International Transport Forum

Congestion in Latin American Cities

Innovative approaches for a critical situation

168 Roundtable

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1. Congestion trends in Latin American cities

Table 1 - Population and urban density in Latin American cities

City	Population (2000-2018) Millions	% Population growth	Built-up density (2000-2018) p/Km^2	% change in density
Bogotá	6,2 - 8,2	25%	22 200 – 24 500	+10%
Buenos Aires (*)	11,3 - 13,9	19%	9 900 – 9 400	-6%
Lima	7,9 - 10,4	24%	12 000 - 11 064	-8%
México City (*)	15,0 - 21,8	32%	12 600 - 11 000	-13%
Santiago	5,6 – 4,8	15%	11 400 – 10 500	-8%
Sao Paulo (*)	17,0 – 21,8	19%	10 800 - 11 400	+5%

Fast growing megacities, with a regional impact

(*) Urban agglomeration information

Source:

(1) Population: United Nations Demographic YearBook (2000-2018).
(2) Density: Atlas of Urban Expansion, 2016, own projections to 2018
(3) Density Lima: Demographia, World Urban Areas, 2010, 2018

1. Congestion trends in Latin American cities

- In general Latin American cities have experienced a strong urban expansion

- With the exception of Colombian cities that have been experiencing growing densities, especially around Mass Transit corridors

Table 3
Average population densities by group and year.

Variable	Control group (without BRT)	Treatment group (with BRT)	Total
Population 2001 (inhabitants/UPZ)	38,000	64,400	58,000
Population 2008 (inhabitants/UPZ)	38,500	71,700	63,700
Density 2001 (inhabitants/km^2)	12,000	17,700	16,300
Density 2008 (inhabitants/km^2)	12,200	19,400	17,700
Δ Density (inhabitants/km^2)	200	1700	1400

Based on data from Bogotá Planning Department.

Source: Bocarejo, Portilla, Pérez, 2013

1. Congestion trends in Latin American cities

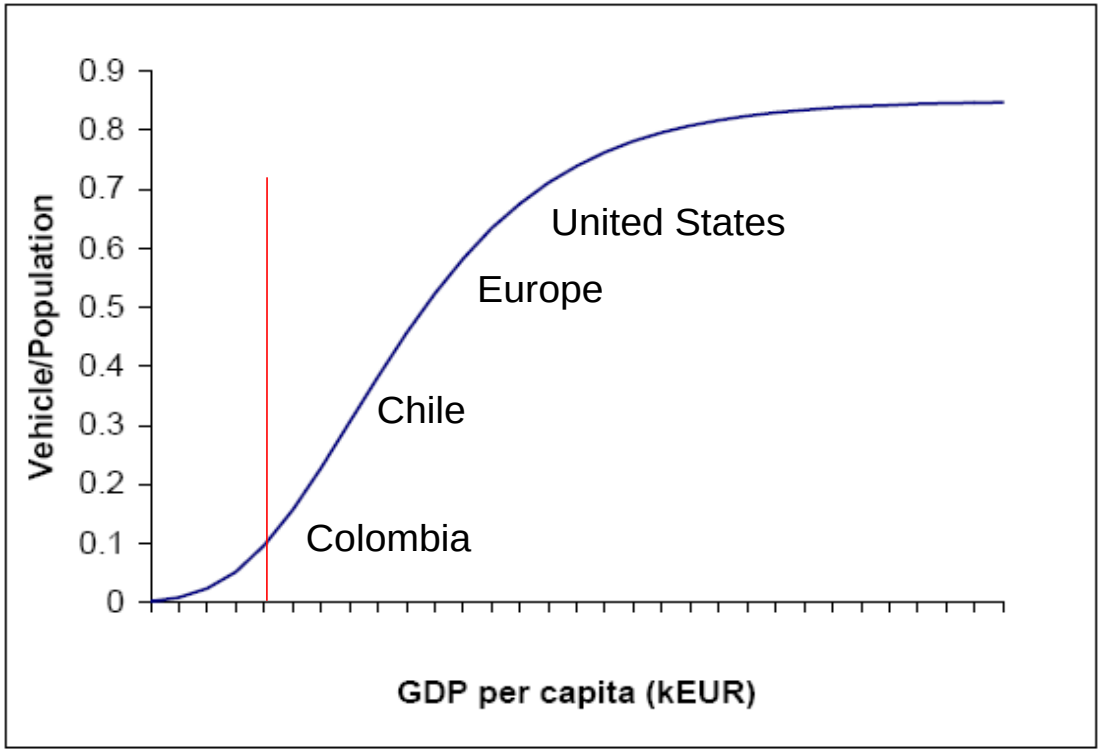
Table 2. Increase of vehicle ownership in Latin America (2010-2018)

City	Cars (2010-2018) Millions	% car growth	Motorbikes (2000-18) Millions	% motorcycle increase
Bogotá	1.0 – 1.8	80%	0.2 – 0.5	150%
Buenos Aires	2.4 – 4.2	75%	0.6 – 1.3	117%
Lima	0.9 – 1.8	100%	0.2 – 0.4	100%
Mexico City	4.0 – 5.2	30%	0.05 – 0.4	700%
Sao Paulo	5.1 – 6.2	22%	0.9 – 1.2	33%
Santiago	0.9 – 1.5	67%	0.06 – 0.1	67%

Sources: Bogotá, Registro Distrital Automotor – RDA; Buenos Aires: Registro de Propiedad Automotor – Dnrpa; Lima: Superintendencia nacional de registros públicos; México City: Instituto Nacional de Estadística y Geografía – INEGI; Sao Paulo: Departamento Estadual de Tránsito de Sao Paulo; Santiago: Instituto Nacional de Estadística – INE.

