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Publication Date
2020-12-08

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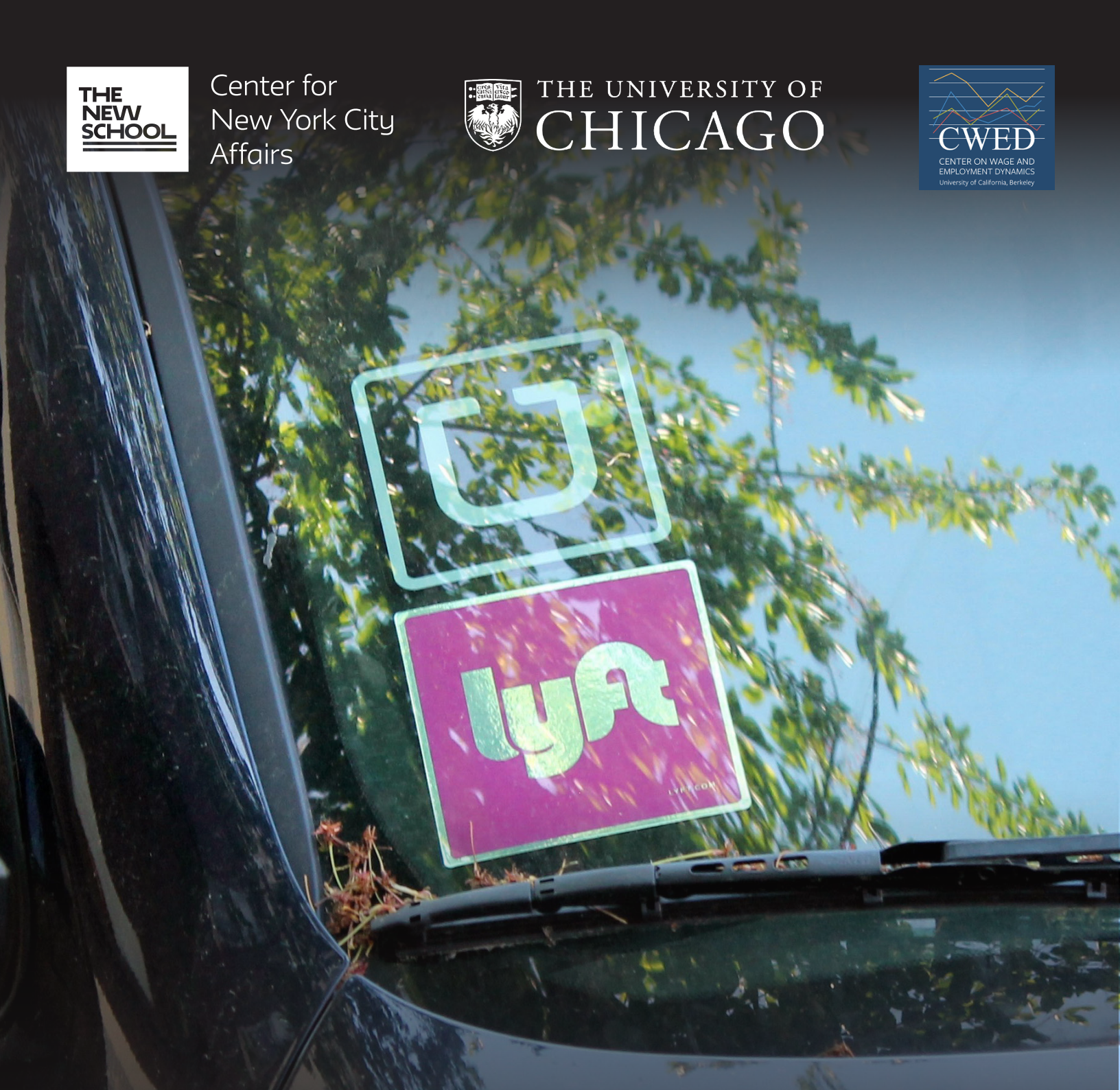

New York City's Gig Driver Pay Standard: Effects on Drivers, Passengers, and the Companies

A report by Dmitri Koustas, James Parrott and Michael Reich

December 2020

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Acknowledgments
This report draws from de-identified data on app-based trips and drivers in New York City, obtained by the authors through a data-sharing agreement with the New York City Taxi and Limousine Commission (TLC), and with support from the Alfred P. Sloan Foundation's New York City Program. We are grateful to the TLC for its cooperation and the Sloan Foundation for its generous support. The TLC has reviewed an advance draft to ensure the protection of confidentiality. Thanks go to Bruce Cory for editorial assistance and to Ana Holschuh for designing the cover. We are grateful to former TLC Commissioner Meera Joshi for her comments. The results in the paper reflect independent analysis by the authors, who alone are responsible for its contents.

Introduction

New York City's minimum driver pay standard, which became effective in February 2019, is intended to protect app-dispatch drivers from being paid less than the equivalent of the city's $15 minimum wage, plus some paid time off.[1] The standard provides a minimum pay for the time spent on a trip and a reimbursement for driving expenses. It is designed to compensate drivers for all their working hours and to account fully for drivers' expenses during all of their working time.

We present here our preliminary research findings concerning the effects of this minimum driver pay standard.[2] We examine the policy's effects on driver pay and hours, passenger fares and company commissions, driver utilization rates, trip length, passenger demand, and passenger waiting time. We also investigate how the effects vary between peak and off-peak demand periods.

The sudden emergence of the Covid-19 pandemic in early 2020 has severely disrupted the app-dispatch transportation industry's economic context. While consumer demand for app-dispatch services plummeted in late March and during April, more recently, New York City trip volume has started to rebound. As of October 2020, app trip volume recovered to about 63 percent of where it was in October of 2019. As the public health crisis moderates, the nature of app services and the dynamics between the companies and the drivers are likely to remain similar to what they were pre-pandemic. The data in the analysis presented here predate the pandemic.

