

An Earnings Standard for New York City's App-based Drivers: Economic Analysis and Policy Assessment



James A. Parrott and Michael Reich

Report for the New York City Taxi and Limousine Commission

July 2018

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Dr. Parrott, Economic and Fiscal Policy Director of the Center for New York City Affairs at the New School, has previously worked as chief economist for the City of New York, the State Comptroller's office, and the Fiscal Policy Institute. He has extensively studied and written about New York City economic and labor market developments for over 25 years. He received his Ph.D. in economics from the University of Massachusetts at Amherst.

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Dr. Reich, Professor of Economics and Chair of the Center on Wage and Employment Dynamics at the University of California, Berkeley, has published 17 books and monographs and has authored over 130 papers. His recent work has focused on the effects of federal, state and citywide minimum wages. A product of New York City's public schools, Reich obtained his Ph.D. in Economics from Harvard University.

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Center for New York City Affairs
72 Fifth Avenue, 6th Floor
New York, NY 10011
212.229.5418
centernyc@newschool.edu
www.centernyc.org

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We provide the first detailed analysis of the app-based transportation industry in a large metropolis. Concerned about reports of low earnings (after costs) among drivers working for the large app-based for-hire vehicle (FHV) companies, the New York City Taxi and Limousine Commission (TLC) wishes to establish a minimum driver pay standard. The policy would set an earnings floor of \$17.22, the independent contractor equivalent of a \$15 hourly wage, with an allowance for paid time off. We examine the need for and likely effects of the TLC's proposed policy. Our analysis draws mainly upon administrative data collected from all the companies by the TLC, and we develop a model to simulate the effects of the policy. We find that a majority of the city's FHV drivers work full-time and that 85 percent make less than the proposed pay standard. Hourly pay is low in large part because the industry depends upon a ready availability of idle drivers to minimize passenger wait times. The proposed policy would increase driver net earnings (after expenses) by 22.5 percent, or an average of \$6,345 per year among the 85 percent of drivers who would get increases. At the same time, company commissions in the city generate very large mark-ups over local operating costs. The policy could be fully paid for by combining an increase of 2.4 minutes in driver trips with passengers per working hour with reductions in company commissions. Fare increases would then be small (five percent or less) and average wait times for passengers would increase by about 12 to 15 seconds. The policy would reward drivers for pooled rides, which would increase as a share of all rides. The policy would substantially reduce growth in the number of new drivers and vehicles and provide some indirect benefits for medallion drivers.

*James A. Parrott, Ph.D. Director, Economic and Fiscal Policy, Center for New York City Affairs, The New School, parrottj@newschool.edu. ** Michael Reich, Ph.D. Professor, University of California, Berkeley and Chair, Center on Wage and Employment Dynamics, UC Berkeley, mreich@econ.berkeley.edu. We are particularly grateful to Commissioner Meera Joshi, and Dawn Miller, Bill Heinzen, Fausto Lopez, Rodney Stiles, and Celine Zakaryan of the TLC staff for invaluable assistance, to Xingxing Yang, Jason Rochford, Qasim Abbas, and Angela Butel for research assistance, to Bruce Cory for editorial assistance, to Milan Gary for designing the cover, to Kamille Vargas and Kristin Morse for general support, and to Eileen Appelbaum, Annette Bernhardt, Juan Camillo Castillo, David Howell, Lawrence Mishel, Carl Nadler, Elliott Sclar, David Weil, Glenn Weyl, and Stephen Zoepf for helpful advice, discussions and reviews. This report was prepared under contracts with the TLC, with additional support from The New School and the University of California, Berkeley. The authors provided technical assistance to the TLC on the likely consequences of alternative policies. TLC members and staff have reviewed this document for accuracy. The report itself is solely the product of the authors, who do not have any financial interests in the FHV industry.

Contents

Preface	3
Section 1 Introduction and Overview	6
Section 2 The Drivers: Demographics, Hours, Expenses and Pay	15
Section 3 The TLC's Proposed Driver Pay Standard	34
Section 4 The App-Based Industry's Business Model	40
Section 5 How Drivers, Companies and Consumers will Adjust	53
Section 6 Effects on Non-App For-Hire-Vehicle Services	63
Section 7 Effects of the Pay Standard on New York City's Economy	69
Section 8 Summary and Conclusions	74
References	77
Appendix Methodology for Driver Earnings Analysis	80
Glossary	84

Preface and Key Findings

This report addresses a critical public policy challenge facing the City of New York—the low pay of app-based drivers. In this preface, we outline our charge from the City's Taxi and Limousine Commission (TLC) concerning a minimum pay standard for these drivers, we summarize our policy design discussions, and we present the key findings that we detail in this report.

Our charge

At the outset, the TLC pointed to the growth in the number of app-based for-hire-vehicles (FHV) and drivers and suggested a possible link to downward pressure on driver earnings. In response, the TLC drafted a policy to ensure minimum earnings for drivers of for-hire vehicles. Drivers would receive a minimum payment per mile and per minute spent transporting passengers. FHV bases would be required to ensure that drivers to whom they dispatch trips do not fall below these minimums over a set period of time. The TLC asked us to evaluate and provide feedback on a proposed policy and to analyze the likely effects. We discussed four policy design questions with the TLC, including how to overcome the reduction of driver trips per hour that might occur if drivers increase their hours in response to increases in driver compensation per trip.

Four policy design questions

The first question for the policy design concerned the level of the pay standard. The prevailing app-based business model in New York City relies on drivers bearing responsibility for all vehicle capital and operating costs. The proposed minimum pay standard is designed to cover the drivers' expenses and still provide the independent contractor equivalent of \$15 an hour. Currently, pay for most drivers does not meet this standard.

The second policy design question concerned the needs of the many drivers who already work long hours. A common understanding is that app drivers work on a flexible and part-time basis—to supplement their pay from another job by using their otherwise idle cars. That profile does not fit the driver workforce in New York City (and probably not in other dense world-class cities, such as London, Paris, and San Francisco). Paying for a vehicle entirely by driving for hire, as over two-thirds of New York City's app drivers try to do, is only possible by working full-time. For the 60 percent-plus of all New York City drivers who are full-time drivers—and who provide 80 percent of all rides—work hours are not flexible. Driving is demanding work; drivers' needs, and safe streets, require some paid time off. Consequently, the standard also includes a modest paid time-off supplement.

The third policy design question involved how to prevent the companies from reducing the drivers' per hour compensation. The app business model relies upon very short wait times for passengers requesting rides, which in turn depends on a large supply of available but idle drivers and vehicles. In this model, a pay increase could be counter-productive because it would encourage part-time drivers to work more hours, which would reduce average driver utilization and reduce pay per hour worked.

Our early policy design discussions with the TLC thus focused on the need for mechanisms to maintain and increase driver utilization rates. Our subsequent analysis suggested that including the utilization rate in the pay standard formula could substantially benefit the drivers and increase driver pay in a sustainable manner. This mechanism would thus better align the interests of the companies with the interests of the drivers. An incentive to drivers for shared rides would go further to improve efficiency, as it would increase the average passenger time.

The fourth policy design question concerned whether the industry would be able to absorb the costs of increasing driver pay. Our analysis indicates that a small increase in the number of driver trips per working hour could offset half or more of the costs to the companies of higher driver pay. This discovery suggested a limited need to raise fares to pay the increased costs. Moreover, it would not perceptibly increase passenger wait times. Finally, our analysis of company net revenues and operating costs in New York City indicated considerable latitude for reduced commission rates, which would further limit fare increases.

The proposed TLC pay standard would set a payment floor of \$17.22 per hour in take-home pay (after expenses). The standard would ensure that drivers' overall pay provides for all vehicle expenses as well as a fair amount for the drivers' time and also some paid time off. If the compensation provided falls below the minimum pay standard, the companies will be required to make up the difference.

The TLC is developing regulatory rules to implement the proposed minimum driver pay standard, with publication of draft rules for public comment planned soon after the release of this report.

Key findings

- The proposed standard would apply to FHV companies that dispatch more than 10,000 trips daily. Initially, the policy would include the four major app dispatch companies—Juno, Lyft, Uber and Via—that combined, dispatched nearly 600,000 rides per day in the first quarter of 2018, and increased their annual trip totals by over 100 percent in 2016 and by 71 percent in 2017. About 80,000 drivers are affiliated with these four companies.
- The proposed pay standard would result in a 14 percent average increase in gross pay—to \$25.76 an hour, and a 22.5 percent increase in net pay—to \$17.22 an hour. The 85 percent of drivers currently paid below the standard would earn an additional \$6,345 per year.
- The TLC's proposed pay policy includes a \$1 bonus per pickup for each shared ride drivers provide. Currently, drivers are under-paid for shared rides; the 40 percent of drivers with the lowest estimated hourly earnings disproportionately provide shared rides.

- The proposed minimum pay standard will ensure that drivers are able to cover all vehicle and related expenses, and a higher expense allowance will apply to drivers of wheelchair-accessible vehicles (WAVs).
- Ninety percent of New York City's app-based drivers are immigrants, and only one out of every six has a four-year college degree. Driving is their only job for two-thirds of the drivers. Eighty percent acquired their vehicle to enter the industry and would risk losing their investment if they switched to working in another industry.
- Half of the drivers support children and provide the bulk of their family's income. Forty percent of drivers have incomes so low they qualify for Medicaid and another 16 percent have no health insurance; 18 percent qualify for federal supplemental nutrition assistance (nearly twice the rate for New York City workers overall).
- Driver pay is low, despite rapid industry growth and high pricing mark-ups, because companies depend upon having a large ready pool of available drivers. This business model reduces driver trips per hour and therefore driver pay per hour.
- The TLC policy would correct some of the inefficiencies and inequities in the app industry by ensuring that driver expenses are covered, incentivizing improved driver utilization, rewarding drivers when they provide shared rides, and reducing growth in the number of new app-based drivers.

The focus of this report is on the operation of the FHV car services market and the compensation of the app drivers. The equally critical situation of medallion drivers is not in our purview. Having studied the app-dispatch industry in detail, we can imagine a series of policy alternatives that would help the medallion drivers; however, a considered analysis would require a separate detailed report. Of course, policies to address the low compensation of app drivers should indirectly benefit medallion drivers and result in fewer empty app cars cruising New York City's streets, improving trip times for all drivers.

Proposals to cap the number of FHV drivers or vehicles also lie outside our purview, as caps currently do not lie within the regulatory capacity of the TLC. However, as we discuss in the report, the TLC's proposed minimum pay policy is likely to reduce substantially the number of new FHV drivers and vehicles.

Section 1 Introduction and Overview

The app-based segment of the for-hire vehicle (FHV) transportation system in New York City consists of companies and drivers who utilize matching algorithms and leverage broad-band smartphone technology to connect drivers and passengers. The companies that make up this industry—Uber, Lyft, Via, and Gett/Juno—have expanded rapidly since 2012. The app-based transportation industry in New York City includes about 80,000 vehicles, dwarfing the city's 13,587 medallion (Yellow) taxis; app-based drivers now complete over 17 million trips in the city each month, double the number of medallion trips.

The industry provides more jobs than many prominent industries, including commercial banking, hotels, and publishing. Uber alone would be the largest for-profit private employer in New York City—if Uber drivers were classified as employees rather than independent contractors.

This rapid growth has generated substantial benefits—including increased convenience for riders and the extension of transportation services to neighborhoods in the outer boroughs that are not well-served by mass transit. The industry has also generated high returns for its investors and created many new jobs for drivers.

Our concern in this report focuses on the well-publicized low pay and long hours of many of the FHV drivers. As we find in this report, 85 percent of app-based drivers currently net below \$17.22 per hour (the independent contractor equivalent of \$15 an hour for employees and a paid time-off supplement). Our goal is to analyze why the industry has not generated higher earnings for the drivers and how regulatory policy might improve their conditions.

Driving for the app-based companies has evolved considerably since the creation of the industry in 2010. In its early years, the app-based industry recruited and appealed to part-time drivers who valued flexibility in their work hours and who could take advantage of their mostly idle cars to generate additional income. Many of these part-timers had other jobs or were students or worked at home. Over time, this driver profile has changed substantially.

In New York City today, as we show in this report, a majority of the app-based drivers are full-time workers who undertook risky capital investments in the vehicles they acquired for driving passengers. These drivers, many of whom cannot obtain better-paying job options elsewhere in the New York economy, face difficult economic circumstances. Their low pay has persisted despite the rapid growth of the industry, the major benefits it has provided to consumers, and the high returns it has generated for the companies and their external investors.

The low pay of the drivers has been highly publicized (*The New York Times* editorial May 7, 2018). FHV drivers and their supporters articulated their concerns loudly and clearly at a New York City Taxi and Limousine Commission (TLC) hearing in April of 2017.¹ In response, the TLC proposes to establish a pay standard for drivers at the largest FHV companies—those dispatching more than 10,000 trips per day. The goal of the policy is to raise driver earnings to a level (\$17.22 per hour) that is equivalent to \$15 an hour, with allowance for the payroll taxes paid by the self-employed and a paid time-off supplement.

The TLC engaged us to analyze the app-based FHV industry, and to provide detailed technical assistance and feedback on the proposed policy compatible with the continued ability of the industry to provide important services to New Yorkers. They also engaged us to analyze the policy's likely effects and to write this report.

1.1 The growth of the app-based industry in New York City

App-based urban transportation services began in the U.S. in San Francisco, with the introduction of luxury UberCab service in July 2010 and Sidecar in 2011. Both companies basically tweaked existing network-based software that connected buyers and sellers, as pioneered by eBay, and leveraged the widespread diffusion of smartphones with GPS capabilities. Uber's initial business model relied on a workforce of part-time drivers, many of whom were attracted by the opportunity for extra earnings while retaining flexibility over their driving hours, and who already owned mostly idle cars. This business model avoids regulatory limits on the number of medallions in the city. As we argue in this report, the business model places much of the economic risk associated with the app sector on the drivers, as they are classified as independent contractors. And the model relies on having many idle cars and drivers, which results in low driver pay per hour.

Uber introduced its flagship UberX standard point-to-point service in New York City in 2012; it was subsequently joined by Via in 2013, Lyft in 2014, and Juno in 2016.² Each of the newer entrants has sought to distinguish its services from those of its predecessors. Uber and Lyft also have introduced a variety of new services, including luxury and shared ride options. While the shared rides component has grown recently, the main lines of business (such as UberX) still account for the majority of all app-based trips.

¹ The hearing focused on the incomes and expenses of all TLC-licensed drivers. Testimony for the hearing can be accessed at: http://www.nyc.gov/html/tlc/downloads/pdf/transcript_04_06_2017.pdf. The New York City Council Committee on For-Hire Vehicles held a hearing on April 30, 2018 on several pieces of legislation addressing problems in the industry, particularly the adverse effects on drivers. A video transcript is available at: <https://council.nyc.gov/>.

² Chariot, now owned by Ford Motor Company, began operating as a black car service with vans in 2017. Because Chariot does not meet the daily trip threshold, it would not currently fall under this policy.

In just a few years, the app-based industry has transformed urban transportation in New York City. In 2015, Uber alone had about 25,000 cars in its New York City fleet, twice the number of taxicabs. The app-based industry's growth accelerated in 2015 and has continued since. As Exhibit 1 shows, the total number of app-dispatched trips grew by double digits in 2016 and 2017, with the number of app trips surpassing the medallion sector in December 2016. The four major app-based companies provided nearly 160 million trips in 2017, almost four times the 2015 number. By February of 2018, the number of app-dispatched trips was double the number of medallion trips. However, the growth in app-dispatched trips far exceeded the decline in medallion trips. Apparently, the rapid growth of the app-based sector has diverted some passengers from mass transit, contributing to the first non-recession declines in New York City subway and bus ridership.³

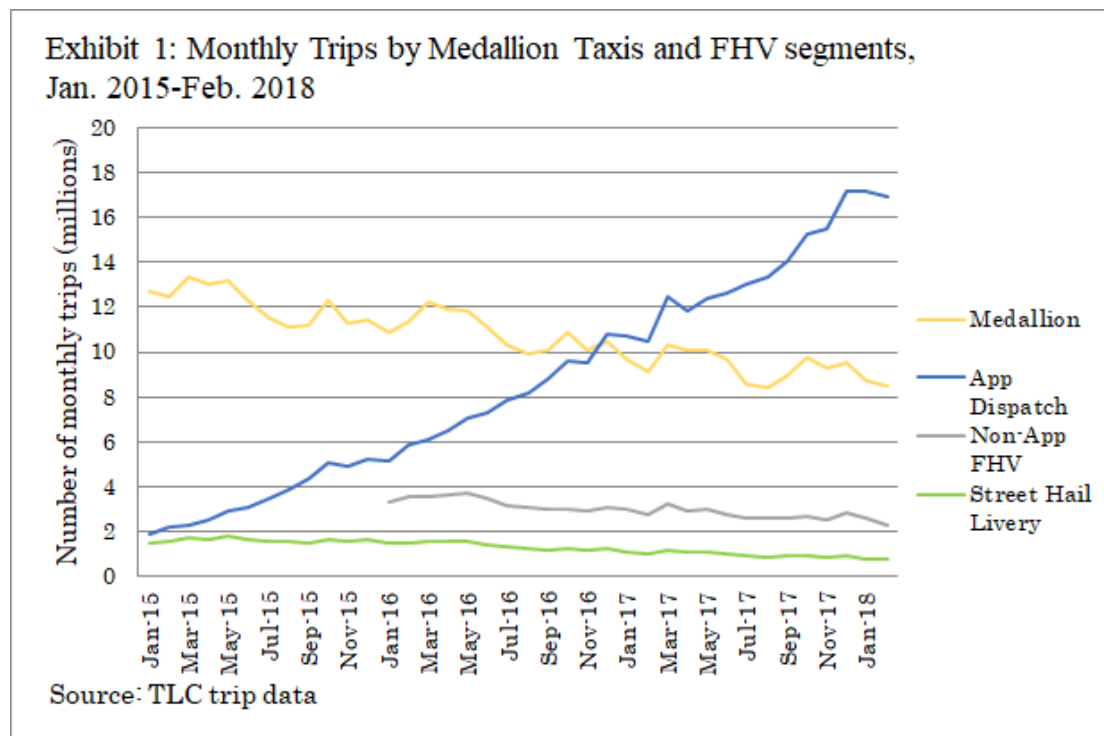


Exhibit 1 also shows a steady decline in the number of medallion trips since the onset of the app industry. TLC data, not shown here, indicate that most of this decline represents a decline in the number of medallion drivers, rather than in the length of their driving shifts or in the number of their trips per driving hour. The situation of the taxi drivers and

³ In its August 2017 [Citywide Mobility Survey](#) of 3,600 New York City residents, the New York City Department of Transportation found that ride-hailing app trips are more often replacing mass transit than any other mode of travel, including taxi or car service, car, walking or bicycling.

medallion owners deserves its own report, but that is not our purpose here. For critical accounts of the effects of the app industry on medallion owners and taxi drivers, see Hill (2015), Horan (2017) and Schaller (2017a, 2017b, 2018).

1.2 Why pay is low in the app-based industry

The company-driver relationship in the app-based industry differs both from traditional and better-known employment relations and from the taxi driver- medallion owner relationship. We discuss here how the nature of this relationship and the app-based industry model constrain pay from increasing even as the industry grows.

The company-driver relationship In traditional employment relationships, owners determine the schedules and total work hours of their employees and pay their employees a fixed rate per hour of work (or per period of time worked for salaried employees). In the “Econ 101” elementary textbook model of labor markets, pay is determined by labor supply conditions and employers have no power to set pay. The number of workers they hire varies with worker productivity for the firm. Pay will be higher for workers who work harder or have more skills. A minimum wage in this elementary model reduces employment.

Advanced labor economics textbooks present more sophisticated models, which take into account features that distinguish the labor market from other markets. These features recognize the important role of employee turnover, especially in low-wage labor markets (Reich, Gordon and Edwards 1973; Manning 2003). Turnover comes with costs—to workers of switching employers, and to employers of recruiting and retaining workers. In these more sophisticated models, employers possess considerable wage-setting power, employee pay may be lower than the value of worker productivity, and employee pay might not increase with productivity. In this context, a minimum wage standard can reduce employee turnover and increase both pay and employment levels.

In the app-based FHV industry, the drivers are independent contractors.⁴ The companies set the fares and the number of new drivers credentialed to drive using their apps. The drivers set their own schedules and total number of work hours and are paid a share of the revenue generated by their passenger trips. However, driver payment is not always a fixed proportion of the passenger fare, depending upon a number of company policies, such as promotions for drivers and riders, treatment of shared rides, and route-based pricing.

⁴ The legal basis for the independent contractor status of the app drivers remains unsettled and is beyond the scope of this report. The employment classification of taxi workers in the U.S. has varied historically between employees and independent contractors, for reasons that lie beyond the scope of this report. In the United Kingdom app drivers are covered by minimum wage, paid holiday and paid break regulations and fall in a category between traditional employees and independent contractors. Some commentators (for example, Harris and Krueger 2015) have proposed a similar intermediate category for “gig” workers in the U.S.

The drivers supply the vehicles and pay for all their driving-related costs. For almost all drivers, variation in the distance and time components of their individual trips tends to average out and so is not a major factor in their hourly pay.

Hourly pay will vary considerably with how much of each hour the drivers transport passengers. Trip demand varies by time of day—with peaks during morning and evening rush hours, in the evenings, and on weekends. The passenger trips are offered electronically to individual drivers with fares that are set upfront by the companies. The fares are usually determined by three components: a fixed passenger pick-up fee, a per-mile cost, and a per-minute cost (and as well as a minimum cost per trip). Companies also offer promotions and surcharges that affect these fares.

Thus far, this account of the piece-rate nature of app-driver compensation resembles a model of the determinants of pay for medallion drivers, who are also independent contractors. In both cases, weekly or hourly driver pay is determined primarily by the availability of passengers. But there are two important differences. First, the medallion drivers pay the medallion owners a fixed amount per week or per day to lease their vehicles. As a result, the medallion drivers maximize their driving hours each lease period to increase earnings.⁵ Second, the number of medallions is fixed. As a result, the supply of taxi hours per week is also fixed; it changes very little with demand for taxi rides. App-based drivers, in contrast, must supply their own capital equipment—a vehicle, and the number of drivers varies with passenger demand, with the companies admitting more app drivers into their systems, and because the number of hours that the drivers choose to work will vary considerably with their earnings per hour.

The industry has been successful at recruiting new drivers to date, even as unemployment rates have fallen. Their success reflects the still high number of workers who work part-time and, in New York City, the limited employment options facing immigrant men without a four-year college degree. The companies have also provided one-time incentives to new drivers.⁶

This variability in hours of existing drivers and the recruitment of new drivers allow the companies to play the dominant role in determining driver pay. The companies compete with each other primarily by minimizing passengers' wait times and, to a lesser extent, by decreasing fares.⁷

⁵ To maximize returns to a particular taxi during its lease period, many taxi drivers share their leased vehicles with other drivers. This feature does not change the overall supply of taxi hours.

⁶ The companies have also emphasized the total pay that drivers receive and underplayed the costs associated with driving. Some drivers also have not been fully aware of those costs or the risks associated with upfront investments in their vehicles.

⁷ They compete also by expanding their coverage with more vehicles to service a larger customer base, especially in areas of New York City that are under-served by mass transit and medallion drivers.

