The effect of Airbnb on the rental housing market: Evidence from London

Amit Chaudhary

University of Warwick
Department of Economics

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Introduction

- House price affordability is a major public policy issue
- Past research has shown that supply constraints in the housing market are the primary reason home prices increase. Hilbert et. al (2016), Saiz (2010), and Hilber & Vermeulen (2015)
- Tourism sector has grown exponentially in the recent decades. Worldwide international tourist arrivals have increased by 600 Million in the last decade [2009-2018].
- Large rise in tourist numbers has been accompanied with the entry of peer-to-peer house sharing platforms like Airbnb
- The growth of Airbnb is likely to affect the local housing rental market by reducing the supply of homes as owners now have an option to shift from traditional long term rental market to short-term letting for tourists in marketplaces like Airbnb

Introduction

- Worldwide, governments have brought regulations for short term rental platforms like Airbnb. Large cities like London, Barcelona, Berlin, Paris, San Francisco, Los Angeles, Amsterdam, New York, Paris, and San Francisco already have some form of regulation for such platforms.
- Despite the various local policy responses we have limited research on the impact of Airbnb on the housing market

Research Question

- Does expansion of Airbnb cause rental prices of houses to increase ?

This paper

- Novel data
  - Individual house-level data of all rental advertisements from a large online real estate company called Zoopla Plc
  - I web-scraped historical rental prices data and property characteristics for the time period 2008-2017
  - I used web-scraped individual listings data from Airbnb and combined it with the property rental data geospatially
- The novel data set allows me to follow the change in rental prices of properties over a period of time as Airbnb listings grow in the neighbourhood.
  - Used difference-in-differences strategy, by year and house type
  - Effect of airbnb on property rents in areas experiencing higher demand shocks due to changes in the school quality

Findings

- 10 percent increase in the number of Airbnb properties in a ward increases real rents by 0.1 percent
- Rental price increase is highest for 1 bedroom properties, which are a close substitute for hotel rooms.
- Airbnb's effect on rental price is higher in wards where there is positive local demand shocks driven by school quality changes. I measure positive school quality change as schools being converted to academies or new academies being opened in the wards

Contribution

- I add to the growing literature on Airbnb which estimates its effect on the housing market. Baron et al. (2020), Koster et al. (2020), Garcia Lopez et. al(2020) for USA, Los Angeles and Barcelona respectively
- I leveraged the individual property panel data to find the price change due to Airbnb.
  - Spatially aggregated average prices are prone to biases due to changes in renting and ownership population composition.
- This is the first study to estimate the impact of Airbnb in London which is a large tourism hub.
- I use reduce form estimate to document the heterogeneity in the housing market based on the size of the property. Smaller properties are in higher demand in the tourist accommodation market thus home owners of smaller properties shift more towards short-term market due to high rental yields.
  - Recent literature structurally estimates the effect of Airbnb on the welfare of heterogeneous agents. Calder-Wang (2020) and Almargo and Dominguez-Lino (2020)

Outline

Airbnb in Greater London

- Airbnb is a platform that connects hosts that own properties with guests seeking temporary accommodation
- Airbnb is one of the world's largest short-term accommodation provider. Over 130 million guests have used Airbnb, and it has a market valuation of over $18B
- Hosts list their properties for a self-established price and offer the lodging to potential guests.
- Airbnb has grown rapidly since its formal launch in London in 2011
- By 2017, Airbnb had more than 100K properties listed on its websites in Greater London

Data: Airbnb

- Data for time period 2008-2017 is extracted from the Airbnb website.
  - I use two sources of Airbnb data. First source is from InsideAirbnb database which collects the Airbnb listings data. Second resource is from my own web-scraping of Airbnb website done in 2017 as InsideAirbnb data was incomplete.
- Web-scraping stores the cross-sectional snapshot of the Airbnb listings data
- Airbnb listings data has postcode based address and other listing details such as type of property, its characteristics, reviews, and the quoted price.
- I measure the time of supply of Airbnb properties using the date on which the property is first listed on the Airbnb platform. Zervas et al. (2017) and Baron et al. (2020)
- Using the Airbnb supply measure, I calculate the growth in the ward level Airbnb listings.

Data: Property rental market

- Data on rental properties are scraped from a major UK private rental listing website Zoopla
- Zoopla attracts 40 million visitors monthly for potential proprty search and has the most exhaustive list of the property advertisements.
- It has made available historical advertisement of all properties going back to 2008
- Web-scraped individual level housing supply panel data example
- To check the validity of data, the comparison with the ONS and census data on housing rental prices and quantity are done. Zoopla's data is a large representative sample of the housing market. ONS comparison Census
- The data include rental prices, location and house characteristics

Data: Schools and academies

- Academies data [2008-2017]
  - Department of Education school data
  - Variables: location and conversion of schools to academies and opening of new academies from 2008-2017

Data

- Exponential growth of Airbnb in Greater London

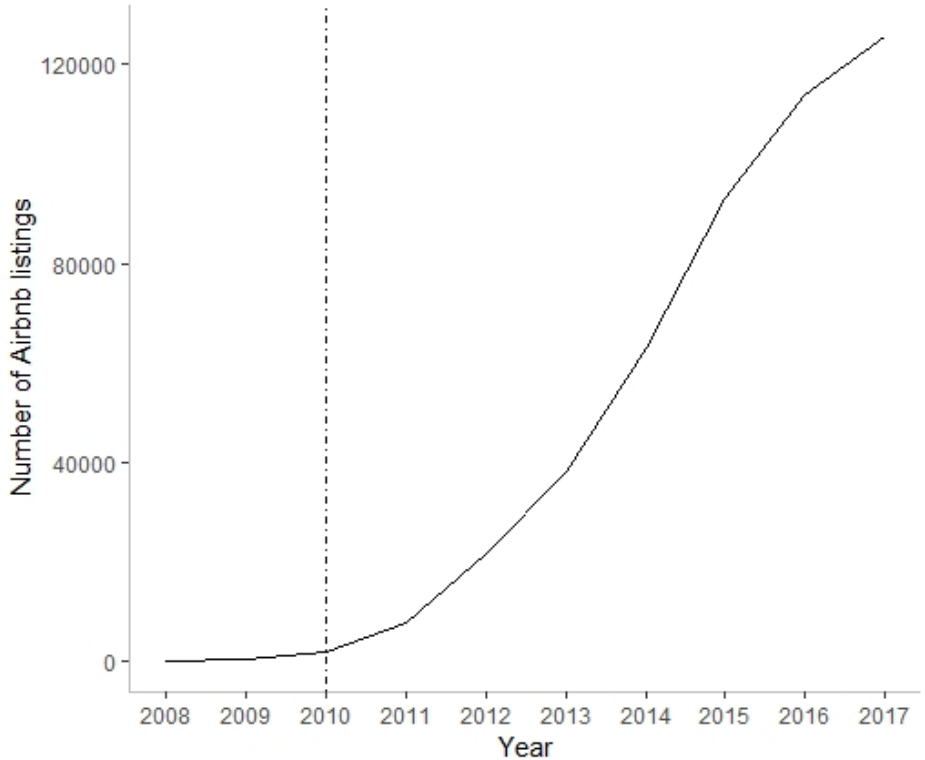


Figure 1: Number of Airbnb listings in Greater London area [2008-2017]

