Growing Platforms by Adding Complementors without Consent: Evidence from On-Demand Food Delivery Platforms

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This empirical research investigates the impact of an aggressive growth strategy used by delivery platforms to add restaurants to their platforms without restaurants' consent. Although these platforms provide a valuable option to consumers to access restaurant services, they experience strong resistance from the other side (restaurants), due to unclear benefits from the partnership and the potential risks of cannibalization. To grow the multi-sided networks, platforms have experimented with a new seeding strategy that enlists restaurants on platforms without restaurants' consent. Such a seeding strategy is controversial and is under regulation scrutiny (e.g., in California). Using a rich panel dataset compiled from public and proprietary sources, this research exploits two shocks to identify the impact of the aggressive platform growth strategy and the retrospective regulation on restaurants. The first shock is non-partnered restaurants being listed on the platform without the restaurants' consent. The second shock is the de-listing of non-partnered restaurants from the platform after California deemed such a platform strategy illegal. Our results suggest that being listed on a platform reduces a restaurant's dine-in visits but increases takeout visits. However, independent restaurants lose more dine-in visits than they gain in takeout visits, resulting in a net loss of total demand. Furthermore, retrospective regulation to de-list non-partnered restaurants actually hurt these restaurants. After the regulation, independent restaurants not only lose takeout visits but also fail to recover to the dine-in visits level prior to being listed. The findings provide practical insights that can help restaurants, delivery platforms and policymakers make informed decisions around policies and regulations.

Key words : Multi-sided platforms, on-demand delivery, network effects, regulation, seeding, platform policy

1. Introduction

Online intermediaries and digital marketplaces have started to play an increasingly important role in traditionally offline businesses. Among all platforms, on-demand food delivery platforms have gained the most traction. The key players in this domain, such as DoorDash, Grubhub, and UberEats, connect freelancers with personal transportation with patrons to fulfill food delivery orders from restaurants (MorganStanley 2020). While such services are unequivocally beneficial to consumers, their impact on restaurants are not well understood. Some restaurants owe their survival to delivery platforms (Durbin 2021, Elejalde-Ruiz 2021), while others are skeptical about whether they may profit from partnering with such platforms.[1] Thus, delivery platforms have found it difficult to further grow their networks organically (McCart 2019). Given strong network effects and the "winner-take-all" tendency of digital markets (McAfee and Brynjolfsson 2008), exploring alternative growth strategies is essential for delivery platforms.

To counter the slow organic growth due to resistance from restaurants, major delivery platforms have been experimenting with an aggressive growth strategy in which platforms add restaurants to their site without the restaurants' consent. For instance, Grubhub was reported to have added 150,000 "non-partnered" restaurants [2] to their platform starting in the last quarter of 2019 (Brooks 2020).[3] Using this aggressive strategy to grow the supply side, delivery platforms expand the selection, which helps attract more consumers due to the positive cross-side network effects (Economides and Viard 2007). Delivery platforms argue that this practice helps restaurants, since they receive free advertising and a new channel to reach consumers and increase sales. However, such a growth strategy faces strong push back from many restaurants and is under regulatory scrutiny. Several states, such as California, have come up with regulations that bar delivery platforms from listing non-partnered restaurants on their platforms (Batey 2021).

[1] Partnered restaurants pay substantial commission fees to these platforms, which can be as high as 30% (TribecaCitizen 2021, Roy 2020). Another concern from many restaurants is that platform delivery may cannibalize restaurants' existing $DineIn$ or $TakeOut$ sales channels.

[2] These non-partnered restaurants do not pay commission fees, and are often unaware of their listing on the platform

[3] For non-partnered restaurants, after receiving a customer-order placed through the platform, a driver will contact the restaurant and place the order on the customer's behalf, pick it up and deliver it to the customer.

