Asymmetric Taxation, Pass-through and Market Competition: Evidence from Ride-sharing and Taxis

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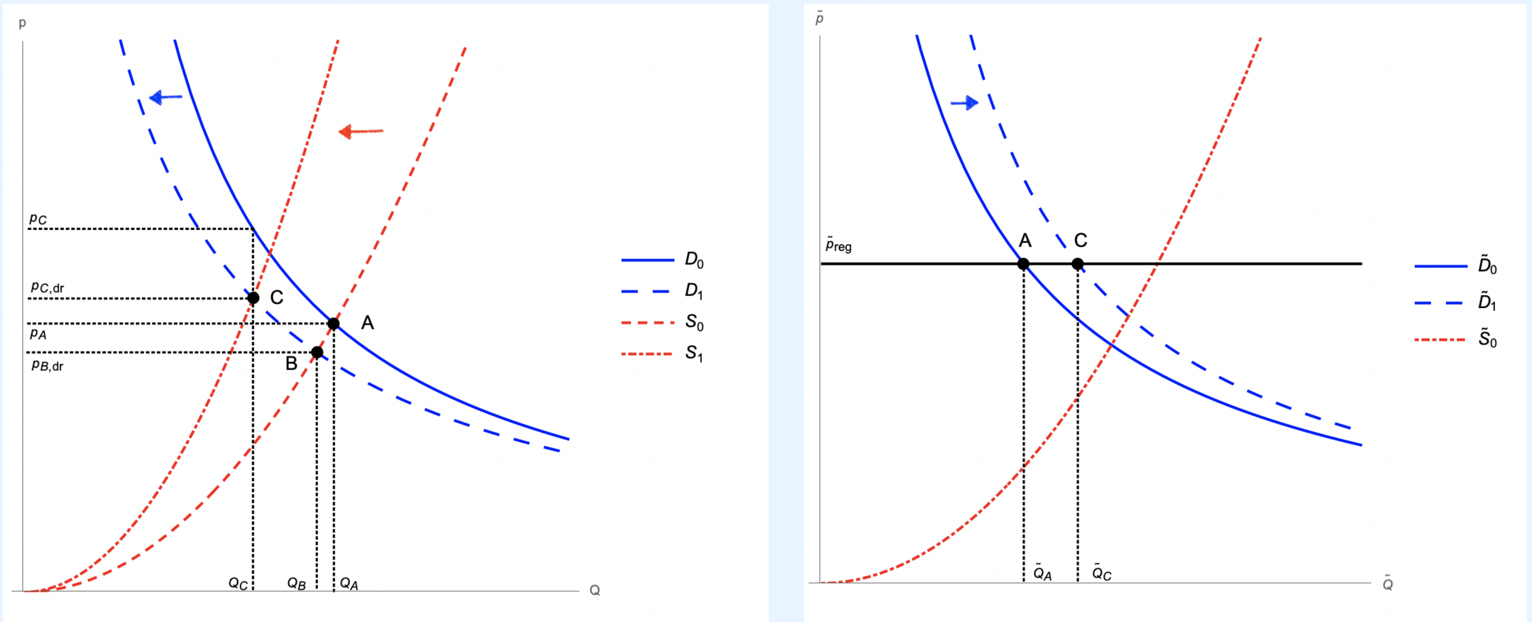
Motivation & Research Question

- Existing literature focuses on taxes imposing the same amount on all products in the market, but some taxes are asymmetric (e.g., environmental taxation or special taxes on big tech platforms)
- Since the equilibrium responses to asymmetric taxes are going to affect the relative prices of different products in the market, asymmetric taxes can have large effects on competition and market outcomes
- The main purpose of this paper is to study empirically the pass-through and the effects on market outcomes of a tax levying different amounts on a subset of products in the market
- Since ride-sharing platforms are peer-to-peer marketplaces, empirically studying pass-through in this setting is another relevant question explored in this paper

Tax Pass-through in Online Two–sided Markets



(a) Ride-sharing (Taxed Product) (b) Taxis (Untaxed Product)

- Indirect network effects between drivers and riders may affect pass-through rates because the reduction in demand following a tax levied on riders, reduces drivers willingness to work for the platforms, shifting supply inwards and further increasing equilibrium prices.
- Two-sidedness of the market combined with the fact that ride-sharing companies are multi-product firms offering two competing services (single and shared rides) can rationalize tax overshifting
- Since demand for ride-sharing and taxis at least partially overlaps, the larger the change in the price of ride-sharing for riders, the larger the increase in demand for traditional cabs.

This Paper in a Nutshell

1. Estimate effect on trip prices and *tax pass-through rates*: pass-through in peer-to-peer marketplaces
2. Estimate effects on the number of ride-sharing and taxi *equilibrium pickups*: substitutability between traditional taxis and ride-sharing
3. Estimate effects on *congestion*
4. Quantify *welfare effects* of the tax by developing and calibrating a logit demand framework that accommodates asymmetric tax schedules

Background of the Study

The Chicago Congestion Tax

Heterogeneous schedule depending on trip endpoints (whether or not the rides starts/ends in the downtown area, where congestion is more pronounced, and on the service (single or shared):

RIDE-SHARING	Non-Downtown	Downtown
Single	\$1.25 (+\$0.53)	\$3.00 (+\$2.28)
Shared	\$0.65 (-\$0.07)	\$1.25 (+\$0.53)

Data

- Trip-level data for taxis and ride-sharing (miles, duration, fare, pick-up and drop-off date, time, location, etc.) from Chicago Data Portal
- Daily information on weather from the National Weather Service Forecast Office