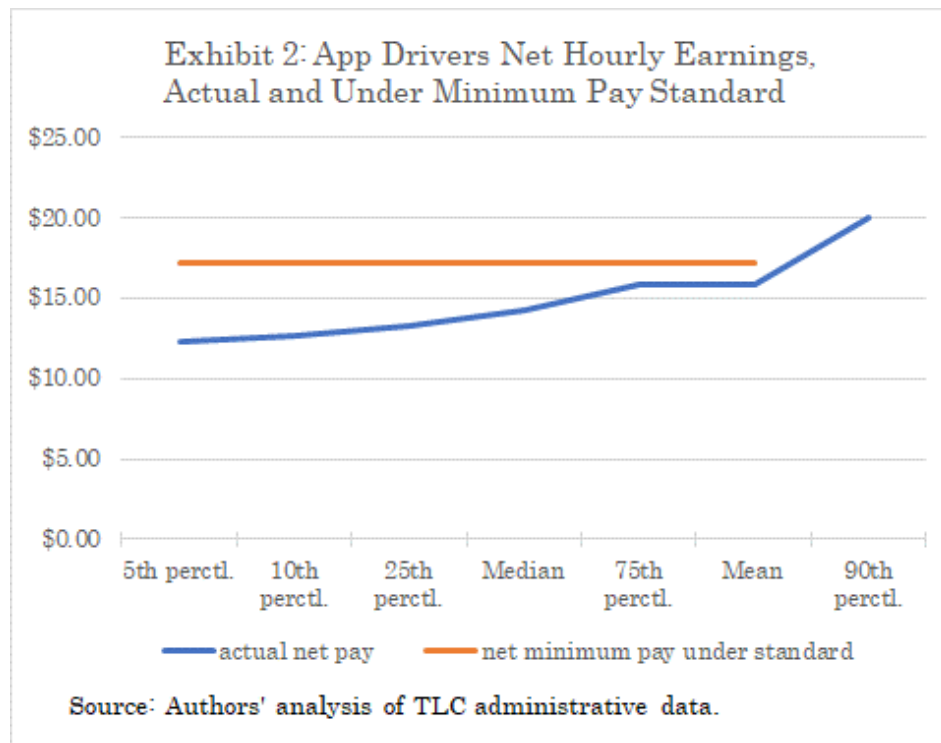
To achieve quick response times, the companies require many idle drivers to be available at any given moment and at many locations. This model creates a gap between the drivers' desires to maximize their earnings —by maximizing trips per working hour—and the companies' desire to minimize response times. In other words, the app business model works only if it keeps driver utilization low, which then keeps drivers' hourly pay low as well.

The only floor on driver pay consists of what economists call the reservation wage—the wage the drivers could obtain in other options, after taking into account the costs of switching jobs (losing their investments in their cars and their job-specific skills) and their probability of finding another job. These switching costs mean that their reservation wage might be below the minimum wage that obtains elsewhere in the local labor market.

1.3 The TLC's proposed driver pay standard

In a simple supply and demand framework, the simplest policy to increase driver pay would limit the inflow of new app-based drivers and/or vehicles to a level consistent with growth in driver trips per hour and the growth of consumer demand. However, the TLC does not have the authority to set any such limits; this authority rests with the New York City Council. To address driver pay, the TLC has instead developed a three-part driver pay standard. The first two parts consist of an amount per mile to cover driving costs, and an amount per minute to cover net driver pay after expenses. These components are divided by each company's specific utilization rate in the previous quarter. (The utilization rate measures the amount of time drivers have passengers in their vehicle.) By incentivizing companies to dispatch more trips to the existing driver pool, this standard would increase driver hourly pay, increase the efficiency of the industry, and provide a major channel through which the companies would absorb the costs of the pay standard. The third component of the policy standard consists of a fixed pick-up bonus for shared rides. This component is intended to reward drivers who have multiple fares in their vehicles during any trip. The policy also sets separate compensation levels for drivers of wheelchair-accessible vehicles.

Any policy that seeks to increase driver pay per trip will encourage some drivers to work more hours. Some of the drivers who already work long hours may choose to work fewer hours as pay per trip increases. But if, on net, drivers work more hours, or the number of drivers increases faster than the growth in the number of trips, each driver will log fewer passenger trips per hour. The result may not increase hourly pay at all. We argue in this report that the TLC's proposed policy includes sufficient incentives for companies to increase the portion of each working hour that drivers transport passengers in their vehicles. The companies could do so by limiting the number of new drivers they recruit.



How the policy can increase driver pay Changes in driver earnings under the TLC's proposed policy will affect the industry's dynamics through a more complex process than we outline above. Some drivers may choose to work more hours, others may want to work fewer hours; attrition among the app-driver workforce will fall, reducing recruitment and retention costs for the companies; and the utilization of each driver's working time will increase. In our report, we also consider whether competition will increase among the app-based companies, leading to reduced commissions, and whether companies are likely to increase their fares. These effects could trigger additional consequences. For example, any fare increases imposed by the companies might reduce demand for rides. Some behavioral responses by the drivers, the companies, and consumers might somewhat counteract the policy goals of increasing earnings per-hour worked. To take into account interactions among the adjustment channels described above, we also draw from estimates of how responsive driver hours are to increased hourly pay and how responsive riders are to higher fares. We assemble all of these components in a simulation model.

1.4 Overview of our findings, our study data, and the outline of this report

Findings We estimate that 85 percent of the app-based drivers do not currently earn the standard desired by the TLC, determined to be \$17.22 an hour as the independent contractor equivalent of \$15 per hour plus an allowance for paid time off. Further, we

estimate that the proposed policy will likely increase driver earnings by about 14 percent, equivalent to about \$6,345 per year for those currently under the proposed threshold. The percentage pay increase is relatively small compared to the high proportion of drivers currently below the minimum because the earnings of many drivers fall within \$2 or \$3 an hour below the proposed minimum standard.

Our simulations indicate that the companies could accommodate the policy through a combination of adjustments: a doable increase in the industry-wide driver utilization rate from its current 58 percent to about 62 percent; a continuing increase in the proportion of shared rides, which now account for about 23 percent of all trips; and by a fall in industry commission rates from their current 16 percent to a level under 10 percent. Passenger fares may not increase at all, although we cannot rule out an increase of about three to five percent. Rider wait times might increase by an average of about 12 to 15 seconds.

The New York City economy will also experience an increase in consumer spending: The estimated \$500 million in industry commissions that flows out of the city's economy each year will be reduced by about one-third, while local spending out of increased driver incomes will increase by about \$300 million.

The proposed pay standard establishes a floor, but not a ceiling. It does not limit driver compensation rates for each ride, nor does it restrict the use of other incentive payments to induce drivers to drive at certain times or areas. No limits are placed on drivers' movement from one app to another. The app system for trip dispatch provides the capacity to track driver earnings, allowing the companies to vary their specific approaches to increase overall utilization. The pay standard will alter the company-driver relationship and better align the interests of companies and drivers. The success of company strategies will become better linked to higher drivers' net earnings and to meeting the drivers' vehicle expenses.

Study data Previous scholarly studies of the industry have mainly drawn on administrative data provided by Uber to selected scholars and its own economists.⁸ We build upon these studies by using administrative data provided by *all* the app-based companies operating in New York City to the TLC, as well as other information sources. The TLC data is the most extensive data yet made available to scholars. Most importantly, we examine the composition of the app drivers in New York City, their gross compensation levels, and the costs of operating an FHV in the city. We thereby determine the level and distribution of driver earnings net of those costs.

Overview of this report Section 2 examines New York City's drivers—who they are, how much they earn, their expenses, their net earnings after expenses, and how many drivers

⁸ Most of these papers are co-authored by Jonathan Hall, Uber's Chief Economist, and draw only on data for Uber drivers. We cite these studies in our list of references and discuss them at various points in this report. We also draw upon many other contributions to the literature on the app industry.

would receive earnings increases if the pay standard is implement. Section 3 describes the components of the proposed policy and explains how it would work. Section 4 analyzes the business model of the New York City app-dispatch companies and discusses how drivers, companies, and consumers might adjust to the policy. Section 5 then applies the model to examine the policy proposal's likely quantitative effects. It does so by estimating three plausible scenarios. Section 6 extends our analysis to the effects of the proposed policy on the non-app FHV companies. Section 7 examines the broader effects of the proposed policy in the New York City economy, and Section 8 summarizes the report.

Section 2 The Drivers: Demographics, Hours, Expenses, and Pay

According to the TLC administrative database, at the end of 2017 about 130,000 drivers worked in the for-hire vehicle (FHV) sector. Approximately 85-90 percent of them are active in any given month.⁹ About 80,000 of these drivers worked for at least one of the major app-dispatch companies, 15,000 drivers worked with non-app black car services, 14,000 with non-app community livery services, and about 4,000 with non-app luxury limousine services.¹⁰

This section first discusses the demographics of New York City's driver workforce and the labor market conditions that facilitated the ability of the app-dispatch companies to recruit tens of thousands of drivers in each of the past five years. We then analyze the distribution of working hours of the app driver workforce, first for Uber alone, and then using data from all four app companies operating in New York City in representative weeks between September 2016 and October 2017.¹¹ Here we use more comprehensive data than has been available to other researchers.

We reach two main findings: (1) The app companies have been able to expand their workforce by drawing principally immigrants without a four-year college degree and who face restricted labor market opportunities; and (2) 60-65 percent of app drivers are full-time, without another job, and about 80 percent acquired a car to earn a living by driving.

Using the TLC data and other information to examine the detailed expenses of the drivers, we then present evidence on the level and distribution of gross and net hourly pay among all app drivers, including by company. An appendix compares our expense model to those in three other widely cited recent papers.

2.1 Demographics of the app driver workforce

The TLC administrative data indicate that FHV drivers in New York City have different characteristics from the drivers in previous national studies (such as Hall and Krueger 2018). Ninety-seven percent are male. More than nine out of ten are immigrants, with about half coming from five countries: the Dominican Republic, Haiti, Pakistan, India, and Bangladesh.

⁹ The TLC maintains extensive data on the taxi and FHV industry that is integral to the analysis in this report. TLC administrative data includes data on all drivers, vehicles, and bases (operating locations) that it licenses, as well as data on all trips provided. Many app (and non-app) drivers have also become affiliated with non-passenger app-based transportation services, such as UberEats, DoorDash, and others. These services lie outside the province of the TLC.

¹⁰ Since a significant proportion of drivers driving for a non-app FHV base also drive part-time for the app services, these numbers overlap to some extent. Some medallion taxi drivers supplement their earnings by driving for the app services or one of the non-app services.

¹¹ The TLC requested data from the four major app companies. The data cover typical one-week periods in September 2016 and in March, June, and October 2017. The data include driver pay and trip miles and minutes by driver, passenger fare revenue (including Black Car Fund fees, sales tax, and tolls), and company commissions. The Appendix provides details on the company data and how we analyzed it.

The U.S. Census Bureau's American Community Survey (ACS) provides additional data on the characteristics of taxi and FHV drivers (but does not distinguish between these two groups). According to the ACS, half of the growth from 2012 to 2016 in the taxi and FHV driver workforce occurred among those under the age of 35.

Exhibit 3 compares the driver workforce to the overall New York City workforce, using data from the ACS place-of-work files. Drivers are somewhat older than the overall workforce. The share of the driver workforce that is immigrant is about twice that of the city workforce overall. More than half (56 percent) have only a high school diploma or less, nearly twice the 30 percent figure (for ages 25 and older) among the entire city workforce. Only one in six drivers (17 percent) has a bachelor's degree or better, compared to 50 percent with a bachelor's degree among the city's overall workforce, 25 and older.

Exhibit 3: Taxi and FHV Drivers and All Workers, Age, Nativity and Education, Working in New York City, 2016

	Employed and Self-Employed Taxi & FHV Drivers	All Employed and Self- Employed
<u>Age</u>		
Median	44	41
Under 35	25%	35%
35-44	25%	24%
45-54	29%	21%
55 and older	21%	20%
<u>Foreign-born share of NYC workers</u>	86%	46%
<u>Education (age >24)</u>		
Less than high school	20%	10%
High school	36%	20%
Some college	27%	20%
Bachelor's or higher	17%	50%

Note: All those working more than 26 weeks; includes all NYS and NJ residents working in NYC.

Source: 2016 American Community Survey.

Exhibit 4 reports additional characteristics of the drivers, again using the ACS. Half of all drivers have children and 30 percent have two or more. Fifty-four percent of the drivers provide over half of their family income; one-fourth provide over 90 percent. Nearly one-fifth of New York City's taxi and FHV drivers receive Supplemental Nutritional Assistance Program aid (food stamps), compared to about 10 percent of the overall local workforce. About 16 percent of all drivers had no health insurance coverage, 40 percent

were covered by Medicaid and 4 percent by Medicare. About 26 percent were covered by employer-provided health insurance plans (either their own or their spouse's), and 14 percent purchased their own health insurance.

**Exhibit 4: Taxi and FHV Drivers Working in New York City,
Selected Characteristics, 2016**

Number of Children--Taxi and FHV Drivers

0	50%
1	20%
2+	30%

Taxi and FHV Driver Share of Family Income

90-100% share	26% of drivers
50% + share	54% of drivers

Receiving Supplemental Nutritional Assistance

Taxi and FHV Drivers	18.4%
All Working in NYC	10.6%

Health Insurance Coverage--Taxi and FHV Drivers

Medicaid	40%
Medicare	4%
Employer provided *	26%
Purchase own insurance	14%
Uninsured	16%
Total	100%

* Includes spousal coverage by employer-provided health insurance.

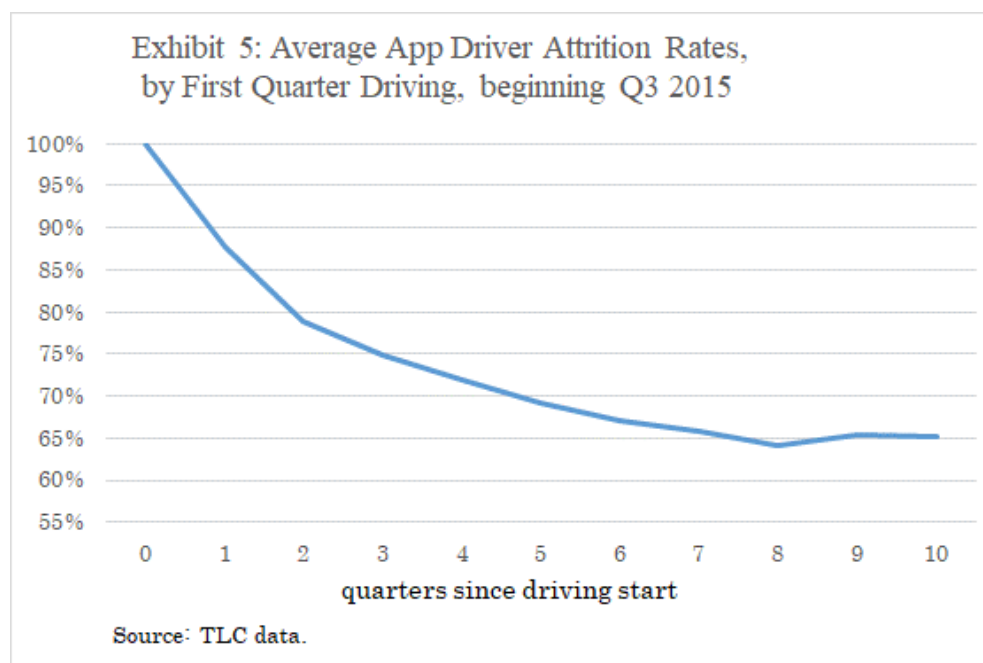
Note: All those working more than 26 weeks; includes all NYS and NJ residents working in NYC.

Source: 2016 American Community Survey.

To summarize, New York City's taxi and FHV drivers, most of whom are now app drivers, include a large share of relatively young immigrants with comparatively low education levels who provide primary support for their families. Drivers concentrate more heavily in these groups than does the city's workforce as a whole. These patterns contrast sharply with those reported in Hall and Krueger (2018), who found that Uber drivers in 2015 in a sample of U.S. cities closely resemble the overall workforce in their cities.

Rapid growth of the app driver workforce TLC data indicate that the number of active FHV drivers increased by 160 percent between 2012 and 2017, a net addition of 66,000 drivers. The TLC data further indicate that the app sector added an average of 36,000 new drivers in each of the last five years.

Attrition has also been substantial. As Exhibit 5 shows, over one-quarter of new drivers leave within their first year, rising to 35 percent leaving by the end of two years.



While New York City's economic and job growth over the past five years has been greater than in any comparable period in the previous 50 years, the app sector's growth is particularly notable. This sector has added a net of 13,000 drivers annually over this time, job growth surpassed only by home health care and restaurants.¹² Indeed, from 2012 to 2017, the number of app drivers grew 10 times faster than did blue collar or overall employment.

The job market for non-four-year degree workers has not grown anywhere as quickly. Only 11 percent of non-four-year degree immigrant males ages 25-44 working in New York City hold professional or managerial jobs. The great majority hold blue collar, lower-paying white collar, or service jobs where 2016 median annual earnings were \$25,190 for 25-34 year-olds and \$28,212 for 35-44 year-olds. Workers who entered driving typically faced relatively unattractive labor market options in food preparation, construction, retail sales, and building services—occupations where low pay is the norm or where subcontracting and misclassification of workers as independent contractors is widespread.¹³ Thus, many younger immigrant men likely were drawn into FHV driving by the promise of better pay in the app-dispatch industry.

¹² Authors' analysis of TLC data and New York State Department of Labor, *Quarterly Census of Employment and Wages*, 2012 to 2017.

¹³ Authors' analysis of 2016 American Community Survey data.

2.2 Driver hours and gross earnings: Uber only

Hours trends, 2014 to 2017 The rapid growth of the app-based industry could not have occurred without a simultaneous rapid increase in the number of app-based drivers. According to Hall and Krueger (2018), much of the initial growth in Uber's national driver work force came from workers who had the flexibility and the desire to increase their working hours as part-time drivers, especially in evenings and on weekends when taxis and mass transit are less available. Many of the early drivers already owned their cars. In their early days, the app companies heavily recruited drivers and provided strong incentives (including cash incentives and surge pricing-inflated fares with a share going to drivers) for driving during peak demand hours.

But as the app industry has grown, the proportion of drivers who work full-time on the app system has increased as well. The upper panel of Exhibit 6 shows the distribution of work hours among UberX drivers in New York City for the years 2014 to 2017.¹⁴ In 2014, only 23 percent of UberX drivers drove 35 hours a week or more.¹⁵ By 2017, 42 percent drove 35 hours a week or more.

Earning trends for 2014 to 2017 The lower panel of Exhibit 6 compares inflation-adjusted earnings data for New York City Uber drivers from October 2014 to October 2017. Some year-to-year variation is evident (down in 2015, up in 2016, back down in 2017), which could reflect changes in Uber's pricing as well as driver payment and commission determination practices. The data nonetheless suggest that driver earnings before expenses have declined since 2014, particularly for those working more than 15 hours per week. For example, for those working 50 hours a week or longer, real before-expense hourly earnings fell about 30 percent between 2014 and 2017. While we do not have sufficient data to pinpoint the reasons for this earnings drop, we suspect that reduced passenger fares and a significant shift away from premium-priced fares were important contributors. However, the earlier data are not fully comparable to the more recent data, suggesting the importance of caution in inferring changes in pay over time.

2.3 Industry-wide driver hours and gross earnings

The above discussion of pay and hours among Uber drivers is suggestive. Here we discuss hours and earnings patterns for all the large app companies in a more definitive manner, using the inclusive administrative data provided to the TLC.¹⁶

Definitions of our key measures Data reported to the TLC from the app companies' administrative records provide a comprehensive and definitive picture of the recent hours

¹⁴ The 2014 and 2015 data were provided by Uber to Jonathan Hall and Alan Krueger. The 2016 and 2017 data were provided by Uber to the TLC.

¹⁵ Hall and Krueger 2018, Table 3. The October 2014 data are from an earlier version of their paper, released in 2015.

¹⁶ Administrative data draw from a universe or near-universe of workers. They are therefore more reliable than survey data, which contain sampling error.

Exhibit 6: Hours Distribution and Gross Mean Hourly Earnings, NYC Uber Drivers, 2014-2017

		Distribution of Working Hours, hrs/wk			
	source	1-15	16-34	35-49	Over 50
Oct. 2014	Hall & Krueger, 2015 <i>actual working time on Uber app</i>	42%	35%	16%	7%
Oct. 2015	Hall & Krueger, 2018 <i>actual working time on Uber app</i>	24%	32%	27%	17%
Sept. 2016	Authors' analysis of TLC administrative data <i>imputed working time on Uber app</i>	37%	33%	18%	12%
Oct. 2017	Authors' analysis of TLC administrative data <i>imputed working time on Uber app</i>	36%	39%	17%	8%
Oct. 2017	Authors' analysis of TLC administrative data <i>actual working time-dedicated Uber drivers</i>	26%	32%	25%	17%
		Gross earnings per hr. (constant Oct. 2017 \$), by hrs./week			
	source	1-15	16-34	35-49	Over 50
Oct. 2014	Hall & Krueger, 2015 <i>actual working time on Uber app--median hourly earnings</i>	\$26.90	\$29.42	\$30.64	\$30.60
Oct. 2015	Hall & Krueger, 2018 <i>actual working time on Uber app</i>	\$23.91	\$25.29	\$25.31	\$24.55
Sept. 2016	Authors' analysis of TLC administrative data <i>imputed working time on Uber app</i>	\$29.41	\$29.21	\$28.09	\$26.25
Oct. 2017	Authors' analysis of TLC administrative data <i>imputed working time on Uber app</i>	\$25.60	\$24.60	\$22.90	\$21.90
Oct. 2017	Authors' analysis of TLC administrative data <i>actual working time-dedicated Uber drivers</i>	\$26.00	\$23.20	\$22.20	\$21.30

Notes: The October 2014 data were included in an earlier version (released in 2015) of the Hall and Krueger analysis published in 2018. Our data for Sept. 2016 and Oct. 2017 are not strictly comparable to the Hall and Krueger data. In the third and fourth rows of the top panel, we imputed working time based on trip time, and in the fifth row we show the actual working time between the first and last trips for drivers working solely on the Uber app. The growth of multi-platform driving in recent years implies that weekly working hours are understated when looking at just one company's data.

and earnings of the app drivers. Each of the four major app companies responded to TLC requests for data on all the trips of individual drivers during four representative weeks over the period from September 2016 to October 2017. The data include passenger payments to the company, company payments to each driver, and combined miles and minutes for all the trips provided by each driver.

We define here our key measures and explain their derivation.

- Actual driver working time: Estimated from the TLC trip files by identifying the starting and ending time by work shift for each driver. Beginning in June 2017, the TLC trip data include not only the pick-up time and location, but also the drop-off time and location. We can therefore use each driver's first and last trips to estimate the duration of that driver's work shift. The TLC has not had access

to individual driver log-on and log-off information. Exhibit 7 provides a fuller discussion of actual working time and how it is used in this report.

- **Average company utilization:** The average portion of each driver hour with a fare-paying passenger in the car. Estimated from the trip files by taking the ratio of passenger time to actual working time for drivers working on only one platform (averaged among all single-platform drivers for each company).¹⁷
- **Imputed driver working time:** We estimate or impute a driver's working time during the course of a week by dividing total trip time on that app from the earnings file by the average utilization for that company. We use imputed driver working time to estimate hourly earnings for each driver on a given platform. We need to use imputed working time since there are many multi-platform drivers and we do not have log-on and log-off information. A multi-platform driver may switch back and forth among apps for trips during the course of a work shift.

The imputation of working time is necessary because of complications in determining company-specific working time when a driver uses more than one platform over the course of a shift. We aggregate earnings data and imputed working time across the four app platforms by driver to estimate combined weekly hours, earnings, and hourly earnings.

Weekly hours Exhibit 8 shows the distribution of drivers' imputed working hours in 10-hour bins for the June 2017 and October 2017 weeks of our data.¹⁸ Mean (33.3) and median (32.5) weekly hours are quite similar to each other (not shown in the exhibit). The October 2017 data indicate an increase in working hours compared to June 2017, particularly among workers driving between 40 and 60 hours per week.

The wide range of hours worked suggests three broad driver groups. One group drives as their full-time job, a second group drives on a very part-time basis to supplement earnings from other (full-time or part-time) jobs, and a third group drives an intermediate number of weekly hours. We consider those working 30 or more hours weekly to be full-time drivers who obtain the bulk of their earnings as an FHV driver.¹⁹ About 60 percent of drivers fall into this category. We consider those working less than 20 hours a week as part-time or occasional drivers—this group is about 25 percent of all drivers. The remainder work between 20 and 30 hours a week. This intermediate group likely contains some part-time and some full-time workers whose weekly hours vary from week to week.

¹⁷ In October 2017, 55 percent of app drivers worked on only one platform. The TLC reports that utilization is similar for one-app and two-app drivers.

¹⁸ Working hour distributions were similar in the first three study weeks.

¹⁹ The Internal Revenue Service defines full-time as at least 30 hours of working time per week. The Bureau of Labor Statistics defines full-time as 35 or more weekly hours. We used 30 hours as the cut-off for full-time.

Exhibit 7: How We Measure Actual Working Time for App Drivers

We measure a driver's working hours as the elapsed time between the beginning of a driver's first trip and the end of the driver's last trip. This work shift benchmark is close to but not identical with another measure: the elapsed time when their apps are turned on to signal their availability. The difference between the two measures consists mainly of a) the time drivers spend on breaks – when they might be able to do other activities, and b) the time drivers spend commuting from and to their homes.

