

APPLICATION OF A METHODOLOGY TO ASSESS POLICIES TO CONTROL PRIVATE VEHICLE TRAFFIC IN CITIES

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Research Objectives

- Vehicle congestion and sustainability of mobility in the long run have been identified as one of the main problems in Latin-American Cities.
- These initiatives, which are frequently used in transport to solve these problems, are well-known as "push and pull" strategies.

Cities of Analyses

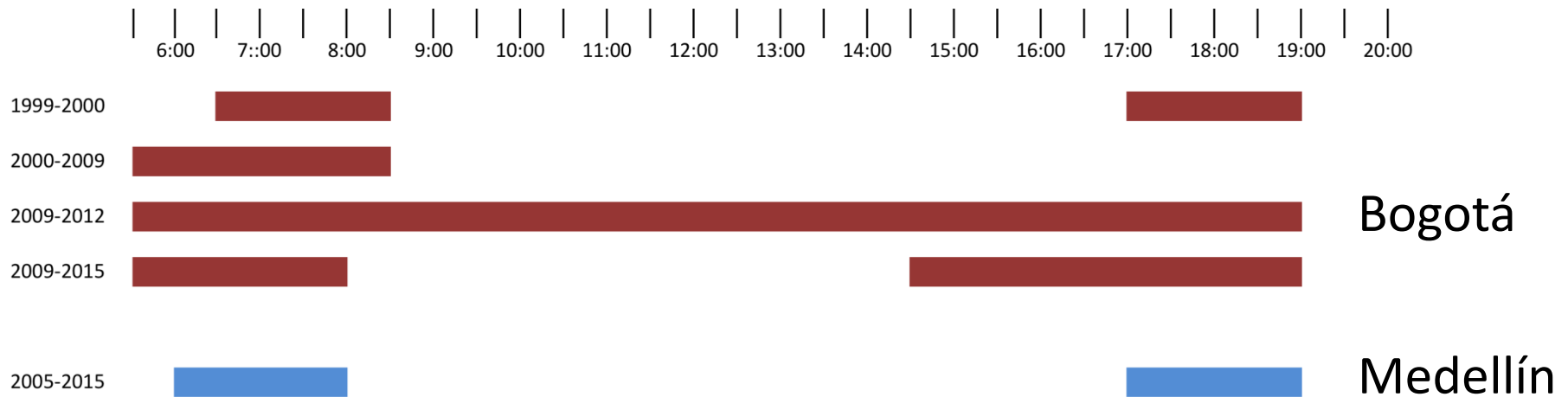


- Bogotá is about 9 million inh. and has about 1,29 million cars.
- Medellín is about 2,7 million inh. and has 357.000 private cars

Research Objectives

- Bogotá city has been subjected to two types of interventions in the past 11 years, restrictions for some hours of the day (1999) and restrictions throughout the day (2009).
- Other cities have had restrictions by hours or some of them have not been subjected to any intervention. Medellín has had restriction since 2005 by hours for private vehicles.
- Clearly these measures affect the decisions of individuals to purchase a new vehicle to evade the measure, but how does this really affect the motorization of a city?

