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The effect of upzoning on house prices and redevelopment premiums in Auckland, New Zealand

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Abstract

We study the short-run effects of a large-scale upzoning on house prices and redevelopment premiums in Auckland, New Zealand. Upzoning significantly increases the redevelopment premium but the overall effect on house prices depends on the economic potential for site redevelopment, with underdeveloped properties appreciating relative to intensively developed properties. Notably, intensively developed properties decrease in value relative to similar dwellings that were not upzoned, showing that the large-scale upzoning had an immediate depreciative effect on pre-existing intensive housing. Our results show that the economic potential for site redevelopment is fundamental to understanding the impact of changes in land use regulations on property values.

Keywords

house prices, land use regulations, redevelopment option, redevelopment premium, upzoning

摘要

我们研究了新西兰奥克兰大规模规划升级对房价和重建溢价的短期影响。规划升级显著增加了再开发溢价，但对房价的总体影响取决于场地再开发的经济潜力，相对于高密度房产，低密度房产升值。值得注意的是，与规划未升级的类似住宅相比，高密度房产的价值下降，这表明大规模规划升级对先前存在的高密度住宅产生了直接的贬值效应。我们的研究结果表明，场地再开发的经济潜力是理解土地使用条例变化对房地产价值影响的基础。

关键词

房价、土地使用条例、重建选项、重建溢价、规划升级

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Introduction

Upzoning is increasingly being advocated as a solution to unaffordable housing (Freeman and Schuetz, 2017; Glaeser and Gyourko, 2003). It refers to changes in regulatory land use regulations (LURs) that enable more-intensive site development (Gabbe, 2018). Because LURs increase house prices by restricting supply (Gyourko and Molloy, 2015), it is thought that a relaxation of these regulations through upzoning can reduce dwelling prices by enabling construction of intensive housing (Freeman and Schuetz, 2017; Glaeser and Gyourko, 2003). Several major cities in the USA have recently upzoned large areas in response to rising housing costs, including Minneapolis, Portland and Seattle (National Public Radio, 2019).

However, our understanding of the impact of upzoning on house prices is limited by a lack of empirical research on the topic (Freemark, 2019a; Schill, 2005).[1] Real option theory suggests that upzoning might instead *increase* house prices by enhancing the redevelopment premium embedded in property values. The option to augment or tear down and replace a residential structure can carry a significant premium (Clapp and Salavei, 2010; Clapp et al., 2012a, 2012b) and upzoning may increase the value of this redevelopment premium by enhancing the extent of permissible development on a parcel of land. Understanding how these opposing appreciatory and depreciatory effects of upzoning are mediated by various factors, such as the redevelopment potential of affected parcels, the scale of the policy and the passage of time, is critical to evaluating the efficacy of upzoning to enhance housing affordability.

In this paper we examine the short-run impact of upzoning on house prices using an empirical method that distinguishes increases in redevelopment premiums from other market equilibrium effects of the policy, such as increases in housing supply. Our study is based on a policy intervention that upzoned large areas within the metropolitan region of Auckland, New Zealand (NZ). To analyse the effects of this policy change, we embed a difference-in-differences structure in a hedonic pricing function, wherein an upzoning quasi-treatment is interacted with a conventional measure of site development: *intensity*. Intensity is the ratio of the value of improvements to the total property value and is often used in empirical hedonic regressions to measure redevelopment premiums because it reflects the economic potential for site redevelopment (Clapp and Salavei, 2010; Clapp et al., 2012a). Intuitively, the opportunity cost in terms of foregone rent from tearing down an apartment block (with a correspondingly high intensity ratio) is much greater than the opportunity cost of tearing down a small house on a large land parcel (with a low intensity ratio). The former therefore has less economic potential for redevelopment than the latter and correspondingly carries a smaller redevelopment premium. By conditioning on intensity, we can isolate enhancements in redevelopment premiums from other policy effects on prices, such as decreases in prices due to actual or anticipated construction. These ideas are theoretically formalised in the third section of this paper using the Clapp and Salavei (2010) real option model.

We find that upzoning significantly increases the hedonic estimate of the redevelopment premium. However, the net effect on house prices is decreasing in intensity, meaning that underdeveloped properties appreciate relative to intensively developed properties. Further, upzoned properties that

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exceeded a sufficiently high level of intensity decreased in price relative to non-upzoned properties, illustrating that the large-scale upzoning had an immediate depreciative effect on pre-existing forms of intensive housing. The existing extent of site development is therefore identified as a key attribute mediating the appreciatory and depreciatory impacts of upzoning. These results hold under several robustness checks and placebo tests.

This paper makes several contributions to the literature. First, while a tremendous amount of research has focused on the static effect of cross-sectional variation in LURs (see Gyourko and Molloy, 2015; Pogodzinski and Sass, 1991; Quigley and Raphael, 2005, for reviews), there has been much less research on the effects of dynamic *changes* in zoning restrictions, in part because large-scale changes in regulations are rare (Freeman and Schuetz, 2017).[2] We break new ground on this understudied topic by examining a policy intervention in which *most* of the residential land in the metropolitan urban area was upzoned. Second, by identifying intensity as a key attribute mediating price effects, we reconcile the fact that upzoning can *decrease* average dwelling prices by enabling supply of more intensive forms of housing, while *increasing* the value of properties that are more-endowed with land relative to those that are less-endowed, as predicted by real option theory. In economic terms, upzoning reduces the minimum amount of land required to produce a dwelling, and this increase in land productivity is captured both by consumers, through lower dwelling prices, and by landowners, through larger factor payments to land. Because a property is a bundle of land and dwelling, the net price effect of upzoning depends on the relative value of its land endowment. Finally, our approach helps assess the credibility of market-led policies to improve housing affordability. Housing construction can be impeded by land assembly problems (O'Flaherty, 1994) and other regulatory barriers (Schill, 2005). Our hedonic model permits us to price intensively developed (i.e. high intensity) dwellings to uncover whether prices on such properties decrease after the policy is announced.

Our data set offers some unique advantages that assist in identifying the effects of upzoning. First, non-upzoned houses provide a quasi-control, thereby permitting a difference-in-differences approach that mitigates some of the concerns related to the endogeneity of regulations in the cross-sectional setting (Gyourko and Molloy, 2015). Second, there is a unique identifier for each property, which enables use of repeat sales to control for time-invariant factors affecting house prices over the sample period. Third, the dataset is sufficiently detailed so that we can control for numerous other potential confounding factors, such as proximity to the central business district (CBD). Finally, we can match the transacted property to its residential planning zone, so that we can pinpoint upzoning in space and time, rather than estimating where and when rezoning occurred.

The remainder of the paper is organised as follows. The following section reviews the extant literature on zoning, house prices, and affordability. The third section contains a detailed description of the institutional background underlying our study. The next section presents the theoretical foundation for our empirical regressions. Empirics are contained in the penultimate section and the final section concludes.

