Differential impact of new public housing announcement on the property prices in more- and less-expensive neighbourhoods

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Contribution

- We investigated the announcement effect of public housing on property prices using a novel hedonic quality adjusted DiD method
- We found that the announcement of new public housing had a differential effect on neighbouring property prices
  - A negative impact in more expensive suburbs
  - No impact in less expensive suburbs

Motivation

- Public housing has been a policy in many countries for decades, providing subsidised shelter to low-income households
- The cost-benefit analysis for public housing should include external effects on the community (Prentice & Scutella 2018)
- The general perception of public housing is that the overall external effect is negative but heterogeneous (Nguyen 2005)
- Local residents' attitude towards public housing is reflected in changes in preferences to live in that neighbourhood (Schwartz et al. 2006)
- Public housing is a place-based policy, and policy formulation requires examining the effect by location (Diamond and McQuade 2019)[†]

A new public housing announcement

- The announcement occurred on 15 March 2017, outlining the construction of new public housing in ACT, Australia
- Single announcement covering all 5 locations
- Public housing is commissioned, and will be administered and managed by the same government authority
- The announcement was unanticipated as evidenced from the subsequent reaction to the announcement of the local residents

A new public housing announcement (cont.)

- Locals in some of the host neighbourhoods fiercely criticized the locations of the new public housing complexes (Burgess 2017)†
- Local residents complained that local amenities and public transport were not sufficient to support the new public housing tenants
- The Chief Minister of the ACT government dismissed the residents' concerns as thinly veiled NIMBY-ism (Burgess, 2017)
- By the end of 2018 (where our data ends), the projects were still on foot although construction work had not yet begun

External effects of public housing

- Positive
  - New building improves the facade of a location (Santiago et al. 2001; Schwartz et al. 2006)
  - Economic activity increases in the neighbourhoods (Diamond and McQuade 2019)
- Negative
  - Overcrowding and increases in crime rates (Gibbons 2004; Aliprantis and Hartley 2015)
  - Crowding-out effect on private rental market (Sinai and Waldfogel 2005; Eriksen and Rosenthal 2010)†

Impact of public housing on nearby property prices

- Results are mixed
  - Positive impact – Nourse (1963) and Rabiega et al. (1984)
  - Negative impact – Goetz et al. (1996) and Lee et al. (1999)
  - Negligible impact – Lyons and Loveridge (1993), Briggs et al. (1999) and Ellen et al. (2007)
- Variety of factors impacting the results
  - Methodology and data used in studies (Schwartz et al. 2006)
  - Type of public housing (Aliprantis and Hartley 2015)
  - Level of compatibility between the public housing and the host neighbourhood (Nguyen 2005)†

Differential impact of public housing on nearby property prices

- Baum-Snow and Marion (2009) reported positive impact on nearby property prices if LIHTC housing is located in declining or stable neighbourhoods, but no such effect in gentrifying neighbourhoods[‡]
- Goujard (2011) found newly constructed public housing in low income suburbs has a positive impact on nearby property prices in Paris[†]
- Diamond and McQuade (2019) found positive impact of LIHTC housing in low income neighbourhoods in the US and vice-versa[§]

Where does our study fit?

- We investigate how the impact of public housing on surrounding property prices *differs* wrt the type of host neighbourhood
  - The type refers to whether the host neighbourhood is more expensive or less expensive than the rest of the ACT
- Our paper distinguishes itself from the few previous studies by
  - Examining the impact of the announcement that public housing is to be constructed (rather than the impact of public housing)
  - Devising a new method in a quasi-experimental framework
  - Identifying the heterogeneity of the impact with a unique set-up
  - Examining the impact of public housing in an new region

DiD models

- DiD Model:

$$Y_{ist} = \delta_0 + \delta_1 Treatment_s + \delta_2 After_t + \delta_3 After_t \times Treatment_s + \varepsilon_{ist}$$

- Treatment group: properties that are located in the suburbs where the public housing will be constructed
- Control group: properties that are located in ACT suburbs where the public housing will not be constructed
- *After* indicates whether a property was sold before or after (both within one year range) the announcement
- Identifying assumption: parallel trend

