The effects of ridesourcing apps on travel behaviour and transport externalities

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Agenda

1. *Ridesourcing* apps.
2. Uber use survey in Chile.
3. Results and concluding remarks

About me

- Civil Engineer and MsC Transport Engineering (U. de Chile)
- PhD, Inst of Transport and Logistics Studies (U. of Sydney)
- Asoc Professor at U. de Chile
- Member of Smartcities and Transport Research Groups, Institute of Complex Engineering Systems, Chile (www.isci.cl)

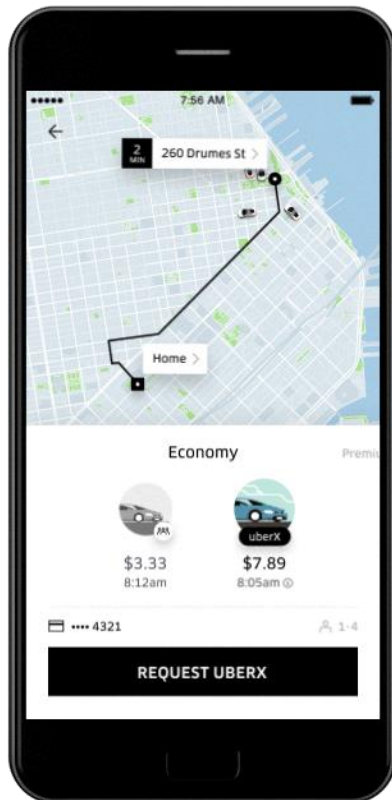# Background:
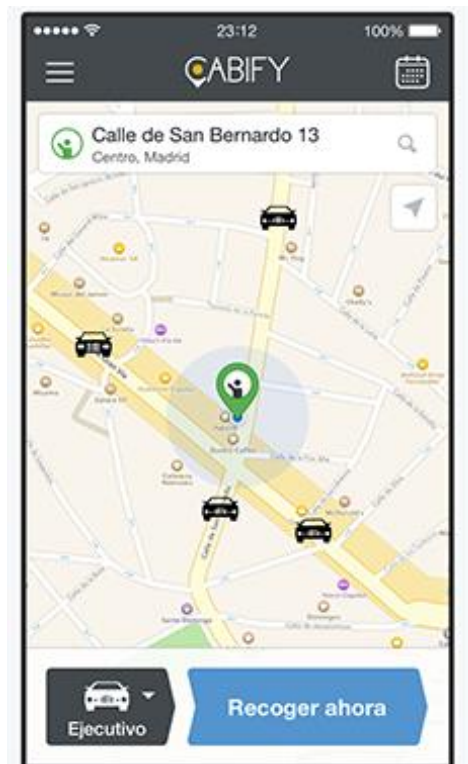# Santiago transport alternatives

video

Background: disruptive mobility technologies

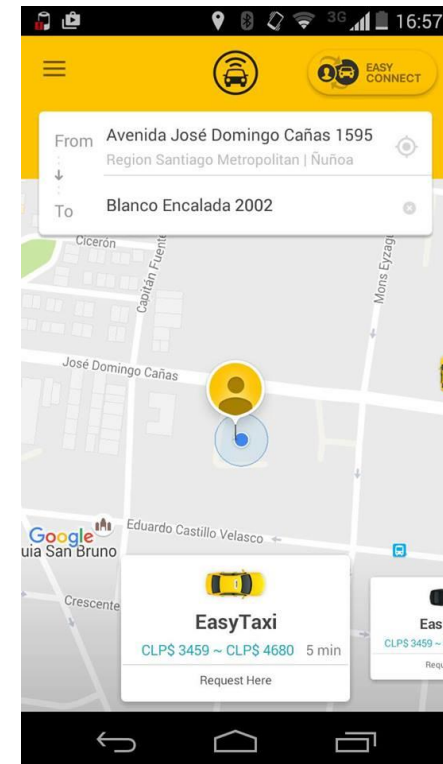*Ridesourcing*: "outsourcing of a ride", using a smartphone app

Around 90%

Around 10%

Taxis

Background: Uber app in Chile

- Rapid growth in unregulated market for ridesourcing (vs regulated taxi market)

  – Arrival 2014.
  – March 2016: more Uber drivers than taxis in Santiago.
  – May 2017: more Uber drivers than taxis in Chile.
  – 2016-2017: taxi drivers demonstrations.

- 2016: government tries to pass new law to regulate ridesourcing (discussion underway).
- Lack of research on the effects of this disruptive new way of travelling.
  – Effect of traffic?

ACTUALIDAD   NACIONAL

TAXISTAS SE MANIFESTARON POR LA ALAMEDA EN CONTRA DE UBER Y CABIFY

SIGUENOS

f 40,990 Fans   ◎ 1,292 Seguidores   🐦 311,204 Seguidores

http://lanacion.cl/2017/07/10/alameda-cortada-hacia-el-oriente-por-manifestacion-de-taxistas-contra-uber-y-cabify/

Santiago
10 July 2017

9

Jan 2017: taxi drivers strike back

Easy Economy: Hoy comienza a operar el servicio que amenaza con bajos precios a Uber y Cabify

Serán 2.500 vehículos particulares los que circularán con la opción de pagar con tarjetas de crédito desde la aplicación de celular.

