively developed sites depreciate in value

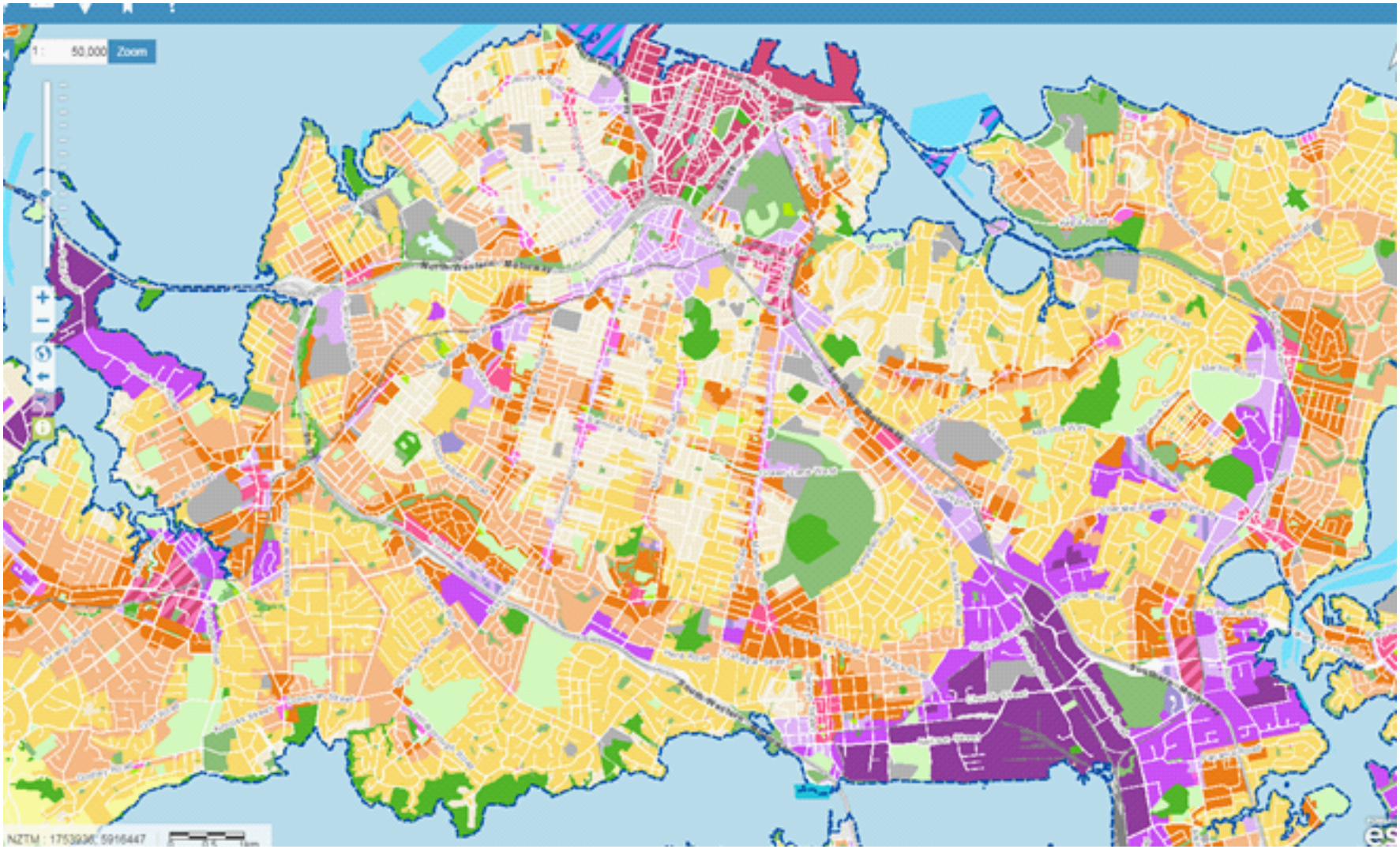
Structure of the Talk

- Related Literature
- Institutional Background
- Empirics
  - Key variables
  - Empirical Model
  - Results
- Concluding Remarks