DiD models: Approach 1

- $Y_{ist} = \delta_0 + \delta_1 Treatment_s + \delta_2 After_t + \delta_3 After_t \times Treatment_s + \beta Z_{ist} + \epsilon_{ist}$
- Pros
  - Simple and used in similar and other contexts (Schwartz et al. 2006; Baum-Snow and Marion 2009; Goujard 2011)
- Cons
  - Restricts the implicit values of the hedonic characteristics to remaining fixed for the whole sample[†]
  - Results in biased estimates of the DiD coefficients

DiD models: Approach 2

- Involves two steps of estimations

- Step 1 (quality adjustment): Hedonic regressions are estimated separately for treatment and control groups
  - Hedonic model: $Y_{ist} = Z_{ist}\theta + \epsilon_{ist}$
  - Identifying assumption: conditional independence†

- Step 2 (identification): DiD regressions are run using the estimated residuals obtained from the first step as the dependent variable:

$$\widehat{\varepsilon}_{ist} = \delta_0 + \delta_1 Treatment_s + \delta_2 After_t + \delta_3 After_t \times Treatment_s + \upsilon_{ist}$$

DiD models: Approach 2 (cont.)

- Pros
  - Allows the implicit values of the hedonic characteristics to vary between treatment and control groups†
  - Reduces the variance of the estimated residuals and improves the precision of the estimates
- Cons
  - Public housing impacts the implicit values of the hedonic characteristics which impacts the post-announcement prices‡
  - Understates the impact of public housing on property prices

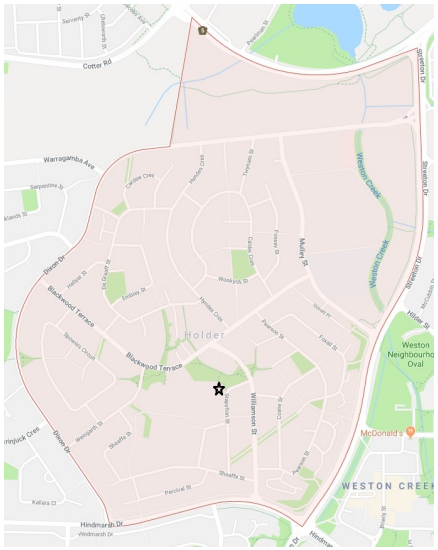
DiD models: Approach 3

- Run separate hedonic regressions for the following four samples
  - Pre-announcement control group properties
  - Post-announcement control group properties
  - Pre-announcement treatment group properties
  - Post-announcement treatment group properties
- Predict prices for each group using the post-announcement period characteristics but with the hedonic coefficients of the sample period
- Run DiD regression with those predicted prices
- Similarly for the pre-announcement period

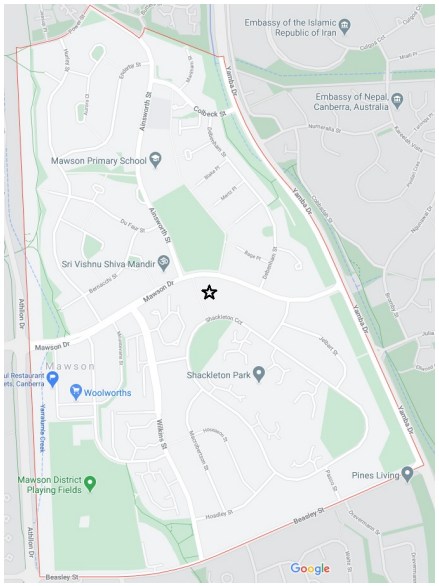
Data

- APM provided data of individual property sales in the ACT
- Cover the period between 15 March 2016 - 14 March 2018 (the announcement took place on 15 March 2017)
- Contain 9,958 houses from 109 suburbs
- Public housing will be constructed in 5 of these suburb but 2 other suburbs share borders with public housing complexes
- Each observation includes information on a number of physical attributes of properties[†]
- Each observation includes property address and transaction date

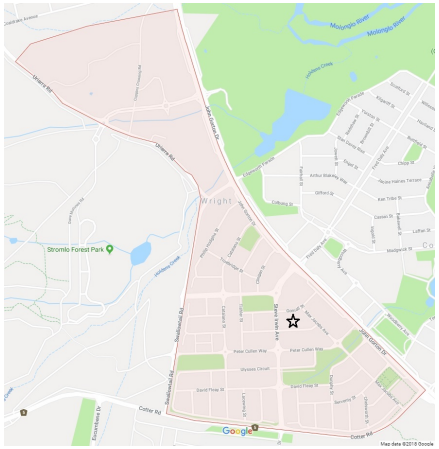
Host suburbs, where the public housing will be located ($\star$)