A strong car ownership growth in the last decade

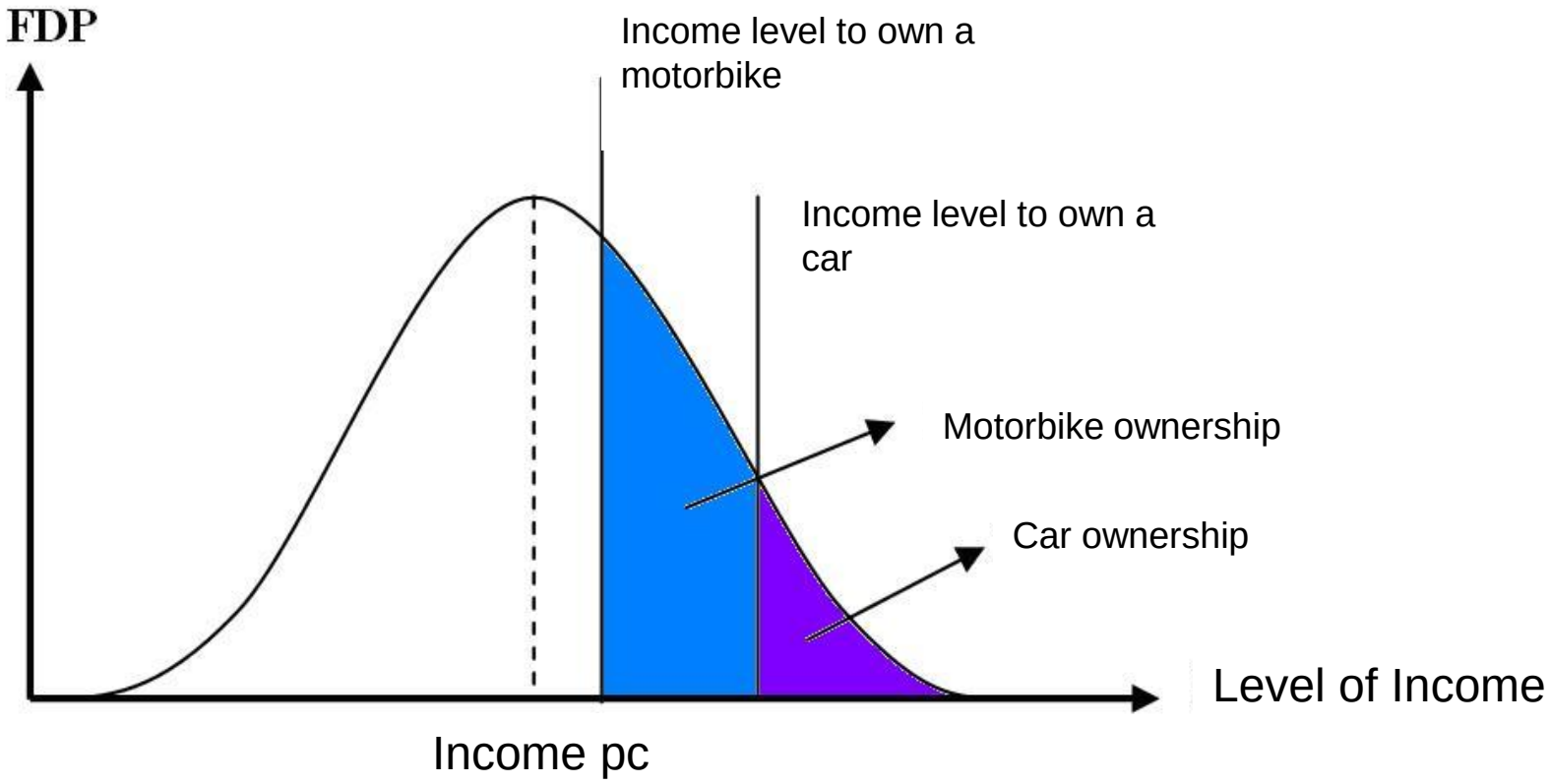
Gompertz Equation $C_t^*(G_t) = \gamma \cdot e^{\alpha \cdot e^{\beta \cdot G_t}}$

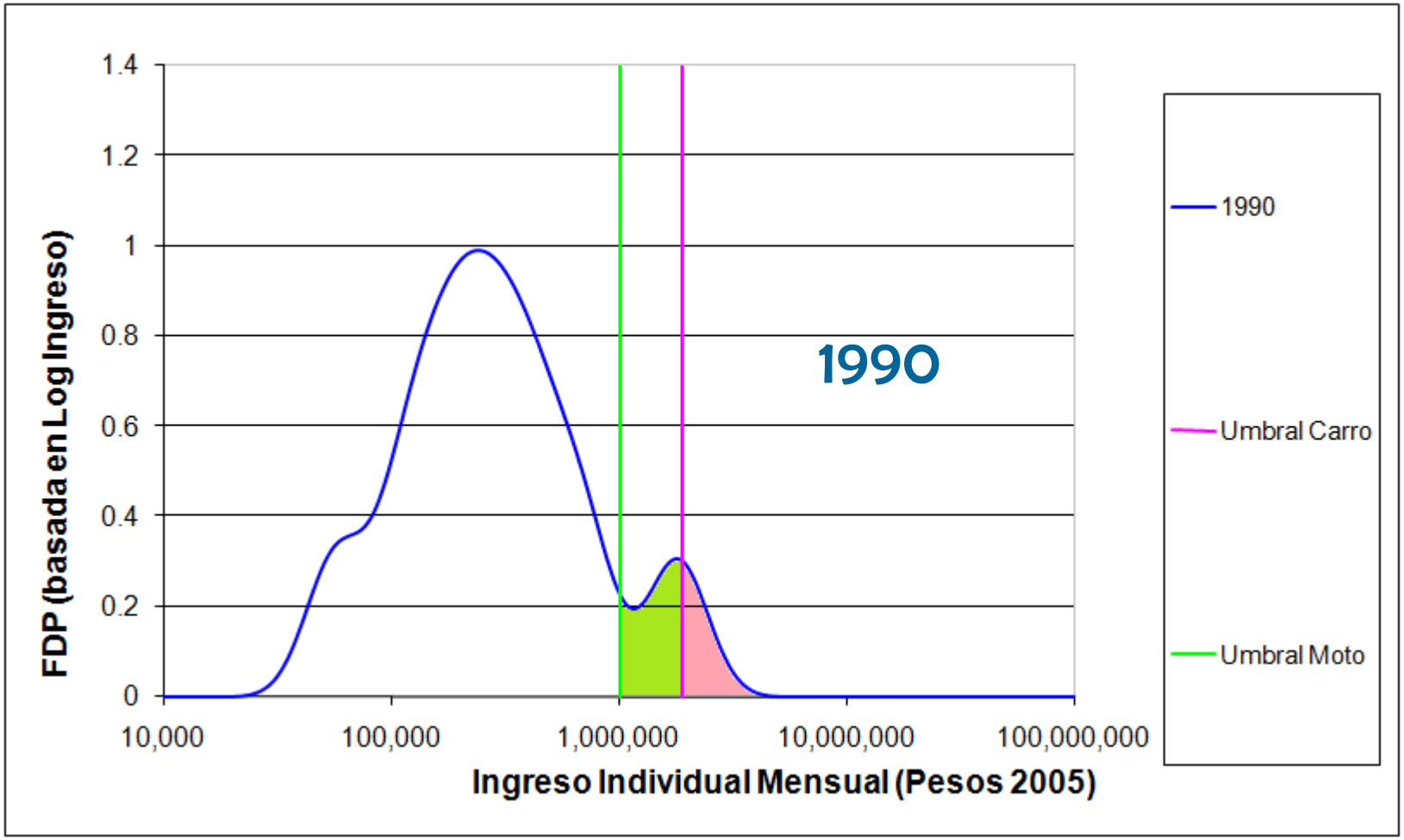


Source: Dargay, Gately (1999)