The pay standard is one of several recent public policies affecting the industry. New York City also implemented a cap on the number of app-based vehicles, which became effective in August of 2018. And New York State introduced a $2.75 congestion charge on each app-based trip in Manhattan south of 96th Street. The pay standard took effect on February 1, 2019 and the congestion charge began the following day. As a result, our findings should be interpreted as the "bundled effect" of the policies taken together. In some cases, our methods allow us to

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[1] Using their algorithms as platforms connecting drivers and passengers, Uber, Lyft, and Via each provide transportation services in New York City. Regulators in different jurisdictions have different names for this industry, including transportation network companies (TNCs), ride-sharing services, for-hire vehicles (FHVs) and app-based dispatch services. New York City uses HV(High-Volume)-FHVs to designate this industry; we refer to the industry here as the app-based or app-dispatch services (or app for short). New York City refers to Yellow Taxis as ride-hailing vehicles and maintains a different set of regulations for the taxi industry.

[2] The broader study the authors are undertaking with support from the Alfred P. Sloan Foundation includes examining the effects of the New York City cap on the number of licensed app-dispatch vehicles and of the State-imposed core Manhattan $2.50 (taxis)/$2.75 (app-dispatch vehicles) congestion charge.

distinguish the separate effects of a particular policy. We provide further background on the industry and these policies in Appendix A.

The pay standard provides a floor on pay per trip, not a minimum wage, and it therefore cannot provide a guaranteed increase in hourly or weekly pay. Whether driver pay increased as a result of these policies is an empirical question, as are the effects on trip length, fares, commissions, utilization, passenger wait times, and passenger demand.

Our approach in this paper uses mainly descriptive data from before and after the minimum driver pay policy was implemented, as well as comparisons for a similar period in Chicago, when available.[3] In a forthcoming companion paper, we present our results more formally and technically, using a causal identification strategy that isolates the effects of the driver pay standard from other changes in the industry.

To provide insight on these questions, we examine de-identified data on nearly a half-billion app-based trips in New York City in 2017 to 2019. These data come from the New York City Taxi and Limousine Commission (TLC). The data were provided to the TLC by four main app-based companies: Uber, Lyft, Juno, and Via. Of these, Uber and Lyft accounted for an overwhelming proportion of all rides. Appendix B provides further details on this dataset. The data included geocodes and time stamps for each trip, origin and destination data, fares and driver earnings, as well as data on the drivers and their vehicles. The data allow us to calculate commissions, defined as fares (excluding tolls) minus pay. The richness of these data allows us to summarize trends before and after the pay standard policy was enacted and to account for changes in the composition of trips and drivers that represent behavioral responses to the policy.

We also employ app-based trip data posted on the City of Chicago's Public Data Portal and aggregate data from Seattle.[4] These data allow us to identify changes in the industry that are not related to New York City's pay standard.

To preview our findings: We find a high rate of compliance with the New York City pay standard. Driver pay increased about nine percent, or $1.33 per trip, for an aggregate pay increase of $340 million in 2019. Some of the pay increases were absorbed by the app-dispatch companies through lower effective commission rates. There is some evidence for increased prices and reduced trip volumes, particularly later in 2019. On the other hand, passenger wait times also fell. Our overall results are consistent with robust passenger demand.

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[3] There is also one comparison involving trip volume data from Seattle.

[4] https://data.cityofchicago.org/Transportation/Transportation-Network-Providers-Trips/m6dm-c72p

In order to fully understand these findings, the responses of the companies must also be taken into account. Before the pay standard policy, drivers had spent about 40 percent of their working time between rides. Soon after the policy went into effect, and in response to it, Uber and Lyft both ceased onboarding new drivers; subsequently, they also began to restrict the number of drivers on their apps during low utilization times of the day and week.[5] For this reason, our findings in this paper should be interpreted as a bundled effect of these developments taken together.[6]

Our paper proceeds as follows. First, we describe our data and methods. Second, using the extensive data set provided to us by the New York City TLC, we examine the effects of the minimum driver pay standard on driver pay. Next, we provide preliminary findings on several related issues of interest, including passenger fares and consumer demand, wait times, and some preliminary findings on the effects on labor supply. We then use data from Chicago and Seattle to place some perspective on the trends we observe for New York City over the 2017 to 2019 period. A final section summarizes key findings and discusses additional research needs.

1. Data and methods

Data We utilize anonymized data on nearly 500 million rides in New York City from August 2017 through December 2019 compiled by the New York City TLC from app-dispatch company administrative data. This unique data set allows us to observe driver earnings and activity across all four major platforms: Uber, Lyft, Juno, and Via.[7] We provide more information on the data and our variable construction in the technical appendix.

Methods In this paper we present simple comparisons of changes in our outcomes before and after the implementation of the pay standard. In a companion paper, we develop and use a causal identification strategy that exploits variations in time of the week and routes for which the pay standard is binding from those for which it is not. This research design allows us to distinguish the effects of the policy from other contemporaneous changes.

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[5] See, for instance, Rubinstein, Dana. "Uber and Lyft stop accepting new drivers in New York City." *Politico*. April 29, 2019. Last accessed November 23, 202011/23/2020. Available at: https://www.politico.com/states/new-york/city-hall/story/2019/04/29/uber-and-lyft-have-stopped-accepting-new-drivers-in-new-york-city-993270.

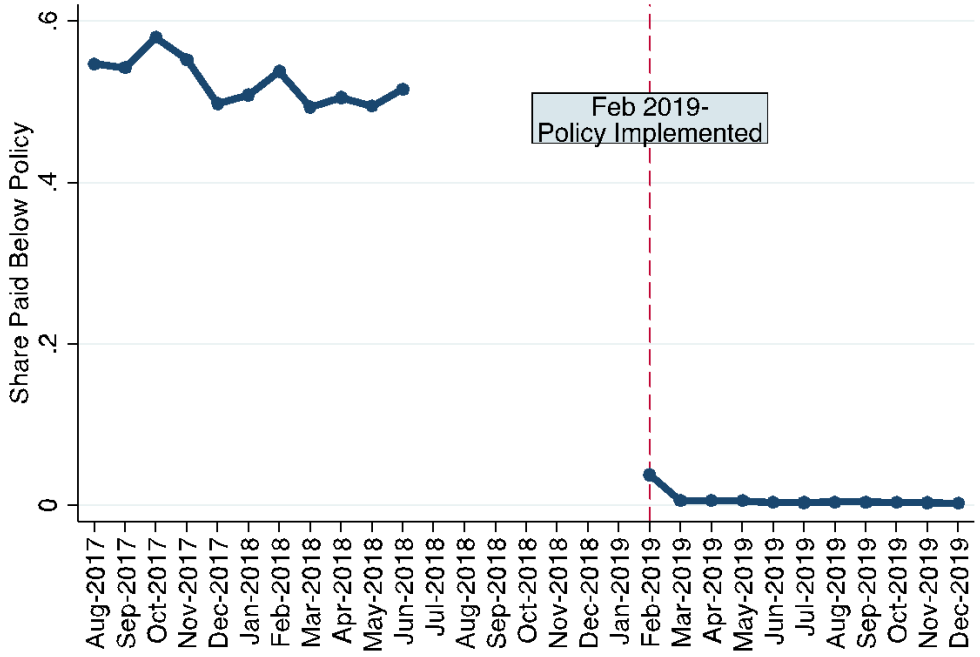
[6] In a forthcoming companion paper, we undertake a more rigorous causal analysis of the effects of the pay standard.