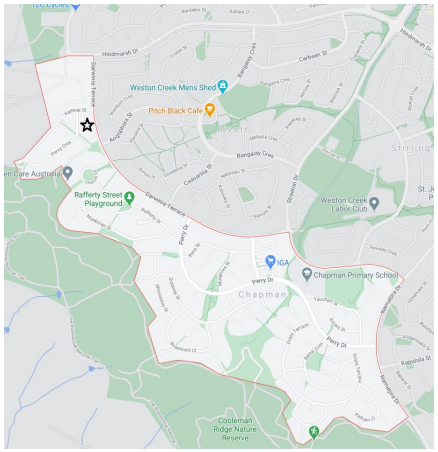
(a) Holder



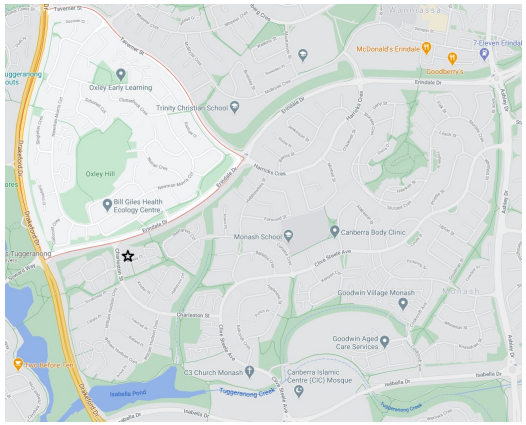
(b) Mawson



(c) Wright

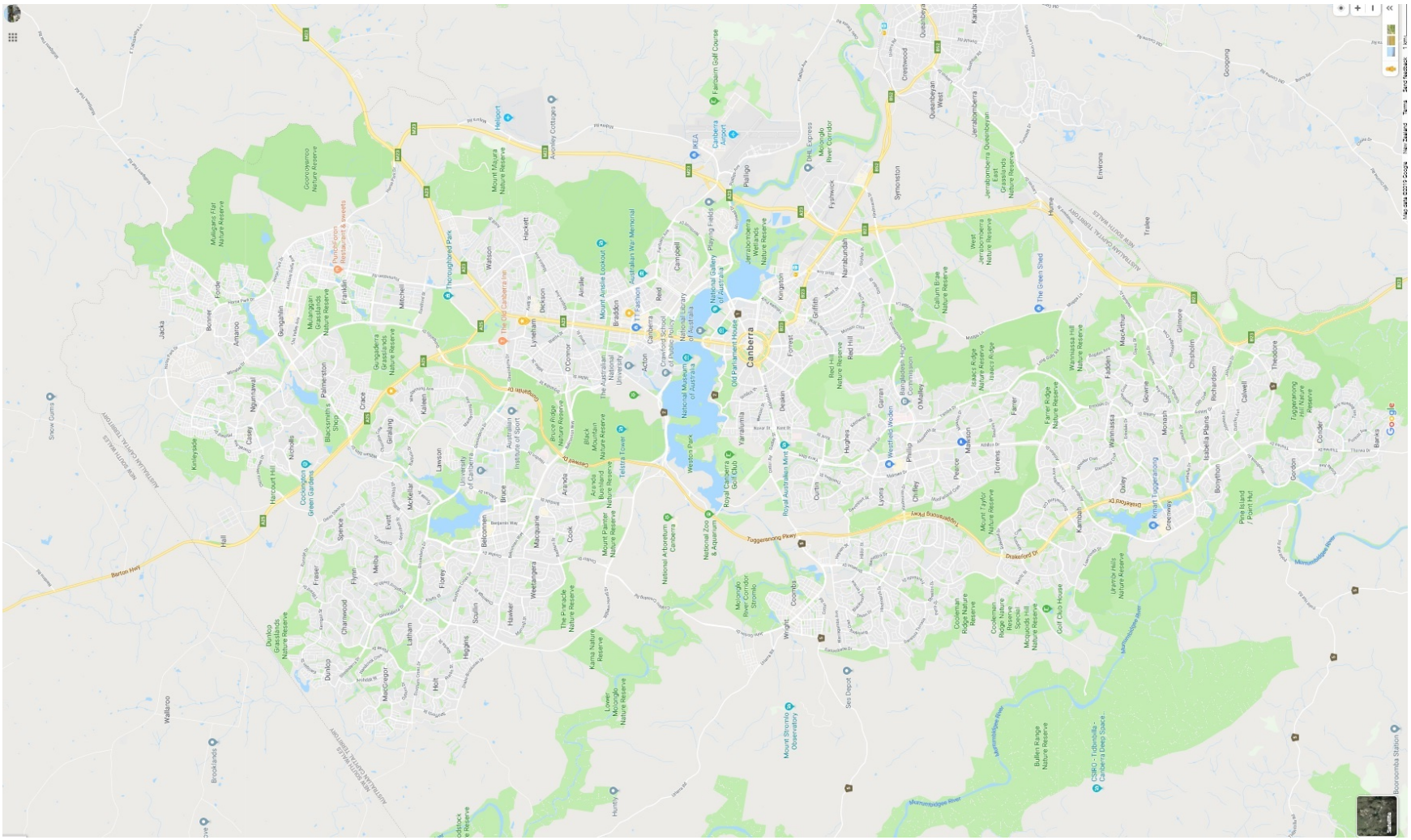


(d) Chapman & Rivett



(e) Monash & Oxley

Location of ACT suburbs analysed in this study



Prices of control and treatment group properties

Property location		Median prices (NZD$ '000)§			Quality-adjusted price differences†		
		Pre	Post	All	% of Base‡	Ranking	Grouping
Control suburbs	Mean	598	633	616	-	-	-
	Median	576	620	600			
	N	[4,646]	[4,751]	[9,397]			
Treatment suburbs	Mean	640	650	645	-	-	-
	Median	628	630	630			
	N	[286]	[275]	[561]			
Wright	Mean	731	716	724	19.32***	1	more expensive
	Median	787	780	782	(4.61)		
	N	[33]	[29]	[62]			
Chapman	Mean	738	757	745	18.85***	2	more expensive
	Median	710	800	749	(2.62)		
	N	[44]	[31]	[75]			
Mawson	Mean	744	691	722	16.19***	3	more expensive
	Median	735	681	713	(1.96)		
	N	[39]	[29]	[68]			
Holder	Mean	604	618	613	0.55	4	close
	Median	638	598	630	(3.02)		
	N	[30]	[50]	[80]			
Rivett	Mean	567	603	588	-3.89**	5	less expensive
	Median	553	600	571	(1.96)		
	N	[48]	[64]	[112]			
Oxley	Mean	632	654	642	-5.88**	6	less expensive
	Median	624	683	645	(2.72)		
	N	[16]	[14]	[30]			
Monash	Mean	552	616	580	-12.66***	7	less expensive
	Median	543	608	569	(2.77)		
	N	[76]	[58]	[134]			