Literature review

Numerous studies have analysed the relationship between zoning regulations and a variety of outcomes, including house prices and affordability, construction and rents (surveys include Gyourko and Molloy, 2015;

Pogodzinski and Sass, 1991; Quigley and Raphael, 2005). The majority of studies find that locations with more regulation have higher house prices and less construction, although planning endogeneity limits our ability to infer causality from these correlations (Gyourko and Molloy, 2015). Nonetheless, empirical studies that account for endogeneity frequently find that tighter LURs *cause* increases in house prices (Dalton and Zabel, 2011; Hilber and Vermeulen, 2016; Ihlanfeldt, 2007; Jackson, 2016) and decreases in construction (Chakraborty et al., 2010; Glaeser and Ward, 2009; Jackson, 2016).

On the basis of this and other work, many researchers argue that a relaxation of LURs will improve affordability and accessibility by enabling more housing construction (Freeman and Schuetz, 2017; Glaeser and Gyourko, 2003; Manville et al., 2020). Yet, many others remain sceptical of the capacity for upzoning to deliver affordable housing, arguing that benefits to lower-income households are limited (Favilukis et al., 2019; Rodriguez-Pose and Storper, 2020). Part of the problem is that our understanding of the manifold impact of upzoning on prices is limited by an acute lack of empirical research on the topic (Freeman and Schuetz, 2017; Schill, 2005). Research adopting a quasi-experimental approach to examine price effects of zoning *changes* is limited to Atkinson-Palombo (2010) and Freemark (2019a). Notably, Freemark (2019a) finds that multifamily buildings *appreciated* relative to controls in Chicago after transit-oriented upzoning.

In addition to upzoning, other policies intended to reduce impediments to market-led supply include relaxing urban growth boundaries (Anacker, 2019); reducing unnecessary regulations and making the development process more certain and transparent (Freeman and Schuetz, 2017); and accelerating land-use and construction approvals (Anacker, 2019). Other researchers instead advocate for direct state intervention. Wetzstein (2019) argues that non-market-based housing supply, demand-side interventions and urban land market interventions are required to ensure housing affordability, while Favilukis et al. (2019) show that direct state-led interventions, such as vouchers and accurately targeted inclusionary zoning, more effectively enhance affordability in a calibrated spatial equilibrium model. Meanwhile Been et al. (2019) argue for a broad policy package that includes both state intervention and the removal of impediments to market-led construction. Freemark (2019b) also advocates for a combination of large-scale state-led intervention and regulatory reform, pointing out that housing unit construction doubled in Paris after renewed government support for affordable housing, repurposing of public land, LUR reform and the introduction of financial incentives for private-sector construction.

Institutional background

Auckland is the largest city in NZ, with an estimated population of approximately 1.7 million in 2017 (Auckland Council, 2017). The region covers 489,363 ha, of which 50,550 ha constitute the core urban area (Auckland Council, 2017). From November 2010 the entire region fell under the jurisdiction of the Auckland Council (AC), formed after amalgamation of eight different city and district councils. Auckland has a population-weighted density of approximately 4310 people per km^2 (source: authors' calculations based on 2013 census data), and the population is evenly distributed outside the CBD (see Figure A1 in the online Supplemental Material).

Auckland's house prices roughly doubled between 2009 and 2016 (see Supplemental Figure A2), which resulted its housing being ranked among the most unaffordable in the world (Demographia, 2018). This increase was predominantly unique to Auckland within NZ. Prices have remained flat since 2016, coinciding with successive governments implementing policies to stem demand and the central bank restricting credit through tighter macroprudential policies.

Recent changes under the Auckland Unitary Plan (AUP) make Auckland an ideal case study to investigate the effects of large-scale upzoning in a metropolitan area. The AUP relaxed regulations to permit increased density in large areas of the city (Balderston and Fredrickson, 2014: 21). Key milestones in development and implementation of the AUP are summarised below:

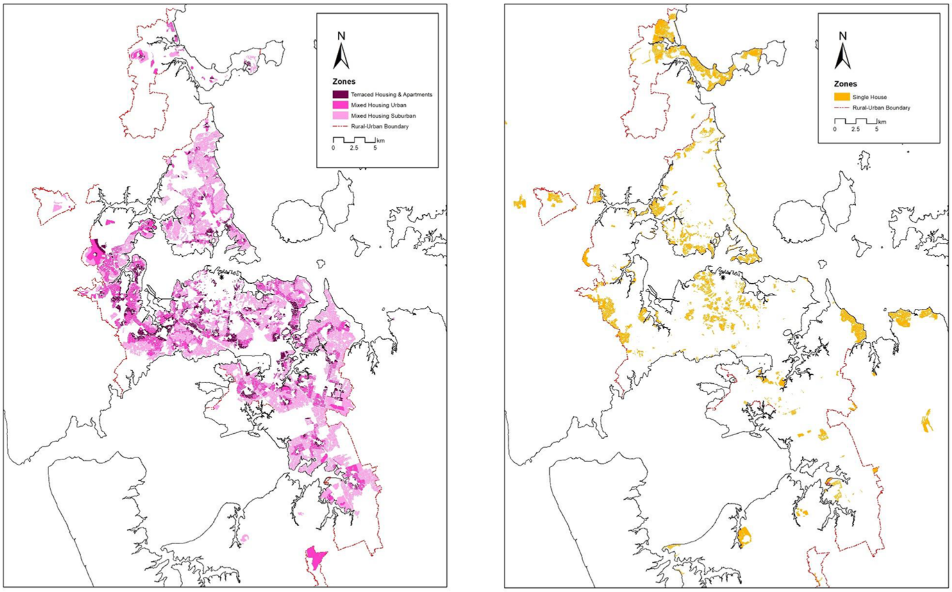
- July 2010: The Local Government Act 2010 passed by the NZ government requires AC to develop a consistent set of urban planning rules.
- 15 March 2013: AC released the 'draft' AUP, followed by 11 weeks of public consultation.
- 30 September 2013: AC released the Proposed AUP (PAUP) and notified the public that the PAUP was open for submissions.
- April 2014 to May 2016: An Independent Hearings Panel (IHP) was appointed by the NZ government and subsequently held 249 days of hearings.
- 22 July 2016: the IHP set out recommended changes to the PAUP. One of the significant recommendations was abolition of minimum lot sizes (except for new subdivisions). AC considered and voted on the IHP recommendations over the next 20 working days.
- 19 August 2016: AC released the 'decisions' version of the AUP. Several of the IHP's recommendations were voted down but abolition of minimum lot sizes was maintained.
- 8 November 2016: AC notified the public through the media that the final AUP version would become operational 15 November 2016.[3]

All AUP versions ('draft', 'proposed', 'decisions' and 'final') proposed new zoning regulations that were easily viewed online. Any interested member of the public could observe the proposed regulations applying to any given parcel in the city.