Changes in restriction



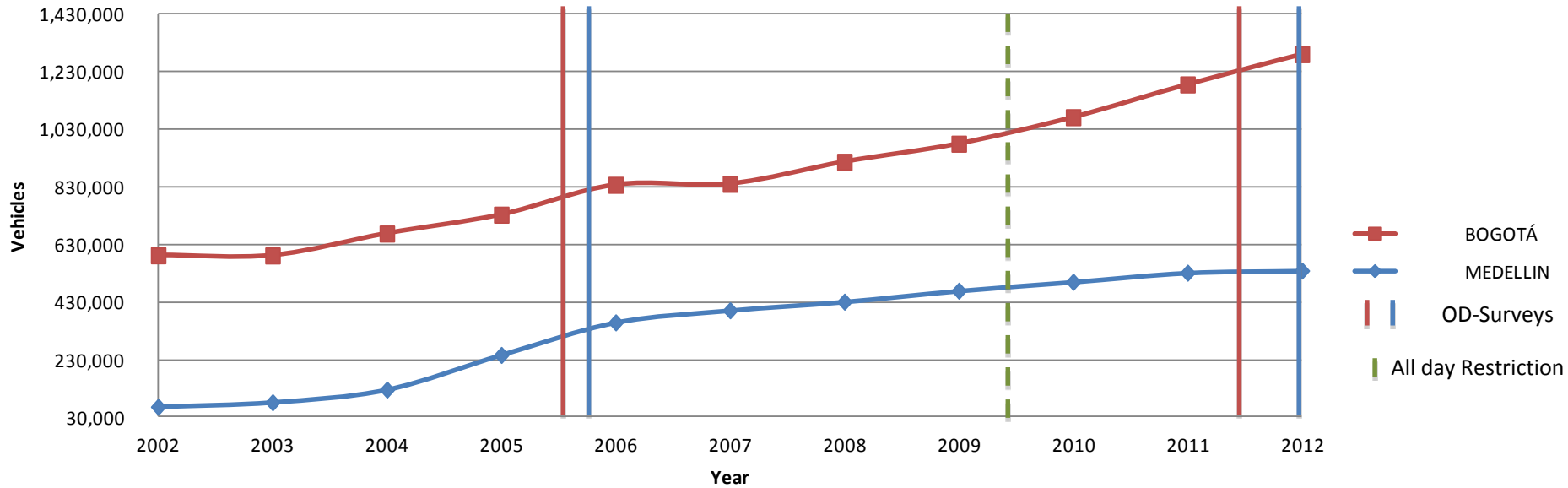
Methodology

- Using O-D surveys of two cities, taken at least in two different periods, comparing the treatment effects of vehicle restriction for the day to establish the effect of the measure on the decision to buy a second vehicle.
- Total database analyzed were 39,000 household surveys, in which households have similar socio-economical characteristics and owning a car, they could afford a second vehicle.

Methodology

- Using a quasi-experimental method on the basis of data from the O-D survey, make a match so that it can be analyzed a treatment group with a control group that keep observable characteristics.
- Double differences method combined with pairing (Propensity Score Matching), through a probit regression model.

Evolución of Private Fleet 2002-2012



YEAR	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
BOGOTÁ	590,930	590,370	666,520	732,090	835,800	839,251	915,647	978,613	1,070,572	1,184,387	1,289,495
MEDELLIN	65,095	80,534	124,560	245,000	358,000	400,000	430,000	468,000	499,000	530,657	537,929

Figure 1 – Evolution of Private Fleet, Bogotá 2002-2006, taken from information SDM, and Environmental Secretary, Bogotá, 2007-2013

Medellín (Secretary of Transportation, Medellín, 2002) <https://upcommons.upc.edu/pfc/bitstream/2099.1/3401/8/41176-8.pdf>

Support and control comparison, years 98-00, 05-05, 11-12

variouscars =

$$\alpha_i + \beta_1 \text{stratum} + \beta_2 \text{vehimotorcycles} + \beta_3 \text{workingadults} + \beta_4 \text{children} + \beta_5 \text{jefeeshombre} + \beta_6 \text{householdjourney} + \beta_7 \text{meanjourneytime} \quad (5)$$

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Probit regression                Number of obs   =       7520
                                LR chi2(7)       =       732.38
                                Prob > chi2        =       0.0000
                                Pseudo R2         =       0.0723

Log likelihood = -4701.6693
    
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	d	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
vehimotorcycles		-1.291264	.0774796	-16.67	0.000	-1.443121 -1.139406
stratum		-.1025859	.0141462	-7.25	0.000	-.130312 -.0748599
nonworkingadults		-.0590677	.0137315	-4.30	0.000	-.085981 -.0321543
children		.1543127	.0174702	8.83	0.000	.1200718 .1885536
jefeeshombre		-.1092496	.0370506	-2.95	0.003	-.1818675 -.0366317
householderjourneys		-.1100928	.0096498	-11.41	0.000	-.1290061 -.0911795
mainjourneytime		-.0000865	.0000501	-1.73	0.084	-.0001846 .0000117
_cons		.9438372	.06751	13.98	0.000	.8115201 1.076154

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
variouscars	Unmatched	.11323693	.106446281	.006790649	.007373572	0.92
	ATT	.113312556	.080078327	.033234228	.007968423	4.17

