Institute of Policy Studies

ENGAGING MINDS, EXCHANGING IDEAS

Closed-Door Discussion on The Sharing Economy in Singapore

Friday, 24 February 2017

Seminar Room 2-3, Level 2, Manasseh Meyer

Lee Kuan Yew School of Public Policy

National University of Singapore

PANEL 2
The Impact of Ridesharing

PRESENTATION BY

Professor Costas Courcoubetis

Engineering Systems and Design
Singapore University of Technology and Design

Drivers, riders and service providers: The impact of ridesharing

Costas Courcoubetis

Singapore University of Technology and Design

joint work with Harald Bernhard and Saif Benjaafar

February 24, 2017

The title

Our interpretation

Sharing economy = Peer-to-peer exchange of goods and services enabled by online platforms / marketplaces that efficiently match supply and demand. (also: platform economy, gig economy, ...)

Today:

- Formulate an equilibrium model to analyse long-term effects of introducing sharing concepts into a society.
- Example: Personal mobility, ride-sharing / car pooling.

Motivation

Congestion: Ride sharing / Car pooling will solve the congestion problems of densely populated urban areas. [1]

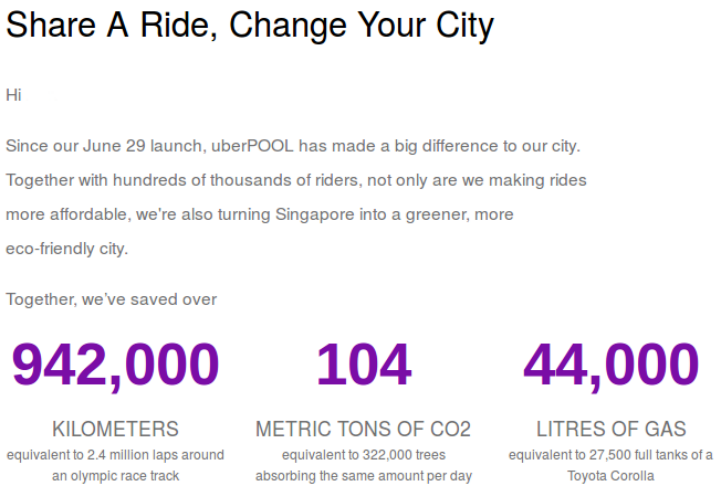


Figure: Promotional material by Uber, September 2016.

[1] http://www.technologyreview.com/featuredstory/541791/lyfts-search-for-a-new-mode-of-transport/

Motivation

Regulation: Yes, please car-share, but don't run an illegal taxi enterprise! [2]

Excerpt form the Road Traffic Act: Road Traffic (Car Pools) (Exemption) Order 2015[3]
[A person is not violating the law in case where:]

(a) the person does not solicit for the passenger on a road or at a parking place or a public stand;

(b) the carriage of the passenger is incidental to the person's use of the private motor car;

(c) the person informs the passenger, before the start of the carriage, of the person's destination;

(d) the person agrees with the passenger, before the start of the carriage, on the date of, pick-up and drop-off points of, and the payment (whether in cash or in kind) for, the carriage;

(e) the amount or the value of any benefit in kind that the person collects from the passenger as payment does not exceed the cost and expenses incurred for the carriage of the passenger;

(f) if there is more than one passenger, the aggregate of the amount or the value of any benefit in kind that the person collects from each of the passengers as payment does not exceed the cost and expenses incurred for the carriage of all the passengers; and

(g) there is nothing in or on the private motor car displaying or referring to the fares for hiring the private motor car.

The exemption [above] only applies in respect of the first 2 car pool trips that a person makes each day on any private motor car.

---

[2] http://www.straitstimes.com/singapore/transport/new-carpooling-laws-allow-drivers-to-be-paid

[3] http://statutes.agc.gov.sg

Motivation

Congestion: Single occupant vehicles are highly inefficient.

"Under the assumption of one person per ride, we show that 98% of the taxi rides currently served by over 13,000 taxis could be served with just 3,000 taxis of capacity four."

Alonso-Mora et al. (2017) on ride sharing in NYC

[figure source]: https://motherboard.vice.com/en_us/article/3000-ubers-could-replace-nycs-entire-taxi-fleet

Motivation

Economics might work in favour of ride sharing.

"[...] with increasing but still relatively low passenger discomfort, cumulative trip length can be cut by 40% or more. This benefit comes with reductions in service cost, emissions, and with split fares, hinting toward a wide passenger acceptance of such a shared service."

Santi et al. (2014) on ride sharing in NYC.