We focus on four residential zones introduced under the AUP, listed in declining levels of permissible site development: *Terrace Housing and Apartments; Mixed Housing Urban; Mixed Housing Suburban*; and *Single House*. See Supplemental Table A1 for an overview of the LURs by zone. These regulations include site coverage ratios and height restrictions, among others. For example, between five and seven storeys and a maximum site coverage ratio of 50% is permitted in *Terrace Housing and Apartments*, whereas only two storeys and a coverage ratio of 35% is permitted in *Single House*. Together, these four zones comprise over 90% of the transactions in our sample.

AC estimated that the new zones increased capacity for new dwellings by over 300%,[4] illustrating the large-scale nature of the upzoning policy. Figure 1 depicts the geographic distribution of the four zones across the city. *Mixed Housing Suburban* is the largest zone by area, covering 44.6% of all residential land (source: authors' calculations), while *Mixed Housing Urban* covers 22.5%. *Single House* is predominantly located either very close to or at the CBD outskirts, and covers 25.5% of residential land. *Terrace Housing and Apartments* covers only 7.4% of residential land.

Our empirical design treats the AUP announcement as a quasi-natural experiment[5] (where *Single House* acts as the control; see



Treatment Zones. Darker shades indicate less restrictive LURs (i.e., more upzoning)

Control Zones (Single House)

Figure 1. Residential zones in Auckland.
Notes: The dot close to the centre of the maps is the location of the 'Skytower' within the CBD. Solid black lines demarcate coastline.

section 'Econometric model'). We therefore must select a time period 'before' and 'after' the treatment has occurred. Unfortunately, as is clear from the timeline above, there is no clean, singular announcement. We adopt a conservative approach and take the years between 2010 and 2012 (inclusive) as pre-treatment (which pre-dates release of the (first) draft AUP), and September 2016 to December 2017 as post-treatment (immediately after the final 'decisions' AUP version is released). We explore several other time periods in our robustness checks.

Theoretical framework

In this section we repurpose the Clapp and Salavei (2010) real option model of housing redevelopment to examine what happens to property values when restrictions on development are relaxed (as occurs under upzoning). These theoretical predictions are empirically tested in the following section. Full details are provided in the Supplemental Material.

The set-up is as follows. Each developed property has a vector of characteristics $\boldsymbol{q}_0$ that earn rents $\boldsymbol{p}$ and depreciate at rate δ. Future rents $\boldsymbol{p}$ (and characteristics $\boldsymbol{q}_0$) are known with certainty. The property owner is permitted to redevelop to the standard given by $\boldsymbol{q}_n$. The cost of redevelopment is $k(\boldsymbol{q})$, such that the construction costs are a function of $\boldsymbol{q} \in \mathbb{R}_{>0}$, and where we assume that $k(\boldsymbol{q}) > 0$, so costs are positive. Then the value of the property is

$$V_0 = \boldsymbol{v}'\boldsymbol{q}_0 + (\boldsymbol{v}'(\boldsymbol{q}_n - \boldsymbol{q}_0) - k(\boldsymbol{q}_n))\left(\frac{\boldsymbol{v}'\boldsymbol{q}_n - k(\boldsymbol{q}_n)}{\boldsymbol{v}'\boldsymbol{q}_0}\right)^{\frac{\rho}{\delta}} \left(\frac{\rho}{\rho + \delta}\right)^{\frac{\rho}{\delta}} \quad (1)$$

where $\boldsymbol{v} = \frac{\boldsymbol{p}}{\rho + \delta}$ and ρ is the discount rate. The redevelopment premium is the second term. It disappears if $\boldsymbol{q}_n = \boldsymbol{q}_0$. We assume $\boldsymbol{v}'(\boldsymbol{q}_n - \boldsymbol{q}_0) > k(\boldsymbol{q}_n)$.

We consider what happens to V_0 when the policymaker increases an element of $\boldsymbol{q}_n$ that represents an overall measure of development intensity (call it $q_n^{(i)}$). We can therefore think of upzoning as an exogenous increase in $q_n^{(i)}$. By taking the partial derivative of V_0 with respect to $q_n^{(i)}$ (refer to the Supplemental Material for details), we obtain two key results to be empirically tested:

(1) An increase in $q_n^{(i)}$ through upzoning increases the property value, all else equal.
(2) The increase in property value is decreasing in $q_0^{(i)}$, meaning that a property with a lower initial level of site development will experience a larger increase in price from upzoning, all else equal.

Although the model abstracts from market equilibrium effects of upzoning, such as the impact of increased housing supply on house prices, it can straightforwardly accommodate common changes in house prices brought about by shifts in supply and demand. If housing in upzoned and non-upzoned areas become imperfect substitutes after upzoning, this reasoning yields a third prediction:

(3) Anticipated dwelling construction in upzoned areas decrease property prices in upzoned areas relative to non-upzoned areas.

Thus, the appreciatory effects of upzoning via the redevelopment channel (1) are potentially offset or altogether dominated by the depreciatory effects of increased construction (3). The relative magnitude of these opposing effects is mediated by the extent of site development, $q_0^{(i)}$, as stipulated under (2). For example, properties that are already developed to the extent permitted after upzoning might depreciate relative to similarly developed properties that were not upzoned, since these properties have no redevelopment potential.

Note that effects (1) and (3) become evident by comparing outcomes in upzoned areas relative to non-upzoned areas. Our conceptual framework does not, therefore, identify *average* changes in redevelopment premiums and house prices across the city. It does, however, permit us to uncover evidence of these city-wide effects because it suggests that upzoning manifests as a distinct and identifiable pattern in house price changes between upzoned and non-upzoned areas provided we condition on site development. Specifically, (3) should manifest as upzoned, pre-existing high intensity dwellings appreciating *relative* to non-upzoned, pre-existing high intensity dwellings. Meanwhile, (1) manifests as underdeveloped, upzoned properties appreciating *relative* to underdeveloped, non-upzoned properties.

Finally, note that (3) can be consistent with no overall increase in the city's dwelling stock if upzoning only reallocates anticipated future construction from non-upzoned to upzoned areas. It is therefore critical to carefully check for evidence of this potential demand shift on house prices and, if necessary, control for it, before concluding that the policy generated an overall increase in anticipated dwellings. We explore this possibility in our spillover robustness checks (section 'Treatment spillovers').