This research empirically investigates the impact of adding restaurants to delivery platforms without their consent and retrospective regulation to bar such growth strategies. The literature has not provided clear predictions on whether such a strategy benefits restaurants, consumers or the platforms overall. The literature on growth strategies in two-sided networks (Rochet and Tirole 2003, Parker and Van Alstyne 2005, Boudreau 2010, Zhu and Iansiti 2012, Economides and Viard 2007) demonstrates the importance of growing platforms using factors such as price, quality, entry decisions, and platform openness. Other studies research on the role of regulating digital platforms (Cohen and Sundararajan 2015, Cusumano et al. 2021) have discussed the impact of external regulation. But none of the prior papers have studied the setup where a platform grows its network by enlisting sellers without their consent and an external regulation is enacted to counter such a growth strategy.

To fill the gap in the literature, this empirical research analyzes a comprehensive dataset compiled from public and proprietary sources. We focus on restaurants in the three states on the west coast, i.e. California, Oregon, and Washington. The empirical strategy leverages two shocks: 1) Grubhub's aggressive addition of non-partnered restaurants to the platform towards the end of 2019, and 2) California's prohibition of such a growth strategy in late 2020 (the other two states did not introduce such regulation during the period covered in this study). We investigate consumer demand for non-partnered restaurants before and after they were added to the platform, as well as when non-partnered restaurants in California were removed from the platform due to the regulation from the state.

Our empirical analysis shows that $TakeOut$ visits to non-partnered restaurants on Grubhub increased by 2.63% after they were added to the platform, whereas $DineIn$ visits decreased by 4.3%. However such a dip in $DineIn$ visits are observed only for independent restaurants. Overall, being listed in the platform results in an increase of $TakeOut$ visits but a substitution of $DineIn$, and independent restaurants lose more overall visits compared to chain restaurants. Next, after being removed from the platform due to the regulation, non-partnered restaurants in California that were previously on Grubhub saw a 2.86% drop in $TakeOut$ visits, whereas these restaurants did not experience an increase in $DineIn$ visits after the regulation. Finally, such a dip in $TakeOut$ visits are only for independent restaurants while the chain restaurants do not see any significant difference after the regulation. Taken together, these findings suggest that the aggressive growth strategy of adding non-partnered restaurants to the platform has both positive and negative effects on restaurants, depending on a particular customer channel and the restaurant type. Furthermore, regulations that prohibit non-partnered restaurants on the platform may backfire, as they reduce $TakeOut$ visits to these restaurants without boosting $DineIn$ visits.

This research makes several contributions. First, the research adds to the discourse on the impact of delivery platforms on restaurants by studying the impact of platform policies that intend to inorganically increase the supply side. Second, this research adds to the ongoing debates on whether policy makers should actively intervene to improve the outcomes for restaurants. Specifically, this research uncovers the nuances of active intervention by studying the heterogeneity of outcomes based on ownership structure (chain vs independent). Finally, this research also contributes to a small yet burgeoning literature on unintended consequences of platform policy changes. The paper shows that, due to the multi-sided nature of the platform, policies designed to affect one side of the network can have unintended consequences on the other side. The insights from this research provides important implications for stakeholders, including restaurants, delivery platforms, and regulators.

2. Related Literature

This research builds on and contributes to two streams of literature: that which studies the impact of delivery platforms on restaurant businesses (e.g., (Cheyre and Acquisti 2018, Zhang et al. 2019, Raj et al. 2020, Li and Wang 2020, 2021) among many others) and that on multi-sided platforms, particularly regarding intra-platform competition and platform governance in the presence of network effects ((Rochet and Tirole 2003, Parker and Van Alstyne 2005, Boudreau and Hagiu 2009, Zhu and Iansiti 2012, Cohen and Sundararajan 2015, Frieden 2017, Cusumano et al. 2021, Gawer and Srnicek 2021) among many others). To place our contributions in perspective, we review the relevant literature, identify the gaps and define our research questions. We also discuss how the insights from this research inform platform strategies, restaurant decisions, and policy making.