Penetration of Airbnb in Greater London area

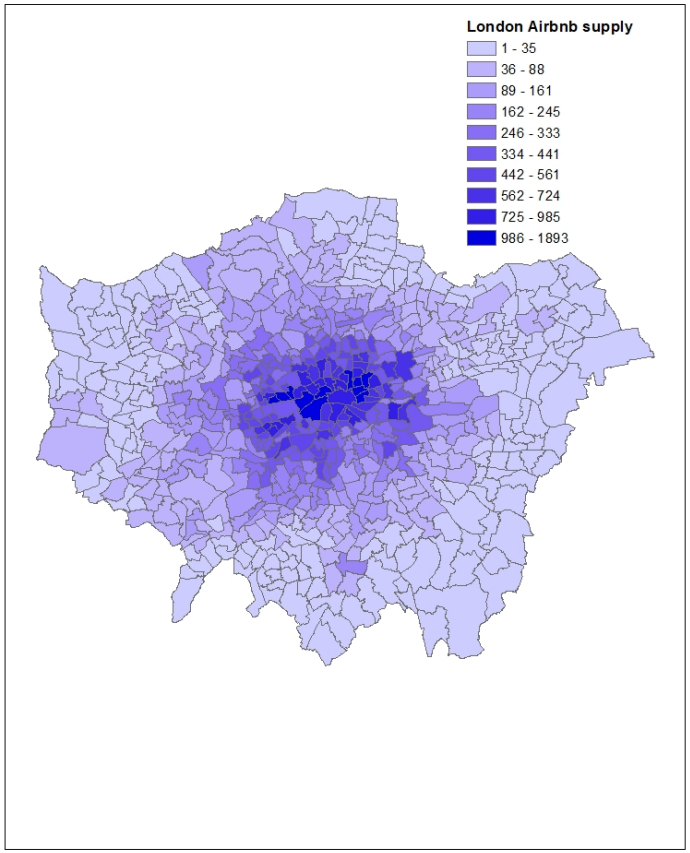


Figure 2: Airbnb supply in wards of Greater London in year 2017

Average Rents in Greater London area

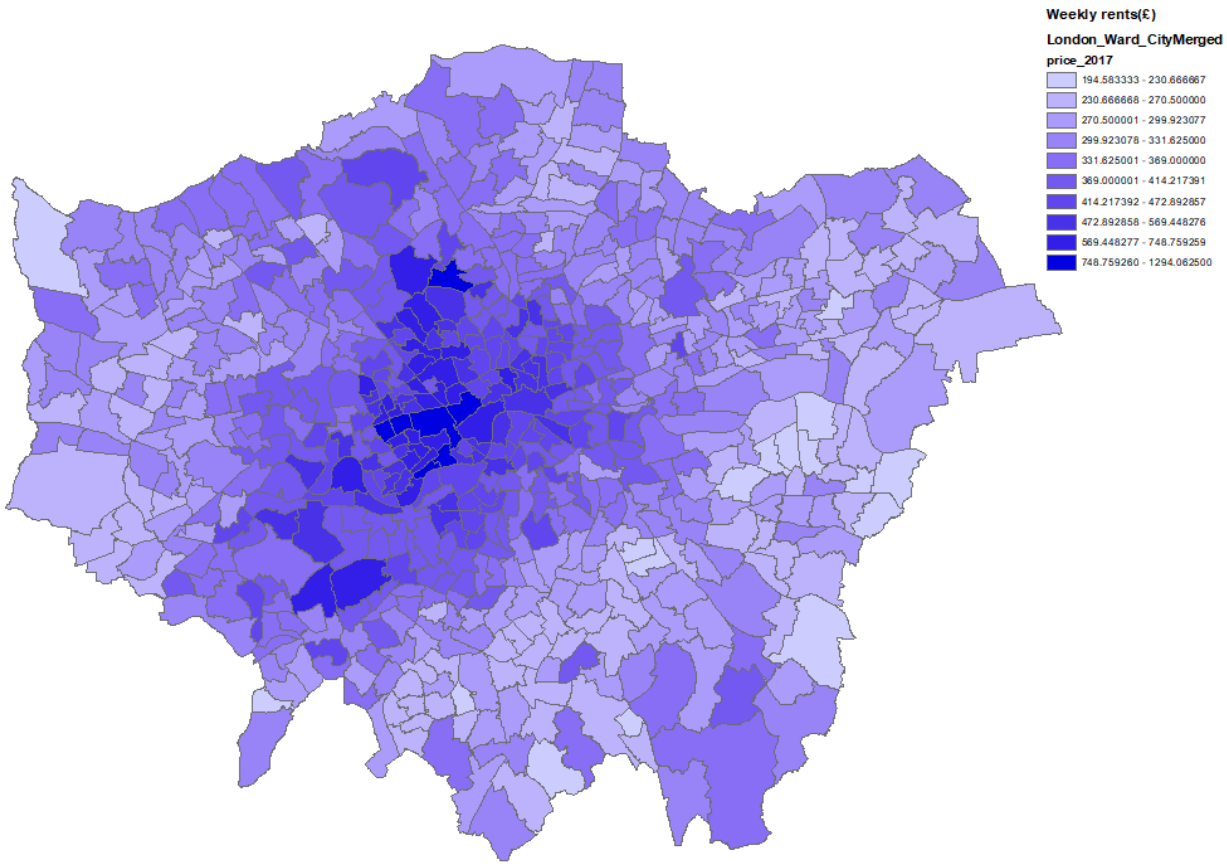


Figure 3: Average weekly rents in wards of Greater London in year 2017

Landlord's earnings in Airbnb

- Given the landlords's choice, shifting the property to short-term rental market place like Airbnb is highly profitable than traditional long-term rental market.