Empirics

Data

Our primary dataset consists of all residential property sales in Auckland between 2010 and 2017 (inclusive). The dataset contains various information on the transacted properties, including: the sales price (excluding chattels); date of sale; assessed value of land and improvements; land area (in hectares), where applicable; floor area and site footprint (in square metres); whether the land title is freehold or leasehold; dwelling type (house, unit or apartment); number of bedrooms and bathrooms; decade of construction; latitude and longitude of the property; and Area Unit (AU) in which the property is located.[6] Each house has a unique identifier, so we can track sales of individual properties over time. We clean the data to remove transactions that appear to have had information incorrectly coded or omitted, that appear to be non-market transactions or that are not relevant to our study (see the Supplemental Material for details).

We also identify properties with joint ownership of the land underlying the building, such as apartments and cross-leases.[7] In our preferred specification we limit the sample to titles with exclusive land ownership, since redevelopment of these sites is not affected by title assembly problems (O'Flaherty, 1994). However, a robustness check reveals that this has no impact on our results (see section 'Including properties with joint land ownership').

The intensity ratio plays a significant role in our empirics. It is constructed as:

$$intensity = \frac{IV}{AV} = 1 - \frac{LV}{AV} \tag{2}$$

where AV is total assessed value, LV is assessed land value and IV is the improved value (or capital value) of the property. $IV = AV - LV$ holds as an identity. Assessed values are based on local government valuations for levying property taxes. The redevelopment premium is decreasing in intensity, meaning that negative coefficients on intensity in hedonic regressions indicate a positive premium. By construction the ratio lies between zero and one, but the ratio does not exceed 0.8 in our sample.

We use longitude and latitude to identify the planning zone in which the property is located, retaining transactions in the four main residential zones introduced in the third section: *Terrace Housing and Apartments* (which we refer to as 'Zone 4'); *Mixed Housing Urban* ('Zone 3'); *Mixed Housing Suburban* ('Zone 2'); and *Single House* ('Zone 1').[8]

Additional variables are generated and employed as controls. We identify houses with two or more storeys (by comparing floor area to site footprint), we derive the approximate building age (difference between the date of sale and decade in which the building was constructed),[9] and longitude and latitude are used to calculate distance to the CBD.[10] To control for neighbourhood income, we use the median household income for the AU in which the property is located.[11]

Econometric model

Suppose that the policy is announced in time period t_0. Our regression is

$$\begin{aligned}\frac{1}{T_i}(p_{i,t_1} - p_{i,t_{-1}}) &= \beta_1 + \sum_{s=2}^{m} \beta_s zone_{s,i} \\ &+ \delta_1 intensity_i + \sum_{s=2}^{m} \delta_s zone_{s,i} intensity_i \\ &+ \gamma' X_i + \varepsilon_i\end{aligned} \tag{3}$$

where:

- i = 1,…,n indexes the transactions (houses) in the sample.
- $p_{i,t_{-1}}$ is log sales price (excluding chattels) of house i in period $t_{-1} < t_0$ (i.e. before the announcement); p_{i,t_1} is log sales price (excl. chattels) of house i in period $t_1 > t_0 > t_{-1}$. A property is therefore included in our sample if it was sold in period t_{-1} and in period t_1. In our baseline empirical specification, we use the years 2010 through 2012 (inclusive) for t_{-1} and September 2016 to December 2017 for t_1, which leaves 2340 observations. If a house was sold more than once within t_{-1} or t_1, we use the first transaction in the period.
- T_i denotes the years between the sale of house i in period t_{-1} and period t_1, so that the dependent variable is an annualised rate of inflation. The average number of years between transactions is 5.64.
- $\{zone_{s,i}\}_{s=2}^{m}$ are upzoning dummies for Zone 2, Zone 3 and Zone 4, respectively. Thus $m = 4$. The reference group is Zone 1 (*Single House*).
- $intensity_i$ is intensity (see eq. (2)) in period t_{-1}.
- X_i is a vector of controls including property attributes and neighbourhood information: (log) land area; (log) floor area; a dummy variable indicating two or more storeys; number of bedrooms; number of bathrooms; approximate building age; (log) distance to CBD;[12] and (log) median household income for the AU. We report regression results with and without these controls.

Eq. (3) is the first difference of a conventional difference-in-differences regression where the treatment is interacted with *intensity*. In the Supplemental Material we demonstrate this equivalence step-by-step.

Table 1 documents sample descriptive statistics for the variables in the model. Supplemental Table A2 contains these descriptives stratified by residential zone, showing that sales in zones that permit more intensive development tend to be closer to downtown and in suburbs with lower incomes. Average intensity is similar across all four zones.

Approximately one-quarter of the transactions (25.5% = 597/2340) fall into the *Single House* zone, which acts as our quasi-control. 51.2% (= 1199/2340) are in *Mixed*

Table 1. Summary statistics.

	Mean	Median	Std dev.	Skew	1st perc	5th perc	95th perc	99th perc
Price appreciation	0.12	0.12	0.03	−0.80	0.04	0.07	0.18	0.21
Intensity	0.43	0.44	0.13	−0.25	0.10	0.21	0.63	0.70
Land area (ha)	0.07	0.07	0.03	4.85	0.02	0.03	0.11	0.18
Floor area (m^2)	154.61	140.00	62.34	1.02	70.00	80.00	274.50	340.60
Bedrooms	3.48	3.00	0.74	0.40	2.00	3.00	5.00	5.00
Bathrooms	1.65	2.00	0.74	1.04	1.00	1.00	3.00	4.00
Building age (yr)	38.72	40.00	26.40	0.64	1.00	2.00	92.00	102.00
Dist. to CBD (km)	17.89	14.37	11.43	1.25	2.24	4.47	41.91	51.27
AU income (NZ$ 000)	64.60	61.60	15.52	0.01	36.90	42.00	95.50	100.00

Notes: Price appreciation is the average annual change in log prices and is based on repeat sale residential transactions between the pre-treatment sample (January 2010 to December 2012) and the post-treatment sample (September 2016 to December 2017). AU income is median household income (NZ$) in the Area Unit (suburb) of the transaction and is obtained from the 2006 census. ‘Skew’ denotes skewness, while ‘perc’ denotes percentile.

Housing Suburban and 18.3% (= 428/2340) fall into *Mixed Housing Urban*. Only 5% (= 116/2340) of the transactions fall into the *Terrace Housing and Apartments* zone, which permits the most site development.

Several features of eq. (3) are worth remarking on.

(1) The coefficients $\{\delta_s\}_{s=2}^{m}$ capture the effect of upzoning on the redevelopment premium. Recall that the coefficient on the intensity ratio from hedonic regressions is used to estimate the redevelopment premium. The coefficient δ_1 therefore captures the change in the redevelopment premium for the reference group (Zone 1), which was not subject to upzoning. In turn, coefficient δ_4 captures the change in the redevelopment premium for houses located in Zone 4 relative to the change in the redevelopment premium for houses in Zone 1. A priori we expect this coefficient to be negative since the redevelopment premium is decreasing in intensity and upzoning should increase the redevelopment premium. Similar statements can be made about δ_2 and δ_3 for Zones 2 and 3.

