People on bikes getting coffee: The impact of cycle lanes on cities

(Preliminary work
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Motivation

- 25% of Europe's greenhouse gas emissions are caused by transportation
- Road transport accounts for 73% of these emissions
- 77% of the European urban population is exposed to air pollution levels above World Health Organization (WHO)

  → During the last years: Pressure on local authorities to take action to provide the necessary infrastructure for **alternative options to the car** as …. public transportation, car sharing, or **bicycle infrastructure**

  + COVID outbreak: urgent need to provide alternatives for crowded public transport to avoid a large switch to the private car

  + Technological innovations: e-bikes!


CITYLAB
Pop-Up Bike Lanes and the Fight Over Berlin's Streets
New spaces created during the pandemic are coming under attack from politicians and the auto industry, while cycling advocates say the changes don't go far enough.
The New York Times
If You Build It, They Will Bike: Pop-Up Lanes Increased Cycling During Pandemic
A study of European cities adds to a growing body of evidence that investments in cycling infrastructure can encourage bike commuting, which helps cut greenhouse gas emissions.
By Veronica Penney
April 1, 2021
Barcelona ampliará aceras y carriles bici para minimizar los contagios
la Repubblica
Milano, il primato delle piste ciclabili nell'anno del Covid: "Ma serve più impegno contro lo smog"
02 MAGGIO 2020
Europe doubles down on cycling in post-Covid recovery plans
Laura Laker
Fri 12 Mar 2021 09.47 GMT
The Guardian
For 200 years
Paris To Create 650 Kilometers Of Post-Lockdown Cycleways
Forbes
ZEIT ONLINE
Mehr Radwege und Sicherheit für Radfahrende
Forbes
Oct 10, 2020, 11:40pm EDT | 4,590 views
This Is The New Transport Trend Sweeping Europe

Motivation & Research questions

Cycle lanes still spark debates:

- Fewer spaces for cars and parking?
- More congestion? Pollution? Noise?
- Are local stores less accessible? Negative impact on retail activity?
- Gentrification?

Whether and why this happens is a question that remains severely understudied

RESEARCH QUESTIONS

- Does cycling infrastructure have an impact on the housing market?
- Is the public bike-sharing system contributing to this impact?
- If so, which could be the channels?
  -local amenities: changes in the retail activity?
  -new residents in the area?

SETTING: City of Barcelona (*Eixample* neighborhood)

Preview of the (preliminary) results

- Cycle lanes affect housing prices (both for sales prices and rents) with mixed effects depending on the distance to the bike infrastructure
- Public sharing biking system positively affect sales' prices and rents (at a very close distance)
- Better connectivity between streets and / or bike friendliness seems to be important→ 1) where the bike lanes are built matters 2) not all the bike lanes have the same impact

Contribution to the literature

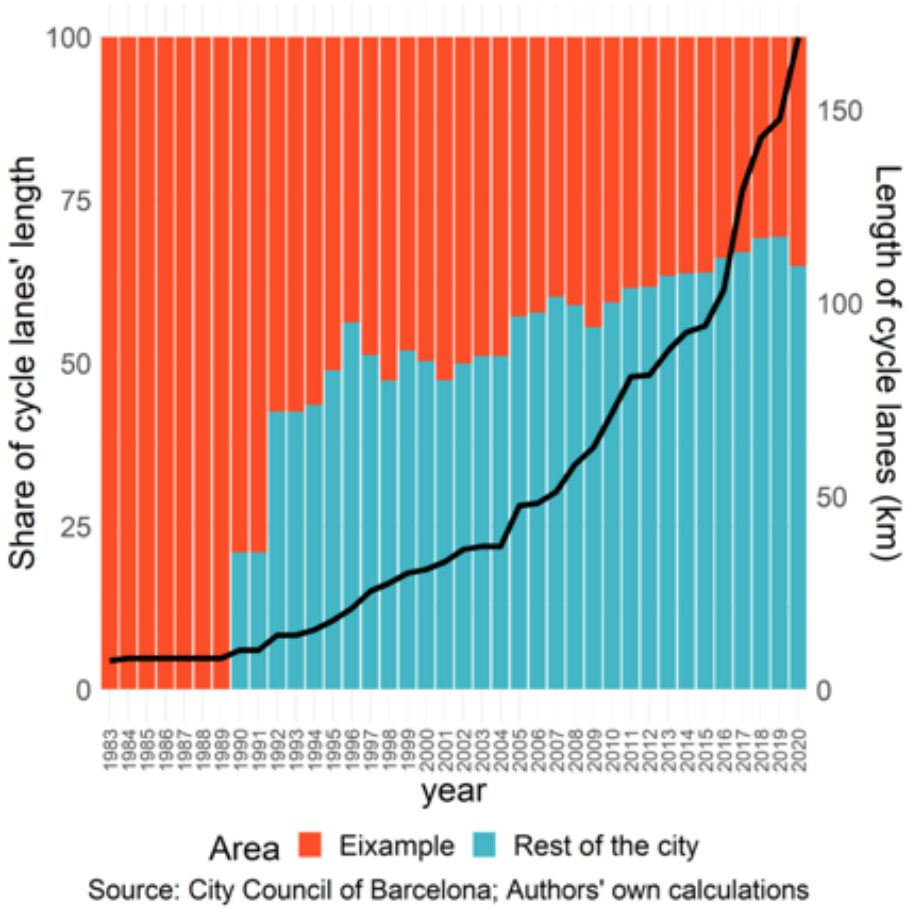
- There is a growing interest to understand the economic/social impact of new transportation infrastructures within cities:

- Bhuyan *et al* (2021): cycling superhighways reduce congestion (London)
- Daniele *et al* (2022): market access due to bike lanes increases revenues (Paris)
- Thorne (2021) *Citi Bike* in NYC has decreased pollution
- Davis *et al* (2022): *Citi Bike* in NYC is affecting local consumption in NYC
- Bernard (2022): cycle lanes and road users in London

→ in this paper:

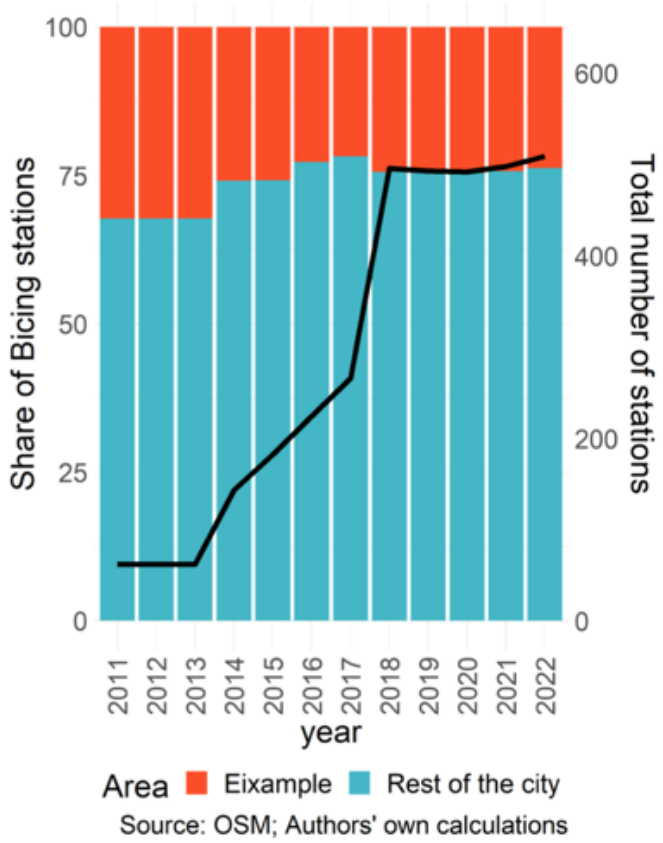
- we analyze the impact of 1) bike lanes and 2) the public bike-sharing system (*Bicing*) on the housing market in Barcelona
- we are able to differentiate the streets by controlling for 'better connectivity' (accessibility)
- we measure all the impacts at a very precise geographical level

Barcelona cycle lanes



- 2011: 93Km → 2021: 208Km
- Big acceleration took place after 2015 (with the new Mayor) + COVID19 (21Km)

Barcelona Bike-Sharing system (*Bicing*)



- The bike-sharing system (*Bicing*) started in 2007
- *Bicing* stations: 519; Bicycles: 7,000 (4,000 mechanical and 3,000 electric)
- Users: > 135,000; 1,2M trips per month

Data

- **Cycling infrastructure**
  - Cycle lanes network (1983 - 2021)
  - Street network segments (14.831 street sections)
  - Geolocation of Bicing stations (2011 - 2022; 509 obs.)
  - Origin-destination Bicing trips (2019 - 2021; 5.6 million obs.)
  - Traffic sensors data (2017 - 2021; 13.760 obs.)
  - Accidents involving bikes (2010-2019; 5.072 obs.)

→ We can measure:

- Cycle lanes Length
- *Bicing* Stations location

→ We can estimate Bikes Traffic (bike friendliness & connectivity)

Data

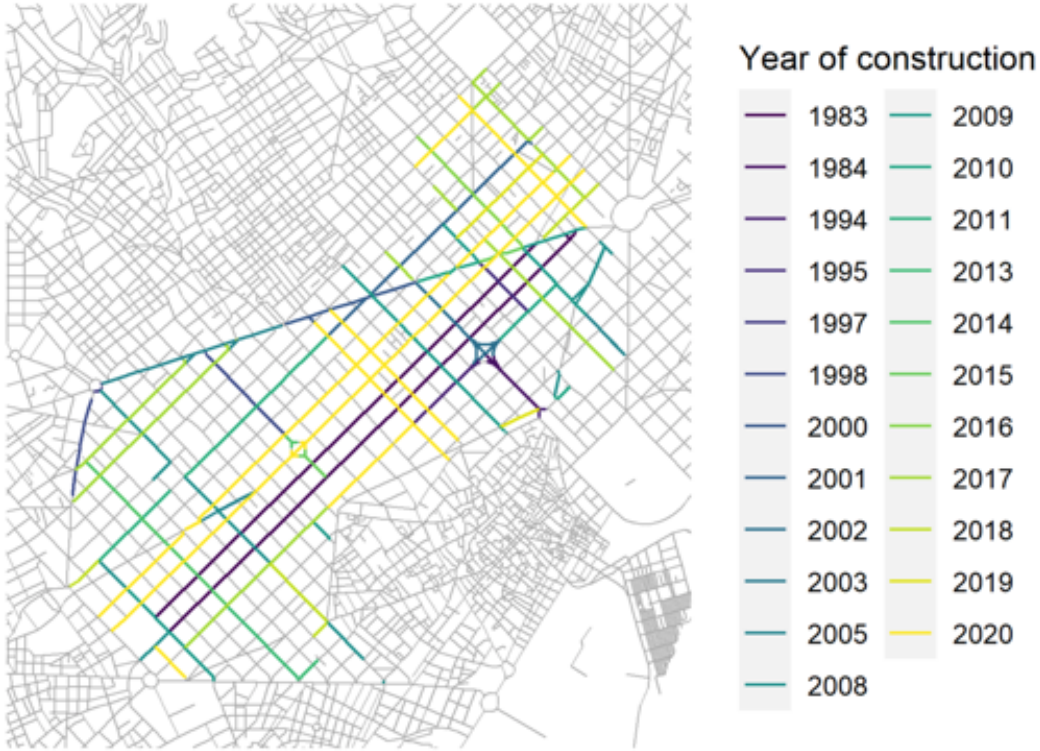
- **Housing prices & characteristics**
  - Catalan Fiscal Agency (2009 - 2019; 64.697 obs.)
  - Idealista (2007 - 2019; 162.475 sales, 141.286 rents)