Number of bedrooms	Rents weekly(£)	Airbnb revenue weekly(£)	Ratio of Airbnb to weekly rents
1	319	714	2.2
2	416	714	2.2
3	571	1596	2.8
3+	736	2130	2.9

Table 1: Comparison of average weekly rents and Airbnb revenue by property size

Outline

Event study

- I estimate the yearly effect of increase in Airbnb supply on rental prices while keeping 2011 as the base year
- Even study: Interacting the Airbnb supply measure with the lead and lag of the year

$$logP^{s}_{iwt} = \sum_{r \neq 2011} \beta_r \times logAirbnb_{wt} + \eta \times logAirbnb_{wt} + \alpha_i + \gamma_w + \tau_t + \epsilon_{iwt}$$

- P^{s}_{iwt} : Rental price of house i in ward w at year t
- $Airbnb_{wt}$: Airbnb listings in ward w at year t
- β_r allows us to check if properties located in the wards which experience increase in the Airbnb supply have undergone any changes to the rental price year-wise
- Event study estimates might suffer from endogeneity as ward-level un-observable characteristics like amenities might be simultaneously correlated to the Airbnb supply as well as the housing market demand.

Event study plot

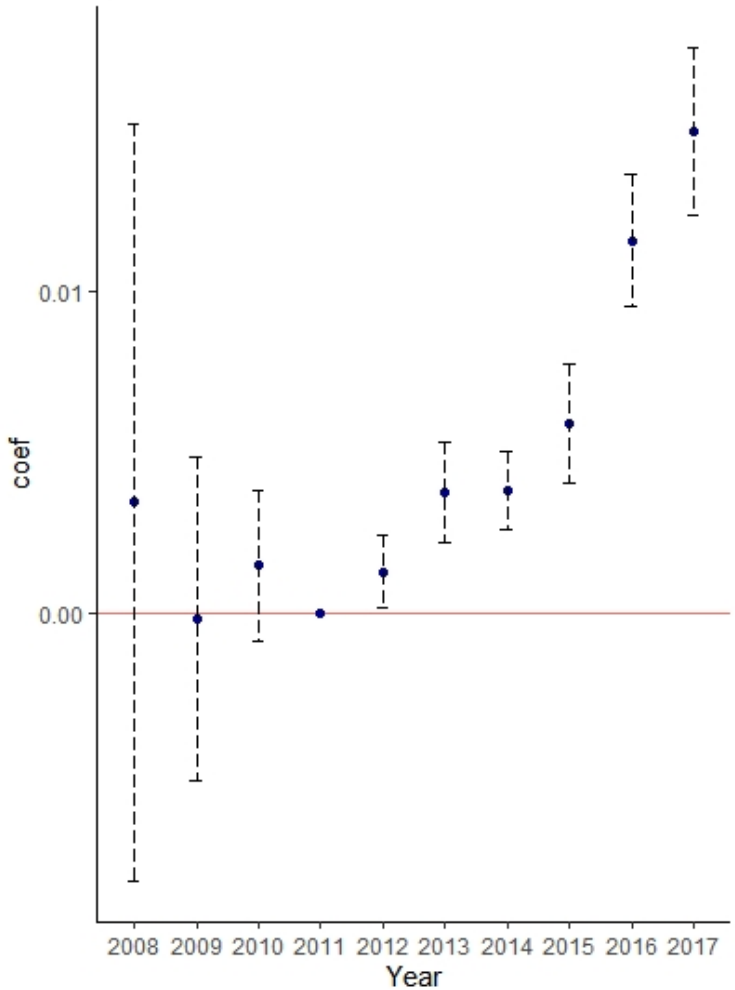
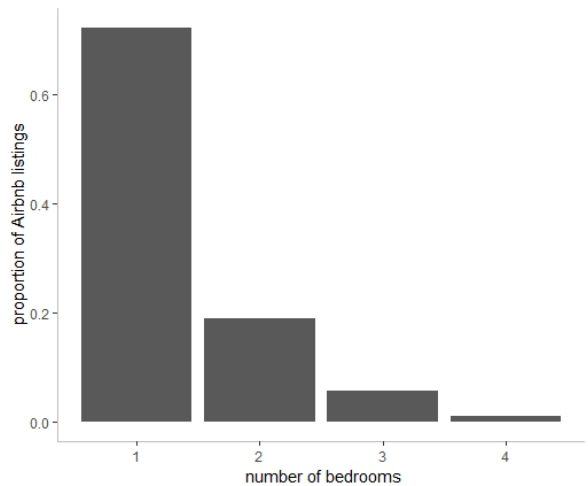


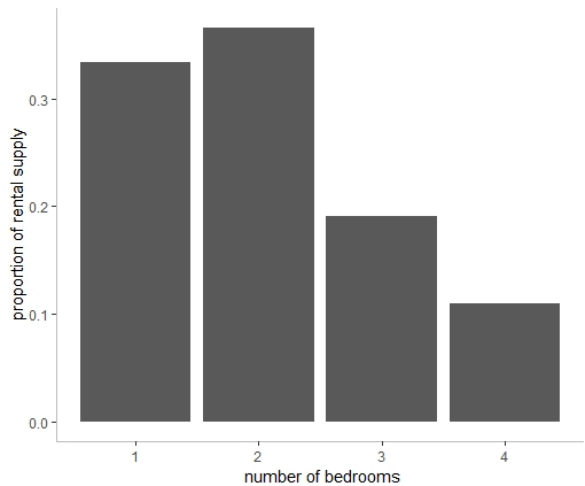
Figure 4: Event study graph for rents and Airbnb supply in wards of Greater London

House types and exposure to Airbnb

- Proportion of houses with more than three bedrooms is 10 percent in rental market, compared to less than 1 percent in Airbnb
- Our hypothesis is that Airbnb reduces the supply of rental homes causing rents to increase
- In long-term rental market, houses with more than three bedrooms are less exposed to Airbnb so they can be used as control group



(a) Airbnb



(b) Zoopla

Figure 5: Proportion of property types in Airbnb and rental housing market

Graphical evidence

- Areas with higher Airbnb presence (red line below) experienced bigger growth in price difference between treated group and control group when compared with the rest of the areas (blue line) which have lower supply of Airbnb.