(2) Because the dependent variable is the change in individual house prices, the empirical model controls for time-invariant confounding factors affecting house prices over the sample period. In this regard, our approach is like that advocated by Dalton and Zabel (2011) and Gyourko and Molloy (2015: 1303–1304), who suggest panel data can be used to address the endogeneity of regulations. Note that our difference-in-differences model is not based on a repeated cross section (c.f. Freemark, 2019a), but a panel.

(3) The vector X_i includes property attributes and geographic characteristics to control for any remaining confounding factors that vary over the sample period. For example, an increase in transport congestion may have inflated the premium for houses closer to downtown, hence we control for distance to the CBD. Because the empirical model is a time-differenced hedonic regression, the parameters associated with X_i can be interpreted as changes in the hedonic coefficients on the attributes between t_{-1} and t_1.

Regression results

Column (A) in Table 2 reports regression results. It includes results for when all controls are omitted and when controls related to the geographic characteristics (household income and distance to downtown) are omitted. See columns (B) and (C).

The coefficients on the three upzoning dummy variables interacted with intensity are negative and statistically significant. This is strong evidence of upzoning increasing the redevelopment premium (see Remark (1) in the preceding section). Furthermore, note that the magnitudes of these coefficients correspond to the ordinal ranking of permissible site development under each zone.

The coefficients on the upzoning dummy variables (not interacted) are positive and statistically significant, indicating that an upzoned property with intensity of zero (i.e. equivalent to an empty lot) appreciated relative to non-upzoned properties. The magnitudes of the estimated coefficients again correspond to the ordinal ranking of permissible development under each zone.

Interestingly, the coefficient on intensity (not interacted) is statistically indistinguishable from zero. This suggests that there was no change in the redevelopment premium for the quasi-control group after the announcement.

Next, to illustrate how the effect of upzoning on overall house prices depends

Table 2. Regression results.

	(A)	(B)	(C)	(D)	(E)	(F)
Constant	0.324***	0.214***	0.129***	0.360***	0.189***	0.126***
Zone 4	0.037***	0.042***	0.042***	0.027***	0.033***	0.033***
Zone 3	0.032***	0.034***	0.034***	0.026***	0.029***	0.028***
Zone 2	0.020***	0.021***	0.015***	0.018***	0.020***	0.014***
Intensity	0.003	0.003	–0.044***	−0.003	0.005	–0.034***
Zone 4 × Intensity	−0.057***	−0.064***	−0.056**	−0.050***	−0.059***	−0.056**
Zone 3 × Intensity	−0.048***	−0.050***	−0.044***	−0.039***	−0.041***	−0.036***
Zone 2 × Intensity	−0.027**	−0.029***	−0.017	−0.026***	−0.030***	−0.017*
ln(land)	0.001	−0.002		−0.002	−0.001	
ln(floor)	−0.025***	− 0.026***		−0.020***	−0.023***	
Bedrooms	0.002	0.002		0.003***	0.003***	
Bathrooms	0.003**	0.003**		0.002**	0.002*	
multiple storey dummy	−0.000	0.005		−0.001	−0.001	
ln(age)	0.003***	0.003***		0.004***	0.004***	
Land dummy				0.002	0.003	
Apartment dummy				−0.005	−0.006	
ln(distance)	−0.004**			−0.002**		
ln(AU income)	−0.009**			−0.016***		
R-squared	0.147	0.143	0.092	0.127	0.120	0.067
Adjusted *R*-squared	0.141	0.138	0.089	0.123	0.116	0.065
Observations	2340	2340	2340	3695	3695	3695

Notes: OLS estimates of the regression equation (3). (A), (B) and (C) are based on the sample of properties with exclusive land ownership. (D), (E) and (F) are based on the sample that includes properties with joint land ownership on the title (such as apartments and houses on cross-leased parcels). We include dummy variables for properties with exclusive land titles and apartments or units in models (E) and (F). The dependent variable is annualised percent change in repeat sale residential transactions between the pre-treatment sample (January 2010 to December 2012) and the post-treatment sample (September 2016 to December 2017). ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively, based on Conley (1999) spatial dependence and heteroscedasticity robust standard errors with a 10 km bandwidth. Zone 4 is the most intensive residential zone under the new LURs; Zone 1 is the least intensive. R-squareds are expressed as a proportion of 1.

on existing site development, we use the estimated regression model to construct predicted changes in house prices conditional on both the residential zone and the intensity ratio. For each of the four zones, Figure 2 plots the expected annualised price appreciation conditional on intensity. For this exercise we set the control variables in X_i to their sample means to construct predicted values.

First, we consider Zone 4, which permits the most site development. Holding all else equal, the model implies that houses located in this zone appreciated by between 14.7% (intensity $=$ 0) and 9.3% per year (intensity $=$ 1). This illustrates how intensity mediates the impact of upzoning on house prices, with properties that had relatively little site development (i.e. low intensity) appreciating relative to properties with more site development (i.e. high intensity).

However, recall that intensity does not exceed 0.8 in our sample. We therefore also consider appreciation rates for houses with