Controls:

- **Socio-Demographic characteristics** at Research Area (ZRP) level (1991 - 2008; 248 obs.) and at Basic Statistical Areas (AEB) level (2009 - 2020; 233 obs.)
- **Local amenities**
  - Commercial Census at unit level (OpenDataBCN; 2014, 2016, 2019; 80.555 obs.)
  - Web-scraped TripAdvisor data on restaurants and bars (Nov. 2020 - 2021; 11.500 obs.)
- **Other variables**
  - Street trees, parks, crimes, public transportation lines and stops, areas 30 (km/h), street's gradient and width, touristic and cultural amenities

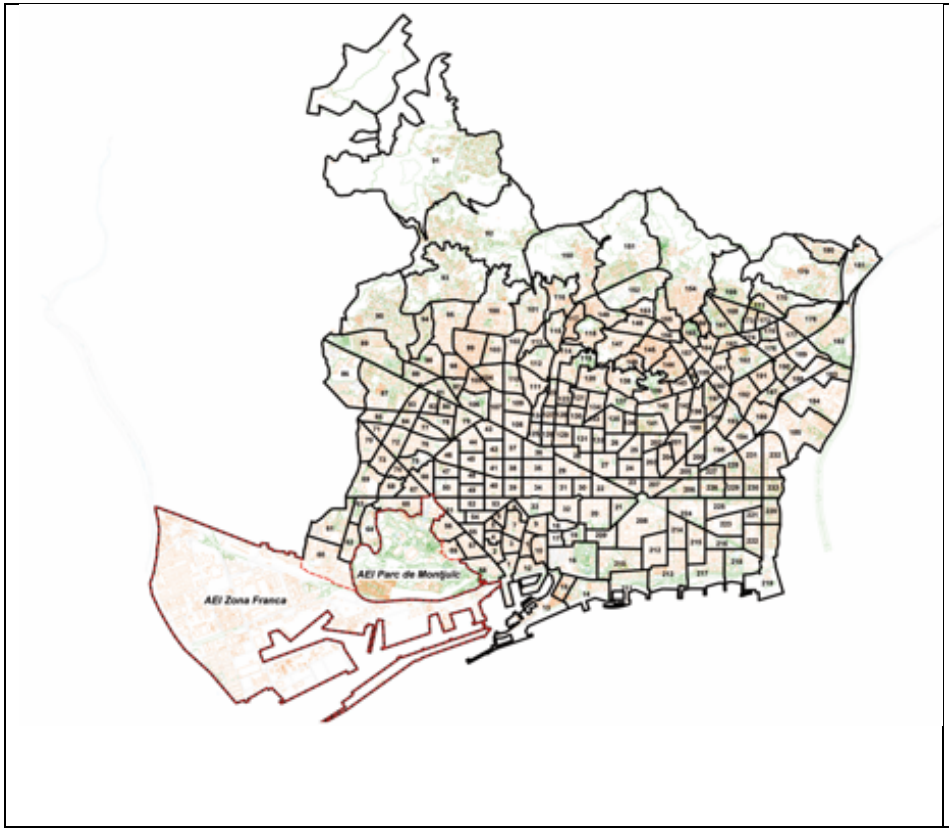
Identification strategy: Eixample district

We restrict the analysis to the **Eixample district** 7,3% of the area of the city (7,5km^2); 16% population (270,000 in 2021) to exploit: Homogenous area (demographics, economic activities) + its grided area



Identification strategy: unit of analysis

What is the best geographical unit of analysis?



Identification strategy: unit of analysis

Our proposal: a micro-geographical approach using rings

Identification strategy: Validity tests

We apply a fixed effects model → Assumption: construction of the cycling lanes infrastructure and the location of the public sharing bike stations are random across time and space

We test the assumption of 'as good as random' across time and space:

1)No systematic correlation with socio-demographic characteristics

$CL\_lenght_{j,t} = \beta_0 + \beta_1 X_{j,t=0} + \epsilon_{j,t}$	$NStations\_opened_{j,t} = \beta_0 + \beta_1 X_{j,t=0} + \epsilon_{j,t}$