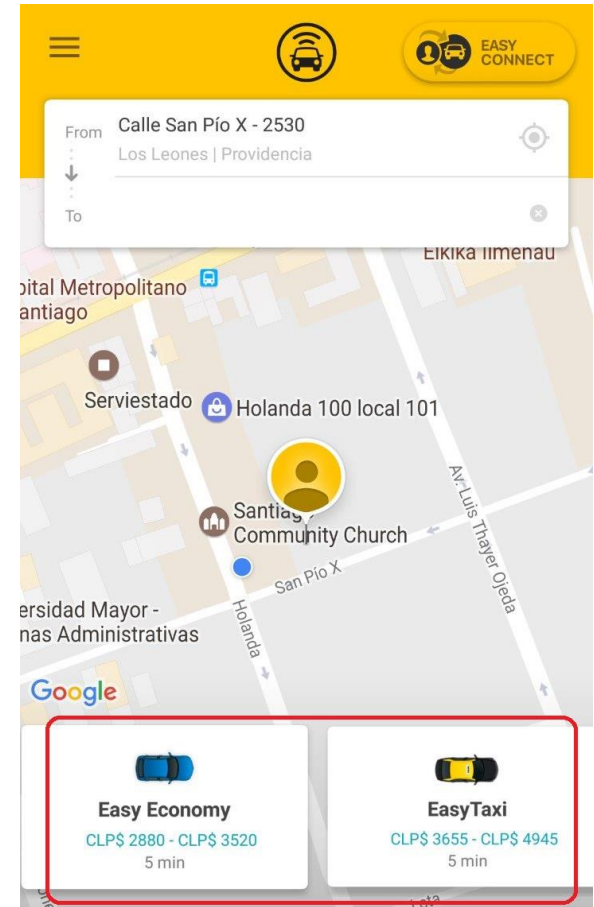16 de Enero de 2017 | 13:03 | Emol

AHORA SE DEBATE

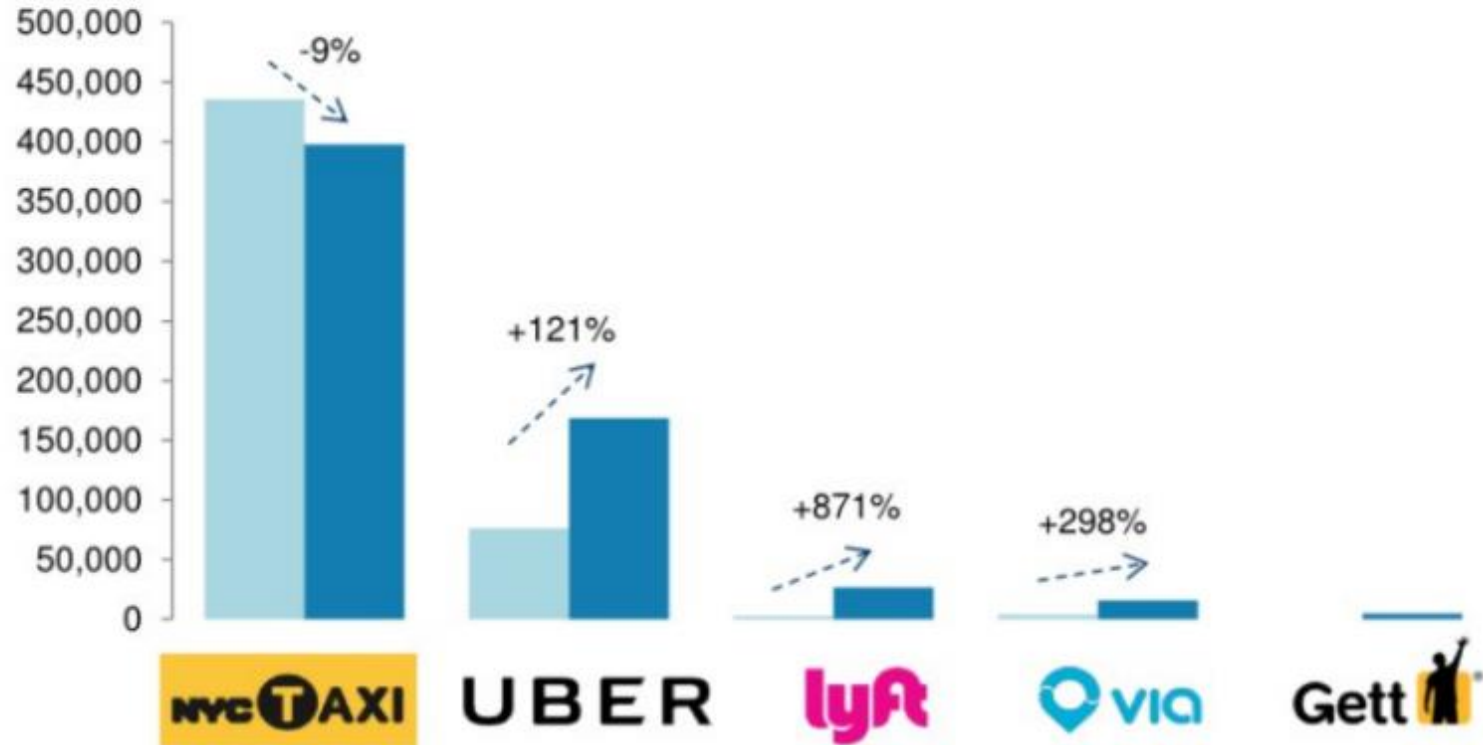Hacienda rebaja estimación de crecimiento de 2017: PIB crecerá sólo 1,5% ¿Cómo lo ves?

Sename: Los dardos que lanzó el diputado Saffirio a Bachelet y militantes DC ¿Qué te parece?

New York

Exhibit 3: Total Dispatched Trips / Day in NYC - April 2016 vs. 2015

Gett was not active in NYC in April 2015.
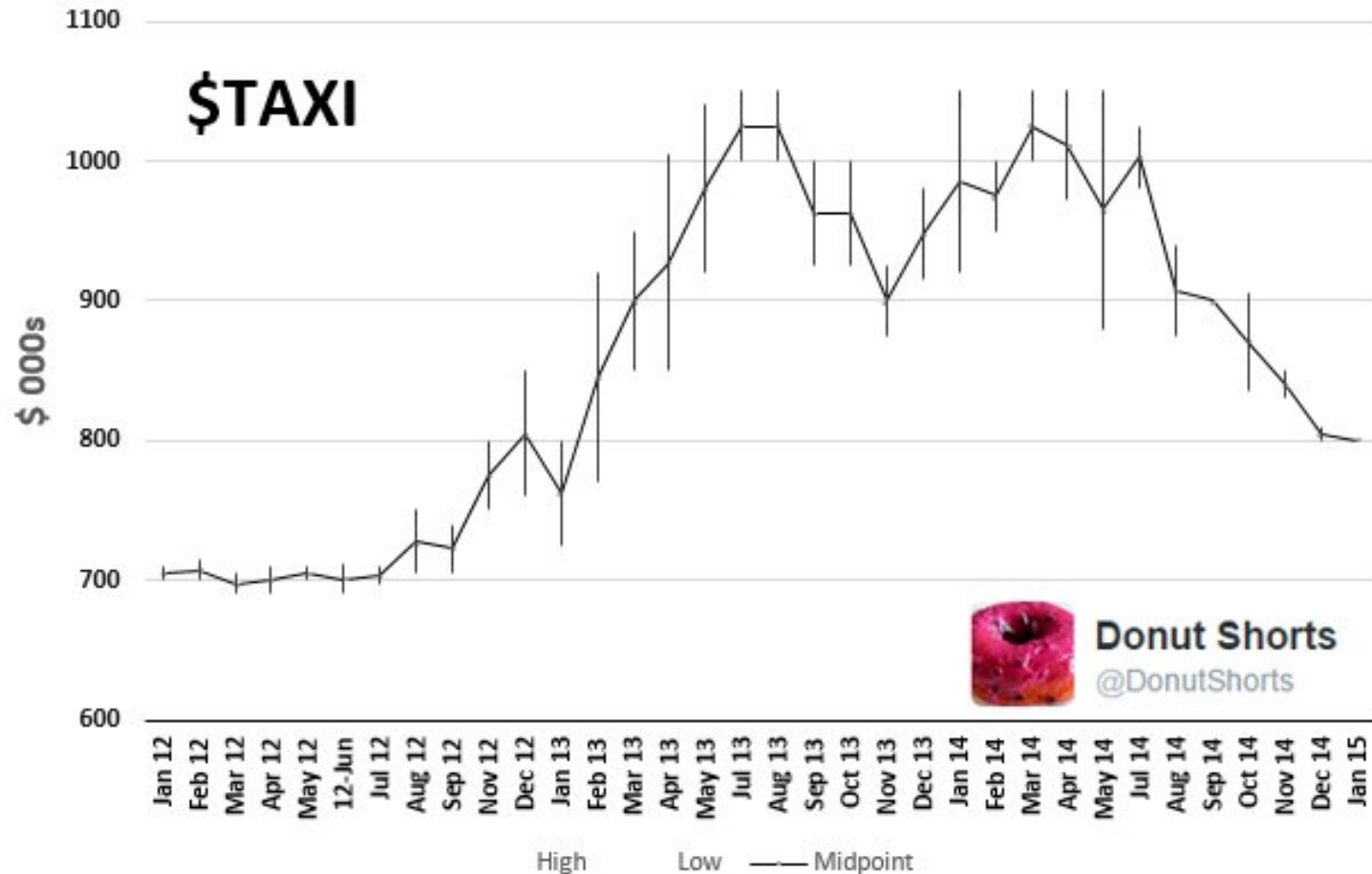
Source: New York City Taxi & Limousine Commission, Morgan Stanley Research

http://www.businessinsider.com/nyc-yellow-cab-medallion-prices-falling-further-2016-10

New York

NYC Independent Unrestriced Medallion Prices
(Excludes Stock Transfers & Partial Interests)

$TAXI

Donut Shorts
@DonutShorts

High   Low   ——— Midpoint

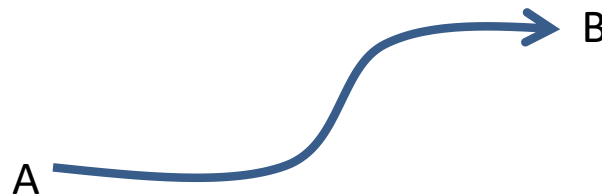http://uk.businessinsider.com/uber-v-medallion-prices-2015-2

Effect of ridesourcing on externalities?
Related to VKT: Congestion, pollution, accidents

- VKT: Vehicle kilometres travelled

- Let us assume 1 trip made by ridesourcing

- Was this trip going to be made without ridesourcing?

- If yes, how?
  - Taxi.
  - Private car
  - Public transport
  - Bicycle
  - Walking
  - ...

Effect on externalities?
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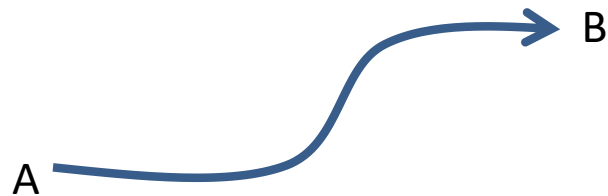 - ...