2.1. Impact of Delivery Platforms on Restaurants

Joining delivery platforms can affect restaurant sales, profits, and survival. For example, Li and Zhu (2020) show that being listed on the delivery platform improves the outcomes for restaurants, but that this is pronounced for chain restaurants. Recent papers have investigated the benefits of joining the platform in terms of improving online and offline sales on the long run (Zhang et al. 2019), improving the survival chances of small restaurants (Raj et al. 2020), or, maintaining their current customers and gaining new customers in a competitive environment (Cheyre and Acquisti 2018). The literature has also documented the costs associated with the partnership with delivery platforms. These platforms facilitate price comparisons that may increase the competition among restaurants (Li and Wang 2020). Cheyre and Acquisti (2018) demonstrate that participating in delivery platforms does not guarantee a long-term benefit to restaurants. We contribute to this literature by exploiting a natural experiment that allows us to identify the impact of being enlisted into the platform without the restaurants' consent.

2.2. Partnership with Delivery Platform

Restaurants have three options: building a formal partnership with the platform, being on the platform as a non-partnered restaurant, or staying off the platform. The literature has shed light on the pros and cons of each partnership. Recent theoretical papers suggest a non-partnered relationship is the most practical partnership between platforms and restaurants (Feldman et al. 2019). However, anecdotal evidence suggests that such a relationship can be inefficient due to operational issues such as incorrect menu prices, improper handling of food etc (e.g., (Saxena 2019, Christians 2020)). We add to the literature by empirically investigating the impact of being on a platform as a non-partnered restaurant.

2.3. Platform Strategy

Extant literature studying multi-sided networks identifies platform owners' role in not just growing the network but also ensuring efficient governance. Some of the seminal work on two-sided networks has demonstrated their role in managing the network by controlling various operational aspects such as price, quality, entry decisions, and openness of the platform (Rochet and Tirole 2003, Parker and Van Alstyne 2005, Boudreau 2010, Zhu and Iansiti 2012). Platform owners strive to attract participants from both the demand and supply side to contribute to the same-side and cross-side network effects. Consequently, the focus has been on studying how the above mentioned strategies help organically grow the network on both sides. Some of the recent works investigate the impact on network effects when two-sided markets grow the network inorganically by merging (Farronato et al. 2020, Burtch and Ramaprasad 2016). The literature has not studied the cross-side and same-side network effects when a platform exogenously increases the size of the supply side.

2.4. Platform Governance and External Regulations

Multi-sided platforms are characterized by positive or negative externalities that affect a broader range of players inside or outside the platforms' boundaries (Boudreau and Hagiu 2009). Platform governance is an essential problem and has attracted researchers from across disciplines such as law, public policy and digital platforms. Extant literature discussing platform governance contrasts the role of self-regulation to external regulation (e.g., (Cohen and Sundararajan 2015, Frieden 2017)). Some of the earlier arguments suggest that external governmental regulations may not be necessary to prevent market failures on platforms. For example, Boudreau and Hagiu (2009)) note that self regulation is more efficient than external regulation. However, prior studies have also noted that platforms may not have the discretion to self-regulate, given the ubiquity and monopolistic market share garnered by platforms. Recent discussions focus on how a credible threat of regulation may be necessary to motivate platforms to better self-regulate (e.g., (Cusumano et al. 2021, Gawer and Srnicek 2021)). While researchers agree that a threat of regulation improves platforms' governance practice, it is unclear if actual regulation is essential.

2.5. Gaps and Research Questions

First, extant literature that has studied the impact of delivery platforms on restaurant businesses (e.g., (Cheyre and Acquisti 2018, Zhang et al. 2019, Raj et al. 2020, Li and Wang 2020, 2021) among many others) do not conclusively address the self-selection of enlisting as a partner restaurant. Given that over half of the restaurants in the US are not on any of the platforms, it is essential to estimate the impact of being on the platform after accounting for self-selection.