[7] 2018 High-Volume FHV market shares were Uber, 70 percent; Lyft, 18 percent; Juno, 7 percent; and Via, 5 percent. Juno ceased New York City operations in November 2019.

2. Effects on driver pay and hours

Compliance with the pay standard The administrative driver pay data indicate a very high degree of compliance with New York City's minimum pay standard. Exhibit 1 shows that during the pre-policy period from August 2017 through June 2018, close to half of all driver trips occurred during times when the 2019 minimum per trip pay standard was not binding. For the other half of trips during that period, drivers were paid below what would become the minimum pay standard. Ninety-six percent of the trips in the first month (February 2019) after the standard took effect were paid at or above the minimum standard. That percentage improved further to 99 percent in the rest of 2019.

Exhibit 1 Compliance with policy: share of trips paid below the pay standard



Note: Non-shared rides starting and ending in New York City.
Driver pay data are not available for the period from August 2018 through January 2019 since the NYC TLC did not receive driver pay data from the High-Volume FHV companies for that period.

Pay As we have noted, the New York City driver pay standard took effect on February 1, 2019. Exhibit 2 displays average and median gross driver pay per trip, per hour, and per week in June of 2018 and June of 2019. Hourly pay is based on hours a driver is logged into any app in any TLC taxi zone, waiting for a dispatch, on dispatch, or on a trip. We de-duplicate the data and therefore do not double-count the time drivers have multiple apps open.

We compare data from the same month to control for seasonality. June 2019 was the fifth month the pay standard was in effect; data for that month reflect the effects of actions by Uber and Lyft in April 2019 to stop onboarding new drivers. We also show the percent change from one year earlier for February-June 2019 in Appendix C and find similar results across other months.

As the first row of Exhibit 2 shows, gross (before expenses) driver pay per trip averaged $14.87 in June 2018, while median gross driver pay per trip was only $10.91. This large difference between average and median pay per trip reflects substantial heterogeneity in the length of trips —such as a short trip within midtown Manhattan compared to a much a longer trip from Manhattan to JFK Airport.

Average pay increased by $1.33 per trip, or 8.9 percent, to $16.20 by June 2019, after the policy was in place. Median pay per trip increased by 3.5 percent after the policy. This smaller increase in median pay per trip compared to average pay per trip suggests a decline in the percentage of trips that paid less than the median. We will return to this question below, when we compare pay during peak and off-peak hours.

Exhibit 2 Pre- and post-policy driver average gross trips, hourly pay, and weekly pay
(medians in parentheses)

	June 2018 (pre-policy)	June 2019 (post-policy)	% Difference
	mean (median)		
Gross driver pay per trip	$14.87 ($10.91)	$16.20 ($11.29)	8.9 (3.5)
Gross hourly pay (excl. tips) *	$28.27 ($28.15)	$30.75 ($30.49)	8.8 (8.3)
Gross weekly pay *	$918.49 ($894.70)	$993.83 ($975.86)	8.2 (9.1)

Note: *Drivers with app on at least one hour during the week and completing at least two trips. See technical appendix for variable definitions.

The second row of Exhibit 2 displays average and median gross hourly pay (excluding tips). Average gross hourly pay increased from $28.27 in June 2018 to $30.75 in June 2019, an increase of 8.8 percent. Note that average and median pay per hour are virtually identical both before and after the pay standard. The pay per hour metric takes into account the differences in trip times that affect the first row.

Row 3 of Exhibit 2 displays gross weekly pay. This metric is affected by changes in weekly hours. Average weekly pay grew by 8.2 percent, while median weekly pay grew by 9.1 percent. These patterns suggest that full-time drivers may have reduced their hours somewhat, while part-time drivers increased their hours.

Driver pay during peak and off-peak hours As we have already suggested, driver pay per trip did not increase uniformly across the hours of the week. Exhibit 3 shows that average pay per trip rose 15.4 percent between June 2018 and June 2019 during weekday off-peak hours (10am to 4pm), a greater increase than in any other time block. Pay per trip had been lowest during off-peak hours; hence, the pay standard had the biggest impact (was more binding) on pay per trip during this time block.

Exhibit 3 Driver pay per trip, by peak and off-peak periods

	June 2018 (pre-policy)	June 2019 (post-policy)	% Difference
	mean (median)		
Weekday Peak	$14.97 ($10.98)	$16.51 ($11.38)	10.3 (3.6)
Weekday Off Peak	$15.02 ($10.70)	$17.33 ($11.68)	15.4 (9.2)
Weekend Nights Peak	$15.20 ($11.28)	$16.25 ($11.63)	6.9 (3.1)
Night and Weekend Off Peak	$14.70 ($10.89)	$15.58 ($11.02)	6.0 (1.2)

Weekday Peak: 6-10am, 4-8pm, M-F
Weekday Off-Peak: 10am-4pm, M-F
Weekend Nights Peak: 9pm-12am, Th-Sa
Night and Weekend Off Peak: all other times

Weekly hours and driver utilization Exhibit 4 provides data on driver hours. Nearly three-fourths of New York City app-based drivers work 20 hours or more per week. The median driver worked around 32 hours per week, the full-time benchmark in low-wage service industries. Mean weekly hours increased by 0.31 of an hour, or 1.0 percent from June 2018 to June 2019.[8]

Exhibit 4 also presents summary data on driver utilization – the percentage of time drivers have a passenger in their vehicle. Driver utilization increased by about 2.0 percent between June of 2018 and June 2019. (Appendix C.2 shows that utilization was lower in February 2019 from the previous year, but increased in subsequent months, exceeding levels from one year earlier.)

[8] In June 2019, full-time drivers (32 or more hours per week) provided 70.7 percent of all trips.