Our use of the drivers' working shift to measure their working time accords with how economists and statistical agencies measure time at work—for both employees and for independent contractors. Not all working time is spent working. Some is used on mandatory meal and rest breaks, changing to and from work clothes, waiting for assignments, waiting for customers or materials to arrive, or in health and safety and other meetings. For employees, these times all are included in the paid work shift.

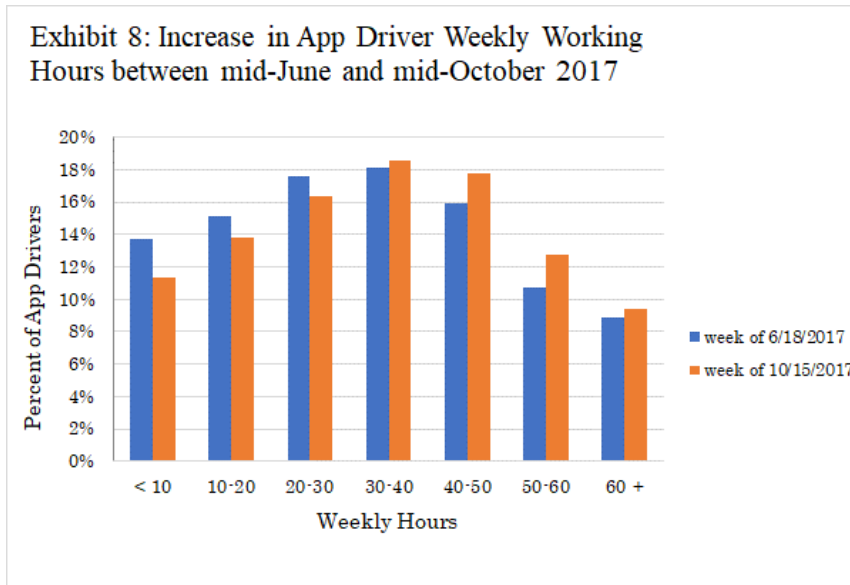
The economic concept here is opportunity cost: whether the worker can use their time as they would choose when not at work. An app driver must keep driving between paying rides when parking is unavailable (as in core Manhattan). They may also stop to rest and for bathroom breaks. All these times should count in drivers' hours worked.

Commuting time to and from home is not counted in work time for employees, but it should be counted in working hours for drivers insofar as they turn on their apps during their commutes. Our work shift measure includes driver on-call time during commutes only when the driver obtains a passenger ride during the commute. We therefore under-estimate driver working hours and over-estimate their earnings per working hour.

We use this measure of actual working time for one-platform drivers to estimate utilization for each of the four major app companies. For single-app drivers, actual working time is very close to imputed working time based on trip time. In estimating earnings, we use imputed working time since many drivers work on more than one platform.

While app-dispatched drivers nominally have the flexibility to work the hours they choose, we find substantial consistency in weekly working hours over time. To examine this pattern, we used TLC trip data from June through December 2017 and divided all drivers into five 15-hour bins (0-15, 15-30, 30-45, 45-60 and 60+.) We assigned each driver to one of the bins based on their average weekly hours over four-week periods. The great majority of drivers (76-92 percent) remained in the same or an adjacent bin during this roughly six-month period.

We also replicated for New York City drivers the Hall and Krueger (2018) analysis of weekly hours variation among Uber drivers. Hall and Krueger estimated a within-driver, across-week coefficients of variation of hours (the ratio of the standard deviation to the mean) of 0.35 for the 25th percentile driver, 0.54 for the median driver, and 0.81 for the 75th percentile driver. We find considerably less weekly hours variation for New York City drivers: 0.28 for the 25th percentile driver, 0.39 for the median driver, and 0.56 for the 75th percentile driver.



Moreover, our estimated 60 percent full-time drivers and 16 percent in an intermediate range above part-time workers accords with the response to a question about multiple job-holding in an on-line survey administered to all TLC-licensed drivers.²⁰ Nearly two-thirds of app drivers responding to the survey reported not having another job besides working as a TLC-licensed driver. Hall and Krueger's workers were much more likely to report that they also held another job.

About 7.5 percent of app drivers in October 2017 carried passengers whose trips were dispatched from non-app companies. Factoring in their working time for non-app FHV companies, these drivers would have a mean working week of 38.1 hours, five hours greater than average weekly working time just for the app companies. Among this subset of drivers, 56 percent of trip time occurs among non-app livery or black car services. Thus, the working hours data in the TLC earnings files understate the length of the work week for some app drivers.

Hourly earnings before expenses Since many drivers work for more than one app platform, we aggregated weekly earnings data across the various platforms for individual drivers. Our earnings data include only earnings from one or more of the four major app-dispatch companies.

We do not include tips in driver earnings. Some of the companies did not start allowing, or

²⁰ The TLC administered the survey, which was provided in English, Spanish, and Bengali. Completed surveys were received from approximately 8,200 drivers (a 5.5 percent response rate). Seventy-eight percent of the responses were in English, 14 percent in Spanish and eight percent in Bengali. The great majority (71 percent) of the app respondents had been driving since 2014. We re-weighted the respondent sample for app drivers (about 3,000 of the respondents) to reflect the distribution of their working hours in the administrative data.

reporting, tips until the second half of 2017. Tips have not been a significant factor for app-dispatched drivers (usually in the low single-digit range relative to regular driver pay). For Uber, tips were 2.0 percent of driver pay in the 4th week; for Lyft, 5.4 percent; and for Via, 1.2 percent. Moreover, the New York State Labor Department is currently considering whether to end employer tip credits against the minimum wage.

Using the administrative data and imputing working time, we estimated hourly earnings for each study week. As Exhibit 9 indicates, median hourly earnings before expenses ranged from \$22.90 to \$25.78. Mean hourly earnings were about \$1.50 to \$2.00 an hour higher.

Exhibit 9: App Driver Gross Hourly Earnings (before Expenses), 4 study weeks

Week beginning	Gross hourly earnings before expenses			
	Mean	25th percentile	Median	75th percentile
9/11/2016	\$27.74	\$23.02	\$25.78	\$29.53
3/19/2017	\$24.79	\$21.16	\$23.24	\$26.12
6/18/2017	\$25.80	\$22.08	\$24.29	\$27.29
10/15/2017	\$24.49	\$21.18	\$22.90	\$25.44

Source: Authors' analysis of TLC administrative data.

2.4 Driver expenses

Since the app-based car service industry depends on drivers to provide their own cars, a comprehensive accounting of all vehicle-related expenses is essential to estimating the level and distribution of driver earnings after covering all their expense costs. Surprisingly little previous research on the app industry focuses on the after-expense earnings of drivers. This report breaks new ground in combining a carefully constructed expense model with extensive administrative data on driver earnings from all the major app companies operating in New York City.

Proportion of drivers who acquired vehicles for business use Our online survey, administered directly to the drivers, indicates that 80 percent of app-based driver respondents purchased their vehicles for the purpose of providing transportation services, with 62 percent of all respondents saying they acquired a vehicle mainly to provide such services and another 18 percent acquiring their cars partly for business and partly for pleasure.²¹ Most vehicle expenses are either relatively fixed costs (such as insurance or lease costs) or annual costs usually paid up front (e.g., licensing and registration).

²¹ Only twenty percent of respondents indicated they acquired their vehicle mainly for personal use.

Cost categories Driver expenses fall into three categories: one-time upfront administrative costs, recurring costs such as license renewal and periodic vehicle inspection, and ongoing vehicle acquisition and operating costs. Exhibit 10A presents the expenses for each of these three categories.

One-time upfront costs and recurring costs Costs in these two categories are mainly determined by the TLC and apply to all drivers and cars licensed by the TLC. The upfront costs an app driver must pay for licensing, vehicle registration, and related requirements total over \$1,500. The TLC itemizes these costs in a flyer distributed to prospective FHV drivers.²²

Operating costs The costs of acquiring, insuring, and operating a vehicle—“operating costs”—obviously constitute the bulk of FHV expenses. Actual vehicle expenses vary from driver to driver depending on their cars’ make and model and on their driving habits. We geared our estimates of operating costs to a late-model, basic five-seat sedan. Although about 25 percent of app-dispatched drivers use a higher-priced, larger or more luxurious model that can command premium fares (e.g., for Uber, an Uber Black or Uber SUV service versus the standard UberX service) that can be costlier to finance and operate, our expenses are based on a moderate-priced Toyota Camry with standard features.

Camrys are by far the most popular model in use in New York City, comprising 27,000 (38 percent) out of about 72,000 non-premium app-dispatched vehicles. The Camry is much more popular than the next four most common basic FHVs: Honda Accord (8,200); Nissan Altima (3,300); Hyundai Sonata (3,100), and Honda CRV (2,600). The purchase and operating costs for the Camry and the next four common models are roughly comparable.

The ongoing monthly costs in Exhibit 10A for vehicle leasing, insurance, and maintenance are based on the February 2018 online driver survey results for all app drivers (re-weighted to reflect the distribution of actual working hours in the trip data file). Based on the driver survey, monthly vehicle leasing costs for app drivers averaged \$635, insurance costs \$400, and maintenance costs \$134.²³ According to TLC data, app drivers typically put a new or relatively new vehicle into service. In 2016 and 2017, 70 percent of cars first placed into FHV service were less than two years old.

Monthly vehicle lease costs of \$635 from the driver survey are very close to depreciation or car payment costs for a new car. Depreciation for a late model Camry would average \$693 per month for the first two years; a 60-month car loan to purchase a 2018 Camry would cost \$518 per month.²⁴ Lease, depreciation, and purchase costs thus turn out to be fairly similar.

²² http://www.nyc.gov/html/tlc/downloads/pdf/thinking_about_driving_fhv.pdf

²³ Monthly values were divided by 4.345 to put them on a weekly basis; thus, weekly costs were as indicated in Exhibit 10A.

²⁴ Financing costs are based on zero down payment, 60 monthly payments, and a 6.74 percent interest rate for a borrower with a credit score below 640. The average of the depreciation and financing options is \$605.50, or \$139.35 per week, very close to the \$146.17 lease cost on a weekly basis (the difference is about one cent per mile.)

Insurance Vehicle insurance costs average \$400 per month, or \$92.49 per week. In New York City, the TLC sets minimum liability insurance coverage levels and vehicle insurance is paid by each driver, not by the companies. Because of concerns about the adequacy and extent of the coverage, TLC regulations specify that company or base umbrella insurance policies can only cover vehicles directly owned by the company.²⁵

Fuel costs We estimated fuel costs using 25 miles per gallon (mpg), the Department of Energy's official mpg rating for city driving for the Toyota Camry.²⁶ Miles driven per week (673) represents the weekly average for 35,000 miles per year—the approximate mean annual distance traveled between periodic TLC vehicle inspections. We add a weekly amount for vehicle cleaning since the drivers for many companies are rated in part based on the cleanliness of their cars.

Mileage In addition to the actual trip miles, vehicle mileage includes travel en route to pick up passengers, any travel back to the driver's preferred service area, cruising mileage between trips, and mileage to and from the driver's home at the beginning and end of the work shift. We approximate total vehicle mileage to reflect cruising, pick-up, and other business-related non-passenger mileage by dividing trip mileage by average company utilization.

The average weekly total cost for a driver to be licensed and to register and operate a 2018 Toyota Camry comes to \$390.

This estimate (\$20,295 on an annual basis) is conservative for the costs borne by a substantial fraction of New York City app drivers. TLC records include the vehicle model driven by each licensed driver. As noted above, about 25 percent of all app drivers use a car model that would qualify for one of Uber's premium fare services above the standard Uber X level—many of these were an SUV. Weekly vehicle payment and gas expenses for these drivers are significantly higher than for a Toyota Camry driver. Five percent of Uber drivers in the administrative earnings files had weekly vehicle lease and insurance costs over \$400, well above the \$239 weekly lease and insurance costs in our expense model. And many young immigrant drivers without a substantial credit history likely are paying high subprime lease rates.²⁷

The annual vehicle acquisition, licensing, insuring, and operating costs in our expense model are placed on a per mile basis by dividing by 35,000 annual miles. This results in an expense figure of 58.0 cents per mile. Excluding the licensing and related TLC costs, the operating costs are estimated at 53.8 cents per mile, an amount remarkably close to the 54.5

²⁵ http://www.nyc.gov/html/tlc/downloads/pdf/veh_insurance_req.pdf

²⁶ Fuel costs are from the U.S. Energy Information Administration's weekly New York City retail gas price series, averaged over the first four months of 2018. For the 13 week period through June 11, 2018, gas prices were 7 percent higher than the \$2.653 per gallon figure used when the expense model was calibrated.

²⁷ Alison Griswold, Uber has ended its subprime car leasing program for New York drivers, *Quartz*, November 10, 2017.

cents figure for 2018 allowed by the IRS for business use of an automobile.²⁸ Costs are understandably higher because of the high cost of vehicle insurance and leases in New York City.

Later in this section of the report we subtract the 58.0 cents per mile expense estimate from gross driver earnings to estimate after-expense hourly driver earnings. This method amortizes vehicle expenses across a year's total mileage, whether the vehicle is used for business or personal use.

Tax treatment of FHV expenses Payments received by drivers to offset licensing and vehicle expenses should not be considered part of driver income. Independent contractor FHV drivers report their IRS form 1099 gross receipts on IRS Schedule C as miscellaneous business income. From gross receipts, they deduct their licensing and vehicle expenses in arriving at net business “profit,” by either itemizing detailed expenses (which we estimate at 58.0 cents per mile) or by taking the IRS allowed mileage rate for business use of a vehicle of 54.5 cents for 2018. The resulting “net profit” amount is then included on the business income line as a component of total income on the IRS 1040 form. We refer to a driver's “net profit” as “after-expense earnings.”²⁹

WAV vehicles We also developed an expense model version for wheelchair-accessible vehicles (WAVs). These vehicles cost more than minivans or SUVs, as they require considerable modification for loading and unloading wheelchairs. Exhibit 10B provides the details. The costs to modify a vehicle for wheelchair accessibility are about \$11,000 per vehicle. Also, our WAV expense model assumes 30,000 average annual miles, rather than the 35,000 miles for standard app-dispatch service vehicles.

To summarize, we estimate total vehicle costs as approximately \$20,295 a year.

2.5 Level and distribution of hourly pay after expenses

We calculate net (after-expenses) hourly earnings by subtracting expenses on a per total mile basis from gross payments (net of tolls) received by the drivers.

Exhibit 11 summarizes the net hourly earnings data in October 2017 for each of the four app companies separately and industry-wide.³⁰ The exhibit shows mean and median weekly hours, and mean and quartile hourly earnings net of expenses, for the 61,000 drivers working in that week. The industry-wide figures in the bottom row indicate median hourly pay of \$14.25, while hourly pay at the 75th percentile was \$15.77, indicating that after-expenses earnings fall well below the TLC's \$17.22 pay standard.

²⁸ <https://www.irs.gov/newsroom/standard-mileage-rates-for-2018-up-from-rates-for-2017>

²⁹ Some observers (including Mishel 2018) emphasize the tax deductibility of driver business expenses. However, driver business expenses are usually reported in IRS Schedule C. They cannot be deducted again elsewhere on tax returns.

³⁰ The combined, industry-wide figures take account of multi-platform driving by some of the drivers.

Exhibit 10A: FHV Expense Model

2018 Toyota Camry, 25 mpg, 35,000 miles per year

Expense Category	Specific Expenditure Item	Annual	Weekly	Per Mile
One-Time--all amortized over 5 years				
	TLC 24-hour course--one time \$175	\$35.00	\$0.67	\$0.001
	TLC 24-hour course exam--one time \$50	\$10.00	\$0.19	\$0.000
	DMV E class license--one time \$113	\$22.60	\$0.43	\$0.001
	TLC fingerprinting--one time \$88.50	\$17.70	\$0.34	\$0.001
	WAV sensitivity training--one time \$60	\$12.00	\$0.23	\$0.000
	SubTotal	\$97.30	\$1.87	\$0.003
Recurring				
	TLC driver license--\$252 every 3 years	\$84.00	\$1.62	\$0.002
	TLC drug test	\$26.00	\$0.50	\$0.001
	Vehicle Registration	\$275.00	\$5.29	\$0.008
	TLC and DMV vehicle inspection	\$130.00	\$2.50	\$0.004
	DMV defensive driving course--\$50 every 3 years	\$16.67	\$0.32	\$0.000
	DMV new plates	\$5.00	\$0.10	\$0.000
	DMV vehicle license and plate renewal	\$400.00	\$7.69	\$0.011
	DMV vehicle use tax	\$40.00	\$0.77	\$0.001
	DMV commercial motor vehicle tax	\$400.00	\$7.69	\$0.011
	SubTotal	\$1,376.67	\$26.47	\$0.039
Operating				
	Gas	\$3,868.96	\$74.40	\$0.111
	Vehicle payment	\$7,600.68	\$146.17	\$0.217
	Commercial insurance	\$4,809.23	\$92.49	\$0.137
	Vehicle maintenance	\$1,606.11	\$30.89	\$0.046
	Vehicle cleaning	\$936.00	\$18.00	\$0.027
	SubTotal	\$18,820.98	\$361.94	\$0.538
	TOTAL	\$20,294.94	\$390.29	\$0.580

Source: Authors' analysis based on TLC and other data sources.

Exhibit 11 also shows how weekly hours and hourly pay vary among the four app companies. Uber and Via's mean weekly hours were more than twice that for Juno. Mean hourly earnings were highest among Via's drivers (\$21.73), equivalent to 43 percent higher than among Lyft's drivers (\$15.16) and 35 percent higher than among Uber's drivers (\$16.03). Net hourly pay was lowest for the two largest app companies.

Exhibit 10B: Wheelchair-Accessible Vehicle (WAV) Expense Model

2018 Chrysler Grand Caravan, 17 city mpg, 30,000 miles per year

Expense Category	Specific Expenditure Item	Annual	Weekly	Per Mile
One-Time--all amortized over 5 years				
	Vehicle downpayment--\$3,000	\$600.00	\$11.54	\$0.020
	TLC 24-hour course--one time \$175	\$35.00	\$0.67	\$0.001
	TLC 24-hour course exam--one time \$50	\$10.00	\$0.19	\$0.000
	DMV E class license--one time \$113	\$22.60	\$0.43	\$0.001
	TLC fingerprinting--one time \$88.50	\$17.70	\$0.34	\$0.001
	WAV sensitivity training--one time \$60	\$12.00	\$0.23	\$0.000
	SubTotal	\$697.30	\$13.41	\$0.023
Recurring				
	TLC driver license--\$252 every 3 years	\$84.00	\$1.62	\$0.003
	TLC drug test	\$26.00	\$0.50	\$0.001
	Vehicle registration	\$275.00	\$5.29	\$0.009
	TLC and DMV vehicle inspection	\$130.00	\$2.50	\$0.004
	DMV defensive driving course--\$50 every 3 years	\$16.67	\$0.32	\$0.001
	DMV new plates	\$5.00	\$0.10	\$0.000
	DMV vehicle license and plate renewal	\$400.00	\$7.69	\$0.013
	DMV vehicle use tax	\$40.00	\$0.77	\$0.001
	DMV commercial motor vehicle tax	\$400.00	\$7.69	\$0.013
	SubTotal	\$1,376.67	\$26.47	\$0.046
Operating				
	Gas	\$4,681.76	\$90.03	\$0.156
	Vehicle payment (includes \$11,000 modification costs)	\$9,334.36	\$179.51	\$0.311
	Commercial insurance	\$4,790.08	\$92.12	\$0.160
	Vehicle maintenance	\$2,270.04	\$43.65	\$0.076
	Vehicle cleaning	\$936.00	\$18.00	\$0.031
	SubTotal	\$22,012.24	\$423.31	\$0.734
	TOTAL	\$24,086.21	\$463.20	\$0.803

Source: Authors' analysis based on TLC and other data sources.

Exhibit 11: App Driver Weekly Hours and Net Hourly Earnings, by Company and Combined, Week of Oct. 15, 2017

company	Imputed hours				Net hourly earnings			
	median	mean	total	share of total	25th percentile	median	mean	75th percentile
Juno	7.9	10.2	169,596	8.5%	\$14.05	\$15.63	\$18.26	\$18.77
Lyft	10.6	15.3	415,345	20.9%	\$12.48	\$13.85	\$15.16	\$15.62
Uber	21.5	23.8	1,320,961	66.4%	\$13.31	\$14.17	\$16.03	\$15.58
Via	15.6	23.8	84,737	4.3%	\$17.70	\$20.99	\$21.73	\$24.38
Combined	31.9	32.5	1,990,639	100.0%	\$13.31	\$14.25	\$15.88	\$15.77

Source: Authors' analysis of the universe of driver earnings for the week of October 15, 2017.

2.6 Proportion of workers earning below the proposed pay standard

Exhibit 11 shows that median net hourly earnings in the industry were \$14.25, nearly \$3 dollars an hour below the \$17.22 minimum pay standard. Exhibit 12 presents the results of our analysis of how many drivers currently fall below the TLC's proposed \$17.22 pay standard. After deducting estimated expenses, we find that 85 percent of app drivers (about 51,700 out of 61,100) are paid below \$17.22 per hour.³¹

Exhibit 12: App Driver Net Pay, and Increases Under Proposed Minimum Pay Standard

	Number of drivers	percentile in driver net pay distribution							mean
		5	10	25	50	75	90	95	
1 Net pay, all drivers	61,111	\$12.26	\$12.65	\$13.31	\$14.25	\$15.77	\$20.00	\$30.12	\$15.88
2 Net pay, drivers getting increases	51,673	\$12.26	\$12.65	\$13.31	\$14.25	\$15.77			\$14.06
3 Percent increases in gross pay	51,673	19.4%	18.2%	15.4%	11.3%	5.3%			14.0%
4 Percent increases in net pay	51,673	40.5%	36.1%	29.4%	20.8%	9.2%			22.5%

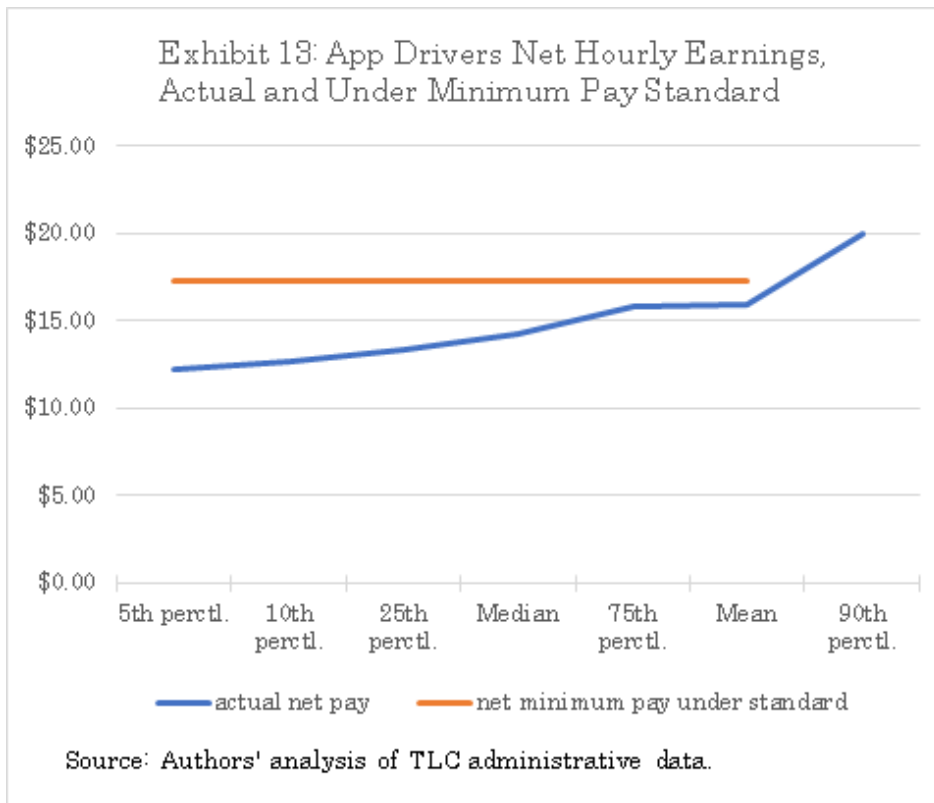
Source: Authors' analysis of the universe of driver earnings for the week of October 15, 2017.