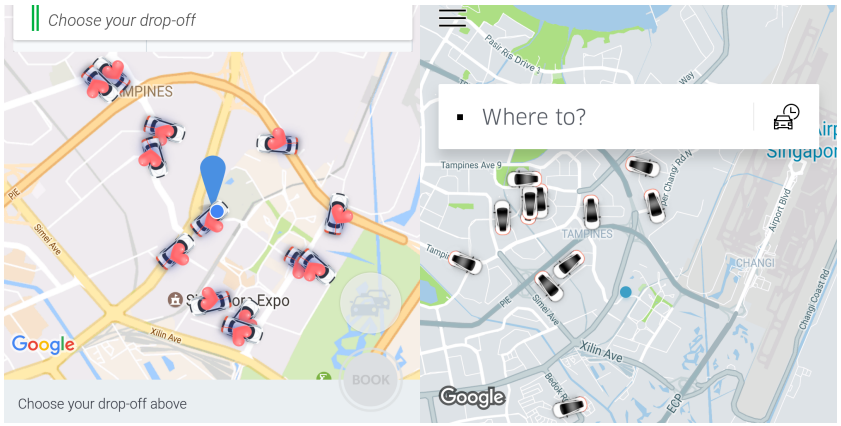
[figure source]: https://www.technologyreview.com/s/541791/lyfts-search-for-a-new-mode-of-transport/

Motivation

Mobile technology increases matching efficiencies compared to taxis.

"[...] UberX drivers spend a significantly higher fraction of their time, and drive a substantially higher share of miles, with a passenger in their car than do taxi drivers."

Cramer and Kruger (2017)

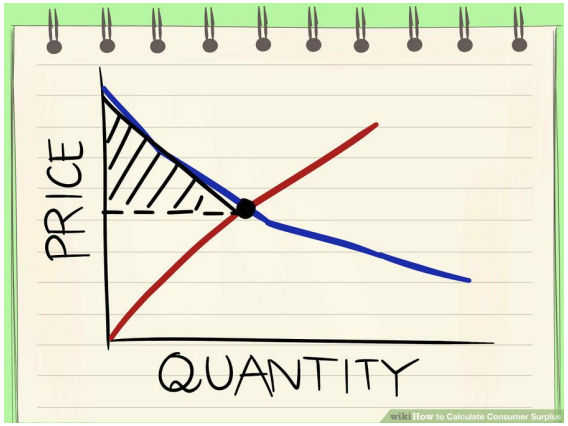


[figure source]: Grab (left), Uber (right) app.

Mobile technology increases matching efficiencies compared to taxis.

"For each dollar spent by consumers, about $1.60 of consumer surplus is generated. Back-of-the-envelope calculations suggest that the overall consumer surplus generated by the UberX service in the United States in 2015 was $6.8 billion."

Cohen et al. (2016)



[figure source]: wikihow.com

Our research

Technology today

Cheap mobile technology + location services + efficient algorithms for matching supply and demand for ride-sharing (not yet).

Questions

- How will wide-spread adoption of ride-sharing affect congestion, ownership, welfare?
- What are the potential benefits and pitfalls.

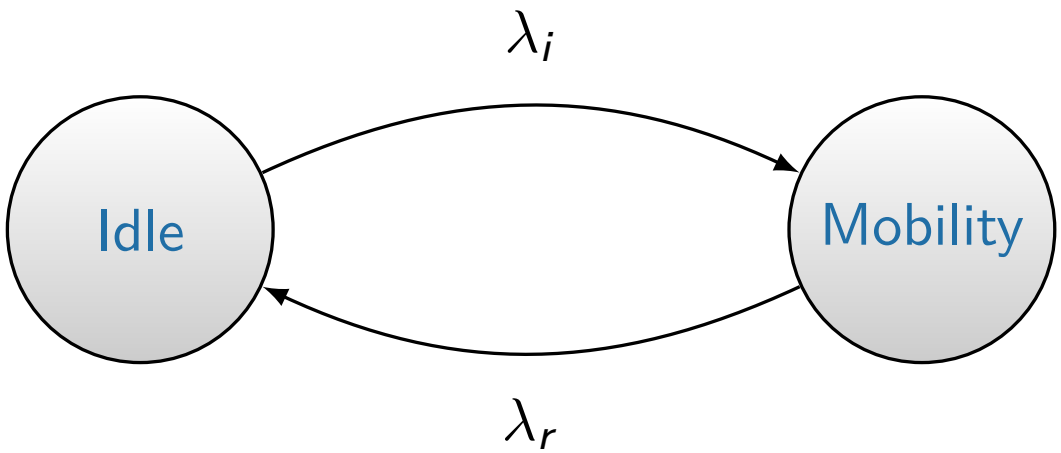
Our research

More questions

- What equilibria will emerge? Shared usage of excess capacity (e.g. traditional long distance car pooling) or pure service (e.g. Uber)?
- Heterogeneous user base: Who will own the assets, which population segment will be the main user base?
- Study congestion (traffic volume), ownership, welfare, platform incentives.