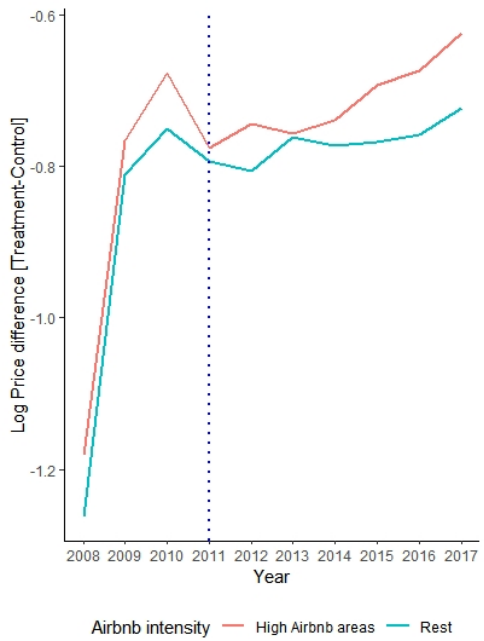


Figure 6: Evolution of difference in log rent [Treatment-control] in High Airbnb intensity wards vs the rest. Treated houses are with bedrooms ≤ 3 and control houses are having bedroom > 3. High Airbnb areas : top 2 deciles of the Airbnb listings in 2017

Empirical strategy: Difference-in-Differences

- My main analysis consists of Difference-in-differences strategy by year (where airbnb intensity varies) and house type
- Endogeneity concerns due to unobserved ward level characteristics can be alleviated using the DID specification below

$$logP^{s}_{iwt} = \alpha_i + \gamma_{wt} + \eta(logAirbnb_{wt}) + \beta(logAirbnb_{wt} \times D_i) + \epsilon_{iwt}$$

P^{s}_{iwt} : Rental price of house i in ward w at year t

$Airbnb_{wt}$: Airbnb listings in ward w at year t

$D_i = 1$ [Treated] if number of bedrooms $<= 3$

$D_i = 0$ [Control] if number of bedrooms > 3

- Identification assumption is that without the Airbnb entry, the growth in rental prices of Treated ($<= 3$ bedrooms) houses and Control (> 3 bedrooms) houses should have similar trends at the neighbourhood level. Parallel Trends

Empirical strategy

- Individual house level panel data is vital to control for time varying ward-level trends.
- Shocks which are specific to neighbourhood (ward) such as urban revival and demographic changes that affect the housing market prices can be controlled. Garcia-Lopez et al. (2020)
- Using the individual house level panel data also corrects the bias in price effect due to unobserved house quality.

Results

	ln Rental Price * 100	
	OLS	OLS
	(1)	(2)
LnAirbnb×Treated	0.6340***	0.9310***
	(0.0868)	(0.0928)
House FE	Yes	Yes
Ward*Year FE	No	Yes
Wards cluster	631	631
N	211,498	211,498

* p<0.1, ** p<0.05, *** p<0.01

All standard errors clustered at property id level.

Treated is a dummy equal to one when house has less than equal to 3 bedrooms

Table 2: Difference-in-differences estimates by year and Treated house (property ≤ 3 bedrooms)

- 10 percent increase in the number of Airbnb properties in a ward increases real rents by 0.1 percent

Heterogeneous effects of Airbnb on the house type

- Properties having less number of bedrooms are most exposed
  - 1 bedrooms properties are most exposed to Airbnb as demand for small property is highest from tourists.
  - 1 bedroom property listed on Airbnb are the substitute of a hotel room as shown in Zervas et al. (2017)
- I measure the heterogeneous impact of Airbnb on the house type defined by number of bedrooms

$$lnP^{s}_{iwt} = \alpha_i + \gamma_{wt} + \sum_{r=1}^{3}(lnAirbnb_{wt} \times d_{ir})\beta_r + \epsilon_{iwt}$$

- d_{ir} is the dummy that indicates if house i has r bedrooms in it.

Heterogeneous effects of Airbnb on the house type

- Coefficient of 1 bedroom is highest indicating larger impact of Airbnb's exposure on smaller properties
  - Airbnb has 70% of the listings as 1 bedroom
- Coefficient of 2 and 3 bedroom properties are ordered as per the exposure in the Airbnb market
  - Proportion of 2 and 3 bedroom properties in Airbnb is 20% and 7% respectively

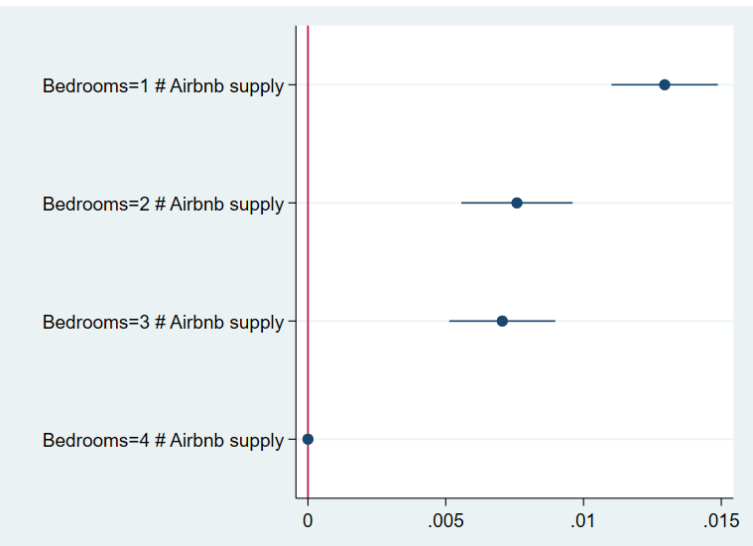


Figure 7: Heterogeneous treatment effect of Airbnb on the house type relative to Control (> 3) bedrooms

Placebo treatments 2008-2010

- Airbnb started London operations in 2011 therefore Airbnb's supply from 2011 to 2017 should not impact the rental prices in 2008-2010
- Two placebo strategies:
  1. Placebo treatment is given to the pre-Airbnb years (2008-2010) by assigning ward-level supply of Airbnb properties in **2012, 2013, and 2014** to 2008, 2009, and 2010 respectively.
  2. Placebo treatment is given to the pre-Airbnb years (2008-2010) by assigning ward-level supply of Airbnb properties in **2014, 2015, and 2016** to 2008, 2009, and 2010 respectively.