Exhibit 12 also shows that many of the drivers below the \$17.22 pay standard earn between \$2 and \$3 per hour below \$17.22. The average net hourly earnings for the nearly 51,700 workers below the minimum is \$14.06. For the average driver below the minimum, pay would increase by 22.5 percent to raise it to \$17.22 an hour. Among the lowest-paid drivers, the 10th percentile driver would obtain a 36 percent pay increase, and a driver at the 25th percentile would receive a 29 percent increase.

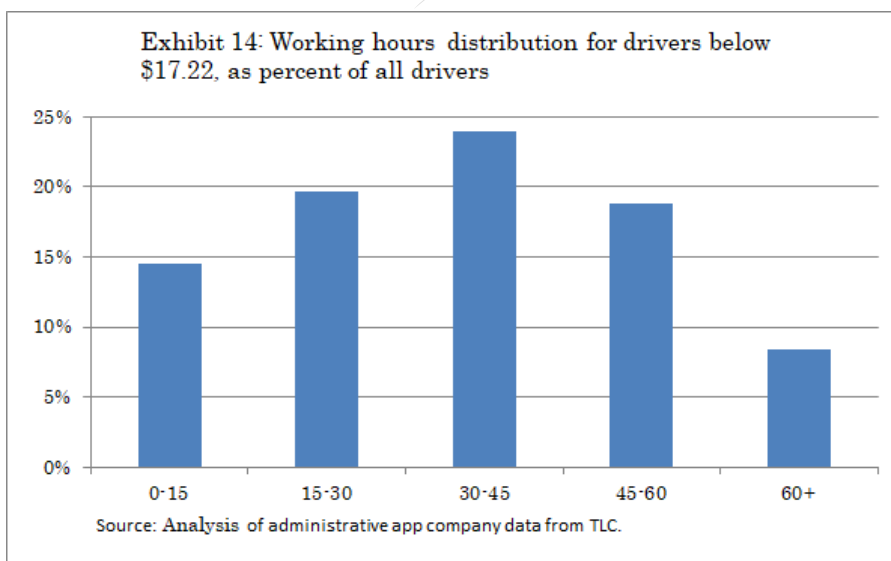
A 14 percent increase in gross earnings translates into a 22.5 percent increase in net pay. The pay standard covers the expense component (\$8.54) that was already applied in estimating the number of drivers below the \$17.22 hourly pay standard. At the median of the driver pay distribution, an 11.3 percent increase in gross earnings (and a 20.8 percent increase in net pay) would bring the driver's net hourly pay to \$17.22. Exhibit 13 shows how hourly earnings would change under the proposed driver pay standard.

Two-thirds of the drivers currently earning above the pay standard drive vehicles that qualify for premium services and higher fares, according to the list of premium-eligible vehicles on Uber's platform. Of the remaining drivers, about two-thirds are part-time drivers and one-third are full-time drivers. The part-time drivers are likely concentrating their driving during peak service hours.

³¹ Other low-wage industries, including fast-food and agriculture, also have similarly large proportions of workers affected by a proposed minimum pay increase. See Reich et.al. 2017.



As Exhibit 14 indicates, workers currently paid less than \$17.22 an hour are broadly distributed across the hours distribution. About 60 percent of drivers working 30 or more hours weekly are paid below the proposed driver pay standard. Part-time drivers also comprise a substantial proportion of workers who are paid below the proposed standard.



2.7 Summary

Many young immigrant men have become app-based drivers in New York City in recent years, in proportions that are twice the share of immigrants in the New York City workforce. In contrast, Hall and Krueger concluded that in most large cities, the demographic characteristics of Uber drivers closely resembled the overall workforce in those cities. Hall and Krueger also concluded that a desire for a flexible and supplemental work arrangement using their otherwise idle cars explained why drivers sought work on an app-based platform.

The pattern in New York City is quite different. Sixty to 65 percent of app drivers are full-time, app-driving is the sole job of most of the drivers, and 80 percent acquired a vehicle for the main or significant purpose of earning a living by driving.

Our detailed expense model finds that per mile expenses (58.0 cents per mile) turn out to be very close to the IRS allowance for business use of a vehicle. We found that median after-expense hourly earnings were \$14.25 in mid-October 2017, based on weekly earnings data for 61,000 drivers. Net hourly earnings were lowest for Uber and Lyft, the two largest app-dispatch companies operating in New York City.

Based upon our analysis of the TLC's administrative data on earnings, 85 percent of all drivers are paid less than \$17.22. To bring the average worker below the standard up to the \$17.22 wage floor, gross hourly earnings would need to rise by 14 percent, to \$25.76. That gross increase would represent a 22.5 percent increase in net pay, from \$14.06 to \$17.22.

Appendix to Section 2 Comparison to other analyses of app-dispatched driver expenses

At least three other studies have looked at the expenses of app drivers. Since these have been widely reported, we compare here their methods and findings with ours.

Hall and Krueger (2018) estimate driver expenses using national average information from the American Automobile Association (AAA). For a medium sedan (the category that includes the Toyota Camry, the most widely-used model in New York City), Hall and Krueger estimate hourly expenses for a full-time driver at \$5.33. In contrast, we estimate hourly vehicle expense in New York City equal \$8.54.³² Our hourly expense figure is considerably higher than the AAA-based Hall and Krueger estimate for several reasons: the AAA estimate uses personal insurance costs rather than the cost of FHV commercial insurance required of all New York City FHV drivers; recent fuel prices are 14 percent higher than in the 2017 AAA estimate; AAA uses a combined city and highway fuel economy average, while we base our fuel costs only on city driving; AAA maintenance costs are based on 15,000 miles per year versus the 35,000 annual mileage in our estimates; AAA uses national averages for sales tax and financing costs rather than the higher New York City-specific factors we use; and Hall and Krueger factor in lower costs for various licensing and registration-related expenses necessitated by TLC requirements.

Two other widely-cited studies also use expense estimates that are lower than ours. In an appendix to their study on gender earnings differences among Uber drivers, Cook et al. (2018) say that vehicle costs average 25 cents a mile. Based on 20 miles driven per hour, they maintain that expenses are \$5.00 per hour. Their cost allowance excludes insurance since in many cities (but not New York City), Uber covers drivers' insurance costs while driving.³³ Zoepf, Chen, Adu and Ozo (2018) found that many app-dispatched drivers had median driver expenses of \$0.30 per mile, about half of what we find for New York City. However, Zoepf et al. used driver earnings data from an online self-reported—and not necessarily representative—survey of 1,100 app drivers throughout the U.S.³⁴

In contrast, our analysis of net driver earnings is based on detailed estimates of vehicle expenses that incorporate all the costs incurred in registering and insuring a car used for commercial purposes in New York City and in meeting the licensing requirements of the TLC and the State Division of Motor Vehicles. We also incorporate the high finance costs incurred by many immigrant New York City drivers, who do not have strong credit ratings. Our New York City expense per mile figure is \$0.580, equivalent to about \$390 in weekly vehicle expenses for driving 35,000 miles a year. Our expense analysis provides the most detailed account to date for New York City's app drivers.

³² Our \$8.54 average hourly expense figure is calculated as the difference between the mean before-expense and mean after-expense hourly earnings figures for the TLC driver data for the week of October 15, 2017.

³³ In our expense model (Exhibit 10A), insurance costs are 23 percent of the total. Adjusting their \$5.00 figure to include insurance would raise expenses to about \$6.50 an hour.

³⁴ Other parts of Zoepf et al. were severely criticized, leading the authors to revise their earnings figures. However, the expense estimates were not questioned. Mishel (2018) simply draws upon the data in Cook et al. 2018. All authors who explicitly deal with New York City data agree that both gross pay and expenses are higher in New York City.

Section 3 The TLC's Proposed Driver Pay Standard

We discuss here the minimum for-hire vehicle (FHV) driver pay standard proposed by the TLC. The policy would apply to companies currently dispatching more than 10,000 trips per day. It would currently cover only the four large app companies.

The proposed pay standard specifies a payment floor to ensure that driver pay provides for all vehicle expenses as well as compensation for the driver's working time. This standard is set to allow drivers to earn \$17.22 per hour after expenses. \$15.90 of this amount equals the impending New York State minimum wage in New York City as of December 31, 2018 (\$15) plus 90 cents for paid time off. An additional \$1.32 accounts for the employer share of payroll tax on \$17.22, which is required of independent contractors, but not employees. The proposal also includes a \$1 bonus per trip above the minimum pay standard to encourage drivers to accept requests for shared rides.

The 90 cents per hour for paid time off equals six percent of \$15. Six percent equals the average cost of paid leave for the occupational group that includes drivers (production, transportation, and material moving occupations), according to the Bureau of Labor Statistics (BLS) report on supplemental pay benefit costs in private industry. (BLS, *Employer Costs for Employee Compensation, December 2017*, released March 20, 2018).

This section details the components of the pay standard.

3.1 The minimum pay standard

The driver pay standard formula combines an expense component and a time component.³⁵ The expense component is based on the \$0.580 per mile expense figure that we calculated from the expense model, as shown in Exhibit 10A of Section 2. The expense component is intended to allow the typical driver to cover all the costs of acquiring and operating a vehicle (as well as the cost of licensing and training). The \$0.287 per minute factor is intended to compensate drivers for their time at \$17.22 an hour (\$0.287 is \$17.22 divided by 60 minutes). Exhibit 15 describes the pay standard in more detail and shows that the expense and the per-minute components are divided by a driver utilization rate. Exhibit 16 explains utilization rate and its policy significance.

The utilization rate is important because drivers are working even when they do not have passengers in their car. Driver working time is measured basically by the time they are logged on to a company app and therefore available to carry passengers. Their work time includes the time they are using their vehicle, and incurring expenses for doing so, even when they are cruising while waiting for a dispatch or heading toward a pickup location after having accepted a ride request or returning from a drop-off location.

³⁵ Precisely, the pay standard formula is: Driver minimum pay per trip = (\$0.580 per mile/utilization factor) + (\$0.287 per minute/utilization factor).

The pay formula is thus constructed to compensate drivers for work-related time and expense when a passenger is not in the vehicle. It does so by dividing the expense and time components by company-specific utilization rates—as measured for each company by the TLC for the previous quarter. In the case of the time factor, the utilization rate adjusts for the portion of each hour that a passenger is not in the vehicle. In the case of the expense factor, the utilization factor adjusts for the expenses associated with pickup, cruising, and other non-passenger vehicle uses during the work shift.

This part of the policy in effect incentivizes each company to raise its company-wide utilization rate from one quarter to the next, that is, by increasing the average number of trips per driver hour. Since the utilization rate appears in the denominator, a higher company utilization rate lowers the company's costs for the expense and time components. At the same time, company policies that increase utilization rates will also benefit the drivers. They will be able to provide more rides in any given hour, thereby earning more on an hourly basis, even though their pay for each trip might be lower. (See Exhibit 16 for more on utilization rates.)

Increases in driver utilization rates represent an improvement in industry efficiency. With greater efficiency, the policy aligns the interests of the drivers with that of the companies and both sides benefit. To implement the policy, the TLC could evaluate the company-specific utilization rates on a quarterly basis. The utilization factor in the above formula would then vary with each company's utilization rate in the prior quarter. (See Exhibit 17 for an example of the pay standard applied to a typical trip.)

The pay standard policy also includes a \$1 bonus per pickup for shared rides. This bonus would encourage drivers to provide shared rides. At present, drivers generally are not compensated adequately for providing shared rides. This bonus would further increase utilization because it extends time that drivers have passengers. The \$1 bonus per pickup for shared rides represents a first approximation. It is derived from feedback that drivers do not share in the economic benefits that accrue to app-based companies from shared rides. The value is set in line with other driver incentives included in TLC-set fares, i.e., the \$1.00 rush hour surcharge on taxi trips and the \$1.00 bonus for trips performed in accessible taxis. The optimal value of the shared ride bonus may be higher or lower. Public discussion could help better inform the optimal bonus amount.

3.2 Wheelchair accessible vehicles

The proposed pay standard comes in two versions, one for non-accessible vehicles, as discussed to this point, and another for wheelchair accessible vehicles (WAV). Drivers of WAVs would receive \$0.803 per mile to reflect the higher expenses involved in converting and operating a minivan.³⁶ The time component would be the same for WAV drivers, and they would also be eligible to receive the per pickup shared ride bonus.

TLC regulations will specify the precise means by which the pay standard will be

³⁶ We discussed the additional expenses of WAVs in Section 2.

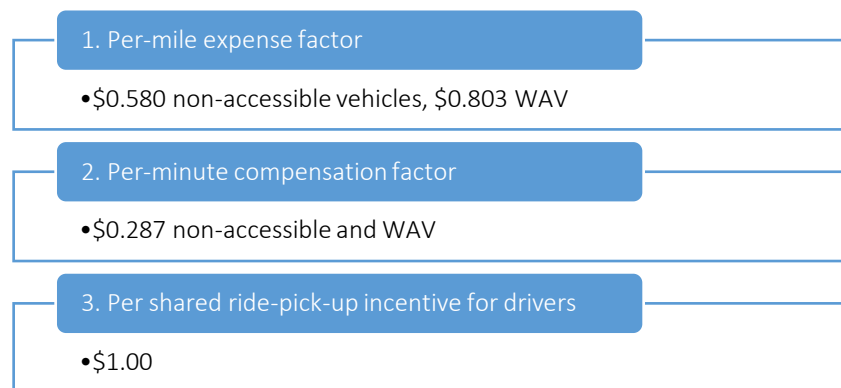
implemented. Generally, for a set time period (such as a week or a month), companies will evaluate each driver's earnings using the total trip mileage and trip minutes for that company. If the compensation provided to a driver falls below the minimum pay standard, the companies will be required to make up the difference.

Exhibit 15: Proposed Driver Pay Standard

The minimum pay standard for FHV drivers takes into account that they are independent contractors and that they are responsible for all costs related to acquiring, licensing, insuring, and operating the vehicle used to provide FHV services. It is designed to allow drivers to fully cover their expenses as well as earn at least \$15.00 an hour and a paid time-off supplement equal to 90 cents per hour (including the employer share of payroll taxes that independent contractors must pay). The paid time-off supplement compensates drivers for the fact that as independent contractors they do not receive any paid time off.

A third element of the pay policy specifies a \$1 bonus to drivers for each pickup for shared rides—this is applied in addition to the \$17.22 minimum pay level.

The pay standard comes in two versions, one for non-accessible vehicles and one for wheelchair accessible vehicles (WAV), with differing formulas for vehicle expenses, as illustrated below. (\$17.22 per hour = \$0.287 per minute)



The per-mile and per-minute factors are each divided by company-specific utilization (percent of drivers' time with a passenger) to promote more efficient use of drivers, increase driver earnings and moderate the number of vehicles.

This driver pay standard is not the passenger fare, and it is not a mandated pay method. Rather, it specifies the basis for a driver earnings floor. Companies will continue to determine their own passenger fare structure. The driver and the company can agree to higher driver pay for any trip and the company may provide incentives in addition to the minimum.

Drivers currently receive no paid time off when they are sick, as the City of New York requires for workers who are employees, nor do they receive any paid time off for holidays or vacation days. A paid time off supplement recognizes that many drivers work very long hours and should be encouraged to reduce their hours without sacrificing total weekly pay. Fewer exhausted drivers on the road will improve safety for passengers, pedestrians and drivers alike.

Exhibit 16: Company-Specific Utilization: What is it? Why does it matter?

What is company-specific utilization?

Utilization is a logical component of a driver minimum pay standard because driver pay depends on the percent of a driver's time with a passenger in the car. For example, if a driver has passengers in the car for 30 minutes out of one hour, that is a 50% utilization rate; 45 minutes would be a 75% utilization rate.

Here are 2017 utilization rates for each of the four major app-dispatch companies serving New York City:

Juno	50%
Lyft	58%
Uber	58%
Via	70%

Utilization rates for each company were calculated by the TLC based on all trip records from June 4 through the end of 2017. Total weekly working hours and weekly trip hours for drivers working for only one company during a given week were aggregated for each week to determine company-specific utilization for that week. Single app drivers accounted for 55 percent of all drivers in the fall of 2017. Weekly company-specific utilization rates for the last seven months of 2017 were averaged to derive the base period utilization rates shown here.

Via's utilization is higher because it primarily provides shared rides. The above rates were estimated from data on drivers who drive for only one company. The TLC is developing a more definitive method that would be used in connection with the minimum pay standard.

Why does utilization matter?

Increasing utilization means drivers are deployed more efficiently, driver earnings per hour increase, and fewer vehicles are needed on the streets.

Annual adjustment To ensure that the purchasing power of the minimum pay standard is maintained over time, its components will be adjusted once per year. The annual adjustment factors would be based on the 12-month percentage increase in the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W) for the NY-NJ-PA metro area.

Exhibit 17: The Proposed Driver Pay Standard Applied to a Typical Trip

A typical FHV trip might be 7.5 miles in distance and 30 minutes in time.

Here is how the driver minimum pay standard (not the passenger fare) would be calculated under the proposal pay standard (assuming an industry-wide average utilization of 58%):

$$\frac{(.580 * 7.5 \text{ miles})}{.58 \text{ utilization}} + \frac{(\$0.287 * 30 \text{ minutes})}{.58 \text{ utilization}} = \$22.34$$

Note: this is the minimum pay standard (for a non-shared ride), not the passenger fare, and the company and the driver can always agree that driver pay for any trip should be higher.

The driver pay standard ensures that the driver can cover vehicle expenses as well as get paid at least the independent contractor equivalent of \$15.00 an hour.

3.3 Monitoring, compliance, and evaluation

Given the dynamic nature of the New York City app-passenger industry, as well as some uncertainty in the behavioral adjustments by drivers, companies, and consumers, it is important for the TLC to regularly monitor and evaluate the effects of the minimum pay standard on drivers and FHV companies, and to make necessary adjustments.

To ensure effective compliance, the TLC will need to monitor trip and driver earnings data for all covered drivers. The trip data includes distance and duration of each trip and identify the driver and the dispatching company. The TLC should combine this information with trip and driver earnings data from all the covered companies to ensure that drivers are paid at least the minimum amount for each trip, as set out by the standard.

The driver payment standard is based on distance and time per trip as well as the company-specific utilization rate for the prior quarter. The utilization factor would serve as a basis for computing total driver working time (see the discussion in Section 2). The TLC should also access and analyze the app-on and app-off data for each driver to more effectively determine how trip pay translates into average hourly earnings for each driver. The TLC will have to determine the best way to account for multi-platform drivers—those who drive for more than one app company and who may be logged into more than one app at a time.

Since our methods to estimate driver pay on an hourly basis are not perfect and there is variability in earnings from week to week, the TLC may need to adjust the formula after a reasonable implementation and evaluation period.

To date, the TLC does not have sufficient information on driver earnings for drivers providing trips dispatched by non-app FHV companies to develop a pay standard for those trips. The TLC might consider requiring the non-app FHV companies to begin

providing such data (including trip times, trip miles, and working hours) to inform policy development.

3.4 Summary

The \$17.22 hourly driver pay standard will enable drivers to better meet the considerable costs involved in providing transportation services and to receive the independent contractor equivalent of \$15 per hour as well as receive a time-off supplement of \$0.90 an hour. The supplement would allow drivers to be compensated at a rate that accounts for the fact that they do not receive paid time off as do most employees. The pay standard creates incentives for companies to more efficiently utilize the availability and working time of drivers. This incentive better aligns the interests of the companies and the drivers.

Section 4 The App-Based Industry's Business Model

We discuss here the business model of New York City's app-based transportation companies. This discussion will illuminate further why driver pay is so low, whether the policy levers in the TLC's proposal would in fact increase driver pay, and the likely adjustment responses of the industry to a pay increase. We then build upon this analysis to model the adjustment process more fully in Section 5, where we conduct a series of quantitative simulation exercises.

We first consider how the industry is a network-based industry. We then demonstrate that the industry has an oligopolistic market structure, with high mark-ups over local costs, especially in comparison to other companies that also mainly provide intermediary services. We then discuss the importance of low driver utilization rates to the industry's business model and how New York City's app-based drivers would respond to pay changes. Finally, we discuss how consumers are likely to respond to any fare changes. We will use these results in Section 5 to illustrate how the TLC's proposed policies can change the industry's business model and overcome its market failures.

4.1 The network-based business model

The app-based companies describe themselves as primarily software platforms that act as intermediaries connecting their networks of riders and drivers. The companies' technological innovation was limited to adapting software that already had been developed in other network-based industries. Their economic innovation consisted mainly of recognizing and exploiting an opportunity to develop a convenient network-based urban transportation system that could out-compete the traditional taxi industry. Convenience was made possible by the creation of dense local networks that connect riders and drivers directly, while also offering upfront fixed pricing (introduced in 2017), and easy payment system and quick response times. The app-based services soon became more convenient and sometimes cheaper than those of taxis.

By classifying themselves as technology companies, the industry sought to skirt the regulatory transportation structures that constrain its closest competitor—medallion cabs. In response, regulators have characterized these companies as transportation companies as well as technology companies—either by describing them as app bases that supply for-hire-vehicle rides, as in New York City, or as transportation network companies, as in California and the rest of New York State.

Economists refer to such an industry as a two-sided market—to emphasize the two networks involved.³⁷ Two-sided markets work well when both of the networks are

³⁷ Rysman (2009) provides an influential and widely-cited nontechnical introduction to the economics of two-sided markets. In two-sided markets an intermediary, such as a credit card payment platform, sells its services simultaneously in two markets. In the credit card case, the two markets are buyers paying with their card and merchants who accept the card for payment.

sufficiently large. These markets are also often characterized as platform-based industries—to emphasize that the companies' software platforms act as the intermediary between the two networks.

Well-known companies in two-sided markets include Amazon, American Express, eBay, Facebook, Google, MasterCard, Twitter, and Visa. As this high-profile list suggests, these companies are the winners of winner-take-all competitions. The leading companies in these competitions dominate their industry by attaining a sufficient network scale to deter users from switching to another network or to deter other companies from entering the industry. In other words, one or two companies dominate these industries because of large economies of scale in the creation and operation of networks.

In the app-dispatched driver industry context, a large initial investment in the intermediary technology and in building the networks constitutes the start-up phase. The initial investment is usually provided by venture capital. But once the company matures, technological innovations become less important and the cost of core company operations generally does not vary when the company marginally increases its size. Economists refer to these costs as fixed costs. The fixed costs include software engineers who maintain and upgrade the software used to operate the system, their managers and support staff, and associated office lease expenses. Other costs, such as for legal counsel, advertising and lobbyists, also do not vary much when the company grows marginally. Some costs, such as for recruiting and training new drivers, do increase when the company grows, but these variable costs are small relative to the fixed costs.

In this circumstance, companies increase their profit margins by spreading their fixed costs over more revenue-generating trips. So long as average costs per trip continue to fall, the company will achieve even greater returns by expanding and driving its smaller and therefore higher-average-cost competitors out of business.

This description corresponds closely to the elementary economic textbook model of natural monopolies. When the first successful entrant to an industry can realize economies of scale and therefore out-compete its subsequent rivals, one company survives and monopolistic behavior that harms consumers will then ensue. The standard policy recommendation for such natural monopolies is to overcome their noncompetitive behavior by regulating them as public utilities. Prominent examples of regulated monopolies include local electricity distribution systems, natural gas, water and waste collection systems, highways, bridges, tunnels, railroads, and municipal buses and subways.³⁸

³⁸ Public regulation also is called for when competition would generate wasteful duplication rather than needed capacity.

4.2 The oligopolistic structure of the app-based industry

Many observers believe that the app-based transportation industry is a winner-take-all market. We argue, however, that two characteristics of app-based transportation make it less monopolistic than many other two-sided markets. Regulatory policies that nudge the industry in a more competitive direction are therefore justified on efficiency and equity grounds but regulating the industry as a natural monopoly is not.