Second, most research papers assume a formal partnership between restaurants and platforms (Raj et al. 2020, Li and Wang 2020), but much is unknown about the impact of a non-partnership on restaurants' cost/benefit structure. Being a partner allows restaurants not only to control the menu and price (e.g., Saxena (2019), Christians (2020)), but also provides these partnered-restaurant better consumer data or favorable customer reach (e.g., (Bushnell 2018, McCarthy 2020)). At the same time, partnering with platforms is often costlier and requires a dedicated workforce. Theoretical studies suggest that the most practical solution would be to have a non-partnered relationship with the platforms (Feldman et al. 2019). Empirically addressing this question can inform restaurants if they decide to enlist on a platform.

Finally, given that external regulations are passively reactive in nature, it is essential to establish the effectiveness of these regulations enacted after platform policy changes. Some of the recent research on external regulations has shown that such regulations may hurt restaurants more than they help them (e.g., Li and Wang (2021)). Thus, empirically investigating the impact of regulation on both different players, intended and unintended, is essential.

Our project addresses these gaps in the literature by exploiting two events that impacted restaurants that did not partner with a delivery platform. In the last quarter of 2019, Grubhub moved to add over 150,000 restaurants to the delivery platform as non-partners. Starting from the last quarter of 2019, they continued to aggressively add restaurants in the first and second quarter of 2020. Later, a California law deemed it illegal for delivery platforms to list restaurants on the platform without the restaurants' consent. The bill was signed into law on September 24th and required delivery platforms to comply immediately or face severe consequences after January 1st, 2021.

Our first research question is to identify the impact of being listed on a delivery platform by contrasting these non-partnered restaurants with similar restaurants that were not listed on the platform. Our first research question asks: "What is the impact of being listed on a delivery platform as non-partnered restaurants on the restaurants' $DineIn$, $TakeOut$ and $TotalFootfall$?" Our second research question is to identify the impact of an external regulation by California, which barred delivery platforms from listing restaurants without consent. We contrast the difference in outcomes for non-partnered restaurants in California to the those of neighboring states, Washington and Oregon, which did not enact this law. In summary, our second research question asks: "What is the impact of retrospective external regulations on the outcomes of non-partnered restaurants?"

3. Empirical Context, Data and Models

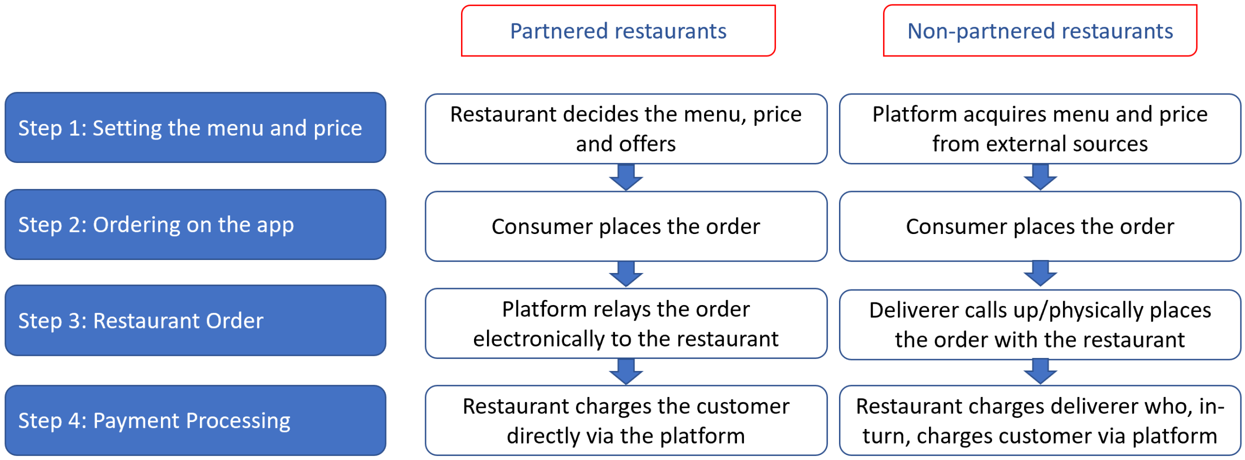
We examined the above research questions on Grubhub, one of the three largest food delivery platforms for restaurants in the US (Statista 2021).[4] Founded in 2004, the platform quickly rose in prominence, aggressively acquiring other platforms (e.g., Seamless and Eat24) and quickly becoming the dominant player in on-demand restaurant delivery. At the core, Grubhub serves as a marketplace connecting three sides of the food ordering and delivery process: consumers, drivers and restaurants.