The New York City TLC included utilization in its pay standard formula to incentivize the companies to increase driver utilization. The intent was to have company-specific pay formulae and adjust the utilization component every six months. To date, the TLC has been using an industry-wide utilization measure. Still, companies may be "managing" labor supply to keep utilization high.

Exhibit 4 Pre- and post-policy driver average hours

	June 2018 (pre-policy)	June 2019 (post-policy)	% Difference
	mean (median)		
Weekly hours active on any a	32.41 (31.88)	32.72 (32.30)	1.0 (1.3)
20 hours/week or more	72.4%	73.9%	2.1
32 hours/week or more	49.7%	50.6%	1.8
Driver utilization	54.80% (55.90%)	55.90% (56.60%)	2.0 (1.3)

Note: Drivers with app on at least one hour during the week and completing at least two trips. See technical appendix for variable definitions.

In Exhibit 5 we show how utilization changed during peak and off-peak hours. Recall that we find the largest increases in pay per trip for weekday off-peak trips. Despite the substantial increase in pay per trip, utilization remained approximately the same or higher than it was one year earlier. This finding implies that the increase in pay per trip translated into increases in hourly wages across all routes.

Taking into account both changes in driver pay per hour and driver hours, we estimate that aggregate driver pay increased $340 million in 2019 because of the pay standard. This calculation is based on a per trip increase of $1.33 multiplied by the 255.8 million total number of trips provided in 2019.[9]

Exhibit 5 Total driver utilization by time block

	June 2018 (pre-policy)	June 2019 (post-policy)	% Difference
	mean		
Weekday Peak	57.8%	58.8%	1.8
Weekday Off Peak	53.6%	53.6%	0.0
Weekend Nights Peak	56.1%	56.6%	0.9
Night and Weekend Off Peak	54.8%	55.6%	1.5

[9] This estimate assumes no change in annual trip volume. The estimated number of annual trips for 2019 was based on daily averages by month from the aggregated monthly data reports available on the TLC website.

These descriptive results on pay and hours are derived from means and medians for all trip observations in our data set. In Exhibit 6, we report regression-adjusted results holding constant driver and trip characteristics.

3. Effects on passengers

Passenger fares Exhibit 6 shows base fares, defined as fares less tolls or other fees. Base fares were 5.9 percent higher in June 2019 than in June 2018. Fares were lower in February and March of 2019 in the weeks before Uber and Lyft filed their S-1 statements with the Securities and Exchange Commission ahead of each company's Initial Public Offering (IPO).[10] In our forthcoming paper we show that fares rose relatively more for routes most affected by the pay standard. (See, also, Exhibit 11 below for a comparison of Chicago and New York City fares.)

Passenger wait times Uber and Lyft compete in part by keeping passenger wait times low. In June of 2018, average New York City passenger wait times were 5.82 minutes. As Exhibit 6 shows, wait times fell by a minute, to 4.79 minutes in June 2019, compared to a year earlier (a decline of 17.6 percent).

Exhibit 6 New York City pre- and post-policy passenger base fares and wait times

	June 2018 (pre-policy)	June 2019 (post-policy)	% Difference
	mean (median)		
Base passenger fare	$17.49 ($12.31)	$18.53 ($12.98)	5.9 (5.4)
Passenger wait time (minutes	5.82 (5.10)	4.79 (4.07)	-17.6 (-20.3)

Regression Estimates at the Route and Driver Level Exhibit 6 shows the estimated changes for key outcomes, using standard multiple regression techniques to estimate changes for the *same routes* and the *same drivers.* We find the increase in hours and weekly pay for the same driver is somewhat lower than what we observe above, suggesting that new entrants may be driving the increase in hours. Otherwise, our results are generally similar to our findings in Exhibits 2 and 3. These results indicate that the descriptive changes we observe are not affected by changing compositions of routes or drivers.

[10] Lyft released its S-1 SEC filing on March 1, 2019 and issued its IPO on March 29, 2019. Uber filed its S-1 statement on April 11, 2019 and issued its IPO on May 9, 2019.

Exhibit 7 Change from one year ago

(log points times 100 is approximately a percent change) *

Change from 1 Year Ago, Log points	June 2019	
	Same Route	Same Driver
Base Passenger Fare	0.10	0.07
Gross Driver Pay Per Trip	0.12	0.09
Gross Hourly Pay		0.04
Weekly Hours		0.00
Weekly Pay		0.03

* Since the number of observations is extremely large, all standard errors clustered on drivers are 0.00.
Note: Estimates from separate fixed-effects regressions. The dependent variable is the log value of the outcome specified in each row. "Same route" is a regression of the specified outcome on a post policy indicator and includes fixed effects for hour by day-day of week-pickup zone drop-off zone interactions, as well as controls for trip time and distance. "Same driver" is a regression of the specified outcome on a post-policy indicator and includes driver fixed effects.

4. Effects on the companies

In this section we draw from gig driver trip data on Chicago and Seattle. Chicago does not have a driver pay standard nor any cap on the number of app-dispatch vehicles. But it has made public a considerable amount of app-dispatch trip data. These data provide informative comparisons to place our New York City pre- and post-policy results in perspective. Information on Chicago trips is publicly available since 2015, and information on passenger fares, trip times, and distance data is available since November 2018. The City of Seattle also compiles data on the number of app-dispatch trips, on a quarterly basis. In this section we use data from Chicago and Seattle to compare trends in the overall number of trips, in the number of shared trips, and in passenger fares.

Growth in trip volume Exhibit 8 compares trends in trip volumes in New York City, Chicago, and Seattle, before and after the implementation of New York City's driver pay standard, and in the wake of the mid-August 2018 vehicle cap. The relative flatness in Chicago's trip volume in late 2018 and during 2019 suggests market saturation that could also have affected the trend in New York City. The Seattle trip volume growth also shows a slowing trend.