All suburbs	Mean	600	634	617	-	-	-
	Median	580	622	600			
	N	[4,932]	[5,026]	[9,958]			

Attributes of properties

Variable	Pre-announcement			Post-announcement		
	Treatment (1)	Control (2)	*p*-value (3)	Treatment (4)	Control (5)	*p*-value (6)
Lot size	1,244 (2,628) [285]	1,241 (4,297) [4,592]	0.99	1,706 (4,409) [274]	1,133 (3,225) [4,718]	0.01
Number of bedrooms	3.522 (0.599) [224]	3.396 (0.616) [3,823]	0.00	3.445 (0.625) [211]	3.397 (0.617) [3,619]	0.27
Number of bathrooms	2.084 (0.706) [286]	1.941 (0.739) [4,646]	0.00	2.051 (0.762) [275]	2.015 (0.757) [4,751]	0.45
Number of parking	2.213 (0.681) [286]	2.079 (0.726) [4,646]	0.00	2.193 (0.722) [275]	2.167 (0.715) [4,751]	0.56
Have study	0.133 (0.340) [286]	0.145 (0.352) [4,646]	0.56	0.131 (0.338) [275]	0.122 (0.327) [4,751]	0.66
Have separatedining	0.108 (0.311) [286]	0.090 (0.286) [4,646]	0.30	0.124 (0.330) [275]	0.068 (0.251) [4,751]	0.00
Have heating	0.472 (0.500) [286]	0.471 (0.499) [4,646]	0.96	0.455 (0.499) [275]	0.394 (0.489) [4,751]	0.05
Have airconditioning	0.283 (0.451) [286]	0.307 (0.461) [4,646]	0.41	0.295 (0.457) [275]	0.286 (0.452) [4,751]	0.76
Have ensuite	0.402 (0.491) [286]	0.412 (0.492) [4,646]	0.73	0.385 (0.488) [275]	0.320 (0.466) [4,751]	0.02
Have garage	0.220 (0.415) [286]	0.233 (0.423) [4,646]	0.62	0.182 (0.386) [275]	0.201 (0.401) [4,751]	0.43