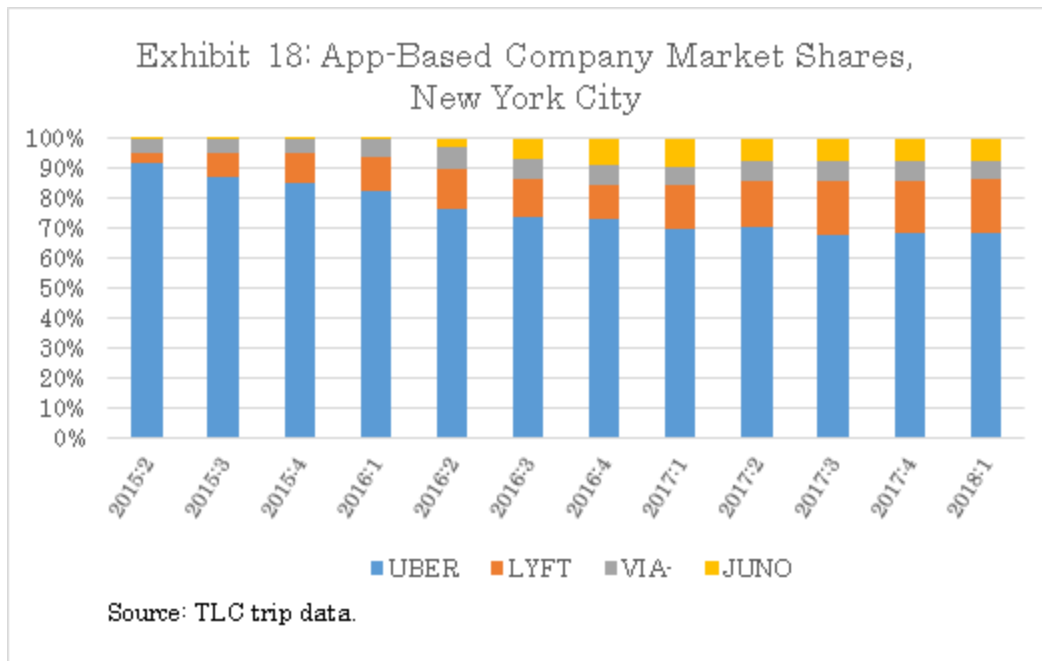
First, the leading firm will become a natural monopoly only if its rider and driver network advantages are substantial enough to deter entry by competitors. Although Uber began as a natural monopoly in this sense, the increase in the market share of Lyft, Juno, and Via in recent years suggests that they too have achieved critical masses in both rider and driver networks. Indeed, Lyft's entry into many other urban markets in the U.S. suggests that it is confident it can achieve such critical mass in any dense market—even though they compete directly with Uber.³⁹

Second, the app-based transportation industry, as we have already discussed in Section 1, works well only if the supply of driver working hours exceeds the demand for rider trip hours. Companies need a supply of idle but available drivers in order to maintain low response times for their network of riders.⁴⁰ Importantly, an increasing proportion of drivers work with more than one app company. These multi-app drivers allow each company to draw upon available drivers who work primarily for one of the other companies. This feature works against the likelihood that any one company will become a natural monopoly.

Market shares Four companies—Uber, Lyft, Via, and Juno (now owned by Gett)—operate in New York City, with Uber and Lyft together accounting for about 87 percent of all app-dispatched trips in 2017. Exhibit 18 shows how the market share of these app companies changed between 2015 and 2017. Uber's market share fell from 88.5 percent of all app-industry trips in New York City in 2015 to 66.5 percent in 2017.

³⁹ The entry and growth of Via, which specializes in shared rides, suggest that companies may also do well by capturing particular market niches. The analogy in the credit card payment industry is American Express.

⁴⁰ Castillo et al. 2017 add that the driver-rider networks can collapse if the number of drivers who are en route to picking up passengers rises too high, relative to the level of idle drivers. In their data, en route trips at Uber average a non-trivial one-tenth the distance of passenger trips.



National data indicate similar patterns in most U.S. cities. As Lyft has entered many urban markets in recent years, its share of the app market has been increasing.⁴¹

It seems likely that the industry will continue to be characterized by oligopolistic competition, rather than having a single monopoly provider. While oligopolies compete with each other, they retain considerable market power. This power is most evident in their high price mark-ups over costs (Hall 2018).

4.3 High mark-ups in the app-based industry

Commissions The app companies set fare prices and routes and allocate rides to individual drivers. They also set a fee that they retain—their commission. These published commissions vary among the companies, ranging between about 10 percent and 25 percent of actual passenger fares. These nominal commission rates can vary from actual rates, including by how long a driver has been affiliated with a company, with incentives offered to recruit drivers, and with promotions offered to recruit riders and associated with particular routes.⁴²

TLC administrative data allow us to calculate actual commission rates, defined as revenues less driver payments all divided by revenues. Actual effective commission rates,

⁴¹ <https://blog.secondmeasure.com/2017/11/02/ubers-not-as-bad-off-as-you-think/>.

⁴² Media and online reports suggest that Uber commission rates exceed 20 percent on particular NYC routes. Uber's website acknowledges that it engages in route-based pricing and that price differentials do not accrue to the drivers.

which were 25 percent in Uber's early days, now vary from about 10 percent at Via and Juno to 20 percent at Uber and Lyft, and average 16.6 percent.⁴³ The smaller companies tend to have lower commissions, suggesting that the larger companies—with more economies of scale—set fares that are above, and pay drivers at rates below, the level that would obtain under conditions of greater competition.

While Lyft, the second largest app-based company in New York City, has a market share about one-third the size of Uber's, its commission level relative to passenger revenue and driver pay is similar to that of Uber. Indeed, as we discuss further below, Lyft has a higher commission rate and lower driver pay than any of the other app companies. This market concentration provides the companies with considerable, but not unlimited, price and commission-setting market power. The companies' price-setting power is also evident in how they vary their prices by neighborhoods and routes (Newcomer 2017).

The industry's average 16.6 percent commission rate in New York City may not seem excessive, relative to mark-ups of 15 percent at Amazon or at some other internet-based companies (Ovide 2016). However, the comparison is inexact, as Amazon has 600,000 employees, maintains large inventories of goods in numerous modern warehouses, and pays its employees mandatory and voluntary benefit packages, which the app-transportation industry's independent contractor drivers do not receive. The next largest e-commerce platforms (after Amazon) provide more apt comparisons. These include eBay (with a fee of 7.7 percent, Etsy (five percent) and Shopify (two percent). As these comparisons suggest, e-commerce retailers' fees reflect the number items in their online stores. Other comparisons of transaction fees in two-sided markets include Visa and MasterCard credit payment clearinghouses, which charge merchants in the neighborhood of two percent, Paypal (also two percent) and financial intermediaries, where the spread between interest rates on savings and on loans is in the neighborhood of two to three percent. The app industry falls somewhere between e-commerce retailers and credit card companies intermediaries. These comparisons suggest that the app industry's commission rates could be as low as six to seven percent and still remain profitable.⁴⁴

Mark-ups We examine mark-ups in the industry by drawing on data for Uber, as data for Lyft and the smaller companies are less available. As Stanford economist Robert Hall (2018) has emphasized, large mark-ups of price over marginal costs indicate market power. Uber's annual revenue from passenger fares in New York City amounts to about \$2 billion, of which it retains about \$375 million in commissions and some smaller fees.⁴⁵ Its

⁴³ We present these data in Section 5.

⁴⁴ Credit card transaction fees are only 0.3 percent in Europe, mainly because anti-competitive restrictions are greater than in the U.S. <https://www.fool.com/investing/2017/12/18/how-ebay-makes-most-of-its-money.aspx>; <https://www.merchantmaverick.com/the-complete-guide-to-credit-card-processing-rates-and-fees/> Uber has reported ongoing multi-billion-dollar losses for the company overall. These losses stem from its investments in autonomous cars and in expansion efforts, especially in Asia and Latin America, not from their domestic operations. Ian King and Eric Newcomer, "Uber Spent \$10.7 Billion in Nine Years. Does It Have Enough to Show for It?" Bloomberg.com, March 6, 2018.

⁴⁵ Extrapolating from the October 2017 TLC earnings data yields \$2.0 billion in annual revenues and \$375

local operating costs consist mainly of payroll costs for approximately 200 employees (primarily software engineers, marketing specialists, fraud checkers and support staff), rent on the office space (including locations in Chelsea and Midtown Manhattan) that houses these employees, expenses for attorneys and lobbyists, and rent on its recruitment and training centers that are scattered among the city's boroughs.⁴⁶

We conservatively estimate that these operating costs for Uber's New York City business add up to roughly \$50 million per year, which equals about 13 percent of its estimated \$375 million in New York City profits. These figures suggest that Uber's mark-up is six times larger than its variable operating costs, or 600 percent.⁴⁷ Such a large mark-up suggests a considerable capacity to increase driver pay.⁴⁸

4.4 How the app-based industry differs from other networked industries

The business model of the app-based transportation industry differs from those in other networked industries— in three important respects.⁴⁹

First, as we have discussed, the industry's cost structure has generated an oligopolistic market structure—permitting two or more firms to compete, but not leading to a single winner. Indeed, at least two app firms (Uber and Lyft) now compete with each other in most U.S. cities, and four app firms operate in New York City. The structure of the industry is therefore an oligopoly. Oligopolies make profits that are well above the norm in much more competitive industries, yet they also compete with each other and cannot be regulated as if they were public utilities.

Second, the app-based transportation industry's business model differs from other networked industries by requiring persistent excess capacity. Its vaunted convenience for riders is most embodied in low wait times for rides—generally five minutes or less.

million in commissions.

⁴⁶The number of Uber's employees in New York City is based on a personal communication with Jonathan Hall of Uber. Most of the costs of screening and licensing new drivers are borne by the drivers or the TLC. Some additional local operating costs can be attributed to a share of overall corporate expenses at Uber's San Francisco headquarters, in proportion to the size of the New York City market relative to Uber's global market. But this share is very small: In 2017 Uber had about 50,000 drivers in New York City and over 1.5 million drivers world-wide (UBER Statistics Report 2017 Business of Apps. www.businessofapps.com/data/uber-statistics/).

⁴⁷ De Loecker and Eckhout (2017) estimate that mark-ups in the U.S. economy are approximately 67 percent, up from 18 percent in 1980. See also Autor et al. (2017) and Hall (2018).

⁴⁸ Some readers may question why we do not include drivers' pay and expenses in the mark-up calculation. After all, the industry is not just a software system; it transports passengers from one point to another. Such costs would be relevant if we were calculating the mark-up rate of the app-based transportation sector as a whole. But they are not relevant when we are considering just the profitability of the app-based companies.

⁴⁹ As we saw in Section 2, the app-based industry's business model in New York City differs somewhat from that in other U.S. cities. Our discussion in this report focuses on the New York City case.

Companies compete for passengers by keeping wait times low, even beyond the value of the saved time for the riders. Such low wait times are made possible by the availability, at any point in time and place, of numerous idle cars and drivers. This condition is facilitated by new driver entry into the industry. Although the drivers and their vehicles must meet the TLC's safety and consumer protection licensing requirements, neither the TLC nor the companies themselves restrict the flow of new drivers into the industry.

Third, the industry's business model relies on drivers to be independent contractors. The drivers pay the considerable investment and operating costs of their vehicles and do not receive the benefits mandated or provided voluntarily to employees. In the New York City context, a large proportion of the independent contractors are drivers who invested in their cars for business use. They must therefore work long hours to recoup their up-front investments or lease costs. The amount of fare revenue that the companies retain is therefore not linked directly to the pay the drivers receive.

These three components of the app-based industry's business model generate three corresponding market failures. First, company mark-ups over local operating costs are higher than is required for the industry to operate effectively, reducing the proportion of revenue that the industry shares with its drivers. Second, the drivers' investments in their vehicles make it difficult to switch their employment to other industries. This barrier keeps driver pay lower than it would be otherwise. Third, inefficient utilization of driver working hours results in lower driver pay per hour and more cars on the streets. We argue that each of these failures would be remedied by the regulatory intervention proposed by the TLC.

4.5 Driver utilization and driver response to pay increases

As we have noted, the companies compete on fares and on customer response time. According to company publications, the standard response time in New York City is five minutes. The companies rely on the availability of drivers; their ability to attract drivers depends on their ability to provide trip opportunities, as the drivers have no independent access to passengers and are not permitted to pick up street hails.

The app-based companies set their own prices and do not interact directly with taxis or their drivers. In contrast, similar companies operating in Europe and elsewhere, such as mytaxi.com, developed apps that enhanced the existing taxi system rather than competing with it.⁵⁰ Uber and its followers instead developed their apps to draw upon the large pool of

⁵⁰ Mytaxi.com, a Germany company, did attempt to enter the U.S. market, in Washington, DC, but quickly withdrew, because of competition with Uber and regulatory obstacles to including Yellow Cabs in their business model. In New York City, riders have been able to hail medallion taxis using an electronic app

unemployed or underemployed workers and their (mostly) idle cars. Moreover, these companies lobbied cities heavily not to restrict the number of app-based vehicles, even at the cost of harming the medallion segment of urban transportation.⁵¹ Thus, in 2015, Uber's aggressive public campaign and lobbying efforts soundly defeated a proposal to cap the number of app-based cars in New York City, clearing a path for unprecedented growth.

As we have emphasized, the app-based companies are able to pass on to the drivers the cost of capital that is embodied in driver-owned or leased vehicles, including the risks on these investments. In other words, the app companies are not responsible for covering most of the industry's capital and labor costs. It is thus not surprising that the enormous growth in the number of trips has not translated into higher net earnings per hour for individual app drivers.

Driver recruitment The rapid growth of app-based urban transportation could not have occurred without a simultaneous rapid increase in the number of app-based drivers. While these drivers decide when and how long to work, they have limited latitude in choosing whether or not to accept individual ride offers.⁵²

The drivers must be licensed by the TLC. A driver can choose whether to purchase or lease a car for business use only, use an existing vehicle for business only (provided it meets vehicle model and year requirements determined by the companies), or use an existing vehicle for a mix of business and personal use. The drivers are responsible for all the costs associated with their rides (licensing, insurance, fuel, leasing or car loan payments, depreciation, maintenance costs, etc.) and they bear the risks of their investments in their cars.

A capital investment and labor supply model Across cities in the U.S., the opportunity provided by the app-based companies for workers to earn additional income by driving several hours a week—and on one's own schedule—has appealed to large numbers of unemployed and under-employed workers. Recall the context—the rapid increase in part-time work and in unemployment during the Great Recession and the slow labor market recovery from the Great Recession.

In New York City, as we documented in Section 2, only a small minority of Uber drivers already had their own cars; many are recent immigrants with limited labor market and

since 2013. Taxi drivers now have access to two app devices (Curb and Arro), but they are less well known even among veteran taxi riders.

⁵¹ The employment status of New York City's taxi drivers shifted from employees to independent contractors in the late 1970s. The app-based drivers also operate as independent contractors. Disputes about their status continue to work their way through the judicial system and are not yet fully resolved. A related literature refers to them as dependent contractors (Bernhardt 2015).

⁵² Uber requires drivers to accept 80-90 percent of ride offers and "deactivates" drivers who fall below that level. Alex Rosenblat, "The Truth About How Uber's App Manages Drivers," *Harvard Business Review*, April 5, 2016.

credit opportunities who can obtain cars only at subprime rates and terms. Unlike in other cities, a substantial fraction of New York City drivers had to acquire cars to enter the industry. As well, they must obtain relatively expensive commercial auto insurance. The resulting high level of fixed costs explains the unusually large proportion of app drivers in New York City who work full-time: 0 percent work more than 30 hours per week and 40 percent work 40 or more hours per week.

Responsiveness of driver hours to pay increases A key issue for regulatory attempts to increase driver pay concerns the responses of the drivers themselves. If enough drivers respond to a pay increase by driving more hours and if more drivers want to enter the industry, the effect of a pay increase could be diluted substantially. More cars and drivers on the streets at any time competing for the same number of rides implies a smaller number of trips per hour for drivers, diluting their pay per hour.

Economists refer to changes in hours worked in response to pay increases as the “elasticity of labor supply.” For example, an elasticity of 0.1 implies that every 10 percent increase in pay results in a one percent increase in labor hours supplied or worked. Increases in hours because new drivers enter the industry are adjustments along an extensive margin; increases in hours by incumbent hours are increases along the intensive margin. Labor supply elasticity consists of adjustment along both margins. Labor supply elasticities for males ages 25 to 54, the demographic group that makes up well over 90 percent of taxi and app drivers, are generally thought to be very low—implying that pay increases have very little effects on this group’s working hours.

A large research literature has debated whether the elasticity of labor supply of taxi drivers is negative (for example, Camerer et al. 1997) or positive (for example, Farber 2015). However, labor supply elasticity studies of taxi drivers are not informative for app drivers. Recall that most taxi drivers must pay the fixed costs of leasing their vehicles; medallion leases generally are for a 12-hour shift or an entire week. App drivers—in principle—have much more flexibility.

We are aware of only two studies that attempt to estimate labor supply elasticities for app-based drivers: Angrist, Caldwell and Hall, 2018; and Hall, Horton and Knoepfle, 2018. Both papers use data on Uber drivers only and both use driver populations that differ markedly from the current app-based driver population in New York City. Angrist et al. draw from a sample of Uber drivers in Boston in July and August of 2016. Hall et al. study Uber drivers’ responses to short-term surge pricing changes in 20 metropolitan areas across the U.S. during the period June 2014 to January 2017.⁵³

Both studies suggest that the labor supply elasticity of Uber drivers is quite high, which

⁵³ Chen et al. 2017 also estimate labor supply elasticities of Uber drivers, but only on a disaggregated basis, with nine weekly time blocks and five types of drivers—morning, evening, weekend, late night and occasional. The occasional drivers make up 56 percent of the driver sample. Chen et al. note that their elasticity estimates are unstable—because few drivers work in two consecutive weeks. This study is therefore not informative for ours.

raises the dilution fears we discussed above. We discuss these papers in detail in the appendix to this section. Our summary is that the 0.5 labor supply elasticity estimated by Horton et al. likely constitutes an upper bound and that supply elasticities in New York City are more likely to be somewhat lower. Previous labor supply studies of low-wage workers, summarized by Katz (2018), estimate a labor supply elasticity of 0.2 for the low-wage part of the labor market. To be conservative, in Section 5 we use a 0.4-0.5 range.

Our takeaway from the research literature is that an effective pay policy must include a tool that prevents a reduction in driver trips per hour because drivers will want to drive more hours. Ideally, such a tool would provide incumbent drivers with more trips per hour. As we saw in Section 3, the proposed TLC policy includes such a tool.

Utilization rates Our simulation exercises in Section 5 will illustrate the power of increasing driver trips per hour as a means of increasing pay while minimizing fare increases. We discuss here the levels and variation of driver utilization in the industry, in order to inform how much the TLC policy tool could increase utilization rates.

In its early years, UberX expanded its revenue by reducing its fares and response time. According to the company's blog, fares fell by 20 percent between September 2013 and September 2014. The resultant acceleration in rider demand lifted UberX drivers' earnings by nearly 40 percent according to the company. These earnings gains occurred primarily by reducing driver idle times—from 36 minutes per hour in September 2013 to 21 minutes per hour in September 2014. The increase in driver earnings subsequently slowed to six percent from September 2014 to September 2015, while idle time fell to 20 minutes in the same time period, according to Uber. Based on TLC-supplied data, it now appears that idle time for both dedicated Uber and Lyft drivers is about 25 minutes.

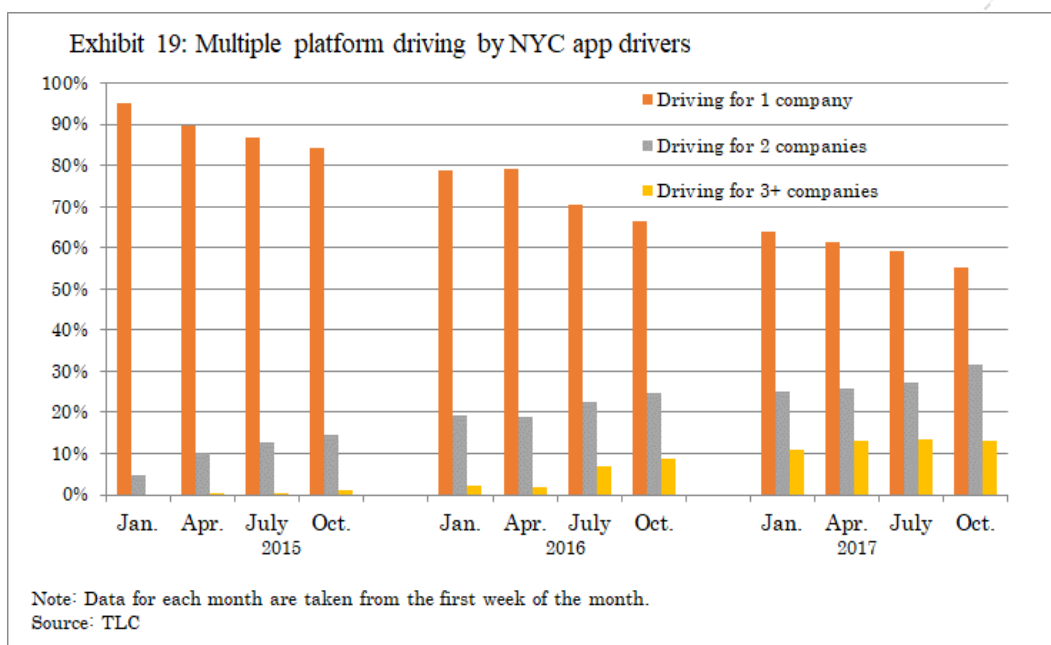
Horton et al. 2018 also suggest that utilization rates could be under-estimated for multi-platform drivers, who may have more than one app on at a time, until they obtain and accept a requested ride. We overcome this problem because we report utilization rates only among single-platform drivers. We can do so because our TLC data permit us to observe which drivers work on more than one platform.

Company control over new driver entry Each company can choose the number of drivers who are credentialed on its system. It does so by admitting new drivers. The companies cannot control each driver's working time on the system—the time the driver has the app opened and is available for rides.⁵⁴ In our model, companies add new drivers to make up for attrition of their existing driver labor force, and as well to meet any shortfall in needed driver hours, after incumbent drivers choose their working hours. By needed driver hours we refer to the number required by passenger demand growth each year.

⁵⁴ The TLC does not limit the supply of licensed drivers, as it lacks the authority to cap the number of drivers. In principle, the City Council could give them such authority, but that possibility lies outside the scope of this report.

Although app passenger demand increased by 60 percent in 2017 alone, such growth is not sustainable. Indeed, much of it occurred by opening new markets for app-dispatched trips in the outer and underserved parts of the city.

Multi-platform driving Because of the drivers' need to increase their utilization and hence earnings capacity, drivers have increasingly chosen to work on multiple platforms, as indicated in Exhibit 19. The companies encourage multi-platform driving as it provides them with an additional supply of potentially idle drivers. The smaller companies have facilitated this process by allowing easy access to their own app to already-licensed drivers for the larger companies. The larger companies benefit from having drivers available to them even if they work primarily for another app.



4.6 How would consumers respond to fare increases?

The final element in the app industry business model concerns its popularity among consumers. Although consumer demand for app trips has grown enormously, it is not clear how consumers would respond to fare increases, in large part because demand growth allows few opportunities to identify how consumers might react to fare increases. The research literature on consumer demand in the app-dispatch industry is therefore extremely thin.

Cohen et al. 2016 use surge pricing by Uber to estimate that a one percent increase in fares reduces passenger demand by between -0.4 and -0.6 percent. However, as Castillo, Knoepfle and Weyl mention, these estimates are based upon extremely short time periods. The demand elasticity for Uber trips is twice as large (Weyl personal communication May 11, 2018). To be conservative, we use the upper end of this range: an elasticity of -1.2.

4.7 Summary

The app-based transportation industry business model requires low driver utilization and relies on drivers to make the capital investments and labor supply commitments—as independent contractors. The industry relies on a surplus of drivers to keep wait times low. Although the cost curve for the industry generates oligopoly, not monopoly, the industry's pricing model yields mark-ups that are well above levels in comparable industries that also provide intermediary services. We review the literature on labor supply and consumer demand elasticities and determine magnitudes of each that we will use in our simulations in Section 5.

Appendix to Section 4 Other labor supply estimates

Angrist, Caldwell and Hall 2017, hereafter ACH. ACH report a labor supply elasticity of 1.2, which they estimate from a randomized control trial among 1,600 Boston Uber drivers in August and September of 2016. The treated group, which alternated with the control group in successive weeks, was offered the option of not having to pay a 25 percent commission to Uber the following week. Of the 1600 drivers, 1031 accepted the offer in either the first or second week of the trial. Drivers who accepted the offer increased their hours by an average of 35 percent. The ACH sample excluded the 23 percent of drivers with zero hours. They state, but do not show details, that there was little variation in responses according to number of hours driven the previous month. They also report that their estimated supply results were the same for drivers with older cars. Such cars were not eligible to be Lyft vehicles, suggesting similar responses among drivers who drove only for Uber.