Exhibit 8 New York City, Chicago and Seattle trip volumes, 2018 and 2019

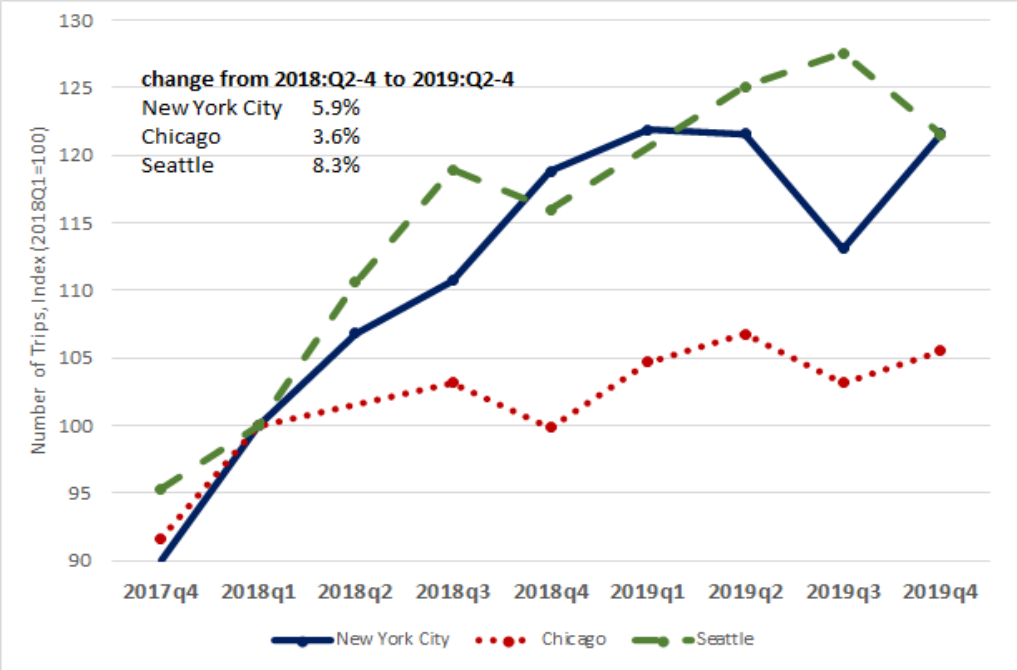
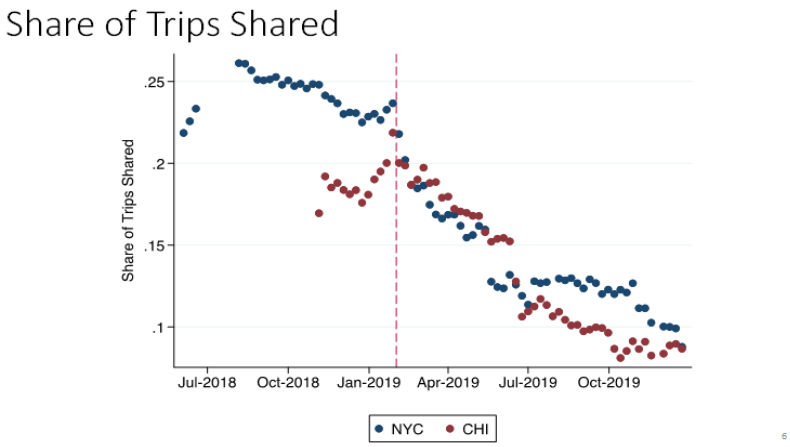


Exhibit 8 also displays changes in trip volumes during the first three full quarters in 2019 following the implementation of New York City's pay standard (quarters 2-4), compared to the same period in 2018. In this period, trip volumes rose 5.9 percent in New York City, 3.6 percent in Chicago and 8.3 percent in Seattle. Growth in the number of trips slowed in all three cities. The overall slowdown in New York City was smaller than Chicago's and about the same as Seattle's. These comparisons suggest that factors other than the pay standard, the congestion fee, or the vehicle cap played a larger role in the slowing of the relatively rapid market growth of the period from 2015 to 2018. Of course, the greater growth of trips in New York City and Seattle compared to Chicago could reflect differences in underlying economic conditions in each city. They could also reflect changes in business policies, such as for shared rides, that were implemented in one city but not another.

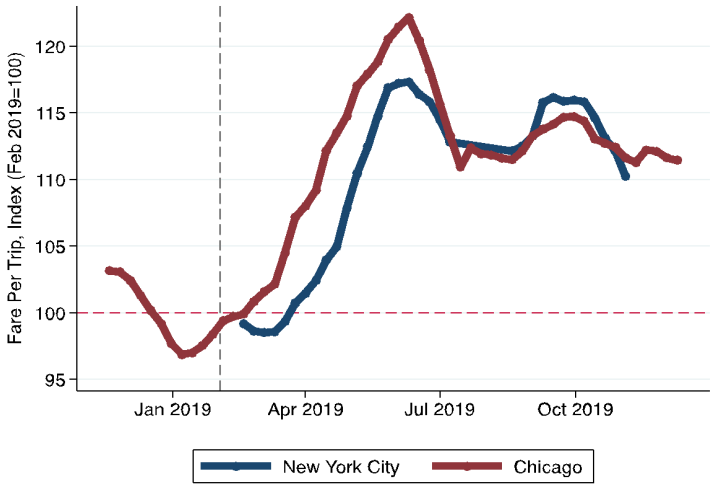
Shared trips We turn next to examining shared trips in New York City and Chicago. Shared trips consist of those with two or more paying passengers, often with different destinations. Exhibit 9 presents trends in the proportion of trips that are shared trips in New York City and Chicago. The relative decline of shared rides in New York City that began in early 2019 around the time of the pay standard is very similar to the relative decline in shared rides in Chicago. These common patterns suggest that other forces may have caused these declines, rather than New York City's pay standard.

Exhibit 9 New York City and Chicago proportion shared trips, 2018-2019



Passenger fares In a previous section, we found that fares increased year over year in June 2019 by 5.9 percent in New York City. An increase of this amount is consistent with the analysis in Parrott and Reich (2018), which predicted that fares would increase about 5 percent. Exhibit 10 takes another look at passenger fares, showing trends in average passenger fares in New York City and Chicago. In the first half of 2019, fares rose in New York City, but they also rose in Chicago. Fares in both cities then declined until July 2019 and then followed very similar patterns thereafter. These common patterns suggest much of the observed fare increases in New York City may represent other factors such as seasonality or even corporate decisions around the time of the Uber and Lyft IPOs in the spring of 2019, and not the effects of the driver pay standard or the vehicle cap. At the aggregate level, it is not obvious that the 5.9 percent increase in fares in New York City is due to New York City-specific policies, although in our forthcoming paper we show that fares rose relatively more for routes most affected by the pay standard.