Related Literature

- Application of Real Option Theory to Real Estate:
  - Titman (1985), Williams (1991), Capozza and Li (1994), Gutherie (2007) and Clapp, Jou and Tan (2012)
- Empirical work:
  - Clapp and Salavei (2010), Clapp, Salavei Bardos and Wong (2012), Clapp, Jou and Tan (2012).
  - Site intensity used as observable proxies for redevelopment premium in a hedonic framework
  - Measures related to site intensity: Bostic, Longhofer and Redfearn (2007); Bourassa, Haurin, Haurin, Hoesli and Sun (2009); Bourassa, Hoesli, Scognamiglio, and Zhang, (2011); Davis and Heathcote (2007)
- Dwelling prices and LURs:
  - Tighter LURs increase average dwelling prices (Quigley and Rosenthal, 2005; Gyourko and Molloy, 2014)
- Martin and Parker (2017)

Institutional Background



Residential Zones

Institutional Background

- The AUP relaxed regulations to increase density in targeted areas.
- Announcement of the AUP treated as a pseudo-natural experiment
  - upzoning is the treatment.
- We focus on four residential zones, ordinal by increasing density:
  - *Single House* (**SH**)
  - *Mixed Use Suburban* (**MUS**)
  - *Mixed Use Urban* (**MUU**)
  - *Terrace Housing and Apartment Building* (**THA**)
- Staggered announcement. *Draft AUP* in March 2013; *Proposed AUP* in September 2013; *Decisions AUP* in August 2016.
  - Baseline model has 2010-2012 as pre-announcement, 2016 as post-announcement

Empirics: Key Variables

- *Site Intensity* ratio used as empirical proxy for redevelopment premium (Clapp *et al*, 2010, 2012a, 2012b):

$$\textit{site intensity} := \frac{\text{improvements value}}{\text{capital value}} = 1 - \frac{\text{land value}}{\text{capital value}}$$

- Clapp *et al* use site intensity to measure the redevelopment premium via hedonic regression
- Note: the redevelopment premium is declining in site intensity

- Upzoning used as a quasi-treatment via dummy variables:
  - Mixed Use Suburban (MUS); Mixed Use Urban (MUU); Terrace Housing and Apartments (THA)
  - Single House (SH) is the reference group (not upzoned)

Empirics: Regression Model

$$\frac{1}{T_i}\left(p_{i,t_1} - p_{i,t_{-1}}\right) = \beta_0 + \sum_{s=1}^{3} \beta_s zone_{s,i} + \delta_0 intensity_{i,t_{-1}} + \sum_{s=1}^{3} \delta_s zone_{s,i} \cdot intensity_{i,t_{-1}} + \gamma' X_{i,t_{-1}} + \varepsilon_i$$

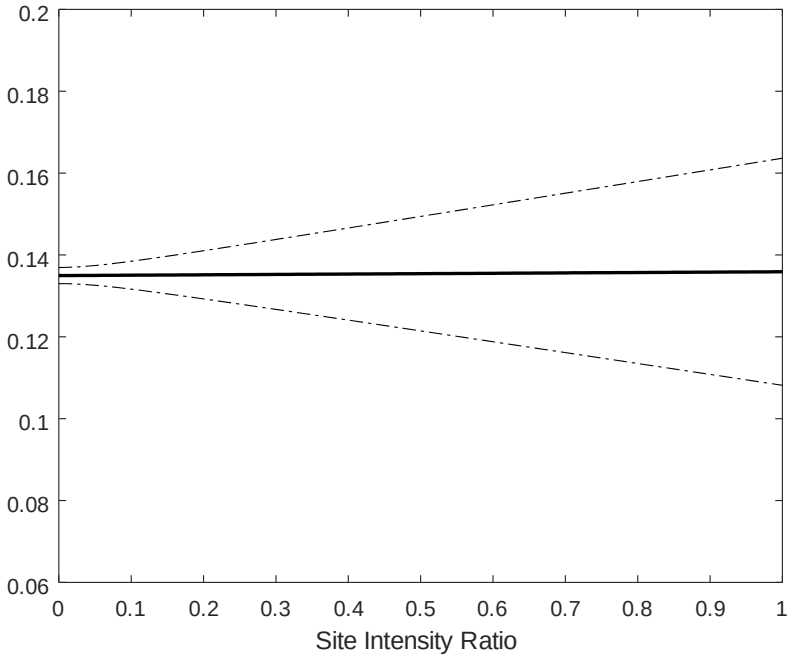
- $i = 1, \ldots, n$ indexes the transactions (houses)
- $p_{i,t}$ is log sales price of house i in period t
  - t_{-1} = pre treatment period (2010-2012), t_1 = post treatment (2016)
  - T_i = time between the sale of house i in period t_{-1} and t_1 in years.
- $zone_{s,i}$ are upzoning dummies for residential zones MUS, MUU, THA
- $intensity_{i,t_{-1}}$ is site intensity of house i in period t_{-1}.
- $X_{i,t_{-1}}$ is a vector of controls