Model

Society $=$ { Set of agents }
An agent alternates between two states:



Income/unit time

Utility/per trip

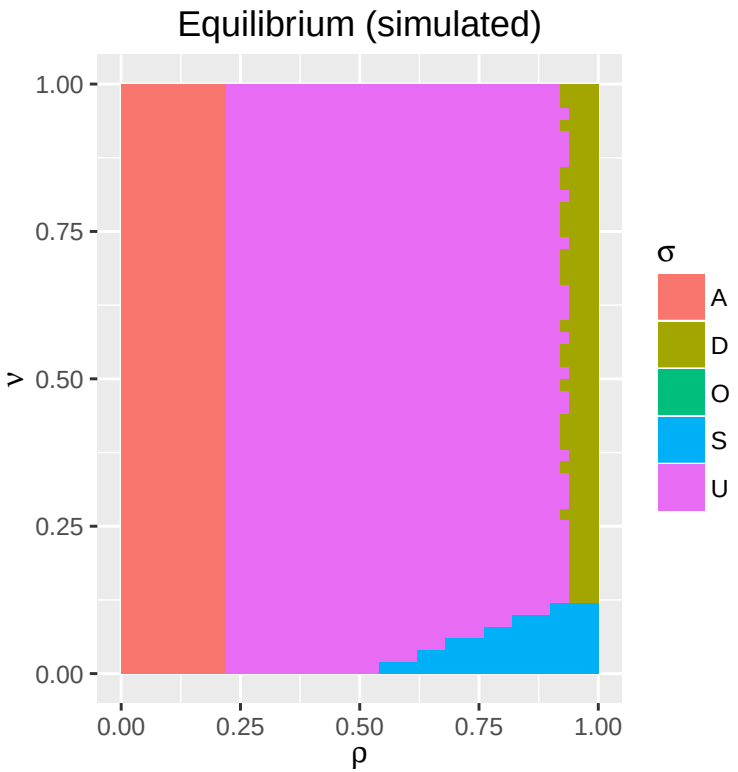
Utility is derived from performing a task that requires transportation.
Using private transportation (through platform or self driving) generates higher utility than using public transportation.

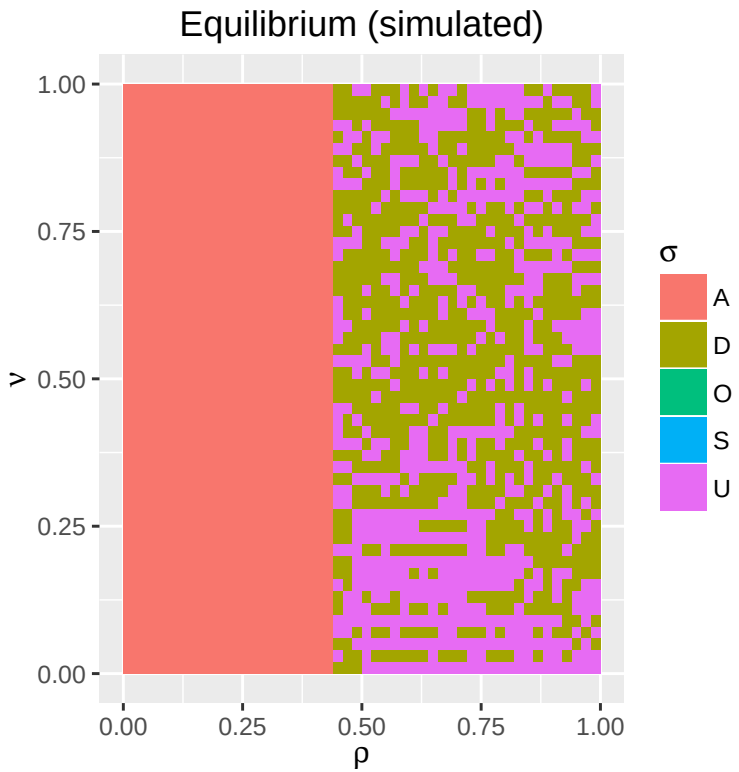
Model

Very optimistic matching of supply and demand. Does not take into account route details by renters and drivers. A 'trip' offered by any driver can be used by any user needing transportation if times match.
Other simplifying assumptions include:

- Individuals are identical save for income and their valuation for private utility.
- Public transport is always available.
- Everyone knows how to drive.
- Individuals are fully rational.
- Inconveniences with ride-sharing are negligible.
- No emotional attachment to cars. Vehicles only serve a purpose in transportation.