Descriptive evidence on Price Changes after the Tax

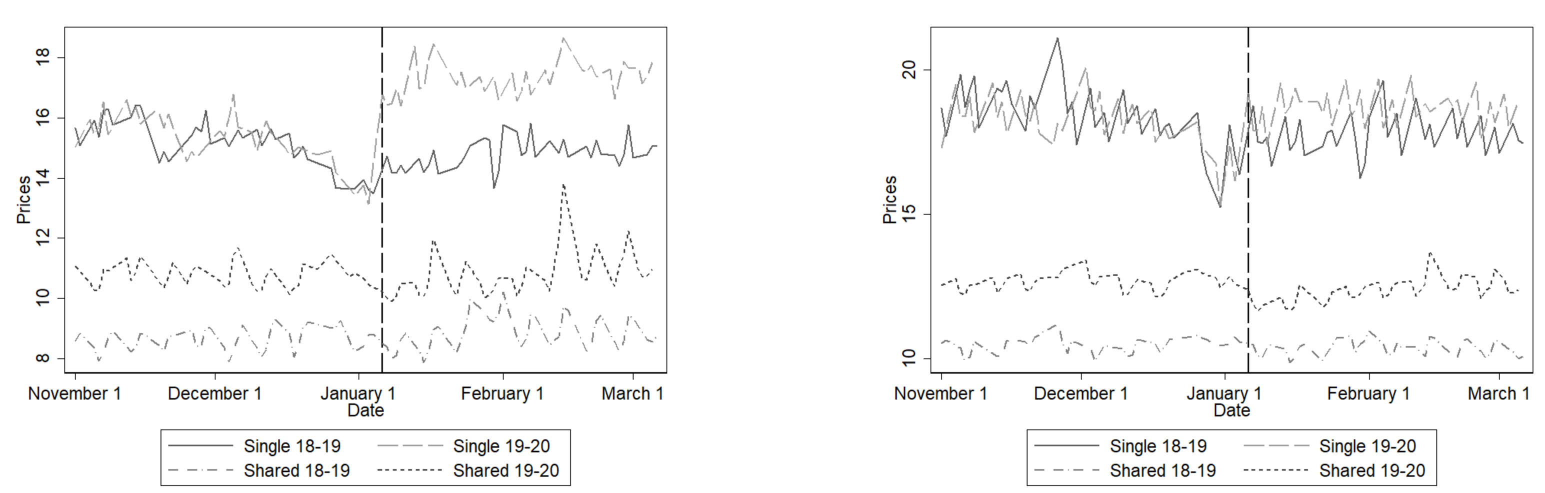


Figure 2. Ride-sharing Prices across Areas

Empirical Framework

- Congestion tax implemented in the *first Monday after holidays*: Seasonality may bias results if not accounted for
- **Pool** together two subsamples: Sample 19-20: includes 29 days on either side of the actual policy date (1/6/2020); Sample 19-20: includes 29 days on either side of the actual policy date (1/6/2020)
- A difference–in–regression–discontinuities design allows to "subtract" post-holiday effect and isolate the effect of the tax
- **Baseline specification** is:

$$Y_t = \alpha_0 + \alpha_t + \alpha \cdot Placebo_t + \beta \cdot Policy_t + \gamma_1 \cdot Date_t + \gamma_2 \cdot Date_t \cdot Policy_t +$$
$$+ \gamma_3 \cdot Date_t \cdot Placebo_t \cdot (1 - Policy_t) + X_t' \cdot \pi + \varepsilon_t$$

where: $Date_t$ measures the days from the hypothetical or actual policy date, $Policy_t$ is a dummy equal to 1 after 1/6/2020 and $Placebo_t$ is a dummy equal to 1 after 1/7/2019 or 1/6/2020

Effects of the Tax on Ride-sharing Prices, Equilibrium Pickups, Congestion and Riders' Welfare

VARIABLES	(1) Single Downtown	(2) Single Other	(3) Shared Downtown	(4) Shared Other
Ride-sharing Price (\$ per ride)				
Estimated effect	2.443***	0.731***	0.434***	-0.230***
	(0.0078)	(0.0095)	(0.0142)	(0.0122)
Pass-through	1.071	1.379	0.818	3.286
# of Ride-sharing Pickups				
Estimated effect	-0.107**	-0.064***	0.282***	0.111***
	(0.0464)	(0.0238)	(0.0437)	(0.0245)
# of Taxi Pickups				
Estimated effect	0.5864***	0.0319		
	(0.07761)	(0.0267)		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Congestion

The paper follows a similar approach to estimate the impact of the tax on congestion (proxied by the average speed of taxis). Results suggest that overall congestion did not decrease, not even if one only looks at the Downtown zone of the city only nor during rush hours

Welfare Analysis

- Develop and calibrate a logit model with two markets (downtown and non-downtown) and three services (single ride-sharing, shared ride-sharing and taxi)
- Utility of consumer i from choosing to ride with product j in market t is:
$$u_{ijt} = \xi_{jt} - \alpha_t p_{jt} + \varepsilon_{ijt} = \delta_{jt} + \varepsilon_{ijt}$$
- As ε_{ijt} is idiosyncratic type I EV, market share of product k is:
$$s_k(\delta; \xi, \alpha) = \frac{e^{\delta_k}}{1 + \sum_{j=1}^{3} e^{\delta_j}}$$

$\implies$ Compute effect of a finite change in the tax τ on market shares

Conclusion

- Pass-through above unity for single rides: consistent with: (i) two–sidedness of the market; (ii) ride-sharing companies are multi-product firms
- Tax *shifted demand back to taxis* in downtown where competition between ride-sharing and traditional taxis is more intense
- No significant effect on congestion
- Tax reallocates share of producer surplus from ride-sharing platforms to taxis but **harmed riders** with a loss in surplus of