Placebo treatment 2008-2010

- *Placebo 2* corresponds to the high Airbnb growth years and the DID coefficient is negative with large standard errors

	ln Rental Price * 100	
	Placebo 1	Placebo 2
	(1)	(2)
LnAirbnb(placebo)×Treated	0.0987	-1.040
	(0.4060)	(1.2100)
House FE	Yes	Yes
Ward*Year FE	Yes	Yes
N	26,214	26,214

* p<0.1, ** p<0.05, *** p<0.01

Standard errors in parentheses clustered at property id level
Placebo 1: The number of airbnb properties in 2012-2014 is re-coded to the same wards in 2008-2010. Placebo 2: The number of airbnb properties in 2014-2016 is re-coded to the same wards in 2008-2010

Table 3: Difference-in-differences (placebo) estimates by year and Treated (less than equal to 3 bedrooms)

Placebo treatments by house type:2008-2010

- Heterogeneous impact of Airbnb *Placebo(1)* on the house type defined by number of bedrooms

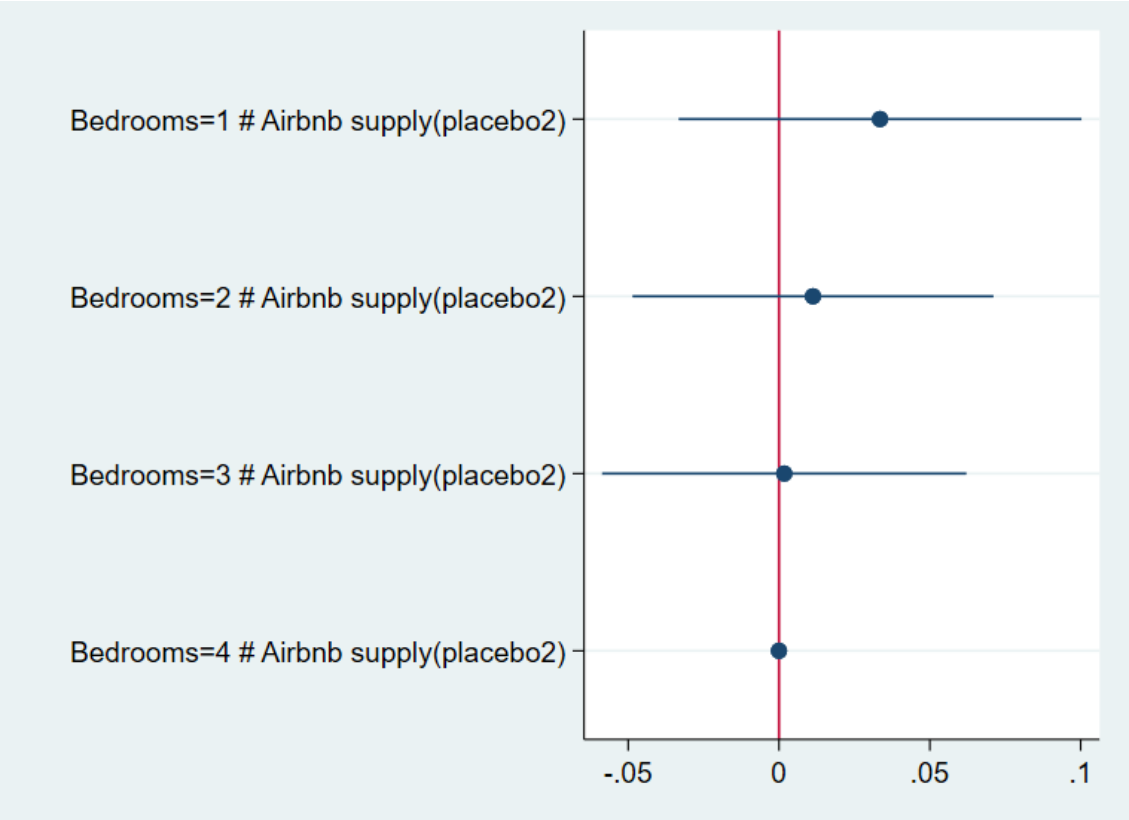


Figure 8: Heterogeneous treatment effect of Airbnb placebo treatment on the house type [2008-2010]

Outline

School quality shocks exacerbate Airbnb's effect

- Improvements in the quality of school increase the housing prices in the neighbourhood.
- Academies in England are autonomous educational institutions associated with higher educational outcomes of students. Machin et al.(2013)
- Parents rank academies higher than normal schools in admission process of pupils and prefer to reside in neighbourhood closer to them. Gibbons et al. (2018)
- Used opening of new academies and conversion of schools to academies as local housing market demand shocks.
- Houses in areas which experience positive school quality shocks have higher impact in the rental prices as Airbnb grows in the neighbourhood.

Local housing demand shock: schools quality

	Ln Rental Price * 100		
	Full sample	academies > 3	academies <= 3
	OLS	OLS	OLS
	(1)	(2)	(3)
LnAirbnb×Treated	0.931***	1.212***	0.767***
	(0.0928)	(0.1571)	(0.0587)
House FE	Yes	Yes	Yes
Ward*Year FE	Yes	Yes	Yes
Wards cluster	631	83	547
N	211,498	19,562	211,498

* p<0.1, ** p<0.05, *** p<0.01

All standard errors clustered at property id level. In specification (3), instrumented *LnAirbnb* by *LnReviews* : Logarithm of ward-level aggregated reviews of Airbnb customer. Treated is a dummy equal to one when house has less than equal to 3 bedrooms

Table 4: Heterogeneous effect of Airbnb: School quality

Difference-in-Differences with IV

- Within neighbourhood there can be unobserved amenities which are valued by the long-term renters as well as tourists (Airbnb guests) leading to omitted variable bias.
  - Amenities such as a) better restaurants and cafes b) less pollution in the area can increase long term rental prices as well as Airbnb listings in the neighbourhood.
- Solution: used an instrument variable to capture the neighbourhood level demand shocks of tourists while not impacting the rental market prices directly. Instrumented Airbnb supply by ward-level aggregated reviews of Airbnb properties written by guests
  - Aggregated review growth represent the popularity of the neighbourhood or demand of tourists to stay in the area.
  - 72 % of the guests write reviews and number of reviews also indicate the occupancy level of the Airbnb properties. (Fradkin et. al, 2018)
- Exclusion restriction: reviews create demand of Airbnb properties and cause supply constraint in rental market which leads to rental price change.