Empirics: Results

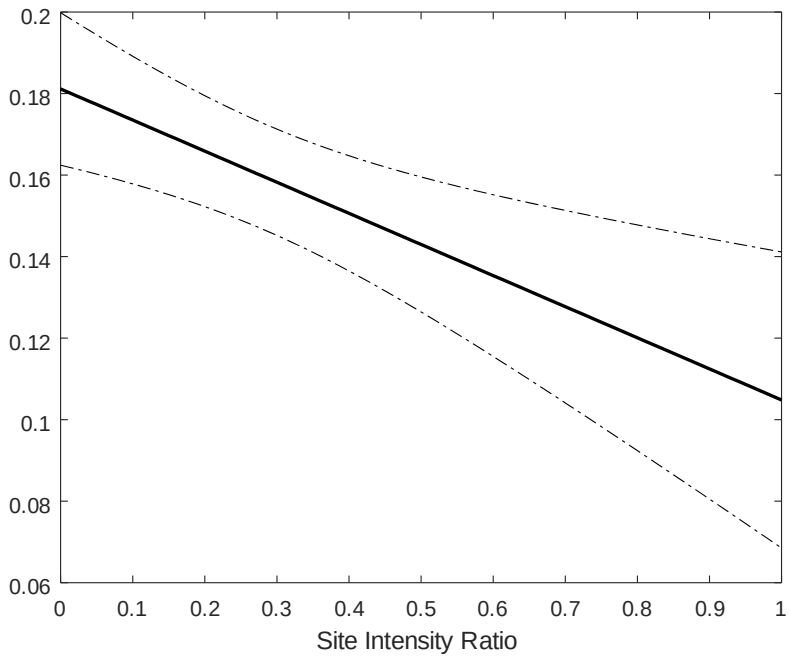
Table 3: Estimated Regression Coeffcients

Constant	0.135***	0.135***	0.135***
THA	0.046***	0.052***	0.052***
MUU	0.043***	0.048***	0.050***
MUS	0.038***	0.040***	0.035***
Site Intensity	0.001	0.005	-0.043***
THA × Site Intensity	-0.077***	-0.085***	-0.072**
MUU × Site Intensity	-0.065***	-0.072***	-0.067***
MUS × Site Intensity	-0.055***	-0.060***	-0.048***
ln(land)	-0.009*	-0.010***	
ln(floor)	-0.017***	-0.018***	
ln(coverage)	-0.011***	-0.012***	
bedrooms	0.004**	0.005***	
bathrooms	-0.001	-0.001	
ln(age)	0.002	0.002*	
ln(distance)	-0.004*		
ln(neighborhood income)	-0.016***		
R-squared	0.153	0.148	0.108
Adjusted R-squared	0.147	0.142	0.104
Observations	1984	1984	1984

Figure: Expected Change in Log House Prices conditional on Site Intensity



Single House



Terrace Housing & Apartments

Dashed lines represent 95% confidence intervals.

Concluding Remarks

- Results are robust:
  - changes in pre- and post- announcement periods
  - "placebo" pre- and post- announcement dates
- First result: Upzoning increases the redevelopment premium
- Second result: Overall effect of upzoning on (relative) prices depends on existing extent of site development
  - Under-developed properties appreciate in value after upzoning
  - Intensively developed properties depreciate in value after upzoning
- Suggests that the effect of upzoning on the redevelopment premium can be negated by concurrent effects of upzoning:
  - disamenities from crowding
  - anticipated increase in supply