Cross table of the log price of properties

	Treatment (1)	Control (2)	Difference (3)
a. More-expensive suburbs			
Post-announcement	13.456	13.323	0.133***
	(0.029)	(0.004)	(0.029)
	[89]	[4,751]	[4,840]
Pre-announcement	13.487	13.262	0.225***
	(0.022)	(0.004)	(0.027)
	[116]	[4,646]	[4,762]
Post-Pre	-0.031	0.061***	-0.092**
	(0.035)	(0.006)	(0.040)
	[205]	[9,397]	[9,602]
b. Less-expensive suburbs			
Post-announcement	13.313	13.323	-0.010
	(0.014)	(0.004)	(0.020)
	[186]	[4,751]	[4,937]
Pre-announcement	13.237	13.262	-0.025
	(0.017)	(0.004)	(0.022)
	[170]	[4,646]	[4,816]
Post-Pre	0.076***	0.061***	0.015
	(0.022)	(0.006)	(0.030)
	[356]	[9,397]	[9,753]

Approach 1: Est. DiD models with quality adjustment

	More expensive suburbs		Less expensive suburbs		All suburbs	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.180***		-0.070*		0.032	
	(0.019)		(0.036)		(0.059)	
Post	0.065***	0.071***	0.065***	0.071***	0.065***	0.071***
	(0.005)	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)
Treatment × post	-0.057***	-0.063***	0.026	0.009	-0.022	-0.018
	(0.010)	(0.013)	(0.021)	(0.019)	(0.029)	(0.020)
Missing lotsize	-0.054**	-0.092***	-0.056**	-0.094***	-0.057**	-0.093***
	(0.027)	(0.031)	(0.027)	(0.031)	(0.026)	(0.031)
Lotsize between 20 & 40 percentile	0.096***	0.089***	0.096***	0.089***	0.090***	0.089***
	(0.024)	(0.013)	(0.024)	(0.012)	(0.024)	(0.012)
Lotsize between 40 & 60 percentile	0.104***	0.123***	0.105***	0.124***	0.103***	0.124***
	(0.023)	(0.014)	(0.024)	(0.014)	(0.024)	(0.014)
Lotsize between 60 & 80 percentile	-0.068**	-0.095***	-0.074**	-0.101***	-0.068**	-0.096***
	(0.029)	(0.025)	(0.029)	(0.024)	(0.029)	(0.024)
Lotsize above 80 percentile	-0.100***	-0.139***	-0.091***	-0.132***	-0.098***	-0.140***
	(0.032)	(0.018)	(0.032)	(0.017)	(0.031)	(0.018)
Missing bedroom	-0.189***	-0.195***	-0.195***	-0.202***	-0.193***	-0.197***
	(0.018)	(0.015)	(0.018)	(0.014)	(0.018)	(0.014)
1 bedroom	-0.325***	-0.462***	-0.309***	-0.457***	-0.316***	-0.463***
	(0.062)	(0.039)	(0.065)	(0.042)	(0.061)	(0.039)
2 bedroom	-0.131***	-0.182***	-0.130***	-0.181***	-0.130***	-0.180***
	(0.024)	(0.019)	(0.024)	(0.019)	(0.024)	(0.019)
4+ bedroom	0.152***	0.154***	0.150***	0.152***	0.151***	0.151***
	(0.014)	(0.010)	(0.014)	(0.010)	(0.013)	(0.010)