Exhibit 10 New York City and Chicago trip fares, 2018-2019



Note: 5-week moving average. New York City passenger fare data not available August 2018-January 2019.

Company commission rates Exhibit 11 shows company commission rates – which are the difference between base passenger fare and driver pay per trip, expressed as a percent of base passenger fare – in June 2018 and June 2019. Averaging over the four time blocks in the exhibit, commission rates declined from 15 percent in June 2018 to 12.5 percent in June 2019.[11] This decline indicates that a part of the increase in driver costs created by the minimum pay standard was absorbed through a 16.7 percent reduction in company commission rates.

Commission rates fell the most during the weekday off-peak time period, as Exhibit 8 shows. Thus, prices increased less on these routes than driver pay.

Exhibit 11 Company commission rates by time block

	Commissions *		
	June 2018 (pre-policy)	June 2019 (post-policy)	% Difference
	mean		
Weekday Peak	13.5%	11.7%	-12.9%
Weekday Off Peak	14.6%	11.5%	-21.1%
Weekend Nights Peak	16.2%	13.4%	-17.1%
Night and Weekend Off Peak	15.7%	13.3%	-15.4%

** commissions = (base passenger fare - driver pay per trip) / base passenger fare*

[11] Parrott and Reich (2018) report that commissions rates in 2018 were 16.8 percent. Our estimate here of 15 percent reflects additional data for 2018.

5. Discussion

New York City provides a unique laboratory to study the app-based for-hire vehicle industry and to assess how well the City's new policies regarding it have fared. New York's policy actions constitute the most far-reaching regulatory measures applied to the app-dispatched car service sector in the U.S. No other city collects such comprehensive data on the industry as a whole, linking drivers across multiple app-dispatching platforms and even to the traditional taxi sector. Most other studies of the industry use data from one particular platform and so are able only to follow driver activity on the particular app.[12] Thus, Uber and Lyft each maintain that most of their drivers work only part-time schedules. But many drivers are "multi-app-ing,"driving for both companies. Our data permit us to observe the hours they work for both companies and the pay they receive.

We present descriptive evidence regarding the effects of New York City's first-in-the-nation app-dispatch driver pay standard. We examine trends before and after the implementation of the pay policy and we compare those trends with data from Chicago (and Seattle for trip volume), cities that did not regulate driver pay during the 2018-2019 period examined here.[13] This approach cannot isolate the causal effect of the pay standard from other simultaneous changes; we take up a causal analysis in our forthcoming companion paper.

We have also obtained, but not presented here, preliminary estimates of the price elasticity of demand for app-based services in New York City. We find that the elasticity of demand varies in a predictable manner with a neighborhood's income and with the availability of mass transit in the neighborhood. Our overall results thus indicate that passenger demand is relatively inelastic with respect to price. This result is consistent with other studies of demand elasticities in other cities.[14] When consumer demand is inelastic, a key result from economic theory finds that cost increases due to regulation are largely passed on to consumers.

In a related companion paper (in progress), we further distinguish the pattern of trips for which the pay standard was binding – generally those in off-peak travel hours – and those for which it was not, and we use these differences to identify the causal effects of the policy. We also

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[12] A recent exception is Louis Hyman, Erica Groshen, Adam Litwin, Martin Wells, and Kwelina Thompson 2020. "Platform Driving in Seattle." Institute for Workplace Studies, ILR School Cornell University.

[13] The City of Seattle recently adopted a minimum pay standard for app-dispatch drivers that will take effect on January 1, 2021.

[14] Hall, Jonathan, John Horton and Daniel Knoepfle 2020. "Ride-Sharing Markets Re-Equilibrate." https://john-joseph-horton.com/papers/uber_price.pdf

compare trends across a large number of geographic zones in the city, which we use to distinguish the effects of the pay standard from the Manhattan congestion charge.

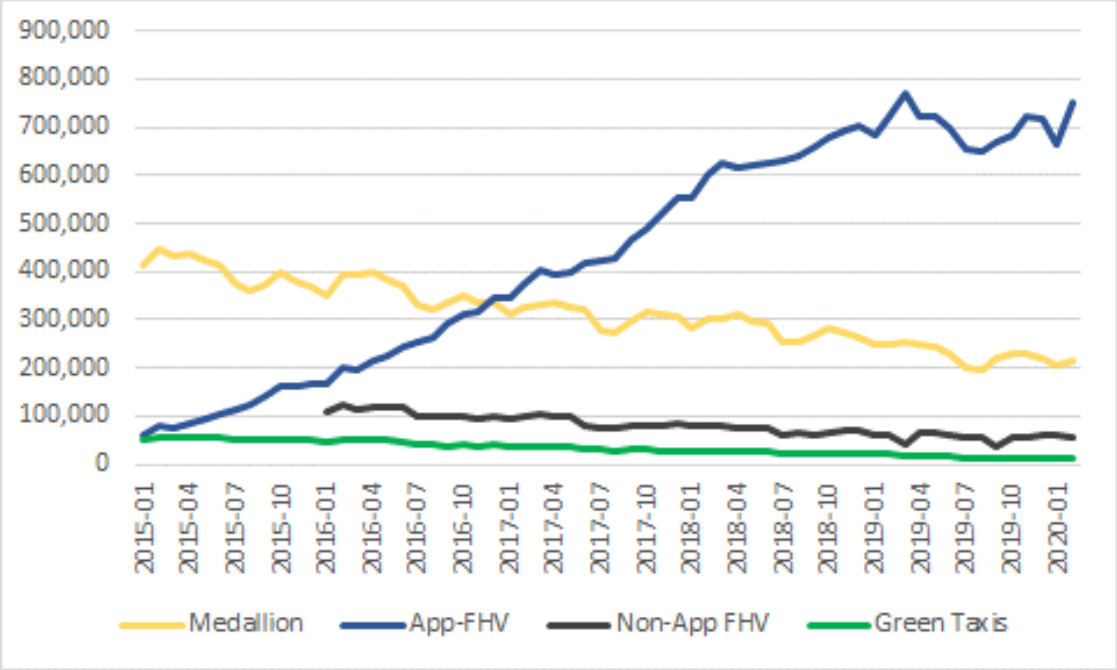
While passenger fares rose after a several month period in tandem with driver pay, passenger fares also rose by a similar amount in Chicago – in the absence of a pay standard. The observed raw fare increases in New York City may therefore not all be due to the result of the pay standard. At the same time, since prices increased, but trip volumes did not, company revenues increased.