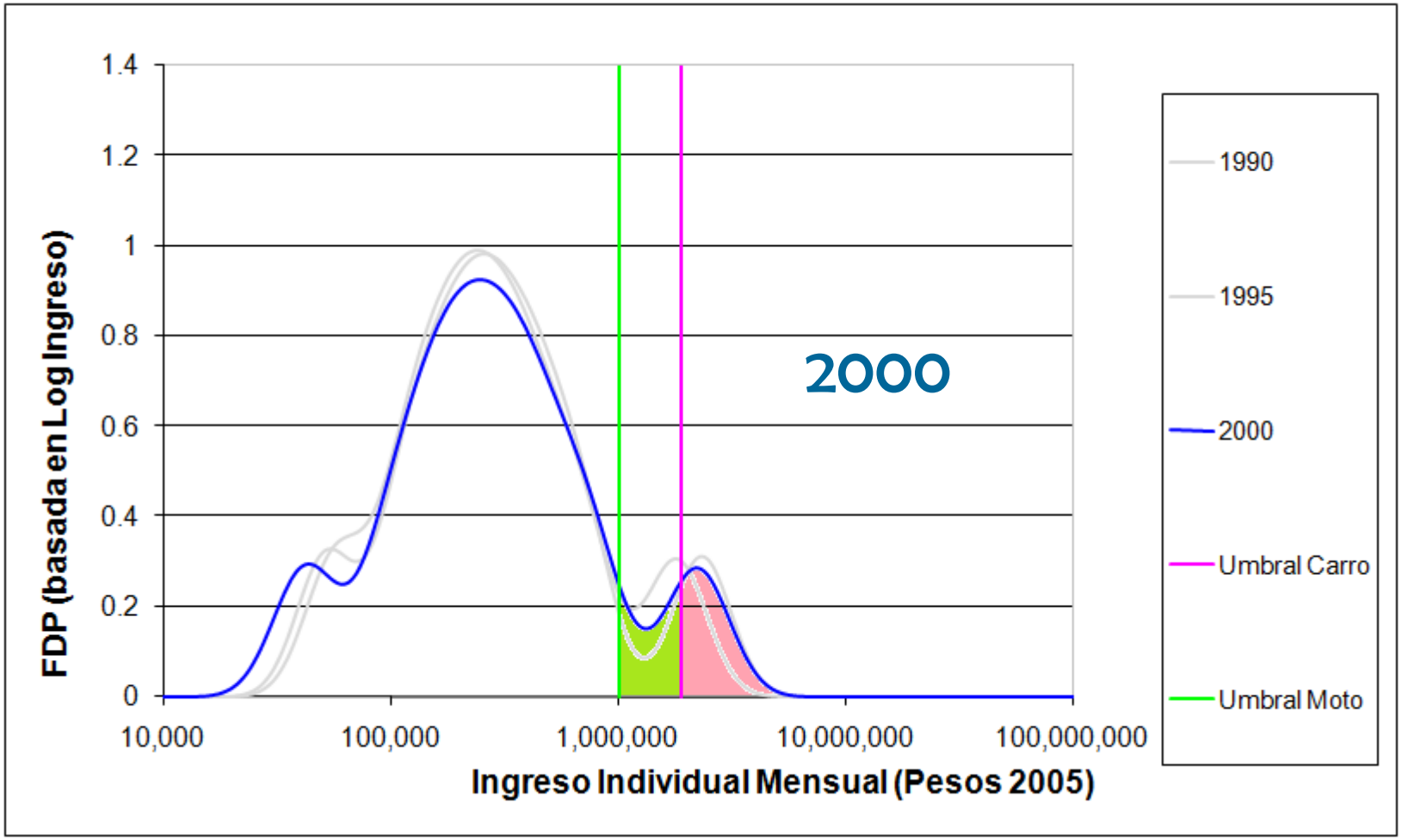
Model

Car ownership in Colombia

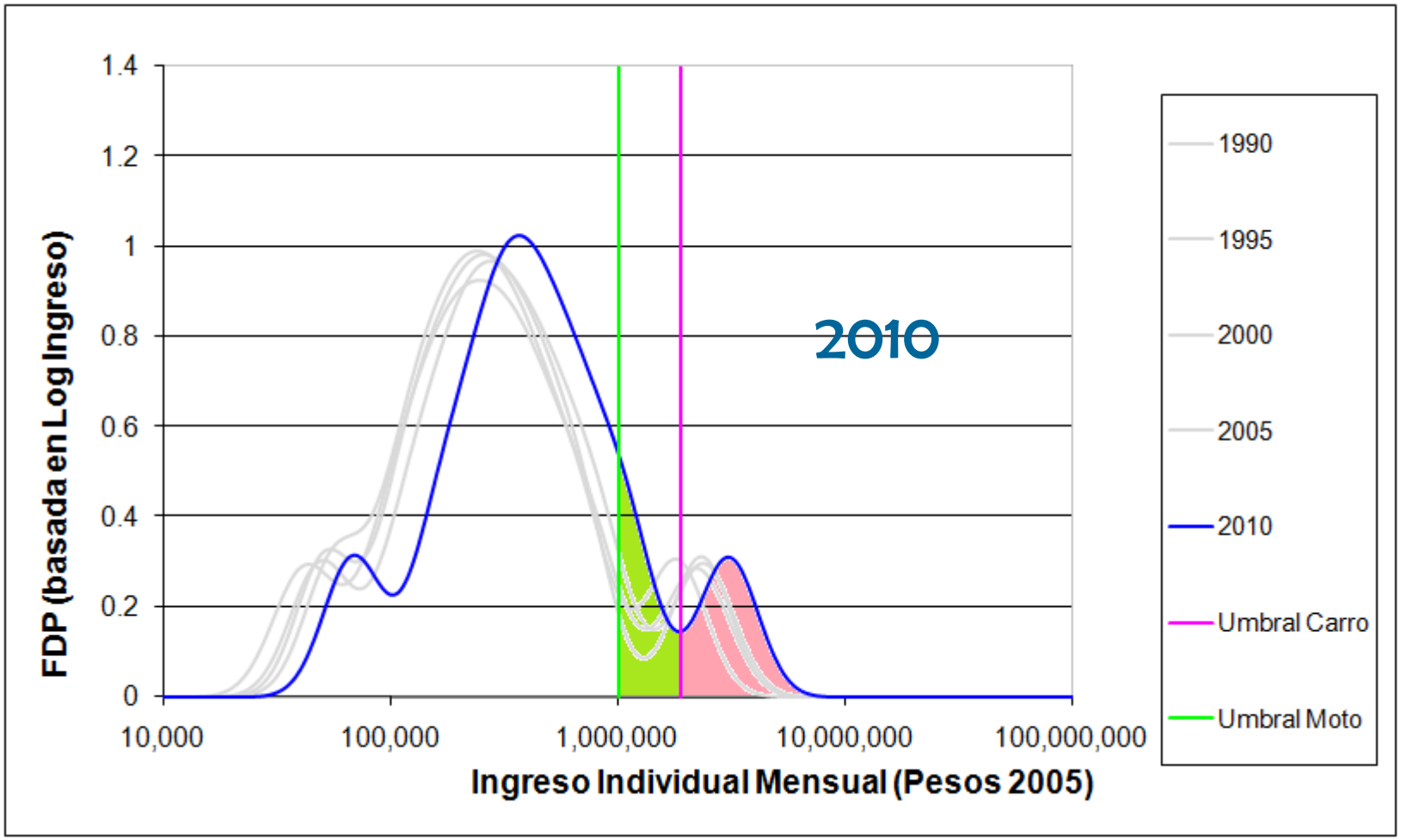




