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Face/Off: The adverse effects of increased competition

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Abstract
Increased competition can result in market efficiency. However, alternatively, it may provoke unethical behavior by sellers attempting to avoid losses—a risk that may be greater in credence goods markets, where consumers find it difficult to determine the value of goods or services received. The New York City (NYC) taxi market allows us to investigate how increased competition due to the launch of green-colored taxis (to serve only certain parts of NYC) may lead to fraudulent behavior by drivers of the established yellow taxis. An empirical study of more than 17 million matched yellow taxi trips revealed that fraudulent behavior was most prevalent on routes in which drivers faced increased competition for both pickups and post-drop-off pick-ups. However, after the launch of green taxis, there was no significant change in the trip distances of yellow taxis for rides subject to a flat-rate fare or for trips to/from office buildings where passengers were more familiar with optimal routes.

Keywords Competition · Taxi market · Overtreatment · Fraudulent behavior · Credence goods

JEL Classification C93 · D40 · D82 · L15

1 Introduction

Rooted in marketization, an increase in competition is often promoted as a solution to problems in many markets (Brunjes, 2020; Dulleck et al., 2011; Gottschalk et al., 2020; Huck et al., 2016; Johansen & Zhu, 2014; Krachler et al., 2022; Rasch & Waibel, 2018). However, although increased competition can result in greater consumer surplus and market efficiency, in the context of credence goods markets, whether consumers benefit from it remains unclear. In credence goods markets, the seller knows more than the consumer about the type or quality of goods or services that best fit the consumer's needs (Dulleck & Kerschbamer, 2006; Dulleck et al., 2011; Jing, 2011). The markets of repair

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services (e.g., automobile, home, and office equipment repair), medical treatment, consulting (e.g., financial or management consulting), and street-hail taxi rides are prime examples of credence goods markets (e.g., Balafoutas & Kerschbamer, 2020; Bhattacharya & Dugar, 2022; Harding et al., 2016). In these markets, the seller knows more about the quality that yields the highest surplus from trade than the consumer (Balafoutas et al., 2013), and it is difficult for the consumer to evaluate the quality of the goods or services received. Such asymmetry of information between sellers and consumers opens the door for sellers to engage in fraudulent behavior—to commit actions that involve fraud.

This study explores the specific issue of fraud in credence goods markets by focusing on policies that result in an elevation in competition through an increase in the number of sellers (with fixed prices that are exogenous to the sellers). Our frame for this analysis is the street-hail taxi ride market, a market in which defrauding passengers is common and costly (CBS Lucky, 2016; Mount, 2014; News, 2010); it also presents characteristics that make certain types of fraud more common, which causes certain types of consumers to be more prone to fraud.[1] Specifically, overtreatment (or overprovision; i.e., providing excessive treatment[2]) is common in taxi markets. In the context of taxi rides, overtreatment means that a driver takes unnecessary detours and deliberately drives a longer distance rather than taking the optimal route, in order to charge a higher fare. Consumers with limited knowledge about the optimal route (as opposed to local residents or frequent visitors) are more likely to experience overtreatment. Another aspect of the street-hail taxi market that may increase the potential for defrauding passengers is the absence of additional information about the seller's past behavior (either through the consumer's own past interactions or through public information). Although overtreatment is prevalent in the taxi market, undertreatment (or underprovision; i.e., providing insufficient treatment considering the amount paid) and overcharging (i.e., charging for a higher quantity or quality of service than what was provided) are less common. This is because of seller liability (as the driver must drop off the passenger at the destination, upon which payment is usually made) and verifiability (through the proper use of a taximeter).[3]

Examining the incentives to defraud consumers in the general credence goods market may offer helpful information for understanding specific issues in the street-hail taxi market. In the credence goods market, the intensity of competition among sellers has been identified as influencing their incentives to defraud consumers differently (Dulleck et al., 2011; Mimra et al., 2016a; Rasch & Waibel, 2018). Intuitively speaking, an increase in competition should decrease sellers' incentives to defraud consumers in the credence goods market because competition intensity provides consumers with an option to choose from several sellers, decreases search costs, and increases easy access to second opinions (Rasch & Waibel, 2018). However, a lack of (cheap) second opinions, the

[1] We use the terms passenger and consumer interchangeably.

[2] We refer to products or services that consumers receive in the credence goods market as treatment.

[3] Undertreatment may occur when, for example, the passenger is not dropped off at the desired destination. Similarly, overcharging may occur in the absence of a reliable taximeter or from a driver's false input to the meter (e.g., by setting the meter to the higher night tariff instead of normal tariff). However, in the context of our study, New York City (NYC) law requires taxi drivers to deliver passengers to their requested destination, and to follow the meter for the correct fare (with meters being checked regularly); thus, we conclude that the credence goods issues of undertreatment and overcharging are not relevant to this study.

absence of the possibility of reputation building, and fixed prices that are exogenous to the seller (therefore, the seller has no direct control over demand) add specific considerations to the market for credence goods. These market considerations may lead to the opposite outcome in markets for credence goods, in that the elevation in competition provokes unethical behavior (among sellers) to avoid or compensate for losses.

In this study, we examine the policy of the NYC Taxi and Limousine Commission (TLC) to license a fleet of green taxis to improve access to street-hail transportation in areas outside of the Manhattan Core (i.e., from south of West 110th Street and East 96th Street; NYC TLC, 2013), and how that decision has affected the behavior of existing sellers (i.e., yellow taxi drivers) and new sellers (i.e., green taxi drivers).[4] The city's decision to license green taxis splintered the yellow taxi market into routes in which yellow taxis may face more competition for pickups or for both pickups and post-drop-off pickups.[5]

Specifically, we conducted a multistep analysis using a dataset of trips by yellow taxis in NYC along with the launch of new green taxis. First, we empirically investigated whether any evidence indicates a change in fraudulent behavior by yellow taxis following the launch of green taxis.[6] Second, we investigated the degree of change in fraudulent behavior by yellow taxis (after the launch of green taxis) depending on (i) whether yellow taxis have a monopoly over pickups or compete with green taxis for pickups and (ii) whether yellow taxis have a monopoly over post-drop-off pickups or compete with green taxis for them.

Third, we investigated the degree of change in the fraudulent behavior of yellow taxis depending on passengers' familiarity with optimal routes; we compared a subset of yellow taxi trips in which the pickup/drop-off locations were office buildings and hotels. In addition, we investigated the degree of change in the fraudulent behavior of yellow taxis across the daily fare schedule and over time.

Our empirical investigation of the NYC taxi market, which comprised more than 17 million matched trips within 14 months, revealed more fraudulent behavior among existing players. We also found that yellow taxis' degree of change in fraudulent behavior varied with competition intensity; it was highest on routes where yellow taxis compete with green taxis for both pickups and post-drop-off pickups. The change in the fraudulent behavior of yellow taxis was greater during the hours of a change in driving shifts, indicating a desire to meet an income target set as a reference point (Camerer et al., 1997; Kukavica et al., 2022). In addition, we found higher levels of change in fraudulent behavior by yellow taxis for passengers traveling to or from hotels (who tend to be tourists and may be less knowledgeable about optimal routes), whereas the same did not hold true for trips to or from office buildings (where passengers tend to be locals and more familiar with optimal routes).

[4] For conciseness and readability, we are using the terms "yellow taxi" and "green taxi" to indicate behaviors of drivers of the taxis.

[5] Before the launch of green taxis, approximately 10% of total pickups by yellow taxi occurred outside of the Manhattan Core (see Panel A of Fig. 1). Therefore, we use the term *more competition* because, almost by definition, the launch of green taxis resulted in increased competition for pickups and post-drop-off pickups in these areas (i.e., outside of the Manhattan Core).

[6] We note that in this study, we investigated *the degree of change in fraudulent behavior by yellow taxis* as a response to an increase in competition—as previous studies provide evidence of existence of fraudulent behavior by yellow taxis in this market (see, e.g., Rajgopal and White (2019) and Liu et al. (2019)).

The remainder of this paper is organized as follows. First, we provide an overview of existing literature and our contributions to current knowledge through this study. We then detail the regulations and mechanisms of the taxi market in NYC, and present our hypotheses. Next, we describe the dataset used in our empirical study, followed by an explanation of the model used and a discussion of the results. The penultimate section details our robustness checks, tests for the validity of the identification strategy, and empirical findings, and provides further insights to support our inferences. Finally, we conclude with the key insights and contributions to the literature.

2 Overview of existing literature and contributions of the current study

Empirical approaches to investigating fraud can be categorized by market, such as repair services (Beck et al., 2014; Kerschbamer et al., 2016, 2019; Mimra et al., 2016a; Schneider, 2012), healthcare (Angerer et al., 2021; Björkman Nyqvist et al., 2022; Domenighetti et al., 1993; Gottschalk et al., 2020; Hennig-Schmidt et al., 2011; Huck et al., 2016; Waibel & Wiesen, 2021), and taxi ride markets (Balafoutas et al., 2013; Rajgopal & White, 2019).

Previous studies have shown that consumers with inadequate information about the quality or value of a service are vulnerable to higher degrees of fraudulent treatment. Through a field experiment involving undercover visits to auto repair shops using a test vehicle, Schneider (2012) found evidence of overtreatment. Beck et al. (2014) confirmed these findings through a lab experiment. In a questionnaire-based study on the healthcare market in Switzerland, Domenighetti et al. (1993) found that physicians (and their family members) had lower rates of surgery than the general population (typically less informed than physicians about the suggested service). Almost three decades later, investigating the underlying reasons for fraudulent behavior in the healthcare market remains a vibrant area of study. In a field experiment involving a test patient in the dental care market, Gottschalk et al. (2020) observed overtreatment recommendations on more than every fourth visit. Through a lab experiment, Huck et al. (2016) found that insurance leads to more overtreatment, whereas more competition helps decrease overtreatment. Hennig-Schmidt et al. (2011) found that patients are overtreated under a fee-for-service system and undertreated under capitation.

Another significant market in which consumer defrauding is common is the street-hail taxi market. Specifically, past studies have found evidence of taxi drivers defrauding passengers who are unfamiliar with local routes and tariffs (Balafoutas et al., 2013), and who explicitly state that their expenses will be reimbursed (Balafoutas et al., 2017). Rajgopal and White (2019) and Liu et al. (2019) also found evidence of defrauding both passengers on trips outside NYC limits (where yellow taxis are not allowed to pick up passengers) and passengers on trips subject to a two-part tariff, respectively. In other studies on the NYC taxi market, Tang (2020) and Liu et al. (2021) found that yellow taxis take passengers on significantly longer detours for metered airport routes.

Past studies related to fraud in credence goods markets have explored the causes of inefficiencies in the markets by investigating sellers' incentives to defraud consumers, specifically, the effect of institutional and market conditions, such as sellers'

liability, treatment verifiability, availability of a second opinion in the market, breaking up the joint provision of diagnosis and treatment, and sellers' reputation building (e.g., Bester & Dahm, 2018; Dulleck & Kerschbamer, 2006; Dulleck et al., 2011; Mimra et al., 2016a). However, the literature indicates a mixed impact of competition on the fraudulent behavior of sellers in credence goods markets (Balafoutas & Kerschbamer, 2020). Although some studies have found that more intense competition decreases seller fraud by reducing consumers' search costs for obtaining a second opinion (Huck et al., 2016; Rasch & Waibel, 2018), or that there is no significant effect of long-term competition on overtreatment (Gottschalk et al., 2020), others have shown contradictory results (e.g., Dulleck et al., 2011; Mimra et al., 2016a).

Our study contributes to the literature on credence goods markets by investigating whether these markets benefit from policies that increase competition. Specifically, our study contributes to the research stream by examining whether credence goods markets benefit from competition-boosting policies. Policymakers often promote competition as a means of marketization (see Krachler et al., 2022) to overcome market issues. Although marketization is exercised in diverse ways in different markets (e.g., see Krachler et al., 2022), the increase in the number of sellers (i.e., the concentration of sellers) is a common proxy that past studies have employed to measure the degree of competition (Johansen & Zhu, 2014; Rasch & Waibel, 2018). Our study contributes to this stream of literature by providing insight into the impact of increased competition on sellers' incentives to defraud consumers. Furthermore, it extends the analysis from a focus on the healthcare and schooling markets to the market for street-hail taxi rides.

Additionally, our study contributes to the literature on credence goods markets by investigating whether policies promoting competition expose specific groups of consumers to higher levels of fraudulent behavior. For example, we investigated whether consumers with inadequate information about the optimal route (e.g., tourists, compared to locals; see also Balafoutas et al., 2013) are vulnerable to higher levels of fraudulent behavior.

3 Details of the taxi market in NYC

3.1 Launch of green taxis in NYC

In August 2013, the NYC TLC (which is responsible for a range of licensing and regulation matters for the city's taxis) began licensing green taxis. By the end of February 2014, 4,200 green taxis (approximately 30% of the total number of yellow taxis) were licensed.[7] The goal of licensing green taxis was to improve access to street-hail transportation outside of the Manhattan Core (NYC TLC, 2013, 2014) by providing "… *yellow-caliber taxi service to the boroughs since 94% of yellow taxi pick-ups occur either in Manhattan or at one of the airports*" (Bloomberg & Yassky, 2014, pp. 1–2; see also Panel A of Fig. 1).

[7] The total number of all kinds of registered vehicles in 2013 in NYC was approximately 2 million (NYC Department of Transportation 2016), making the impact of the addition of 4,200 unique vehicles negligible on traffic (also, see our insights around NYC's downward traffic trend during the time period of our analysis in the Discussion and Conclusion section).

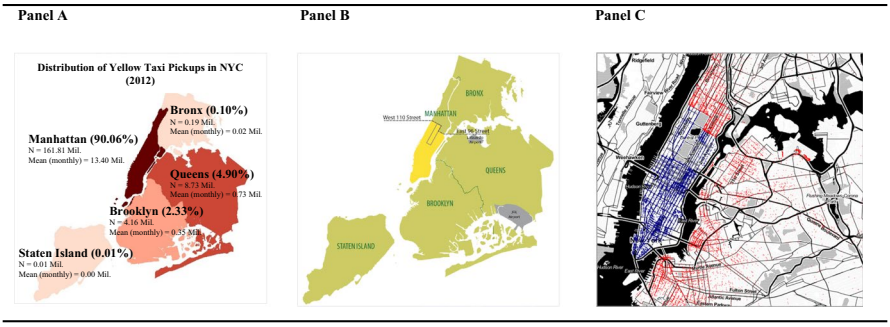

Fig. 1 Examples of Trips by Yellow Taxis in NYC and Areas of NYC Where Green Taxis Are/Are Not Allowed to Pick Up Passengers. Notes: In Panel A, darker colors represent a larger number of pickups. Similar patterns existed for pickups using yellow taxis before 2012. In Panel B, the exclusionary zone is highlighted in yellow. Green taxis can pick up passengers by street-hail outside the Manhattan exclusionary zone and by pre-arranged reservation (only) at airports (highlighted in grey; source: NYC TLC). In Panel C, the blue dots represent the pickup locations of trips in *CR EN*, and the red dots represent the drop-off locations of the respective pickups outside the exclusionary zone

3.2 Regulation of fare and activity area of the taxi market in NYC

Both yellow and green taxis have the same fare structure: (i) standard-rate fare (i.e., a two-part fare consisting of a fixed fee and a variable fee) and (ii) flat-rate fare (e.g., fares for trips between John F. Kennedy (JFK) International Airport and Manhattan). In the time frame of this study, standard-rate fare passengers would pay a fixed amount of $2.50 after pickup, plus a $0.50 variable fee per "unit." Each unit is calculated as 1/5 of a mile or 60 s, depending on the speed of the taxi. If the taxi drives faster than 12 miles per hour (mph), then the unit of variable cost is defined as 1/5 of a mile. Otherwise, the unit of variable cost is defined as 60 s. However, under the flat-rate fare, the passenger would pay a fixed amount of $52 plus other surcharges (e.g., tolls, or rush-hour and overnight surcharges).

Unlike yellow taxis, green taxis are not authorized to accept street-hail passengers from south of West 110th Street and East 96th Street (i.e., the Manhattan Core), which is considered an "exclusionary zone" where yellow taxis have a monopoly on picking up passengers (see Panel B of Fig. 1). However, green taxis may drop passengers off at any location.

4 Set-up and predictions

4.1 Set-up of competitive routes

This study divides NYC into four Competitive Routes (*CR EE–CR NN*; see Table 1), determined by whether yellow taxis compete with green taxis for

Table 1 Summary of Competitive Routes of NYC Street-Hail Taxi Market

		Drop-offs by yellow taxis in the …	
		exclusionary zone (lower Manhattan)	non-exclusionary zone (areas other than exclusionary zone)
Pickups by yellow taxis in the …	exclusionary zone (lower Manhattan)	*CR EE* (H_1)	*CR EN* (H_{2a}; H_{2b})
	non-exclusionary zone (areas other than exclusionary zone)	*CR NE* (RQ)	*CR NN* (H_{2a}; H_{2b})

CR EE, *CR EN*, *CR NE*, and *CR NN* represent trips within the exclusionary zone, trips from exclusionary zone to non-exclusionary zone, trips from non-exclusionary zone to exclusionary zone, and trips within the non-exclusionary zone, respectively

pickups or post-drop-off pickups. As Table five shows, depending on the competitive route, yellow taxi behavior is affected by a combination of conditions: (i) whether they are competing with green taxis to pick up passengers or whether they have a monopoly over it, and (ii) whether they are competing with green taxis to pick up passengers post-drop-off or whether they have a monopoly over it. The competitive nature of this structure means that the launch of green taxis in NYC, which was primarily intended to improve access to street-hail transportation (Bloomberg & Yassky, 2013, 2014; NYC TLC, 2013, 2014), has the potential to affect the behavior of yellow taxis with regard to both the pickup and drop-off locations of the trip.

4.2 Hypotheses and research question

Before the launch of green taxis in NYC, yellow taxis had a monopoly on street-hail pickups in all five boroughs of NYC, that is, the entire NYC. However, after the introduction of green taxis, their monopoly shrank to the exclusionary zone, leaving them to compete with green taxis for picking up passengers from other areas of NYC. Yellow taxis have continued to enjoy the same level of demand in *CR EE* (where they have a monopoly over pickups and post-drop-off pickups) before and after the launch of green taxis.

Hence, we make the following hypothesis.

H_1: After the launch of green taxis, yellow taxis do not engage in higher levels of fraudulent behavior on trips within CR EE.

Even after the launch of green taxis, yellow taxis are the only available street-hail option for exclusionary zone passengers whose destination is the non-exclusionary zone. In the context of yellow taxis, the shrinkage of their monopoly

over street-hail pickup areas from the whole of NYC to the exclusionary zone is considered a loss, and may motivate them to defraud passengers (more than they used to).

Yellow taxis already know that for trips from the exclusionary zone to the non-exclusionary zone (i.e., *CR EN*, where they held a monopoly before the launch of green taxis), they must compete with green taxis to pick up passengers post-drop-off. In credence goods markets, ex-ante, one cannot draw a straightforward conclusion that the benefit that consumers receive from lower prices (caused by competition among sellers) exceeds the loss they may face at the hands of fraudulent sellers who are incentivized to defraud by the lowering of prices (Kerschbamer & Sutter, 2017). However, exogenous prices to the seller (in our case, it means taxis having no control over the fare as NYC TLC regulates it) leave sellers with limited control over increasing their demand (e.g., by lowering prices/fares), and an increase in competition in such a situation may provide sellers with a stronger incentive to defraud passengers.

Additionally, previous studies have observed that NYC cab drivers may set an income target as a reference point and attempt to meet their income targets (Camerer et al., 1997; Kukavica et al., 2022). Since the launch of green taxis, yellow taxis have to search more for post-drop-off pickups on trips within *CR EN*, which delays their achieving the specific income target. In this regard, taking detours may be a way to compensate for the time needed to reach their income target (and the high opportunity cost of leaving the exclusionary zone) in order to break away from the constraints of a more competitive situation.

Unlike in *CR EN*, where yellow taxis have a monopoly over street-hail pickups, in *CR NN*, they must compete with green taxis for both pickups and post-drop-off pickups. In other words, in contrast to *CR EN* trips, for *CR NN* trips, yellow taxis must compete at least once more with green taxis post-drop-off (i.e., competing for pickups in addition to competing for post-drop-off pickups, as in trips within *CR EN*). Such a setting for trips within *CR NN* may provide yellow taxis with an even stronger motivation to defraud passengers on these trips.

Thus, we make the following hypotheses.

H_{2a}: After the launch of green taxis, yellow taxis engage in higher levels of fraudulent behavior on trips within CR EN as well as CR NN.
H_{2b}: After the launch of green taxis, yellow taxis engage in higher levels of fraudulent behavior on trips within CR NN than on trips within CR EN.

On trips within *CR NE*, the yellow taxis return to their exclusionary zone. Upon return, they experience a demand for post-drop-off pickups similar to what they had experienced before the launch of green taxis, yet they have to compete with green taxis to pick up passengers. Moreover, trips within *CR NE* often follow trips within *CR EN*/*CR NN*, where we hypothesize that yellow taxis had engaged in fraudulent behavior. In this regard, a priori, it is difficult to predict whether yellow taxis will engage in more fraudulent behavior on trips

within *CR NE*. Accordingly, instead of formally formulating a hypothesis, we explore the effect of the launch of green taxis on yellow taxis in *CR NE* by investigating the following research question:

RQ: Do yellow taxis engage in higher levels of fraudulent behavior on trips within CR NE since the launch of green taxis?

5 Data

Figure 2 displays the number of monthly street-hail pickups by yellow and green taxis from January 2012 to January 2015 and August 2013 to January 2015. As Fig. 2 illustrates, after the launch of green taxis, the total number of monthly pickups in NYC increased compared to the number of pickups in the same month in previous years. Moreover, Fig. 2 shows that, overall, the number of monthly yellow taxi pickups decreased compared to the number of pickups in the same month in previous years. These observations can be considered an overall increase in the number of pickups outside the exclusionary zone and an overall decrease in the share of the yellow taxi market.

We limited the timeframe of our analysis to the period from January 2013 to March 2014 for two reasons. First, an increase in the variable fee (from \$0.40 to \$0.50) implemented in September 2012 would affect our conclusions; therefore, we considered January 2013 as the beginning date of our analysis (i.e., seven months before the launch of green taxis).

Second, as Fig. 2 illustrates, during the first few months after the launch of green taxis in NYC, the monthly number of pickups by green taxis increased steadily until it remained stable around March, 2014. Therefore, to ensure that our empirical analysis captured the effect of the launch of green taxis on the fraudulent behavior of yellow taxis (and to avoid the launch and popularity of peer-to-peer ridesharing in the later months of 2014 affecting our results), we focused on data of yellow taxi trips seven months after the launch of green taxis (i.e., end of February 2014; see Fig. 2).