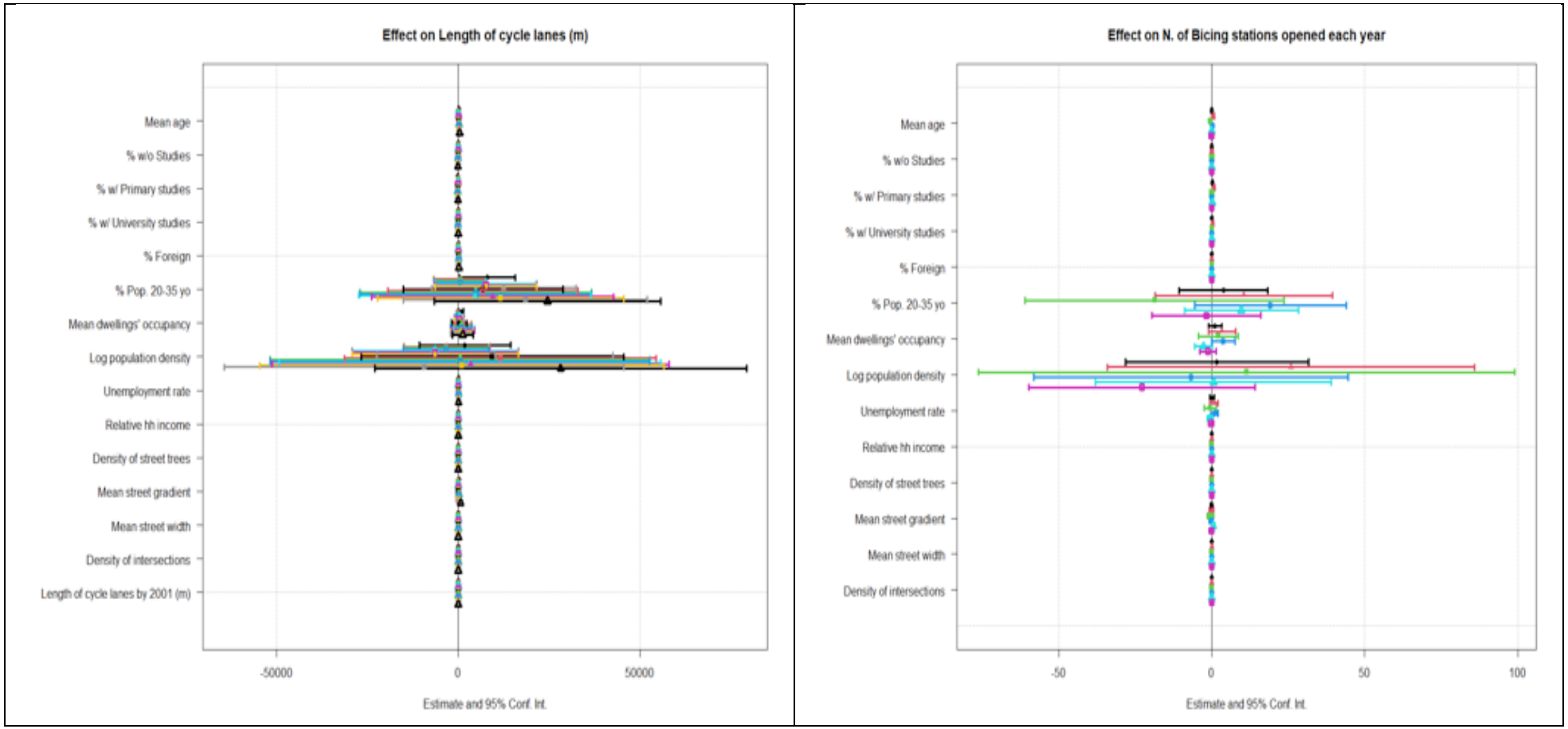
2)No anticipation effect

$$log(P_{i,s,j,t}) = \beta_0 + \beta_1 Time2Treat_s + \beta_2 X_i + \beta_3 Z_s + \theta_j + \gamma_t + \epsilon_{i,s,j,t}$$

3)No correlation with price trends/Price levels

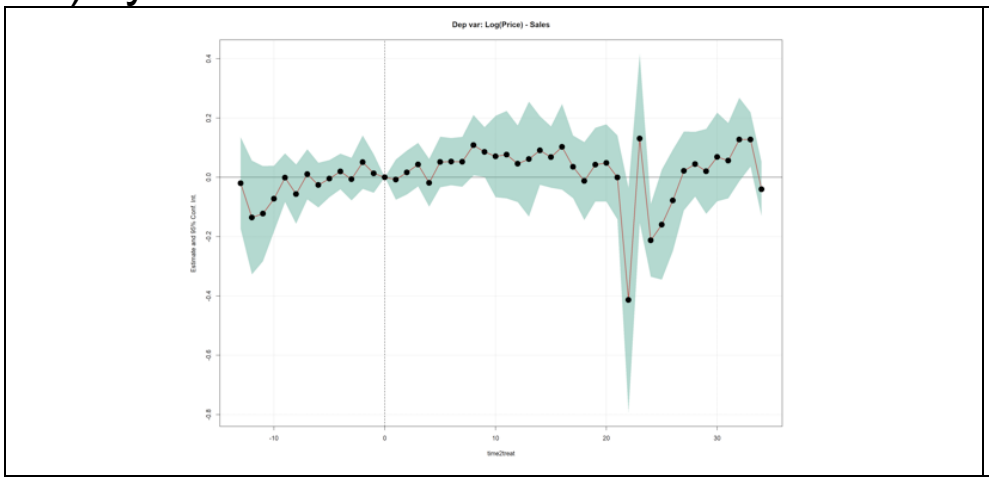
$Corr\left(CL\_lenght_{j,t}; \frac{\ln(P_{j,t})}{\ln(P_{j,t-1})}\right)$	$Corr\left(NStations\_opened_{j,t}; \frac{\ln(P_{j,t})}{\ln(P_{j,t-1})}\right)$