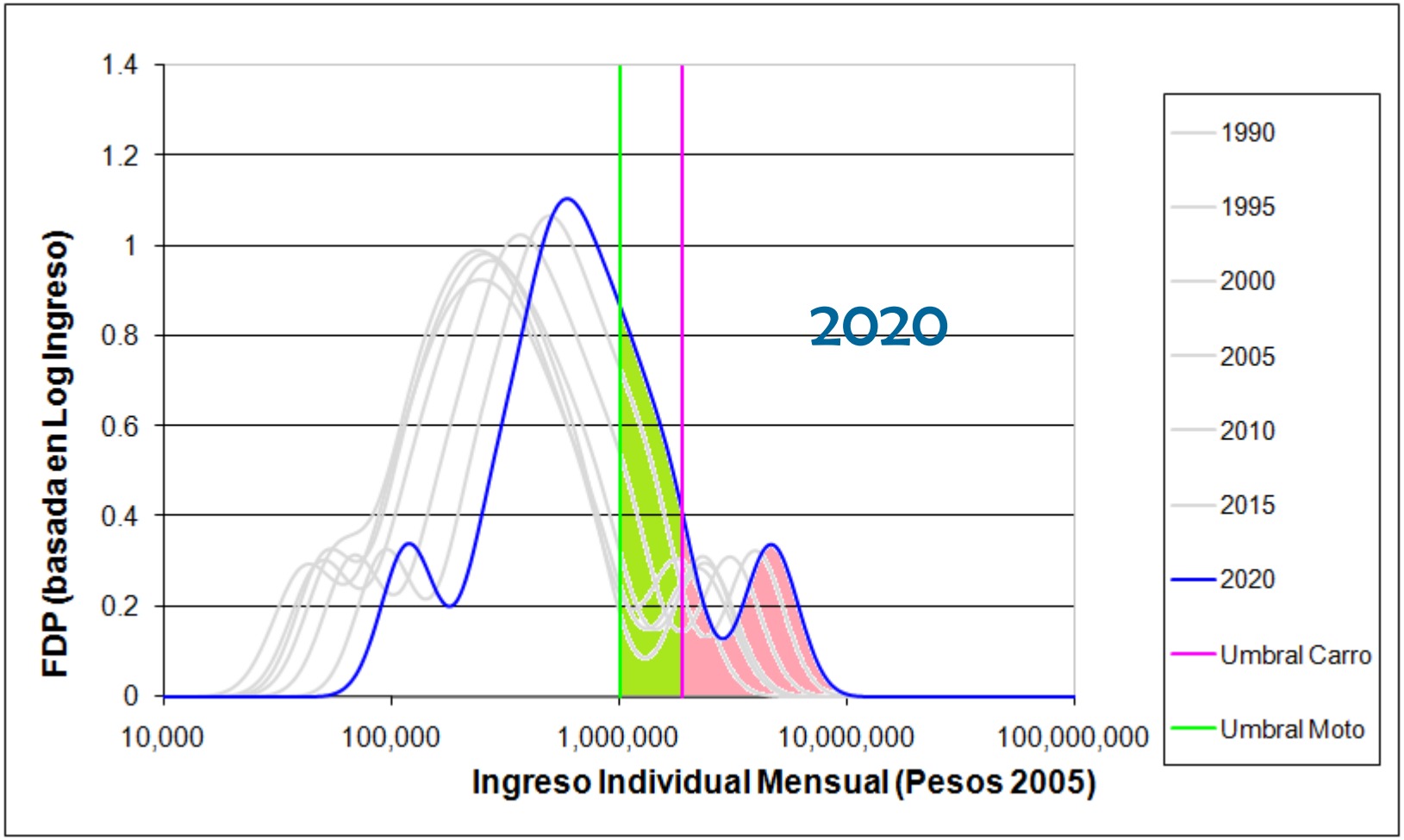
Source: Acevedo et al (2010)

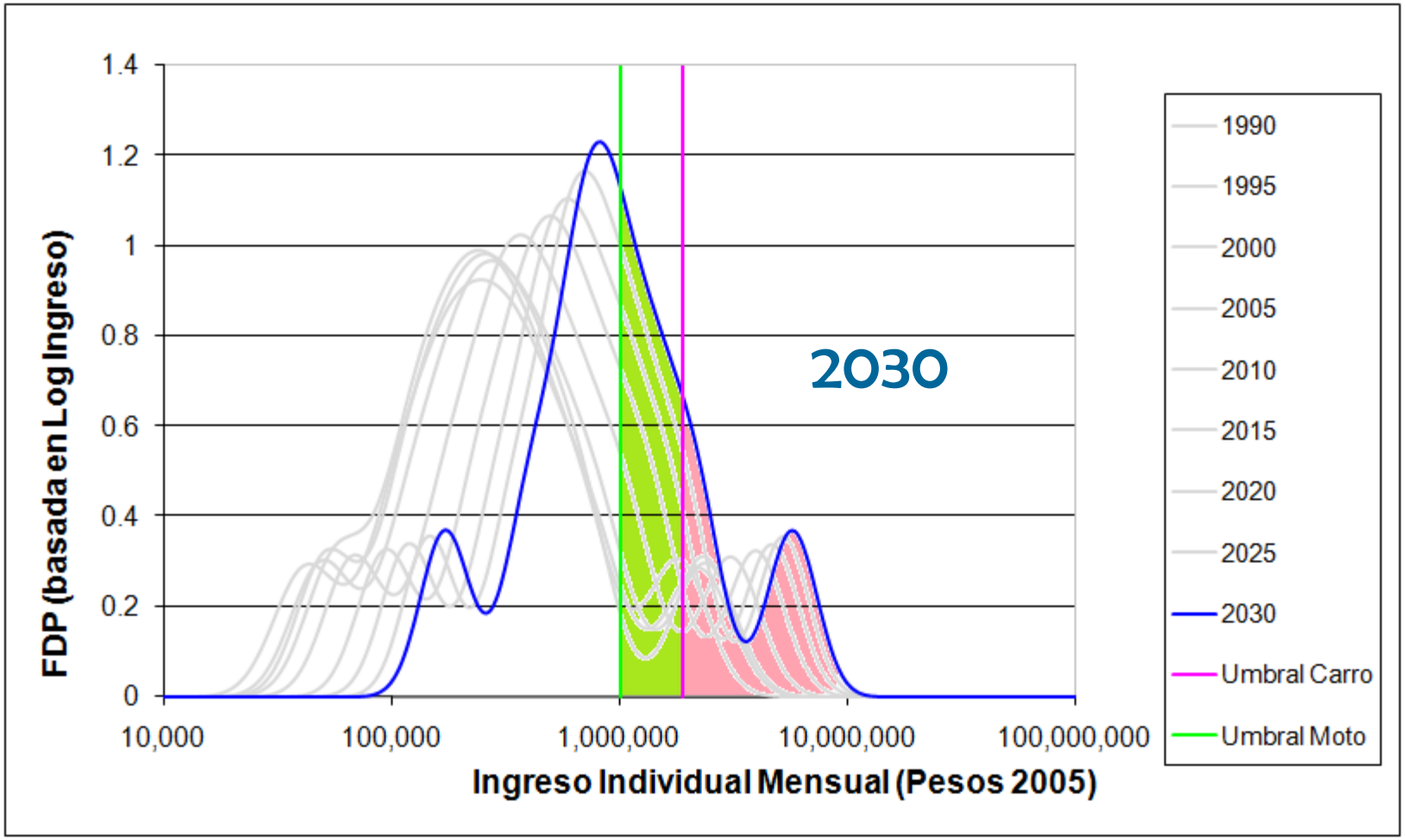


Source: Acevedo et al (2010)