ACH report that 14 percent of active drivers in Boston are female, their mean age is 42, and they drove an average of 13 hours per week in the month preceding the trial. This profile differs considerably from the New York City app driver labor force and the proportion who drive full-time. The trial was short-run, suggesting that the extra income per hour was seen as a windfall and does not represent the adjustments drivers might make if the trial was made permanent. We conclude that the ACH experiment is not informative for New York City.

Hall, Horton and Knoepfle 2018, hereafter HHK. HHK estimate a labor supply elasticity of 0.5 for Uber only. The response was almost entirely among incumbent drivers (intensive margin) and not by attracting additional drivers (extensive margin). They acknowledge that labor supply elasticity for the industry as a whole would be much lower, since switching costs among app firms are close to zero. HHK suggest that hours could be over-estimated in their data, leading to lower estimated earnings (before expenses), insofar as drivers have their apps on while commuting from their homes to areas of high demand, such as downtown Manhattan. Since most drivers live in the Bronx, Brooklyn, or Queens and half of all trips begin or end in these boroughs, this problem should not be present in our data.

Section 5 **How Drivers, Companies, and Consumers Will Adjust**

The proposed pay standard for app-based drivers will generate benefits and costs, with incidences that will vary among groups. In Section 2, we noted that 85 percent of drivers are currently paid below the proposed standard and that an average increase of 14 percent would raise these drivers to the proposed payment standard. In Section 4 we discussed the important role of idle drivers and vehicles in the industry's business model and the high levels of commissions relative to those in related industries. That discussion showed that idle time for the drivers constituted a benefit for the companies without any corresponding cost, while at the same time imposing substantial costs on drivers. The policy proposed by the TLC would better align the companies' interests with those of the drivers. The resulting improved efficiency could provide a major means of absorbing the costs of higher driver pay.

In this section, we examine through a simulation model how drivers, riders, and the app-based companies will react to the policy. The policy will increase the payments collected by drivers during their working time. In principle, the companies could absorb this increase simply by increasing consumer prices by a similar amount. However, as we discussed in Section 4, passenger demand for app rides is relatively price-elastic. Companies might not want to incur revenue losses if they raise fares, nor might they want to reduce their market shares if other companies do not raise their prices. They might prefer to absorb the costs of the pay standard through other actions, including increasing driver utilization rates, increasing the proportion of shared rides, and reducing commission rates. We argued in Section 3 that the proposed policy incentivizes all three of these responses. By presenting a series of alternative adjustment scenarios, our simulation model quantifies the importance of each of these responses. It turns out that the incentive to increase driver utilization provides the largest effect on the adjustment process.

5.1 **Direct effects on the drivers**

Drivers are paid basically on a piecework basis, that is, for each trip. Driver weekly pay therefore depends on three elements: their pay for an average trip, the number of trips they provide per hour, and the number of hours in a week that they are available for trips.

Although the pay standard will raise pay per trip for most drivers, increased utilization will reduce average trip pay, but this will be offset by the increased number of trips per hour. The company-specific utilization rate in the pay standard formula encourages companies to offer drivers more trips per hour.⁵⁵ With utilization in the denominator of the pay standard formula, increasing utilization means that the companies can reduce the per trip payment to drivers. Some drivers, especially those who now drive part-time, will increase their weekly working hours.

As we estimated in Section 2, before-expense driver earnings for the 85 percent of drivers below the standard will increase by 14 percent, averaged across the companies. Relative to overall driver pay, including the 15 percent of drivers above the standard, the cost of

⁵⁵ The utilization factor in the pay standard formula is the company-wide utilization for the prior quarter.

the pay increase for the companies is 11.3 percent. The \$1 per-pickup shared ride bonus is applied on top of the minimum pay standard, to compensate drivers for the additional labor in providing shared rides. When the cost of the shared ride bonus is factored in, the total cost of the proposed pay policy to the app-based companies is 13.2 percent of current total driver pay. Increases for individual companies will vary from the average. Our estimate assumes that companies will manage the overall assignment of rides to drivers in a manner that increases their utilization.

The driver pay increases will benefit all app drivers, but particularly the 85 percent who currently are paid below the pay standard. The average increase for drivers currently below the pay standard would be approximately \$6,345 per year, including the shared ride bonus. The 15 percent of drivers currently above the pay standard would get an average of a little over \$700 for the shared ride bonus. The increase in aggregate driver earnings would equal \$335 million per year.

As we noted in Section 4, these direct effects are subject to indirect effects on the drivers that arise from adjustments to the policies by the drivers themselves, by the companies, and by riders. We turn next to describing and quantifying the policy adjustment process more broadly.

5.2 The policy adjustment process: a qualitative perspective

We consider here adjustments in labor supply, driver utilization, shared rides, fare increases, and commission rates.

Labor supply If hourly earnings effectively rise due to the pay standard, drivers on average will increase their labor supply, that is, their time working. But this will vary depending on the hours they usually drive and on individual considerations. Drivers currently working very long hours, including the 22 percent of drivers working 50 or more hours each week, are likely to reduce their hours if their effective hourly pay rises. Other full-time drivers and many part-time drivers may respond to the earnings increases per hour by increasing their working hours.

Driver utilization Since the utilization rate appears in the denominator of the per-mile and per-minute components in the pay standard formula, companies are effectively rewarded for increased utilization by reducing the per trip driver payment. Increasing driver utilization rates has the potential to absorb a substantial portion of the increased costs to the companies. For the last half of 2017, utilization rates were about 58 percent for Uber and Lyft, with Juno's utilization about 50 percent. In contrast, Via's utilization rates were close to 70 percent. Low utilization means a higher number of drivers and vehicles are cruising while waiting for rides, which reduces hourly compensation for drivers as well as contributes to congestion. The prevailing business model of the app companies provides insufficient incentives to raise utilization.

Compared to two or three years ago, the app companies can now more easily satisfy trip

demand growth with existing drivers. Consequently, they could increase driver utilization by better managing the entry of new drivers into their systems. A pay standard policy that incentivizes driver utilization will be more successful than one that relies only on increases in driver earnings. Drivers would then realize more pay per trip from the standard, greater trip volume, and more passenger time (and earnings) per hour. According to Hall et. al. 2018 and Cook et.al. 2018, increasing utilization in the range discussed here (four to six percentage point increases) is not likely to result in a significant increase in wait times.

Shared rides The proportion of all rides that are shared rides has been increasing steadily, from 17 percent in the third quarter of 2017 to 23 percent in the first two months of 2018.⁵⁶ A further increase in the proportion of shared rides increases utilization. It also rewards companies by generating additional passenger revenues, and rewards drivers since the pay standard policy gives drivers a \$1 bonus for each shared ride pickup. As noted in Section 3, shared rides are disproportionately provided by drivers in the two lowest-earning quintiles of the earnings distribution. That suggests they are currently under-paid for providing shared trips and underscores the purpose of the shared ride driver bonus in the proposed pay policy.⁵⁷ We consider the increase in shared rides as part of the way the policy increases driver pay and also utilization.

Fares and commissions The portion of the pay increase not absorbed by increased utilization can be accommodated through a combination of adjustments to passenger fares and company commissions. Our estimate for consumer demand price elasticity (-1.2) leads us to expect the companies to consider reducing their commissions to maintain market share in a competitive environment.⁵⁸

Commissions for the app companies have considerable room to adjust. As we have noted, commissions in the industry exceed company costs by much greater amounts than in other high-technology sectors. Moreover, app-based commissions vary substantially over time for individual companies and as well across companies. Uber and Lyft, the two largest companies, charge the highest commissions, despite or perhaps because of their larger economies of scale. They also have the lowest average net hourly driver earnings.

5.3 Simulating alternative pay adjustment scenarios: a quantitative perspective

We estimate here a model that simulates alternative adjustments to the pay standard by the drivers, the companies, and the consumers. We use information from the TLC administrative data to inform our estimates for the key parameters, including driver

⁵⁶ TLC trip data.

⁵⁷ See, e.g., Lyft: <https://help.lyft.com/hc/en-us/articles/115012926987-Lyft-Line-driver-pay>

⁵⁸ Consumer price elasticity for app services throughout the five boroughs is much higher than the Schaller estimate of demand elasticity for Manhattan-oriented taxi services and is higher than the experience following the 2012 medallion fare increase. In any case, the price elasticity of demand throughout the five boroughs is likely to be higher than in core Manhattan since rider incomes are lower in the other boroughs where service has expanded rapidly in the last two years. Moreover, the elasticity facing an individual company in an oligopolistic market will be greater than in a market environment with a single, regulated fare.

hours, driver pay, passenger fares, and commission rates. We draw from the research literature for the labor supply and consumer demand elasticities. As noted above, we focus on the policy-induced impacts by leaving aside the impact on fare revenue from changes in the number of trips, except in the case of the effect of fare changes on the demand for trips and the associated revenue impact.

The adjustment process would occur simultaneously using all of its channels. However, to keep our presentation simple (and nontechnical), we will discuss the model as if it proceeded in an iterative fashion through three stages.

Stage 1: The effect of initial driver labor supply responses, an increase in the portion of shared rides, and the effect on company costs of utilization adjustments by the companies.

Stage 2: The choice companies would make in responding to the remaining additional company costs not covered by increased utilization. We model this choice as a tradeoff between fare increases and commission rate adjustments.

Stage 3: Adjustments to driver supply and fare revenue if a passenger fare increase leads to reduced consumer demand for trips.

Stage 1: Effects on company costs

Driver supply responses Our discussion in Section 4 of the labor supply estimates in Katz (2017) and Hall et al. (2018) suggested driver labor supply elasticity estimates of at least 0.2 and lower than 0.5. To be conservative, we use 0.4 on average. We consider three groups of drivers: full-time, part-time drivers leaning full-time, and part-time drivers not likely to seek additional hours. Full-time drivers include those working 30 hours a week or more. Those at the lower end of the full-time spectrum may seek to work additional hours in response to the prospect of higher net pay; those working very long hours may seek to reduce their hours (if their behavior conforms to the income-targeting hypothesis). For full-time drivers as a group we use an average labor supply elasticity of 0.35. For drivers usually working 20-30 hours a week—the group we consider the part-time, leaning full-time group—we use a supply elasticity of 0.7. We use a supply elasticity of 0.5 for regular part-time drivers (those working less than 20 hours a week), who likely have another job or another reason for working such limited hours. These elasticities imply an overall driver supply elasticity of 0.4, which for a 10.7 percent pay increase would mean a 4.3 percent increase in driver hours.

Company utilization response Without the pay standard and the role that utilization plays in the pay standard formula, the companies have no incentive to manage driver time efficiently, so long as driver net pay does not fall below their reservation wage, i.e., the wage they would receive if they could find an alternative job, less the costs of switching jobs. A utilization increase is effectively a productivity increase since drivers will be logging more passenger time each hour. With the new policy, companies will seek ways to

increase utilization, such as: limiting the entry of new drivers into their systems; queuing the next ride when a driver is close to completing the current ride; allocating trips to drivers whose driving records suggest they drive very long hours and are therefore likely to reduce their hours; and by promoting more shared rides that increase measured utilization. The app technology provides the companies real-time information on driver time and history. In sum, the app companies could readily improve their management of driver utilization.⁵⁹

Our simulations will show that increasing utilization will provide the companies' primary means of absorbing the effect of the pay standard. Our simulation is independent of the actual likely rates of continuing market growth. The increased driver productivity will not lead to a net reduction in driver hours if there is substantial further market growth, which seems likely. The companies will still allow new entrants, beyond those required to replace drivers leaving because of attrition, at rates that fill the gap between market growth and the increased trips that would be provided by incumbent drivers.

Stage 2: Passenger fare increase and commission rate change

The companies' decision on a passenger fare increase is effectively part of a joint decision about changes in the company commission rate as well. The choice of holding fares steady or increasing them essentially determines the commission rate and reflects each company's perceptions of the impact on their market position.⁶⁰

Since the drivers bear almost all the capital costs associated with providing app-passenger services, the operating costs of the companies are limited, giving them considerable latitude to lower commission rates from current levels. As we showed in Section 4, in a more competitive industry, app companies would be receiving commission rates well below the approximately 20 percent that are now charged by the major companies. The policy proposal should nudge the industry to be more competitive by reducing commissions rather than raising fares in response to the driver pay increase. To monitor how the companies comply with the policy, TLC should collect per-trip fare data, including driver payments, and passenger fares.

Stage 3: Effects of any fare increases on driver pay and trips

Stage 3 of the simulation model incorporates the feedback effect of any fare increase-related decline in passenger demand on drivers and company revenue. If passenger fares rise, the consumer demand response is likely to reduce the number of trips demanded. Driver trips and pay will decline accordingly. Still, any fare increase-related reduction in trip demand is likely to be much smaller than the other factors discussed here that

⁵⁹ Rosenblat, for example, argues that once a driver is logged onto Uber's app the driver's activities are heavily monitored and algorithmic management is used to influence driver performance. Alex Rosenblat, *The Truth About How Uber's App Manages Drivers*, *Harvard Business Review*, April 6, 2016.

⁶⁰ The recently enacted MTA surcharge for app services adds \$2.75 per trip for vehicles entering or leaving the core Manhattan business areas. This mandate will increase passenger fares for an average trip by about 20 percent. The fare increase will generate some reduction in demand for trips in Manhattan and it will likely increase passenger sensitivity to further price increases. These effects are not part of our analysis, as they are independent of the proposed driver pay standard.

contribute to increased labor supply or demand (and pay) from likely market growth.

Wait times The pay standard's effect on utilization is not likely to significantly lengthen passenger wait times. The current industry standard for average app response time to a passenger request is five minutes (300 seconds). According to Cook et al. (2018) a 10 percent increase in driver utilization rates would likely increase response times by six percent, which amounts to 18 seconds.

We envision a smaller utilization increase—of six percent, which implies a wait time increase of 12 seconds. We do not have data on whether wait times differ by neighborhood. They may be somewhat higher in areas with low trip densities, such as in the outer boroughs. However, population density in these areas is much higher than in other U.S. cities, where wait times also average five minutes. If wait times were six minutes instead of five, the increase in wait time would be 15 seconds.

5.4 Simulation results under three plausible scenarios

Exhibit 20A summarizes the results of our simulations for three scenarios for a 14 percent average increase in driver pay. Each scenario applies a plausible set of assumptions for the utilization increase, consumer price elasticity, and fare increase. The three scenarios show how the results vary with different parameter assumptions. We consider these three to be the most likely scenarios. In section 5.5, we vary the key parameters differently and summarize the results of additional scenarios, which are shown in Exhibit 20B.

The three scenarios in Exhibit 19A all utilize a 0.4 labor supply elasticity, a four percentage point utilization increase (58 to 62 percent), and a -1.2 consumer demand elasticity. Scenario A assumes no fare increase, Scenario B a three percent fare increase, and Scenario C a five percent fare increase. Our three most important results are shown in rows 8-10 of Exhibit 19A: the company commission rate; the change in passenger wait times; and the share of the cost of the pay increase absorbed by increased utilization. Key intermediate results include the increase in trips provided by incumbent drivers (rows 3 and 5), the reduction in trip demand resulting from a fare increase (row 4), and the overall change in incumbent driver pay (row 6).

In Scenario A with no fare increase, the average commission rate drops by about two-thirds, from 16.6 percent (as estimated from the mid-October 2017 TLC data) to 5.6 percent (row 8). Increased utilization absorbs a little over half of the policy-related driver pay increase (row 10), with the balance met through a reduction in the commission rate when passenger fares are unchanged.

Under Scenario B, a three percent fare increase, the commission rate is reduced less, declining from 16.6 to 8.3 percent. Even an 8.3 percent commission is well above the rate that would prevail under conditions of more effective competition in the industry. With a five percent fare increase as in Scenario C, the commission rate is reduced to 10.1 percent.

The four percentage point utilization increases in all three scenarios are associated with the

same 52 percent absorption of the driver pay increase and the same very slight 12-second increase in wait times (the wait time effect was scaled to Cook et.al.'s [2018] estimate that a 10 percent utilization increase added six percent to wait times).

Note that the simulations in Exhibit 19A focus on the immediate impacts of the pay policy change. They do not incorporate the effects of increased market demand on revenues and driver pay. Since commissions are the residual after drivers are paid from passenger revenues, factoring in market-related revenue gains would raise the amount of commissions and the commission rate (commissions as a percent of passenger revenues). Thus, the results in Exhibit 19A overstate the likely impact of the pay standard implemented in the context of continued market growth.

Exhibit 20A: Simulation Results Using Three Pay Adjustment Models

Effects of a 13.2 percent increase in the cost of total driver pay, under three scenarios. (The 13.2 percent increase includes the shared ride bonus and is the increase for total driver pay; the 14.0 percent increase cited in the text is the average increase for those below the standard to bring them up to the standard.)

Scenarios vary with changes in passenger fares.

Trips provided by incumbent drivers increase because drivers increase their hours and as a result of utilization increases.

Labor supply elasticities: full-time drivers 0.35; part-time drivers leaning full-time 0.7; part-time drivers 0.5; average = 0.4

Key parameters in pay adjustment model ==>	A	B	C
	4 percentage point utilization increase, no fare increase	4 percentage point utilization increase, 3% fare increase, -1.2 demand elasticity	4 percentage point utilization increase, 5% fare increase, -1.2 demand elasticity
1 Percent increase in hours worked by incumbent drivers in response to pay increase (13.2 x 0.4)	5.3	5.3	5.3
2 Percent increase in trips provided by incumbent drivers as utilization increases (%)	6.9	6.9	6.9
3 Percent increase in trips provided by incumbent drivers (row 1+row 2)	12.2	12.2	12.2
4 Percent change in demand for trips resulting from fare changes	0.0	-3.6	-6.0
5 Net change in # trips by incumbent drivers (row 3 + row 4)	12.2	8.6	6.2
6 Percent change in overall pay of incumbent drivers after adjusting for effects of fare changes	13.2	9.1	6.4
7 Net percentage change in fare revenue, relative to no policy change	0.0	-0.7	-1.3
8 Company commission rate (percent). Current = 16.6 percent.	5.6	8.3	10.1
9 Change in passenger median wait times (seconds)	12	12	12
10 Share of cost of pay increase absorbed by increased utilization rates (6.9% efficiency gain divided by 13.2%), (in percent)	52.3	52.3	52.3

Source: Authors' analysis.

5.5 Alternative pay adjustment scenarios

We present four additional scenarios in Exhibit 20B. Under Scenario D, utilization increases by six percentage points instead of four, and passenger fares rise by three percent. This greater utilization increase absorbs almost all of the cost of the driver pay increase and results in an 8.3 percent commission rate. Customer wait times rise by about 19 seconds. Scenario E shows the effect of a three percent fare increase without any change in utilization. The net change in incumbent driver pay remains the same—9.1 percent—as in Scenario D, and the commission rate also stays the same, at 8.3 percent. No change in utilization leaves wait times unchanged but with the absence of productivity gains, there is no offset for any of the driver pay increase.

Exhibit 20B: Alternative Pay Adjustment Scenarios

Effects of a 13.2 percent increase in the cost of total driver pay, under three scenarios. (The 13.2 percent increase includes the shared ride bonus and is the increase for total driver pay; the 14.0 percent increase cited in the text is the average increase for those below the standard to bring them up to the standard.)

Scenarios vary with changes in (1) utilization; (2) fares; and (3) labor supply elasticity

Trips provided by incumbent drivers increase because drivers increase their hours and as a result of utilization increases.

Labor supply elasticity: 0.4 (see Exhibit 19A) except Scenario F.

		D	E	F	G
Key parameters in pay adjustment model =		<u>6 percentage point utilization increase, 3% fare increase, -1.2 demand elasticity</u>	<u>No utilization change, 3% fare increase, -1.2 demand elasticity</u>	<u>0.5 labor supply elasticity, 4 percentage point utilization increase, 3% fare increase, -1.2 demand elasticity</u>	<u>4 percentage point utilization increase, 10% fare increase, -1.2 demand elasticity</u>
1	Percent increase in hours worked by incumbent drivers in response to pay increase	5.3	5.3	6.6	5.3
2	Percent increase in trips provided by incumbent drivers as utilization increases (%)	10.3	0.0	6.9	6.9
3	Percent increase in trips provided by incumbent drivers (row 1+row 2)	15.6	5.3	13.5	12.2
4	Percent change in demand for trips resulting from fare changes	-3.6	-3.6	-3.6	-12.0
5	Net change in # trips by incumbent drivers (row 3 + row 4)	12.0	1.7	9.9	0.2
6	Percent change in overall pay of incumbent drivers after adjusting for effects of fare	9.1	9.1	9.1	-0.4
7	Net percentage change in fare revenue, relative to no policy change	-0.7	-0.7	-0.7	-3.2
8	Company commission rate (percent). Current = 16.6 percent.	8.3	8.3	8.3	14.2
9	Change in passenger median wait times (seconds)	19	12	12	12
10	Share of cost of pay increase absorbed by increased utilization rates (efficiency gain divided by 13.2 percent), (in percent)	78.0	0.0	52.3	52.3

Source: Authors' analysis.

Scenario F is the same as Scenario B (in Exhibit 20A), except that Scenario F assumes a labor supply elasticity of 0.5 instead of 0.4. Compared to Scenario B, the only simulation change in F involves a net change in trips by incumbent drivers (row 5). This result follows directly from the assumed greater responsiveness of drivers' desire to supply more trips in response to the pay increase.

Scenario G seems particularly unlikely since it has several adverse consequences. It shows that a 10 percent fare increase allows a fairly high commission rate of 14.2 percent. However, such a large fare increase would reduce passenger trips by 12 percent. It would therefore eliminate the policy-related driver pay increase for all incumbent drivers.

5.6 Summary

This section has analyzed the likely behavioral responses of the drivers, companies, and passengers to the 14 percent pay increase needed to lift FHV app drivers above the proposed pay standard. On average, drivers are likely to increase their working hours. At the same time, the structure of the pay standard should encourage companies to improve utilization—the efficiency with which they manage the drivers' time. This increase in driver productivity would absorb a large part of the cost of the driver pay increase.

The simulation model analyzes the overall effects of alternative scenarios, with different passenger fare increases, utilization increases, and driver responses to higher pay. These exercises show that the pay increase likely can be readily absorbed through a combination of utilization increases, commission reductions, and modest fare increases.

Our three most likely scenarios use core assumptions that we believe are highly plausible: a 0.4 labor supply elasticity, a four-percentage point utilization increase, and a -1.2 consumer demand elasticity. These scenarios then consider alternative passenger fare increases of zero, three, and five percent, and examine the implications for commission rates. Holding fares steady reduces the commission rate from 16.6 percent to 5.6 percent. With a three percent fare increase, a commission rate of 8.3 percent would result, and the commission rate would be 10.1 percent with a five percent fare increase.

Four additional scenarios, which we consider less likely, help illustrate the interaction among the key elements in the pay adjustment model. These additional scenarios provide three key insights: commission rate rises further with greater fare increases; a six, instead of a four, percentage point utilization increase would absorb three-fourths of the cost of the driver pay increase; and a greater fare increase would entail a greater consumer elasticity-related decline in trips, offsetting much of the initial increase in driver pay associated with the implementation of the pay standard.

All forecasts are inevitably uncertain. We do not claim that the behavioral responses by drivers, companies, and passengers will conform precisely to the expectations outlined here. But based on our own study of the industry and on the research literature on app-

dispatch services, we believe we have provided a reasonable assessment of the most salient factors. In any event, given the importance of the TLC policy proposal to drivers, the industry, and the riding public, we recommend that the TLC conduct ongoing and careful monitoring of the effects of the policy.



Section 6 Effects on the Non-App FHV Car Services

The proposed for-hire vehicle (FHV) driver pay standard currently will apply only to companies that dispatch more than 10,000 trips per day. This restriction limits the applicability of the proposal to the four app-dispatch companies—Uber, Lyft, Juno, and Via. The app-dispatch companies are part of the FHV sector, which is licensed by the TLC. The other FHV segments are traditional black car companies, livery services, and luxury limousine services. This section considers the current situation of these non-app FHV companies and how they will be affected by the FHV driver pay standard.

Black cars typically serve business clients who generally pay fares via vouchers or credit cards. Livery cars are typically neighborhood-based and serve individuals paying mostly in cash. Luxury limousine operators serve a mix of business and individual customers, with payment through business accounts or credit card.