As we used data provided by the NYC TLC, it was necessary to carry out several steps to prepare the dataset (see Table 5 of Appendix A for details). We used the NYC shapefile to identify yellow taxi pickup and drop-off neighborhoods (districts within boroughs, as in the example of SoHo in Lower Manhattan). By identifying the pickup and drop-off neighborhoods of a trip, we can determine the *CR* of the respective trips and focus on trips within the NYC boundaries. For example, Panel C of Fig. 1 shows a screenshot of a sample of trip pickup and drop-off locations in *CR EN*.

For our dataset, we matched trips before the launch of green taxis with those after the launch of green taxis. We considered trips within an approximate radius of 0.025 miles to have the same pickup or drop-off location (i.e., approximately half the block size in Manhattan (Fréchette et al., 2019)). Precisely, we matched

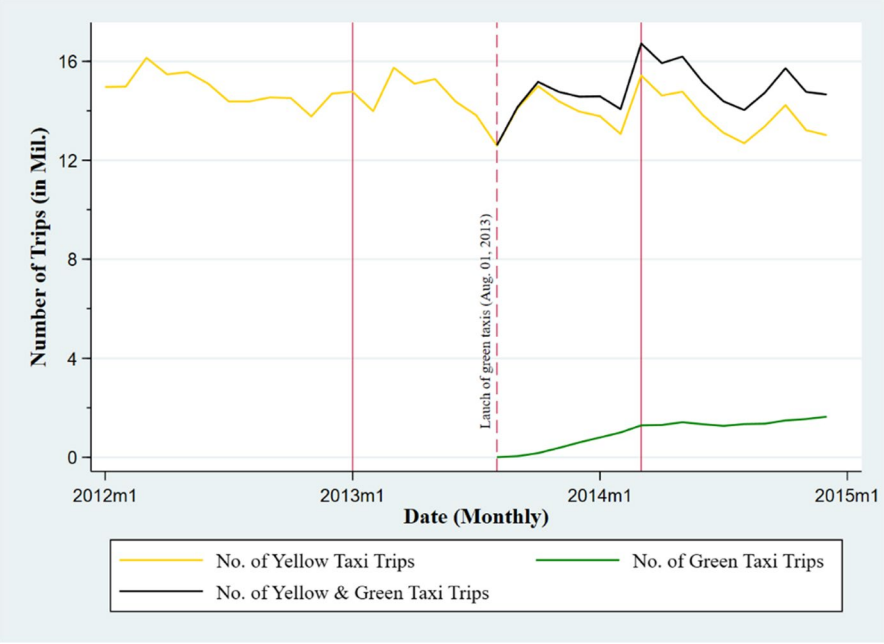

Fig. 2 Monthly Number of Street-Hail Trips by Yellow and Green Taxis in NYC. Notes: The number of trips is based on the number of pickups reported by the NYC TLC Taxi Passengers Enhancement Program. The solid vertical lines represent the beginning and end dates of the trips in the dataset. The dashed vertical line represents the launch date of green taxis

trips (i) on an hourly basis, by breaking down a day into 24 h, and (ii) that have both the same pickup and drop-off locations.

Matching trips (i.e., matching yellow taxi trips before the launch of green taxis with yellow taxi trips after the launch) on an hourly basis according to their pickup and drop-off locations is an important step in our analysis. First, matching trips allowed us to create a balanced sub-sample of yellow taxi trips with the same pickup and drop-off locations. This allowed us to isolate the effect (i.e., the launch of green taxis) by excluding unmatched yellow taxi trips, for example, from new (existing) locations that may (may not) become (un)popular owing to the launch of green taxis. Second, matching allowed us to create a subsample of trips that are comparable to each other and, consequently, to further isolate different variations, such as those due to traffic congestion throughout the day or the pickup or drop-off location of the trip, affecting our analysis.

Table 2 summarizes the number of trips subject to the standard-rate fare and compares the distance, duration, and fare in each *CR* before and after the green taxi launch. Table 2 shows that the sample of (matched) trips was balanced before

and after the launch of green taxis across the four *CR*s. Table 2 also reveals that the average speed of trips in *CR EE* before the launch of green taxis is slower than 12 mph (10.21 = 1.48 miles / (8.70 / 60) h), indicating that the duration of the trip is the main driver of the fare. However, for trips within *CR EN*, *CR NE*, and *CR NN*, similar calculations reveal that the average speed of trips is higher than 12 mph, indicating that the distance of the trip is the main driver of the fare.

Moreover, Table 2 shows that the trip distance, duration, and fare of yellow taxi trips within *CR EN*, *CR NE*, and *CR NN* (at a significance level of 5%) did not decrease after the launch of green taxis. Specifically, except for the distance of trips in *CR NE*, the trip characteristics of yellow taxis increased within these routes after the launch of green taxis, which seems to provide some model-free evidence for H_{2a}.

6 Description of the statistical model

Using matched trips, we investigated the effect of the launch of green taxis on the natural log-transformation of the distance of trips (by yellow taxis) separately for each competitive route. Specifically, for each competitive route, we investigated

Table 2 Summary of Matched Yellow Taxi Trips (Subject to Standard-Rate Fare) Considered for Empirical Analysis

Route	Variable	Before the launch of green taxis			After the launch of green taxis			t-Statistic	p-Value
		Mean	Std. Dev	N	Mean	Std. Dev	N		
CR EE	trip distance	1.48	0.97	7,809,976	1.48	0.97	7,709,191	8.88	0.00
	trip duration	8.70	5.34	7,809,976	9.05	5.68	7,709,191	−130.00	0.00
	trip fare	8.02	3.43	7,809,976	8.16	3.56	7,709,191	−77.44	0.00
CR EN	trip distance	6.56	4.06	364,385	6.67	4.04	389,532	−10.92	0.00
	trip duration	18.78	10.91	364,385	19.13	11.06	389,532	−13.48	0.00
	trip fare	21.61	11.31	364,385	21.93	11.38	389,532	−12.17	0.00
CR NE	trip distance	7.88	3.91	389,161	7.86	3.88	384,241	1.26	0.21
	trip duration	23.28	11.77	389,161	24.25	12.57	384,241	−35.17	0.00
	trip fare	25.80	10.98	389,161	26.05	11.16	384,241	−9.79	0.00
CR NN	trip distance	4.45	4.77	150,349	4.55	4.82	144,763	−5.87	0.00
	trip duration	12.97	11.18	150,349	13.11	11.33	144,763	−3.45	0.00
	trip fare	15.35	12.85	150,349	15.59	13.00	144,763	−4.94	0.00

Two-tailed p-values. The trip distance, trip duration, and trip fare are in miles, minutes, and dollars, respectively

whether yellow taxi trip distances changed after the launch of green taxis. For this, we use:

$$\begin{aligned}\ln\left(\text{Trip Distance}_{jmd}\right) = {} & \beta_0 + \theta \times \text{GL}_m \\ & + \left[\gamma \times \text{GLT}_m + \alpha \times \text{T}_m + \lambda \times \text{T}_m^2\right] \\ & + \beta_1 \times \text{No. of Yellow Pickups}_m + \beta_2 \times \text{No. of Green Pickups}_m \\ & + \beta_3 \times \text{Toll}_j + \left[\beta_4 \times \text{Overnight}_j + \beta_5 \times \text{Ruch Hour}_j\right] \\ & + \left[\beta_6 \times \text{Credit Card}_j + \beta_7 \times \text{Unknown}_j\right] \\ & + [\beta_8 \times \text{Two Passengers}_j + \beta_9 \times \text{Three Passengers}_j + \beta_{10} \times \text{Four Passengers}_j \\ & + \beta_{11} \times \text{Five Passengers}_j + \beta_{12} \times \text{Six Passengers}_j] \\ & + \left[\beta_{13} \times \text{Rain}_d + \beta_{14} \times \text{Snow}_d + \beta_{15} \times \text{Max Temp}_d + \beta_{16} \times \text{Min Temp}_d\right] \\ & + \beta_{17} \times \text{MFIN}_d + \varepsilon_{jmd},\end{aligned} \tag{1}$$

where the dependent variable ln (Trip Distance$_{jmd}$) is the natural log-transformed distance of trip j (in miles) in month m (= {1, 2, …, 14}) and on day d (= {(January 1, 2013), …, (February 28, 2014)}) in the respective competitive route. Therefore, the coefficients on the right-hand side of Eq. (1) represent the percentage change in our dependent variable, due to a "one unit change" in the independent variable.

We denote August 2013 (i.e., m = 8) as the month of the launch of green taxis. The variable GL_m, which is a step dummy variable that takes a value of 1 when $m \geq 8$ and zero otherwise, is used to allow for a level shift at the time of the launch of green taxis. Consequently, coefficient θ in Eq. (1) captures the percentage change in the distance of trips after the launch of green taxis.

To avoid unobservable time-varying effects on the dependent variable (i.e., trip distance) in Eq. (1), and to control for the nonlinear effect of time, we include a deterministic (monthly) trend variable T_m and a quadratic term for the deterministic trend variable T_m^2. Essentially, variable T_m takes on values from 1 to 14 from January 2013 to February 2014. The variable GLT_m takes the value of $m - 8 + 1$ when $m \geq 8$ and zero otherwise. As such, this allows for the growth rate of the trend curve at the time of the launch of green taxis.

No. of Yellow Pickups_m is a variable representing the number of monthly pickups by yellow taxis (in millions) in month m. Moreover, to control for the increasing activity of green taxis, we control for the number of monthly pickups by green taxis, No. of Green Pickups_m (in millions). Controlling for the number of monthly pickups also allows us to capture the seasonality effect.

Toll_j is a dummy variable equal to one if trip j includes a toll. Overnight_j and Rush Hour_j are dummy variables that control for variations in traffic congestion, and are equal to one for overnight and rush-hour trips. The standard-rate fare structure also sets a fixed *rush-hour* surcharge of $1.00 for trips between 4:00 p.m. and 8:00 p.m. on weekdays. An additional fixed charge of $0.50, an *overnight* surcharge, applies to trips between 8:00 p.m. and 6:00 a.m.

In Eq. (1), Credit Card_j and Unknown_j are dummy variables equal to one if trip j is paid by credit card or has an unknown payment, respectively. Moreover, we

control for the number of passengers on trip j by introducing dummy variables. $Rain_d$, $Snow_d$, Max $Temp_d$, and Min $Temp_d$ control for the level of rain or snow (in inches) and the maximum and minimum temperatures (in Fahrenheit) in NYC on day d, respectively (Table 12 of Appendix B summarizes the sources of the data that we utilize for our analysis).

$MFIN_d$ is the daily stock price of the Medallion Financial Corp (NASDAQ: MFIN), a publicly traded company with leading positions in markets that include taxi medallion lending, and is a good proxy for taxi market performance in NYC. Finally, we used robust standard errors to estimate Eq. (1).

Under the standard-rate fare structure, the trip fare is a function of the combination of trip distance, taxi speed, and the time taken for the respective trip. Therefore, to obtain a complete understanding of the effect of the launch of green taxis, we use both the natural log-transformed trip duration and trip fare as separate dependent variables and run a regression on the same independent variables as in Eq. (1).

7 Results

Table 3 presents the effect of the launch of green taxis based on our regression results for all four *CR*s (for the robustness of the results in Table 3, see Panel A of Fig. 3). Table 3 shows that after the launch of green taxis in NYC, the distance of yellow taxi trips in *CR EE* increased by 2%. A 2% increase in the trip distance in *CR EE* translates to less than 0.03 miles (<0.05 miles, which is the approximate block size in Manhattan; see Table 2 for mean distance, duration, and fare of trips in *CR*s before the launch of the green taxis). However, we found that the trip duration and trip fare in *CR EE* decreased by 4% and 2%, respectively (i.e., <0.5 min and \$0.16, respectively).

Trips in *CR EE* constitute short routes (see Table 2) and occur in an area with higher demand (i.e., the exclusionary zone), making (further) defrauding current passengers by increasing the variable fee less attractive than the income generated by the fixed fee of picking up a new passenger. These results, in line with the findings of past literature (Dulleck & Kerschbamer, 2006; Liu et al., 2021), indicate that yellow taxis are advantaged by taking as many trips as possible to exploit the proportionally large fixed fee of the fare (i.e., \$2.50, which equals a detour of 5 min for trips moving slower than 12 mph) at the expense of a one-unit decrease in the variable fee.[8] As in the case of H_1, these findings do not provide evidence of the (higher) fraudulent behavior of yellow taxis on trips within *CR EE*.

Table 3 shows that in *CR EN*, the distance of yellow taxi trips significantly increased by 5% after the launch of green taxis (i.e., approximately 0.33 miles). The

[8] In *CR EE*, where taxis (on average) move slower than 12 mph (see Table 2), a detour of 5 min (i.e., an extra 5×0.50=\$2.50) is equivalent to the fixed amount in the standard-rate fare structure. Detouring 5 min in *CR EE*—which is approximately 60% of the time that an average trip takes in *CR EE* (i.e., approximately 9 min; see Table 2)—creates a high opportunity cost for detouring, and makes defrauding passengers less attractive.

Table 3 Effect of the Green Taxi Launch on Distance, Duration, and Fare of Yellow Taxi Trips Subject to the Standard-Rate Fare

Competitive Route	*CR EE*	*CR EE*	*CR EE*	*CR EN*	*CR EN*	*CR EN*	*CR NE*	*CR NE*	*CR NE*	*CR NN*	*CR NN*	*CR NN*
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
Introduction of Green Taxis to NYC												
Green Launch (GL)	0.02^{***}	-0.04^{***}	-0.02^{***}	0.05^{***}	0.05^{***}	0.04^{***}	0.05^{***}	-0.06^{***}	0.00	0.17^{***}	0.04^{*}	0.10^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.45)	(0.00)	(0.04)	(0.00)
Control for Time Trend												
GLT	-0.01^{***}	0.04^{***}	0.02^{***}	-0.06^{***}	-0.07^{***}	-0.05^{***}	-0.05^{***}	0.04^{***}	-0.01^{**}	-0.20^{***}	-0.08^{***}	-0.12^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
T	0.00^{***}	0.03^{***}	0.02^{***}	0.01^{*}	0.01^{**}	0.01^{**}	−0.00	0.05^{***}	0.02^{***}	0.01	0.01	0.01
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)	(0.98)	(0.00)	(0.00)	(0.12)	(0.44)	(0.12)
T^2	-0.00^{***}	-0.00^{***}	-0.00^{***}	0.00^{*}	0.00	0.00^{*}	0.00^{**}	-0.00^{***}	-0.00^{**}	0.00^{**}	0.00^{*}	0.00^{**}
	(0.00)	(0.00)	(0.00)	(0.04)	(0.06)	(0.04)	(0.01)	(0.00)	(0.00)	(0.00)	(0.05)	(0.01)
Monthly Number of Taxi Pickups												
Yellow	0.00^{***}	-0.00^{*}	0.00	0.01^{**}	0.01^{***}	0.01^{***}	0.01^{*}	0.00	0.00^{*}	0.04^{***}	0.02^{***}	0.03^{***}
	(0.00)	(0.04)	(0.11)	(0.00)	(0.00)	(0.00)	(0.01)	(0.67)	(0.03)	(0.00)	(0.00)	(0.00)
Green	0.04^{***}	-0.08^{***}	-0.03^{***}	0.13^{***}	0.23^{***}	0.12^{***}	0.13^{***}	−0.00	0.06^{**}	0.58^{***}	0.23^{***}	0.37^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.90)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Toll												
Toll	–	–	–	1.22^{***}	0.79^{***}	0.92^{***}	1.19^{***}	0.80^{***}	0.89^{***}	1.16^{***}	0.75^{***}	0.80^{***}
				(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Demand (base: Normal − Hour)												
Overnight	0.12^{***}	-0.13^{***}	-0.03^{***}	0.25^{***}	0.10^{***}	0.14^{***}	0.08^{***}	-0.27^{***}	-0.03^{***}	-0.06^{***}	-0.16^{***}	-0.09^{***}

Table 3 (continued)

Competitive Route	*CR EE*	*CR EE*	*CR EE*	*CR EN*	*CR EN*	*CR EN*	*CR NE*	*CR NE*	*CR NE*	*CR NN*	*CR NN*	*CR NN*
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rush Hour	−0.02***	−0.02***	−0.02***	−0.10***	0.06***	−0.06***	−0.11***	−0.11***	−0.09***	0.28***	0.27***	0.21***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)												
Credit Card	0.12***	0.10***	0.08***	0.09***	0.09***	0.07***	0.13***	0.10***	0.09***	0.29***	0.23***	0.21***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Unknown	0.16***	0.12***	0.10***	0.00	0.01	0.00	0.07***	0.06***	0.05***	0.14***	0.19***	0.12***
	(0.00)	(0.00)	(0.00)	(0.90)	(0.27)	(0.73)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for No. of Passengers (base: One)												
Two	0.02***	0.00***	0.00***	0.01***	−0.00	−0.00*	0.01***	−0.00	−0.00**	0.02***	−0.00	−0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.12)	(0.03)	(0.00)	(0.19)	(0.00)	(0.00)	(0.64)	(0.88)
Three	0.03***	0.01***	0.00***	0.01	−0.01*	−0.01***	0.02***	−0.00	−0.01*	0.00	−0.01	−0.01*
	(0.00)	(0.00)	(0.00)	(0.07)	(0.02)	(0.00)	(0.00)	(0.50)	(0.03)	(0.99)	(0.08)	(0.04)
Four	0.03***	0.01***	0.01***	0.00	−0.01**	−0.01**	0.02***	−0.00	−0.00	0.02	−0.01	−0.01
	(0.00)	(0.00)	(0.00)	(0.44)	(0.00)	(0.00)	(0.00)	(0.60)	(0.47)	(0.24)	(0.57)	(0.48)
Five	0.02***	0.00	0.00	0.03***	0.01**	0.00	0.03***	−0.00	0.00	0.03***	0.01	0.00
	(0.00)	(0.13)	(0.65)	(0.00)	(0.01)	(0.10)	(0.00)	(0.95)	(0.80)	(0.00)	(0.13)	(0.42)
Six	0.03***	−0.00***	−0.00**	0.01***	−0.01***	−0.01**	0.02***	−0.01*	−0.01**	−0.01	−0.03***	−0.02***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.41)	(0.00)	(0.00)
Control for Weather Condition												
Rain	−0.01***	0.02***	0.00***	−0.01**	0.03***	0.00	−0.01***	0.03***	−0.00	−0.03***	0.00	−0.02***

Table 3 (continued)

Competitive Route	*CR EE*	*CR EE*	*CR EE*	*CR EN*	*CR EN*	*CR EN*	*CR NE*	*CR NE*	*CR NE*	*CR NN*	*CR NN*	*CR NN*
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.13)	(0.00)	(0.00)	(0.48)	(0.00)	(0.61)	(0.00)
Snow	-0.00^{***}	0.00^{***}	-0.00^{***}	-0.01^{***}	-0.00^{***}	-0.00^{***}	-0.00^{***}	-0.00^{***}	-0.00^{***}	-0.01^{***}	0.00	-0.01^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.50)	(0.00)
Max. Temp	0.00^{***}	0.00^{***}	0.00^{***}	-0.00^{***}	0.00^{***}	-0.00	-0.00	0.00^{**}	-0.00	-0.00	0.00^{*}	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.18)	(0.24)	(0.00)	(0.36)	(0.81)	(0.01)	(0.40)
Min. Temp	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{***}	-0.00^{***}	0.00	0.00	-0.00^{**}	0.00	0.00^{***}	0.00^{*}	0.00^{**}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.18)	(0.11)	(0.00)	(0.86)	(0.00)	(0.05)	(0.00)
Control for Economic Performance												
MFIN Stock Price	0.00^{**}	0.01^{***}	0.01^{***}	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{***}	0.01^{***}	0.01^{***}	-0.01	0.00	-0.00
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.09)	(0.64)	(0.37)
Constant												
Constant	0.03^{***}	1.77^{***}	1.85^{***}	0.78^{***}	2.05^{***}	2.27^{***}	(0.00)	(0.00)	(0.00)	(0.67)	(0.00)	(0.00)
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	773,402	773,402	773,402	295,112	295,112	295,112
Number of Trips	15,519,167	15,519,167	15,519,167	753,917	753,917	753,917	773,402	773,402	773,402	295,112	295,112	295,112
R − squared	0.02	0.02	0.01	0.45	0.30	0.46	0.51	0.38	0.52	0.11	0.11	0.12
Adjusted R − squared	0.02	0.02	0.01	0.45	0.30	0.46	0.51	0.38	0.52	0.11	0.11	0.12

p-values are in parentheses. * $p<0.05$, ** $p<0.01$, *** $p<0.001$. Dist. represents distance. The trip distance, Duration, and fare are in miles, minutes, and dollars, respectively. Robust standard errors were used for estimations. Trips in *CR EE* have no tolls

trip duration and trip fare in *CR EN* also increased by 5% and 4%, respectively (i.e., approximately 1 min and $0.86, respectively). These findings are in line with H_{2a}, indicating that the shrinkage in the monopolistic area of yellow taxis from the whole of NYC to the exclusionary zone, as a consequence of the launch of green taxis in NYC along with the elevation in competition post-drop-off, provides yellow taxi drivers with conditions that provoke the further defrauding of passengers in *CR EN*.

Our results in Table 3 indicate that trips within the non-exclusionary zone face the highest percentage increase—a 17% increase (i.e., approximately 0.80 miles in *CR NN*). Moreover, the trip duration and trip fare in *CR NN* also increased by 4% (approximately 0.5 min) and 10% (approximately $1.50), respectively. These findings are consistent with H_{2a} and H_{2b}.

For trips within *CR NE*, we found that the distance traveled increased by 5%. However, the trip durations decreased by 6%, and the trip fares did not change significantly (Table 3). Together, these findings do not provide evidence for a change in the fraudulent behavior of yellow taxis. However, they reveal that yellow taxis drive longer distances faster for trips from the non-exclusionary zone to the exclusionary zone (with a greater opportunity for pickups). These results provide an answer to the RQ. The underlying reason for this observation may be that yellow taxis drive to their "base" (i.e., monopoly area) for trips in *CR NE*, where they enjoy high demand and do not need to compete with green taxis for post-drop-off pickups. Consequently, a $2.50 fixed fee from picking up a new passenger may outperform detouring the current passenger.

8 Validity and robustness of the results

8.1 Robustness checks and flat-rate fare trips

We tested the robustness of our results through a battery of sensitivity analyses; the findings are presented in Table 3 (also see Panel A of Fig. 3). Using a specification curve (SPECC), we visualized how the coefficient magnitudes and precision varied across different specifications (see, e.g., Gathergood et al., 2021). Overall, we find that our central findings detailed in the Results section remain robust across various specifications, thus supporting our main conclusions. Moreover, we checked the robustness of our results using trip distance, trip duration, and trip fare as dependent variables (instead of their log-transformed values); our main conclusions in the Results section remain the same (see Table 6 of Appendix A).