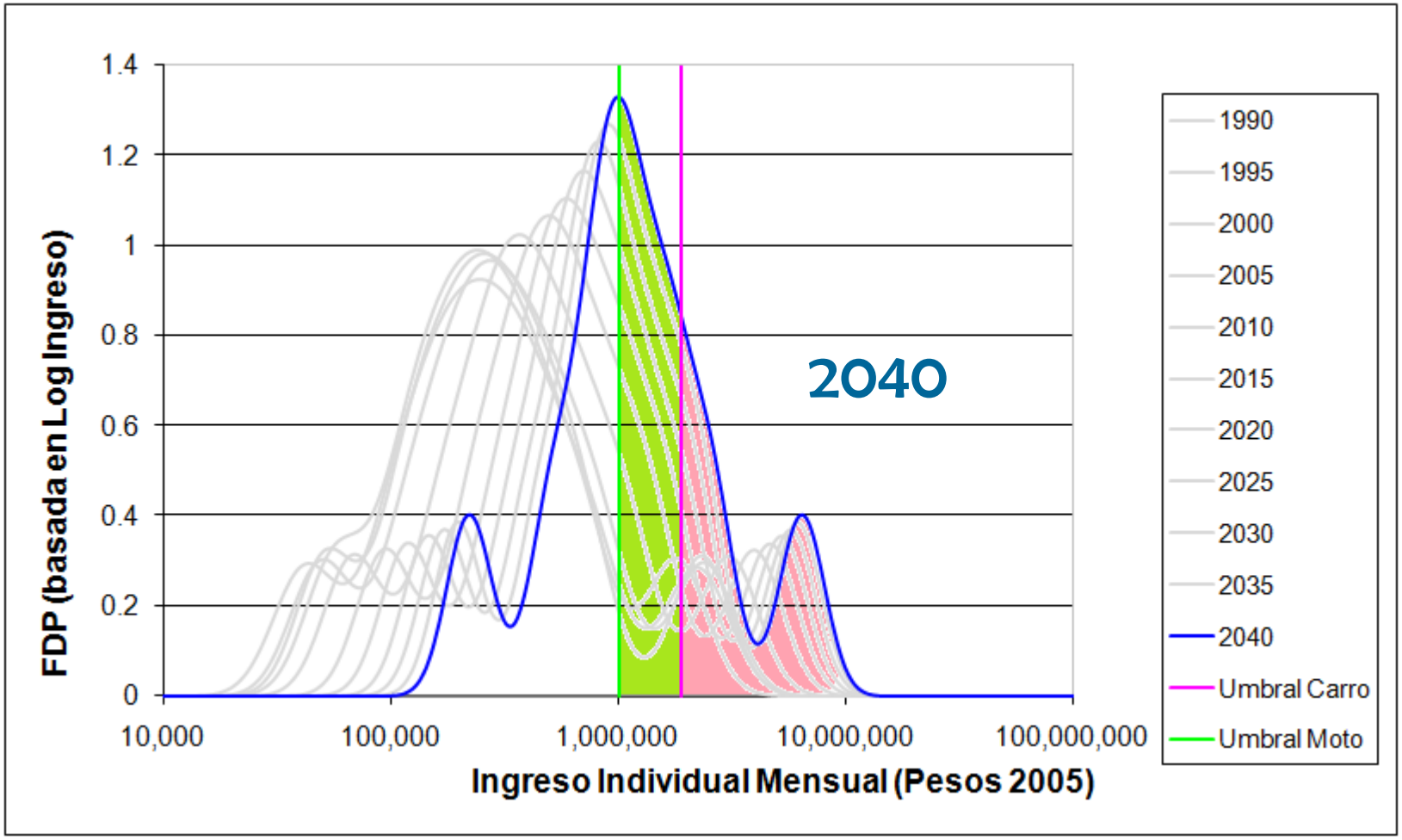


Source: Acevedo et al (2010)


1.4
1.2
1
0.8
0.6
0.4
0.2
0
FDP (basada en Log Ingreso)
2020
10,000
100,000
1,000,000
10,000,000
100,000,000
Ingreso Individual Mensual (Pesos 2005)
1990
1995
2000
2005
2010
2015
2020
Umbral Carro
Umbral Moto



Source: Acevedo et al (2010)



Source: Acevedo et al (2010)

1. Congestion trends in Latin American cities

Table 1 - Prospective vehicle fleet in Bogota (millions)

	2010	2020	2030	2040
Car	0,71	1,28	2,19	3,34
Motorcycle	0,2	0,5	0,8	1,4

urce: Acevedo *et al* (2010)

1. Congestion trends in Latin American cities

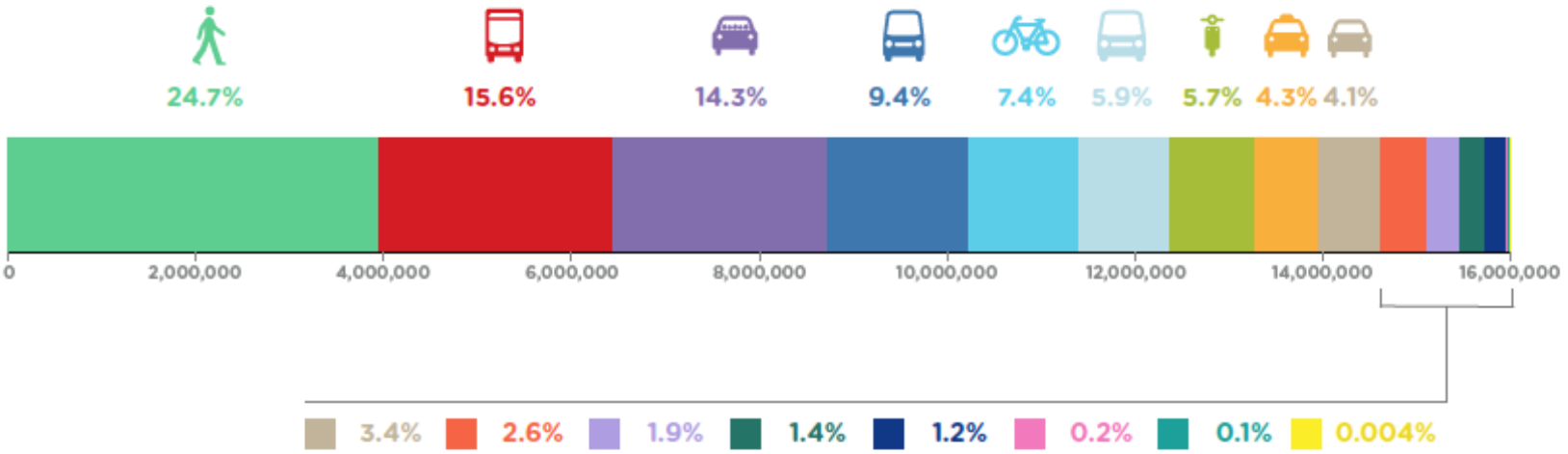
Table 4. Congestion in Latin American Cities

City	TomTom Ranking 2019	Waze ranking 2019
Bogotá	3	166
Buenos Aires	66	107
Lima	7	169
Mexico City	13	135
Sao Paulo	24	129
Santiago	26	128

Source: TomTom, Waze (2019).

