Second-Hand Gentrification:
Theory and Evidence from High-Speed Rail Extensions

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Motivation

- Wide coverage of concerns about the spread of gentrification from large to mid- or small-sized cities: **second-hand gentrification**.

- Recent examples include Berlin-Leipzig, London-Brighton, Toronto-Hamilton, Paris-Bordeaux, etc.

News coverage
(The Guardian, 03/2018)

Political coverage
(Mayor of Bordeaux, 03/2018)

NGO coverage
(NRDC, 06/2018)
Social unrest about (possible) heterogeneous effects

◊ Whereas workers (esp. skilled) of primary cities migrate to enjoy lower housing prices, more space...

◊ ... “natives” of secondary cities are voicing concerns about gentrifying trends in their cities.

◊ Example: stickers in Bordeaux appeared in the second part of 2017

Lit: “Parisian, go home”

◊ Less intuitive effects? Reduced pressure on housing market in primary cities?
⇒ Yet, we know little about the mechanisms behind this phenomenon and its distributional effects.
This paper

◊ Study **whether (and how) gentrification spreads along intercity transport connections**.

◊ Propose a model with **two monocentric cities, heterogeneous skills, intra- and inter-city commuting**

◊ Exploit 2017 **extension of French HSR network** from Paris to Bordeaux and Rennes to assess the theoretical predictions.

◊ **High-frequency and high-spatial resolution data**, including:
  - Universe of **housing transactions** between 2014 and 2020 at the unit level with geo-localization
  - Universe of **intra- and inter-city migration & commuting flows** between 2013 and 2018 at the individual level

◊ Confirming theoretical predictions, observe that the HSR extensions:
  - led to **housing prices increase in Bordeaux/Rennes and decrease in Paris**
  - increased migratory flow of **skilled parisians to Bordeaux/Rennes**
  - increased the share of skilled workers in central Bordeaux/Rennes
HSR extensions in France in July 2017

- HSR extensions have lead to **important reduction in inter-city travel times**:
  - **Paris-Bordeaux**: 35% reduction in travel time from 3h12min to 2h04min
  - **Paris-Rennes**: 32% reduction in travel time from 2h04min to 1h25min
The Model - Overview

◊ **Two monocentric cities**, \( i \in \{1, 2\} \). Primary (Paris) and secondary (Bordeaux/Rennes)

◊ Two types of individuals: "skilled" and "unskilled", \( j \in \{S, U\} \)

◊ Population is exogenous (closed system): \( N = N_S + N_U \)

◊ Individuals choose to:
  - live in city 1 or 2
  - where to live within each city
  - work in city 1 or 2

◊ Wages (daily)
  - Unskilled \( w_U \) (do not depend on city)
  - Skilled \( w_{1S} > w_{2S} > w_U \) (wage premium in city 1)
The Model - Work and Travel

- Individuals have time endowment (n. of workdays), normalized to one
- They can live in city $i$ and work in $\tilde{i}$ (possibly different and not same every day)
- If work+live in same city ($\tilde{i} = i$), at $x$ from CBD, time cost $T_{i,i}(x) = tx$
- If work+live in different cities ($\tilde{i} \neq i$), time cost $T_{i,\tilde{i}}(x) = tx + k$
  - Travel to train station, then long distance to other CBD (cost $k$)
The Model - Work and Travel

- **Unskilled**: work where they live ($\tilde{i} = i, \forall i$). No wage premium, no long-distance travel
  - Income: $w_U(1 - tx)$

- **Same for skilled living in city 1**: $\tilde{i} = 1$. No long-distance travel
  - Income: $w_{1s}(1 - tx)$

- **Skilled living in city 2**: work $1 - \alpha$ days in city 2 ($\tilde{i} = 2$), $\alpha$ in city 1 ($\tilde{i} = 1$) and travel long-distance
  - Income: $\alpha w_{1s}(1 - tx - k) + (1 - \alpha)w_{2s}(1 - tx)$

- **Note**: (i) $0 < \alpha \leq 1$ is exogenous (ii) can allow for lower wage when commuting long distance (key: $> w_U$)
Second-hand gentrification with HSR

- HSR extension reduces $k$:
  
  $\Rightarrow$ Area occupied by skilled in city 2 expands, unskilled driven towards periphery, migration by skilled from city 1.
  