Approach 1: Est. DiD models with quality adjustment

	More expensive suburbs		Less expensive suburbs		All suburbs	
	(1)	(2)	(3)	(4)	(5)	(6)
2 bathroom	0.107***	0.076***	0.107***	0.077***	0.108***	0.076***
	(0.012)	(0.007)	(0.012)	(0.007)	(0.012)	(0.007)
3+ bathroom	0.201***	0.168***	0.204***	0.172***	0.205***	0.169***
	(0.016)	(0.012)	(0.016)	(0.012)	(0.015)	(0.011)
2 parking	0.049***	0.053***	0.048***	0.053***	0.048***	0.052***
	(0.012)	(0.006)	(0.012)	(0.006)	(0.012)	(0.006)
3+ parking	0.034***	0.053***	0.031***	0.051***	0.032***	0.052***
	(0.012)	(0.006)	(0.011)	(0.006)	(0.011)	(0.006)
Has study	0.052***	0.033***	0.051***	0.032***	0.051***	0.032***
	(0.007)	(0.006)	(0.007)	(0.005)	(0.007)	(0.005)
Has separatedining	0.012	0.015***	0.011	0.014***	0.009	0.015***
	(0.009)	(0.005)	(0.008)	(0.005)	(0.008)	(0.005)
Has heating	-0.012**	0.010***	-0.012**	0.010***	-0.012**	0.010***
	(0.006)	(0.004)	(0.006)	(0.004)	(0.005)	(0.004)
Has airconditioning	-0.024***	-0.002	-0.023***	-0.001	-0.023***	-0.001
	(0.007)	(0.003)	(0.007)	(0.003)	(0.007)	(0.003)
Has ensuite	-0.015**	-0.003	-0.016**	-0.003	-0.015**	-0.003
	(0.007)	(0.005)	(0.007)	(0.005)	(0.007)	(0.005)
Has garage	-0.028***	-0.003	-0.027***	-0.002	-0.027***	-0.003
	(0.008)	(0.005)	(0.008)	(0.005)	(0.007)	(0.005)
Constant	13.077***	12.920***	13.079***	12.923***	13.080***	12.922***
	(0.030)	(0.013)	(0.030)	(0.013)	(0.030)	(0.013)
Adjusted R^2	0.33	0.62	0.32	0.61	0.32	0.61
N	9,602	9,602	9,753	9,753	9,958	9,958

Approach 2: Estimated DiD models using the residuals from the first step hedonic regressions

	More expensive suburbs		Less expensive suburs		All suburbs	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.031***	0.031***	-0.005	-0.006	0.009	0.011
	(0.006)	(0.005)	(0.007)	(0.005)	(0.009)	(0.009)
Post	0.069***	0.069***	0.069***	0.069***	0.069***	0.069***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Treatment × post	-0.059***	-0.059***	0.008	0.009	-0.017	-0.021
	(0.012)	(0.010)	(0.018)	(0.014)	(0.019)	(0.019)
Constant	-0.035***	-0.035***	-0.035***	-0.035***	-0.035***	-0.035***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Adjusted R^2	0.04	0.04	0.04	0.04	0.04	0.04
N	9,602	9,602	9,753	9,753	9,958	9,958

Approach 3: Estimated hedonic models

	Control suburbs		Treatment suburbs	
	(Pre)	(Post)	(Pre)	(Post)
Missing lotsize	-0.136***	-0.039	-0.020	-0.033
	(0.037)	(0.041)	(0.066)	(0.064)
Lotsize between 20 & 40 percentile	0.093***	0.087***	0.026	0.137*
	(0.016)	(0.014)	(0.067)	(0.066)
Lotsize between 40 & 60 percentile	0.133***	0.113***	0.109	0.202**
	(0.018)	(0.016)	(0.064)	(0.077)
Lotsize between 60 & 80 percentile	-0.106***	-0.092***	0.100	-0.096
	(0.028)	(0.029)	(0.201)	(0.106)
Lotsize above 80 percentile	-0.109***	-0.148***	-0.227**	-0.283***
	(0.018)	(0.024)	(0.081)	(0.076)
Missing bedroom	-0.179***	-0.210***	-0.174***	-0.164**
	(0.020)	(0.020)	(0.043)	(0.058)
1 bedroom	-0.422***	-0.497***	-0.556***	-0.500***
	(0.056)	(0.057)	(0.063)	(0.041)
2 bedroom	-0.157***	-0.202***	-0.217***	-0.035
	(0.021)	(0.020)	(0.051)	(0.046)
4+ bedroom	0.152***	0.156***	0.078***	0.104***
	(0.011)	(0.011)	(0.019)	(0.027)
2 bathroom	0.070***	0.080***	0.053*	0.081***
	(0.010)	(0.009)	(0.023)	(0.017)
3+ bathroom	0.169***	0.166***	0.194***	0.124**
	(0.016)	(0.015)	(0.032)	(0.043)