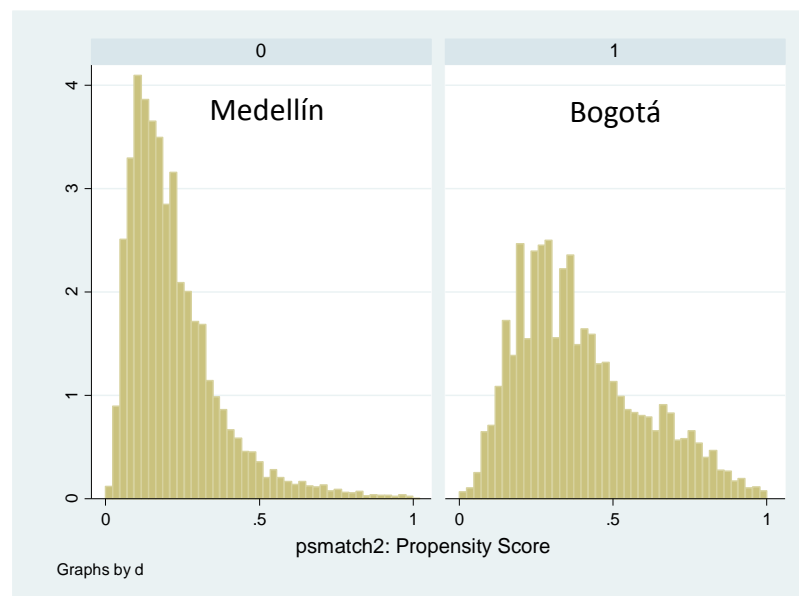
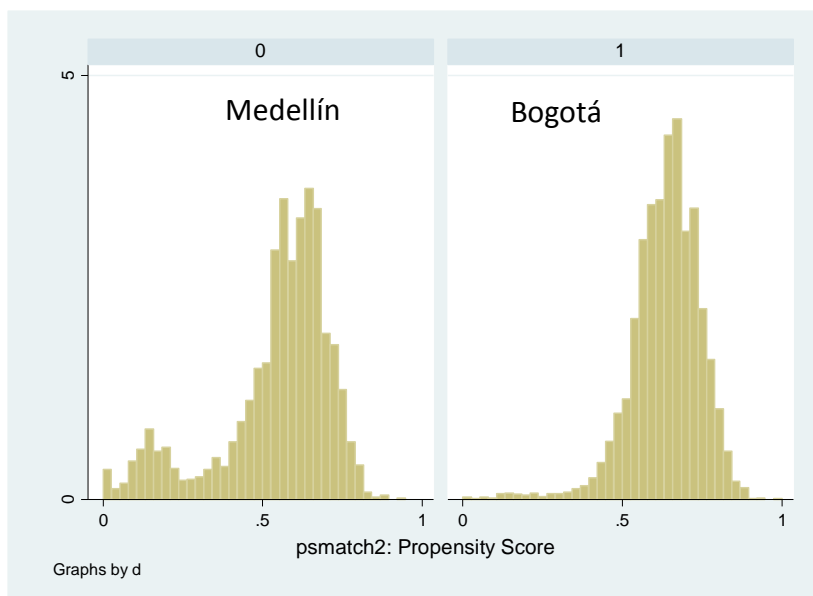
Note: S.E. does not take into account that the propensity score is estimated.

psmatch2: Treatment assignment	psmatch2: Common support		
	Off suppo	On suppor	Total
Untreated	0	3,025	3,025
Treated	3	4,492	4,495
Total	3	7,517	7,520