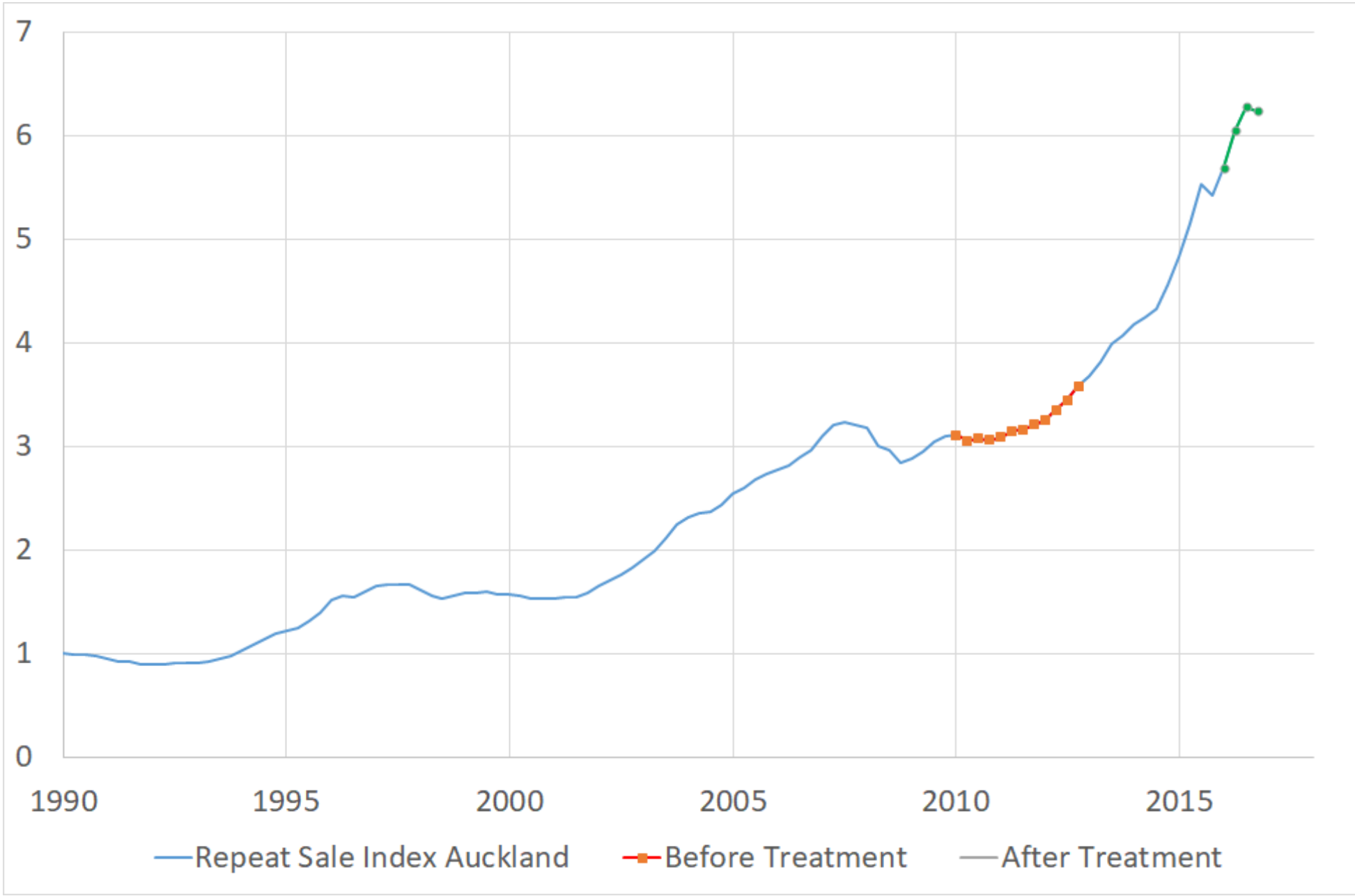

7
6
5
4
3
2
1
0
1990
1995
2000
2005
2010
2015
Repeat Sale Index Auckland
Before Treatment
After Treatment

Table: Summary Statistics

	mean	median	std dev	skew	5th per	95th per
Avg Chge in Log Prices	0.11	0.10	0.04	0.48	0.05	0.18
Site Intensity Ratio	0.43	0.44	0.13	-0.31	0.21	0.63
Land Area (hectares)	0.07	0.07	0.03	4.74	0.03	0.11
Floor Area (sq meters)	154.05	140	63.48	1.13	80	277
Coverage Ratio	0.21	0.19	0.09	0.74	0.09	0.37
Bedrooms	3.51	3	0.76	0.5	3	5
Bathrooms	1.66	2	0.74	0.99	1	3
Building Age (years)	36.47	37	25.27	0.69	7	90
Dist. to downtown (km)	17.29	14.31	10.47	1.25	4.46	40.75
Hhold Inc. ($000, 2006)	64.53	61.3	15.15	0.67	44.7	95.3