Latin American cities are World Champions in congestion rankings

1. Congestion trends in Latin American cities



Source: Mobility Survey, 2019

2. Demand management

Table 5. Increasing costs of car use

City	Taxes on fuel	Parking
Bogotá	- 25% tax on fuel - Charged to consumer - Destination: 50% mass transit, 20% pavement maintenance, 30% Access to poor neighbourhoods.	- Off-street surcharge denied three times by city council - Fare regulation to off-street parking - On-street parking project (2019)
Mexico City	- Local Surcharge through special tax on production (IEPS) - two national taxes - Tax for polluting fuels	- On-street parking scheme "ecopark", since 2012
Santiago	- Consumer tax aimed at financing infrastructure maintenance	- Concession of on-street parking in city centre 2013

Source: Bocarejo, Lopez Ghio and Blanco (2018).

2. Demand management

Car use restriction

- Mexico city and Santiago – Pollution
- Bogota and Colombian cities – Congestion
- Bogota 2003 – A daily loss of US$ 600.000 (Bocarejo,2008)
- An increase of a 2nd vehicle ownership – Old car or motorbike (Moncada, 2018)

3. Congestion charge in Bogota

Transportation Model

- Trip generation
- Trip atraction
- Trip distribution
- Trip assigment

Economic Model

- Demand curve
- Individual cost
- Social cost

Financial Model

- Collection scheme and cost
- Enforcement scheme and cost

Despite the Mayor's strong political decision, the City Council rejected a congestion charging initiative three times between 2013 and 2015

- Veh-km
- Speed
- Generalized Cost
- Emissions

- Congestion cost
- Optimal charge
- Collected charge
- Economic appraisal

- Managerial structure
- Cost effectiveness

3. Congestion charge in Bogota

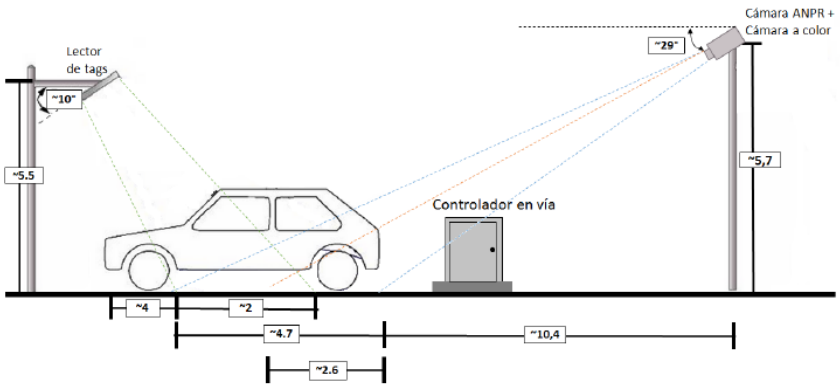
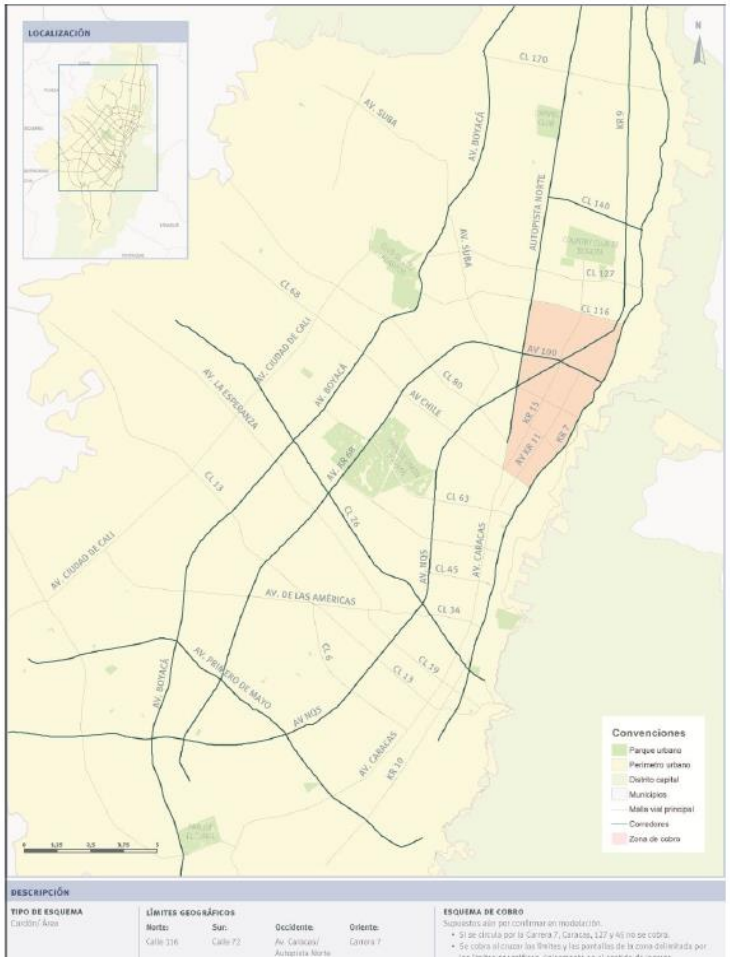