To further increase our confidence in the results, we investigated whether the launch of green taxis in NYC affects the trip distance and trip duration of yellow taxi trips subject to a flat-rate fare. We considered 173,063 trips between Manhattan and JFK International Airport, subject to a flat-rate fare (i.e., $52 plus other surcharges).

Intuitively, after the launch of green taxis in NYC, yellow taxis should have no incentive to increase the distance of trips subject to a flat-rate fare. This conclusion is confirmed by the results illustrated in Panel B of Fig. 3, which show that the distances of yellow taxi trips subject to a flat-rate fare did not increase significantly after the launch of green taxis in NYC. Moreover, the results in Panel

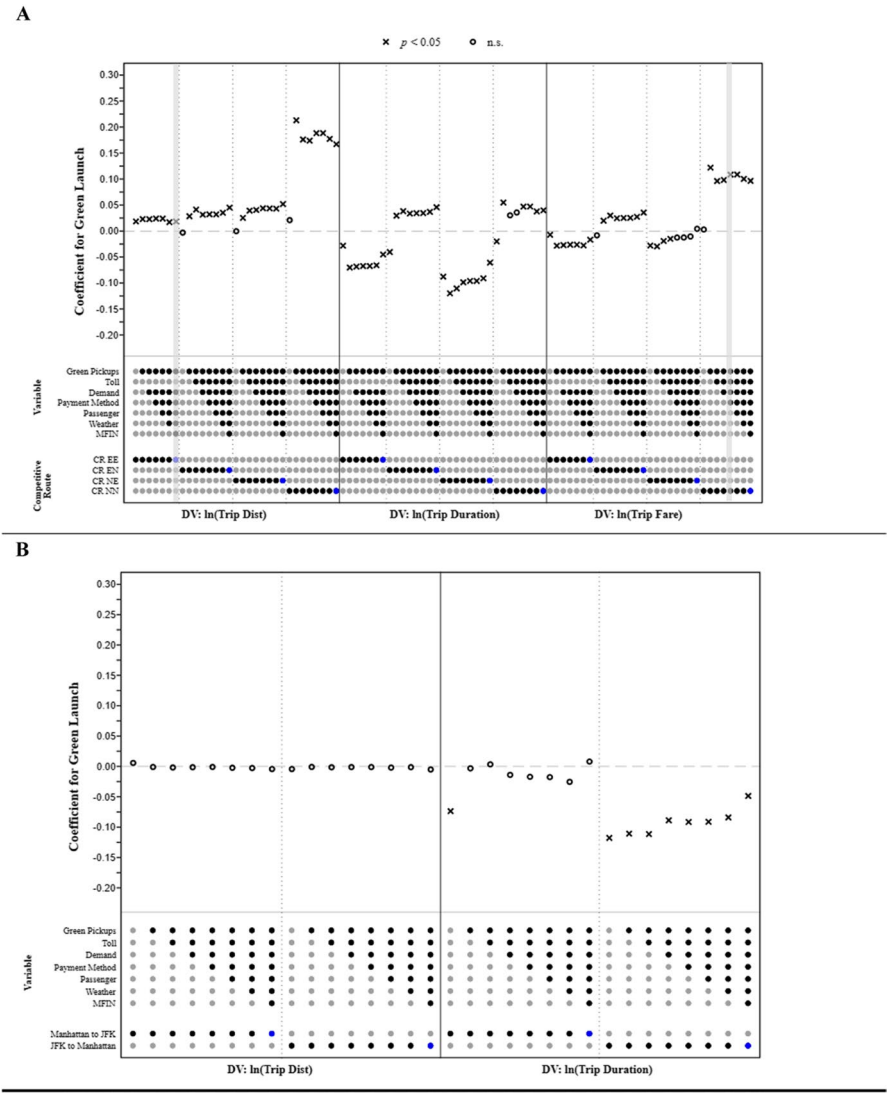

Fig. 3 Specification Curves Illustrating Effect of the Green Taxi Launch on Distance and Duration (and Fare) of Yellow Taxi Trips. variables and competitive routes. The black-filled (grey-filled) dots represent the presence (absence) of the respective control variables in the regression. The blue dots represent the estimations from the models with all control variables. Trips in *CR EE* have no tolls. For full regression results, see Appendix G (for Panel A) and Appendix H (for Panel B). Reading Examples: (i) the left (grey) highlighted column in Panel A represents the coefficient for the variable GL_m (i.e., θ) in *CR EE* estimated from Eq. (1) (for full results, see results under column *CR EE* and ln (Trip Dist.) of Table 3); (ii) the right (grey) highlighted column in Panel A represents the coefficient for the variable GL_m (i.e., θ) in *CR NN* estimated from the following modified version of Eq. (1): $\ln(\text{Trip Distance}_{jm}) = \beta_0 + \theta \times GL_m + [\gamma \times GLT_m + \alpha \times T_m + \lambda \times T_m^2] + \beta_1 \times \text{No. of Yellow Pickups}_m + \beta_2 \times \text{No. of Green Pickups}_m + \beta_3 \times \text{Toll}_j + [\beta_4 \times \text{Overnight}_j + \beta_5 \times \text{Rush Hour}_j] + [\beta_6 \times \text{Credit Card}_j + \beta_7 \times \textit{Unknown}_i] + \varepsilon_{jm}$

B of Fig. 3 do not show an increase in the trip durations of flat-rate fare trips, providing evidence that after the launch of green taxis, yellow taxis did not drive slower in these routes (see Table 7 of Appendix A for results from the model with all independent variables and Table 8 for respective results without log-transformation) Fig. 3.

8.2 Decomposition of trips by borough

To further check the validity of our main findings (i.e., H_{2a}), we decomposed trips in *CR EN* and *CR NN* (where we found strong evidence for the fraudulent behavior of yellow taxis) by their drop-off and pickup boroughs, respectively. We then ran a regression on the same independent variables as in Eq. (1) (see Fig. 5 in Appendix A). Overall, the results from the decomposition of trips by the pickup/drop-off borough do not reveal inconsistent patterns (compared to our main results, presented in Table 3) and are in line with our main conclusions. Specifically, we found that after the launch of green taxis, the trip distance, trip time, and trip fare of yellow taxi trips in *CR EN* and *CR NN* did not (significantly) decrease.[9]

8.3 Variation in treatment of yellow taxis

We conducted different analyses to verify the validity of our results and generate additional insights. We mainly focused on matched yellow taxi trips (subject to standard tariff fares) in *CR NN* (the competitive route with the highest level of fraudulent yellow taxi behavior).

8.3.1 Consumer information

In the context of credence goods, past studies have highlighted the role of consumer information in improving their position (e.g., Balafoutas & Kerschbamer, 2020). Therefore, we checked the concurrent validity of our results by investigating whether the heterogeneity in passenger information about the optimal route affected the degree to which they were defrauded. We used matched yellow taxi trips (subject to standard tariff fares) in *CR NN* and conducted two different analyses.

We differentiated between (i) trips for which the pickup/drop-off is near office buildings (as a proxy for passengers' familiarity with the optimal route, which provides them with some degree of *diagnosis ability*) and (ii) trips for which the pickup/drop-off is near a hotel (as a proxy for passengers' unfamiliarity with the optimal route). We then investigated whether after the launch of green taxis, passengers on trips in (i) are treated differently than those on trips in (ii).

Specifically, we considered trips for which there was an office building or hotel within a 0.025 miles radius of a passenger's pickup/drop-off. To obtain location data

[9] We ran a similar analysis for decomposed trips in *CR NE*, by their pickup borough. In line with our main conclusions in Table 3, we found that the trip distance, trip time, and trip fare of yellow taxi trips in *CR NE*, respectively, did not (significantly) decrease, increase, and increase.

Table 4 Robustness Checks: Effect of Green Taxi Launch on Distance, Duration, and Fare of Yellow Taxi Trips to/from Office Buildings and Hotels in CR NN and Subject to Standard-Rate Fare

Pickup/drop-off near …	office building			hotel		
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
Introduction of Green Taxis to NYC						
Green Launch (GL)	0.15	0.01	0.05	0.24*	0.22*	0.21*
	(0.095)	(0.939)	(0.408)	(0.041)	(0.015)	(0.012)
Control for Time Trend						
GLT	−0.18*	−0.08	−0.10	−0.16	−0.15	−0.14
	(0.018)	(0.209)	(0.054)	(0.123)	(0.054)	(0.061)
T	−0.05	−0.04	−0.03	0.05	0.03	0.03
	(0.143)	(0.090)	(0.140)	(0.176)	(0.345)	(0.233)
T^2	0.01*	0.01*	0.01*	−0.00	−0.00	−0.00
	(0.044)	(0.048)	(0.040)	(0.571)	(0.746)	(0.632)
Monthly Number of Taxi Pickups						
Yellow	0.04*	0.03	0.03	0.06	0.06**	0.05*
	(0.049)	(0.160)	(0.068)	(0.067)	(0.009)	(0.013)
Green	0.27	−0.05	0.05	0.92**	0.85***	0.79***
	(0.298)	(0.820)	(0.767)	(0.004)	(0.001)	(0.001)
Control for Toll						
Toll	1.25***	0.55***	0.79***	0.67***	0.53***	0.51***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Control for Demand (base: Normal − Hour)						
Overnight	0.05***	−0.10***	−0.01	−0.57***	−0.60***	−0.47***
	(0.000)	(0.000)	(0.248)	(0.000)	(0.000)	(0.000)
Rush Hour	0.23***	0.21***	0.16***	−0.03	−0.01	−0.04*
	(0.000)	(0.000)	(0.000)	(0.134)	(0.458)	(0.024)

Table 4 (continued)

Pickup/drop-off near …	office building			hotel		
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
Control for Payment Method (base: Cash)						
Credit Card	0.26***	0.21***	0.18***	0.22***	0.22***	0.20***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Unknown	−0.10	−0.01	−0.06	−0.41	−0.14	−0.15
	(0.384)	(0.933)	(0.403)	(0.191)	(0.386)	(0.421)
Control for No. of Passengers (base: One)						
Two	0.00	−0.01	−0.01	−0.02	−0.04*	−0.03*
	(0.915)	(0.663)	(0.414)	(0.438)	(0.049)	(0.049)
Three	0.02	−0.03	−0.01	0.04	−0.01	−0.00
	(0.589)	(0.349)	(0.743)	(0.285)	(0.668)	(0.853)
Four	0.01	0.02	0.00	−0.02	−0.04	−0.03
	(0.834)	(0.544)	(0.970)	(0.777)	(0.415)	(0.425)
Five	0.01	−0.02	−0.01	0.02	−0.01	−0.01
	(0.815)	(0.171)	(0.316)	(0.461)	(0.457)	(0.469)
Six	0.02	−0.02	−0.01	0.08**	0.02	0.03
	(0.478)	(0.309)	(0.502)	(0.006)	(0.354)	(0.185)
Control for Weather Condition						
Rain	0.00	0.03	0.01	−0.01	0.02	−0.00
	(0.927)	(0.050)	(0.625)	(0.798)	(0.180)	(0.823)
Snow	−0.01	0.01	−0.00	0.01	0.01	0.00
	(0.492)	(0.097)	(0.814)	(0.419)	(0.389)	(0.726)
Max. Temp	0.00	0.00*	0.00	0.00	0.00	0.00
	(0.214)	(0.018)	(0.061)	(0.988)	(0.442)	(0.761)

Table 4 (continued)

Pickup/drop-off near …	office building			hotel		
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
Min. Temp	−0.00	−0.00	−0.00	0.00	0.00	0.00
	(0.308)	(0.063)	(0.096)	(0.324)	(0.829)	(0.472)
Control for Economic Performance						
MFIN Stock Price	0.00	0.01	0.01	−0.01	−0.00	−0.01
	(0.654)	(0.117)	(0.411)	(0.236)	(0.854)	(0.415)
Constant						
Constant	−0.42	1.30***	1.53***	0.74	1.72***	2.07***
	(0.225)	(0.000)	(0.000)	(0.109)	(0.000)	(0.000)
Number of Trips	15,501	15,501	15,501	14,034	14,034	14,034
R − squared	0.16	0.09	0.15	0.10	0.17	0.13
Adjusted R − squared	0.16	0.09	0.15	0.10	0.17	0.13

p-values are in parentheses. * $p<0.05$, ** $p<0.01$, *** $p<0.001$. Dist. represents distance. The trip distance, Duration, and fare are in miles, minutes, and dollars, respectively. Robust standard errors were used for estimations

for office buildings and hotels, we used information collected by The Primary Land Use Tax Lot Output (PLUTO) and provided by the Department of City Planning (DCP; see Appendix B). Next, we used the natural log-transformed trip distance, trip duration, and trip fare as dependent variables and ran a regression on the same independent variables as in Eq. (1), using trips for which the pickup/drop-off was near an office building and a hotel.

We found that when the pickup/drop-off occurred near an office building, the distance, duration, and fare of trips remained unchanged after the launch of green taxis (see Table 4).[10] However, our results showed that after the launch of green taxis, trips for which the pickup/drop-off was near a hotel experienced 24%, 22%, and 21% increases in distance, duration, and fare, respectively.

8.3.2 Daily treatment of yellow taxis

We checked whether the fraudulent behavior of yellow taxis changed throughout the hours of the day on routes within *CR NN*; we used the natural log-transformed trip distance, trip duration, and trip fare as dependent variables and ran regressions similar to Eq. (1), with the following changes: (i) we controlled for hours of the day and the interaction of the hours of the day with the step dummy (i.e., GL_m) and (ii) we removed $Overnight_j$ (due to collinearity; see Appendix C and the respective results in Table therteen).

Our results show that trips carried out between 1:00 p.m. and 5:00 p.m. have a relatively greater increase in distance, duration, and fare, indicating a greater change in fraudulent behavior in *CR NN* during these hours. This finding is important when noting that around 5:00 p.m. is the traditional time for yellow taxis to change their working shifts (de Blasio & Joshi, 2016; Grynbaum, 2011). These observations echo the notion of an income reference point for taxi drivers, indicating that taxi drivers may set an income target as the reference point (Camerer et al., 1997; Kukavica et al., 2022). The increase in the fraudulent behavior of yellow taxis before the change in their working shifts may be a result of attempts to reach their unmet income targets (driven by the decrease in their market share as a consequence of the introduction of thousands of green taxis in a span of a few months).[11]

[10] To test for the robustness of this finding, we ran a similar analysis for trips in *CR EE*, *CR EN*, and *CR NE*. We found that the distance, duration, and fare of trips for which the pickup/drop-off was near office buildings did not increase after the launch of green taxis (see Table 9 in Appendix A).

[11] Our results in Table 14 also show trips carried out within a few hours after the change in the working shifts have a relatively greater increase in distance, duration, and fare. Forward-looking reference points of yellow taxi drivers (based on recent expectations) may provide us with an explanation for the increase in the fraudulent behavior of yellow taxis during these hours (Koszegi and Rabin 2006; Thakral and Tô 2021). Specifically, yellow taxis' (recent) experience of increased competition for pickups for trips within *CR NN* (in the early stages of their working shifts) may provide them (i.e., yellow taxis) with motivations for an attempt to meet their income reference point.

8.3.3 Treatment of yellow taxis during the months after the launch of green taxis

We also investigated the fraudulent behavior of yellow taxis over time. In particular, we examined the fraudulent behavior of yellow taxis during the months following the launch of green taxis on trips within *CR NN*. To do so, we ran regressions similar to those in Eq. (1) with the following modification: We introduced six dummy variables, one for each month following the launch of green taxis, in our dataset and considered August 2013 as our base level (see Appendix D).

Our results revealed that from September 2013 to February 2014 (i.e., the months after green taxis were launched), the trip distance, trip time, and trip fare of yellow taxis within *CR NN* were not higher than those during August 2013 (i.e., the month in which green taxis were launched). Specifically, we found that within the months after green taxis were launched, yellow taxis had a relatively lower distance and fare compared to the month in which green taxis were launched (i.e., August 2013). These findings can be interpreted as an elevation in competition, leading to an (abrupt) increase in the fraudulent behavior of sellers, while its magnitude diminished over time.[12]

8.4 Validation of the identification strategy

In our primary analysis, we matched yellow taxi trips before and after the launch of green taxis, which raises questions regarding the validity of our identification strategy. To support the validity of our identification strategy and our main conclusion on the impact of the NYC TLC's decision on street-hail transportation outside of the Manhattan Core, we utilized green taxi trips. Specifically, we created two additional datasets, consisting of green taxi trips in *CR NE* and *CR NN* which were matched with (i) yellow taxi trips before the launch of green taxis (referred to as the GvYB dataset) and (ii) yellow taxi trips after the launch of green taxis (referred to as the GvYA dataset; see Table 10 of Appendix A).[13]

We used matched trips in the GvYB and GvYA datasets and ran regressions using a modified version of Eq. (1); the visualized magnitudes of the coefficients are depicted in Fig. 4 (for the full regression results, see Table 11 in Appendix A).

Figure 4 demonstrates that the sizes of coefficients for green taxi trips in *CR NN* in Panel A of Fig. 4 are larger than those in Panel B. In other words, within matched trips in *CR NN*, green taxis had longer trip distances and trip durations and higher trip fares in the GvYB dataset than in the GvYA dataset.[14] This finding (indirectly) indicates that yellow taxis had relatively longer trip distances and trip durations and higher trip fares in *CR NN* after the launch of green taxis. This finding supports the validity of our identification strategy, and is consistent with (part of) H_{2a}.

[12] We reached similar conclusions for trips within *CR EN* (see Table 15 of Appendix D).

[13] While preparing these datasets, we followed the same steps that we took for yellow taxis (see Table 5 of Appendix A).

[14] Unlike yellow taxis, which face a new market structure due to the launch of green taxis; green taxis enter the NYC market with prior knowledge about the market structure. Moreover, both yellow and green taxis face similar conditions in *CR NN* (i.e., they have the same fare structure and must compete for both pickups and post-drop-off pickups). Such a setting in trips within *CR NN* provides us with a reasonable control group to check the validity of our identification strategy.

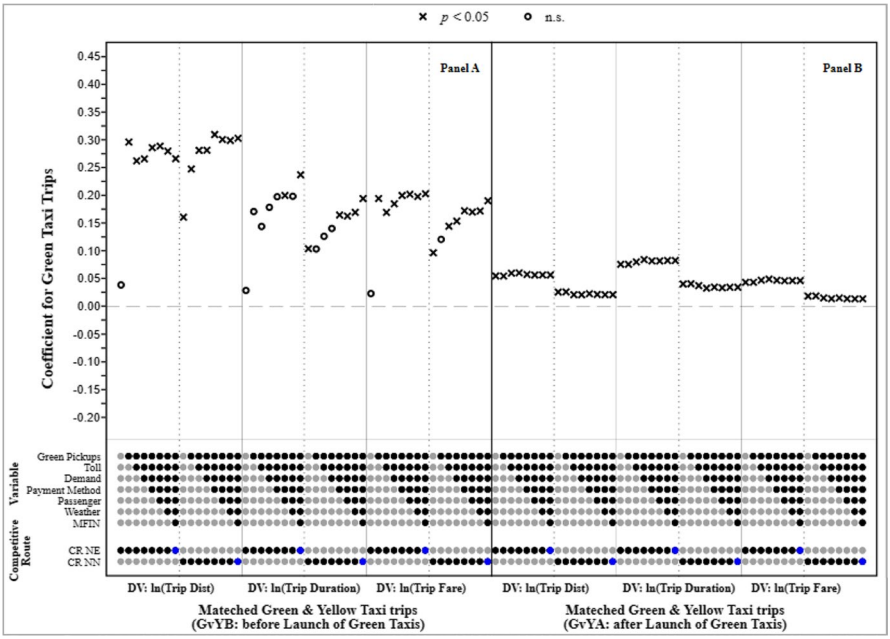

Fig. 4 Specification Curves Comparing Green and Yellow Taxi Trips for Distance, Duration, and Fare. Notes: Each column shows estimations from a separate regression with a combination of control variables and competitive routes. The black-filled (grey-filled) dots represent the presence (absence) of the respective control variables in the regression. The blue dots represent the models with all control variables (see the regression results in Table 11 of Appendix A)

9 Discussion and conclusion

9.1 Discussion

The question of whether markets benefit from increased competition has been controversial (Gilbert, 2006), as more competition may reinforce incentives to reduce service quality (see also, e.g.,Brekke et al., 2011; Gozvrisankaran & Town, 2003). For many markets (especially those in which the consumer has difficulty determining the value of goods or services received), it is unclear whether consumers always benefit from increased competition, and past literature shows mixed results regarding the effects of competition (Balafoutas & Kerschbamer, 2020; Johansen & Zhu, 2014; Krachler et al., 2022).

This study revealed that increased competition does not always help to overcome market issues. We examined the policy implemented by the NYC TLC, which resulted in an increase in competition in the NYC taxi market. Using trip information for taxis in NYC that covers the NYC TLC's decision to launch green taxis, which led to an increase in the number of street-hail vehicles (and consequently, an elevation in competition in specific areas), we sought answers to several questions. Does an increase in competition improve the NYC taxi market? Or does it provoke (higher levels of) fraudulent behavior among taxi drivers? Does the intensity of competition affect the degree of change in fraudulent behavior? Do taxi drivers' assumptions regarding consumers' information about the optimal route affect the degree to which the consumer is defrauded (e.g., trips to/from office buildings versus those to/from hotels)?

In a study of millions of matched standard-rate fare taxi trips in NYC (i.e., facing similar daily traffic congestion and having the same pickup and drop-off locations), we found significant evidence of a change in the fraudulent behavior of yellow taxis after the launch of green taxis, with the highest change in the overtreatment of passengers on routes where yellow taxis compete with green taxis for both pickups and post-drop-off pickups. Our results show that the degree of change in defrauding passengers depends not only on the characteristics of the trip (e.g., whether yellow taxis face competition in pickups/post-drop-off pickups or whether they are allowed pickups post-drop-off) but also on the drivers' assumptions regarding passengers' familiarity with the optimal route.

Our results provide insights for policymakers who are required to assess the extent of competition in a market and those tasked with promoting it (Littlechild, 2018; Warner & Hefetz, 2008). When tasked with regulating or overseeing market systems, they must understand the range of implications that their policies would impose on both sellers and consumers. Among such regulatory concerns, policymakers should address seller fraud, which imposes significant monetary costs on consumers and on the larger society. This is especially true in markets for credence goods, where consumers are not positioned to effectively determine the quality or value of a good or service and must rely on policymakers to protect for their interests.