A ⟶ B

Effect on externalities?
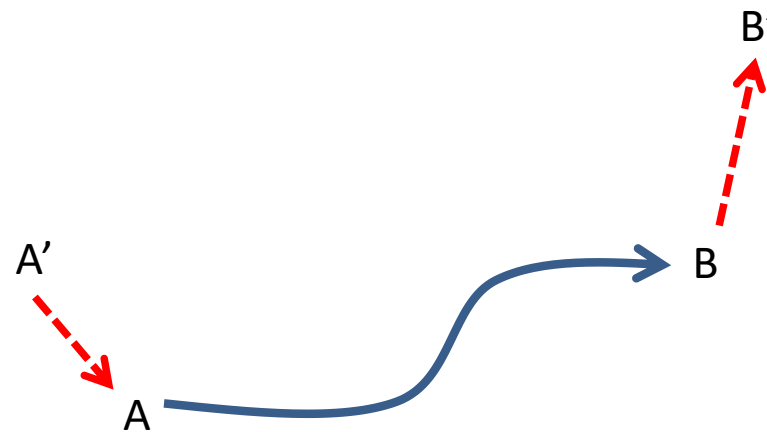## Related to VKT: Congestion, pollution, accidents

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  - Bicycle
  - Walking
  - ...

B'

A'

B

A

- - -> Empty kilometres

Ridesourcing: gain in efficiency

- Capacity utilization rate (CUR) = distance_with_passengers/total_distance_travelled

Figure 1: Capacity Utilization Rate (Percent of Miles Driven with a Passenger) for Taxi and UberX Drivers in Los Angeles and Seattle

Percent of Total Miles
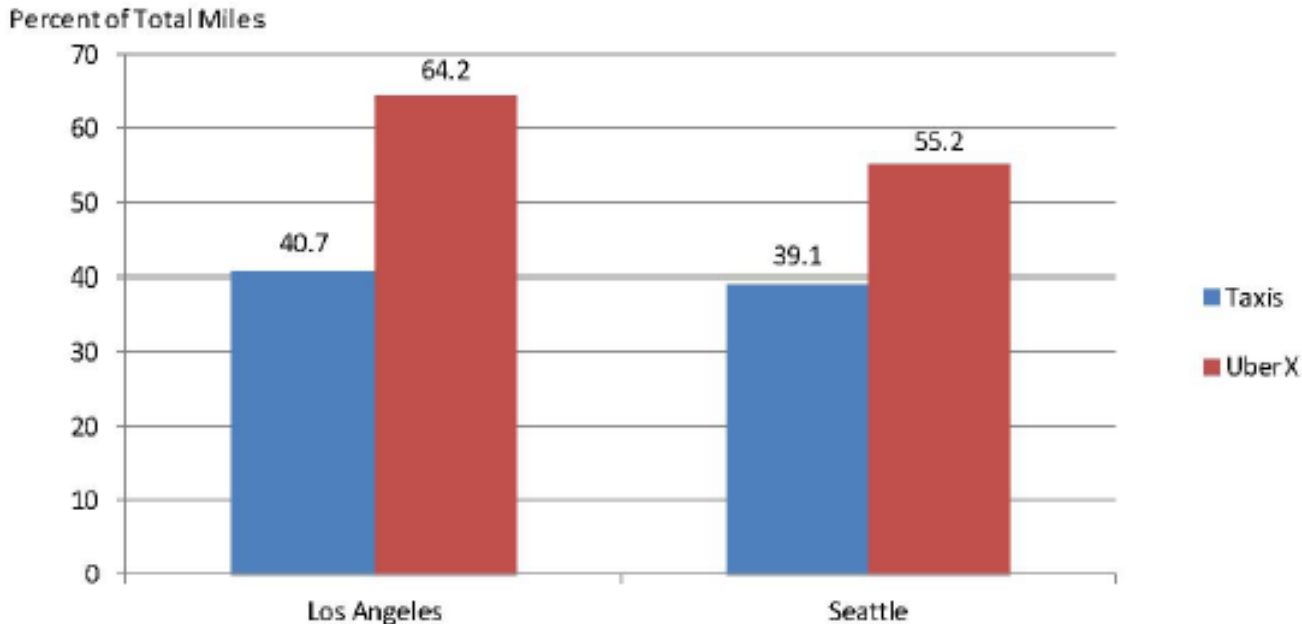
Cramer and Krueger (2016): increase in 45-57% in CUR due to ridesoucing

Source: Uber Technologies, Inc.; LADOT; City of Seattle, Regulatory Compliance and Consumer Protection Division; Authors' calculations.
Notes: LA and Seattle are 2013-14 and Uber is the 12 months ending December 1, 2015; see text for further details.

Cramer, J., & Krueger, A. B. (2016). Disruptive change in the taxi business: the case of Uber. NBER Working Paper 22083

16

Section 1 of 3

Encuesta usuarios plataforma Uber

Encuesta desarrollada por investigadores de la Universidad de Chile para entender los hábitos de viaje de los usuarios de la plataforma tecnológica Uber. La encuesta toma menos de 10 minutos y es anónima. Los resultados servirán para un estudio que será publicado. Muchas gracias por su cooperación.