FIGURA 3.3 ALTERNATIVA 3 AREA / CORDON



3. Congestion charge in Bogota

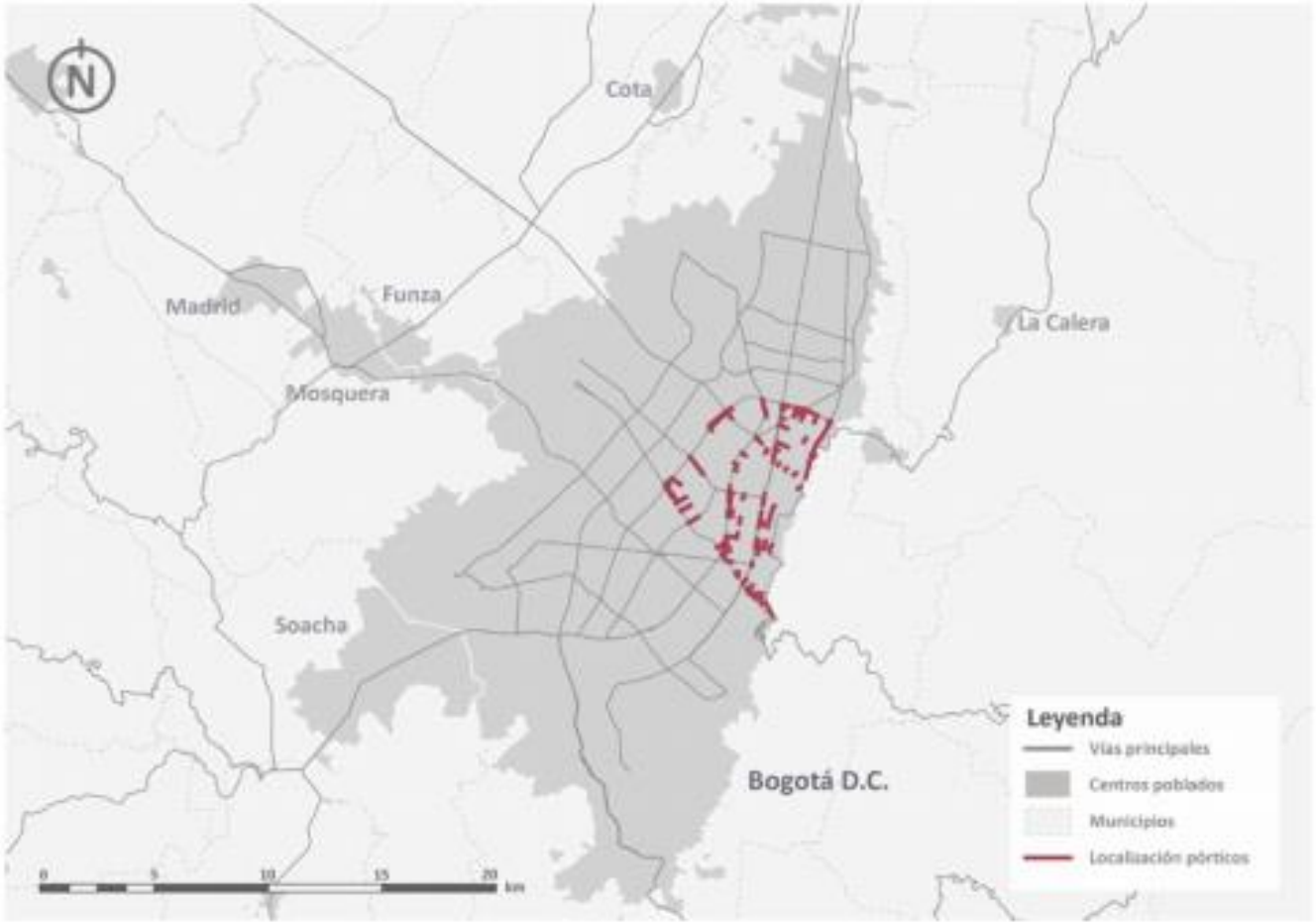
Bogota congestion charge scheme -2014

ITEM	VALUE
Congestion zone	9 km^2
Optimal Fare	US$ 2,6
Traffic reduction congestion zone	20%
Traffic reduction overall city	5%
Change in speed congestion zone	17,5 Km/h -20,9 km/h
Change in speed overall city	20,0 Km/h - 20,5 Km/h
Internalized congestion cost per year	US$ 14 millions
Collected charge per year	US$ 44 millions
Operational Cost	US$ 15 millions

Source: Secretary of Mobility - UT SDG, PHR, Akiris (2013)

3. Congestion charge in Bogota

Charge by Km



3. Congestion charge in Bogota

Charge by Km (2018)

ITEM	VALUE
Congestion zone	45 km^2
Optimal Fare	US$ 0,2 base + US $ 0,1 by Km
Traffic reduction congestion zone	5%
Change in speed	20 km/h - 23 Km/h
Collected charge per year	US$ 27 millions
Investment Cost	US$ 105 millions
Annual Operational Cost	US$ 15 millions

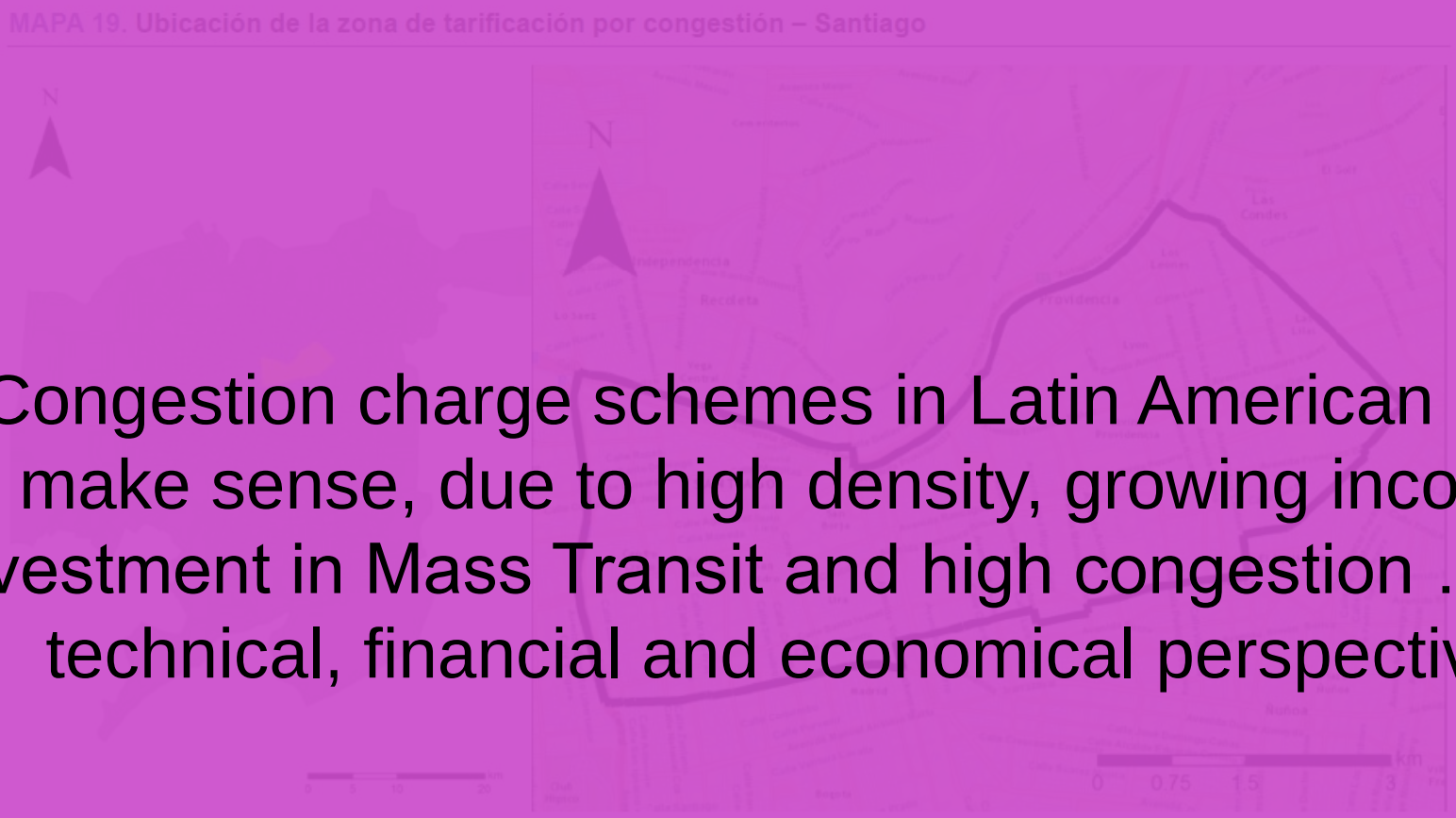
Source: Secretary of Mobility - UT SDG, PH(2018)

