Resource Pooling Benefits of Ride-Sharing Services: Quasi-Experimental Evidence from Uber’s Entry in California

Urban planners and policy makers have hailed ride sharing as a potential approach for reducing automobile usage and mitigating traffic concerns. Proponents of ride-sharing argue that the use of ride-sharing services can, at least to some degree, mitigate various driving-related externalities such as emissions, air pollution and safety (Caulfield 2009). A 2005 study estimated that adding one person to every commute trip, in each of the countries in the OECD, would result in a reduction in the total VMT by 12.5% (International Energy Agency 2005). Jacobson and King (2009) estimate that if one additional passenger were added for every ten vehicles in the U.S., the potential savings would be 7.54–7.74 billion gallons of fuel per year. These studies show that ride-sharing programs can generate considerable environmental and social benefits. However, the above studies have mostly relied on analytical models, descriptive data or sensitivity analysis for various scenarios of ride-sharing adoption. As a result, we lack a causal understanding of the impact of ride-sharing services on traffic.

Although primitive forms of ride-sharing (e.g., neighborhood, community and work travel programs) have existed for a long time, they have had limited success. While these programs allowed users to share car-related expenses, they lacked flexibility and efficiencies of scale. In the early 2000s dynamic ride-sharing programs (Agatz et al. 2012) such as PickupPal, GoLoco and Zimride gained popularity. However, more recently mobile-based platforms such as Uber and Lyft have brought ride-sharing in the mainstream, making it a popular mode of transportation in urban areas. Among the existing ride-sharing platforms, Uber is by far, the market leader concerning market valuation (MacMillan and Demos 2015) and penetration (DePillis 2013). By 2016, Uber had entered more than 66 countries and 507 cities worldwide. Recent research has attributed this
success of ride-sharing programs to their online apps that can more efficiently match patrons with drivers (Rayle et al. 2016) compared to traditional ride-sharing programs and taxi services.

Despite their popularity and rapid growth, whether ride-sharing programs such as Uber actually provide social benefits such as improvements in traffic conditions remains questionable. On the one hand, ride-sharing services evidently provide advantages through resource pooling (Agatz et al. 2012) and efficient capacity scheduling (Cachon, Daniels, and Lobel 2017). By pooling the resource (vehicle) across multiple passengers, ride-sharing programs can improve utilization of available vehicle capacity, which can lead to a reduction in the overall VMT. On the other hand, ridesharing may necessitate extra travel to pick up passengers from their locations, which may mitigate the potential benefits from ride-sharing. Furthermore, since ride-sharing may reduce the hassle involved in traveling, we could potentially observe a counterproductive effect (Avci, Girotra, and Netessine 2015). In other words, increased convenience from ride-sharing leads people to increase their trip frequency and length, which may in turn increase the overall VMT. Thus, effectiveness of ride-sharing programs in alleviating traffic concerns depends on the relative magnitudes of these opposite forces. We empirically investigate this trade-off by leveraging a quasi-experimental setup provided by Uber’s rapid growth in California.

Taking advantage of Uber’s staggered entry into various markets in the state of California, we execute a regression-based difference-in-difference design to estimate the potential pooling benefits of ride-sharing services. In particular, we examine the effect of the entry of Uber’s most popular discounted personalized ride-sharing service (Uber X) in various markets (i.e., California counties) on traffic flows. For our main analysis, we use monthly traffic flow data collected from approximately 9,000 vehicle detector station (VDS) units deployed across California’s mainline roads by the California Department of Transportation (CalTrans). We obtain monthly micro data
between January 2010-December 2015 from CalTrans. Our results based on fixed effects models using various demographic controls, seasonal dummies and time dummies, show that Uber entry can generate up to 3%-7% reduction in traffic flows. Using relative time models based on several leads/lags, we also show that the pooling benefits are only seen four-six months after Uber’s entry. Finally, we conduct various robustness checks to alleviate concerns related to endogeneity, serial correlation and sampling. To further bolster our claim regarding the resource pooling benefits of ride-sharing platforms, we conduct additional analysis on fuel consumption in cities across California. The basic idea is that, if Uber does lead to a reduction in traffic, we should see second-order benefits (e.g., reduced fuel consumption). To this end, we obtained longitudinal data from the California Retail Survey to analyze fuel consumption across 269 cities in California. The analysis shows that the pooling benefits generated through ride-sharing also result in a by 5%-7% annual reduction in fuel consumption following Uber’s entry. Together, the findings using monthly micro-level traffic data and city-level fuel consumption data convey a compelling fact – ride-sharing services do provide pooling benefits.

REFERENCES