→ No systematic correlation

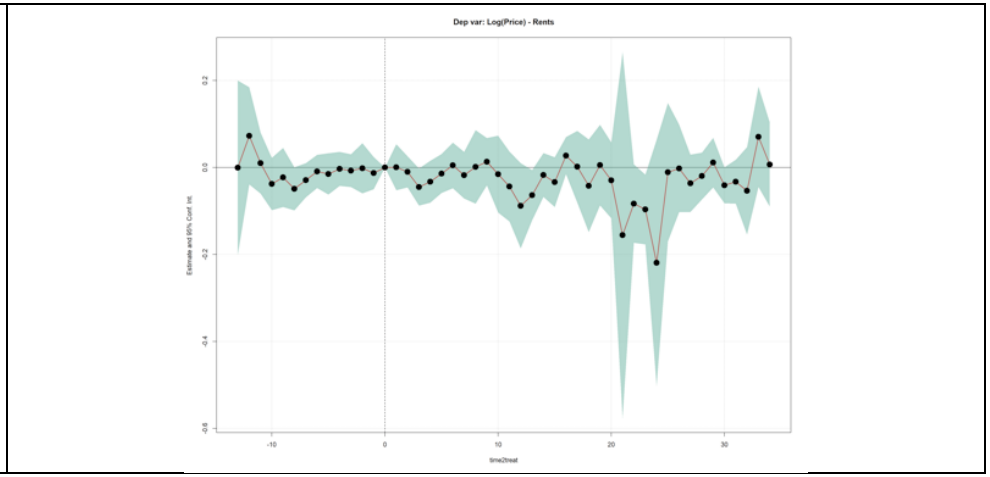


→ No anticipation effect:

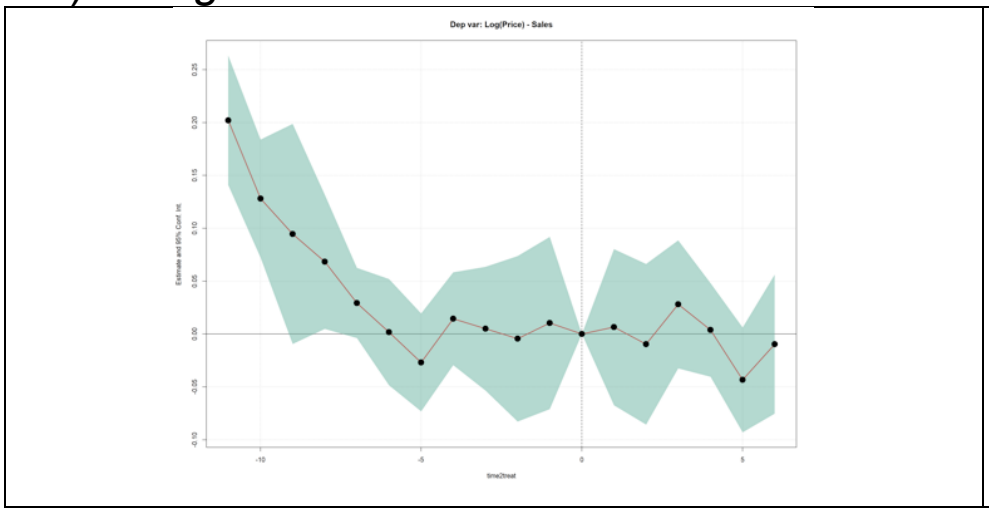
a) Cycle lanes Sales



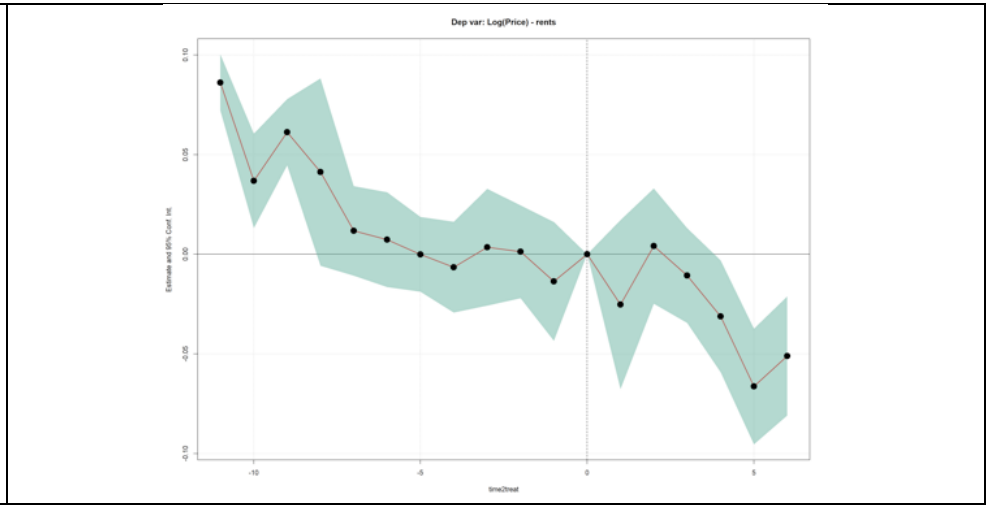
Rents



b) *Bicing* stations Sales

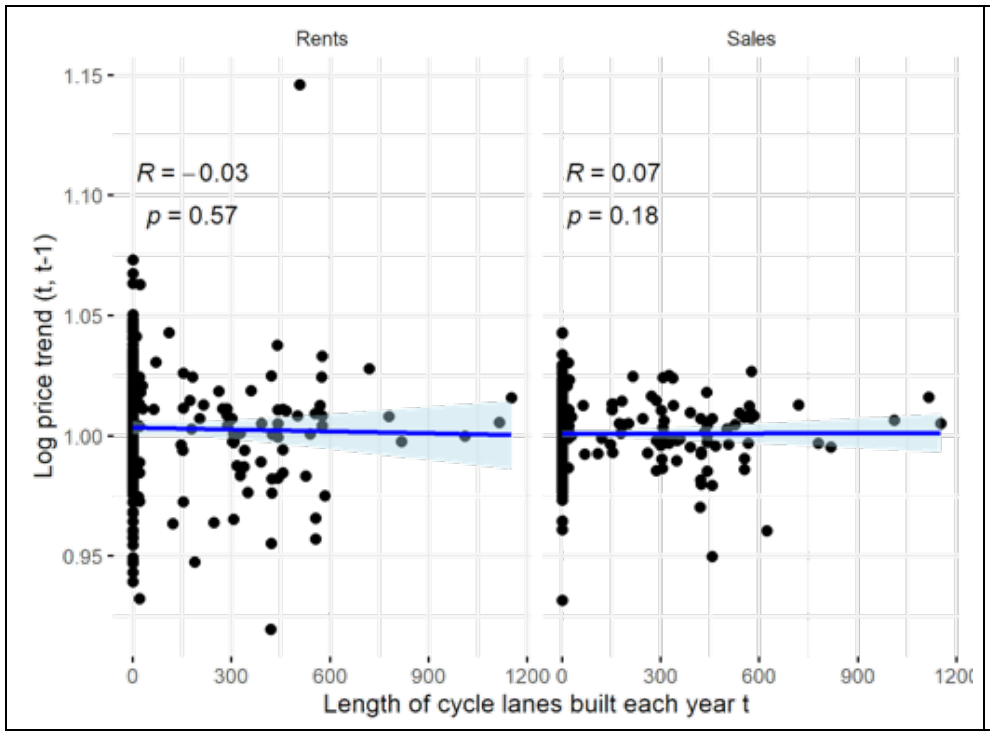


Rents

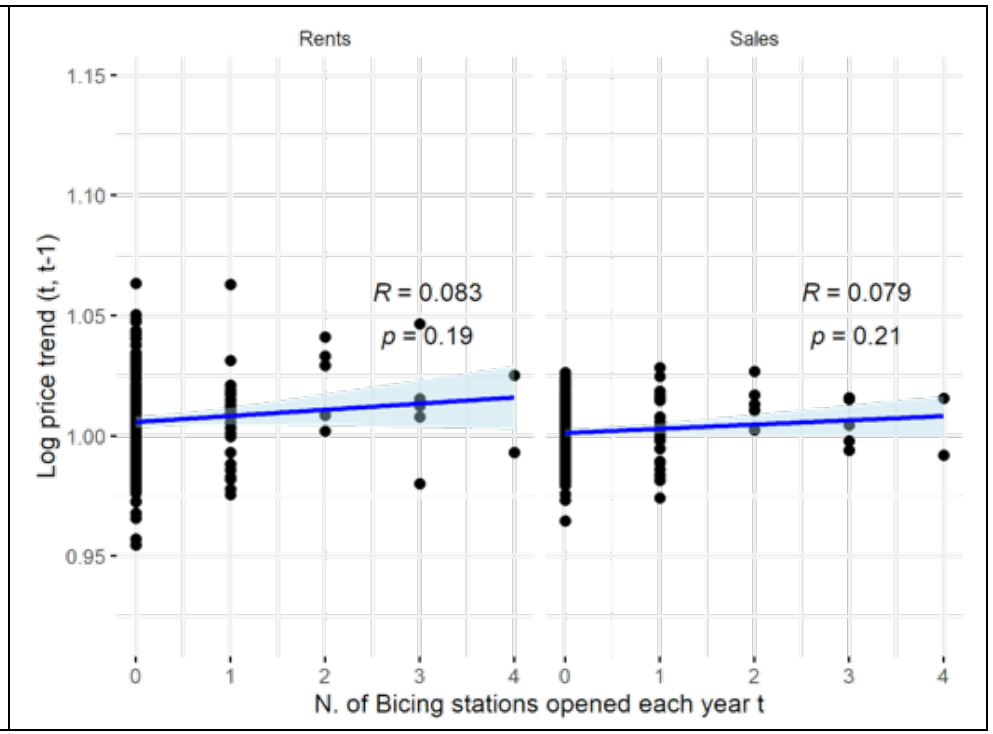


→ No correlation with the price trend

Cycle lanes:



Bicing stations:



Empirical estimation: Housing market

$$\ln(P_{i,s,j,t}) = \beta_0 + \beta_1 BIKE_{j,t} + \beta_2 X_i + \beta_3 Z_s + \beta_4 Y_j + \theta_j + \gamma_t + \epsilon_{i,s,j,t}$$