  $\Rightarrow$ Opposite effect in city 1.

(a) Primary city

(b) Secondary city

Notes: Bold lines represent the rental price of land given lower long-distance commuting costs. Variables conditional on lower long-distance commuting costs denoted with superscript "H".
Testable implications

**H1.** HSR increases housing prices in secondary city

**H2.** HSR has a negative effect on housing prices in primary city (close to "treated" HSR station)

**H3.** HSR induces migration of skilled from primary to secondary city

**H4.** HSR increases share of skilled in secondary city, particularly close to CBD
Data

- **Housing market**: housing price data on the universe of housing property sold in France between Jan 1st, 2014 and Dec 31st, 2020 - source: https://app.dvf.etalab.gouv.fr/

- **Residential migration**: individual location of residence at year $t$ and $t - 1$, 2013-2018. Location defined at the municipal level (arrondissement in Paris). Information about individual education - source: INSEE

- **Residential commuting**: individual location of residence and workplace at year $t$, 2013-2018. Location defined at the municipal level (arrondissement in Paris). Information about individual education - source: INSEE

- **Residential density**: individual-level information about population of "neighborhoods" (IRIS) - units of 1,800 to 5,000 inhabitants. Information about individual education, but only about region (Departement) of residence in previous year - source: INSEE

- Municipality-level additional information (population count, size, age composition, etc).
H1 and H2: Effects on housing prices. Identification

◊ We aim at capturing the causal effects of the HSR extension; focusing on both the overall effects as well as their dynamics.

◊ We adopt a Event-Study Difference-in-Difference approach following Schmidheiny and Siegloch (2021):

\[ p_{oit} = \sum_{j=j_{\text{pre}}}^{j_{\text{post}}} \beta_j T_{it}^j + X'_{oit} \gamma + \mu_i + \theta_t + \varepsilon_{oit} \]  \hspace{1cm} (1)

◊ where:

▶ \( p_{oit} \): price (per sqm) for transaction \( o \) in municipality \( i \) at semester \( t \)

▶ \( \sum_{j=j_{\text{pre}}}^{j_{\text{post}}} \beta_j T_{it}^j \): Sum of year \( \times \) treatment dummies, with \( \beta_j \) being the parameters of interest.

▶ \( X_{oit} \): housing unit controls (size, n. of rooms, etc.)

▶ \( \mu_i, \theta_t \): municipality- and time-fixed effects

▶ \( \varepsilon_{oit} \): error term
H1: Does HSR have positive effect on prices in Bordeaux/Rennes?

Control group: (i) other top 10 French largest cities excluding Paris, Toulouse and Nantes, (ii) other MAs with "high potential" for HSR

Result: approx. $206€/m^2$ (approx. 5%), increase in property prices.
H1: Are houses and apartments similarly affected in Bordeaux/Rennes?

(a) Apartments (€ per m²)  
(b) Houses (€ per m²)

Notes: ES-DiD model (1) using 95% CIs.
H2: Does HSR have negative effect on prices close to Paris Montparnasse?

Notes: Authors’ own illustration.
H2: Does HSR have negative effect on prices close to Paris Montparnasse?

Define the control group as (i) all other Parisian arrondissements, and (ii) all other arrondissements hosting a HSR station.

Result: $255/\text{m}^2$ (approx. 3%) decrease property prices around Montparnasse (14th and 15th Arr.).
H2: How far does the effect spread from Paris Montparnasse?

(a) All transactions

(b) Within 100m of metro to HSR

◊ Housing price (relative) decline in Paris is driven by location within 100m of a metro station (on a direct line to Montparnasse HSR station).
H3: Are skilled Parisians more likely to move to Bordeaux/Rennes?

- We adopt a **Triple Difference** (DiDiD) approach.