Ingrese la ciudad donde vive   *

○ Santiago

○ Concepción

○ Valparaíso - Viña del Mar

○ Iquique

○ La Serena - Coquimbo

Survey January 2017, N=1600

Reasons to use Uber
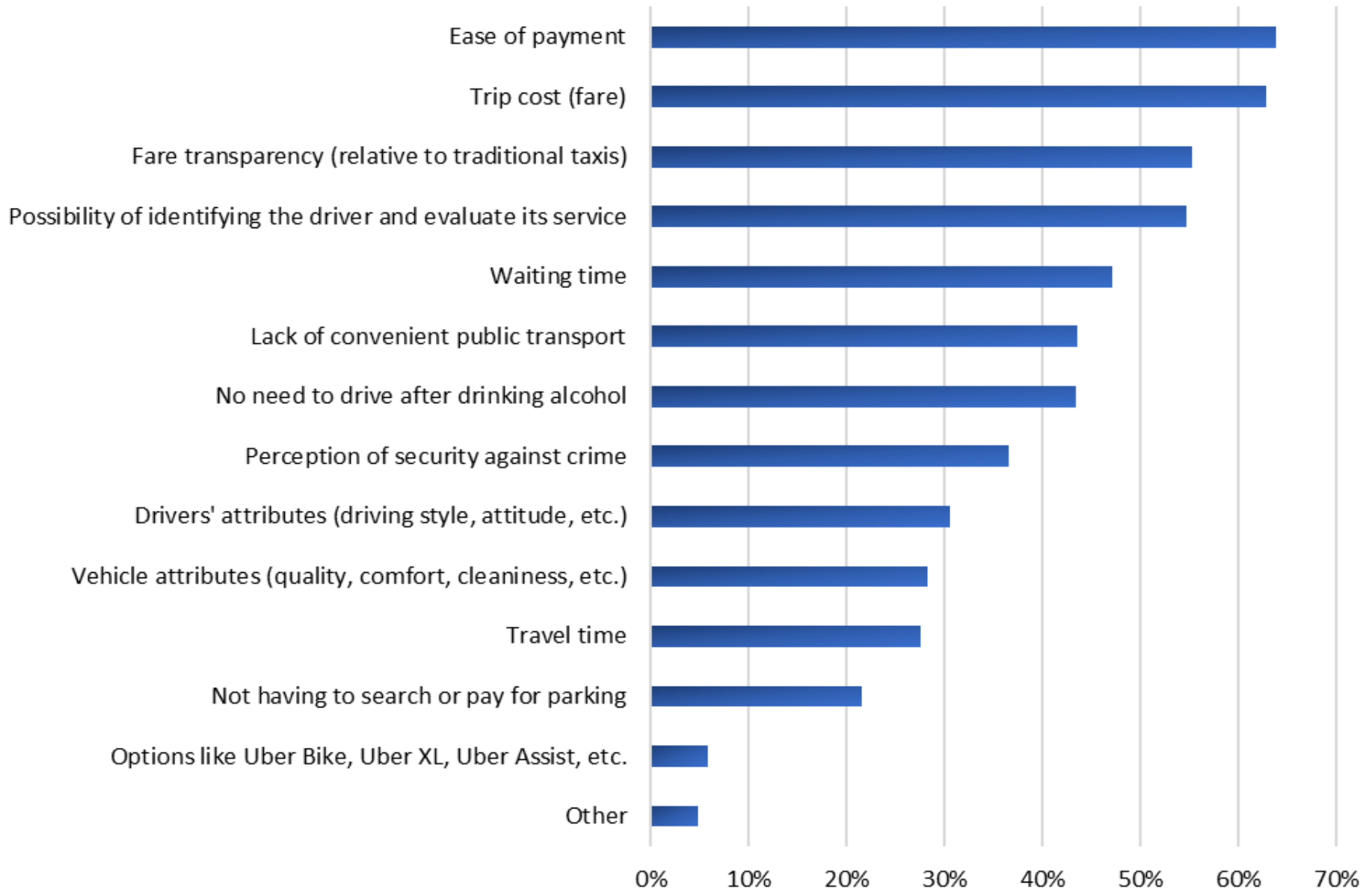
Trip purpose when travelling with Uber
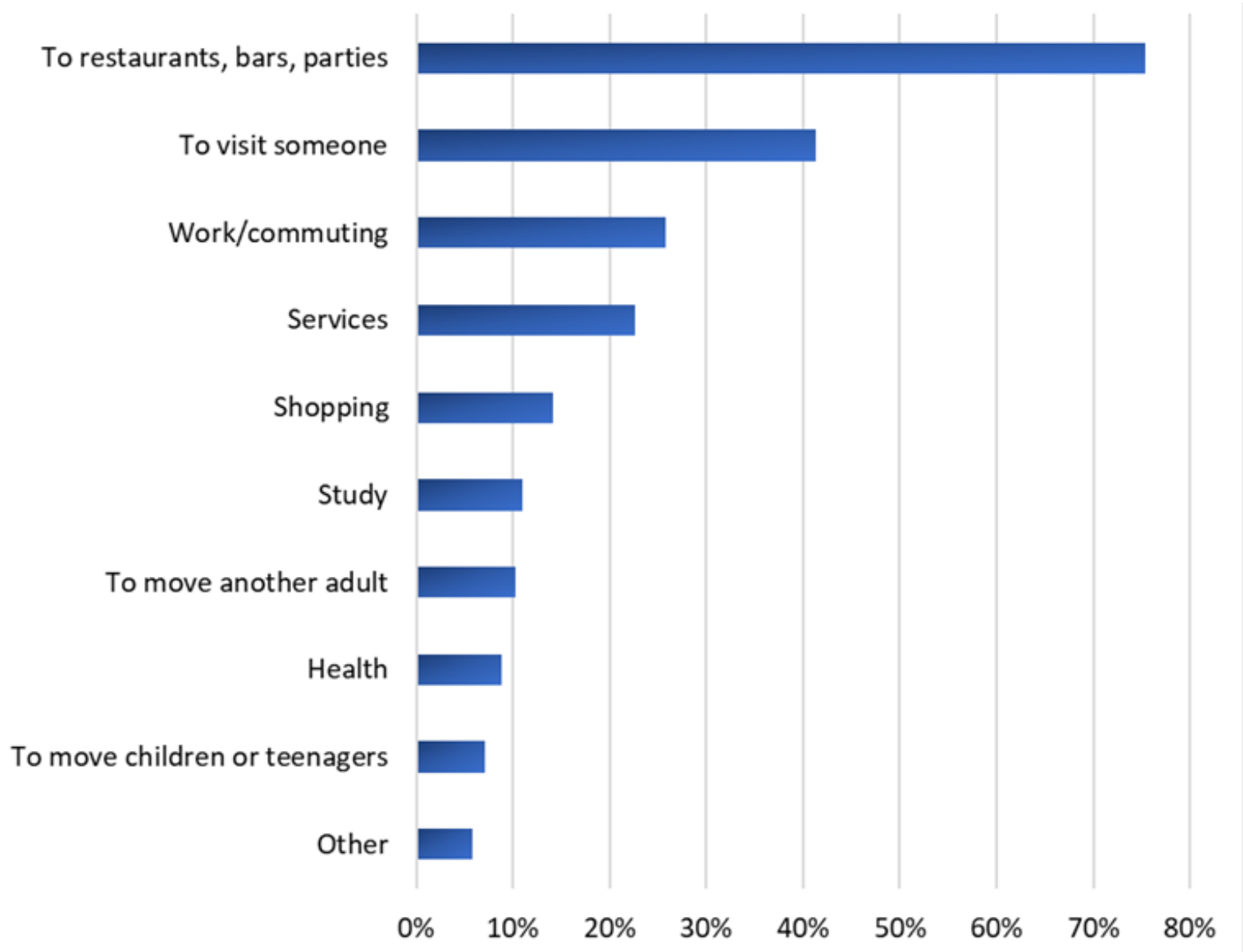
Uber data: use in Santiago

La expansión de la plataforma tecnológica en dos años

Según describen los mismos conductores de la aplicación, los viajes han tendido a concentrarse en zonas periféricas como Puente Alto, Maipú y Quilicura.

2014 | 2015 | 2016

Viaje por hora en Santiago

Lunes | Martes | Miércoles | Jueves | Viernes | Sábado | Domingo

Medianoche Mediodía Medianoche Mediodía Medianoche Mediodía Medianoche Mediodía Medianoche Mediodía Medianoche Mediodía Medianoche Mediodía
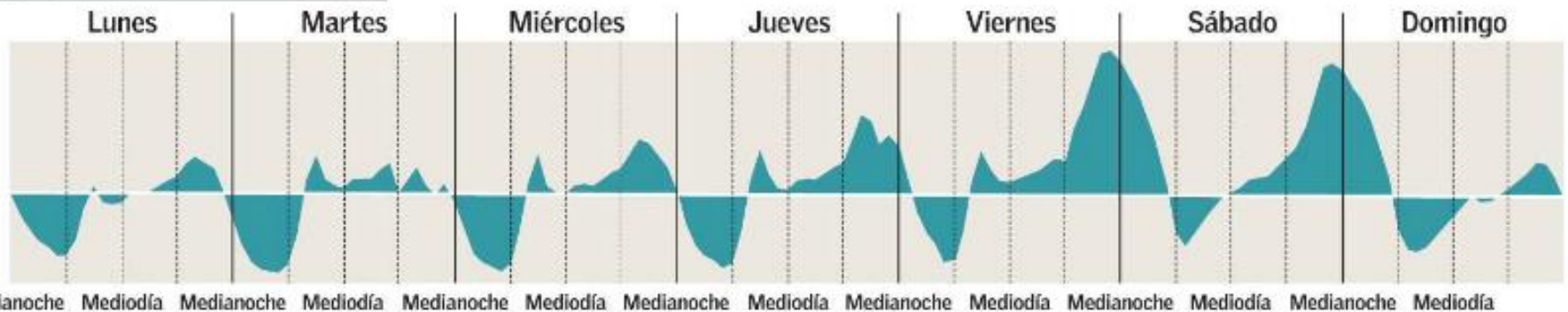
Fuente Uber Chile