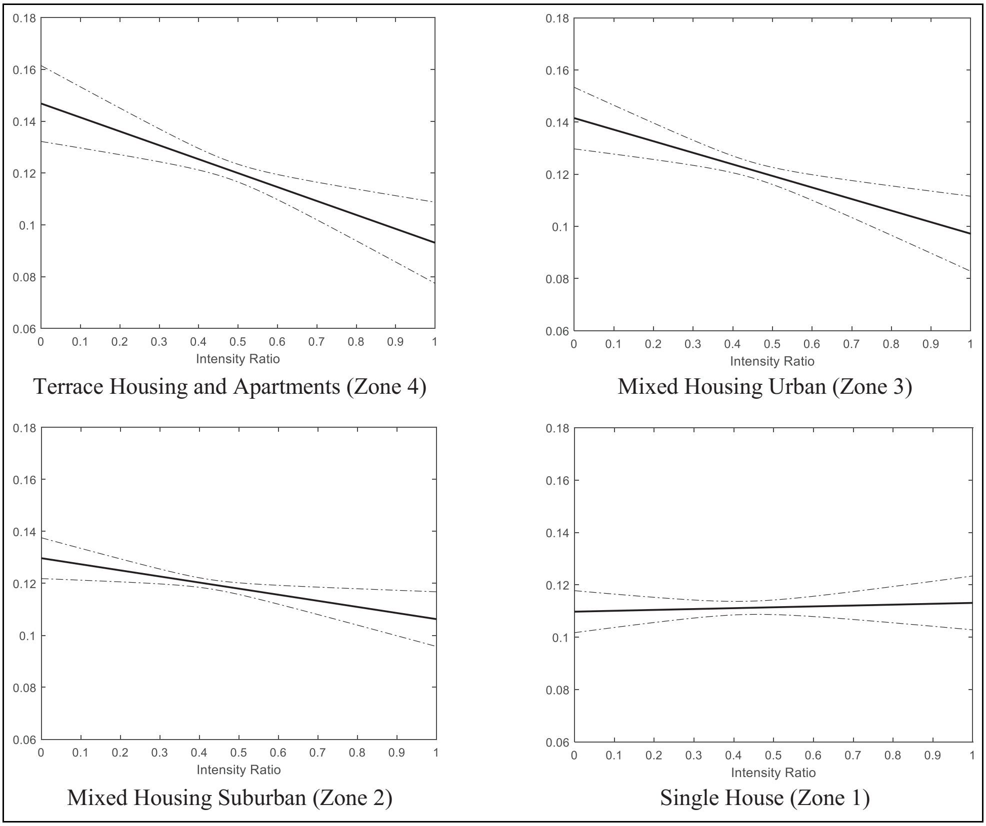


Figure 2. Expected price appreciation conditional on intensity ratio and residential zone.
Notes: Conditional expectations are based on OLS estimation of (3). See Table 2 for estimated coefficients. Dashed lines represent 95% confidence intervals. Standard errors are robust to spatial dependence and heteroscedasticity.

an intensity at either end of the empirical distribution – specifically at the 1st and 99th percentiles. Across all zones, the 1st and 99th percentiles of the intensity ratio are 0.103 and 0.705 (see Table 1). The model implies that Zone 4 properties at the 1st percentile appreciated by 14.1% on average, whereas properties at the 99th percentile appreciated by 10.9%.

Next, we consider Zone 1, which permits the least site development and is the quasi-control. The coefficient on intensity is close to zero, which implies very little variation in expected house price appreciation conditional on intensity, varying between 11.0% (*intensity* = 0) and 11.3% (*intensity* = 1). The difference in appreciation rates at the 1st and 99th percentiles of intensity is smaller (11.0% versus 11.2%).

The difference in appreciation rates between Zone 4 (upzoned) and Zone 1 (non-upzoned) reveals how the price impact of upzoning depends on intensity. This difference is depicted in Supplemental Figure A4. Notably, houses in Zone 4 with intensity above 0.63 (the 95th percentile) *depreciated* when compared with houses in Zone 1 with intensity above 0.63. This implies that upzoning decreased prices on pre-existing high intensity housing. Conversely, houses in Zone 4 with intensity below 0.63 appreciated relative to houses in Zone 1 with intensity below 0.63, implying that upzoning increased prices of moderate and low intensity housing.

Predicted price changes in Zones 2 and 3 further corroborate the predictions of the real option model. Houses located in Zone 3 (which permits more development than Zones 1 and 2, but less than Zone 4) appreciated by between 14.1% (intensity = 0) and 9.7% (intensity = 1). Corresponding figures at the 1st and 99th percentiles are 13.7% and 11.1%. Houses located in Zone 2 (which permits more development than Zone 1, but less than Zones 3 and 4) appreciated by between 13.0% (intensity = 0) and 10.6% (intensity = 1) per year. Corresponding figures at the 1st and 99th percentiles are 12.7% and 11.3%.

A consistent pattern emerges. The impact of upzoning on prices diminishes as intensity increases. Beyond a sufficiently high intensity, the upzoned property depreciates relative to similar properties that were not upzoned.

The statistically significant controls also merit brief comment. House price appreciation is decreasing in distance to downtown (perhaps reflecting increased congestion costs), increasing in building age, and increasing in number of bathrooms (consistent with the well-documented increase in population pressures in Auckland over the sample period). Interestingly, however, after conditioning other controls, including the number of bedrooms and bathrooms, larger homes appreciated by less over the sample period.

One potential drawback of our approach is that we do not take into account the residential zone of the transacted house prior to the AUP implementation.[13] For example, houses rezoned to *Terrace Housing and Apartments* may have already been in areas that permitted intensive development. However, there is no statistically significant difference in either the average population densities across the four zones in our sample of transactions, suggesting that this is unlikely.[14]

Robustness checks

Including properties with joint land ownership. We expand the sample to include properties that have joint ownership of the underlying land on the title, which includes apartments and houses on cross-leased sites. We alter the empirical specification slightly by including dummy variables for properties with exclusive land ownership[15] and for dwellings identified as apartments. Results are reported in columns (D) through (F) of Table 2.

Our main findings are unaffected. First, the coefficients on intensity interacted with the upzoning treatments are negative and statistically significant. Second, price appreciation is decreasing in site intensity: Supplemental Figure A3 shows that predicted price appreciations (by residential zone and conditional on intensity) are very similar to those exhibited in Figure 2. However, the fitted model implies that a larger proportion of upzoned houses decreased in value relative to houses that were not upzoned, with houses with intensity above 0.55 (the 80th percentile) depreciating when located in Zone 4 compared with Zone 1 (see Figure A4, available online). This is unsurprising given that many of the dwellings with joint land ownership are high intensity (units and apartments) and further corroborates upzoning having an immediate depreciative effect on high intensity dwellings.[16]

Alternative pre- and post-treatment periods. We also explore the extent to which our results are sensitive to the selected pre-treatment and post-treatment periods. We consider three different designs. The first examines whether market participants anticipated which areas would be targeted for upzoning soon after the Local Government Act of 2010 required AC to generate a new unified set of LURs (see section 'Institutional background'), using 2007 to 2009 as the pre-treatment period. The second examines whether our findings are robust in a larger sample that uses 2007 to 2012 as the pre-treatment period. The third examines whether houses prices adjusted immediately after the draft AUP announcement in March 2013, using 2014 to 2017 as the post-treatment sample.

Columns (A) through (C) in Table A3 (available online) exhibit the results. Our qualitative conclusions remain the same. The coefficients on the upzoning dummies interacted with intensity are negative and statistically significant at the 1% level (except in two cases). Interestingly, the coefficient on intensity is negative and statistically significant when 2007 to 2009 is the pre-treatment period, perhaps indicating that the redevelopment premium was increasing across the city as a whole over this longer sample period.

Treatment spillovers. Upzoning may have reallocated development from non-upzoned to upzoned areas, resulting in a demand spillover that would cause our estimates to overstate the price effects of upzoning. A standard approach to control for spillovers in difference-in-differences is to exploit variation in the geographic distance between treatment and control areas under the assumption that the magnitude of the spillover decreases with distance (Clarke, 2017). We implement two robustness checks based on this principle. We describe our main findings below, but specific details and results from the methods can be found in the Supplemental Material.