3.1. Context

Grubhub's initial focus was on growing the supply side of the platform by aggressively partnering with restaurants and "ghost kitchens" without dine-in space. This policy formalized a four-step partnership. Restaurants decided the menu items and prices to be listed on the platform. Consumers chose the item and placed the order. The platform released the orders to the restaurant electronically and dispatched a driver to pick up the food and deliver it. After the order is picked up, the restaurant charged the consumer via the platform. However, in the last quarter of 2019,

[4] Grubhub, along with its parent company (Just Eat Takeaway), is the largest delivery platform outside of China.

Figure 1 Comparison of Partnered and Non-Partnered Restaurants



Grubhub announced a policy change where it started enlisting "non-partnered" restaurants on their platform. This new growth strategy incorporated a non-partnered arrangement, where the driver proxied for a Grubhub customer in placing the order via one of the restaurant's existing channels. The platform acquires restaurant menu items from external sources and lists them on the platform. A consumer places the order. The platform directs a driver to place the order on the consumer's behalf. Finally, a driver picks up the order by paying for the food (to get reimbursement from the platform). Figure 1 contrasts the ordering processes between partnered and non-partnered restaurants.

Many restaurants filed complaints about this growth strategy and advocated for regulatory intervention. The state of California enacted a law prohibiting this strategy. This presents an opportunity to exploit two distinct shocks: one that involuntarily adds restaurants to the platform and one that involuntarily removes them. As shown in Figure **??**, the count of non-partnered restaurants in California grew until the regulation stopped it. About 40% of the restaurants on the platform in California were non-partnered before the regulation. On the other hand, Oregon and Washington did not impose such a regulation, so Grubhub continued to list non-partnered restaurants on its platform.

Our chosen research context has several elements that make it worthy of investigation. First, unlike most other settings where joining a platform is a choice by the participant, our setting investigates involuntary addition to the platform. This allows us to measure the outcomes of platform participation with less of self-selection concerns. Second, we can measure the impact of a platform strategy change followed by the impact of an external regulation that prohibits such a strategy. Grubhub's addition of non-partnered restaurants and California's regulatory law happened within a year of each other, which allows us to study the impact of the platform policy as well as the external regulation. Third, given this time frame, we observe a group of non-partnered restaurants added to the platform as well as a group of restaurants that were not on the platform till the end. This provides us with a quasi-experimental setting, where we can contrast the outcomes between two similar groups of restaurants, one were added to the platform the other were not.

3.2. Data

We compiled a comprehensive panel data set by triangulating across multiple sources. Our raw dataset consists of all restaurants[5] in the states of California, Oregon and Washington.[6]

3.2.1. Restaurant Foot Traffic. The foot traffic data is provided by SafeGraph Inc., a data company that collects anonymized location data from approximately 35 million unique devices in the United States. Researchers from over 1000 organizations (e.g., Chiou and Tucker (2020)) have used the SafeGraph data to understand visit patterns. To preserve anonymity, the visiting data for a specific location is aggregated on a weekly basis. SafeGraph further splits the total number of visits based on the duration of stay: shorter than 10-minutes (capturing $TakeOut$ visits), between 11 and 120 minutes (capturing $DineIn$ visits), 121 to 240 minutes (special case visits), and longer than 240 minutes (potentially employees working in the restaurant). This specificity allows us to identify the impact of listing on a platform on restaurants' $TakeOut$ and $DineIn$ visits separately.

3.2.2. Restaurant-Platform Partnership. Restaurant partnership data is provided by Grubhub. The longitudinal data captures which restaurants are listed on the platform on a given week, which are non-partnered and when they were added to the platform. Our dataset also captures when non-partnered restaurants in California were removed per state's regulation.