Approach 3: Estimated hedonic models

	Control suburbs		Treatment suburbs	
	(Pre)	(Post)	(Pre)	(Post)
2 parking	0.055***	0.054***	-0.006	-0.003
	(0.007)	(0.008)	(0.015)	(0.009)
3+ parking	0.053***	0.052***	-0.005	0.003
	(0.008)	(0.008)	(0.015)	(0.022)
Has study	0.040***	0.026***	-0.026	0.048*
	(0.006)	(0.009)	(0.024)	(0.020)
Has separatedining	0.014**	0.014**	0.032	0.012
	(0.007)	(0.006)	(0.026)	(0.020)
Has heating	0.019***	-0.001	0.037*	0.054*
	(0.005)	(0.006)	(0.015)	(0.024)
Has airconditioning	0.002	-0.008*	0.046	0.011
	(0.005)	(0.004)	(0.028)	(0.014)
Has ensuite	0.009	-0.011	0.003	-0.028
	(0.008)	(0.008)	(0.021)	(0.018)
Has garage	-0.003	0.000	-0.036	0.006
	(0.006)	(0.007)	(0.021)	(0.013)
Constant	13.430***	13.465***	13.357***	13.254***
	(0.014)	(0.013)	(0.076)	(0.049)
Adjusted R^2	0.62	0.60	0.50	0.59
N	4,646	4,751	286	275

Approach 3: Estimated DiD model

	More expensive	Less expensive	All suburbs
a. Using pre-announcement property characteristics			
Post	0.070***	0.070***	0.070***
	(0.004)	(0.004)	(0.004)
Treatment × post	-0.059***	0.015	-0.015
	(0.014)	(0.019)	(0.022)
Constant	13.267***	13.261***	13.266***
	(0.002)	(0.002)	(0.002)
Adjusted R^2	0.70	0.70	0.68
N	9,524	9,632	9,864
b. Using post-announcement property characteristics			
Post	0.071***	0.071***	0.071***
	(0.004)	(0.004)	(0.004)
Treatment × post	-0.081***	0.001	-0.025
	(0.009)	(0.013)	(0.018)
Constant	13.256***	13.252***	13.255***
	(0.002)	(0.002)	(0.002)
Adjusted R^2	0.67	0.67	0.65
N	9,680	9,874	10,052

Approach 3: Placebo test

	More expensive	Less expensive	All suburbs
a. Using pre-announcement property characteristics			
Post (placebo)	0.053***	0.053***	0.053***
	(0.004)	(0.004)	(0.004)
Treatment × post (placebo)	-0.003	-0.023	-0.016
	(0.009)	(0.032)	(0.022)
Constant	13.236***	13.231***	13.236***
	(0.002)	(0.002)	(0.002)
Adjusted R^2	0.54	0.51	0.51
N	9,752	9,900	10,096
b. Using post-announcement property characteristics			
Post (placebo)	0.057***	0.057***	0.057***
	(0.006)	(0.006)	(0.006)
Treatment × post (placebo)	-0.027	-0.037	-0.033*
	(0.018)	(0.026)	(0.019)
Constant	13.211***	13.205***	13.211***
	(0.003)	(0.003)	(0.003)
Adjusted R^2	0.40	0.40	0.39
N	9,524	9,632	9,864

Conclusion

- We investigated the announcement effect of public housing on property prices using a novel hedonic quality adjusted DiD method
- Our set up was facilitated by
  - A single unanticipated government announcement of new public housing in multiple locations in ACT, Australia
  - The fact that these locations included suburbs both more expensive and less expensive than the ACT suburbs

Conclusion (cont.)

- We found that the announcement of new public housing had a differential effect on neighbouring property prices
  - A negative impact (7% of prices) in more expensive suburbs
  - No impact in less expensive suburbs
- Our findings will make important contributions to policy/ decision making regarding the location of public housing

Policy implication

- We reconfirm that policymakers need to consider the negative external effect of public housing
- Locating public housing complexes to high-priced suburbs
  - would not be efficient
  - but may reduce inequality and segregation
- Efficiency vs. equity trade-off exists in the housing market[†]
- Our positive analysis may encourage planners to devise a mechanism for generating outcome that is socially desirable