3. Congestion charge in Bogota

Payment to avoid car restriction

- Car users can pay a 6 month or 1 year public cost to avoid car restriction
- The fare is close to US$ 1 250 per year
- 60 000 car owners are willing to pay
- This new source will be entirely assigned to public transport improvement

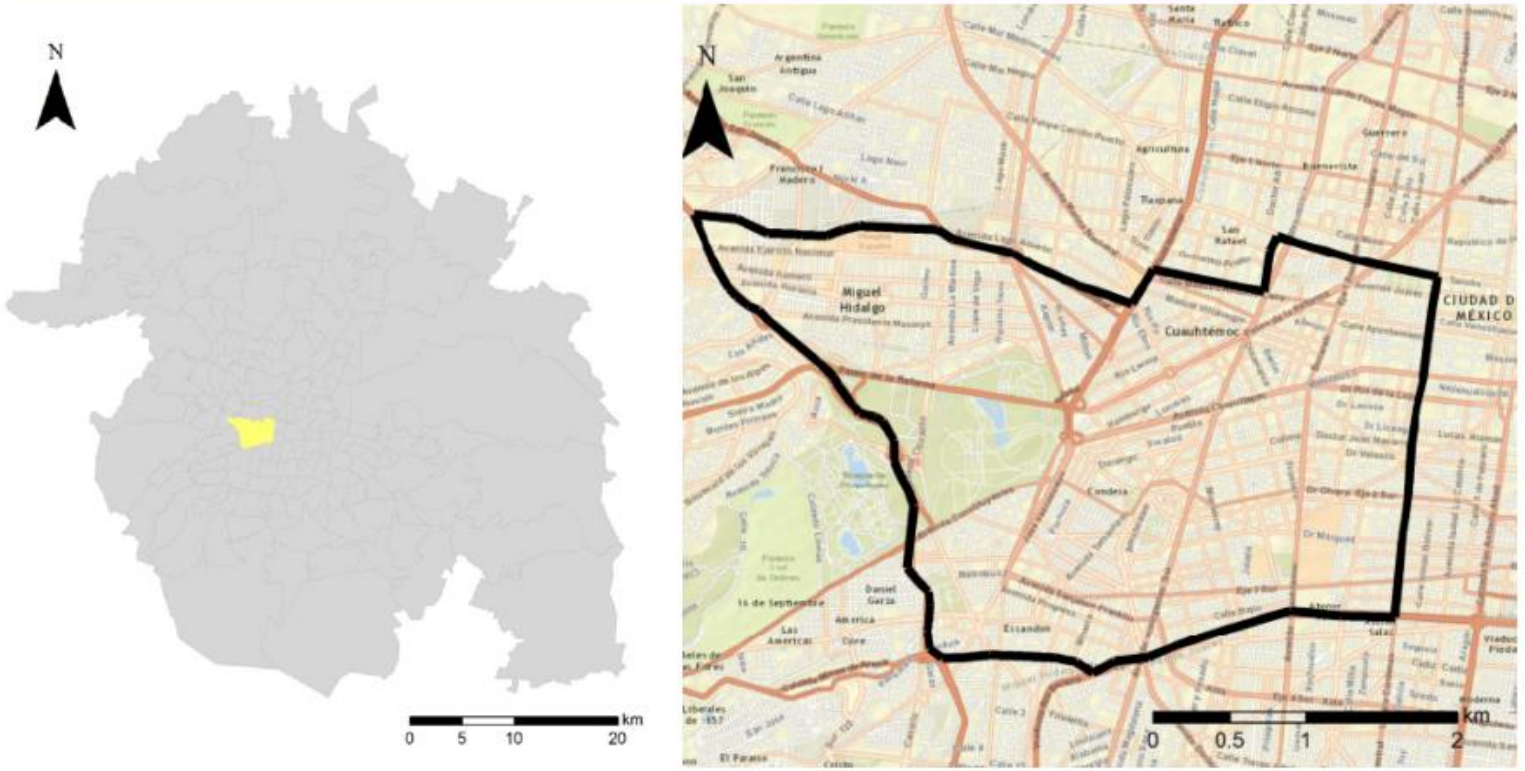
4. Congestion charge in other Latin American cities



Congestion charge schemes in Latin American cities make sense, due to high density, growing income, investment in Mass Transit and high congestion … from technical, financial and economical perspectives

4. Congestion charge in other Latin American cities

MAPA 11. Ubicación de la zona de tarificación por congestión – Ciudad de México



4. Congestion charge in other Latin American cities

Table 8. Congestion charge alternatives for three Latin American cities

Item	Bogotá	Mexico City	Santiago
Area (km^2)	9	27	16
Daily Fare (USD)	2.00	1.26	0.94
Average speed change (km/h)	17 – 23	11 – 19	21 – 26
Decrease in car use (km 1000)	182 (28%)	592 (29%)	617 (25%)
Internalisation of congestion cost (USD/day)	70 500	400 773	137 560
Reduction in CO_2 emissions (g/km)	60	102	130
Revenue (USD 1 000/day)	154	611	447

Source: Bocarejo, Lopez Ghio & Blanco (2018).

5. Acceptability

Congestion charge as a source for better public transport

- Santiago has doubled its metro network and is operating a fleet of more than 200 electric buses
- Bogota is finally starting the construction of its first metro line that will be integrated to Transmilenio BRT. New Transmilenio buses are CNG EURO 6 emission standard. This year a 485 electric bus fleet will start operation
- Sao Paulo has implemented a driverless subway line, has a PPP scheme and operates a network of more than 370 km
- Mexico City has developed a BRT system of more than 100 km in a 15 year period
- Buenos Aires has already implemented 60 km of BRT and has renewed much part of its regional train system

Congestion charge is not progressing in the LA Region due to lack of acceptability

5. Acceptability

The motorist is the State´s cash cow

- Most vehicles in Latin America are from middle income owners
- Taxes on vehicle ownership and fuel may represent an important part of revenues for local governements
- What kind of taxes are more effective?

5. Acceptability

Regulatory and technological frameworks

- A national regulation to allow congestion charge is often necessary
- Technological standards for collection and enforcement
- Higher autonomy to local authorities