[5] A total of 36,749 partnered restaurants, 27,966 non-partnered restaurants and 51,174 restaurants not on the platform

[6] California is the first state that introduced a regulation that prohibits non-partnered restaurants and the other two states did not have such a regulation. These geographical variations allow us to contrast the outcomes for non-partnered restaurants in California compared to restaurants in the other two states

Table 1 Variable Explanation

Variable	Description
Dependent Variables	
$TakeOut_{it}$	Count of visitors that spent 0 to 10 minutes in a restaurant i on week t
$DineIn_{it}$	Count of visitors that spent 11 to 120 minutes in a restaurant i on week t
$TotalFootfall_{it}$	Count of visitors that visited a restaurant i for any duration on week t
Explanatory Variables	
$NonPartnered_i$	Whether a restaurant i has partnered with GrubHub
$ChainRestaurant_i$	Whether a restaurant i is a chain restaurant
$State_i$	A categorical variable indicating whether restaurant i is located in either the state of California, Oregon or Washington
$PostPolicy_{it}$	Whether the platform growth policy was implemented on restaurant i on week t
$PostRegulation_t$	Whether the California regulation barring platforms from adding non-partnered restaurants was signed on week t

Note. Non-partnered restaurants were added to the platform at different weeks

Table 2 Summary Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
$TakeOut_{it}$	8,464,898	16.08	25.89	0	15,820
$DineIn_{it}$	8,464,898	26.08	49.21	0	36,295
$TotalFootfall_{it}$	8,464,898	39.19	61.57	1	40,025
$ChainRestaurant_i$	8,471,437	0.23	0.42	0	1
$NonPartnered_i$	8,471,437	0.40	0.49	0	1
$PostPolicy_{it}$	8,471,437	0.14	0.35	0	1
$PostRegulation_t$	8,471,437	0.23	0.42	0	1

Note. For anonymity reasons, SafeGraph does not report footfall data if the total number of visits to the location is less than 5 in a week.

3.2.3. Variables and Measurement. The main variables and their summary statistics are presented in Table 1 and Table 2, respectively. The pertinent outcome variables are consumers' visits to restaurants. As defined in Table 1, we investigate two types of visits based on duration.

Takeout Visits (visits lasting less than 10 minutes): Upon arriving at a restaurant, customers typically wait less than 10 minutes before their orders are ready for takeout, drive-through, or pickup. $TakeOut$ visits include customers picking up orders themselves or delivery drivers fulfilling platform orders. The number represents the total $TakeOut$ orders for restaurants.

Dine-in Visits (visits lasting 11 to 120 minutes): Customers typically stay for about half an hour if dining-in individually, to one hour if with a small/medium group. The duration of visits may be longer for events such as parties, though the fraction of such visits is small.

Total Footfall: This includes the total number of visits from 0 minutes to over 240 minutes, which could include patrons as well as employees. The fixed effect specification in our models should annul the effect of employees, who are expected to be constant across the panel.

Non-Partnered Restaurants: This is a dichotomous variable that carries the value of 1 for any restaurant that was added to the platform without the restaurant's consent. We only retain those restaurants whose value does not change across the panel [7].

Chain Restaurants: This is a dichotomous variable that carries the value of 1 for any restaurant that is part of a chain restaurant business including franchises and company-owned locations.

3.3. Empirical Strategy

Our research follows a two-fold empirical strategy. The first empirical strategy is to exploit a platform-driven shock (i.e., restaurants listed on the Grubhub platform without consent) to investigate the impact of platform-listing on restaurant's footfall. The second empirical strategy is to exploit regulation-driven shock that mandates platforms to de-list non-partnered restaurants in certain locations. We compare the footfall for non-partnered restaurants that got de-listed with a matched set of non-partnered restaurants that continued to stay on the platform.

Both empirical strategies leverage two distinct policy shocks that affected a sub-group of restaurants while the other remained unaffected. These variations in policy shocks allow us to utilize a quasi-experimental design and adopt a difference-in-differences (DiD) method (Card and Krueger 1994, Meyer 1995). We use two variants of DiD estimators in the two empirical strategies: the first strategy uses the staggered DiD estimation technique, while the second follows the standard panel DiD estimation.