EL MERCURIO

Santiago: trip timing - all modes

Figura 7: Distribución horaria de los viajes en día laboral temporada normal

2012 Santiago's Origin-Destination Survey
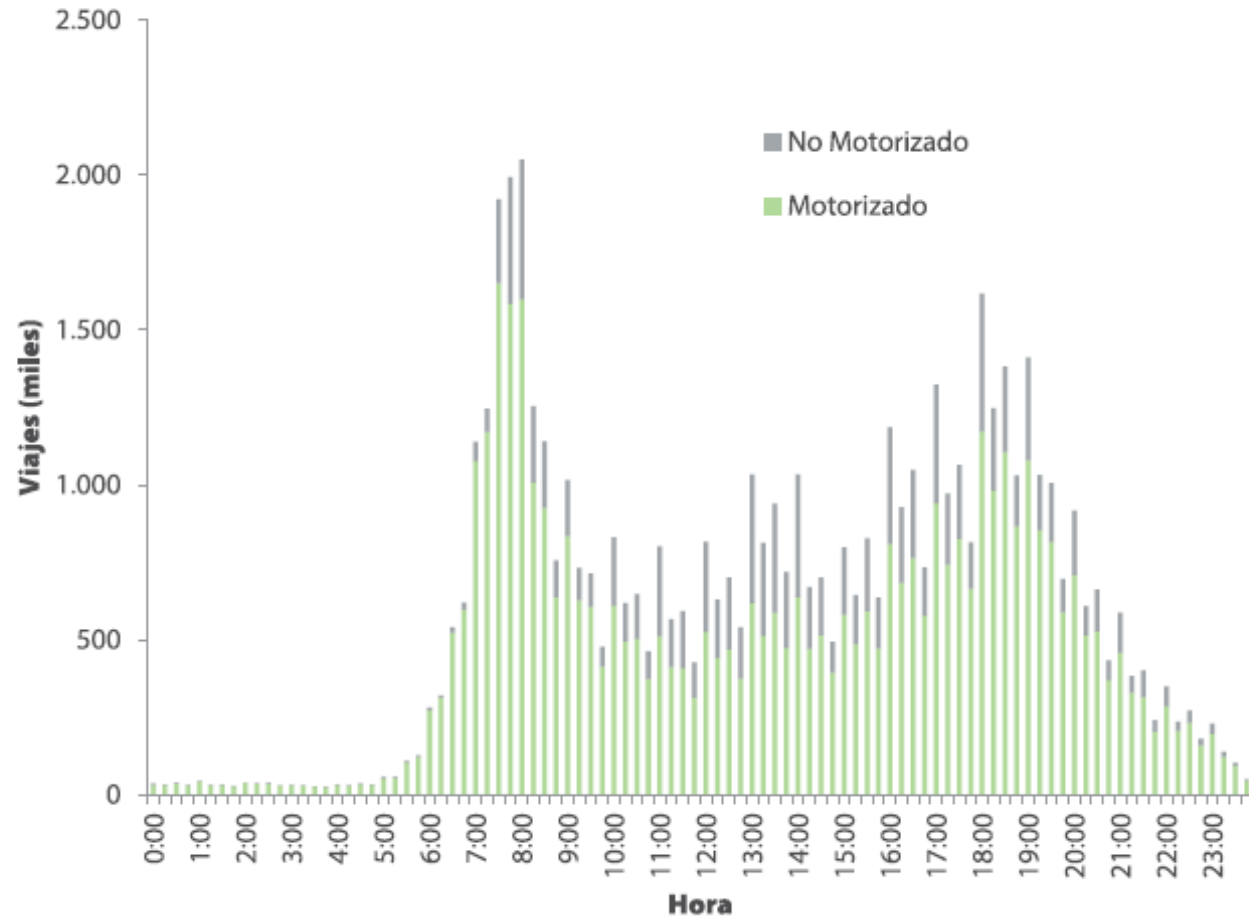
Questions over the last trip made by Uber

Santiago (N=1474)

If Uber did not exist, how would you have travelled?

Mode	Percentage
Taxi	40.7%
Public transport: total	32.5%
Public transport: bus	16.8%
Public transport: bus-metro	10.3%
Public transport: metro	5.4%
Car	12.1%
Walking	2.4%
Shared taxi (colectivo)	1.6%
Bicycle	1.3%
Another mode	4.1%
I would have not traveled	5.4%
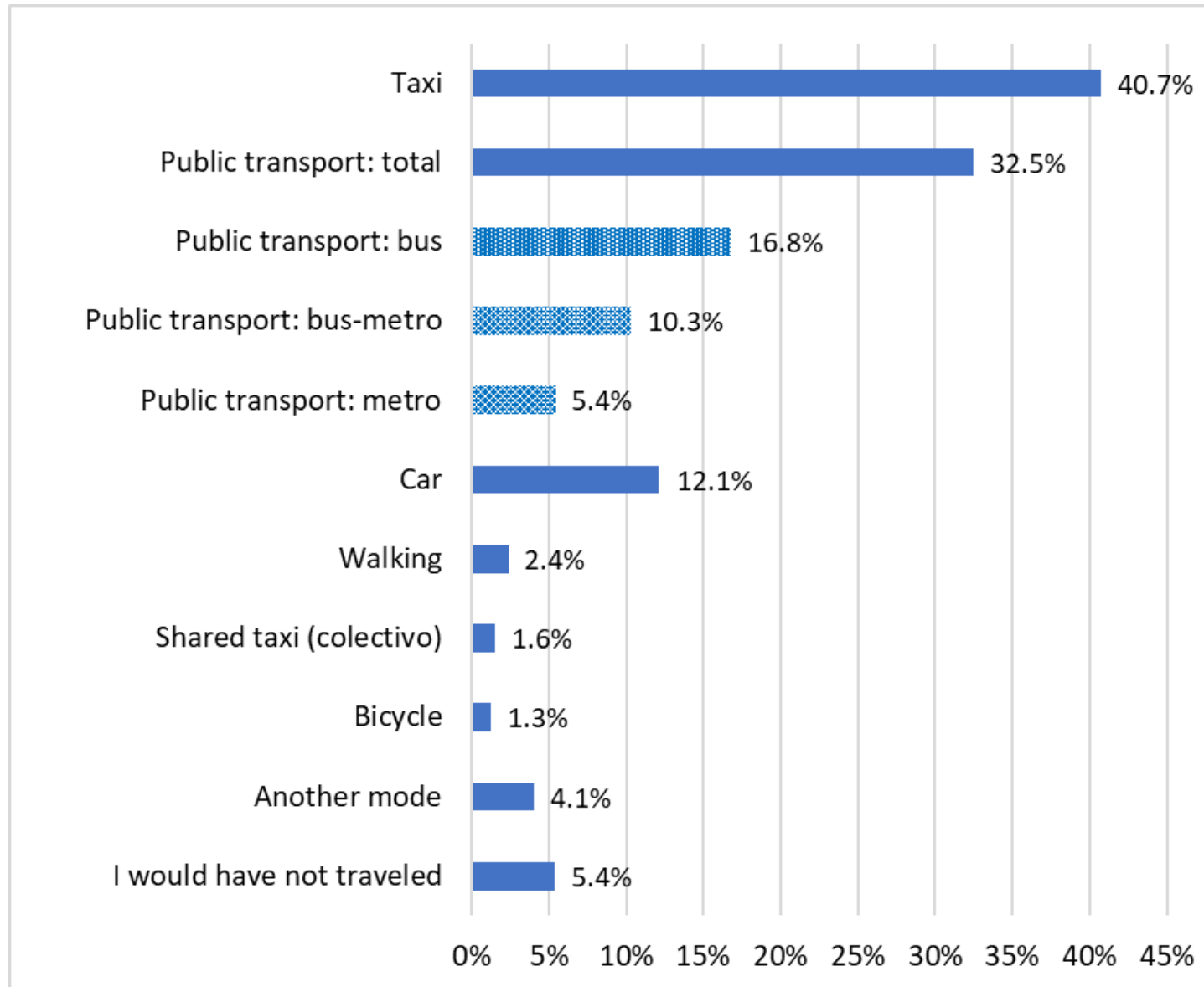
Santiago (N=1474)

If Uber did not exist, how would you have travelled? (percentages)

Reference	Rayle et al (2016)	Henao (2017)	Tirachini (2017)
City	San Francisco	Denver	Santiago
Country	USA	USA	Chile
Taxi	36	9.6	40.7
Public transport	31	22.2	32.5
Car	6	32.8	12.1
Bicycle	2	11.9	1.3
Walking	7		2.4
Other modes	10	11.3	5.6
I would have not made the trip	8	12.2	5.4
Total	100	100	100
Ridesourcing used in combination with other modes	No info	5.5	No info
Sample Size	313	308	1474

If Uber did not exist, how would you have travelled?