Our results indicate that competition intensity does not always help consumers. This finding is important for regulators, who have often not effectively promoted the need for competition (see, e.g.,Littlechild, 2018; Podnar et al., 2007). The launch of green taxis in NYC is a good example of regulation-based competition that did not have the full effect desired. The launch of green taxis primarily aimed to provide street-hail services in areas traditionally less popular for yellow taxis (Bloomberg & Yassky, 2014; NYC TLC, 2014). However, in practice, the introduction (and the consequent increase in competition in parts of NYC) affected the taxi market in NYC in unanticipated ways, which resulted in certain types of consumers being more subject to taxi fraud.

The effect of regulations is an important issue in a broad range of public policy areas. Regulations apply to a wide spectrum of markets, including healthcare, education, telecommunications, television broadcasts, pharmaceuticals, energy, airport and railway markets, and taxis (e.g.,Bilotkach & Hüschelrath, 2019; Bollinger, 2015; Broman & Eliasson, 2019; Epple et al., 2016; Johansen & Zhu, 2014). However, applying or enforcing regulations may affect the market in different ways and sometimes negatively. Therefore, in line with our findings, we suggest that when public policymakers want to impose changes that increase the consumer surplus, they must carefully assess the market situation before making concrete decisions regarding the transition from a regulated monopoly to deregulation and competitive entry into the markets. For example, the short- and long-term consequences of decisions such as adding doctors to the healthcare system should be carefully considered (Daily Mail, 2021).

From an economic perspective, poorly examined public policy decisions can impose huge costs on consumers. For example, our study on the yellow taxi market in NYC found increased fraud for trips subject to standard-rate fares in boroughs other than Manhattan (*CR NN*). Although the level of fraud was small (increasing the trip fare by approximately $1.50), it translates to an additional approximately $6.8 million within the seven months following the launch of green taxis.

Our results also have direct implications for the restrictions imposed on peer-to-peer ridesharing platforms (e.g., Uber) for picking up passengers in specific areas.

For instance, in some countries, Uber drivers are not allowed to pick up passengers from airline terminals. Fewer restrictions on their presence may help decrease fraud in the taxi market in many ways, for example, by making second opinions more accessible, which is supported by past studies indicating that second opinions help to reduce overtreatment (Mimra et al., 2016b).

9.2 Limitations and future research

Despite its important findings, the current study has some limitations. First, identifying fraudulent behavior among sellers is challenging, and few studies have investigated the existence and magnitude of sellers' fraudulent behavior in a real-world setting using actual secondary data (Rasch & Waibel, 2018). Generally, testing for fraud (or changes in it) among sellers in practice requires variation in the data (e.g., an abrupt change in policy) or the availability of a counterfactual (i.e., the service that the seller would have provided had the buyer been adequately informed). Although such variation is not available in our dataset, we checked the validity (and robustness) of our results in many ways (see Validity and Robustness of the Results section).

Second, our analysis does not consider the effect of peer-to-peer ridesharing, particularly Uber's one-year e-hail pilot program in NYC. We believe that over the period of our observation, the launch of Uber resulted in a limited change in the behavior of NYC street-hail taxis for several reasons: (i) in the time period of our analysis, MFIN stock prices were at their highest since 2010 (see Fig. 6 of Appendix E), indicating that the street-hail taxi market in NYC remained healthy during the study period. Similarly, the highest corporate (and private) medallion sales in 2012 − 2014 were recorded in May and June 2013, and the second highest occurred in 2014 (NYC Bloomberg & Yassky, 2014; TLC, 2012, 2013); (ii) peer-to-peer ridesharing applications offer "pre-arranged" rides through smartphones (as opposed to the street-hail service that we considered in our analysis), and during the period of our study, accounted for a smaller market share. Furthermore, given that there were no geographic restrictions, such as an exclusionary zone for Uber's activity (Uber Blog, 2013), its launch had a uniform effect on yellow taxi trips in NYC.[15] Thus, we believe that our main conclusions continue to have merits.

Third, our analysis does not directly account for changes in traffic levels and street/roadway construction in NYC. However, we believe that they do not affect our main conclusions for several reasons: (i) the absence of a significant change in the distance of trips subject to flat-rate fares provides some evidence against arguments such as significant changes in traffic and street/roadway construction during the time period of our analysis; and (ii) in fact, NYC experienced a downward citywide traffic trend during the time period of our analysis (see the citywide traffic trend from 2013 to 2014 reported by the NYC Department of Transportation (2016)).

In summary, our study demonstrates that changes in credence markets, such as an increase in competition resulting from an increase in the number of sellers, can significantly affect the fraudulent behavior of sellers. Policymakers should handle these markets with caution and carefully consider the consequences of their policies on sellers' behavior and the impact it will have on consumers.

[15] Our results show that, of all Uber pickups from April–September 2014, more than 78% were in Manhattan, followed by Brooklyn and Queens, providing some support for our claim (see Appendix F for more details).

Appendix A

Table 5 Steps for Preparing Yellow Taxi Trip Dataset (Using Data Provided by NYC TLC) for Analysis, and Respective Changes in Number of Observations

Step	Description	Number of Trips by …	
		Yellow Taxis[a]	Green Taxis
A	Keep trips for which distance is recorded to the second decimal place[b]	99,376,771	2,892,792
B1	Remove trips with unknown latitudes and/or longitudes for pickups/drop-offs	98,143,097	2,883,328
B2	Remove trips with unknown pickup/drop-off locations (e.g., drop-off outside the NYC boundaries)	97,506,456	2,874,876
C	Remove trips that their distance is missing or not positive	97,416,189	2,826,268
D	Remove trips that their time is missing or not positive (according to recorded pickup and drop-off times)	96,776,801	2,803,648
E1	Remove trips that their fare is missing or less than/equal to $2.50 (i.e., equal to fixed fee of standard-rate fare)	96,746,625	2,800,679
E2	Remove trips that are subject to flat-rate fare but their fare is missing or not equal to $52	96,746,538	—
F	Remove trips that their MTA tax is not equal to $.50	96,746,189	2,798,337
G	Keep trips with number of passengers = {1, 2, 3, 4, 5, 6}	96,746,187	2,798,282
R	Remove trips with other mistakes (e.g., hours not matching surcharge, toll[c] for trips in *CR EE*, etc.)	96,693,002	2,711,117
For each CR: removing the 0.10% lowest and highest values for:			
W1	trip distance	96,517,163	2,705,960
W2	trip duration	96,422,656	2,703,313
W3	trip fare[d]	96,334,153	2,700,406
Match for pickup and drop-off location, hour, and CR for:			
M1	yellow taxi trips, before and after launch of green taxis (including yellow taxi trips subject to flat-rate fare)	17,514,661	—
M2	green taxi trips with yellow taxi trips (before the launch of green taxis; GvYB dataset)	—	155,493
M3	green taxi trips with yellow taxi trips (after the launch of green taxis; GvYA dataset)	—	171,878

[a] Includes both trips subject to standard-rate fares and flat-rate fares. [b] In the NYC TLC data, trip distance is stated in miles, rounded down to the first or second decimal place. Therefore, to avoid introducing bias and to increase confidence in results, we only use trips rounded to the second decimal place. [c] Trips with a toll in *CR EE* may be due to an error in recorded data or due to trips that traveled outside Manhattan and returned to Manhattan again. However, we note that we cannot differentiate between these two cases in the data provided by TLC. [d] Not applicable to trips subject to flat-rate fare

Table 6 Robustness Checks: Effect of Green Taxi Launch on Distance, Duration, and Fare of Yellow Taxi Trips Subject to the Standard-Rate Fare

Competitive Route	*CR EE*	*CR EE*	*CR EE*	*CR EN*	*CR EN*	*CR EN*	*CR NE*	*CR NE*	*CR NE*	*CR NN*	*CR NN*	*CR NN*
Dependent Variable	Trip Dist	Trip Duration	Trip Fare	Trip Dist	Trip Duration	Trip Fare	Trip Dist	Trip Duration	Trip Fare	Trip Dist	Trip Duration	Trip Fare
Introduction of Green Taxis to NYC												
Green Launch (GL)	0.03***	−0.54***	−0.17***	0.22***	1.05***	0.70***	0.17***	−1.98***	−0.28*	0.75***	0.55*	1.75***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.03)	(0.00)
Control for Time Trend												
GLT	−0.02***	0.44***	0.16***	−0.28***	−1.30***	−0.88***	−0.20***	1.23***	−0.01	−0.87***	−0.98***	−2.11***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.96)	(0.00)	(0.00)	(0.00)
T	0.01***	0.31***	0.15***	0.03*	0.25***	0.14***	0.01	1.56***	0.50***	0.05	0.30***	0.18
	(0.00)	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.70)	(0.00)	(0.00)	(0.14)	(0.00)	(0.07)
T^2	−0.00*	−0.03***	−0.01***	0.00*	0.00	0.01	0.00	−0.13***	−0.03***	0.01**	−0.00	0.03**
	(0.02)	(0.00)	(0.00)	(0.04)	(0.42)	(0.08)	(0.09)	(0.00)	(0.00)	(0.00)	(0.84)	(0.01)
Monthly Number of Taxi Pickups												
Yellow	0.00***	−0.02***	0.00	0.04***	0.25***	0.14***	0.02	−0.06	0.02	0.19***	0.28***	0.48***
	(0.00)	(0.00)	(0.50)	(0.00)	(0.00)	(0.00)	(0.09)	(0.07)	(0.50)	(0.00)	(0.00)	(0.00)
Green	0.06***	−1.01***	−0.33***	0.65***	5.47***	2.32***	0.56***	−0.28	0.83*	2.62***	4.48***	6.64***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.49)	(0.01)	(0.00)	(0.00)	(0.00)
Control for Toll												
Toll	–	–	–	6.06***	11.51***	16.31***	5.78***	12.81***	16.04***	3.71***	8.19***	10.41***
				(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Demand (base: Normal − Hour)												
Overnight	0.17***	−1.31***	−0.29***	0.26***	−0.50***	0.26***	0.17***	−7.20***	−1.85***	−0.56***	−3.08***	−2.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Table 6 (continued)

Competitive Route	*CR EE*	*CR EE*	*CR EE*	*CR EN*	*CR EN*	*CR EN*	*CR NE*	*CR NE*	*CR NE*	*CR NN*	*CR NN*	*CR NN*
Dependent Variable	Trip Dist	Trip Duration	Trip Fare	Trip Dist	Trip Duration	Trip Fare	Trip Dist	Trip Duration	Trip Fare	Trip Dist	Trip Duration	Trip Fare
Rush Hour	-0.05^{***}	-0.15^{***}	-0.20^{***}	-0.61^{***}	2.22^{***}	-1.08^{***}	-0.44^{***}	-1.71^{***}	-1.66^{***}	1.05^{***}	4.31^{***}	3.22^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)												
Credit Card	0.17^{***}	0.73^{***}	0.61^{***}	0.31^{***}	1.10^{***}	0.97^{***}	0.49^{***}	1.16^{***}	1.35^{***}	1.09^{***}	2.54^{***}	3.07^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Unknown	0.24^{***}	0.89^{***}	0.80^{***}	-0.13^{*}	-0.32	-0.34^{*}	0.16^{**}	0.10	0.27	0.26	1.46^{***}	1.01^{*}
	(0.00)	(0.00)	(0.00)	(0.02)	(0.09)	(0.04)	(0.00)	(0.63)	(0.07)	(0.14)	(0.00)	(0.04)
Control for No. of Passengers (base: One)												
Two	0.02^{***}	0.03^{***}	0.02^{***}	0.04^{***}	-0.00	-0.03	0.04^{***}	0.02	-0.06^{*}	0.04	-0.01	-0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.98)	(0.26)	(0.00)	(0.59)	(0.02)	(0.12)	(0.84)	(0.84)
Three	0.02^{***}	0.07^{***}	0.03^{***}	0.01	-0.04	-0.12^{**}	0.04^{**}	0.06	-0.06	-0.02	-0.18	-0.19
	(0.00)	(0.00)	(0.00)	(0.41)	(0.44)	(0.01)	(0.01)	(0.32)	(0.15)	(0.67)	(0.05)	(0.09)
Four	0.03^{***}	0.06^{***}	0.04^{***}	0.01	-0.15^{*}	-0.16^{*}	0.09^{***}	0.01	0.00	-0.00	-0.20	-0.16
	(0.00)	(0.00)	(0.00)	(0.68)	(0.04)	(0.02)	(0.00)	(0.87)	(0.98)	(0.98)	(0.14)	(0.30)
Five	0.01^{***}	0.01^{*}	0.00	0.08^{***}	0.06	0.04	0.09^{***}	-0.05	-0.05	0.03	0.02	-0.04
	(0.00)	(0.02)	(0.31)	(0.00)	(0.06)	(0.18)	(0.00)	(0.13)	(0.07)	(0.22)	(0.71)	(0.59)
Six	0.01^{***}	-0.03^{***}	-0.01^{**}	0.04^{***}	-0.15^{***}	-0.08^{*}	0.05^{***}	-0.14^{***}	-0.14^{***}	-0.08^{**}	-0.32^{***}	-0.36^{***}
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Control for Weather Condition												
Rain	-0.02^{***}	0.22^{***}	0.05^{***}	-0.02	0.75^{***}	0.08^{**}	-0.06^{***}	0.76^{***}	0.02	-0.12^{***}	0.16^{**}	-0.25^{***}

Table 6 (continued)

Competitive Route	*CR EE*	*CR EE*	*CR EE*	*CR EN*	*CR EN*	*CR EN*	*CR NE*	*CR NE*	*CR NE*	*CR NN*	*CR NN*	*CR NN*
Dependent Variable	Trip Dist	Trip Duration	Trip Fare	Trip Dist	Trip Duration	Trip Fare	Trip Dist	Trip Duration	Trip Fare	Trip Dist	Trip Duration	Trip Fare
	(0.00)	(0.00)	(0.00)	(0.07)	(0.00)	(0.00)	(0.00)	(0.00)	(0.46)	(0.00)	(0.00)	(0.00)
Snow	-0.00^{***}	0.01^{***}	-0.01^{***}	-0.02^{***}	-0.12^{***}	-0.10^{***}	-0.01^{**}	-0.16^{***}	-0.10^{***}	-0.04^{***}	-0.06^{*}	-0.12^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.00)
Max. Temp	0.00^{***}	0.00^{**}	0.00^{***}	-0.00^{***}	0.02^{***}	-0.00	-0.00	0.01^{*}	-0.00	-0.00	0.02^{***}	0.00
	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.23)	(0.13)	(0.02)	(0.18)	(0.81)	(0.00)	(0.32)
Min. Temp	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{***}	-0.02^{***}	0.00	0.00	-0.02^{***}	-0.00	0.01^{**}	0.00	0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.49)	(0.50)	(0.00)	(0.27)	(0.01)	(0.78)	(0.06)
Control for Economic Performance												
MFIN Stock Price	0.00^{*}	0.09^{***}	0.04^{***}	0.02^{**}	0.07^{***}	0.06^{***}	0.02^{***}	0.35^{***}	0.17^{***}	-0.02	0.07^{*}	-0.03
	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.08)	(0.03)	(0.38)
Constant												
Constant	1.21^{***}	6.82^{***}	6.69^{***}	3.06^{***}	7.36^{***}	11.23^{***}	3.46^{***}	9.10^{***}	12.16^{***}	0.56	4.52^{***}	4.70^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.16)	(0.00)	(0.00)
Number of Trips	15,519,167	15,519,167	15,519,167	753,917	753,917	753,917	773,402	773,402	773,402	295,112	295,112	295,112
R – squared	0.02	0.02	0.01	0.53	0.29	0.50	0.54	0.34	0.52	0.08	0.11	0.09
Adjusted R – squared	0.02	0.02	0.01	0.53	0.29	0.50	0.54	0.34	0.52	0.08	0.11	0.09

p-values are in parentheses. * $p<0.05$, ** $p<0.01$, *** $p<0.001$. Dist. represents distance. The trip distance, Duration, and fare are in miles, minutes, and dollars, respectively. Robust standard errors were used for estimations. Trips in *CR EE* have no toll

Table 7 Effect of Green Taxi Launch on Trip Distance and Trip Duration of Yellow Taxi Trips Subject to a Flat-Rate Fare

Trips from…	Manhattan to JFK	Manhattan to JFK	JFK to Manhattan	JFK to Manhattan
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Dist.)	ln (Trip Duration)
Introduction of Green Taxis to NYC				
Green Launch (GL)	−0.00	0.01	−0.00	−0.05***
	(0.791)	(0.621)	(0.672)	(0.000)
Control for Time Trend				
GLT	0.00	0.01	−0.00	0.02*
	(0.997)	(0.705)	(0.728)	(0.012)
T	0.01	0.02***	0.01**	0.05***
	(0.256)	(0.000)	(0.003)	(0.000)
T^2	−0.00	−0.00***	−0.00	−0.00***
	(0.891)	(0.000)	(0.353)	(0.000)
Monthly Number of Taxi Pickups				
Yellow	−0.00	0.01*	0.00	0.01***
	(0.690)	(0.022)	(0.799)	(0.000)
Green	−0.03	0.26***	−0.00	0.14***
	(0.382)	(0.000)	(0.901)	(0.000)
Control for Toll				
Toll	0.01***	−0.09***	−0.02***	−0.09***
	(0.000)	(0.000)	(0.000)	(0.000)
Control for Demand (base: Normal − Hour)				
Overnight	0.01*	−0.42***	0.00	−0.39***
	(0.021)	(0.000)	(0.418)	(0.000)
Rush Hour	−0.01*	0.27***	−0.01***	0.02***
	(0.013)	(0.000)	(0.000)	(0.000)
Control for Payment Method (base: Cash)				
Credit Card	0.01**	−0.04***	0.00	−0.04***
	(0.004)	(0.000)	(0.781)	(0.000)
Unknown	−0.01	−0.03	−0.00	−0.06***
	(0.741)	(0.287)	(0.838)	(0.000)
Control for No. of Passengers (base: One)				
Two	0.02***	0.01*	0.01***	0.01**
	(0.000)	(0.031)	(0.000)	(0.009)
Three	0.02***	−0.00	0.02***	0.01*
	(0.000)	(0.890)	(0.000)	(0.016)
Four	0.02**	0.00	0.02***	0.00
	(0.008)	(0.892)	(0.000)	(0.972)
Five	0.02***	0.01*	0.03***	−0.00
	(0.000)	(0.028)	(0.000)	(0.152)
Six	0.03***	0.01	0.03***	−0.00
	(0.000)	(0.075)	(0.000)	(0.193)

Table 7 (continued)

Trips from…	Manhattan to JFK	Manhattan to JFK	JFK to Manhattan	JFK to Manhattan
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Dist.)	ln (Trip Duration)
Weather Condition				
Rain	−0.00	0.06***	−0.00	0.04***
	(0.683)	(0.000)	(0.458)	(0.000)
Snow	0.00	−0.01***	−0.00	−0.01***
	(0.798)	(0.000)	(0.480)	(0.000)
Max. Temp	0.00	0.00***	−0.00	0.00*
	(0.354)	(0.000)	(0.873)	(0.031)
Min. Temp	−0.00	−0.00*	−0.00	0.00
	(0.156)	(0.026)	(0.321)	(0.452)
Control for Economic Performance				
MFIN Stock Price	−0.00	0.02***	−0.00	0.02***
	(0.553)	(0.000)	(0.092)	(0.000)
Constant				
Constant	2.85***	3.28***	2.87***	3.36***
	(0.000)	(0.000)	(0.000)	(0.000)
Number of Trips	57,663	57,663	115,400	115,400
R − squared	0.01	0.24	0.01	0.35
Adjusted R − squared	0.00	0.24	0.01	0.35

p-values are in parentheses. * $p<0.05$, ** $p<0.01$, *** $p<0.001$. Dist. represents distance. The trip distance, Duration, and fare are in miles, minutes, and dollars, respectively. JFK represents John F. Kennedy International Airport. Robust standard errors were used for estimations

Table 8 Robustness Checks: Effect of Green Taxi Launch on Trip Distance and Trip Duration of Yellow Taxi Trips Subject to a Flat-Rate Fare

Trips from…	Manhattan to JFK	Manhattan to JFK	JFK to Manhattan	JFK to Manhattan
Dependent Variable	Trip Dist	Trip Duration	Trip Dist	Trip Duration
Introduction of Green Taxis to NYC				
Green Launch (GL)	−0.06	−0.34	−0.04	−2.77***
	(0.638)	(0.652)	(0.678)	(0.000)
Control for Time Trend				
GLT	0.02	0.80	−0.05	1.89***
	(0.854)	(0.205)	(0.581)	(0.000)
T	0.08	1.45***	0.13***	2.45***
	(0.107)	(0.000)	(0.000)	(0.000)
T^2	−0.00	−0.17***	−0.01	−0.23***
	(0.602)	(0.000)	(0.213)	(0.000)
Monthly Number of Taxi Pickups				
Yellow	−0.03	0.32	0.01	0.50***
	(0.343)	(0.077)	(0.741)	(0.000)
Green	−0.43	11.96***	0.01	5.48***
	(0.261)	(0.000)	(0.961)	(0.000)
Control for Toll				
Toll	0.19***	−3.73***	−0.30***	−4.07***
	(0.000)	(0.000)	(0.000)	(0.000)
Control for Demand (base: Normal − Hour)				
Overnight	0.07*	−15.59***	−0.00	−16.32***
	(0.020)	(0.000)	(0.785)	(0.000)
Rush Hour	−0.09**	13.01***	−0.11***	0.71***
	(0.003)	(0.000)	(0.000)	(0.000)
Control for Payment Method (base: Cash)				
Credit Card	0.05**	−1.66***	0.01	−1.71***
	(0.007)	(0.000)	(0.291)	(0.000)
Unknown	−0.10	−1.46	0.02	−2.71***
	(0.634)	(0.227)	(0.890)	(0.000)
Control for No. of Passengers (base: One)				
Two	0.13***	0.30	0.09***	0.23*
	(0.000)	(0.077)	(0.000)	(0.025)
Three	0.08	−0.18	0.11***	0.39*
	(0.059)	(0.512)	(0.000)	(0.024)
Four	0.15*	−0.00	0.08	−0.09
	(0.021)	(1.000)	(0.066)	(0.713)
Five	0.17***	0.38*	0.20***	−0.18
	(0.000)	(0.029)	(0.000)	(0.112)
Six	0.21***	0.41*	0.22***	−0.17
	(0.000)	(0.048)	(0.000)	(0.206)

Table 8 (continued)

