The Welfare effects of subsidies:

A case study of public transport

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Research Question

How does decreasing costs of public transport affect:

1. Urban mobility:
   - How much does a public transit subsidy affect transport mode choice?
   - What is the impact on mode choice on travel times?

2. Welfare gains:
   - How much does consumer plus increase for treated participants?
   - What are the heterogeneous effects by trip motive and gender?

What we do

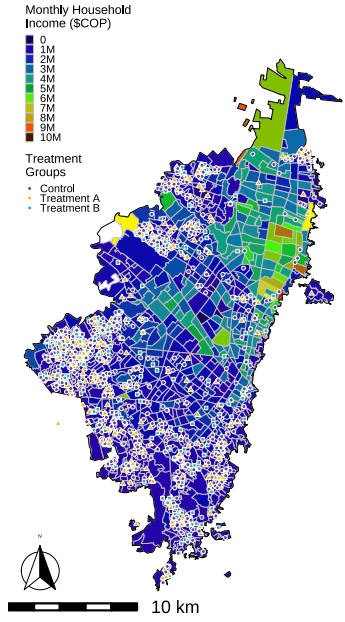
We run an experiment with Transmilenio´s users in Bogotá, Colombia

- Recently frequent users of Transmilenio are invited to participate in a “study for travel behaviours”
- Users willing to participate in the experiment answer the baseline survey and are randomly assigned into three groups:
  1. Control
  2. Treatment A: Monthly subsidies for $7.5 USD
  3. Treatment B: Monthly subsidies for $5.6 USD
- Intervention did not attempt to change conditions faced by users.

▸ Intervention’s timeline

Data

1. Baseline and (15) follow-up surveys:
   - **Travel history**: Transport modes, travel times, costs, motive, etc.
     ▸ Baseline modal share
   - **Travel history**: Income, education, labor market, etc.
   - Total of **14,807 baseline** and **follow-up** surveys and **1,598** experiment participants
2. Transmilenio's Administrative data:
   - Smartcard activity, fare, treatment use
     ▸ Staggered treatment adoption



Impact of Subsidies

Mixed Logit Estimates ▸ Demand estimates alternative

Table: Transportation decisions - Mixed Logit model estimates with controls

	Dependent variable: *Alternative choosen*				
	Complete	Trip motive		Timing	
	Sample	Work trips	Non-work trips	Before	During
	(1)	(2)	(3)	(4)	(5)
Random coefficients					
Monetary costs (θ_i)	-0.259***	-0.997***	-0.0544	-0.461***	-0.237***
	(0.0326)	(0.0885)	(0.0390)	(0.0786)	(0.0374)
Opportunity costs (β_i)	-0.0272***	-0.0369***	-0.0300***	-0.0250***	-0.0330***
	(0.0018)	(0.0037)	(0.0024)	(0.0034)	(0.0019)
Observations	88,518	58,908	29,610	23,958	64,560
Controls	Yes	Yes	Yes	Yes	Yes
Standard Errors	Participant	Participant	Participant	Participant	Participant
Number of participants	1,564	1,396	1,282	1,455	1,345
Number of trips	14,753	9,818	4,935	3,993	10,760

Impact of Subsidies

Welfare gains estimates

Table: Heterogeneous effects in welfare change by treatment group

	Monthly welfare change ($USD)				
	Complete sample	Trip motive		Gender	
		Work trips	Non-work trips	Female	Male
Treatment	12.82	5.59	26.69	21.19	16.57
	[11.41, 14.24]	[3.92, 7.26]	[24.17, 29.22]	[16.79, 22.6]	[14.23, 18.9]
Treatment A: $7.5 USD	15.56	7.9	30.75	24.65	18.51
	[13.92, 17.2]	[5.98, 9.83]	[27.94, 33.55]	[23.01, 26.3]	[15.8, 23.88]
Treatment B: $5.6 USD	10.17	3.36	22.44	17.45	14.82
	[8.46, 11.88]	[1.37, 5.35]	[19.8, 25.08]	[15.82, 19.07]	[12.13, 19.49]

▸ Welfare gains densities

Main findings

Demand for mobility: ↑ **Public transport improvements** ↓ **externalities**

- Participants prefer **lower** prices and travel times
- Subsidies **increased public transport demand** compared to the "outside good"
- Participants are **income constrained**

Travel Behaviour

- **Heterogeneous** effects by trip motive. Higher increase in demand for non-work trips.
- **Lower travel times** for treated participants. Evidence of transport mode substitution.