Modal substitution vs personal monthly income
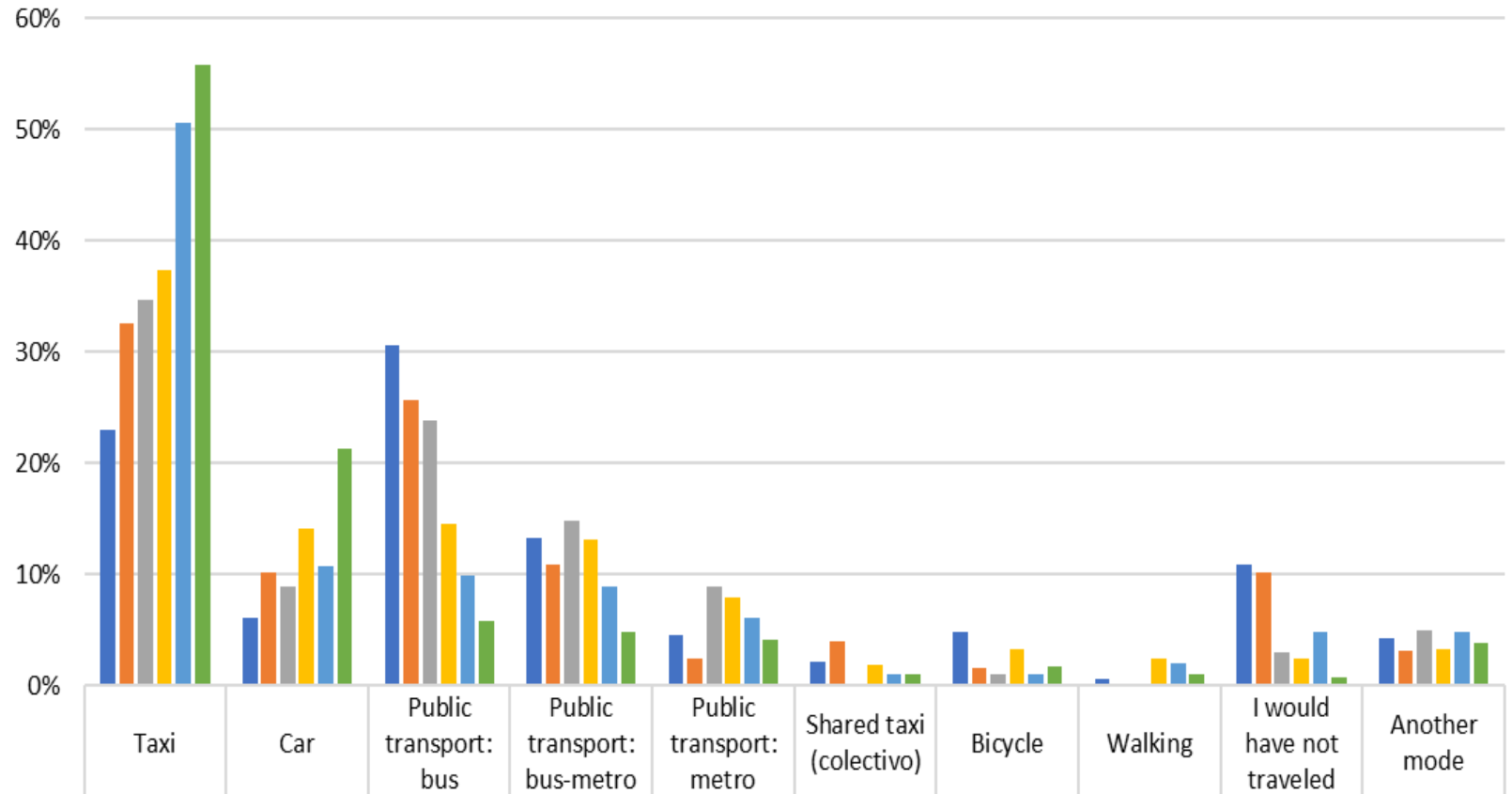
	Taxi	Car	Public transport: bus	Public transport: bus-metro	Public transport: metro	Shared taxi (colectivo)	Bicycle	Walking	I would have not traveled	Another mode
Less than $312	23%	6%	31%	13%	5%	2%	5%	1%	11%	4%
$312-$624	33%	10%	26%	11%	2%	4%	2%	0%	10%	3%
$625-$937	35%	9%	24%	15%	9%	0%	1%	0%	3%	5%
$938-$1,562	37%	14%	14%	13%	8%	2%	3%	2%	2%	3%
$1,563-$3,125	51%	11%	10%	9%	6%	1%	1%	2%	5%	5%
More than $3,125	56%	21%	6%	5%	4%	1%	2%	1%	1%	4%

If Uber did not exist, how would you have travelled?