Results

	ln Rental Price * 100		
	OLS	OLS	2SLS
	(1)	(2)	(3)
LnAirbnb×Treated	0.6340***	0.9310***	0.9140***
	(0.0868)	(0.0928)	(0.0996)
House FE	Yes	Yes	Yes
Ward*Year FE	No	Yes	Yes
First stage F statistics(K-P)			59
Wards cluster	631	631	631
N	211,498	211,498	211,498

* p<0.1, ** p<0.05, *** p<0.01

All standard errors clustered at ward level. In specification (3), instrumented *LnAirbnb* by *LnReviews* : Logarithm of ward-level aggregated reviews of Airbnb customer. Treated is a dummy equal to one when house has less than equal to 3 bedrooms

Table 5: Difference-in-differences and 2SLS estimates by year and Treated (less than equal to 3 bedrooms)

- Bias is small in magnitude (OLS vs 2SLS)

Conclusion

- I study how Airbnb affects the rental housing market using the novel individual houses panel data
- I apply difference-in-differences strategy by year (where airbnb intensity varies) and the house type
- The result shows that Airbnb's growth in London has led to increase in rental prices
- The effect of Airbnb on rental housing market is not very large : 10 percent increase in Airbnb activity leads to 0.1 percent increase in the rental prices.
- These estimates can be used by policymakers to design specific regulations for Airbnb
  - Since 2017 there is a regulation which limits the rental duration of Airbnb properties in Greater London to 90 nights per calendar year.
  - The prominent reason for implementing this regulation was that Airbnb was impacting rental housing market prices.

Appendix

Zoopla and ONS data

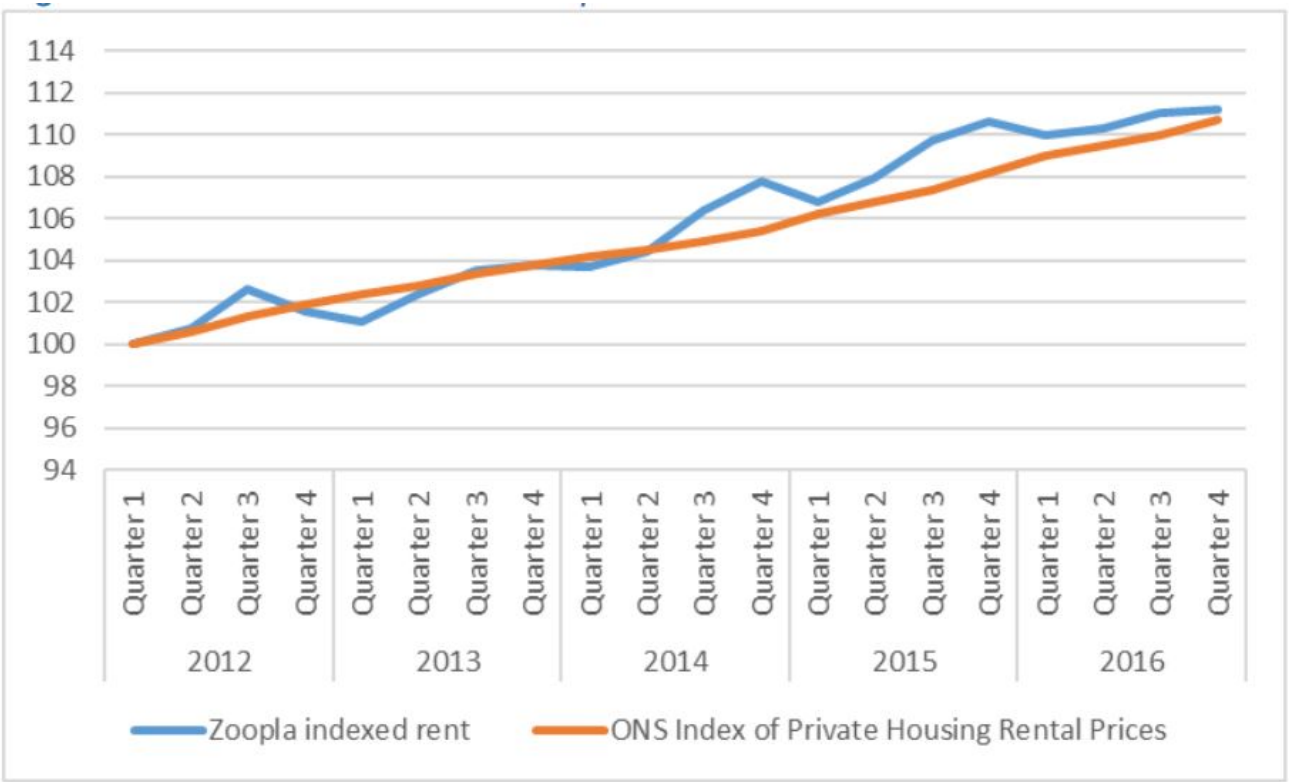


Figure 9: Comparison of ONS private housing rental prices and Zoopla indexed rent