Trips from…	Manhattan to JFK	Manhattan to JFK	JFK to Manhattan	JFK to Manhattan
Dependent Variable	Trip Dist	Trip Duration	Trip Dist	Trip Duration
Weather Condition				
Rain	−0.04	3.02***	−0.03	2.12***
	(0.087)	(0.000)	(0.140)	(0.000)
Snow	0.00	−0.66***	−0.02*	−0.54***
	(0.702)	(0.000)	(0.021)	(0.000)
Max. Temp	0.00	0.11***	−0.00	0.01
	(0.982)	(0.000)	(0.461)	(0.136)
Min. Temp	−0.00	−0.03**	−0.00	0.01
	(0.238)	(0.009)	(0.164)	(0.350)
Control for Economic Performance				
MFIN Stock Price	−0.00	0.70***	−0.01	0.83***
	(0.718)	(0.000)	(0.158)	(0.000)
Constant				
Constant	17.86***	24.30***	18.30***	27.06***
	(0.000)	(0.000)	(0.000)	(0.000)
Number of Trips	57,663	57,663	115,400	115,400
R − squared	0.00	0.22	0.01	0.30
Adjusted R − squared	0.00	0.22	0.01	0.30

p-values are in parentheses. * $p<0.05$, ** $p<0.01$, *** $p<0.001$. Dist. represents distance. The trip distance, Duration, and fare are in miles, minutes, and dollars, respectively. JFK represents John F. Kennedy International Airport. Robust standard errors were used for estimations

Table 9 Robustness Checks: Effect of Green Taxi Launch on Distance, Duration, and Fare of Yellow Taxi Trips to/from Office Buildings in *CR EE*, *CR EN*, and *CR NE* and Subject to Standard-Rate Fare

Competitive Route	*CR EE*			*CR EN*			*CR NE*		
Pickup/drop-off near …	office building			office building			office building		
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
Introduction of Green Taxis to NYC									
Green Launch (GL)	−0.00	−0.09***	−0.05***	−0.02	0.02	−0.01	−0.01	−0.13***	−0.05***
	(0.294)	(0.000)	(0.000)	(0.445)	(0.308)	(0.644)	(0.514)	(0.000)	(0.000)
Control for Time Trend									
GLT	0.01**	0.07***	0.04***	−0.02	−0.04	−0.01	0.01	0.10***	0.03**
	(0.001)	(0.000)	(0.000)	(0.265)	(0.065)	(0.348)	(0.594)	(0.000)	(0.001)
T	0.01***	0.04***	0.02***	−0.01	0.01	−0.00	0.01	0.08***	0.03***
	(0.000)	(0.000)	(0.000)	(0.113)	(0.471)	(0.538)	(0.236)	(0.000)	(0.000)
T^2	−0.00***	−0.00***	−0.00***	0.00*	0.00	0.00	−0.00	−0.01***	−0.00***
	(0.000)	(0.000)	(0.000)	(0.016)	(0.757)	(0.151)	(0.454)	(0.000)	(0.000)
Monthly Number of Taxi Pickups									
Yellow	−0.00	−0.01***	−0.00***	0.00	0.01	0.00	−0.01	−0.01**	−0.00
	(0.721)	(0.000)	(0.000)	(0.773)	(0.087)	(0.657)	(0.182)	(0.006)	(0.108)
Green	−0.01	−0.19***	−0.10***	−0.13	0.14*	−0.06	−0.05	−0.13**	−0.07
	(0.489)	(0.000)	(0.000)	(0.051)	(0.033)	(0.250)	(0.355)	(0.007)	(0.064)
Control for Toll									
Toll	–	–	–	1.02***	0.68***	0.81***	0.83***	0.48***	0.61***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table 9 (continued)

Competitive Route	*CR EE*			*CR EN*			*CR NE*		
Pickup/drop-off near …	office building			office building			office building		
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
Control for Demand (base: Normal – Hour)									
Overnight	0.12***	−0.15***	−0.04***	0.09***	0.04***	0.05***	0.02***	−0.35***	−0.09***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Rush Hour	0.01***	0.02***	0.00**	−0.07***	0.14***	−0.02***	−0.05***	−0.05***	−0.04***
	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Control for Payment Method (base: Cash)									
Credit Card	0.10***	0.09***	0.07***	0.02***	0.04***	0.02***	0.05***	0.04***	0.04***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Unknown	0.16***	0.13***	0.10***	−0.10**	−0.07*	−0.09***	−0.01	0.04	0.01
	(0.000)	(0.000)	(0.000)	(0.002)	(0.026)	(0.001)	(0.796)	(0.145)	(0.712)
Control for No. of Passengers (base: One)									
Two	0.03***	0.01***	0.00***	0.01**	−0.01	−0.01	0.03***	0.01	0.00
	(0.000)	(0.000)	(0.000)	(0.006)	(0.136)	(0.094)	(0.000)	(0.178)	(0.590)
Three	0.03***	0.01***	0.01***	0.02*	0.00	−0.00	0.02***	0.01	−0.00
	(0.000)	(0.000)	(0.000)	(0.028)	(0.885)	(0.708)	(0.000)	(0.382)	(0.957)
Four	0.03***	0.01***	0.01***	0.03*	0.01	0.00	0.03**	0.00	−0.00
	(0.000)	(0.001)	(0.000)	(0.026)	(0.626)	(0.638)	(0.003)	(0.655)	(0.859)
Five	0.03***	0.00	0.00	0.02***	−0.01	−0.01	0.04***	0.00	0.00
	(0.000)	(0.442)	(0.421)	(0.000)	(0.300)	(0.176)	(0.000)	(0.289)	(0.489)
Six	0.03***	−0.00	0.00	0.01*	−0.01*	−0.01*	0.03***	0.00	−0.00

Table 9 (continued)

Competitive Route	*CR EE*			*CR EN*			*CR NE*		
Pickup/drop-off near …	office building			office building			office building		
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
	(0.000)	(0.487)	(0.411)	(0.045)	(0.043)	(0.027)	(0.000)	(0.376)	(0.728)
Control for Weather Condition									
Rain	-0.01^{***}	0.02^{***}	0.01^{***}	−0.00	0.03^{***}	0.00	−0.01	0.04^{***}	0.01^{*}
	(0.000)	(0.000)	(0.000)	(0.391)	(0.000)	(0.415)	(0.175)	(0.000)	(0.018)
Snow	−0.00	-0.00^{**}	-0.00^{***}	−0.00	−0.00	−0.00	0.00	-0.01^{***}	−0.00
	(0.130)	(0.009)	(0.000)	(0.719)	(0.077)	(0.104)	(0.271)	(0.000)	(0.123)
Max. Temp	0.00^{***}	-0.00^{***}	−0.00	−0.00	0.00^{**}	0.00	-0.00^{*}	0.00	−0.00
	(0.000)	(0.001)	(0.400)	(0.534)	(0.007)	(0.726)	(0.034)	(0.356)	(0.210)
Min. Temp	0.00^{***}	0.00^{***}	0.00^{***}	−0.00	-0.00^{**}	−0.00	0.00	−0.00	0.00
	(0.000)	(0.000)	(0.000)	(0.669)	(0.002)	(0.213)	(0.100)	(0.089)	(0.723)
Control for Economic Performance									
MFIN Stock Price	0.00	0.01^{***}	0.01^{***}	0.00	0.00	0.00	0.00	0.01^{***}	0.01^{***}
	(0.083)	(0.000)	(0.000)	(0.099)	(0.430)	(0.156)	(0.488)	(0.000)	(0.000)
Constant									
Constant	0.05^{**}	1.89^{***}	1.90^{***}	1.22^{***}	2.30^{***}	2.57^{***}	1.47^{***}	2.68^{***}	2.79^{***}
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of Trips	3,029,182	3,029,182	3,029,182	92,828	92,828	92,828	101,769	101,769	101,769
R − squared	0.017	0.020	0.013	0.478	0.310	0.489	0.389	0.293	0.433

Table 9 (continued)

Competitive Route	*CR EE*			*CR EN*			*CR NE*		
Pickup/drop-off near …	office building			office building			office building		
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
Adjusted $R-squared$	0.017	0.020	0.013	0.478	0.310	0.489	0.389	0.293	0.433

p-values are in parentheses. $^{*}\ p<0.05$, $^{**}\ p<0.01$, $^{***}\ p<0.001$. Dist. represents distance. The trip distance, Duration, and fare are in miles, minutes, and dollars, respectively. Robust standard errors were used for estimations. Trips in *CR EE* have no toll

Table 10 Summary of Matched Green and Yellow Taxi Trips (Subject to Standard-Rate Fare) Considered for Empirical Analysis

Green taxi trips matched with …	Route	Variable	Green taxis			Yellow taxis			t-Statistic	p-Value
			Mean	Std. Dev	N	Mean	Std. Dev	N		
yellow taxis trips before launch (GvYB)	*CR NE*	trip distance	2.48	1.62	27,918	2.40	1.59	32,346	− 5.86	0.00
		trip duration	12.17	7.73	27,918	10.73	6.87	32,346	− 24.21	0.00
		trip fare	11.09	5.47	27,918	10.47	5.16	32,346	− 14.17	0.00
	CR NN	trip distance	1.66	1.71	48,902	1.72	1.79	46,327	4.57	0.00
		trip duration	7.75	5.99	48,902	7.40	5.63	46,327	− 9.05	0.00
		trip fare	7.98	5.18	48,902	7.99	5.24	46,327	0.49	0.62
yellow taxis trips after launch (GvYA)	*CR NE*	trip distance	2.71	1.83	29,745	2.61	1.80	34,449	− 6.64	0.00
		trip duration	12.85	8.10	29,745	11.90	7.74	34,449	− 15.17	0.00
		trip fare	11.76	5.96	29,745	11.29	5.79	34,449	− 10.15	0.00
	CR NN	trip distance	1.76	1.82	55,691	1.80	1.91	51,993	3.52	0.00
		trip duration	8.03	6.10	55,691	7.77	5.92	51,993	− 6.84	0.00
		trip fare	8.26	5.41	55,691	8.29	5.57	51,993	0.85	0.40

Table 11 Comparison of Distance, Duration, and Fare of Green Taxi Trips with Those of Matched Yellow Taxi Trips

Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Green Taxi Trips Matched with …	Yellow Taxi Trips before the Launch of Green Taxis (i.e., GvYB Dataset)						Yellow Taxi Trips after the Launch of Green Taxis (i.e., GvYA Dataset)					
Competitive Route	*CR NE*	*CR NE*	*CR NE*	*CR NN*	*CR NN*	*CR NN*	*CR NE*	*CR NE*	*CR NE*	*CR NN*	*CR NN*	*CR NN*
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
Which Taxi Type Made the Trip												
Green Taxi	0.27**	0.24*	0.20**	0.30***	0.19*	0.19***	0.06***	0.08***	0.05***	0.02***	0.03***	0.01***
	(0.01)	(0.02)	(0.01)	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Time Trend												
GLT	−0.17**	−0.11*	−0.11**	−0.15***	−0.09*	−0.09**	−0.19**	0.09	−0.01	−0.01	0.23***	0.11**
	(0.00)	(0.05)	(0.01)	(0.00)	(0.05)	(0.00)	(0.00)	(0.22)	(0.86)	(0.88)	(0.00)	(0.00)
T	−0.01	−0.00	−0.00	−0.02**	−0.02*	−0.01**	0.00	0.01*	0.00	−0.00	0.00	−0.00
	(0.40)	(0.78)	(0.95)	(0.01)	(0.01)	(0.01)	(0.71)	(0.02)	(0.53)	(0.21)	(0.75)	(0.16)
T^2	0.00*	0.00	0.00	0.00**	0.00*	0.00*	0.07*	−0.02	0.00	0.01	−0.09***	−0.04*
	(0.02)	(0.36)	(0.18)	(0.00)	(0.04)	(0.02)	(0.02)	(0.44)	(0.90)	(0.69)	(0.00)	(0.01)
Monthly Number of Taxi Pickups												
Yellow	0.02*	0.02*	0.01*	0.01	0.00	0.01	1.07***	−0.69*	0.02	0.14	−1.30***	−0.53**
	(0.01)	(0.03)	(0.02)	(0.06)	(0.88)	(0.13)	(0.00)	(0.03)	(0.92)	(0.56)	(0.00)	(0.00)
Green	0.56*	0.51*	0.44*	0.43*	0.30	0.31*	0.87***	0.65***	0.62***	1.73***	1.10***	1.19***
	(0.02)	(0.04)	(0.02)	(0.03)	(0.12)	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Toll												
Toll	0.92***	0.69***	0.66***	1.77***	1.16***	1.23***	0.17***	−0.11***	0.03***	0.05***	−0.10***	−0.03***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Table 11 (continued)

Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Green Taxi Trips Matched with …	Yellow Taxi Trips before the Launch of Green Taxis (i.e., GvYB Dataset)						Yellow Taxi Trips after the Launch of Green Taxis (i.e., GvYA Dataset)					
Competitive Route	*CR NE*	*CR NE*	*CR NE*	*CR NN*	*CR NN*	*CR NN*	*CR NE*	*CR NE*	*CR NE*	*CR NN*	*CR NN*	*CR NN*
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
Control for Demand (base: Normal – Hour)												
Overnight	0.12^{***}	-0.11^{***}	0.01	-0.01^{**}	-0.13^{***}	-0.07^{***}	-0.20^{***}	-0.21^{***}	-0.17^{***}	0.03^{***}	0.05^{***}	0.01^{***}
	(0.00)	(0.00)	(0.07)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rush Hour	-0.15^{***}	-0.17^{***}	-0.13^{***}	0.00	0.03^{***}	−0.00	0.22^{***}	0.21^{***}	0.16^{***}	0.17^{***}	0.14^{***}	0.11^{***}
	(0.00)	(0.00)	(0.00)	(0.76)	(0.00)	(0.47)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)												
Credit Card	0.19^{***}	0.18^{***}	0.14^{***}	0.16^{***}	0.13^{***}	0.10^{***}	0.37^{***}	0.36^{***}	0.28^{***}	0.41^{***}	0.37^{***}	0.28^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Unknown	0.12	0.24	0.12	0.44^{**}	0.38^{**}	0.29^{**}	-0.02^{**}	−0.01	-0.01^{*}	−0.01	−0.00	−0.01
	(0.37)	(0.12)	(0.25)	(0.00)	(0.00)	(0.00)	(0.01)	(0.24)	(0.03)	(0.30)	(0.54)	(0.06)
Control for No. of Passengers (base: One)												
Two	−0.00	−0.01	−0.01	0.02^{***}	0.02^{*}	0.01	−0.01	0.00	−0.01	−0.00	0.02	−0.00
	(0.57)	(0.23)	(0.24)	(0.00)	(0.02)	(0.06)	(0.39)	(0.98)	(0.43)	(0.95)	(0.12)	(0.96)
Three	−0.01	−0.01	−0.01	0.03^{*}	0.03^{*}	0.01	0.01	0.02	0.00	0.01	0.01	0.00
	(0.69)	(0.52)	(0.26)	(0.03)	(0.02)	(0.07)	(0.59)	(0.35)	(0.81)	(0.75)	(0.68)	(0.66)
Four	0.03	0.02	0.01	0.02	0.00	0.01	0.00	−0.00	−0.00	0.01	−0.00	0.00
	(0.16)	(0.25)	(0.35)	(0.32)	(0.79)	(0.61)	(0.94)	(0.80)	(0.96)	(0.38)	(0.91)	(0.70)

Table 11 (continued)

Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Green Taxi Trips Matched with …	Yellow Taxi Trips before the Launch of Green Taxis (i.e., GvYB Dataset)						Yellow Taxi Trips after the Launch of Green Taxis (i.e., GvYA Dataset)					
Competitive Route	*CR NE*	*CR NE*	*CR NE*	*CR NN*	*CR NN*	*CR NN*	*CR NE*	*CR NE*	*CR NE*	*CR NN*	*CR NN*	*CR NN*
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
Five	−0.00	−0.01	−0.01	0.03***	0.01	0.01	0.01	0.01	0.00	−0.02*	−0.02*	−0.02**
	(0.60)	(0.45)	(0.24)	(0.00)	(0.40)	(0.11)	(0.33)	(0.61)	(0.57)	(0.04)	(0.02)	(0.00)
Six	0.02	0.01	0.00	0.00	−0.01	−0.01	−0.00	−0.00	−0.01	−0.01	0.00	−0.00
	(0.18)	(0.62)	(0.82)	(0.79)	(0.31)	(0.20)	(0.88)	(0.78)	(0.38)	(0.38)	(0.70)	(0.39)
Control for Weather Condition												
Rain	−0.01	0.02**	0.00	−0.00	0.02***	0.00	−0.00	0.01***	0.00	−0.00*	0.01***	−0.00
	(0.11)	(0.00)	(0.66)	(0.50)	(0.00)	(0.67)	(0.08)	(0.00)	(0.67)	(0.01)	(0.00)	(0.39)
Snow	−0.00	0.00	−0.00	−0.00	0.01***	0.00	0.00***	0.00*	0.00**	0.00	0.00	0.00
	(0.10)	(0.14)	(0.28)	(0.28)	(0.00)	(0.98)	(0.00)	(0.04)	(0.00)	(0.07)	(0.53)	(0.11)
Max. Temp	0.00	0.00	0.00	0.00	0.00	0.00	−0.00	−0.00*	−0.00	0.00	0.00	0.00
	(0.05)	(0.36)	(0.13)	(0.10)	(0.66)	(0.39)	(0.44)	(0.04)	(0.17)	(0.07)	(0.22)	(0.07)
Min. Temp	−0.00	−0.00	−0.00	0.00	0.00*	0.00*	0.00	−0.00	0.00	0.00	−0.00	−0.00
	(0.70)	(0.85)	(0.87)	(0.14)	(0.04)	(0.01)	(0.28)	(0.92)	(0.85)	(0.98)	(0.19)	(0.68)
Control for Economic Performance												
MFIN Stock Price	−0.00	0.01	0.00	0.00	0.00	0.00	−0.18	2.36***	2.15***	−0.08	2.64***	2.23***

Table 11 (continued)

Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Green Taxi Trips Matched with …	Yellow Taxi Trips before the Launch of Green Taxis (i.e., GvYB Dataset)						Yellow Taxi Trips after the Launch of Green Taxis (i.e., GvYA Dataset)					
Competitive Route	*CR NE*	*CR NE*	*CR NE*	*CR NN*	*CR NN*	*CR NN*	*CR NE*	*CR NE*	*CR NE*	*CR NN*	*CR NN*	*CR NN*
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
	(0.50)	(0.06)	(0.74)	(0.81)	(0.15)	(0.10)	(0.60)	(0.00)	(0.00)	(0.78)	(0.00)	(0.00)
Constant												
Constant	0.29*	1.76***	1.95***	−0.12	1.64***	1.73***	64,194	64,194	64,194	107,684	107,684	107,684
	(0.01)	(0.00)	(0.00)	(0.22)	(0.00)	(0.00)	0.087	0.061	0.077	0.227	0.133	0.251
Number of Trips	60,264	60,264	60,264	95,229	95,229	95,229	64,194	64,194	64,194	107,684	107,684	107,684
R − squared	0.060	0.049	0.058	0.245	0.150	0.283	0.087	0.061	0.077	0.227	0.133	0.251
Adjusted R − squared	0.060	0.049	0.057	0.245	0.150	0.283	0.087	0.061	0.077	0.227	0.133	0.251

p-values are in parentheses. * $p<0.05$, ** $p<0.01$, *** $p<0.001$. Dist. represents distance. The trip distance, Duration, and fare are in miles, minutes, and dollars, respectively. Robust standard errors were used for estimations

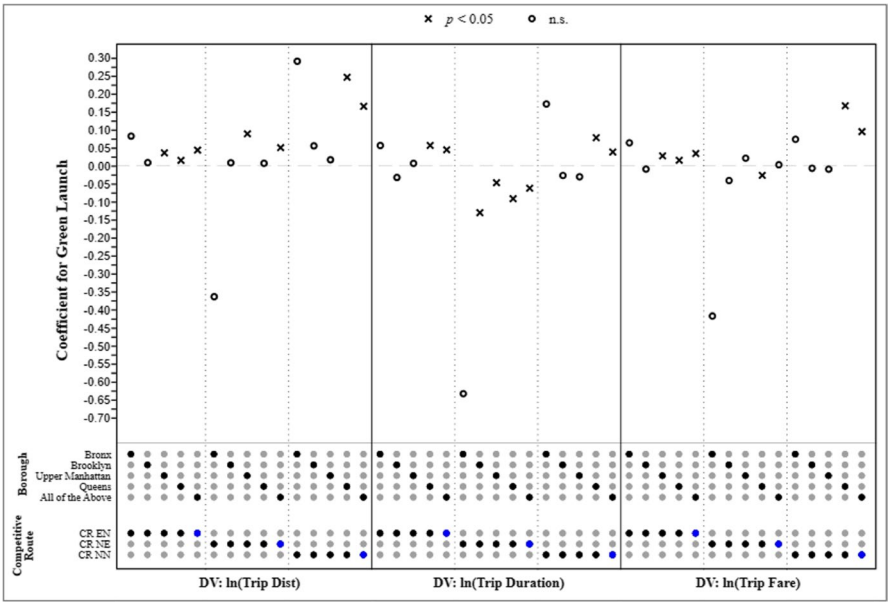

Fig. 5 Specification Curves Comparing Effect of the Green Taxi Launch on Distance and Duration, and Fare of Yellow Taxi Trips: Decomposition of Trips within *CR EN*, *CR NE*, and *CR NN* by Borough. Notes: Each column shows estimations from a separate regression. The black-filled dots represent trips to (from) boroughs within *CR EN* (*CR NE* and *CR NN*). The blue dots represent the model consisting of all trips with the respective competitive route (see the regression results in Table 3)

Appendix B

Table 12 provides sources of the data used in analysis.