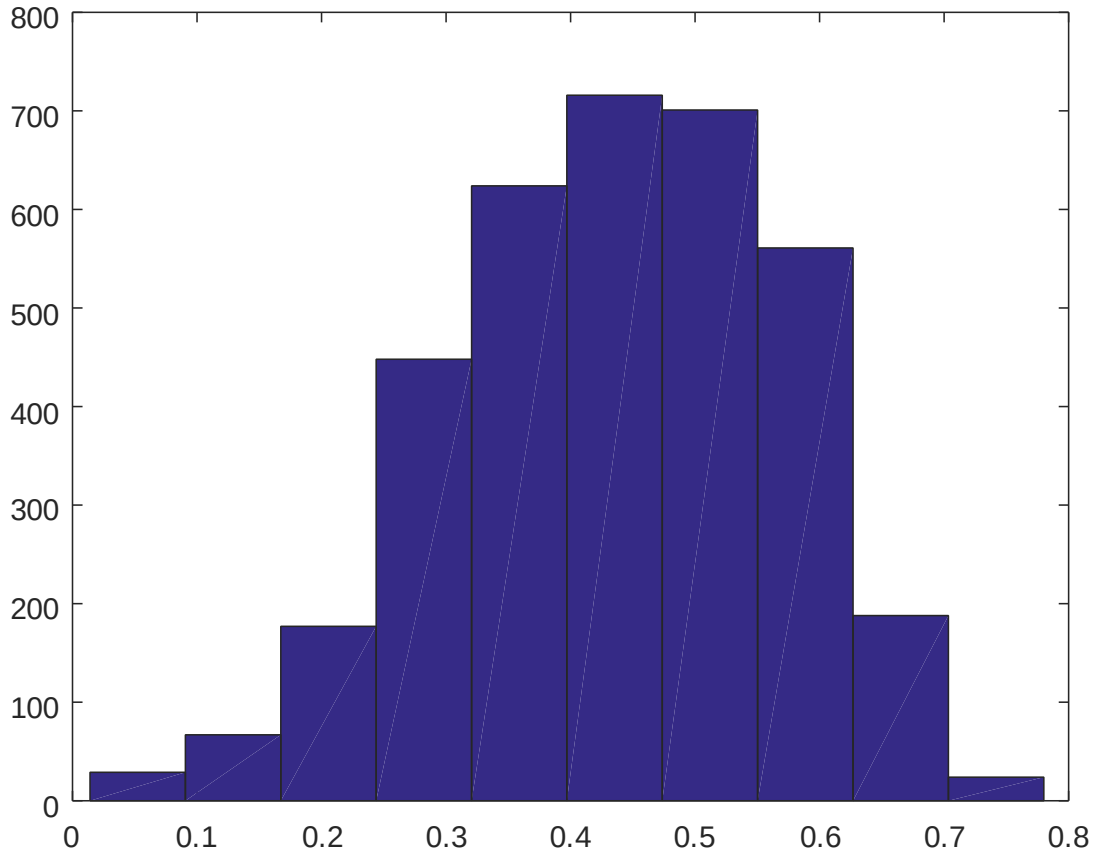


Figure: Histogram of the Site Intensity Ratio

Table: Sample Characteristics of Residential Zones

	SH	MHS	MHU	THA	All Zones
Observations	712	1923	708	187	3530
Proportion of sample	0.202	0.545	0.201	0.053	1

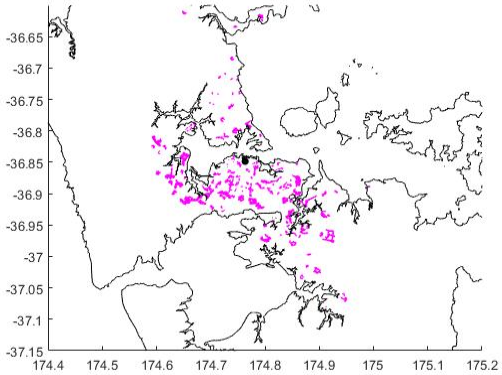
Summary of Land Use Regulation by Residential Planning Zone