back

Census and Zoopla data comparison

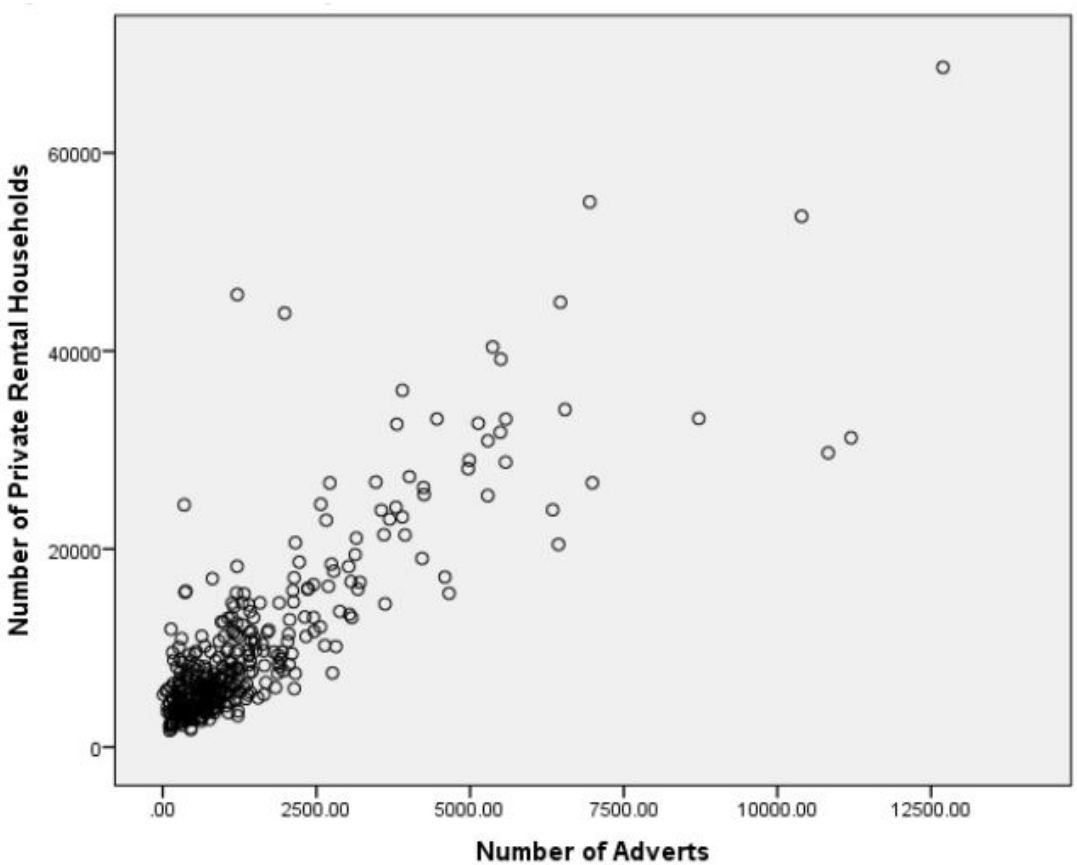


Figure 10: Number of private rental housholds(Census(2011) and house listings from Zoopla

back

Scraping: example

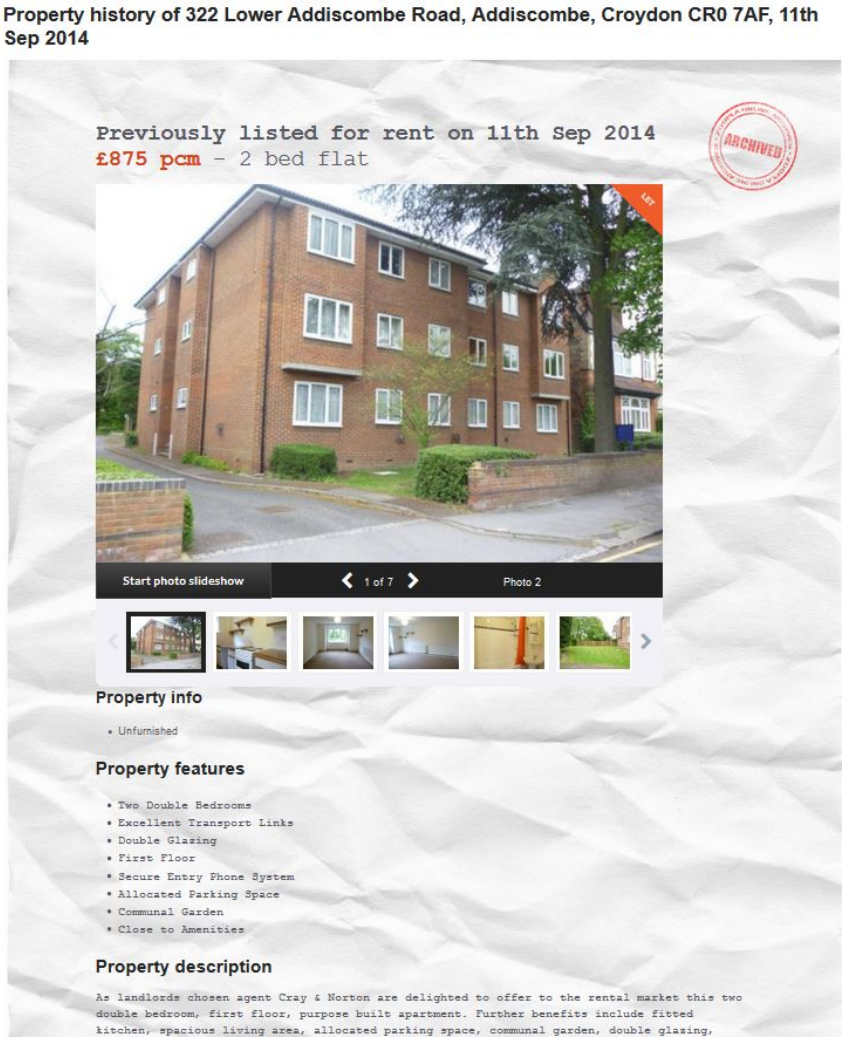
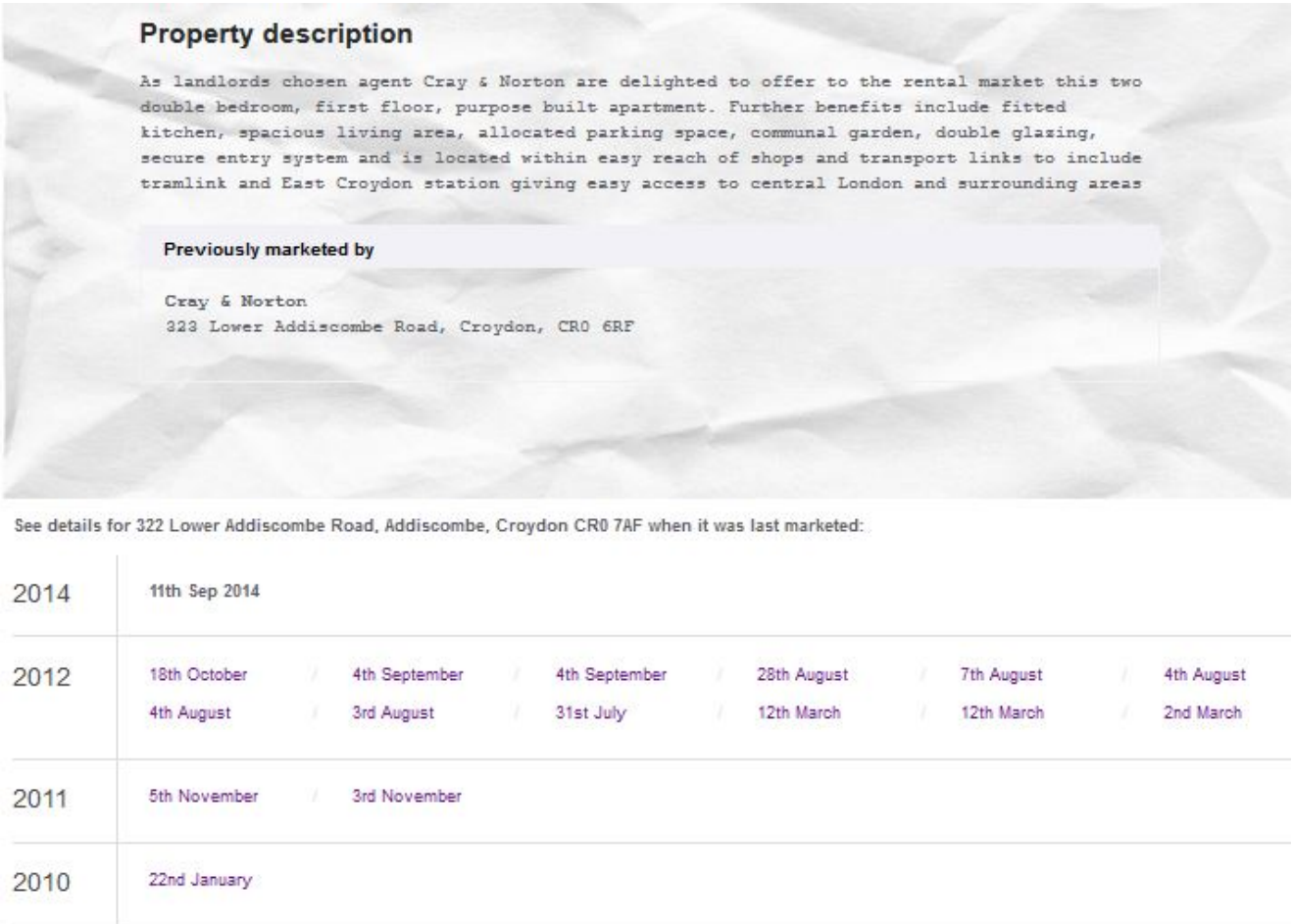