- $\ln(P_{i,s,j,t})$: log of posted price (sales' prices or rents) of dwelling *i* on street section *s* in street section *j* and year *t*

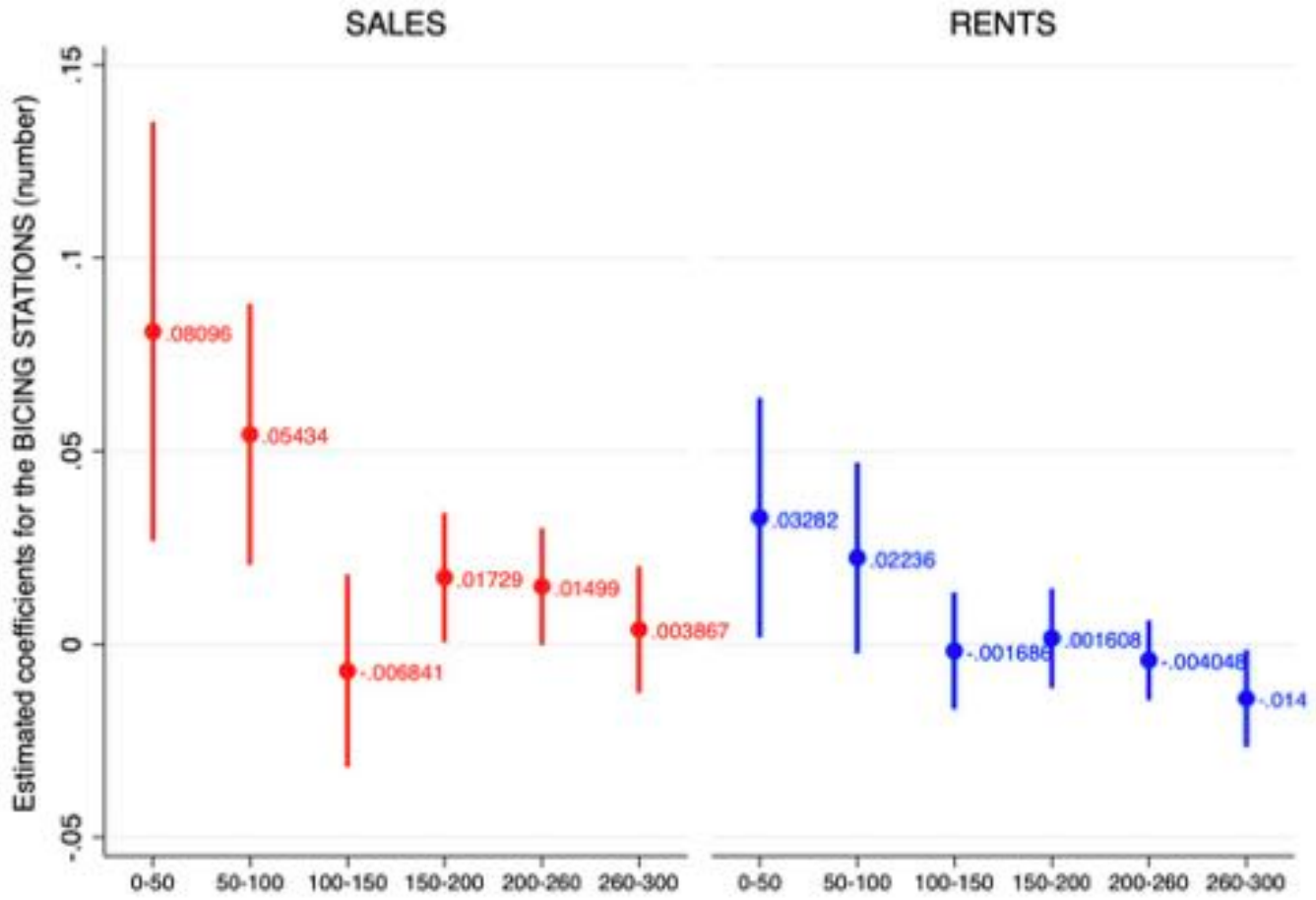
- $BIKE_{j,t}$: 1) cycle lanes length (in m) in *j* year t;
  2) Number of '*Bicing*' stations *j* and year *t*
  3) Rings from 50m to 300m

- X_i, Z_s, Y_j :Characteristics of the dwelling, the street section and the AEB
- θ_j, γ_t: Street and year fixed effects

- t= [2007-2017]