Planning Regulation	Terrace House & Apartments	Mixed Housing Urban	Mixed Housing Suburban	Single House
Height	16 to 22.5m 5 to 7 storeys	11m+1m roof three storeys	8m+1m roof two storeys	8m+1m roof two storeys
Height to boundary	3m + 45° side & rear	2.5m + 45° side & rear	2.5m + 45° side & rear	2.5m + 45° side & rear
Site Cover. Ratio	50%	45%	40%	35%
Min dwelling size (1 bed)	$45m^2$	$45m^2$	$45m^2$	n/a
Min Lot Size Vacant land	$1200m^2$	$300m^2$	$400m^2$	$600m^2$

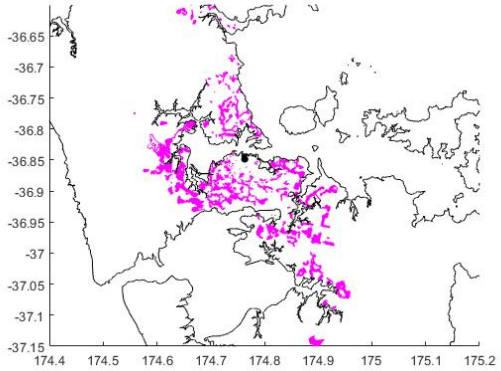
Table: Population densities by Residential Zone

	mean	median	std. dev.	skewness	5th perc.	95th perc.
All Zones	4193	3422	8138	11	587	6250
THA	4224	3345	8200	9	691	6573
MHU	3852	3406	6477	17	634	6000
MHS	4135	3438	7750	12	589	6204
SH	4680	3416	10329	8	564	6474

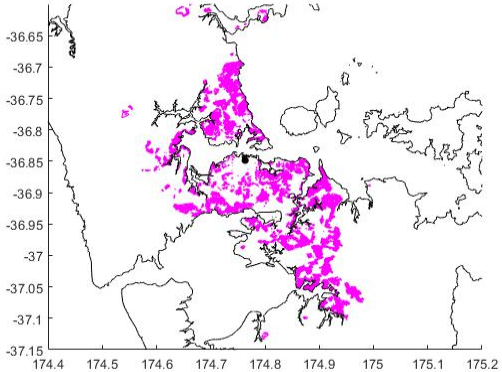
Note: Population densities (persons per km^2) are based on the Census 2013 meshblocks where the transacted house is located.