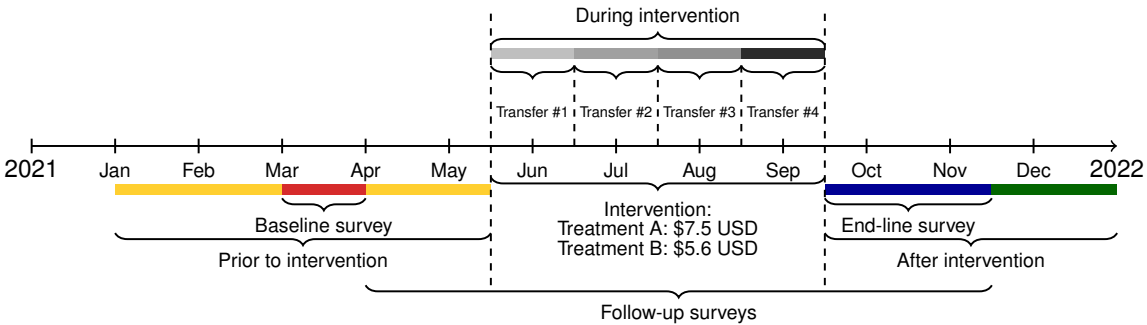
Welfare: ⟶ **Subsidies targeting**

- Treated participants, on average, have monthly **welfare gains** of $12.8 USD
- Presence of **heterogeneous treatment effects** by trip motive and gender.

Annex

Intervention timeline

Figure: Intervention's timeline



▸ What we do

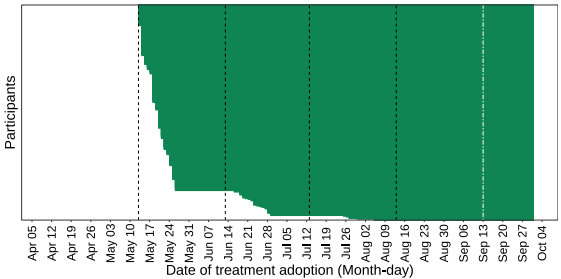
Baseline modal share

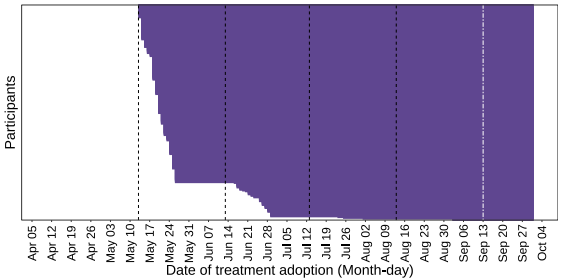
Table: Modal choices

	Treatment Groups					
	Complete sample		Control		Treatment	
	(N = 1,607)		(N = 806)		(N = 801)	
Transport Mode	Mean	Stand. Dev.	Mean	Stand. Dev.	Mean	Stand. Dev.
Bus	0.5111	0.4999	0.5179	0.4997	0.5051	0.5000
BRT	0.3271	0.4692	0.3034	0.4598	0.3485	0.4765
Automobile and Motorcycle	0.0583	0.1610	0.0622	0.1644	0.0547	0.1578
Walk	0.0332	0.1792	0.0407	0.1976	0.0264	0.1606
Taxi	0.0322	0.1766	0.0346	0.1828	0.0301	0.1709
Other	0.0381	0.1914	0.0413	0.1991	0.0352	0.1842

▸ Data

Staggered Treatment Adoption

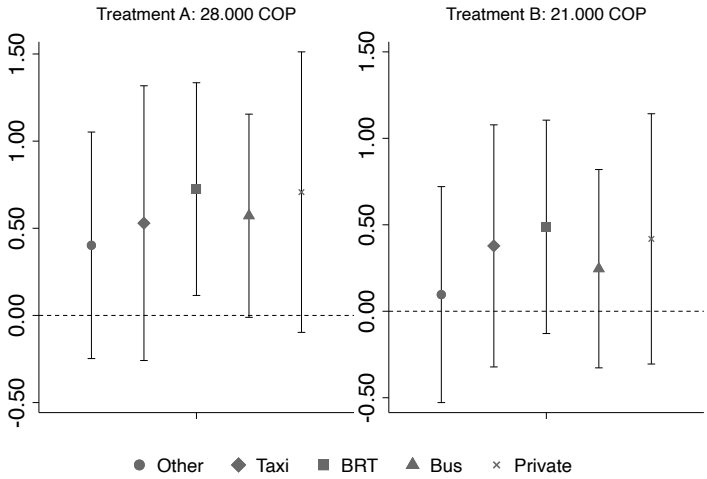




▸ Data

Impact of Subsidies

Demand for transport alternatives



▸ Mixed Logit estimates

Impact of Subsidies

Welfare gains densities ▸ Welfare gains estimates