The FHV drivers who work for these services are mainly independent contractors who mostly own or lease their own vehicles and bear responsibility for auto insurance, fuel, and all related operating costs. FHV drivers typically pay an affiliation fee to the operators, or “bases” as they are known in the trade. In some cases, the operators may also charge a commission fee, usually calculated as a percent of the passenger fare. In limited instances, some drivers for livery and luxury limousine services are hired as hourly employees and drive a company-owned car.

Most non-app FHV companies connect with passengers by phone, although a growing number use a website or an app of their own, or a combination of these methods.⁶¹ Both large and small FHV companies employ bookkeepers, dispatchers, and owner-managers. Larger ones may also have a small staff in human resources, customer service, and other general administrative and management occupations.

6.1 Non-app FHV base numbers, affiliated drivers, and trip trends

To analyze trends and impacts, we separate the app-dispatch operators into their own category, and consider the remaining black, livery, and luxury limousine operators as the “non-app” FHV segments.⁶² Exhibit 21 shows a significant decline in the number of livery and luxury limousine operators over the past four years, but a very substantial increase in black car operators, even when excluding the app-dispatch ones.

⁶¹ This information comes from an online survey of TLC-licensed FHV bases conducted in February 2018.

⁶² The app-dispatch companies, which are far larger than other FHV companies in terms of drivers, trip volume, and passengers, have bases across the three segments. Bases are the business entities licensed by the TLC to dispatch pre-arranged car services. Uber operates 26 black car licensed-bases, two livery bases, and one luxury limo base in New York City. Lyft, Juno, and Gett each operate two black car bases. Gett acquired Juno in mid-2017 and now operates under the Juno name. Via operates one black car base.

Exhibit 21: For-Hire Vehicle (FHV) Base Operators

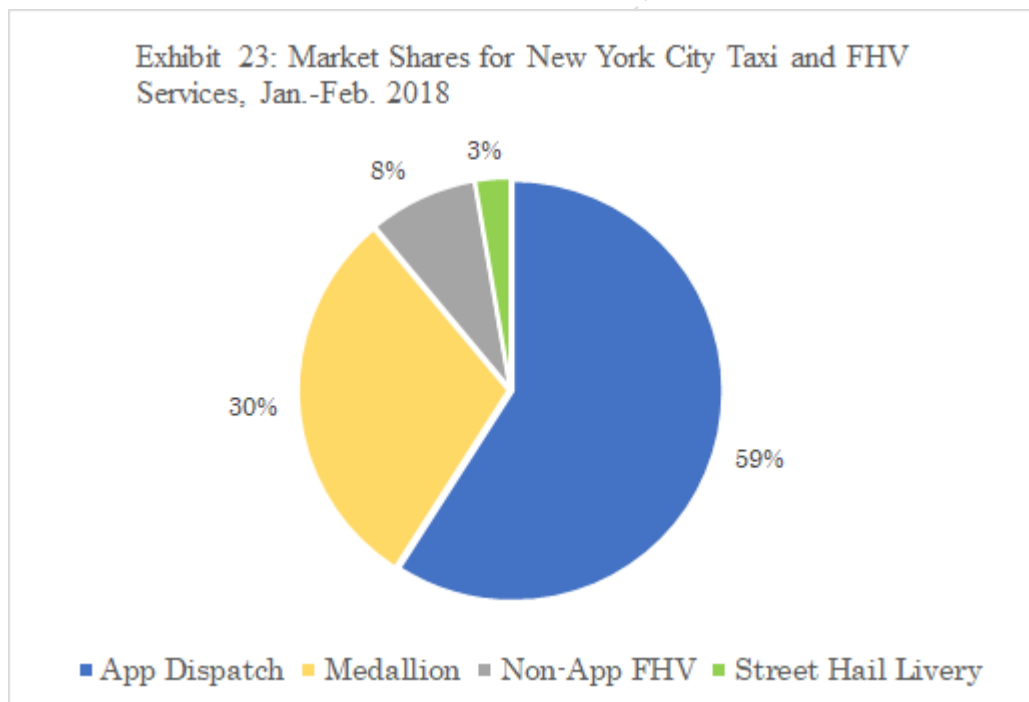
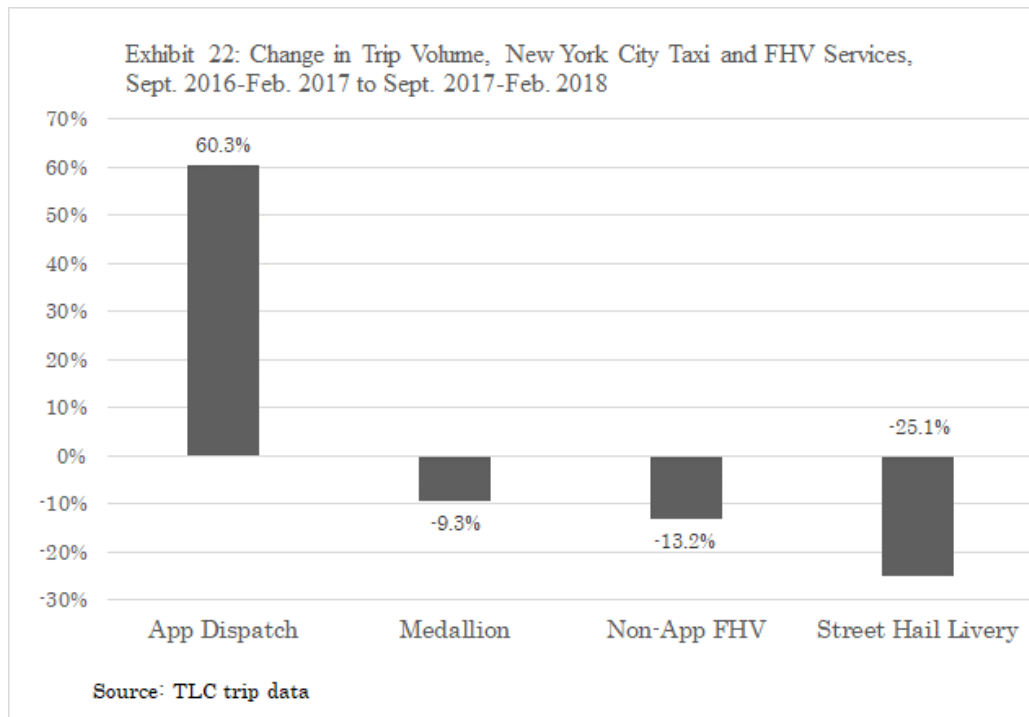
	end of 2013	end of 2017	change 2013-17
<u>Non-app base operators</u>			
Black car	104	302	198
Livery	495	448	-47
Luxury Limousine	225	159	-66
<i>subtotal</i>	824	909	85
<u>App-dispatched base operators</u>			
Black car	31	33	2
Livery	3	2	-1
Luxury Limousine	1	1	0
<i>subtotal</i>	35	36	1

Source: TLC annual reports, 2013, 2017, and TLC information on app companies.

As of March 2018, the TLC-licensed non-app FHV base operators encompassed about 33,700 drivers of affiliated vehicles—15,300 in black cars, 14,400 in livery cars, and 4,000 in luxury limousine services.⁶³ The TLC began to collect data from all the FHV operators in the first half of 2015. As Exhibit 22 shows, a dramatic shift is apparent from mid-2016 on. From the six-month September 2016 to February 2017 period to the same months a year later, the number of passenger trips provided by app-dispatch companies soared by 60 percent, while the non-app FHV companies experienced a 13 percent trip decline; medallion trips fell by nine percent; and trips by green taxis dropped by one-quarter. Even the 10 largest livery car companies, which averaged 240 affiliated cars each at the end of 2017, experienced a fall in combined trip volume of 19 percent—between the first quarter of 2016 and the last quarter of 2017.

The ability to request car services through an app on a smartphone and to access precise information on the arrival time and location of the car is customer-friendly, convenient, and popular throughout the city. The trip volume trends since mid-2016 show that taxi and FHV services are increasingly dominated by the app companies. As Exhibit 23 shows, app-based services had 59 percent of the citywide total market in the first two months of 2018, nearly twice the medallion share, and more than five times the size of the combined shares of the non-app FHV and green taxi segments. The non-app FHV share of the citywide market fell by one-third over the past year, from 12 percent in the first two months of 2017 to eight percent in the same months of 2018.

⁶³ About 40 percent of the TLC-licensed luxury limousine services (and affiliated drivers) are located in suburban areas outside of the city. Only a handful of black car companies are based outside of the city. All livery companies are city-based.



While some of the larger livery and black car companies have 100 to 500 affiliated vehicles, the great majority are very small businesses. Well over half of all livery and black car companies have fewer than 20 affiliated vehicles. The roughly 1,000 taxi and car service companies located in New York City employ an average of 5.1 workers; annual payroll for the 5,360 employees totaled about \$200 million in 2016.⁶⁴

Over the past two years, the app-based companies have dramatically expanded their services across most neighborhoods throughout all of the city's five boroughs, and especially beyond Manhattan. Exhibit 24 shows the increased trip volume by app-based companies at a zone level for the five boroughs.

A recent Citywide Mobility Survey sheds additional light on the extent of, and reasons for the citywide increased app-dispatch patronage. The non-app companies have been losing business as the app companies have steadily grown by providing "fast," "reliable," and "convenient" service. These were the factors most prominently mentioned by respondents in the city's recent Citywide Mobility Survey, conducted during the spring of 2017.⁶⁵ In seven of 10 areas designated in the survey report (three sub-borough areas in Queens, two each in the Bronx, Brooklyn and Manhattan, and all of Staten Island), 41 percent or more of survey respondents reported using at least one ride-hailing app, and many used more than one. In Inner and Middle Queens, and in Northern Manhattan and Northern Bronx, higher percentages of respondents said they used ride-hailing apps than in the Manhattan Core area.⁶⁶

App trips in Staten Island, Inner Queens, Inner Brooklyn, and the Manhattan Core were more likely to be for social or recreational purposes, while shopping trips were a common purpose for app trips in Southern Bronx, Northern Bronx, and Staten Island. Across almost all parts of the city, 20 to 30 percent of app users indicated they used the app services for commuting to/from work. In most neighborhoods outside of Manhattan, 42 to 46 percent of app-using passengers reported that they previously used taxis or livery cars.

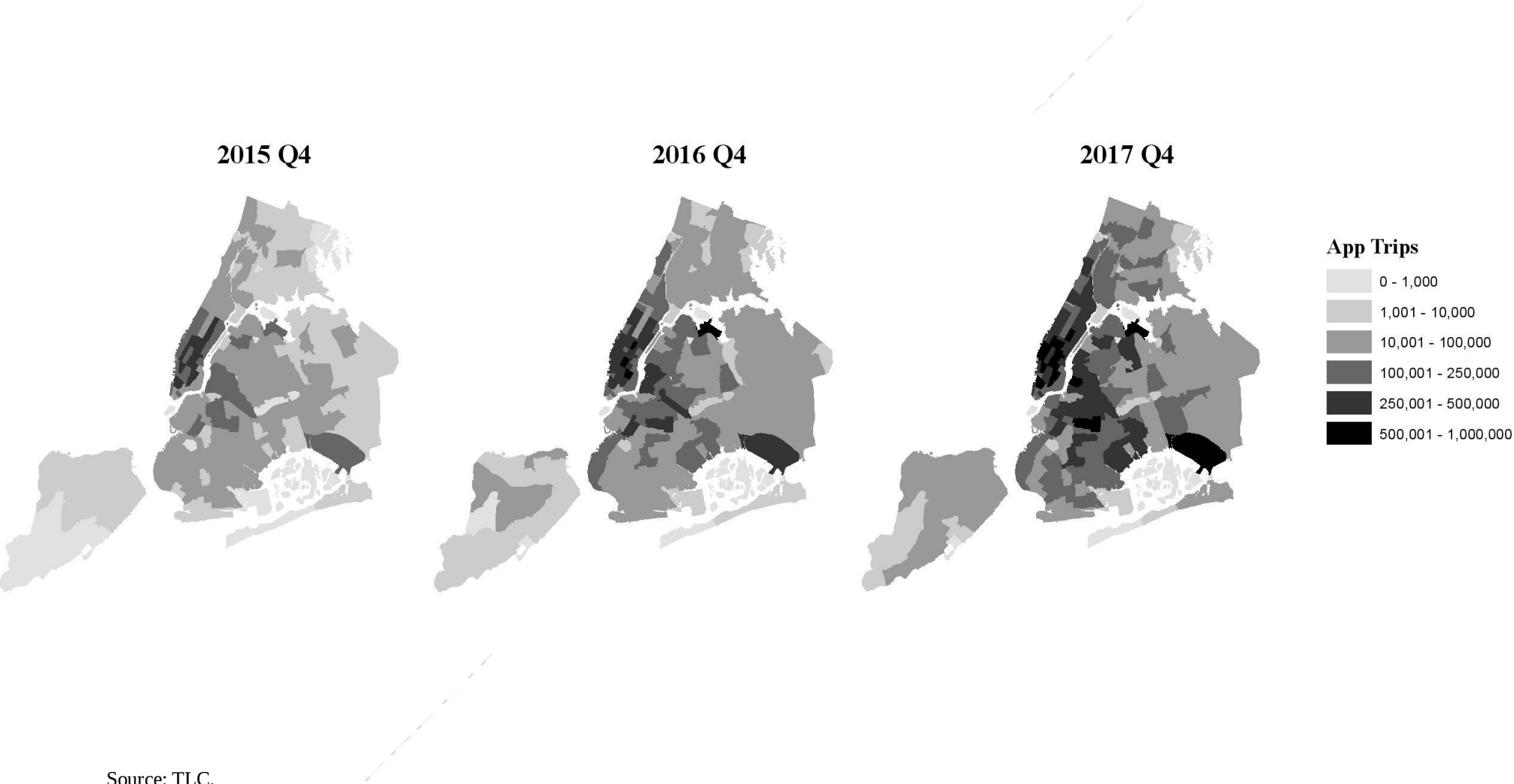
Increasingly, many drivers who have traditionally driven for the non-app services are now also driving for the app-based companies. In mid-October 2017, nearly 5,000 full-time drivers (only about eight percent of the total in the app earnings files but still a sizable number) divided their time between app- and non-app companies, with about 56 percent of their trip time for non-app services. The fact that drivers for the traditional services also drive for the app companies might help some traditional companies stay in business, since their drivers can supplement their earnings.

⁶⁴ These numbers exclude most of the drivers because they are independent contractors, not employees. Data from the Quarterly Census of Employment and Wages for the "taxi and limousine services" industry. Average employment size ranges from 3.8 in Staten Island to 6.9 in the Bronx.

⁶⁵ Among six choices, "inexpensive" received by far the fewest mentions among survey respondents.

⁶⁶ The survey results cited in this and the following paragraph are from the New York City Department of Transportation's Citywide Mobility Survey, Prepared by PSB, August 2017.

Exhibit 24: Growth in App Services Trip Volume



The proposed driver pay standard applied to companies with high trip volumes may create new pressure on traditional FHV operators to raise driver pay or make other changes that appeal to drivers, such as allowing the use of vehicle models not accepted by the large app-based companies. Some traditional companies might also see an opportunity to slightly raise their fares should the app companies also raise fares. In other cases, traditional community and black car services might introduce their own apps to pool requests and dispatch drivers, as some have already been doing.

6.2 Summary

The impact of the proposed pay standard on the non-app FHV services is likely to be relatively small and is likely to neither ease the pressure on this sector from the app companies nor significantly exacerbate trends that have been occurring independently of this policy. The non-app FHV sector's share of all trips citywide, which has been declining for some time, fell by an additional one-third (from 12 percent to eight percent) between early 2017 and early 2018 alone.

The non-app FHV companies are likely to continue to lose drivers to the app-based sector regardless of the driver pay standard. Some traditional FHV companies may do better: those that serve niche markets; that have a loyal customer base; that provide working conditions that appeal to certain drivers; or that adapt their services—including introducing their own app and providing more reliable services. But the competitive challenges facing the traditional non-app companies are likely to continue.

Section 7 Effects of the Pay Standard on New York City's Economy

The magnitude of New York City's app-driving sector suggests that the driver pay standard could have sizable effects on the city's economy. About 80,000 drivers earn roughly \$3 billion annually in gross pay by providing app-dispatched services in New York City. After expenses, the median driver earns \$14.25 per hour, but does not receive employment-related benefits and must pay the employer payroll tax.

The combined weekly hours of the drivers for the four large app-based companies exceed the employee hours among prominent New York City industries, including commercial banking, hotels, insurance carriers, drugstores, and publishers.⁶⁷ If Uber's drivers were employees instead of independent contractors, the company would be the largest private sector employer in New York City, a city with hundreds of large employers.⁶⁸ The establishment of the pay standard could usher in a new era for an industry that has surpassed several other industries in size, and yet provides inadequate compensation to most of its drivers.

As we have seen in previous sections, the TLC driver pay standard proposal will increase driver pay an average of 14 percent. We have also found that the app-based transportation system could easily accommodate this increase without causing a reduction in trip volume. This section builds upon these results to estimate the broader economic effects of the policy proposal on the New York City economy.

7.1 The boost to New York City consumer spending

The projected average 14 percent increase in driver compensation represents a larger increase in after-expenses hourly pay. The difference occurs because driver expenses are essentially constant per week. Since expenses account for a little over one-third of driver gross compensation, the pay increase affects only the nearly two-thirds' share that comprises driver net pay. The average driver's net pay increase is therefore approximately 22.5 percent. This amount is very similar to the 23 percent estimated \$15 minimum wage-related earnings increase for workers in New York City and elsewhere in the state who will receive pay increases because of the state's \$15 minimum wage phase-in (Cooper 2016; Reich et al. 2016).

⁶⁷ Estimated app driver hours for the first quarter of 2018 equals 67,400 FTE positions. Average annual employment for 2017 from the Quarterly Census of Employment and Wages: commercial banking (56,100), publishing (44,500), hotels (51,900), drug stores (46,500), and insurance carriers (55,700).

⁶⁸ Beside three private hospital networks that each have large facilities outside of New York City, the largest private employer in New York City is JP Morgan Chase with 29,000 employees, according to the 2018 Crain's New York Business Book of Lists, p. 18. The number of imputed working hours by Uber drivers during the week of October 15, 2017 was over 1.3 million. Those driver hours were provided by over 55,000 drivers. The 1.3 million hours divided by 40 weekly hours and 50 weeks per year equals a little over 33,000 FTEs on an annual basis, larger than the JPMorgan Chase workforce in New York City.

As we discussed in Section 5, this net driver pay increase will likely be absorbed from three sources: increased utilization of drivers' time, which will increase driver pay at a reduced cost to the companies; reduced company commissions among the largest app-based companies; and slightly higher passenger fares paid by consumers.⁶⁹

The increase in driver pay and any decrease in company commissions will together generate more total consumer demand in the New York City economy; any fare increase will reduce consumer demand by much less. In other words, the net change in consumer demand will be positive.

In Section 2 we estimated that New York City-based commissions (company profits) approximate \$500 million per year for the app-based industry. These commissions largely flow out of the local economy since they are mostly used to finance expansion of the companies in other locations. Any amount distributed to owners would flow to other locations, such as where the investors (including Silicon Valley venture capitalists) reside. Reducing commissions thus will have a very small effect on consumption or investment in New York City.

The increase in driver pay will increase spending mainly within the New York City economy. A large majority—85 percent— of drivers who work in New York City also live in New York City; three-fourths of them live in the Bronx, Brooklyn, and Queens. According to our calculations in Section 5, total driver income would increase annually by about \$335 million. The 85 percent New York City resident driver share of that amount would therefore approximate \$284 million annually.

In the event of a passenger fare increase the growth in net incomes would be offset by small real income declines for passengers paying higher fares.⁷⁰ The companies should want to minimize fare increases since fare increases would reduce their revenues, given the sensitivity of consumer demand to the prices of app-based services. As driver incomes rise, drivers' receipts of public benefits, particularly food stamps and Medicaid, will fall somewhat, which will also induce a slight reduction in the cost to taxpayers.⁷¹

Since the app companies' profits now mainly flow out of New York City, reduced commissions imply reduced outflows. Consequently, reduced commissions would have

⁶⁹ The minimum wage research literature suggests that driver attrition will also fall, reducing recruitment and replacement costs for the companies (Dube, Lester and Reich 2016).

⁷⁰ According to a recent New York City Department of Transportation Mobility Survey (p. 69), 28 percent of ride-hailing users had household incomes of \$100,000 or more, one-third had incomes between \$50,000 and \$100,000, and 39 percent had incomes of less than \$50,000. Passengers thus include a broader distribution of household incomes than do drivers. Consequently, their spending reduction rates are smaller than the increase in spending rates by the drivers.

⁷¹ As we noted in Section 2, ACS data on New York City taxi and FHV drivers indicate that 40 percent rely on Medicaid for health insurance coverage and 18 percent receive food stamps. Higher incomes may also lead some drivers to purchase health insurance, since 16 percent were uninsured in 2016. Previous research on minimum wage increases has shown that such reductions offset only a small fraction of the earnings gains for workers (Reich and West 2015).

little negative effect on spending in the city's economy.⁷² Business taxes paid to the City and the State might be slightly lower, although such taxes paid now might be minimal. Many companies in other industries use licensing or royalty payments to corporate headquarters to shift profits generated locally to other jurisdictions.⁷³

Our conservative (and very approximate estimate) suggests that the net increased income for New York City residents is likely to be nearly \$300 million. Much of this additional income will translate into additional consumer spending in the local economy. In economic parlance, the mostly low-income drivers have very high propensities to consume out of their income.⁷⁴ In other words, they will spend almost all their additional earnings on goods and services in New York City, especially in their own predominantly immigrant neighborhood economies.

As we have mentioned, passengers of app-based companies who would bear a possible fare increase will experience a small loss in real income. If app passengers on average spend five percent of their income on app-based rides and if one-fourth of New York City residents are app passengers, the income loss from a five percent fare increase would be only .06 percent. The actual effect on spending is likely to be smaller, since some passengers will absorb their loss in part by reducing their savings.

App-based passengers are distributed over a larger part of the income distribution than are the drivers. Lower-income passengers spend proportionately more of their income on services, but they are also much more price-sensitive to any possible fare increases than higher-income riders. Higher-income passengers have low propensities to consume; their small real income losses will partly result in reduced savings, not just reduced consumption. The owners and managers of the app companies, only some of whom reside in New York City, spend an even lower share of their incomes in New York City.

An overall consumer stimulus on the order of \$300 million is not large, relative to the size of the \$800-plus billion New York City economy. But it is not negligible either. Moreover, much of the increased spending on goods and services will be locally produced, implying a local economic multiplier impact. The overall increase in consumer spending would thus mean somewhat more sales for local businesses, greater local employment, and higher local income and sales taxes.

⁷² Spending on advertising and on professional services provided by New York City-based firms might fall somewhat. Such amounts likely would be smaller in magnitude. A definitive estimate would require more detailed financial information than the app companies have released.

⁷³ In other words, an app company that is profitable in New York City might offset some of those profits (and local income tax liability) by making unusually large payments to corporate headquarters.

⁷⁴ A number of minimum wage studies have examined the aggregate effects of minimum wage increases on consumer spending. The most persuasive is Cooper, Luengo-Prades and Parker 2017.

7.2 Effects on the other segments of New York City's transportation system

The non-app FHV companies Since the non-app FHV companies have much lower daily trip volumes than the four large app-dispatch companies, they would not be subject to the proposed pay standard. Nonetheless, the pay standard will affect the non-app FHV companies since many of their drivers also drive for the app companies.

The TLC universal driver's license makes it easy for drivers to work in different segments of the FHV market. If the pay standard increases app pay above the level earned in the non-app companies, these drivers may be able to improve their earnings by concentrating more of their driving for the app companies and reducing the time they drive for the non-app companies. This shift may put pressure on the lower-paying non-app companies to raise their driver compensation. (Some of the non-app companies, particularly the black car services, already pay more than the proposed TLC standard.)

As we noted in Section 6, the citywide taxi and FHV market share of the non-app FHV companies has been falling for some time. This fall has continued, from 12 percent market share in the first two months of 2017 to eight percent in February 2018. It seems likely that many of the smaller non-app companies will continue to lose market share to the rapidly growing app sector, independent of the introduction of a pay standard. Some may adapt by improving the quality and convenience of their services; otherwise, they likely face continued significant challenges.