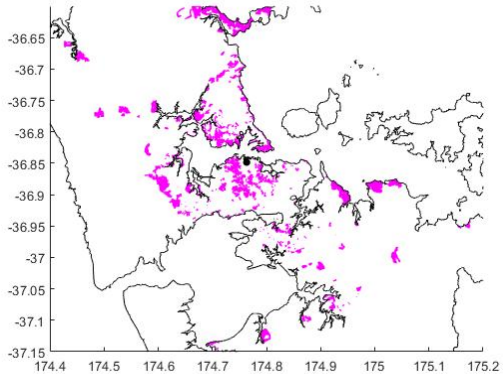
THA



MHU



MHS



SH

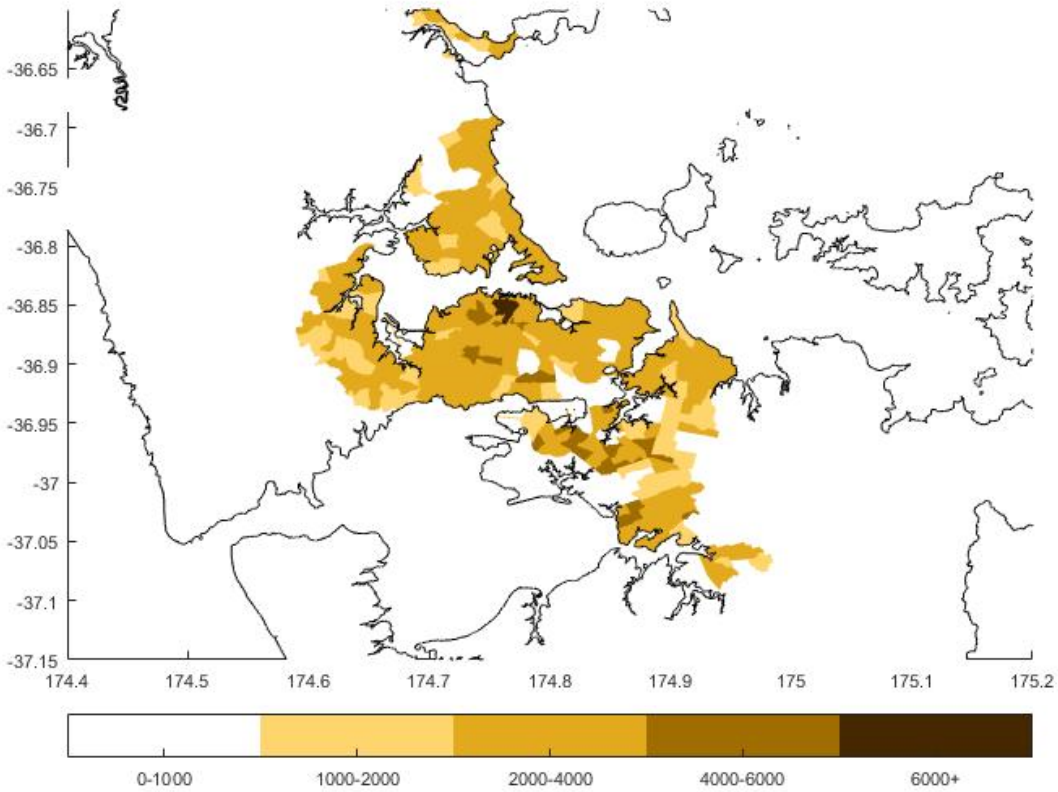
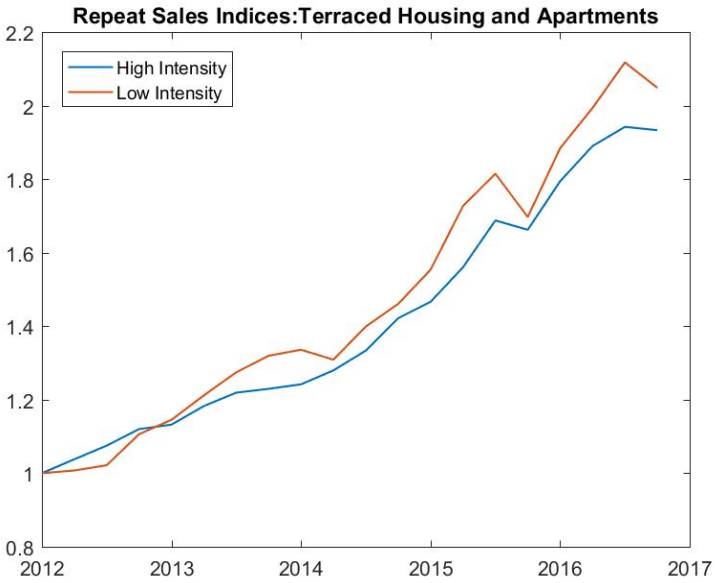
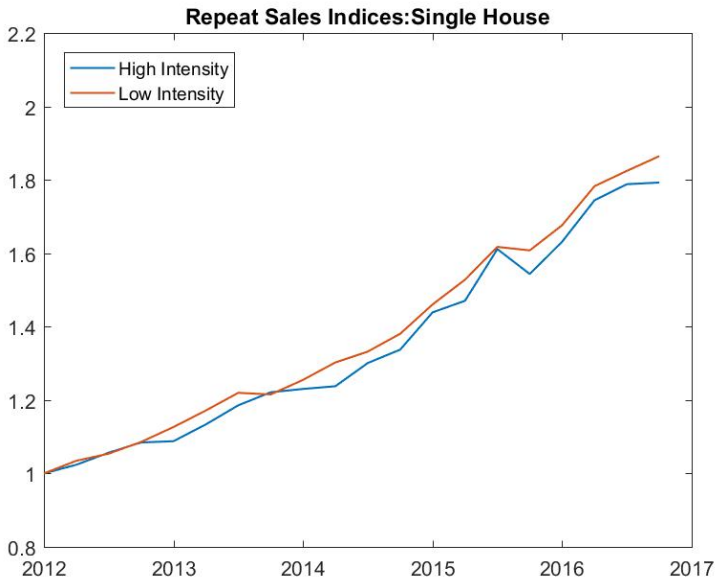


Figure: Population densities (persons/km^2) across Area Units in Auckland. Authors' calculations based on 2013 census.


Repeat Sales Indices:Terraced Housing and Apartments
High Intensity
Low Intensity
2.2
2
1.8
1.6
1.4
1.2
1
0.8
2012
2013
2014
2015
2016
2017


Repeat Sales Indices:Single House
High Intensity
Low Intensity
2.2
2
1.8
1.6
1.4
1.2
1
0.8
2012
2013
2014
2015
2016
2017