In the first empirical investigation, we measure the differential trajectory of visits to restaurants after they were added to the platform. The treatment is staggered as each restaurant may be added to the platform at different times. We follow prior research (Gao and Zhang 2017, Mayya et al. 2021) that normalizes the time-period of listing on the platform as t=0 and lists the pretreatment period reverse chronologically (..., -2, -1) and post-treatment period chronologically (1, 2, ..).

In the second empirical investigation, we model the differential trajectory of visits after non-partnered restaurants were removed from the platform. On September 24th 2020, the governor of

[7] We drop those restaurants which were added as non-partnered restaurants but they signed formal partnership during the duration of our panel

California signed a bill, which outlawed platforms listing restaurants without restaurants' consent. We consider the date of enacting the law as t=0 and list the pre-, post-periods accordingly.

3.3.1. Propensity Score Matching. There are a few well-documented estimation issues when DiD is used in quasi-experimental setting without pre-processing the data. The first is that the treatment is not distributed randomly. Such issues have been addressed by pre-processing data using some known matching techniques, such as the Propensity Score Matching (PSM). PSM in conjunction with DiD has been used for causal inferences across disciplines (Liu and Lynch 2011, Mayya and Viswanathan 2021, Smith and Todd 2005). The procedure requires us to predict the propensity of the restaurant to be listed on the platform using various time-variant covariates (e.g., overall footfall, $TakeOut$ traffic, $DineIn$ traffic, median distance from consumers' home) and time-invariant covariates (e.g., zipcode, restaurant sub-category). Specifically, we matched the time-variant covariates based on their mean value before treatment and enforced additional constraints such as the treated-control restaurant pair should be from the same zip code and the same restaurant category. Finally, we performed a one-to-one match without replacement of the matched control restaurants. This rigorous matching procedure resulted in 10,661 treated restaurants and 10,661 matched control restaurants. Table 3 shows that the treatment and control groups are balanced.

3.3.2. Parallel Trends Assumption. The second issue with using DiD in a non-experimental setup is the possibility of a diverging trend that started well before the treatment period i.e., a violation of parallel-trends assumption. To get a better sense of time trends, we plot them in Appendix Figure A2. We find that the treated and control restaurants have common time trends before the treatment. Next, we test the parallel trends using relative time models (Autor 2003). In this test, we introduce interaction terms by interacting pre- and post-time periods with the treatment. If the coefficients of the interaction terms involving pre-time dummies are jointly insignificant, we can econometrically argue that parallel trends hold. Appendix Table A1 shows the outcome. The parallel-trend assumption is not violated.

Table 3 Main Effects of Being Added to the Platform on Restaurant Demand

Covariates	Pre-Match	Pre-Match (Overall)	Pre-Match (Treated)	Difference (Control)	t-test	Post-Match	Post-Match (Treated)	Difference (Control)	t-test
Overall Footfall	40.43	44.36	38.02	6.34	8.14	26.69	26.37	0.32	1.22
Distance from Home (in metres)	21363.31	13335.99	26356.39	-13020.4	-23.80	14005.05	14896.66	-891.61	1.40
TakeOut	16.09	16.42	15.89	0.54	1.75	8.71	8.86	-0.15	1.40
DineIn	27.35	30.73	25.29	5.44	12.84	18.96	18.68	0.28	1.36

Note: Apart from these continuous variables, the procedure performed an exact match based on zip code and restaurant sub-category.