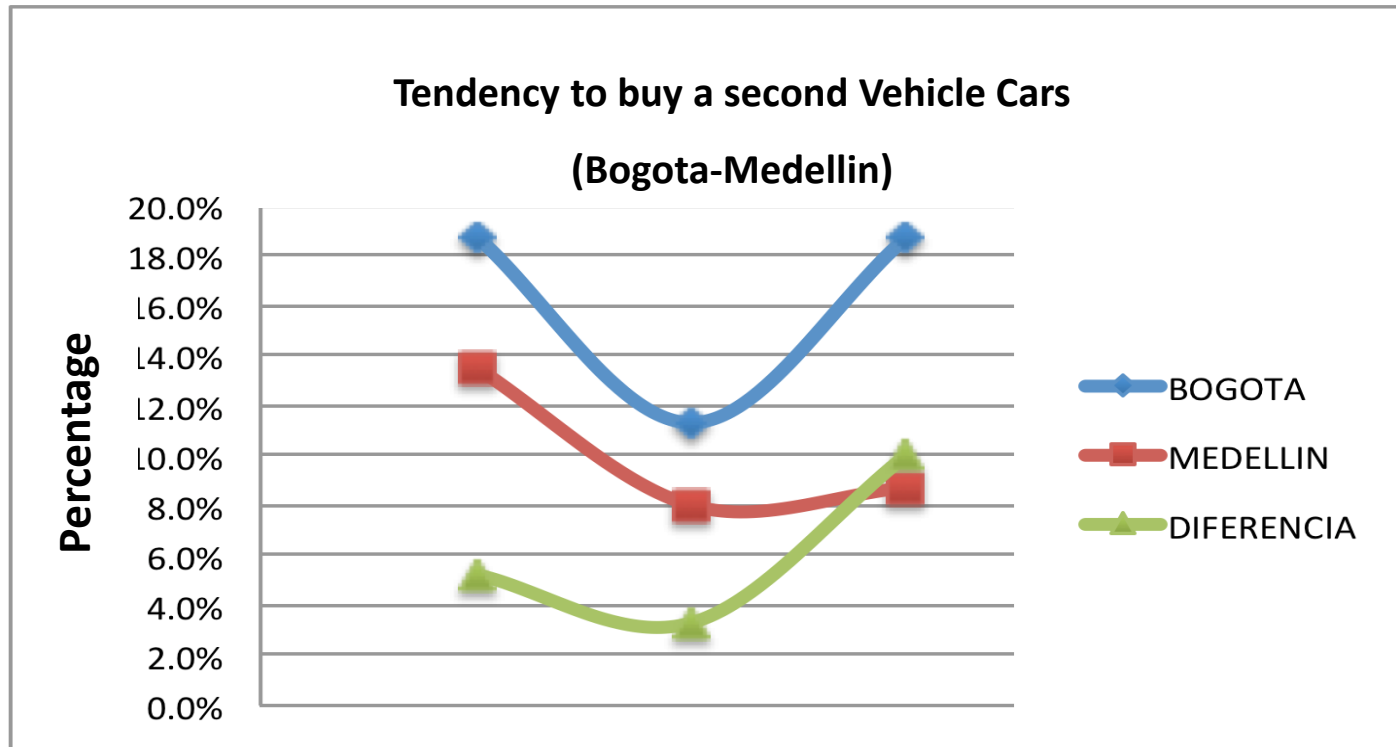
support and control comparison, years 98-00, 05-05, 11-12

variouscars =

$$\alpha_i + \beta_1 \text{stratum} + \beta_2 \text{vehimotorcycles} + \beta_3 \text{workingadults} + \beta_4 \text{children} + \beta_5 \text{jefeeshombre} + \beta_6 \text{householdjourney} + \beta_7 \text{meanjourneytime} \quad (5)$$



Results for cars



YEARS	98-00	05-05	11-12
BOGOTA	18.7%	11.3%	18.7%
MEDELLIN	13.5%	8.0%	8.7%
DIFERENCIA	5.2%	3.3%	10.0%

Results for motorcycles

. tab cars motorcylces

1998

Cars	<u>Motorcylces</u>						Total
	0	1	2	3	4	5	
1	7,225	480	35	2	2	1	7,745
2	1,109	47	1	1	0	0	1,158
3	214	5	1	0	0	0	220
4	43	1	0	0	0	0	44
5	9	1	0	0	0	0	10
6	2	0	0	0	0	0	2
Total	8,602	534	37	3	2	1	9,179

2005

<u>SumaDeCarr</u> os	<u>SumaDeMotos</u>				Total
	0	1	2	3	
1	6,504	331	19	3	6,857
2	788	5	6	0	842
3	106	6	0	0	112
4	13	0	0	0	13
5	5	0	0	0	5
6	1	0	0	0	1
Total	7,417	385	25	3	7,830