Modal substitution vs car availability

	Taxi tradicional	Automóvil particular	Transporte público	Transporte público: bus	Transporte público: combinación bus-metro	Transporte público: metro	Taxi colectivo	Caminando	En bicicleta	No hubiese hecho el viaje	De otra forma
Ninguno	41%	1%	38%	19%	12%	6%	3%	4%	1%	7%	5%
Uno	42%	13%	31%	16%	10%	5%	3%	2%	2%	3%	4%
Dos o más	34%	22%	29%	18%	8%	4%	1%	2%	1%	7%	4%
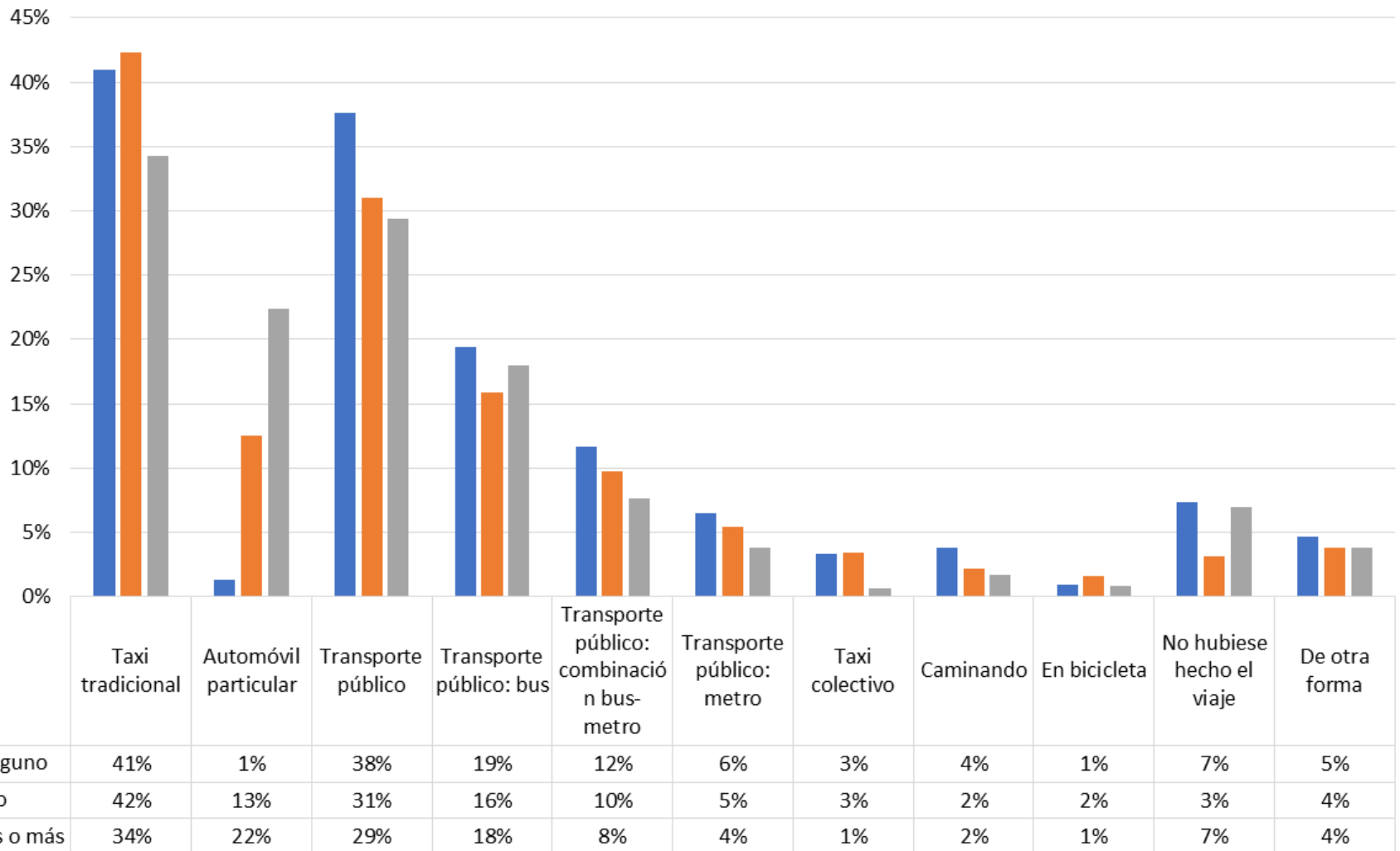
If Uber did not exist, I would have not travelled:
induced demand per time period
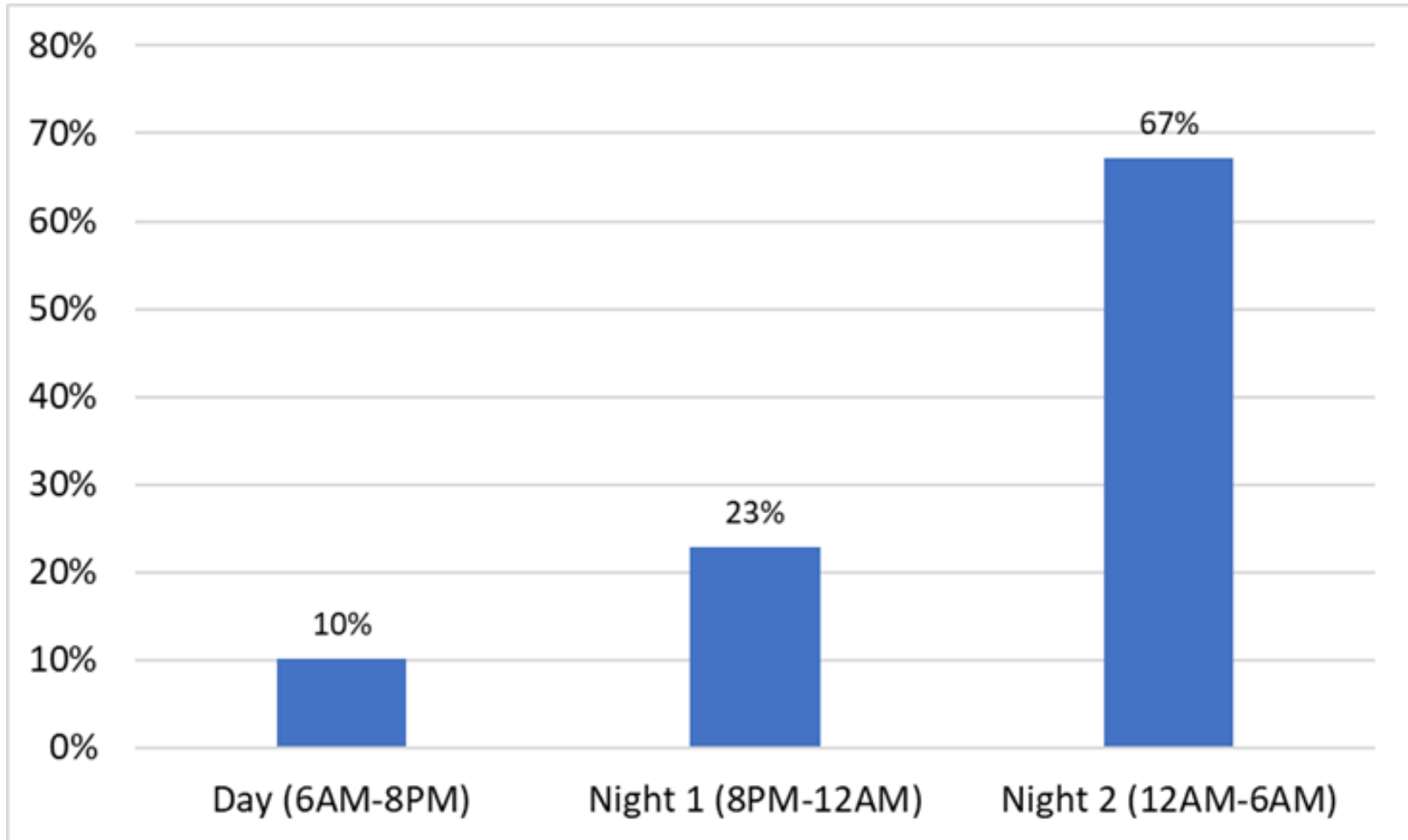
Santiago (N=79)

Vehicle kilometres travelled (VKT) model

VKT total

$$VK_{tot} = VK_{app} + VK_t + VK_p + VK_b$$

VKT car

$$VK_a = (1 + \theta) \cdot L_a \cdot \frac{V_a}{O_a}$$

VKT taxi

$$VK_t = (1 + \mu_t) \cdot L_t \cdot \frac{V_t}{O_t}$$

VKT bus

$$VK_b = \beta \cdot L_b \cdot \frac{V_b}{O_b}$$

VKT ridesourcing

$$VK_{app} = (1 + \mu_{app}) \cdot L_{app} \cdot \frac{V_{app}}{O_{app}}$$

With Andrés Gómez-Lobo (FEN UChile)

Vehicle kilometres travelled (VKT) model

Effect of one extra ridesourcing trip

$$\frac{dVK_{tot}}{dV_{app}}$$

$$= \underbrace{\bar{L} \cdot \frac{(1 + \mu_{app})}{O_{app}}}_{ridesourcing\ effect} + \underbrace{\bar{L} \cdot \frac{(1 + \mu_t) \cdot (1 + \tau_t)}{O_t} \cdot \frac{dV_t}{dV_{app}}}_{taxi\ effect} + \underbrace{\bar{L} \cdot \frac{(1 + \theta) \cdot (1 + \tau_a)}{O_a} \cdot \frac{dV_a}{dV_{app}}}_{car\ effect}$$

$$+ \underbrace{\bar{L} \cdot \beta \cdot \frac{(1 + \tau_b)}{O_b} \cdot \frac{dV_b}{dV_{app}}}_{bus\ effect}$$

$$\left| \frac{dV_t}{dV_{app}} + \frac{dV_a}{dV_{app}} + \frac{dV_b}{dV_{app}} \right| < 1$$

Monte Carlo Simulation

Uniform distributions

Parameter	Unit	Min	Max
Trip length $\overline{L}$	Km	4.0	8.0
Occupancy taxi O_t	Pax/veh	1.3	1.4
Occupancy car O_a	Pax/veh	1.4	1.5
Occupancy bus O_b	Pax/veh	28	66
Extra distance rate auto τ_a	-	0.0	0.1
Extra distance rate taxi τ_t	-	0.0	0.1
Extra distance rate bus τ_b	-	0.1	0.3
Increased occupancy rate ridesourcing F_o	-	1.0	1.3
Extra distance rate parking θ	-	0.01	0.1
Reduced rate of empty kilometers G_o	-	0.60	0.74
Rate of taxi empty kilometers μ_t	-	0.45	0.58
Bus equivalency factor β	bus/car	1.5	3.0
Substitution rate car	-	-0.09	-0.15
Substitution rate taxi	-	-0.31	-0.51
Substitution rate bus	-	-0.20	-0.34

Base case result

- Monte Carlo simulation 20,000 replications.
- Base case result: the probability that ridesourcing reduces VKT is zero.
- Average ridesourcing effect: 5.24 km/trip
- Average taxi effect: -2.88 km/trip
- Average car effect: -0.56 km/trip
- Average bus effect: -0.10 km/trip

