Commuting Technologies, City Structure and Urban Inequality: Evidence from Bogotá’s TransMilenio

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This Paper

• Rapidly growing cities can become congested and characterised by inequality

• Does poor transport infrastructure cause poverty and increase inequality?

• In this paper, I study the impact of TransMilenio, a novel Bus Rapid Transit system in Bogotá, Colombia

• Questions:

  1. (Aggregate) Can we quantify the benefits of BRT relative to its cost?

  2. (Distributional) Can BRT raise the income and welfare of a city’s poorest citizens and reduce inequality?
     • Reduce commuting times
     • Reduce spatial mismatch between low-skill workers and firms
TransMilenio
Bus Rapid Transit System (BRT) in Bogotá, Colombia

[Image of a busy street with a bus and cars]
TransMilenio
Bus Rapid Transit System (BRT) in Bogotá, Colombia

- Opened in December 2000, announced just two years prior
- Most used BRT in the world - currently 2.2mn trips/day
- System of feeder buses serve portals at end of routes at no additional cost
- But has become congested, with usage exceeding planned capacity
TransMilenio
Multiple lines covering much of the city
Data

• I leverage a rich set of spatial data available before and after TM’s construction, across >37,000 city blocks:
  
  ▶ **Land**: Land and property value, commercial vs residential usage, floor area, building characteristics
  
  ▶ **Commuting Microdata**: Origin, destination, demographics and trip characteristics
  
  ▶ **Residential Population**: Population and demographics
  
  ▶ **Employment, Firm Level**: Complete enumeration of firms, with industry and # workers
  
  ▶ **Employment, Worker Level**: Income, employment and demographics microdata
Develop a Theory

- I build quantitative model of city structure with (i) multiple groups of workers and (ii) multiple modes of transit
Develop a Theory

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• Spatial Mismatch: Commuting costs distort matching between workers and firms, but extent of distortion within groups depends on
  ▶ Use of different commuting modes
  ▶ Absolute vs comparative advantage
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- **Spatial Mismatch**: Commuting costs distort matching between workers and firms, but extent of distortion within groups depends on
  - Use of different commuting modes
  - Absolute vs comparative advantage

- Two forces determine relationship between poverty and geography:
  - (Geography ⇒ Poverty) Spatial Mismatch
  - (Poverty ⇒ Geography) Residential Sorting
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  - (Poverty $\Rightarrow$ Geography) Residential Sorting

- Use natural experiment to let the data quantify the importance of both forces
Test the Theory
Exploiting the natural experiment provided by TransMilenio’s construction

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   ▶ Staggered station openings for falsification
   ▶ Historical maps of the city to predict route placement
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2. Provide reduced form evidence on effect of TM on outcomes using
   - Staggered station openings for falsification
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3. Estimate structural model, and quantify
   - The benefits of TM relative to its cost
   - The gains across worker groups, and the role of spatial mismatch in affecting these gains
   - Counterfactual returns to new line construction
Preliminary Findings

- Commuting:
  - TM used mostly by low/middle-income individuals
  - Disproportionately reduced commuting times for long trips

- Other outcomes:
  - Land values have increased close to stations, especially in peripheral neighbourhoods
  - Land has reallocated to commercial use near stations
  - Wages grew approx. 7% more for blocks <500m from stations vs those >1km away, greater in peripheral neighbourhoods

- Falsification tests suggest effects are causal

- Results for employment, and quantifying total aggregate and distributional effects forthcoming
Conclusions

• BRT is an attractive alternative to subways for cities with little public transit infrastructure

• My findings so far suggest a sizeable impact on land and labor markets

• My quantitative results will provide estimates of the
  1. Cost efficiency of BRT
  2. Distributional effects of BRT
  3. Whether spatial mismatch matters in L/MIC cities

• Remaining Question: How did Bogotá’s land use policy limit the gains from TransMilenio?