Results: Length of cycle lanes on Sales' prices and Rents

Results: Bicing Stations on Sales'a prices and Rents



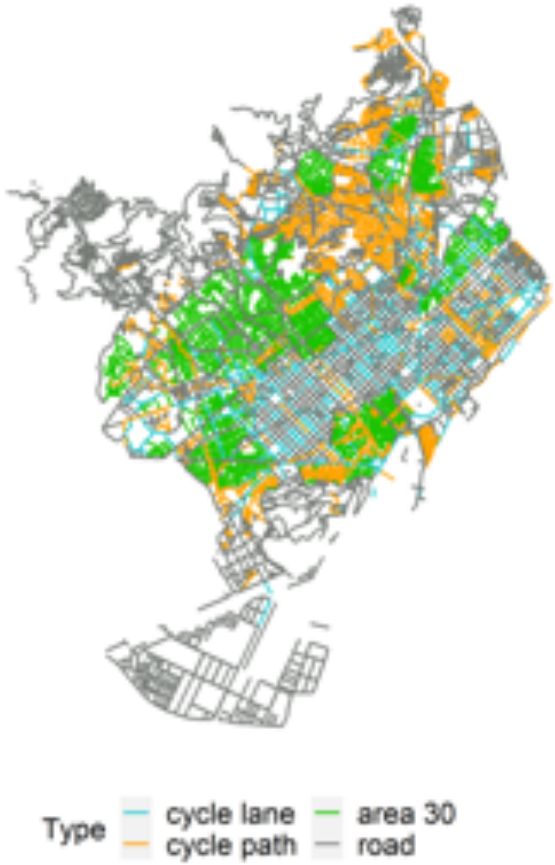
Bike traffic

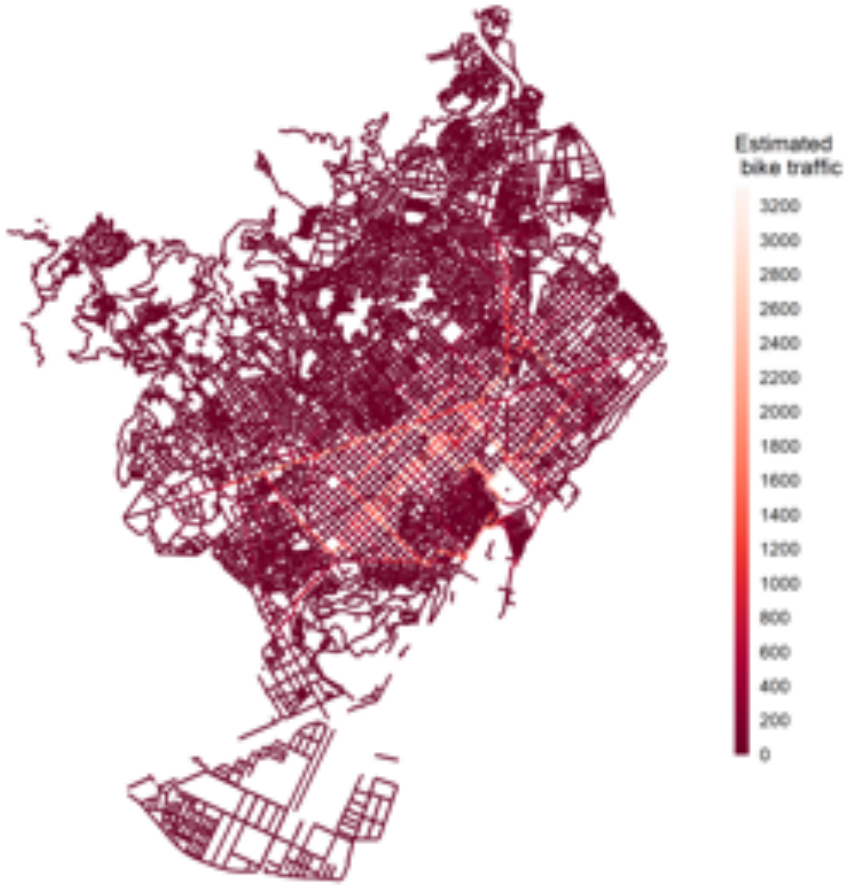
What if not all the street sections are equally connected or are less bike-friendly (even having a bike lane and a '*Bicing*' station)?

→ create an algorithm to estimate bike traffic:

- Estimate least cost paths between each pair of Bicing O-D stations
- Weights = cycling infrastructure (cycle lanes, cycle paths, area30, roads)
- Calculate number of Bicing bikes passing on each street section
- Limit data to weekday, morning hours
- Cross-section 2019

Estimated bike traffic





Empirical estimation: Connectivity and Housing prices

$$ln(P_{i,s}) = \beta_0 + \beta_1 Log(BicingTraffic_s) + \beta_2 X_i + \beta_3 Z_s + \theta_j + \epsilon_{i,s}$$

- $ln(P_{i,s})$: Log of posted price (sales or rents) of **dwelling i** on **street section s**
- $Log(BicingTraffic_s)$: Log of Bicing bikes passing on street s on an average Wednesday morning of 2019
- X_i, Z_s: Characteristics of the dwelling and of the street section (incl. accidents, public transport, bikes and cycling network within 500m)
- $t = 2019$

Results (preliminary)

Type	Rents			Sales		
Dependent Variable:	log(Price)					
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
Log(Bicing traffic)	0.011***	0.005**	0.0003	0.020***	0.014***	0.012***
	(0.004)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)
Controls						
Dwelling		Yes	Yes		Yes	Yes
Street			Yes			Yes
Fit statistics						
Adjusted R^2	0.00500	0.54079	0.60577	0.01014	0.67797	0.74571
Observations	1,771	1,771	1,771	3,370	3,370	3,370

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

To do list…

- Include new data on:

  1) Cycle lanes' characteristics

  2) 'Bicing' stations' characteristics

- Improve the Connectiveness estimations (bike traffic) by refining the algorithm

Conclusions

- We consider cycling infrastructure as cycle lanes and the public bike-sharing service
- O-D bike trips seem to be a good proxy for ‘bike-friendliness’ and the relevance of streets as connection links
- We find a positive and significant effect of both cycle lanes and bike-sharing stations on housing prices (some differences in rents and sales)
- We find significant different effects depending on the distance from the dwelling to the bike infrastructure: political economy implications

Thank you!

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