First, we estimate the baseline regression using a 'doughnut' sample.[17] The control group consists only of *Single House* transactions in townships that are located far from the urban core of Auckland. These townships contain no, or very little, land that has been upzoned and thus are not subject to the confounding demand-shifting spillover within the township. Meanwhile, we restrict our treatment sample to upzoned areas within the urban core of Auckland. We find that price appreciation rates conditional on intensity are statistically indistinguishable from those obtained from the baseline sample, suggesting that these spillover effects are negligible, if present. Refer to Figure A6 and the associated discussion in the Supplemental Material.

Second, we implement the Clarke (2017) method by constructing an indicator for control group (i.e. *Single House*) transactions that are within a specified distance to a treatment area. This proximity control dummy is then included in the baseline regression and is also interacted with intensity, so that the upzoning treatment is measured relative to control group observations that exceed the specified distance to treatment areas. We use both the 80th and 90th percentile distances between *Single House* transactions and upzoned areas as distance cut-offs, leaving 20% and 10% of the control sample, respectively, to identify the treatment effects. The regression results indicate no spillover effect. Specifically, the proximity control dummy indicator and the dummy interacted with intensity are both statistically insignificant, indicating that there is no statistical evidence of a differential treatment effect between proximate treatment and control groups relative to distant treatment and control groups. See Supplemental Table A5.

Placebo tests. We apply the placebo test proposed by Chetty et al. (2009) by estimating the same model over pre- and post-treatment periods that altogether precede the AUP announcement. These placebo tests serve two purposes. First, they indicate whether geographic variation in upzoning is related with any omitted variables driving long-run variation in house prices. Second, they tell us whether the upzoning treatment was anticipated by the market prior to the draft AUP announcement in 2013.

We focus on three placebo pre- and post-treatment periods: 2005 to 2007 (pre) and September 2011 to 2012 (post); 2004 to 2006 (pre) and September 2010 to 2011 (post); and 2003 to 2005 (pre) and September 2009 to 2010 (post). These dates mimic the pre- and post-treatment structure used in our preferred specification, but the relevant periods have been pushed back in time by between 5 and 7 years, so that the first draft AUP announcement in March 2013 is omitted altogether from the sample periods. Columns (D) through (F) in Supplemental Table A3 exhibit the results.

In all placebo samples the coefficients on the upzoning dummies are mostly statistically insignificant. The single exception is the coefficients on the Zone 3 dummies in the 2003–2005 to September 2009–2010 sample, which are significant at the 5% level but incorrectly signed. From this we may conclude that there is no differential effect of intensity on house price inflation across the four zones prior to the draft AUP announcement in 2013. This suggests that the geographic variation in upzoning is unrelated to any omitted variables driving long-run variation in house prices, and that the market did not anticipate which areas would be upzoned prior to the first announcement.

Conclusion

This paper examines the short-run impact of a large-scale upzoning on house prices and redevelopment premiums in Auckland. Upzoning unambiguously increases redevelopment premiums, as predicted by real option theory, but the net effect of the policy on house prices is mediated by the property's economic potential for site redevelopment, with less-developed properties appreciating relative to intensively developed properties. These findings passed several robustness checks and placebo tests.

Upzoning is increasingly advocated and implemented in response to unaffordable housing (Freeman and Schuetz, 2017; National Public Radio, 2019), and our findings have important implications for evaluating the efficacy and impacts of upzoning programmes. First, policy evaluation should primarily be based on prices of targeted intensive housing forms (apartments and terraced housing), not those of underdeveloped, single house properties that are likely to appreciate from upzoning. Second, there are immediate distributive impacts of upzoning on wealth within the population of home-owning households, with owners of underdeveloped properties realising an increase in wealth relative to owners of intensively developed properties.

We also find that properties that exceeded a sufficiently high level of development depreciated relative to similar non-upzoned properties, indicating that upzoning can have an immediate depreciative effect on pre-existing high intensity housing. Although this is consistent with the market anticipating future construction of intensive housing, concerns remain regarding the capacity for upzoning to generate an increase in construction sufficient to significantly reduce house prices (Favilukis et al., 2019) or improve housing affordability for middle and lower income households (Rodriguez-Pose and Storper, 2020; Wetzstein, 2019). Thus, the long-run impact of the AUP on house prices and affordability hinges on a variety of additional factors that merit further investigation. This includes the amount of intensive housing construction generated; the pricing composition of that housing; distributional impacts on housing accessibility and home ownership across socioeconomic groups; and the intersection and coordination of zoning with urban transportation and development policies. These areas are beyond the scope of this paper but are worthy potential future research topics.

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Notes

1. Freemark (2019a: 5) states: ‘Schill noted in 2005 that there has been insufficient study of the effects of land use reforms on housing supply and values, and that remains true today’.
2. Freeman and Schuetz (2017: 229) state ‘[T]o date no city has systematically upzoned large shares of land as a mechanism to promote affordability’.
3. Two elements of the AUP were not fully operational at this time: (1) parts subject to Environment Court and High Court under the Local Government Act 2010, and (2) the regional coastal plan of the PAUP, which required Minister of Conservation approval.
4. Prior to the AUP, with infill and redevelopment there was estimated capacity for 345,176 additional dwellings (Fredrickson and Balderston, 2013: 15). After the AUP, this figure was 1,076,267 (Auckland Council, 2017: 38).
5. DiNardo (2008) explains that quasi-natural experiments are ‘serendipitous situations in which persons are assigned randomly to a treatment (or multiple treatments) and a control group’, which permit analysis of outcomes with respect to the particular treatment. In our setting, the unit of observation are properties and the treatment is upzoning.
6. AUs are non-administrative geographic areas defined by Statistics NZ. Within residential urban areas, AUs are typically a collection of city blocks or suburbs and contain 3000–5000 persons. For additional details see http://aria.stats.govt.nz/aria/#ClassificationView:uri=http://stats.govt.nz/cms/ClassificationVersion/cVYnMpeILgJRAY7E
7. Cross-leasing was an inexpensive alternative to subdivision in NZ, whereby two or more title holders jointly own the land underlying the residential structures and lease use of the land back to one-another at a peppercorn rate.

8. AUP geographic vector data obtained from the Department of Geography, University of Auckland.
9. Because we only have the decade in which the house was built, ages are approximated based on the first year of the decade.
10. We use the location of the iconic 'Skytower'.
11. 2006 census data. The next census is in 2013, which is during the observation period. Median incomes above NZ$100,000 are truncated to NZ$100,000 for 19 of the approximately 340 AUs.
12. We also considered the distance to the nearest rail, ferry or express busway station instead of distance to downtown. Our main findings were unaffected but model fit reduced marginally.
13. There was no uniform set of planning rules for the region. Prior to amalgamation (see section 'Institutional background') the seven authorities used different plans, resulting in approximately 99 residential zones.
14. Results not reported for brevity but are available upon request.
15. The dummy is effectively interacted with (log) land area because our dataset only has land area for houses with exclusive ownership of land on the title.
16. Without information on the entire stock of dwellings we cannot use the model to estimate the proportion of housing that decreased in relative price from upzoning. However, the model implies that 26.9%, 1.74% and 0.38% of the transacted houses in Zones 4, 3 and 2, respectively, experienced a decrease. However, selection effects mean that this sample of transacted houses is unlikely to be representative of Auckland's housing stock.
17. We thank an anonymous referee for suggesting this approach.