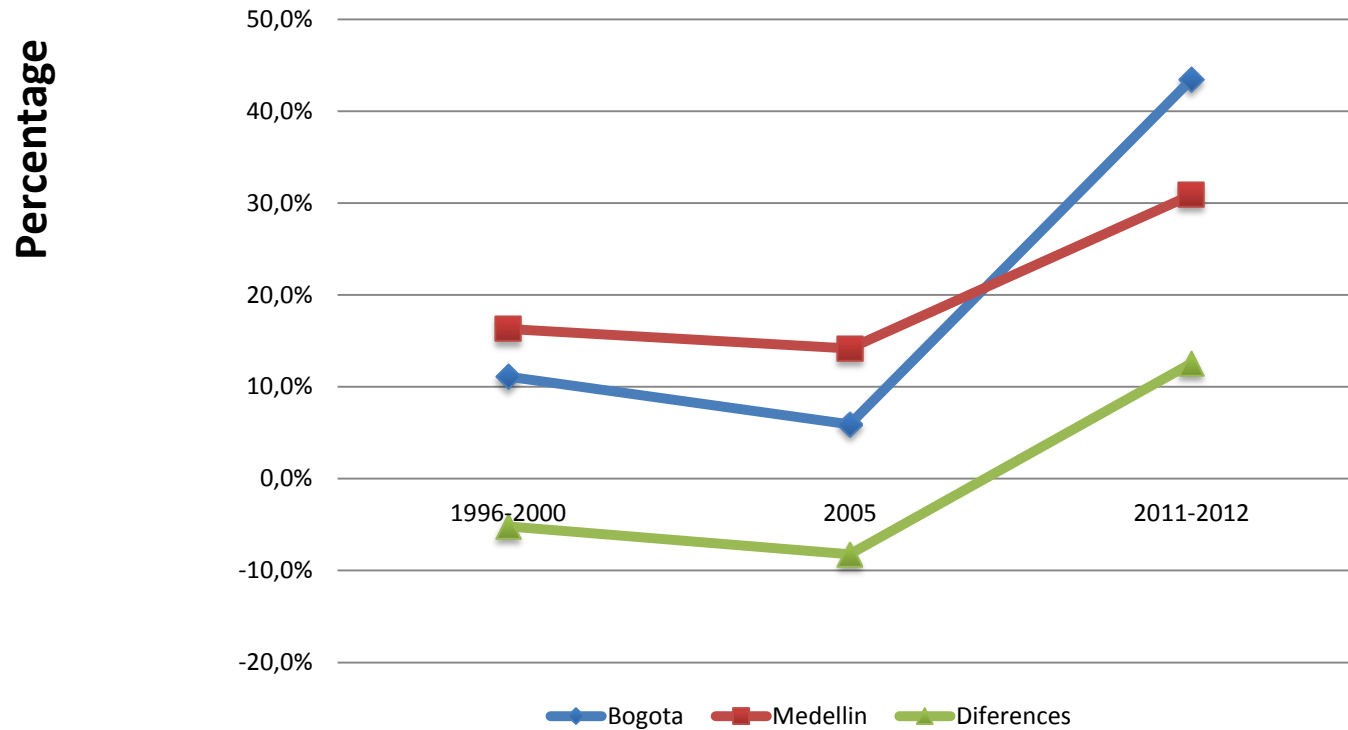
Results for motorcycles

2011

. tab numberofvehicles vehmotorcycles

NumberOfVehicles	VehMotorcycles					Total
	0	1	2	3	4	
1	6,554	1,241	28	4	1	7,828
2	1,228	53	46	1	0	1,578
3	191	57	11	2	0	261
4	45	14	12	2	1	74
5	5	2	0	1	0	8
6	3	1	0	1	0	5
Total	8,026	1,618	97	11	2	9,754

Tendency to buy a second Vehicle- Motorbyke (Bogotá-Medellín)



	1996-2000	2005	2011-2012
Bogota	11,1%	5,9%	43,4%
Medellin	16,3%	14,2%	30,9%
Diferences	-5,2%	-8,2%	12,6%

YEARS

Conclusions

- This approach can be used with O-D surveys as cross-sectional analysis for Private and Public transport policy assessment.
- Just observation and big data management can offer new levels of information using econometric techniques.
- These surveys allow to determine people's choices with similar socioeconomic characteristics in cities with uniform travel habits. They also can only be directly compared in certain periods of time.
- Policies of restriction can be counter-measures that could adversely affect sustainability of cities.