

Introduction

- Cities are experiencing increasing air travel demand and transformations in urban mobility.
- Travel to and from the airport represents more than 2% of all vehicle miles traveled generated by the case study regions.
- Airports, generally sub-jurisdictions to cities and primary mobility hubs, typically charge fees to commercial services accessing the airport curb front, generating revenue and providing a data trail to quantify key impacts of new mobility options (e.g. ridehailing).



Figure 1. Ground transportation at Denver International Airport (Source: Henao)

Research Questions

- How does **ridehailing impact mode share** for ground transportation trips to and from airports?
- Is the **independence of irrelevant alternatives (IIA)** property appropriate to use with ridehailing and mode choice? IIA is the assumption that the ratio of probabilities of choice between alternatives remains unchanged following the addition of one or more alternatives

Data & Methods

- **Public data requests** to case study Denver (DEN) and Seattle-Tacoma (SEA) airports:
 - ✓ Number of enplaned and deplaned air passengers
 - ✓ Transactions and revenue reflecting ground access to the airport including parking, car rental, and commercial vehicles (including taxis and ridehailing)
 - ✓ Transit transactions collected via public transportation authorities (Sound Transit for Seattle-Tacoma and the Regional Transportation District for Denver)
- Analysis of patterns and **testing the “independence of irrelevant alternatives”** property

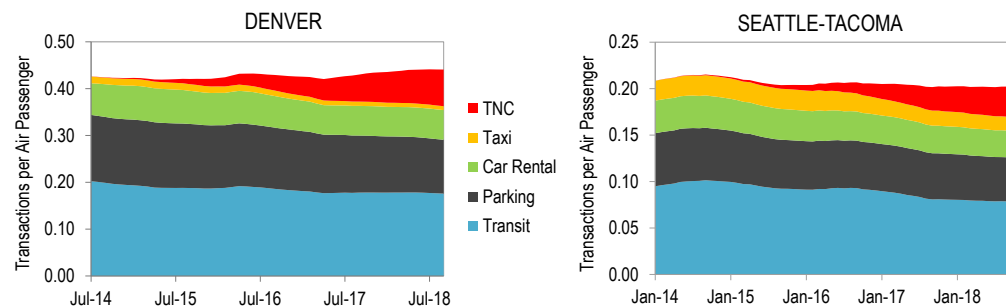


Figure 2. Ground transportation revenue transactions per air passenger at Denver and Seattle-Tacoma airports

Key Findings

- Analysis of mode replacement (Figure 3) indicates that for every 100 new ridehailing transactions to and from DEN, approximately **35% replaced transit, 39% replaced parking (someone driving their personal vehicle to the airport), 16% replaced car rental, and 10% replaced taxis**. Similarly, at SEA, ridehailing replaced transit, parking, car rental, and taxi trips at 27%, 35%, 17%, and 21%, respectively.

Mode (DEN)	Estimate	Pr (> t)	95% C.I.	
transit	-0.3475	< 2e-16 ***	(-0.3610	-0.3340)
parking	-0.3896	< 2e-16 ***	(-0.4031	-0.3761)
car rental	-0.1658	< 2e-16 ***	(-0.1793	-0.1523)
taxi	-0.0971	< 2e-16 ***	(-0.1106	-0.0836)

Mode (SEA)	Estimate	Pr (> t)	95% C.I.	
transit	-0.2714	< 2e-16 ***	(-0.3226	-0.2201)
parking	-0.3483	< 2e-16 ***	(-0.3995	-0.2970)
car rental	-0.1739	9.35E-11 ***	(-0.2251	-0.1226)
taxi	-0.2065	2.75E-14 ***	(-0.2578	-0.1553)

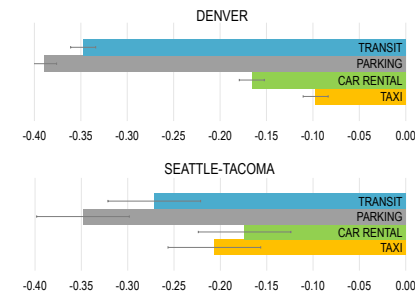


Figure 3. Decreases in other modes due to ridehailing at Denver and Seattle-Tacoma airports

- Analysis of the **independence of irrelevant alternatives (IIA)** property (Table 1) shows that:
 - ✓ Only **car rental passes the IIA property test**
 - ✓ **Transit, parking, and taxi modes are differentially impacted** (statistically significant).

Table 1. Independence of Irrelevant Alternatives Test for Ground Transportation Transactions

ln_mode (DEN)	Estimate	Pr(> t)	ln_mode (SEA)	Estimate	Pr(> t)
reference	-1.0000		reference	-1.0000	
ln_tnc (transit) (ref=-1)	0.2649	2.29E-16 ***	ln_tnc (transit) (ref=-1)	0.3956	7.17E-05 ***
ln_tnc (parking) (ref=-1)	-0.1899	0.0006 ***	ln_tnc (parking) (ref=-1)	-0.2009	0.0424 *
ln_tnc (car rental) (ref=-1)	0.0334	0.5424	ln_tnc (car rental) (ref=-1)	-0.0251	0.7992
ln_tnc (taxi) (ref=-1)	-2.3610	< 2e-16 ***	ln_tnc (taxi) (ref=-1)	-1.1010	< 2e-16 ***

Conclusions

- The first statistical regressions aim to help predict the change in the number of transactions for existing modes after ridehailing uptake. For example, **for every three new ridehailing trips, roughly one parking space may no longer be needed at airports**.
- Differential results for the IIA property suggest that alternative-specific modeling methods, such as multinomial probit models or nested logit models, may be more appropriate.

Future Research

- Continued monitoring of **adoption rates and mode choice transitions**
- Air passenger **surveys** to better understand access and egress at airports
- **Decision support tools** for quantifying mobility, revenue, and energy impacts with various management approaches and infrastructure investments by airports and cities.