References

Anacker KB (2019) Introduction: Housing affordability and affordable housing. *International Journal of Housing Policy* 19(1): 1–16.

Atkinson-Palombo C (2010) Comparing the capitalisation benefits of light-rail transit and overlay zoning for single-family houses and condos by neighborhood type in Metropolitan Phoenix, Arizona. *Urban Studies* 47(11): 2409–2426.

Auckland Council (2017) National policy statement on urban development capacity 2016: Housing and business development capacity assessment for Auckland. Auckland: Auckland Council. Available at: https://knowledgeauckland.org.nz/publications/national-policy-statement-on-urban-development-capacity-2016-housing-and-business-development-capacity-assessment-for-auckland/

Balderston K and Fredrickson C (2014) Capacity for Growth Study 2013 (Proposed Auckland Unitary Plan): Results. Auckland Council technical report, TR2014/010. Auckland: Auckland Council.

Been V, Ellen IG and O'Regan K (2019) Supply skepticism: Housing supply and affordability. *Housing Policy Debate* 29(1): 25–40.

Chakraborty A, Knaap G-J, Nguyen D, et al. (2010) The effects of high-density zoning on multifamily housing construction in the suburbs of six US Metropolitan areas. *Urban Studies* 47(2): 437–451.

Chetty R, Looney A and Kroft K (2009) Salience and taxation: Theory and evidence. *American Economic Review* 99(4): 1145–1177.

Clapp JM and Salavei K (2010) Hedonic pricing with redevelopment options: A new approach to estimating depreciation effects. *Journal of Urban Economics* 67(3): 362–377.

Clapp JM, Jou J-B and Lee T (2012a) Hedonic models with redevelopment options under uncertainty. *Real Estate Economics* 40(2): 197–216.

Clapp JM, Salavei Bardos K and Wong SK (2012b) Empirical estimation of the option premium for residential redevelopment. *Regional Science and Urban Economics* 42(1): 240–256.

Clarke D (2017) *Estimating difference-in-differences in the presence of spillovers*. Munich Personal RePEc Archive (MRPA) Working Paper 81604. Available at: https://mpra.ub.uni-muenchen.de/81604/

Conley TG (1999) GMM estimation with cross sectional dependence. *Journal of Econometrics* 92(1): 1–45.

Dalton M and Zabel J (2011) The impact of minimum lot size regulations on house prices in

Eastern Massachusetts. *Regional Science and Urban Economics* 41(6): 571–583.

Demographia (2018) *15th Annual Demographia International Housing Affordability Survey*. Available at: http://demographia.com/dhi2019.pdf

DiNardo J (2008) Natural experiments and quasi-natural experiments. In: Macmillan Palgrave (ed.) *The New Palgrave Dictionary of Economics*. London: Palgrave Macmillan.

Favilukis J, Mabille P and Van Nieuwerburgh S (2019) *Affordable housing and city welfare*. NBER Working Paper 25906. Cambridge, MA: National Bureau of Economic Research.

Fredrickson C and Balderston K (2013) *Capacity for Growth Study 2012*. Working Report, Auckland Council. WR2012/006. Auckland: Auckland Council. Available at: https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/unitary-plan/history-unitary-plan/documents-section32reportproposedaup/appendix-3-4-8.pdf

Freeman L and Schuetz J (2017) Producing affordable housing in rising markets: What works? *Cityscape: A Journal of Policy Development and Research* 19(1): 217–236.

Freemark Y (2019a) Upzoning Chicago: Impacts of a zoning reform on property values and housing construction. *Urban Affairs Review* 56(3): 758–789.

Freemark Y (2019b) Doubling housing production in the Paris region: A multi-policy, multi-jurisdictional response. *International Journal of Housing Policy*. Epub ahead of print 19 December 2019. DOI: 10.1080/19491247.2019.1682233

Gabbe CJ (2018) Why are regulations changed? A parcel analysis of upzoning in Los Angeles. *Journal of Planning Education and Research* 38(3): 289–300.

Glaeser EL and Gyourko J (2003) The impact of building restrictions on housing affordability. *Economic Policy Review* 9(2): 21–39.

Glaeser EL and Ward B (2009) The causes and consequences of land use regulation: Evidence from Greater Boston. *Journal of Urban Economics* 65(3): 265–278.

Gyourko J and Molloy R (2015) Regulation and housing supply. In: Duranton G, Henderson JV and Strange WC (eds) *Handbook of Regional and Urban Economics. Vol. 5 of Handbook of Regional and Urban Economics*. Amsterdam: Elsevier, pp. 1289–1337.

Hilber CA and Vermeulen W (2016) The impact of supply constraints on house prices in England. *The Economic Journal* 126(591): 358–405.

Ihlanfeldt K (2007) The effect of land use regulation on housing and land prices. *Journal of Urban Economics* 61: 420–435.

Jackson K (2016) Do land use regulations stifle residential development? Evidence from California cities. *Journal of Urban Economics* 91: 45–56.

Manville M, Monkkonen P and Lens M (2020) It's time to end single-family zoning. *Journal of the American Planning Association* 86(1): 106–112.

National Public Radio (2019) How U.S. cities are tackling the housing affordability crisis. Available at: https://www.npr.org/2019/08/28/755113175/1a-across-america-how-u-s-cities-are-tackling-the-affordable-housing-crisis (accessed 10 September 2019).

O'Flaherty B (1994) Land assembly and urban renewal. *Regional Science and Urban Economics* 24(3): 287–300.

Pogodzinski JM and Sass TR (1991) Measuring the effects of municipal zoning regulations: A survey. *Urban Studies* 28(4): 597–621.

Quigley JM and Raphael S (2005) Regulation and the high cost of housing in California. *American Economic Review* 95(2): 323–329.

Rodriguez-Pose A and Storper M (2020) Housing, urban growth and inequalities: The limits to deregulation and upzoning in reducing economic and spatial inequality. *Urban Studies* 57(2): 223–248.

Schill MH (2005) Regulations and housing development: What we know. *Cityscape: A Journal of Policy Development and Research* 8(1): 5–20.

Wetzstein S (2019) Assessing post-GFC housing affordability interventions: A qualitative exploration across five international cities. *International Journal of Housing Policy*. Epub ahead of print 30 October 2019. DOI: 10.1080/19491247.2019.1662639