Long term equilibrium analysis





Numerical Analysis

...for a uniform society!
Let half of the population own a car before introducing the sharing platform.

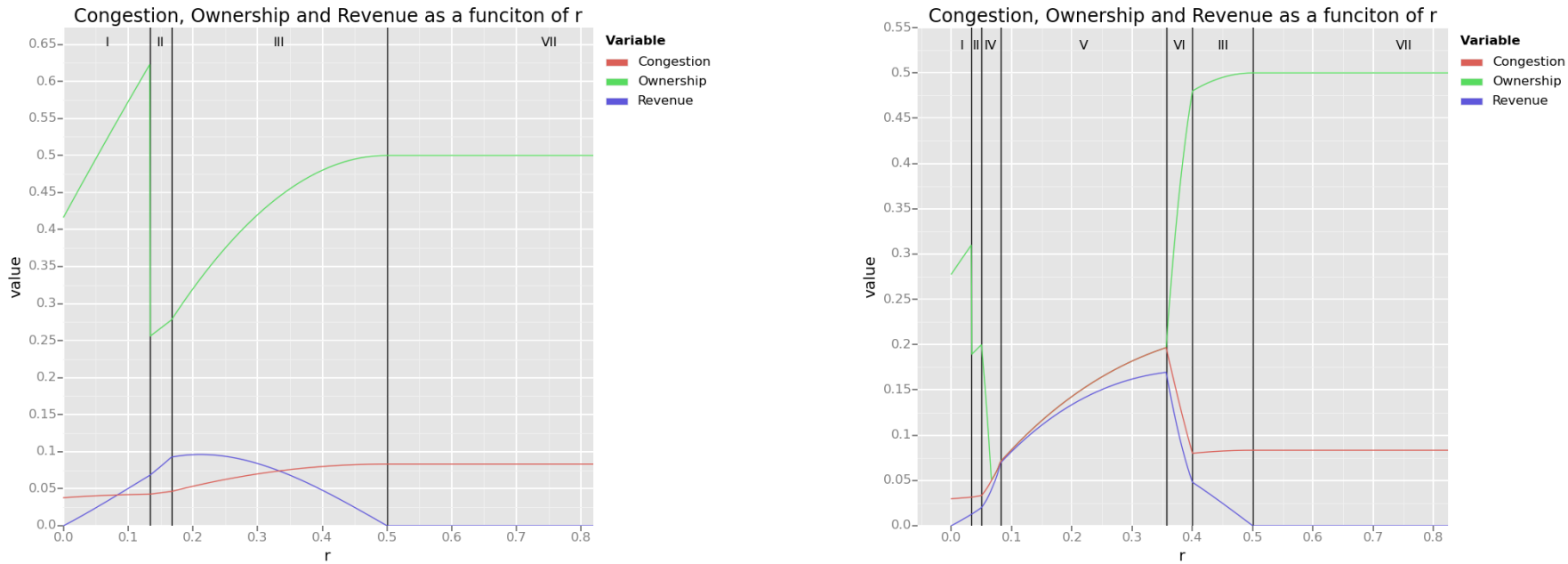
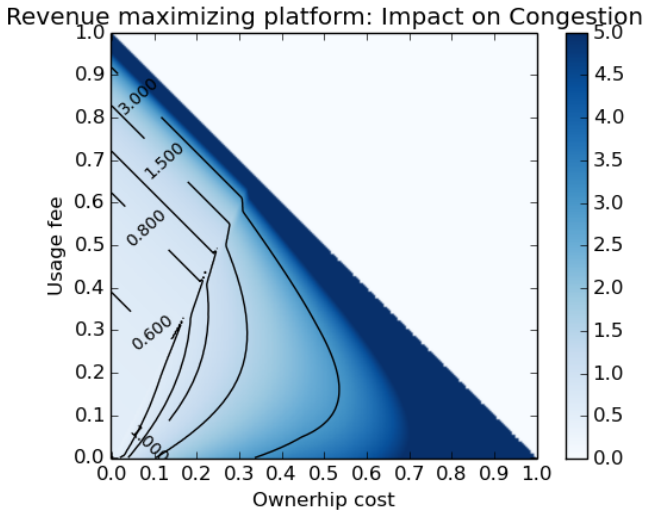
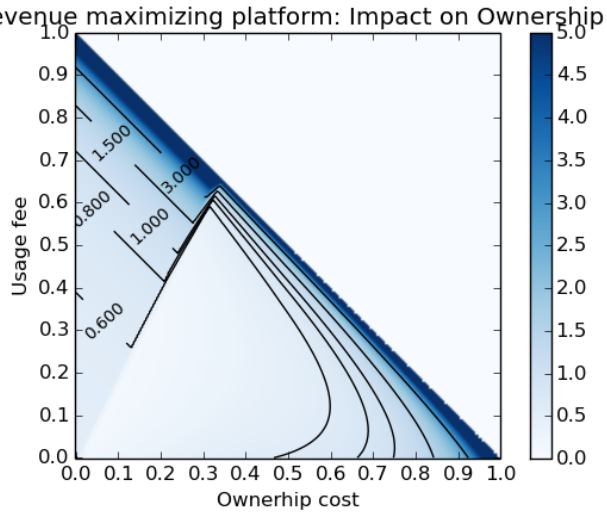