Increased occupancy rate
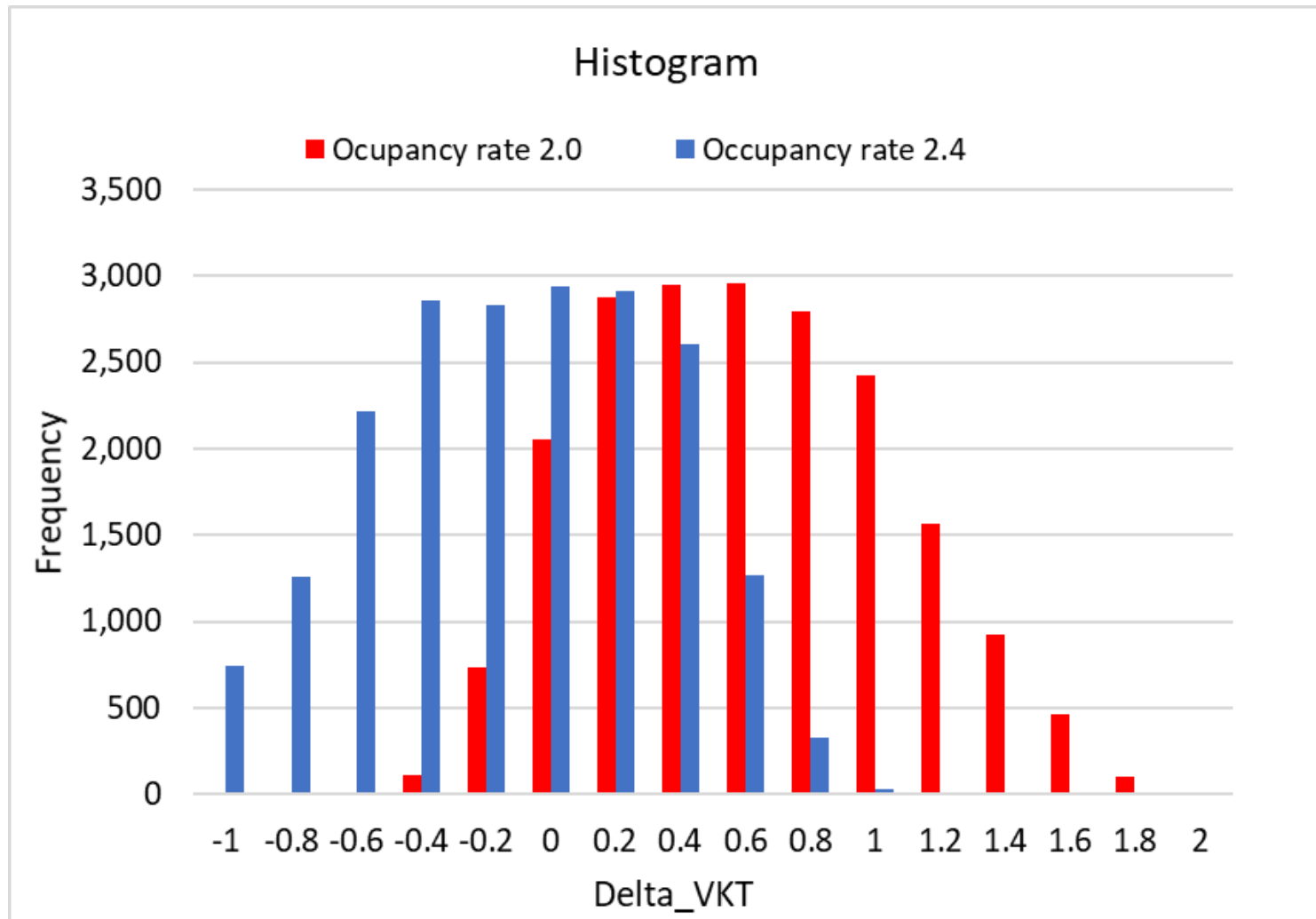
Mean ridesourcing occupancy rate 2.0 pax/veh, prob of reducing VKT is 15%
Mean ridesourcing occupancy rate 2.4 pax/veh, prob of reducing VKT is 50%

What if trips are shared with other people? Ridesharing

Probability of reducing VKT
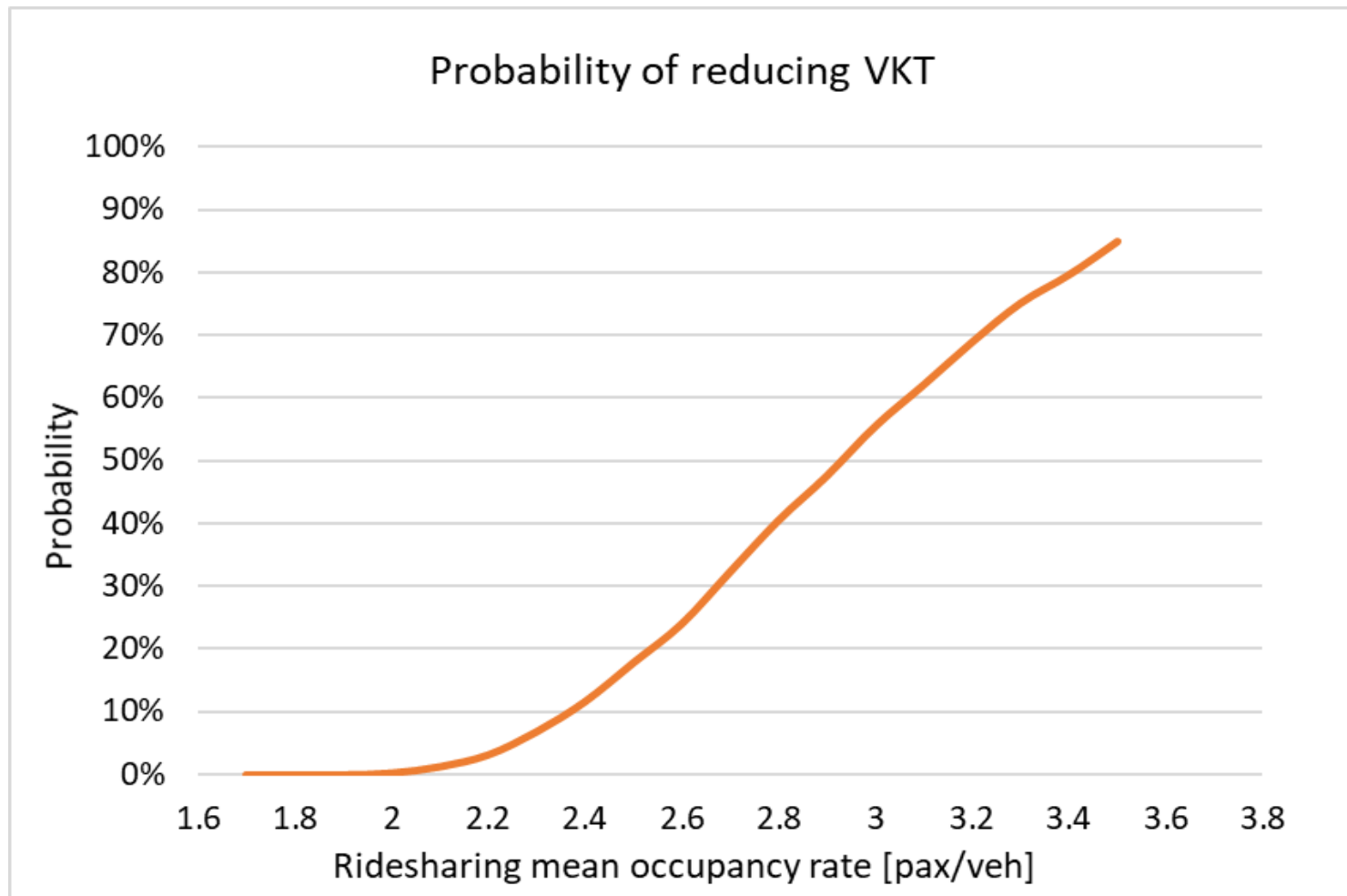
Tirachini, A., Gomez-Lobo, A. (2017) Does ridesourcing increase or decrease vehicle kilometres traveled (VKT)? A simulation approach for the case of Santiago, Chile

Results summary

- **Travel behavior effects**
  - Modal switch
  - Trip generation
  - Change of time period and duration activities
- **Benefits**
  - Reduced generalised cost for users
  - Uber allows engagement in activities (specially at night for lower income users)
- **Costs**
  - Increased VKT (and externalities related to it)
  - Ridesharing is a key

Danke schön

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http://www.uchile.cl/portafolio-academico/impresion.jsf?username=alejandro.tirachini