Our findings here are consistent with a conclusion that New York City's driver pay standard achieved its main objectives. The standard raised driver pay, without significantly dampening growth in trip volume, beyond what might be expected in a maturing market. Moreover, passenger wait times declined significantly.

Appendix A The app-based transportation industry and New York City's regulatory landscape

Urban transportation markets in the U.S., and in New York City in particular, have changed dramatically in recent years. As Exhibit A shows, from early 2015 through February 2020 average daily trips of app-dispatch high-volume for-hire vehicles in New York City rose more than 600,000, while the number of taxi medallion trips declined by half. Before the coronavirus pandemic began in early 2020, the combined number of medallion taxi and app trips was nearly one million per day, about twice the level it had been five years earlier.[15]

Exhibit A Average daily New York City trips, January 2015-February 2020



Source: TLC data through February 2020.

Of course, the sudden emergence of the Covid-19 pandemic in early 2020 has severely disrupted the industry's economic context. While consumer demand for app-dispatch services plummeted in late March and during April, more recently, New York City trip volume has started to rebound.

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[15] Using their algorithms as platforms connecting drivers and passengers, Uber, Lyft, and Via each provide transportation services in New York City. Regulators in different jurisdictions have different names for this industry, including transportation network companies (TNCs), ride-sharing services, for-hire vehicles (FHVs) and app-based dispatch services. New York City uses HV(High-Volume)-FHVs to designate this industry; we refer to the industry here as the app-based or app-dispatch services (or app for short). New York City refers to Yellow Taxis as ride-hailing vehicles and maintains a different set of regulations for this industry.

As of October 2020, app trip volume recovered to about 63 percent of where it was in October of 2019.[16] As the public health crisis moderates, the nature of app services and the dynamics between the companies and the drivers are likely to remain similar to what they were pre-pandemic.

The rapid growth of the app-dispatch industry represents a triumph of technology, expanding service and convenience to millions of riders. However, it also generated immense problems for the city's transportation system and for the gig-based drivers the industry relies on. Pre-pandemic, medallion taxis had fallen from just under half to just over one-quarter of all trips, while the app-dispatched share jumped from one-third to nearly two-thirds. These changes reach beyond the market structure of the taxi industry, affecting demand for buses and subways as well as earnings and employment status of app and medallion drivers, and in labor markets more broadly. In addition, the dramatic increase in vehicle miles traveled in New York City is linked to increased traffic volume, greater congestion, and much higher rates of greenhouse gas emissions.[17]

The rapid growth in the 2010s in the gig economy was dominated by the transportation sector, with most of that growth occurring among app-dispatch drivers. Researchers at the JPMorgan Chase Institute found that transportation platforms have dominated the gig economy, in both numbers of participants and total transaction volume.[18]

Policymakers and regulators across the U.S. are struggling to respond to these new challenges. New York City has been in the vanguard, both in obtaining data from the app-dispatch companies and in evolving effective regulatory policies. New York City was the first city to require detailed reporting on trips and driver earnings by the major app-based companies, in line with existing reporting requirements for the traditional taxi industry. New York City regulatory reforms include a minimum driver pay standard, and a cap on new app-dispatched vehicles. New

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[16] April 2020 was the pandemic low-point for monthly trip volume for both New York City app-dispatch services and for medallion taxi service. For the app services, trip volume was about 20 percent in April of 2020 compared to April 2019, while for medallion taxis, April trip volume was only three percent of what it was in April 2019. By October, medallion trip volume had recovered to 23 percent of the year before. The slower rebound for core Manhattan-centric medallion service is largely related to the combined weaknesses stemming from the near-total shutdown of tourism and performing arts and a million fewer office workers.

[17] Average weekday travel speeds in Midtown Manhattan slowed to 4.3 mph in November 2018, compared to 6.1 mph in November 2010. Greenhouse gas emission related to taxi and FHV travel in New York City increased over 50 percent from 2013 to 2018 (NYC TLC and DOT, 2019).

[18] Diana Farrell, Fiona Greig and Amar Hamoudi, "The Online Platform Economy in 2018: Drivers, Workers, Sellers, and Lessors." JPMorgan Chase Institute, 2018.

York State has in addition added a congestion-related charge for every taxi and for-hire vehicle (FHV) trip in the core Manhattan business district.

Appendix B Technical Appendix

The TLC's de-identified raw data varied in both format and coverage over time. The data were mostly complete from the period July 2017 to June 2018, and again from February 2019 to December 2019. Trip information, but not driver pay or fare data, was available for the period from August 2018 through January 2019.

Our first step processed and harmonized variables across separate files and reporting periods. We then constructed a number of derived variables. After sorting trips by driver and platform, we created a consistent identifier for shared ride segments over time, inferred based on drop-off and pickup times. After the pay standard was implemented, one of the companies separately reported pay for shared ride segments as a whole. We assign the pay for these trips to trip segments proportionally, based on the time the passenger is in the vehicle. We define P3 as total time with at least one passenger in the vehicle. For shared trips, P3 is calculated starting from the first pickup and ending with the last drop-off.

In our main analysis, we exclude Via since most drivers for Via are paid on an hourly basis. Weeks are defined as starting on a Monday and ending on a Sunday. We map weeks to months as follows. (Note: the same number of days of the week are in our definition of a "month.")

	Date range	
Month	**2018**	**2019**
February	2/5/2018-3/4/2018	2/4/2019-3/3/2019
March	3/5/2018-4/1/2018	3/4/2019-3/31/2019
April	4/2/2018-4/29/2018	4/1/2019-4/28/2019
May	4/30/2018-5/27/2018	4/29/2019-5/26/2019
June	5/28/2018-6/24/2018	5/27/2019-6/23/2019