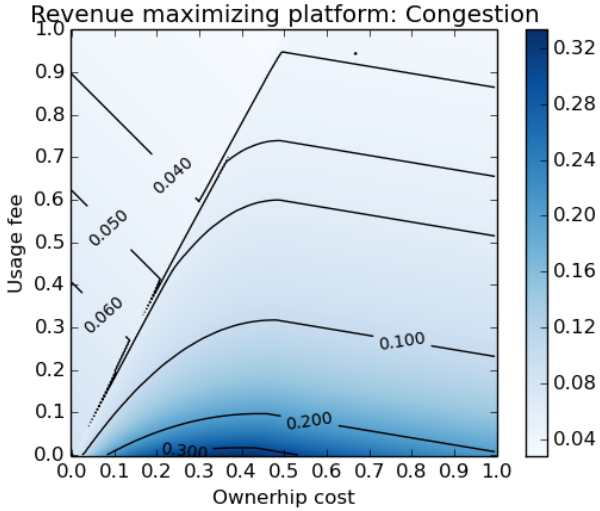
Figure: Left: Usage expensive compared to ownership. Right: Usage cheap compared to ownership.

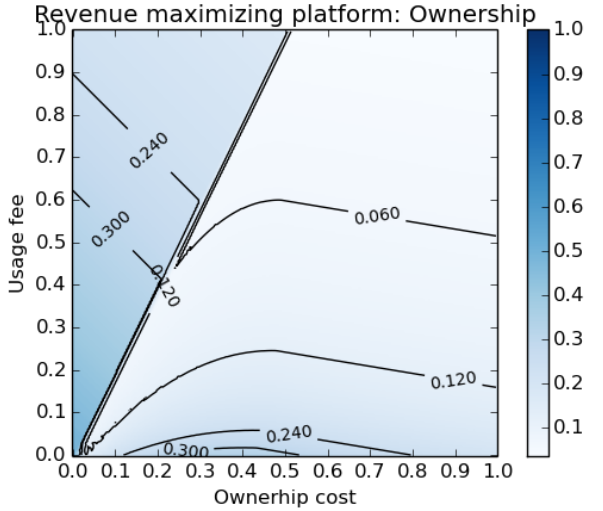
The impact on ownership and congestion

...for a uniform society!









Conclusion

- We define a game capturing different behavioural aspects of interacting with a sharing platform.
- Clear distinction:
  - If *usage* is expensive as compared to *ownership*, the sharing economy will tend to be cost driven. Sharing revenues subsidise the usage cost.
  - If *ownership* is expensive as compared to *usage*, the sharing economy will tend to be profit driven. Sharing revenues subsidise the ownership cost and riding service is provided by professionals.
- The impact of sharing on congestion and ownership depends crucially upon how widespread car ownership is before the introduction of the platform. If there is little ownership to start with, sharing will lead to more traffic and ownership.
- Higher welfare combined with lower traffic can be achieved if the right controls are placed.

Institute of Policy Studies

ENGAGING MINDS, EXCHANGING IDEAS

Closed-Door Discussion on The Sharing Economy in Singapore

Friday, 24 February 2017

Seminar Room 2-3, Level 2, Manasseh Meyer

Lee Kuan Yew School of Public Policy

National University of Singapore