Table 12 Description and Corresponding Links of Data Utilized for Analysis

Source	Description	Website
A	TLC trip record data: yellow and green taxi trip information (e.g., pickup and drop-off dates/times, pickup and drop-off locations, trip distance)	https://www1.nyc.gov/site/tlc/index.page
B	NYC shapefile (to identify trips' pickup and drop-off neighborhoods from data in A)	https://github.com/
C	NYC daily weather data	https://www.ncdc.noaa.gov/
D	Medallion Financial Corp (NASDAQ: MFIN)	https://finance.yahoo.com/
E	The Primary Land Use Tax Lot Output, provided by the Department of City Planning	https://www1.nyc.gov/site/planning/index.page

Appendix C

We used the following equation to investigate whether and how the trip distance of yellow taxis changes throughout the hours of the day:

$$\begin{aligned}\ln\left(\text{Trip Distance}_{jmdk}\right) = {} & \beta_0 + \left[\gamma \times \text{GLT}_m + \alpha \times \text{T}_m + \lambda \times \text{T}_m^2\right] \\ & + \left[\beta_1 \times \text{No. of Yellow Pickups}_m + \beta_2 \times \text{No. of Green Pickups}_m\right] \\ & + \left[\sum_{k=1}^{23} \left(\eta_k + \text{hour}_k + \delta \times \text{GL}_m + \theta_k \times \text{hour}_k \times \text{GL}_m\right)\right] \\ & + \beta_3 \times \text{Toll}_j + \beta_4 \times \text{Rush Hour}_j \\ & + \left[\beta_5 \times \text{Credit Card}_j + \beta_6 \times \text{Unknown}_j\right] \\ & + [\beta_7 \times \text{Two Passengers}_j + \beta_8 \times \textit{Three} \text{ Passengers}_j + \beta_9 \times \text{Four Passengers}_j \\ & + \beta_{10} \times \text{Five Passengers}_j + \beta_{11} \times \text{Six Passengers}_j] \\ & + \left[\beta_{12} \times \textit{Rain}_d + \beta_{13} \times \text{Snow}_d + \beta_{14} \times \text{Max Temp}_d + \beta_{15} \times \text{Min Temp}_d\right] \\ & + \beta_{16} \times \text{MFIN}_d + \varepsilon_{jmdk},\end{aligned} \tag{C.1}$$

where hour_k ($k = \{1, 2, \ldots, 23\}$) is a dummy variable equal to one if $\text{hour}_k = k$ and zero otherwise; δ represents the percentage change in the trip distance of yellow taxi trips on routes within *CR NN* at midnight and after the launch of green taxis (i.e., the base); θ_k represents additional changes (to the baseline) in the trip distance during hour k. We used both natural log-transformed trip duration and trip fare as separate dependent variables, and ran a regression on the same independent variables as in Eq. (C.1). All results are presented in Table 13.

Table 13 Effect of Green Taxi Launch on Trip Distance, Duration, and Fare of Yellow Taxi Trips in CR NN that Are Subject to a Standard-Rate Fare

Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
Introduction of Green Taxis to NYC			
Green Launch (GL)	0.14***	0.02	0.07***
	(0.00)	(0.30)	(0.00)
Control for Time Trend			
GLT	−0.19***	−0.07***	−0.11***
	(0.00)	(0.00)	(0.00)
T	0.03**	0.01*	0.02**
	(0.00)	(0.04)	(0.00)
T^2	0.00*	0.00	0.00
	(0.05)	(0.37)	(0.17)
Monthly Number of Taxi Pickups			
Yellow	0.04***	0.02***	0.02***
	(0.00)	(0.00)	(0.00)
Green	0.61***	0.25***	0.39***
	(0.00)	(0.00)	(0.00)
Dummy for Hour of the Day	yes	yes	yes
Interaction of Introduction of Green Taxis and Hour of the Day			
Green Launch (GL) × 1:00 a.m	−0.01	−0.00	0.00
	(0.74)	(0.90)	(0.98)
Green Launch (GL) × 2:00 a.m	−0.01	0.01	−0.01
	(0.59)	(0.73)	(0.71)
Green Launch (GL) × 3:00 a.m	0.00	0.01	0.00
	(0.91)	(0.47)	(0.83)
Green Launch (GL) × 4:00 a.m	0.02	0.01	0.01
	(0.43)	(0.53)	(0.49)
Green Launch (GL) × 5:00 a.m	−0.03	−0.01	−0.02
	(0.42)	(0.63)	(0.45)
Green Launch (GL) × 6:00 a.m	−0.02	0.01	−0.00
	(0.45)	(0.63)	(0.80)
Green Launch (GL) × 7:00 a.m	0.00	0.03	0.01
	(0.94)	(0.07)	(0.42)
Green Launch (GL) × 8:00 a.m	0.02	0.05***	0.03**
	(0.18)	(0.00)	(0.01)
Green Launch (GL) × 9:00 a.m	0.03	0.02	0.02
	(0.11)	(0.34)	(0.17)
Green Launch (GL) × 10:00 a.m	0.04	−0.00	0.02
	(0.09)	(0.83)	(0.31)
Green Launch (GL) × 11:00 a.m	0.05	−0.01	0.03
	(0.08)	(0.80)	(0.17)
Green Launch (GL) × 12:00 p.m	0.05	−0.00	0.03
	(0.07)	(0.97)	(0.16)
Green Launch (GL) × 1:00 p.m	0.10***	0.04*	0.07***

Table 13 (continued)

Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
	(0.00)	(0.02)	(0.00)
Green Launch (GL) × 2:00 p.m	0.08**	0.02	0.05**
	(0.00)	(0.28)	(0.01)
Green Launch (GL) × 3:00 p.m	0.12***	0.06**	0.08***
	(0.00)	(0.00)	(0.00)
Green Launch (GL) × 4:00 p.m	0.11***	0.07***	0.07***
	(0.00)	(0.00)	(0.00)
Green Launch (GL) × 5:00 p.m	0.01	− 0.00	0.01
	(0.57)	(1.00)	(0.58)
Green Launch (GL) × 6:00 p.m	0.06**	0.05**	0.04**
	(0.01)	(0.01)	(0.00)
Green Launch (GL) × 7:00 p.m	0.04	0.03*	0.03*
	(0.05)	(0.04)	(0.04)
Green Launch (GL) × 8:00 p.m	0.05*	0.04*	0.03
	(0.02)	(0.02)	(0.05)
Green Launch (GL) × 9:00 p.m	0.03	0.02	0.02
	(0.12)	(0.21)	(0.11)
Green Launch (GL) × 10:00 p.m	0.03	0.01	0.02
	(0.13)	(0.66)	(0.20)
Green Launch (GL) × 11:00 p.m	0.01	− 0.00	0.00
	(0.72)	(0.73)	(0.79)
Control for Toll			
Toll	1.07***	0.69***	0.73***
	(0.00)	(0.00)	(0.00)
Control for Demand (base: Normal − Hour)			
Rush Hour	− 0.08***	0.04***	− 0.03***
	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)			
Credit Card	0.28***	0.22***	0.20***
	(0.00)	(0.00)	(0.00)
Unknown	0.15***	0.20***	0.13***
	(0.00)	(0.00)	(0.00)
Control for No. of Passengers (base: One)			
Two	0.01*	− 0.01	− 0.01
	(0.01)	(0.08)	(0.21)
Three	− 0.01	− 0.02**	− 0.02**
	(0.30)	(0.00)	(0.00)
Four	0.01	− 0.01	− 0.01
	(0.62)	(0.13)	(0.13)
Five	0.03***	0.01	0.00
	(0.00)	(0.11)	(0.29)
Six	− 0.00	− 0.02***	− 0.02***

Table 13 (continued)

Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
	(0.65)	(0.00)	(0.00)
Control for Weather Condition			
Rain	-0.02^{***}	0.01^{**}	-0.01^{**}
	(0.00)	(0.01)	(0.00)
Snow	-0.01^{***}	0.00	-0.01^{***}
	(0.00)	(0.32)	(0.00)
Max. Temp	0.00	0.00^{**}	0.00
	(0.91)	(0.00)	(0.22)
Min. Temp	0.00^{***}	0.00	0.00^{**}
	(0.00)	(0.14)	(0.01)
Control for Economic Performance			
MFIN Stock Price	−0.00	0.00	−0.00
	(0.15)	(0.39)	(0.55)
Constant			
Constant	-0.30^{**}	1.41^{***}	1.55^{***}
	(0.00)	(0.00)	(0.00)
Number of Trips	295,112	295,112	295,112
R − squared	0.17	0.17	0.18
Adjusted R − squared	0.17	0.17	0.18

p-values are in parentheses. * $p<0.05$, ** $p<0.01$, *** $p<0.001$. Dist. represents distance. The trip distance, Duration, and fare are in miles, minutes, and dollars, respectively. Robust standard errors were used for estimations

Appendix D

We use the following equation to investigate the changes in the trip distance of yellow taxis during the months following the launch of green taxis:

$$\begin{aligned}\ln\left(\text{Trip Distance}_{\text{jmdk}}\right) = {} & \beta_0 + \left[\sum_{\text{k}}\left(\theta_{\text{k}} \times \text{Month}_{\text{k}}\right)\right] \\ & + \left[\alpha \times \text{T}_{\text{m}} + \lambda \times \text{T}_{\text{m}}^2\right] \\ & + \beta_1 \times \text{No. of Yellow Pickups}_{\text{m}} \\ & + \beta_2 \times \text{Toll}_{\text{j}} + \left[\beta_3 \times \text{Overnight}_{\text{j}} + \beta_4 \times \text{Rush Hour}_{\text{j}}\right] \\ & + \left[\beta_5 \times \text{Credit Card}_{\text{j}} + \beta_6 \times \text{Unknown}_{\text{j}}\right] \\ & + [\beta_7 \times \text{Two Passengers}_{\text{j}} + \beta_8 \times \text{Three Passengers}_{\text{j}} + \beta_9 \times \text{Four Passengers}_{\text{j}} \\ & + \beta_{10} \times \text{Five Passengers}_{\text{j}} + \beta_{11} \times \text{Six Passengers}_{\text{j}}] \\ & + \left[\beta_{12} \times \text{Rain}_{\text{d}} + \beta_{13} \times \text{Snow}_{\text{d}} + \beta_{14} \times \text{Max Temp}_{\text{d}} + \beta_{15} \times \text{Min Temp}_{\text{d}}\right] \\ & + \beta_{16} \times \text{MFIN}_{d} + \varepsilon_{jmd\text{k}},\end{aligned} \tag{D.1}$$

where Month_{k} ($\text{k} \in \{\text{September 2013}, \ldots, \text{February 2014}\}$) is a dummy variable equal to one if $\text{Month}_{\text{k}} = \text{k}$ and zero otherwise. August 2013 is the base level; therefore, θ_{k} represents additional changes (to the baseline) in the trip distance during month k following the month that green taxis were launched. We used both natural log-transformed trip time and trip fare as separate dependent variables, and ran a regression on the same independent variables as in Eq. D.1 and presents all results in Table 14.

Table 14 Effect of the Green Taxi Launch on Distance, Duration, and Fare of Yellow Taxi Trips Subject to the Standard-Rate Fare During the Months After the Launch of Green Taxis

Competitive Route	*CR EN*	*CR EN*	*CR EN*	*CR NN*	*CR NN*	*CR NN*
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
Monthly controls for Green Taxis Launch (base: August 2013)						
September 2013	-0.08^{***}	-0.01	-0.04^{***}	-0.24^{***}	-0.08^{***}	-0.14^{***}
	(0.00)	(0.23)	(0.00)	(0.00)	(0.00)	(0.00)
October 2013	-0.15^{***}	-0.03	-0.09^{***}	-0.46^{***}	-0.17^{***}	-0.27^{***}
	(0.00)	(0.05)	(0.00)	(0.00)	(0.00)	(0.00)
November 2013	-0.20^{***}	-0.06^{**}	-0.12^{***}	-0.61^{***}	-0.25^{***}	-0.37^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
December 2013	-0.23^{***}	-0.03	-0.13^{***}	-0.66^{***}	-0.24^{***}	-0.39^{***}
	(0.00)	(0.33)	(0.00)	(0.00)	(0.00)	(0.00)
January 2014	-0.31^{***}	-0.02	-0.18^{***}	-0.85^{***}	-0.31^{***}	-0.50^{***}
	(0.00)	(0.47)	(0.00)	(0.00)	(0.00)	(0.00)
February 2014	-0.39^{***}	0.02	-0.20^{***}	-1.16^{***}	-0.43^{***}	-0.68^{***}
	(0.00)	(0.60)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Time Trend						
T	-0.00	0.03^{***}	0.00	-0.04^{***}	-0.02^{*}	-0.02^{***}
	(0.36)	(0.00)	(0.09)	(0.00)	(0.01)	(0.00)
T^2	0.00^{***}	-0.00^{**}	0.00^{**}	0.01^{***}	0.00^{***}	0.01^{***}
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Monthly Number of Taxi Pickups						
Yellow	0.01^{***}	0.00	0.01^{***}	0.05^{***}	0.02^{***}	0.03^{***}
	(0.00)	(0.45)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Toll						
Toll	1.22^{***}	0.79^{***}	0.92^{***}	1.16^{***}	0.75^{***}	0.80^{***}

Table 14 (continued)

Competitive Route	*CR EN*	*CR EN*	*CR EN*	*CR NN*	*CR NN*	*CR NN*
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Demand (base: Normal − Hour)						
Overnight	0.25^{***}	0.10^{***}	0.14^{***}	-0.06^{***}	-0.16^{***}	-0.09^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rush Hour	-0.10^{***}	0.06^{***}	-0.06^{***}	0.28^{***}	0.27^{***}	0.21^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)						
Credit Card	0.09^{***}	0.09^{***}	0.07^{***}	0.29^{***}	0.23^{***}	0.21^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Unknown	0.00	0.01	0.00	0.14^{***}	0.19^{***}	0.12^{***}
	(0.90)	(0.26)	(0.71)	(0.00)	(0.00)	(0.00)
Control for No. of Passengers	yes	yes	yes	yes	yes	yes
Control for Weather Condition						
Rain	-0.01^{**}	0.03^{***}	0.00	-0.03^{***}	0.00	-0.02^{***}
	(0.01)	(0.00)	(0.17)	(0.00)	(0.69)	(0.00)
Snow	-0.01^{***}	-0.00^{***}	-0.00^{***}	-0.01^{***}	0.00	-0.00^{**}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.21)	(0.01)
Max. Temp	-0.00^{**}	0.00^{***}	−0.00	0.00	0.00^{**}	0.00
	(0.00)	(0.00)	(0.25)	(0.45)	(0.01)	(0.11)
Min. Temp	0.00^{***}	-0.00^{***}	0.00	0.00^{***}	0.00^{*}	0.00^{**}
	(0.00)	(0.00)	(0.36)	(0.00)	(0.04)	(0.00)
Control for Economic Performance						
MFIN Stock Price	0.00^{*}	0.01^{***}	0.00^{***}	−0.00	0.01^{**}	0.00
	(0.05)	(0.00)	(0.00)	(0.85)	(0.01)	(0.34)

Table 14 (continued)

Competitive Route	*CR EN*	*CR EN*	*CR EN*	*CR NN*	*CR NN*	*CR NN*
Dependent Variable	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)	ln (Trip Dist.)	ln (Trip Duration)	ln (Trip Fare)
Constant						
Constant	0.71^{***}	2.08^{***}	2.24^{***}	-0.33^{***}	1.51^{***}	1.59^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of Trips	753,917	753,917	753,917	295,112	295,112	295,112
R − squared	0.450	0.298	0.462	0.113	0.114	0.120
Adjusted R − squared	0.450	0.298	0.462	0.113	0.114	0.120

p-values are in parentheses. * $p<0.05$, ** $p<0.01$, *** $p<0.001$. Dist. represents distance. The trip distance, Duration, and fare are in miles, minutes, and dollars, respectively. Robust standard errors were used for estimations

Appendix E

Figure 6 illustrates stock prices for Medallion Financial Corp (NASDAQ: MFIN), a publicly-traded company with leading positions in a number of markets, including the taxi medallion market. As Fig. 6 illustrates, MFIN stock prices are relatively higher during the period of our study (see solid vertical lines), providing evidence that the taxi market in NYC remains healthy during that period.

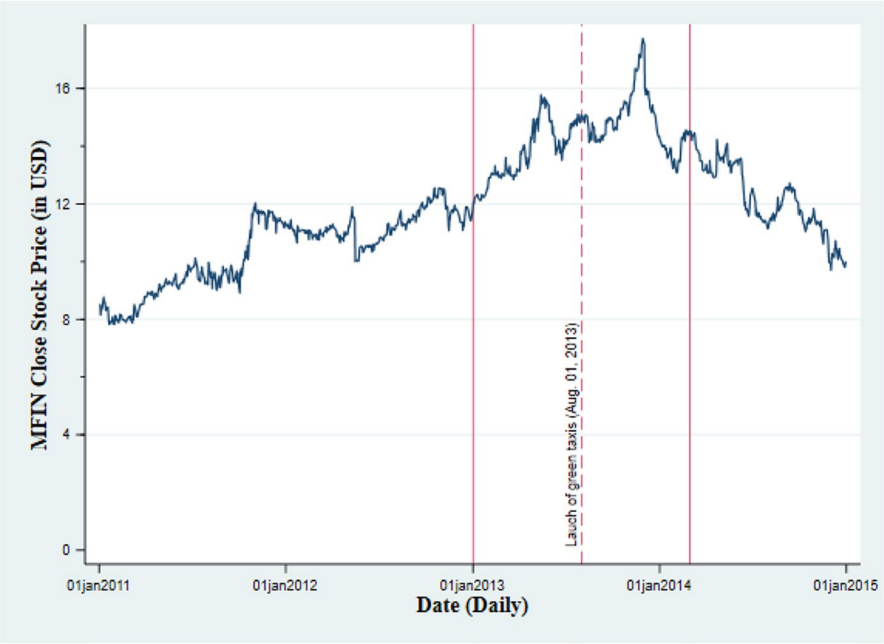

Fig. 6 Stock Prices for Medallion Financial Corp (NASDAQ: MFIN). Notes: Solid vertical lines represent the beginning and end dates of trips in our dataset. Dashed vertical line represents the date of the launch of green taxis

Appendix F

The Uber trip data we used was provided by the opinion poll analysis website FiveThirtyEight (information they had received in response to a Freedom of Information Law request made to the NYC TLC). The data covers the period from April – September 2014[16] and shows the distribution of pickups across the five NYC boroughs. Our results show that of all pickups by Uber, 78.08% were in Manhattan, followed by Brooklyn (13.41%), Queens (7.76%), the Bronx (0.72%), and Staten Island (0.02%). Similarly, most of the trips made by yellow taxis in 2012 ended in Manhattan (86.77%), followed by Brooklyn (4.92%), Queens (4.89%), the Bronx (0.52%), and Staten Island (0.02%).

[16] For more information and the data, visit: https://github.com/fivethirtyeight/uber-tlc-foil-response.

Appendix G

Table 15 Table of Results for Specification Curves: Yellow Taxi Trips (Subject to Standard-Rate Fare)

Competitive Route: *CR EE*							
Dependent Variable: ln (Trip Dist.)							
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Introduction of Green Taxis to NYC							
Green Launch (GL)	0.02^{***}	0.02^{***}	0.02^{***}	0.02^{***}	0.02^{***}	0.02^{***}	0.02^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Time Trend							
GLT	-0.02^{***}	-0.03^{***}	-0.03^{***}	-0.03^{***}	-0.03^{***}	-0.01^{***}	-0.01^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
T	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
T^2	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{***}	-0.00^{***}	-0.00^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Monthly Number of Taxi Pickups							
Yellow	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Green		0.02^{**}	0.01^{*}	0.02^{**}	0.02^{**}	0.04^{***}	0.04^{***}
		(0.01)	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Toll							
Toll			–	–	–	–	–
Control for Demand (base: Normal – Hour)							
Overnight			0.12^{***}	0.12^{***}	0.12^{***}	0.12^{***}	0.12^{***}
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rush Hour			-0.02^{***}	-0.02^{***}	-0.02^{***}	-0.02^{***}	-0.02^{***}
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)							

Table 15 (continued)

Credit Card	0.12***	0.12***	0.12***	0.12***
	(0.00)	(0.00)	(0.00)	(0.00)
Unknown	0.16***	0.16***	0.16***	0.16***
	(0.00)	(0.00)	(0.00)	(0.00)
Control for No. of Passengers (base: One)				
Two		0.02***	0.02***	0.02***
		(0.00)	(0.00)	(0.00)
Three		0.03***	0.03***	0.03***
		(0.00)	(0.00)	(0.00)
Four		0.03***	0.03***	0.03***
		(0.00)	(0.00)	(0.00)
Five		0.03***	0.02***	0.02***
		(0.00)	(0.00)	(0.00)
Six		0.03***	0.03***	0.03***
		(0.00)	(0.00)	(0.00)
Control for Weather Condition				
Rain			−0.01***	−0.01***
			(0.00)	(0.00)
Snow			−0.00***	−0.00***
			(0.00)	(0.00)
Max. Temp			0.00***	0.00***
			(0.00)	(0.00)
Min. Temp			0.00***	0.00***
			(0.00)	(0.00)
Control for Economic Performance				
MFIN Stock Price				0.00**
				(0.01)

Table 15 (continued)

Constant								
Constant	0.13***	0.12***	0.09***	0.04***	0.03***	0.04***	0.03***	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
Number of Trips	15,519,167	15,519,167	15,519,167	15,519,167	15,519,167	15,519,167	15,519,167	
R − squared	0.001	0.001	0.010	0.020	0.020	0.020	0.020	
Adjusted R − squared	0.001	0.001	0.010	0.019	0.020	0.020	0.020	
Competitive Route: *CR EN*								
Dependent Variable: ln (Trip Dist.)								
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Introduction of Green Taxis to NYC								
Green Launch (GL)	−0.00	0.03*	0.04***	0.03**	0.03**	0.03**	0.04***	0.05***
	(0.68)	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Time Trend								
GLT	−0.03***	−0.05***	−0.06***	−0.05***	−0.05***	−0.05***	−0.05***	−0.06***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
T	0.04***	0.04***	0.02***	0.01***	0.01***	0.01***	0.02***	0.01*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
T^2	−0.00*	−0.00*	0.00	0.00	0.00	0.00	0.00	0.00*
	(0.02)	(0.03)	(0.17)	(0.31)	(0.32)	(0.33)	(0.62)	(0.04)
Monthly Number of Taxi Pickups								
Yellow	0.01**	0.01***	0.01*	0.01*	0.01*	0.01*	0.01*	0.01**
	(0.01)	(0.00)	(0.02)	(0.04)	(0.04)	(0.04)	(0.03)	(0.00)
Green		0.10**	0.13***	0.09**	0.09**	0.09**	0.12***	0.13***
		(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Table 15 (continued)

Control for Toll						
Toll	1.15***	1.23***	1.22***	1.22***	1.22***	1.22***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Demand (base: Normal − Hour)						
Overnight		0.25***	0.25***	0.25***	0.25***	0.25***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rush Hour		−0.10***	−0.10***	−0.10***	−0.10***	−0.10***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)						
Credit Card			0.09***	0.09***	0.09***	0.09***
			(0.00)	(0.00)	(0.00)	(0.00)
Unknown			0.00	0.00	0.00	0.00
			(0.91)	(0.91)	(0.90)	(0.90)
Control for No. of Passengers (base: One)						
Two				0.01***	0.01***	0.01***
				(0.00)	(0.00)	(0.00)
Three				0.01	0.01	0.01
				(0.07)	(0.07)	(0.07)
Four				0.00	0.00	0.00
				(0.42)	(0.44)	(0.44)
Five				0.03***	0.03***	0.03***
				(0.00)	(0.00)	(0.00)
Six				0.01***	0.01***	0.01***
				(0.00)	(0.00)	(0.00)
Control for Weather Condition						
Rain					−0.01**	−0.01**
					(0.01)	(0.00)
Snow					−0.01***	−0.01***