Medallion and street hail livery service The minimum driver income policy is not designed to ameliorate pressures facing the yellow or green taxi drivers or non-driving medallion or base owners. However, policies to address the low compensation of app drivers should indirectly benefit medallion drivers. Proposals to cap the number of FHV drivers or vehicles also lie outside our purview, as caps currently do not lie within the regulatory capacity of the TLC. Still, the TLC's proposed minimum pay policy is likely to reduce the number of new FHV drivers and vehicles.

Congestion and cars on city streets While the pay standard is not designed to address the congestion problem directly, to the extent it succeeds in increasing utilization the TLC standard will have a moderating effect. Any tapering in the growth of the number of drivers and vehicles providing app-based services would likely moderate a further worsening in traffic congestion in New York City. But it seems unlikely that the pay standard by itself would meaningfully ameliorate such congestion.

7.3 Effects on consumer wait times, government, and the local labor market

Consumers Consumer convenience is a major factor in the demand for app-dispatched car services. The pay standard is not likely to measurably affect that convenience. The average app response time to a passenger request is five minutes (300 seconds). According to Cook et al. (2018) a 10 percent increase in driver utilization rates (which would be substantial) would likely increase response times by six percent, which amounts to only 18 seconds. It

does not seem likely that riders would notice such a small increase.

Government As we discussed in Section 7.1 above, when the earnings of low-income workers like app drivers rise, they rely less on government for public benefits such as nutrition assistance and Medicaid. In addition to savings from reduced public benefits, the public treasury also gains since better-compensated workers will pay more in income taxes on their earnings and in sales taxes on the goods and services they purchase.

Local labor market The pay standard will also have repercussions for the thousands of other New York City independent contract workers who have become engaged in the “gig economy.” The pay standard will test the feasibility of regulating such labor market practices. If it is successful, the TLC standard may also inspire other jurisdictions in the U.S. to formulate pay standards for independent contractors.

The TLC standard may also indirectly improve working and pay conditions of tens of thousands of other New York City workers. The ongoing increase in the State’s minimum wage (which will reach \$15 an hour at the end of 2018, from \$7.25 five years earlier) is raising earnings and family incomes for approximately one-third of all New York City workers (Cooper 2016; Reich et al. 2016). The rising minimum wage (together with sustained low unemployment in recent years) is pressuring many businesses to raise pay, improve working conditions, and institute operating changes to improve their overall efficiency (Woodruff and Parrott 2018). The TLC standard may reinforce these changes.

7.4 Summary

The driver minimum pay standard would have small but beneficial effects on the New York City economy. The policy would raise the earnings of 80,000 drivers (in addition to those whose pay would rise from the pay standard, all drivers providing shared rides would receive the \$1 per pickup shared ride bonus); the industry-wide increase will total \$335 million. This increase in driver income would be spent mainly in New York City, in contrast with the industry’s roughly \$500 million in New York City-based net commissions, which mainly leak out of the local economy. The estimated increase in consumer spending is small, compared to the size of the city’s economy, but it is positive and not negligible. The other effects on the New York City economy would be even smaller.

Section 8 Summary and Conclusions

This report examines net pay and hours among app-based drivers in New York City, presents a proposal to create a minimum driver pay standard, and examines how the industry would absorb the cost of such a standard. We have undertaken a wide-ranging study of the app-based business model, industry driver characteristics and earnings, and regulatory levers and limits. Since New York is a world-class metropolis, the study involved a complex analysis. We were very fortunate to have access to extensive administrative data on all the drivers and companies in the industry, as provided to us by New York City's Taxi and Limousine Commission. Our work was eased considerably by assistance from the TLC's very capable data and policy analysts.

Our study, the first of its kind, examines the salient characteristics of the app-based industry as it has evolved in New York City and appraises the TLC's innovative policy design. The transportation app industry in New York City shares characteristics of the industry in other dense world-class cities, such as London, Paris, and San Francisco. However, the New York City industry differs substantially from the view presented in earlier studies that relied on national data for just one company. The policy design is innovative because the companies for the first time will pay a cost to maintain increasing pools of low-utilized drivers; the policy compels the companies to allocate rides in a manner benefitting the drivers. This policy may well serve as a model for other cities. The policy will also be a model in setting the first pay standards for independent contractors in the United States.⁷⁵

The app-dispatch industry has grown rapidly in New York City, to the point that it now accounts for twice the number of trips as medallion cabs. The industry provides more jobs than many prominent industries, including commercial banking, hotels, and publishing. Uber alone would be the largest for-profit private employer in New York City—if Uber drivers were classified as employees rather than independent contractors.

Throughout the U.S., the business model of the app transportation industry calls on drivers to become independent contractors who drive their own vehicles. Many app drivers across the U.S. already owned their own cars when they started driving. But in New York City, a large majority of the app drivers had to acquire vehicles to drive for business purposes. The associated capital investment—and the risks associated with it—make it necessary for many of these drivers to work full-time or more. The capital investment also makes it difficult for them to switch to non-driving employment opportunities. As a result, drivers will stay in the industry even if hourly compensation falls below minimum wage standards in the rest of the local economy.

⁷⁵ The Bureau of Labor Statistics' 2017 Contingent and Alternative Employment Arrangements Survey counted the proportion of workers whose primary job was classified as an independent contractor. The overall proportion of independent contractors did not change since the previous survey in 2005. However, the proportion in transportation increased by 50 percent, indicating the growing importance of the app industry business model. <https://www.bls.gov/news.release/pdf/conemp.pdf>

New York City's app drivers are indeed much more likely to be full-time drivers than in other cities. The drivers are predominantly immigrants who provide the bulk of their family's earnings. Administrative earnings records indicate that hourly earnings are low for most drivers, after accounting for vehicle and licensing costs.

Unlike the winner-take-all characteristics of other network-based industries, the cost characteristics of the app-driving industry are generating competition among a small group of companies. To compete successfully, the app firms seek to minimize customer wait times. To do so they maximize the drivers available at any given time, which implies lower driver earnings per hour worked. Moreover, each company benefits by having a pool of multi-platform drivers, as their existence expands the unutilized driver work force available for all of them. It is thus not surprising that the enormous growth in the demand for app drivers has not translated into higher net earnings per hour for individual drivers.

Since drivers supply their own vehicles and are not employees, the operating costs of the app companies are very low relative to the commissions they collect. As a result, mark-ups over local variable costs approach 600 percent. Commission rates could be much lower and still generate profit rates well above the norm among comparable industries that provide intermediary services.

Our analysis of the app-based companies reveals industry inefficiencies and inequities: incentives to increase the number of drivers without regard for the consequences on driver pay; low driver utilization per driver working hour; and commissions that generate large mark-ups over local operating costs for the dominant industry firms. Only recently have the companies begun to increase their proportion of shared rides.

Our analysis of the TLC's data reveals low driver earnings. After deducting their estimated driving expenses, we find that 85 percent of app drivers are currently paid below the proposed minimum pay standard of \$17.22. To remedy this situation, the TLC proposes to establish a minimum pay standard for drivers in the largest FHV companies. The pay standard includes a paid time off component, in consideration of the long hours worked by many drivers, and the beneficial effect paid time off would have on passenger, pedestrian, and driver safety.

The pay increase would amount to about \$6,345 per year for drivers now below the standard, equivalent to a 22.5 percent increase in their net compensation, after paying for vehicle expenses. Since vehicle expenses would not be much changed, this increase in net pay can be accomplished with a much smaller proportionate cost increase to the companies. Overall driver pay would rise 13.2 percent, with drivers currently below the standard receiving an average 14 percent increase in gross pay—to \$25.76 per hour.

How would the industry absorb a 13.2 percent cost increase? The policy includes per-mile and per-minute factors, adjustments for driver utilization rates and an extra payment to drivers for shared rides. Our simulation model suggests that a little over half of the costs could be borne by an increase of 2.5 minutes of paid trip time within each working hour and by increasing the proportion of shared rides. The companies can choose how to

allocate the remainder of these costs—whether through fare increases or commission reductions or a combination of the two. Fares might not increase at all or could increase by three to five percent. Passenger wait times could increase by about 12 to 15 seconds. These outcomes are consistent with the industry meeting the continued growth in demand for app-based rides.

It thus seems feasible to improve the standard of living of app drivers while also allowing the industry to continue to meet passenger demand. We conclude that the policy may very well result in a 22.5 percent increase in take-home pay for over 50,000 drivers—with thousands of additional drivers benefiting from increased pay for shared rides.

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Appendix Methodology for Driver Earnings Analysis

We provide here details on our data, how we compile the data into trip and earnings files, how we calculate driver's expenses per hour, and a fuller explanation of how we estimate the effects of the proposed pay policy on the level and distribution of driver pay.

A. Data

This study relies extensively on detailed driver-specific administrative earnings data for the major app-dispatch companies for four study weeks in 2016 and 2017. Through its authority under the New York City Charter to regulate the for-hire vehicle (FHV) industry, the Taxi and Limousine Commission (TLC) obtained detailed driver earnings data from Uber, Lyft, Juno, Gett, and Via for the weeks of September 11-17, 2016; March 19-25, 2017; June 18-24, 2017, and October 15-21, 2017. (Gett merged with Juno in mid-2017.)

The TLC then compiled administrative earnings files on the universe of app-dispatch drivers for these four study weeks. Earnings were compiled for each driver for each company; combined earnings across companies were tallied for drivers working for more than one company in any given week. In all, earnings data were analyzed for 41,291 drivers in the September 2016 study week, 50,657 drivers in the March 2017 week, 56,429 in the June 2017 week, and 61,729 in the October 2017 week. Our study permits an unprecedented analysis of driver earnings across companies for an entire city's app sector. Previous earnings studies have either drawn from data on just one company (Uber) or from surveys of the drivers.⁷⁶

The files on each company vary somewhat. The Uber data includes two sub-files. A *trip* file includes each driver's TLC license number ("hack" number); week range; service type (regular or shared); total trip minutes; total trip miles; total rider payment; total gross amount earned by driver; total amount deducted from gross driver payment, including Uber's fee, Black Car Fund 2.5 percent surcharge (a statewide workers' compensation fund for black car services—most of those covered drive in New York City); sales tax; total trip tolls and surcharges; and total net amount paid to driver after deductions (driver payment). The fourth study week (October 2017) file for Uber included tips—the Uber app was only modified in mid-2017 to allow passengers to include a tip amount in the rider payment. An *expense* file provides hack number, and information on incentive payments, gas card deductions, vehicle lease or rental costs, equipment fees, rider vehicle cleaning fees, and miscellaneous payments. The TLC staff merged these two files by driver hack numbers.

The Lyft data includes drivers' hack number, total number of trips, total trip minutes, total trip miles, driver payment, tips, tolls, Black Car Fund fee, sales tax, Lyft's commission, and total rider payment.

⁷⁶ Hall and Krueger (2018) and other papers co-authored by Jonathan Hall, Uber's Chief Economist. A prominent blogger on the app driving industry, Harry Campbell ("The Rideshare Guy"), conducts an annual survey of drivers. See, e.g., <https://therideshareguy.com/2018-uber-and-lyft-driver-survey-results-the-rideshare-guy/>

The Via data provides daily driver data for each of the four study weeks. The Via file includes starting date, week range, drivers' hack number, total number of trips (per shift), first start time and last end time of the day, total hours on the app (which we interpret as working time), total distance driven, total trip miles, total trip time, total gross driver payment, promotions and deductions, and driver payment.

The Juno data consists of drivers' hack numbers, total number of trips, total trip miles, total trip minutes, tolls, total rider payment, and driver payment.

The Gett data consists of drivers' hack number, total number of trips, waiting time, total trip minutes, total trip miles, total rider payment, tips, Gett's commission, Black Car Fund fee, sales tax, tolls, and driver payment.

The four earnings data sets described above aggregate data for each driver on a weekly basis. (The Via, Gett, and Lyft data also provide information on tips.) Using hack numbers and the TLC driver database, the TLC staff added vehicle-specific information to all the company data files, including vehicle plate, vehicle identification (VIN) number, car year, and car make and model. With this additional information, we determined whether the driver is eligible to provide premium-priced car services.

From the TLC's FHV trip records database, the TLC staff extracted a "shift table" file that includes drivers' actual weekly working hour information. In this extract, the TLC defines a driver's actual shift working time as the time difference between the first pickup time and the last drop-off time for that shift. A gap between trips greater than three hours defines a new shift. Thus, the total actual weekly working time would be the sum of working hours for all shifts in that week. However, the FHV trip data includes drop-off time only beginning in June of 2017. The shift table file provided by the TLC therefore includes data for a 30-week period from June 4 to December 24, 2017. (December 25 to 31 are excluded because they are unrepresentative.)

B. Compiling the data

We combined the individual company earnings files and organized the data in as consistent a manner as possible. We discarded all abnormal records in which trip distance or net driver payment were negative or when trip times exceeded 83 hours (which is equivalent to 120 working hours based on 0.7 utilization rate—the highest rate among the four companies). We aggregated the Via data on a weekly basis.

We computed gross driver pay (pay before expenses but excluding tolls) and "net rider pay":

$$(1) \text{ Gross driver pay} = \text{driver payment} - \text{tolls}$$

$$(2) \text{ Net rider pay} = \text{total rider payment} - \text{tolls} - \text{black car fund} - \text{sales tax}$$

The Black Car Fund fee and the sales tax are legally mandated charges remitted by the company. We exclude driver-paid bridge and tunnel tolls from drivers' net pay.

For Via we imputed a value for its net rider payment by using the 10 percent commission rate published by the company.

We computed driver earnings separately for each of the four study weeks. However, we rely mainly on the results from the most recent study week, the week of October 15, 2017. This study week best reflects recent changes in the industry and company compensation policies and therefore provides the closest approximation to current practices.

C. Computing before and after expenses hourly earnings

We use driver utilization rates by company and individual driver hours to estimate each driver's working hours for each company. We then use this "imputed" working time and expense records to estimate each driver's gross (before expenses) and net (after expenses) average hourly earnings.

Drawing from their trip records database for the 30-week period during the last seven months of 2017, TLC staff computed for us each company's average utilization rate and the average number of trips per hour. We calculated each driver's working time for a given company by dividing the driver's total trip hours for the company by the company-level utilization rate. We call this the driver's imputed working time.

$$(3) \text{ Imputed working time} = (\text{trip minutes}/60) / \text{utilization rate}$$

$$(4) \text{ Hourly earnings before expenses} = \text{gross driver pay} / \text{imputed hours}$$

To estimate each driver's expenses per hour worked, we draw on our estimates of expenses per mile (58.0 cents per miles, as presented in Section 2.4), company-wide data on driver trip minutes per hour, (utilization rate), TLC data on individual driver's trip miles, and an allowance for driver cruising and return ("dead-head") miles between trips. We use this amount to estimate a driver's total work mileage driven by dividing trip miles by the company utilization rate to allow for cruising and dead-head mileage driven between passenger trips.

$$(5) \text{ Hourly expenses} = 58.0 \text{ cents per mile} * (\text{trip miles} / \text{utilization rate}) / \text{imputed work hours}$$

$$(6) \text{ Hourly earnings after expenses (net earnings)} = \text{hourly earnings before expenses} - \text{hourly expenses}$$

D. The effects of the proposed policy on the level and distribution of driver pay

To examine the effects of the policy proposal we applied the proposed standard to each driver's trip and driving time records to estimate what earnings would be for each driver under the proposal.

The pay standard, which we presented in Section 3, comprises three elements: a per-mile expense cost (58.0 cents/mile), a per-minute compensation factor (28.7 cents/minute), and a \$1 per pickup shared ride driver bonus. On an hourly basis, the compensation factor of 28.7

cents per minute equals \$17.22, of which \$15.00 is the minimum hourly earnings target, \$1.32 covers the employer payroll tax share that independent contractors pay, and 90 cents equals the paid time-off supplement. The \$1 shared ride bonus is in addition to the \$17.22 hourly pay standard.

In equations 7 to 9 we apply the per-mile and per-minute elements of the proposed pay standard to the actual trip mileage and time data from the earnings file for the October 2017 study week. This calculation illustrates the relation of current earnings to what they would be under the proposed pay standard policy.

$$(7) \text{ Policy earnings} = \text{per mile cost} * \text{trip distance} / \text{utilization rate} + \text{per minute standard} * \text{trip minutes} / \text{utilization rate};$$

[this is used only for the company-level earnings file]

$$(8) \text{ Policy hourly earnings before expenses} = \text{policy earnings} / \text{imputed hour};$$

$$(9) \text{ Policy hourly earnings after expenses} = (\text{per minute standard} * \text{trip minutes} / \text{utilization rate}) / \text{imputed hour}.$$

This set of formulas provides an estimated hourly earning rate for each driver by company by week.

Since many drivers work for multiple companies, we aggregate the earnings data across the companies by driver number for each week to compile each driver's combined earnings for each study week. For example, if a driver accepted trips from both Uber and Lyft in the study week, that driver would have earning records in both the Uber and Lyft files. We combine these two earning records in our earnings file; that is, we sum all the columns of these two records—trip minutes, trip miles, net driver pay, policy earning, and imputed hours. Applying equations 4, 5, 6, 8, and 9 to this combined earning file, we obtain the pre-policy and post-policy hourly earnings rates for each driver. In Section 3, we report the driver counts, the summary statistics of imputed hours, hourly earnings after expense, hourly earnings before expense, and the percentage of drivers falling below the policy earnings standard for each week for the combined earning data.

Next, to better understand the working pattern of below-minimum drivers, we extracted their earning records in the third and fourth weeks. We merged these earning records with the shift table file of corresponding weeks and obtained the actual working hour of these drivers. We grouped them into five-hour buckets and determined the frequency of each bucket. This provided an overview of working hours distribution of the below-minimum drivers (reported at the end of Section 3).

To better understand characteristics of the drivers above the minimum pay standard, we identified those drivers who used premium service vehicles who would be eligible to command higher passenger fares. Slightly over two-thirds of all drivers with earnings already above the pay standard (for whom we could identify vehicle make and model) drove premium-service vehicles. Among the other one-third of drivers making more than the standard, about two-thirds were part-time drivers whose driving schedules concentrated at peak rush hours, when they could obtain a higher number of trips each hour.

Glossary

Actual working hours

The time from the beginning of a driver's first trip until the end of the driver's last trip, as measured by data in the TLC trip files. This work shift metric is similar to but not identical with the time that drivers' apps are turned on to signal their availability. Our work shift measure includes the time drivers spend on breaks and excludes the time drivers spend commuting from and to their homes.

After-expense (or net) driver earnings

The amount of income earned by drivers after netting out vehicle and related expenses. Expenses include one-time upfront administrative costs, recurring costs such as license renewal and annual vehicle inspections, and ongoing vehicle acquisition and operating costs.

App companies

Companies that use smartphone software technology and matching algorithms to connect drivers and passengers. The four major app companies that provide transportation services in New York City are Uber, Lyft, Via, and Juno. (Gett acquired Juno in 2017 and now operates under the Juno name.) See also *transportation network companies*.

App dispatch

The allocation of passenger trips to drivers of affiliated vehicles through mobile apps.

Bases

Business entities that are licensed by the TLC to dispatch car services. The TLC distinguishes among three types of for-hire vehicle (FHV) bases: black car, livery car, and luxury limousine. All FHV services are arranged through a base or a dispatch service provider working with a base.

Black cars

Black cars provide prearranged car services to passengers, typically through mobile apps or agreements with corporate clients. Approximately 90 percent of black car business is conducted with non-cash payment.

Black Car Fund Fee

A 2.5 percent surcharge applied to FHV passenger fares to be paid into the Black Car Fund (technically the New York Black Car Operators' Injury Compensation Fund), a non-profit organization established by New York State in 1999 to provide workers' compensation coverage for black car drivers. The app companies collect the Black Car Fund Fee and remit it to the Fund.

Commission

A fee charged to drivers by app companies and other base operators, usually calculated as a percentage of the passenger fare but also affected by driver incentive payments and rider

promotions Actual commission rates in this report draw from TLC administrative data and consist of passenger revenues less driver payments, divided by passenger revenues.

Consumer price elasticity

The responsiveness of consumer demand for a product to price changes for that product. Consumer demand can be relatively elastic or inelastic. If consumer demand is elastic, the quantity demanded varies along with the change in price. If demand is relatively inelastic, the quantity demanded will change much less than the price change.

Driver labor supply elasticities, intensive and extensive

Driver labor supply elasticity measures the responsiveness of driver hours worked to changes in pay per trip. The intensive margin refers to changes in the hours worked by incumbent drivers, who can choose their schedules. The extensive margin reflects the addition of new drivers and is managed by the companies.

Fixed and variable costs

Fixed costs remain constant with incremental changes in production. Examples of fixed costs include advertising, rent and insurance. Variable costs change with incremental changes in the quantity of output. Examples of variable costs include fuel and vehicle maintenance costs.

FHV

An FHV or for-hire vehicle is a motor vehicle licensed by the TLC to provide rides to passengers on a pre-arranged basis. FHVs include app-based and traditional livery car, black car, and luxury limousine services.

Green taxis

Also referred to as street-hail liveries (SHLs), green taxis provide both street hail and prearranged for-hire service in northern Manhattan and the outer boroughs. The TLC sets the fare for green taxi street hails, and the affiliated base sets the fare for prearranged trips. Green taxis are a type of FHV.

Gross (or pre-expense) driver earnings

The income earned by drivers before accounting for all vehicle and licensing expenses. It excludes bridge and tunnel tolls, the Black Car Fund fee, and any State and local sales taxes collected by the companies. The companies remit to the drivers the tolls they pay since the tolls are assessed on the driver's vehicle.

Imputed working time

Total trip durations divided by average company utilization. Imputed working time is used to estimate hourly earnings for all drivers on a given platform. The imputation of working time is necessary because of complications in determining company-specific working time when a driver uses more than one platform over the course of a working shift.

Livery cars

Livery cars provide for-hire service to passengers on a pre-arranged basis. They are typically neighborhood-based and serve individuals paying mostly in cash.

Mark-ups

Mark-ups are the amount included in a cost price to cover overhead and profit. We refer to mark-ups as a percentage over the cost of production (variable cost).

Medallion taxis

Yellow taxicabs permitted to pick up passengers across the five boroughs in response to a street hail. Yellow taxis must have a medallion issued by the TLC. The total number of medallions is fixed by the TLC.

Network scale economies

Network scale economies are present when the value of a product or service to each network member increases when the total number of users increases. Facebook and Twitter are examples of network scale economies—a greater number of users increases the value of the service to each member.

Oligopoly

An oligopoly is a market condition in which a small number of firms dominate a market.

Peak and off-peak hours

Peak hours are the busiest time of day for drivers. Peak hours coincide with weekday morning and evening business rush hours, and during weekend evenings and nights. Off-peak hours are the hours in-between peak hours when demand is lower and infrequent.

Reservation wage

The lowest wage rate that a worker would be willing to accept to perform a particular job. The reservation wage is influenced by many factors, including but not limited to the nature of the job, the cost of switching jobs, and the worker's education level, general health, marital status and probability of finding another job.

Transportation network companies

A transportation network company (TNC) connects passengers through websites and mobile apps with affiliated drivers who use personal vehicles. App companies operating in New York State but outside of New York City—currently Uber and Lyft—are classified as TNCs under a 2017 state law that created a different regulatory system. The app companies have argued that they are intermediaries who provide network technology, and hence not subject to transportation regulations. Regulators in many other jurisdictions, notably California and San Francisco, consider them as a specific kind of transportation company.

TLC

TLC is the abbreviation for the New York City Taxi and Limousine Commission. The TLC is charged with licensing and regulating New York City's medallion taxicabs, for-hire vehicles, commuter vans, and paratransit vehicles.

Two-sided markets

A two-sided market is a meeting place for two sets of agents who interact through an online intermediary or platform. Well-known companies in two-sided markets include Amazon, American Express, eBay, Facebook, Google, MasterCard, Twitter, and Visa.

Universal TLC license

A single license issued by the TLC for all taxi and for-hire vehicle (FHV) drivers in New York City. It was introduced in 2016. Medallion and FHV driver's license holders were automatically converted to this new, combined license that allows drivers to operate all TLC-licensed vehicles, except for paratransit and commuter vans.

Utilization rate

The proportion of total working time during which drivers have passengers in their vehicles.

WAV

Wheelchair accessible vehicles (WAVs) are vehicles designed to permit access to and enable the transportation of persons in wheelchairs.