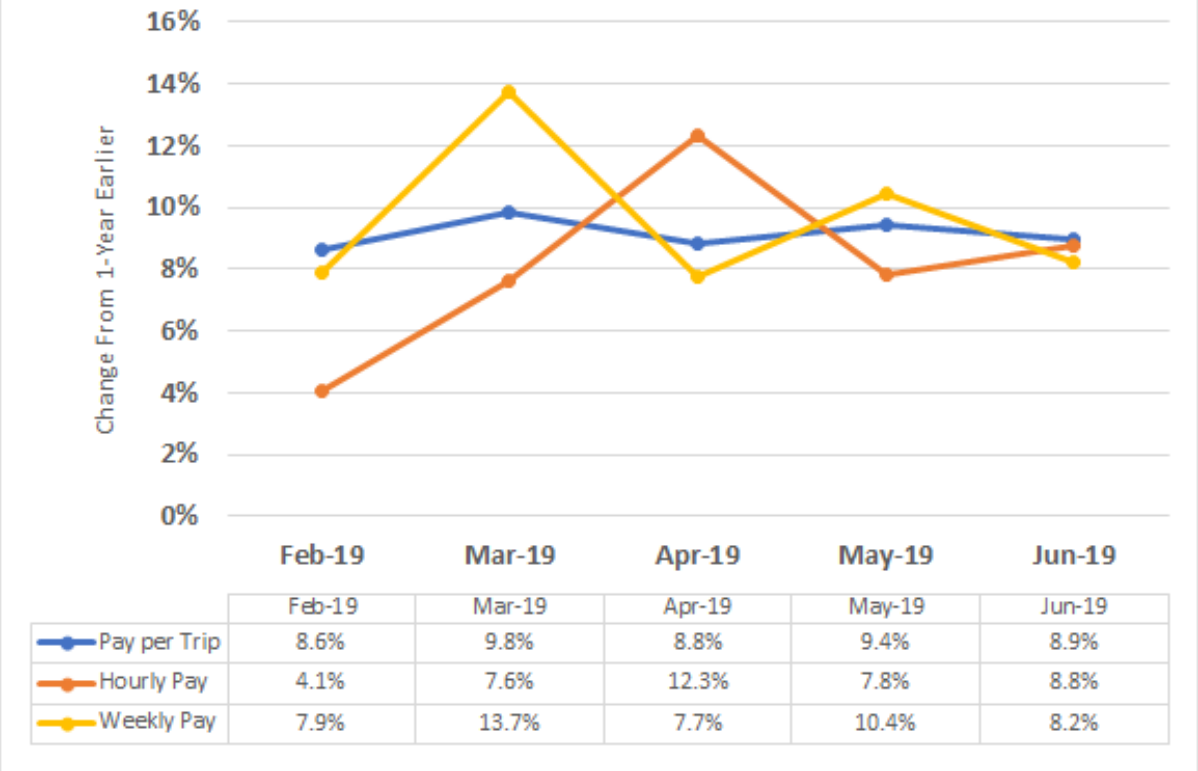
To calculate per trip means and medians, we read in our cleaned and processed data at the trip-level, restrict the sample to months as defined above, winsorize values at the one percent level to reduce the influence of outliers, and calculate the mean and median.

To calculate weekly pay, weekly hours, hourly pay and utilization, we first aggregate the data to driver-by-week. We restrict to driver-weeks having a least one hour of recorded session time and at least two trips during the course of the week. We define the hourly wage as total weekly pay divided by total hours the app is on. We define utilization as P3 divided by total hours the app is

on. For all variables, we winsorize at the one percent level to remove the influence of outliers and calculate the mean and median.

Appendix C Results for February to June 2019, compared to one year earlier

Exhibit C1 Percent Changes from One Year Earlier, February to June 2019



	Feb-19	Mar-19	Apr-19	May-19	Jun-19
Pay per Trip	8.6%	9.8%	8.8%	9.4%	8.9%
Hourly Pay	4.1%	7.6%	12.3%	7.8%	8.8%
Weekly Pay	7.9%	13.7%	7.7%	10.4%	8.2%

Figure shows percent change from one year earlier, for the indicated outcome and month.

Appendix C

Exhibit C2 Market Utilization, Feb-June 2018 v. 2019

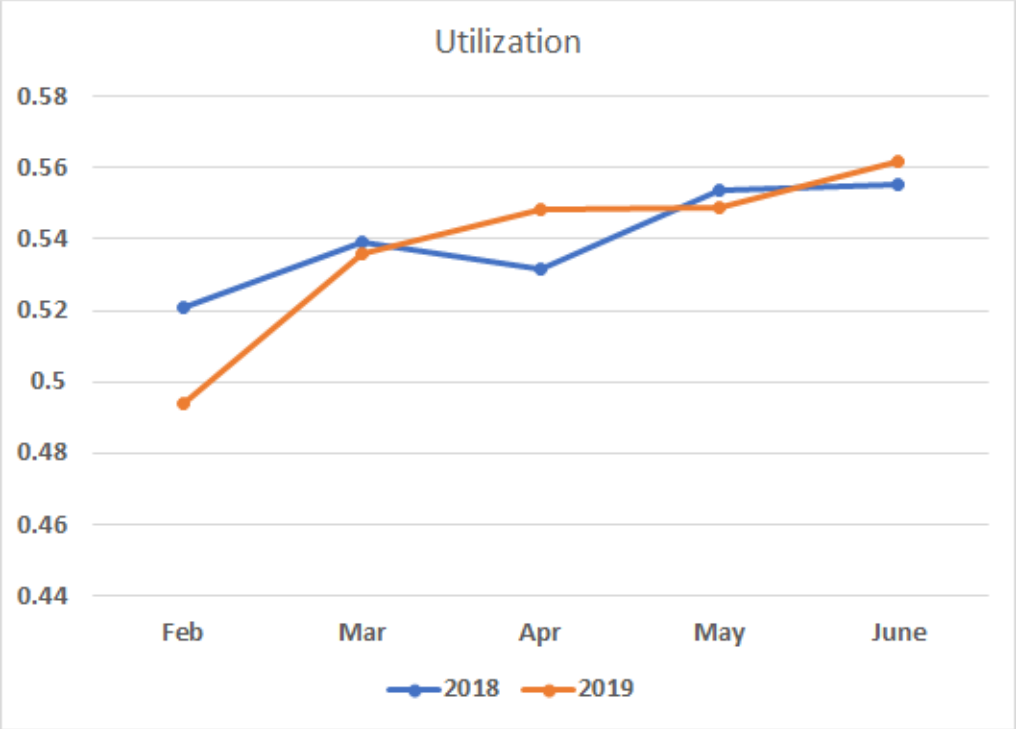


Figure shows overall market utilization, defined as total time with passengers (P3), divided by total hours active on any app, for the indicated time period. Via, which has much-higher driver utilization and a slightly different business model than Uber or Lyft, is excluded from the utilization measure presented in this chart.