  - Compare "extra" flow of Parisian skilled (around Montparnasse) to Bordeaux and Rennes (wrt non-skilled), to "extra" flow of such workers elsewhere (wrt non-skilled), over several years.

\[
y_{\omega i'i t} = \alpha_1(D_t \times Skill_{\omega}) + \alpha_2(D_t \times HSR_i) + \alpha_3(Skill_{\omega} \times HSR_i) \\
+ \alpha_4(D_t \times Skill_{\omega} \times HSR_i) + \mu_i + \nu_{i'} + \theta_t + \rho_{\omega} + \varepsilon_{\omega i'i t}
\]

- where:

  - $y_{\omega i'i t}$: flow of workers of skill $\omega$ who moved from $i'$ to $i$ between years $t - 1$ and $t$
  - $Skill_{\omega}$: Indicator equal to one if individuals hold a tertiary education degree (skilled)
  - $HSR_i$: Indicator equal to one if destination of move is Bordeaux or Rennes
  - $D_t$: Post treatment indicator.
  - $\alpha_4$: Parameter of interest.
H3: Are skilled Parisians more likely to move to Bordeaux/Rennes?

<table>
<thead>
<tr>
<th>Outcome:</th>
<th>Migration flows</th>
<th></th>
<th>Commuting flows</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Control:</td>
<td>Top 10 MA</td>
<td>HSR potential</td>
<td>Top 10 MA</td>
<td>HSR potential</td>
</tr>
<tr>
<td>DiDiD ($\alpha_4$)</td>
<td>15.206*</td>
<td>24.011**</td>
<td>2.256*</td>
<td>3.158*</td>
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<td></td>
<td>(8.024)</td>
<td>(12.060)</td>
<td>(1.309)</td>
<td>(1.773)</td>
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<tr>
<td>Obs.</td>
<td>494</td>
<td>131</td>
<td>2,493</td>
<td>977</td>
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<td>$R^2$</td>
<td>0.78</td>
<td>0.83</td>
<td>0.37</td>
<td>0.49</td>
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</tbody>
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*Notes: Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$*

◇ **Result:** Increase in the flow of skilled Parisian workers moving to Bordeaux/Rennes.

◇ **Approx.** 15% commute on very frequent basis.
H4: Do in-moving skilled workers locate in central locations?

◊ We go back to the **ES-DiD** approach – but using different units of observation.

  ▶ Compare share of skilled in-movers in the (3 and 5) most central neighborhoods in Bordeaux and Rennes to share in other neighborhoods of same cities, over several years

\[
y_{it} = \sum_{j=1}^{\bar{j}} \beta_j T_{it}^j + \mu_i + \theta_t + \varepsilon_{it}.
\]

◊ where:

  ▶ \(y_{it}\) share of skilled workers among in-movers into neighborhood \(i\) at year \(t\)
  
  ▶ \(\mu_i\) and \(\theta_t\) neighborhood- and year- fixed effects
  
  ▶ \(\varepsilon_{it}\) error term
H4: Do skilled moving in secondary cities locate in central locations?

\[ \beta = 0.077^{***} (0.028) \]

- **High-speed rail opening**

<table>
<thead>
<tr>
<th>Year</th>
<th>Treated: 3 most central neighborhoods</th>
<th>Treated: 5 most central neighborhoods</th>
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<tbody>
<tr>
<td>2013</td>
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<td>2018</td>
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(Number of observations: 1034)

- Compare central and non-central neighborhoods in Bordeaux/Rennes.
- Result: 7.7%p. increase in the share of skilled workers in central Bordeaux/Rennes.
H4bis: Are periphery locals in Bordeaux/Rennes crowded out of the center?

◊ **Result:** Unskilled workers from peripheral locations in Bordeaux and Rennes are 10% less likely to move to the center.
Conclusion

• We developed a **model of second-hand gentrification** with heterogeneous individuals locating in a primary and a secondary city.

• Improving the **HSR network increases the accessibility of the primary city** (from treated secondary cities).
  
  ▶ Skilled workers, as well as unskilled in primary city are predicted to benefit from the reform.
  
  ▶ Yet, in line with media coverage, unskilled in secondary cities are harmed due to the increase in housing prices.

• Theoretical predictions are empirically validated **exploiting the extension of the French HSR in 2017**.

• Analysis confirms the **important effects in Bordeaux/Rennes**, but also evidence of **reduced housing prices in Paris Montparnasse area**.