Figure 11: Example showing the individual house history on Zoopla website

Scraping example cont.



Property description

As landlords chosen agent Cray & Norton are delighted to offer to the rental market this two double bedroom, first floor, purpose built apartment. Further benefits include fitted kitchen, spacious living area, allocated parking space, communal garden, double glazing, secure entry system and is located within easy reach of shops and transport links to include tramlink and East Croydon station giving easy access to central London and surrounding areas

Previously marketed by

Cray & Norton
323 Lower Addiscombe Road, Croydon, CR0 6RF

See details for 322 Lower Addiscombe Road, Addiscombe, Croydon CR0 7AF when it was last marketed:

2014	11th Sep 2014
2012	18th October / 4th September / 4th September / 28th August / 7th August / 4th August 4th August / 3rd August / 31st July / 12th March / 12th March / 2nd March
2011	5th November / 3rd November
2010	22nd January

Figure 12: Example showing the individual house history on Zoopla website

back

Parallel trends [2008-2010]

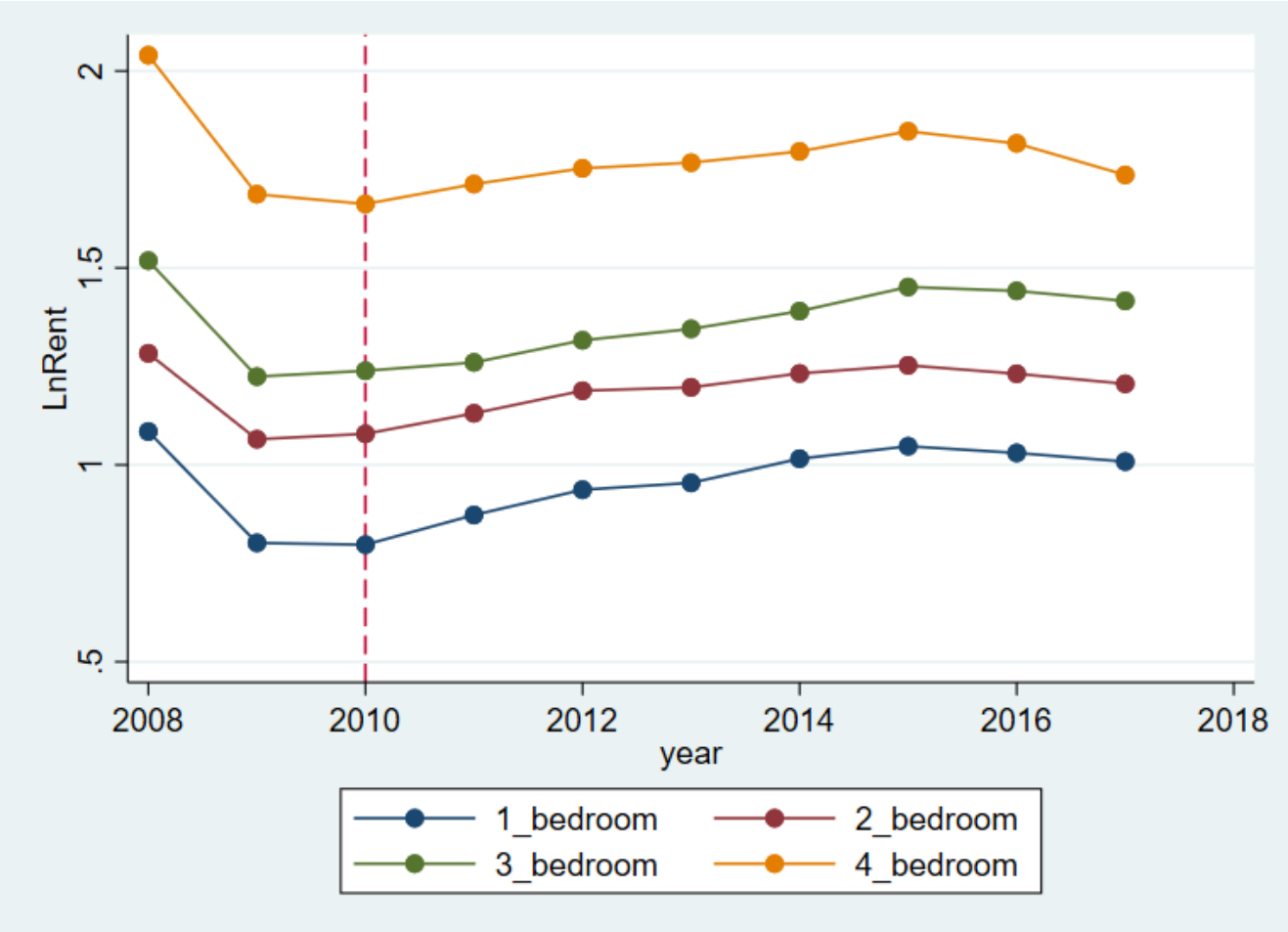


Figure 13: Parallel trends : [2008-2010]

back