Table 15 (continued)

							(0.00)	(0.00)
Max. Temp							-0.00^{***}	-0.00^{***}
							(0.00)	(0.00)
Min. Temp							0.00^{***}	0.00^{***}
							(0.00)	(0.00)
Control for Economic Performance								
MFIN Stock Price								0.00^{***}
								(0.00)
Constant								
Constant	1.32^{***}	1.24^{***}	0.99^{***}	0.91^{***}	0.86^{***}	0.86^{***}	0.85^{***}	0.78^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of Trips	753,917	753,917	753,917	753,917	753,917	753,917	753,917	753,917
R − squared	0.004	0.004	0.429	0.448	0.450	0.450	0.450	0.450
Adjusted R − squared	0.004	0.004	0.429	0.448	0.450	0.450	0.450	0.450
Competitive Route: *CR NE*								
Dependent Variable: ln (Trip Dist.)								
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Introduction of Green Taxis to NYC								
Green Launch (GL)	0.00	0.03^{*}	0.04^{***}	0.04^{***}	0.04^{***}	0.04^{***}	0.04^{***}	0.05^{***}
	(0.98)	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Time Trend								
GLT	-0.01^{*}	-0.03^{**}	-0.05^{***}	-0.04^{***}	-0.05^{***}	-0.05^{***}	-0.05^{***}	-0.05^{***}
	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
T	0.01^{***}	0.01^{***}	0.00	0.00	0.01^{*}	0.01^{*}	0.01^{*}	−0.00
	(0.00)	(0.00)	(0.40)	(0.07)	(0.03)	(0.03)	(0.01)	(0.98)

Table 15 (continued)

T^2	−0.00	−0.00	0.00**	0.00	0.00	0.00	0.00	0.00**
	(0.33)	(0.38)	(0.01)	(0.07)	(0.12)	(0.11)	(0.26)	(0.01)
Monthly Number of Taxi Pickups								
Yellow	−0.00*	−0.00	0.00	0.00	0.00*	0.00*	0.00	0.01*
	(0.04)	(0.79)	(0.07)	(0.07)	(0.04)	(0.04)	(0.06)	(0.01)
Green		0.08*	0.08**	0.09***	0.10***	0.10***	0.12***	0.13***
		(0.02)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Toll								
Toll			1.20***	1.21***	1.19***	1.19***	1.19***	1.19***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Demand (base: Normal − Hour)								
Overnight				0.08***	0.08***	0.08***	0.08***	0.08***
				(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rush Hour				−0.11***	−0.11***	−0.11***	−0.11***	−0.11***
				(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)								
Credit Card					0.13***	0.13***	0.13***	0.13***
					(0.00)	(0.00)	(0.00)	(0.00)
Unknown					0.07***	0.07***	0.07***	0.07***
					(0.00)	(0.00)	(0.00)	(0.00)
Control for No. of Passengers (base: One)								
Two						0.01***	0.01***	0.01***
						(0.00)	(0.00)	(0.00)
Three						0.02***	0.02***	0.02***
						(0.00)	(0.00)	(0.00)
Four						0.02***	0.02***	0.02***
						(0.00)	(0.00)	(0.00)

Table 15 (continued)

Five						0.03***	0.03***	0.03***
						(0.00)	(0.00)	(0.00)
Six						0.02***	0.02***	0.02***
						(0.00)	(0.00)	(0.00)
Control for Weather Condition								
Rain							−0.01***	−0.01***
							(0.00)	(0.00)
Snow							−0.00***	−0.00***
							(0.00)	(0.00)
Max. Temp							−0.00	−0.00
							(0.19)	(0.24)
Min. Temp							0.00	0.00
							(0.10)	(0.11)
Control for Economic Performance								
MFIN Stock Price								0.00***
								(0.00)
Constant								
Constant	1.84***	1.78***	1.00***	0.99***	0.92***	0.91***	0.91***	0.85***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of Trips	773,402	773,402	773,402	773,402	773,402	773,402	773,402	773,402
R − squared	0.001	0.001	0.495	0.500	0.505	0.505	0.505	0.505
Adjusted R − squared	0.001	0.001	0.495	0.500	0.505	0.505	0.505	0.505
Competitive Route: *CR NN*								
Dependent Variable: ln (Trip Dist.)								
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Table 15 (continued)

Introduction of Green Taxis to NYC								
Green Launch (GL)	0.02	0.21^{***}	0.18^{***}	0.17^{***}	0.19^{***}	0.19^{***}	0.18^{***}	0.17^{***}
	(0.09)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Time Trend								
GLT	-0.15^{***}	-0.27^{***}	-0.25^{***}	-0.24^{***}	-0.26^{***}	-0.26^{***}	-0.21^{***}	-0.20^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
T	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.01
	(0.14)	(0.15)	(0.75)	(0.60)	(0.69)	(0.67)	(0.42)	(0.12)
T^2	0.01^{***}	0.01^{***}	0.01^{***}	0.01^{***}	0.01^{***}	0.01^{***}	0.00^{***}	0.00^{**}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Monthly Number of Taxi Pickups								
Yellow	0.02^{***}	0.05^{***}	0.04^{***}	0.04^{***}	0.04^{***}	0.04^{***}	0.04^{***}	0.04^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Green		0.63^{***}	0.49^{***}	0.48^{***}	0.52^{***}	0.52^{***}	0.60^{***}	0.58^{***}
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Toll								
Toll			1.25^{***}	1.23^{***}	1.16^{***}	1.16^{***}	1.16^{***}	1.16^{***}
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Demand (base: Normal – Hour)								
Overnight				-0.05^{***}	-0.06^{***}	-0.06^{***}	-0.06^{***}	-0.06^{***}
				(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rush Hour				0.29^{***}	0.28^{***}	0.28^{***}	0.28^{***}	0.28^{***}
				(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)								
Credit Card					0.29^{***}	0.29^{***}	0.29^{***}	0.29^{***}
					(0.00)	(0.00)	(0.00)	(0.00)

Table 15 (continued)

Unknown	0.15***	0.15***	0.14***	0.14***
	(0.00)	(0.00)	(0.00)	(0.00)
Control for No. of Passengers (base: One)				
Two		0.02***	0.02***	0.02***
		(0.00)	(0.00)	(0.00)
Three		−0.00	0.00	0.00
		(1.00)	(0.99)	(0.99)
Four		0.02	0.02	0.02
		(0.23)	(0.24)	(0.24)
Five		0.03***	0.03***	0.03***
		(0.00)	(0.00)	(0.00)
Six		−0.01	−0.01	−0.01
		(0.42)	(0.41)	(0.41)
Control for Weather Condition				
Rain			−0.03***	−0.03***
			(0.00)	(0.00)
Snow			−0.01***	−0.01***
			(0.00)	(0.00)
Max. Temp			−0.00	−0.00
			(0.84)	(0.81)
Min. Temp			0.00***	0.00***
			(0.00)	(0.00)
Control for Economic Performance				
MFIN Stock Price				−0.01
				(0.09)
Constant				

Table 15 (continued)

Constant	0.48***	0.02	0.05	0.03	−0.13	−0.13	−0.12	−0.04
	(0.00)	(0.82)	(0.52)	(0.67)	(0.12)	(0.10)	(0.15)	(0.67)
Number of Trips	295,112	295,112	295,112	295,112	295,112	295,112	295,112	295,112
R − squared	0.005	0.005	0.086	0.096	0.112	0.112	0.113	0.113
Adjusted R − squared	0.005	0.005	0.086	0.096	0.112	0.112	0.113	0.113
Competitive Route: *CR EE*								
Dependent Variable: ln (Trip Duration)								
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Introduction of Green Taxis to NYC								
Green Launch (GL)	−0.03***	−0.07***	−0.07***	−0.07***	−0.07***	−0.07***	−0.04***	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
Control for Time Trend								
GLT	0.03***	0.05***	0.05***	0.05***	0.05***	0.06***	0.04***	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
T	0.04***	0.04***	0.04***	0.04***	0.04***	0.04***	0.03***	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
T^2	−0.00***	−0.00***	−0.00***	−0.00***	−0.00***	−0.00***	−0.00***	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
Monthly Number of Taxi Pickups								
Yellow	0.00***	−0.00***	−0.00***	−0.00***	−0.00***	−0.00***	−0.00*	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.04)	
Green		−0.14***	−0.13***	−0.13***	−0.13***	−0.12***	−0.08***	
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
Control for Toll								
Toll			–	–	–	–	–	

Table 15 (continued)

Control for Demand (base: Normal – Hour)					
Overnight	-0.12^{***}	-0.13^{***}	-0.13^{***}	-0.13^{***}	-0.13^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rush Hour	-0.02^{***}	-0.02^{***}	-0.02^{***}	-0.02^{***}	-0.02^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)					
Credit Card		0.10^{***}	0.10^{***}	0.10^{***}	0.10^{***}
		(0.00)	(0.00)	(0.00)	(0.00)
Unknown		0.12^{***}	0.12^{***}	0.12^{***}	0.12^{***}
		(0.00)	(0.00)	(0.00)	(0.00)
Control for No. of Passengers (base: One)					
Two			0.00^{***}	0.00^{***}	0.00^{***}
			(0.00)	(0.00)	(0.00)
Three			0.01^{***}	0.01^{***}	0.01^{***}
			(0.00)	(0.00)	(0.00)
Four			0.01^{***}	0.01^{***}	0.01^{***}
			(0.00)	(0.00)	(0.00)
Five			0.00	0.00	0.00
			(0.15)	(0.14)	(0.13)
Six			-0.00^{***}	-0.00^{***}	-0.00^{***}
			(0.00)	(0.00)	(0.00)
Control for Weather Condition					
Rain				0.02^{***}	0.02^{***}
				(0.00)	(0.00)
Snow				0.00^{***}	0.00^{***}
				(0.00)	(0.00)

Table 15 (continued)

Max. Temp						0.00***	0.00***	
						(0.00)	(0.00)	
Min. Temp						0.00***	0.00***	
						(0.00)	(0.00)	
Control for Economic Performance								
MFIN Stock Price							0.01***	
							(0.00)	
Constant								
Constant	1.86***	1.95***	1.98***	1.93***	1.93***	1.92***	1.77***	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
Number of Trips	15,519,167	15,519,167	15,519,167	15,519,167	15,519,167	15,519,167	15,519,167	
R − squared	0.002	0.002	0.009	0.016	0.016	0.016	0.016	
Adjusted R − squared	0.002	0.002	0.009	0.016	0.016	0.016	0.016	
Competitive Route: *CR EN*								
Dependent Variable: ln (Trip Duration)								
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Introduction of Green Taxis to NYC								
Green Launch (GL)	−0.04***	0.03**	0.04***	0.03***	0.03***	0.04***	0.04***	0.05***
	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Time Trend								
GLT	−0.01*	−0.06***	−0.06***	−0.06***	−0.06***	−0.06***	−0.06***	−0.07***
	(0.04)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
T	0.04***	0.04***	0.02***	0.02***	0.02***	0.02***	0.02***	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
T^2	−0.00***	−0.00**	−0.00	−0.00	−0.00	−0.00	0.00	0.00

Table 15 (continued)

	(0.00)	(0.00)	(0.60)	(0.42)	(0.41)	(0.40)	(0.75)	(0.06)
Monthly Number of Taxi Pickups								
Yellow	0.00	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***
	(0.43)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Green		0.22***	0.24***	0.22***	0.23***	0.23***	0.21***	0.23***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Toll								
Toll			0.77***	0.81***	0.79***	0.79***	0.79***	0.79***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Demand (base: Normal – Hour)								
Overnight				0.10***	0.10***	0.10***	0.10***	0.10***
				(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rush Hour				0.06***	0.06***	0.06***	0.06***	0.06***
				(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)								
Credit Card					0.09***	0.09***	0.09***	0.09***
					(0.00)	(0.00)	(0.00)	(0.00)
Unknown					0.01	0.01	0.01	0.01
					(0.25)	(0.26)	(0.27)	(0.27)
Control for No. of Passengers (base: One)								
Two						−0.00	−0.00	−0.00
						(0.12)	(0.12)	(0.12)
Three						−0.01*	−0.01*	−0.01*
						(0.02)	(0.02)	(0.02)
Four						−0.01**	−0.01**	−0.01**
						(0.00)	(0.00)	(0.00)
Five						0.01**	0.01**	0.01**

Table 15 (continued)

						(0.01)	(0.01)	(0.01)
Six						−0.01***	−0.01***	−0.01***
						(0.00)	(0.00)	(0.00)
Control for Weather Condition								
Rain							0.03***	0.03***
							(0.00)	(0.00)
Snow							−0.00***	−0.00***
							(0.00)	(0.00)
Max. Temp							0.00***	0.00***
							(0.00)	(0.00)
Min. Temp							−0.00***	−0.00***
							(0.00)	(0.00)
Control for Economic Performance								
MFIN Stock Price								0.00***
								(0.00)
Constant								
Constant	2.56***	2.38***	2.21***	2.17***	2.13***	2.13***	2.12***	2.05***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of Trips	753,917	753,917	753,917	753,917	753,917	753,917	753,917	753,917
R − squared	0.003	0.003	0.291	0.294	0.298	0.298	0.298	0.298
Adjusted R − squared	0.003	0.003	0.291	0.294	0.298	0.298	0.298	0.298
Competitive Route: *CR NE*								
Dependent Variable: ln (Trip Duration)								
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Table 15 (continued)

Introduction of Green Taxis to NYC								
Green Launch (GL)	-0.09^{***}	-0.12^{***}	-0.11^{***}	-0.10^{***}	-0.10^{***}	-0.10^{***}	-0.09^{***}	-0.06^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Time Trend								
GLT	0.08^{***}	0.10^{***}	0.09^{***}	0.08^{***}	0.07^{***}	0.07^{***}	0.07^{***}	0.04^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
T	0.09^{***}	0.09^{***}	0.08^{***}	0.08^{***}	0.08^{***}	0.08^{***}	0.07^{***}	0.05^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
T^2	-0.01^{***}	-0.01^{***}	-0.01^{***}	-0.01^{***}	-0.01^{***}	-0.01^{***}	-0.01^{***}	-0.00^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Monthly Number of Taxi Pickups								
Yellow	-0.01^{**}	-0.01^{***}	-0.01^{***}	-0.01^{**}	-0.01^{**}	-0.01^{**}	-0.00^{*}	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.67)
Green		-0.10^{***}	-0.11^{***}	-0.06^{**}	-0.05^{*}	-0.05^{*}	-0.06^{**}	-0.00
		(0.00)	(0.00)	(0.00)	(0.02)	(0.02)	(0.01)	(0.90)
Control for Toll								
Toll			0.81^{***}	0.81^{***}	0.80^{***}	0.80^{***}	0.80^{***}	0.80^{***}
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Demand (base: Normal – Hour)								
Overnight				-0.27^{***}	-0.27^{***}	-0.27^{***}	-0.27^{***}	-0.27^{***}
				(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rush Hour				-0.10^{***}	-0.10^{***}	-0.10^{***}	-0.11^{***}	-0.11^{***}
				(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)								
Credit Card					0.10^{***}	0.10^{***}	0.10^{***}	0.10^{***}
					(0.00)	(0.00)	(0.00)	(0.00)
Unknown					0.06^{***}	0.06^{***}	0.06^{***}	0.06^{***}

Table 15 (continued)

					(0.00)	(0.00)	(0.00)	(0.00)
Control for No. of Passengers (base: One)								
Two						−0.00	−0.00	−0.00
						(0.19)	(0.20)	(0.19)
Three						−0.00	−0.00	−0.00
						(0.49)	(0.50)	(0.50)
Four						−0.00	−0.00	−0.00
						(0.58)	(0.59)	(0.60)
Five						−0.00	−0.00	−0.00
						(0.93)	(0.92)	(0.95)
Six						−0.01*	−0.01*	−0.01*
						(0.01)	(0.01)	(0.01)
Control for Weather Condition								
Rain							0.03***	0.03***
							(0.00)	(0.00)
Snow							−0.01***	−0.00***
							(0.00)	(0.00)
Max. Temp							0.00*	0.00**
							(0.01)	(0.00)
Min. Temp							−0.00**	−0.00**
							(0.00)	(0.00)
Control for Economic Performance								
MFIN Stock Price								0.01***
								(0.00)
Constant								
Constant	2.86***	2.93***	2.40***	2.45***	2.39***	2.39***	2.38***	2.16***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Table 15 (continued)

Number of Trips	773,402	773,402	773,402	773,402	773,402	773,402	773,402	773,402
R – squared	0.005	0.005	0.348	0.373	0.378	0.378	0.378	0.378
Adjusted R – squared	0.005	0.005	0.348	0.373	0.378	0.378	0.378	0.378
Competitive Route: *CR NN*								
Dependent Variable: ln (Trip Duration)								
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Introduction of Green Taxis to NYC								
Green Launch (GL)	-0.02^{*}	0.06^{**}	0.03	0.04	0.05^{*}	0.05^{*}	0.04^{*}	0.04^{*}
	(0.04)	(0.01)	(0.11)	(0.06)	(0.01)	(0.01)	(0.04)	(0.04)
Control for Time Trend								
GLT	-0.07^{***}	-0.12^{***}	-0.11^{***}	-0.11^{***}	-0.12^{***}	-0.12^{***}	-0.08^{***}	-0.08^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
T	0.01^{*}	0.01^{*}	0.01	0.01	0.01	0.01	0.01	0.01
	(0.03)	(0.03)	(0.25)	(0.17)	(0.21)	(0.19)	(0.23)	(0.44)
T^2	0.00^{**}	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{***}	0.00	0.00^{*}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.05)	(0.05)
Monthly Number of Taxi Pickups								
Yellow	0.01^{*}	0.02^{***}	0.02^{***}	0.02^{***}	0.02^{***}	0.02^{***}	0.02^{***}	0.02^{***}
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Green		0.24^{***}	0.15^{**}	0.17^{**}	0.20^{***}	0.20^{***}	0.23^{***}	0.23^{***}
		(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Toll								
Toll			0.83^{***}	0.80^{***}	0.75^{***}	0.75^{***}	0.75^{***}	0.75^{***}
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Demand (base: Normal – Hour)								

Table 15 (continued)

Overnight	−0.16***	−0.16***	−0.16***	−0.16***	−0.16***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rush Hour	0.28***	0.27***	0.27***	0.27***	0.27***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)					
Credit Card		0.23***	0.23***	0.23***	0.23***
		(0.00)	(0.00)	(0.00)	(0.00)
Unknown		0.19***	0.19***	0.19***	0.19***
		(0.00)	(0.00)	(0.00)	(0.00)
Control for No. of Passengers (base: One)					
Two			−0.00	−0.00	−0.00
			(0.63)	(0.64)	(0.64)
Three			−0.01	−0.01	−0.01
			(0.07)	(0.08)	(0.08)
Four			−0.01	−0.01	−0.01
			(0.59)	(0.57)	(0.57)
Five			0.01	0.01	0.01
			(0.13)	(0.13)	(0.13)
Six			−0.03***	−0.03***	−0.03***
			(0.00)	(0.00)	(0.00)
Control for Weather Condition					
Rain				0.00	0.00
				(0.59)	(0.61)
Snow				0.00	0.00
				(0.52)	(0.50)
Max. Temp				0.00*	0.00*
				(0.01)	(0.01)

Table 15 (continued)

Min. Temp							0.00*	0.00*
							(0.05)	(0.05)
Control for Economic Performance								
MFIN Stock Price								0.00
								(0.64)
Constant								
Constant	1.97***	1.79***	1.82***	1.82***	1.70***	1.70***	1.69***	1.68***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of Trips	295,112	295,112	295,112	295,112	295,112	295,112	295,112	295,112
R − squared	0.003	0.003	0.067	0.096	0.113	0.113	0.114	0.114
Adjusted R − squared	0.003	0.003	0.067	0.096	0.113	0.113	0.114	0.114
Competitive Route: *CR EE*								
Dependent Variable: ln (Trip Fare)								
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Introduction of Green Taxis to NYC								
Green Launch (GL)	−0.01***	−0.03***	−0.03***	−0.03***	−0.03***	−0.03***	−0.02***	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
Control for Time Trend								
GLT	0.01***	0.02***	0.02***	0.02***	0.02***	0.03***	0.02***	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
T	0.02***	0.02***	0.02***	0.02***	0.02***	0.02***	0.02***	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
T^2	−0.00***	−0.00***	−0.00***	−0.00***	−0.00***	−0.00***	−0.00***	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
Monthly Number of Taxi Pickups								

Table 15 (continued)

Yellow	0.00***	−0.00**	−0.00*	−0.00*	−0.00*	−0.00***	0.00
	(0.00)	(0.00)	(0.03)	(0.02)	(0.02)	(0.00)	(0.11)
Green		−0.07***	−0.07***	−0.06***	−0.06***	−0.05***	−0.03***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Toll							
Toll			–	–	–	–	–
Control for Demand (base: Normal – Hour)							
Overnight			−0.02***	−0.03***	−0.03***	−0.03***	−0.03***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rush Hour			−0.02***	−0.02***	−0.02***	−0.02***	−0.02***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)							
Credit Card				0.08***	0.08***	0.08***	0.08***
				(0.00)	(0.00)	(0.00)	(0.00)
Unknown				0.10***	0.10***	0.10***	0.10***
				(0.00)	(0.00)	(0.00)	(0.00)
Control for No. of Passengers (base: One)							
Two					0.00***	0.00***	0.00***
					(0.00)	(0.00)	(0.00)
Three					0.00***	0.00***	0.00***
					(0.00)	(0.00)	(0.00)
Four					0.01***	0.01***	0.01***
					(0.00)	(0.00)	(0.00)
Five					0.00	0.00	0.00
					(0.68)	(0.68)	(0.65)
Six					−0.00**	−0.00**	−0.00**
					(0.00)	(0.00)	(0.00)

Table 15 (continued)

Control for Weather Condition								
Rain						0.01^{***}	0.00^{***}	
						(0.00)	(0.00)	
Snow						-0.00^{***}	-0.00^{***}	
						(0.00)	(0.00)	
Max. Temp						0.00^{***}	0.00^{***}	
						(0.00)	(0.00)	
Min. Temp						0.00^{***}	0.00^{***}	
						(0.00)	(0.00)	
Control for Economic Performance								
MFIN Stock Price							0.01^{***}	
							(0.00)	
Constant								
Constant	1.91^{***}	1.96^{***}	1.96^{***}	1.93^{***}	1.93^{***}	1.92^{***}	1.85^{***}	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
Number of Trips	15,519,167	15,519,167	15,519,167	15,519,167	15,519,167	15,519,167	15,519,167	
R − squared	0.002	0.002	0.003	0.012	0.012	0.013	0.013	
Adjusted R − squared	0.002	0.002	0.003	0.012	0.012	0.013	0.013	
Competitive Route: *CR EN*								
Dependent Variable: ln (Trip Fare)								
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Introduction of Green Taxis to NYC								
Green Launch (GL)	−0.01	0.02^{*}	0.03^{***}	0.03^{***}	0.03^{***}	0.03^{***}	0.03^{***}	0.04^{***}
	(0.09)	(0.04)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Time Trend								

Table 15 (continued)

GLT	−0.02***	−0.04***	−0.04***	−0.04***	−0.04***	−0.04***	−0.04***	−0.05***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
T	0.04***	0.04***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
T^2	−0.00**	−0.00**	0.00	0.00	0.00	0.00	0.00	0.00*
	(0.00)	(0.00)	(0.63)	(0.82)	(0.83)	(0.84)	(0.74)	(0.04)
Monthly Number of Taxi Pickups								
Yellow	0.01**	0.01***	0.01**	0.01**	0.01**	0.01**	0.01**	0.01***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)
Green		0.09**	0.11***	0.09***	0.09***	0.09***	0.10***	0.12***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Toll								
Toll			0.89***	0.93***	0.92***	0.92***	0.92***	0.92***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Demand (base: Normal − Hour)								
Overnight				0.13***	0.14***	0.14***	0.14***	0.14***
				(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rush Hour				−0.06***	−0.06***	−0.06***	−0.06***	−0.06***
				(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)								
Credit Card					0.07***	0.07***	0.07***	0.07***
					(0.00)	(0.00)	(0.00)	(0.00)
Unknown					0.00	0.00	0.00	0.00
					(0.72)	(0.73)	(0.72)	(0.73)
Control for No. of Passengers (base: One)								
Two						−0.00*	−0.00*	−0.00*
						(0.02)	(0.03)	(0.03)

Table 15 (continued)

Three						−0.01***	−0.01***	−0.01***
						(0.00)	(0.00)	(0.00)
Four						−0.01**	−0.01**	−0.01**
						(0.00)	(0.00)	(0.00)
Five						0.00	0.00	0.00
						(0.10)	(0.10)	(0.10)
Six						−0.01**	−0.01**	−0.01**
						(0.00)	(0.00)	(0.00)
Control for Weather Condition								
Rain							0.00	0.00
							(0.08)	(0.13)
Snow							−0.00***	−0.00***
							(0.00)	(0.00)
Max. Temp							−0.00	−0.00
							(0.15)	(0.18)
Min. Temp							0.00	0.00
							(0.19)	(0.18)
Control for Economic Performance								
MFIN Stock Price								0.00***
								(0.00)
Constant								
Constant	2.68***	2.61***	2.41***	2.37***	2.33***	2.33***	2.33***	2.27***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of Trips	753,917	753,917	753,917	753,917	753,917	753,917	753,917	753,917
R − squared	0.004	0.004	0.449	0.459	0.462	0.462	0.462	0.462
Adjusted R − squared	0.004	0.004	0.449	0.459	0.462	0.462	0.462	0.462

Table 15 (continued)

Competitive Route: *CR NE*

Dependent Variable: ln (Trip Fare)								
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Introduction of Green Taxis to NYC								
Green Launch (GL)	-0.03***	-0.03**	-0.02**	-0.01*	-0.01	-0.01	-0.01	0.00
	(0.00)	(0.00)	(0.00)	(0.02)	(0.05)	(0.05)	(0.11)	(0.45)
Control for Time Trend								
GLT	0.02***	0.02**	0.01*	0.01	0.01	0.01	0.00	-0.01**
	(0.00)	(0.00)	(0.04)	(0.11)	(0.22)	(0.22)	(0.73)	(0.01)
T	0.04***	0.04***	0.03***	0.03***	0.03***	0.03***	0.03***	0.02***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
T^2	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***	-0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Monthly Number of Taxi Pickups								
Yellow	-0.00*	-0.00	-0.00	-0.00	0.00	0.00	0.00	0.00*
	(0.02)	(0.05)	(0.63)	(1.00)	(0.83)	(0.83)	(0.63)	(0.03)
Green		-0.01	-0.01	0.01	0.02	0.02	0.03	0.06**
		(0.84)	(0.66)	(0.55)	(0.22)	(0.21)	(0.11)	(0.00)
Control for Toll								
Toll			0.90***	0.90***	0.89***	0.89***	0.89***	0.89***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Demand (base: Normal – Hour)								
Overnight				-0.03***	-0.03***	-0.03***	-0.03***	-0.03***
				(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rush Hour				-0.09***	-0.09***	-0.09***	-0.09***	-0.09***
				(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Table 15 (continued)

Control for Payment Method (base: Cash)				
Credit Card	0.09***	0.09***	0.09***	0.09***
	(0.00)	(0.00)	(0.00)	(0.00)
Unknown	0.05***	0.05***	0.05***	0.05***
	(0.00)	(0.00)	(0.00)	(0.00)
Control for No. of Passengers (base: One)				
Two		-0.00**	-0.00**	-0.00**
		(0.00)	(0.00)	(0.00)
Three		-0.01*	-0.01*	-0.01*
		(0.03)	(0.03)	(0.03)
Four		-0.00	-0.00	-0.00
		(0.47)	(0.47)	(0.47)
Five		0.00	0.00	0.00
		(0.81)	(0.82)	(0.80)
Six		-0.01**	-0.01**	-0.01**
		(0.00)	(0.00)	(0.00)
Control for Weather Condition				
Rain			-0.00	-0.00
			(0.70)	(0.48)
Snow			-0.00***	-0.00***
			(0.00)	(0.00)
Max. Temp			-0.00	-0.00
			(0.22)	(0.36)
Min. Temp			0.00	0.00
			(0.77)	(0.86)
Control for Economic Performance				

Table 15 (continued)

MFIN Stock Price								0.01^{***}
								(0.00)
Constant								
Constant	3.08^{***}	3.08^{***}	2.49^{***}	2.51^{***}	2.45^{***}	2.45^{***}	2.45^{***}	2.34^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of Trips	773,402	773,402	773,402	773,402	773,402	773,402	773,402	773,402
R – squared	0.001	0.001	0.514	0.517	0.522	0.522	0.522	0.522
Adjusted R – squared	0.001	0.001	0.514	0.517	0.522	0.522	0.522	0.522
Competitive Route: *CR NN*								
Dependent Variable: ln (Trip Fare)								
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Introduction of Green Taxis to NYC								
Green Launch (GL)	0.00	0.12^{***}	0.10^{***}	0.10^{***}	0.11^{***}	0.11^{***}	0.10^{***}	0.10^{***}
	(0.70)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Time Trend								
GLT	-0.09^{***}	-0.16^{***}	-0.15^{***}	-0.15^{***}	-0.16^{***}	-0.16^{***}	-0.13^{***}	-0.12^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
T	0.01^{*}	0.01^{*}	0.00	0.01	0.01	0.01	0.01	0.01
	(0.04)	(0.04)	(0.34)	(0.25)	(0.31)	(0.28)	(0.20)	(0.12)
T^2	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{***}	0.00^{**}	0.00^{**}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
Monthly Number of Taxi Pickups								
Yellow	0.01^{***}	0.03^{***}	0.03^{***}	0.03^{***}	0.03^{***}	0.03^{***}	0.03^{***}	0.03^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Green		0.39^{***}	0.29^{***}	0.30^{***}	0.32^{***}	0.33^{***}	0.37^{***}	0.37^{***}

Table 15 (continued)

	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Toll							
Toll		0.87***	0.85***	0.80***	0.80***	0.80***	0.80***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Demand (base: Normal – Hour)							
Overnight			−0.09***	−0.09***	−0.09***	−0.09***	−0.09***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rush Hour			0.21***	0.21***	0.21***	0.21***	0.21***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)							
Credit Card				0.21***	0.21***	0.21***	0.21***
				(0.00)	(0.00)	(0.00)	(0.00)
Unknown				0.12***	0.12***	0.12***	0.12***
				(0.00)	(0.00)	(0.00)	(0.00)
Control for No. of Passengers (base: One)							
Two					−0.00	−0.00	−0.00
					(0.87)	(0.88)	(0.88)
Three					−0.01*	−0.01*	−0.01*
					(0.04)	(0.04)	(0.04)
Four					−0.01	−0.01	−0.01
					(0.50)	(0.48)	(0.48)
Five					0.00	0.00	0.00
					(0.41)	(0.42)	(0.42)
Six					−0.02***	−0.02***	−0.02***
					(0.00)	(0.00)	(0.00)

Table 15 (continued)

Control for Weather Condition								
Rain							-0.02^{***}	-0.02^{***}
							(0.00)	(0.00)
Snow							-0.01^{***}	-0.01^{***}
							(0.00)	(0.00)
Max. Temp							0.00	0.00
							(0.38)	(0.40)
Min. Temp							0.00^{**}	0.00^{**}
							(0.00)	(0.00)
Control for Economic Performance								
MFIN Stock Price								−0.00
								(0.37)
Constant								
Constant	2.12^{***}	1.84^{***}	1.86^{***}	1.86^{***}	1.74^{***}	1.74^{***}	1.75^{***}	1.78^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of Trips	295,112	295,112	295,112	295,112	295,112	295,112	295,112	295,112
R − squared	0.004	0.005	0.086	0.102	0.119	0.119	0.119	0.119
Adjusted R − squared	0.004	0.005	0.086	0.102	0.119	0.119	0.119	0.119

p-values are in parentheses. * $p<0.05$, ** $p<0.01$, *** $p<0.001$. Dist. represents distance. The trip distance, Duration, and fare are in miles, minutes, and dollars, respectively. Robust standard errors were used for estimations. Trips in *CR EE* have no tolls

Appendix H

Table 16 Table of Results for Specification Curves: Yellow Taxi Trips (Subject to Flat-Rate Fare)

Trips from Manhattan to JFK								
Dependent Variable: ln (Trip Dist.)								
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Introduction of Green Taxis to NYC								
Green Launch (GL)	0.01	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00
	(0.31)	(0.97)	(0.93)	(0.95)	(0.97)	(0.90)	(0.87)	(0.79)
Control for Time Trend								
GLT	−0.00	−0.00	0.00	−0.00	−0.00	0.00	−0.00	0.00
	(0.51)	(0.96)	(1.00)	(0.99)	(0.98)	(0.93)	(0.89)	(1.00)
T	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	(0.31)	(0.30)	(0.29)	(0.29)	(0.30)	(0.28)	(0.31)	(0.26)
T^2	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	0.00	−0.00
	(0.97)	(0.91)	(0.88)	(0.89)	(0.90)	(0.84)	(0.95)	(0.89)
Monthly Number of Taxi Pickups								
Yellow	0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00
	(0.91)	(0.81)	(0.77)	(0.79)	(0.80)	(0.74)	(0.74)	(0.69)
Green		−0.02	−0.02	−0.02	−0.02	−0.03	−0.03	−0.03
		(0.58)	(0.56)	(0.57)	(0.58)	(0.51)	(0.41)	(0.38)
Control for Toll								
Toll			0.01***	0.01***	0.01***	0.01***	0.01***	0.01***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Demand (base: Normal − Hour)								
Overnight				0.01*	0.01*	0.01*	0.01*	0.01*
				(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Rush Hour				−0.01*	−0.01*	−0.01*	−0.01*	−0.01*

Table 16 (continued)

	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Control for Payment Method (base: Cash)					
Credit Card		0.00**	0.01**	0.01**	0.01**
		(0.01)	(0.00)	(0.00)	(0.00)
Unknown		−0.01	−0.01	−0.01	−0.01
		(0.74)	(0.74)	(0.74)	(0.74)
Control for No. of Passengers (base: One)					
Two			0.02***	0.02***	0.02***
			(0.00)	(0.00)	(0.00)
Three			0.01***	0.02***	0.02***
			(0.00)	(0.00)	(0.00)
Four			0.02**	0.02**	0.02**
			(0.01)	(0.01)	(0.01)
Five			0.02***	0.02***	0.02***
			(0.00)	(0.00)	(0.00)
Six			0.03***	0.03***	0.03***
			(0.00)	(0.00)	(0.00)
Control for Weather Condition					
Rain				−0.00	−0.00
				(0.67)	(0.68)
Snow				0.00	0.00
				(0.77)	(0.80)
Max. Temp				0.00	0.00
				(0.34)	(0.35)
Min. Temp				−0.00	−0.00
				(0.15)	(0.16)

Table 16 (continued)

Control for Economic Performance								
MFIN Stock Price								−0.00
								(0.55)
Constant								
Constant	2.83***	2.85***	2.84***	2.84***	2.84***	2.84***	2.84***	2.85***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of Trips	57,663	57,663	57,663	57,663	57,663	57,663	57,663	57,663
R − squared	0.001	0.001	0.002	0.002	0.002	0.004	0.005	0.005
Adjusted R − squared	0.001	0.001	0.002	0.002	0.002	0.004	0.004	0.004
Trips from JFK to Manhattan								
Dependent Variable: ln (Trip Dist.)								
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Introduction of Green Taxis to NYC								
Green Launch (GL)	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00
	(0.40)	(0.97)	(0.93)	(0.94)	(0.94)	(0.88)	(0.94)	(0.67)
Control for Time Trend								
GLT	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.01	−0.00
	(0.87)	(0.72)	(0.76)	(0.76)	(0.76)	(0.80)	(0.42)	(0.73)
T	0.01**	0.01**	0.01**	0.01**	0.01**	0.01**	0.01**	0.01**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
T^2	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00
	(0.38)	(0.40)	(0.36)	(0.34)	(0.34)	(0.36)	(0.67)	(0.35)
Monthly Number of Taxi Pickups								
Yellow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 16 (continued)

	(0.69)	(0.62)	(0.65)	(0.65)	(0.65)	(0.69)	(0.62)	(0.80)
Green		0.01	0.01	0.01	0.01	0.01	0.00	−0.00
		(0.70)	(0.72)	(0.69)	(0.69)	(0.79)	(0.91)	(0.90)
Control for Toll								
Toll			−0.02***	−0.02***	−0.02***	−0.02***	−0.02***	−0.02***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Demand (base: Normal − Hour)								
Overnight				0.00	0.00	0.00	0.00	0.00
				(0.46)	(0.46)	(0.42)	(0.41)	(0.42)
Rush Hour				−0.01***	−0.01***	−0.01***	−0.01***	−0.01***
				(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)								
Credit Card					0.00	0.00	0.00	0.00
					(0.95)	(0.76)	(0.77)	(0.78)
Unknown					−0.00	−0.00	−0.00	−0.00
					(0.82)	(0.83)	(0.83)	(0.84)
Control for No. of Passengers (base: One)								
Two						0.01***	0.01***	0.01***
						(0.00)	(0.00)	(0.00)
Three						0.02***	0.02***	0.02***
						(0.00)	(0.00)	(0.00)
Four						0.02***	0.02***	0.02***
						(0.00)	(0.00)	(0.00)
Five						0.03***	0.03***	0.03***
						(0.00)	(0.00)	(0.00)

Table 16 (continued)

Six						0.03***	0.03***	0.03***
						(0.00)	(0.00)	(0.00)
Control for Weather Condition								
Rain							−0.00	−0.00
							(0.42)	(0.46)
Snow							−0.00	−0.00
							(0.56)	(0.48)
Max. Temp							−0.00	−0.00
							(0.94)	(0.87)
Min. Temp							−0.00	−0.00
							(0.31)	(0.32)
Control for Economic Performance								
MFIN Stock Price								−0.00
								(0.09)
Constant								
Constant	2.84***	2.83***	2.85***	2.85***	2.85***	2.84***	2.84***	2.87***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of Trips	115,400	115,400	115,400	115,400	115,400	115,400	115,400	115,400
R − squared	0.002	0.002	0.003	0.003	0.003	0.006	0.006	0.006
Adjusted R − squared	0.002	0.002	0.003	0.003	0.003	0.005	0.006	0.006
Trips from Manhattan to JFK								
Dependent Variable: ln (Trip Duration)								
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Introduction of Green Taxis to NYC								

Table 16 (continued)

Green Launch (GL)	-0.07^{***}	-0.00	0.00	-0.01	-0.02	-0.02	-0.02	0.01
	(0.00)	(0.88)	(0.84)	(0.41)	(0.31)	(0.29)	(0.13)	(0.62)
Control for Time Trend								
GLT	0.04^{***}	-0.00	-0.01	-0.00	0.00	0.00	0.04^{**}	0.01
	(0.00)	(0.77)	(0.49)	(0.94)	(0.96)	(0.93)	(0.00)	(0.70)
T	0.06^{***}	0.06^{***}	0.06^{***}	0.06^{***}	0.06^{***}	0.06^{***}	0.05^{***}	0.02^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
T^2	-0.00^{***}	-0.00^{***}	-0.00^{***}	-0.00^{***}	-0.00^{***}	-0.00^{***}	-0.01^{***}	-0.00^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Monthly Number of Taxi Pickups								
Yellow	-0.00	0.01^{*}	0.01^{*}	0.01	0.01	0.01	0.00	0.01^{*}
	(0.31)	(0.05)	(0.02)	(0.06)	(0.08)	(0.09)	(0.34)	(0.02)
Green		0.22^{***}	0.23^{***}	0.23^{***}	0.22^{***}	0.22^{***}	0.21^{***}	0.26^{***}
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Toll								
Toll			-0.08^{***}	-0.09^{***}	-0.09^{***}	-0.09^{***}	-0.09^{***}	-0.09^{***}
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Demand (base: Normal − Hour)								
Overnight				-0.42^{***}	-0.42^{***}	-0.42^{***}	-0.42^{***}	-0.42^{***}
				(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rush Hour				0.27^{***}	0.27^{***}	0.27^{***}	0.27^{***}	0.27^{***}
				(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)								
Credit Card					-0.04^{***}	-0.04^{***}	-0.04^{***}	-0.04^{***}
					(0.00)	(0.00)	(0.00)	(0.00)
Unknown					-0.03	-0.03	-0.03	-0.03

Table 16 (continued)

					(0.23)	(0.24)	(0.28)	(0.29)
Control for No. of Passengers (base: One)								
Two						0.01*	0.01*	0.01*
						(0.02)	(0.03)	(0.03)
Three						0.00	−0.00	−0.00
						(0.97)	(0.90)	(0.89)
Four						0.00	0.00	0.00
						(0.74)	(0.85)	(0.89)
Five						0.01*	0.01*	0.01*
						(0.03)	(0.02)	(0.03)
Six						0.01*	0.01	0.01
						(0.05)	(0.07)	(0.07)
Control for Weather Condition								
Rain							0.06***	0.06***
							(0.00)	(0.00)
Snow							−0.01***	−0.01***
							(0.00)	(0.00)
Max. Temp							0.00***	0.00***
							(0.00)	(0.00)
Min. Temp							−0.00*	−0.00*
							(0.04)	(0.03)
Control for Economic Performance								
MFIN Stock Price								0.02***
								(0.00)
Constant								
Constant	3.63***	3.43***	3.47***	3.51***	3.54***	3.54***	3.53***	3.28***

Table 16 (continued)

	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of Trips	57,663	57,663	57,663	57,663	57,663	57,663	57,663	57,663
R – squared	0.009	0.009	0.019	0.232	0.235	0.235	0.242	0.243
Adjusted R – squared	0.009	0.009	0.019	0.231	0.235	0.235	0.242	0.243
Trips from JFK to Manhattan								
Dependent Variable: ln (Trip Duration)								
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Introduction of Green Taxis to NYC								
Green Launch (GL)	-0.12***	-0.11***	-0.11***	-0.09***	-0.09***	-0.09***	-0.08***	-0.05***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Time Trend								
GLT	0.08***	0.08***	0.08***	0.05***	0.05***	0.05***	0.06***	0.02*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
T	0.10***	0.10***	0.10***	0.08***	0.08***	0.08***	0.07***	0.05***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
T^2	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Monthly Number of Taxi Pickups								
Yellow	-0.00	-0.00	-0.00	0.01**	0.01**	0.01**	0.01**	0.01***
	(0.26)	(0.64)	(0.59)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Green		0.02	0.02	0.07*	0.06*	0.06*	0.07**	0.14***
		(0.49)	(0.51)	(0.01)	(0.04)	(0.03)	(0.01)	(0.00)
Control for Toll								
Toll			-0.03***	-0.09***	-0.09***	-0.09***	-0.09***	-0.09***

Table 16 (continued)

	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Demand (base: Normal – Hour)						
Overnight		-0.39***	-0.39***	-0.39***	-0.39***	-0.39***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Rush Hour		0.02***	0.02***	0.02***	0.02***	0.02***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control for Payment Method (base: Cash)						
Credit Card			-0.04***	-0.04***	-0.04***	-0.04***
			(0.00)	(0.00)	(0.00)	(0.00)
Unknown			-0.06***	-0.06***	-0.06***	-0.06***
			(0.00)	(0.00)	(0.00)	(0.00)
Control for No. of Passengers (base: One)						
Two				0.01**	0.01**	0.01**
				(0.01)	(0.01)	(0.01)
Three				0.01*	0.01*	0.01*
				(0.01)	(0.01)	(0.02)
Four				0.00	0.00	0.00
				(0.91)	(1.00)	(0.97)
Five				-0.00	-0.00	-0.00
				(0.15)	(0.15)	(0.15)
Six				-0.00	-0.00	-0.00
				(0.17)	(0.18)	(0.19)
Control for Weather Condition						
Rain					0.04***	0.04***
					(0.00)	(0.00)

Table 16 (continued)

Snow							-0.01***	-0.01***
							(0.00)	(0.00)
Max. Temp							0.00	0.00*
							(0.17)	(0.03)
Min. Temp							0.00	0.00
							(0.34)	(0.45)
Control for Economic Performance								
MFIN Stock Price								0.02***
								(0.00)
Constant								
Constant	3.56***	3.54***	3.57***	3.62***	3.64***	3.64***	3.63***	3.36***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of Trips	115,400	115,400	115,400	115,400	115,400	115,400	115,400	115,400
R − squared	0.023	0.023	0.024	0.344	0.348	0.348	0.351	0.353
Adjusted R − squared	0.023	0.023	0.024	0.344	0.348	0.348	0.351	0.352

p-values are in parentheses. * $p<0.05$, ** $p<0.01$, *** $p<0.001$. Dist. represents distance. The trip distance, Duration, and fare are in miles, minutes, and dollars, respectively. Robust standard errors were used for estimations

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Data Availability The necessary material for replicating the main analysis and specification curves is available at: https://data.mendeley.com/datasets/383wc6f6d6/1.

Declarations

Conflicts of interest The author has no conflicts of interest to declare and has no financial interest to report. The author confirms that the submission is original work and is not under review at any other journal.

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