3.3.3. Model Specification. We specify the empirical models as follows:

$$\ln Y_{it} = \alpha + \beta\, NonPartnered_i \#\# PostPolicy_{it} + \mathbf{X}_{it}\theta + \mu_i + \upsilon_t + \varepsilon_{it} \tag{1}$$

$$\ln Y_{it} = \gamma + \delta\, NonPartnered_i \#\# PostRegulation_t \#\# state_i + \mathbf{X}_{it}\theta + \mu_i + \upsilon_t + \varepsilon_{it} \tag{2}$$

where i and t index a restaurant and week, respectively and μ_i and υ_t represent the fixed effect for restaurant i and the time effect for week t. The outcome variables of interest, Y, are TakeOut_{it}, DineIn_{it} and $\text{TotalFootfall}_{it}$, which are the dependent variables defined in Table 1. The coefficients β and δ capture the DiD point estimates in the two settings i.e., the effect of being added to the platform and the effect of being removed from the platform.

4. Empirical Analysis and Results

4.1. Impact of Adding Restaurants without Consent

The results of model 1 are presented in Table 4. As seen in column (1), after being added to the platform without a formal partnership, these non-partnered restaurants saw a 2.63% increase in *TakeOut* visits (β = 0.026; ($e^{0.026}$-1)*100 = 2.63%). However, *DineIn* visits decreased by 4.3% (β = -0.044 in column (2); ($e^{-0.044}$-1)*100 = -4.3%). Finally, column (3) suggests that the overall footfall decreases by 1.5% (β = -0.015; ($e^{-0.015}$-1)*100 = -1.5%). These findings suggest that the platform's aggressive growth strategy of listing non-partnered restaurants, while it increases the total *TakeOut* orders, has a marginal negative outcome on restaurant footfall.

Heterogeneous Effects. In this section, we estimate the heterogeneous impact of listing non-partnered restaurants for chain versus an independent restaurants. We include a three-way interaction term that carries a value of 1 for a non-partnered chain restaurant after being listed. Table 5

Table 4 Main Effects of Being Added to the Platform on Restaurant Demand

	(1)	(2)	(3)
Dependent Variables	$log(TakeOut)$	$log(DineIn)$	$log(TotalFootfall)$
PostPolicy	0.006	0.005	0.009
	(0.004)	(0.006)	(0.005)
NonPartnered#PostPolicy	0.026***	-0.044***	-0.015**
	(0.005)	(0.007)	(0.006)
Constant	2.097***	2.796***	3.205***
	(0.003)	(0.003)	(0.003)
Observations	1,106,470	1,106,470	1,106,470
R^2	0.714	0.740	0.790
Restaurant FE	YES	YES	YES
Week Dummy	YES	YES	YES

Note. Standard errors clustered around restaurants in parentheses; *** p<0.001, ** p<0.01, * p<0.05

shows the model estimation. We find that the platform's aggressive growth strategy has differential effects on independent restaurants compared to the chain restaurants. From column (1), we find that the effect on $TakeOut$ visits is not significantly different. However, the negative impact on $DineIn$ visits or $TotalFootfall$ are only significant for independent restaurants, while chain restaurants see significant improvements in their $TakeOut$ and $Total$ orders. For example, being on the platform decreases the $DineIn$ visits of an independent restaurant by 4.88% ($e^{-0.050}$-1)*100 = -4.88%) while it increases the $DineIn$ visits of a chain restaurant by 8.22% ($e^{0.079}$-1)*100 = 8.22%. Though it is surprising that the $DineIn$ visits improve after being listed on a delivery platform, such an outcome could be an artefact of variable measurement. As noted in Table 1, any visits over 10 minutes are treated as $DineIn$ traffic in our analysis. However, it is likely that the pickup orders in chain restaurants are well over 10 minutes. Appendix Table A2 shows the median time spent inside the top 5 chain restaurants in our dataset. We see that for most chain restaurants that Grubhub does not have a partnership with, visitors spent over 10 minutes (median time) in the restaurant. Figure A1 in the appendix further shows that the median time spent on all chain restaurants is 13 minutes. Furthermore, not having a formal partnership means that the only way a driver can get the order from these chain restaurants is to stand in line and place the order. [8]

In summary, the first analysis suggests that being on the platform can improve the $TakeOut$ orders

[8] In an unreported table, we altered the definition of $DineIn$ visits as any visit that took more than 20 minutes. In that analysis, we found that the chain restaurants have meager gains (less than 1% increase) if any.

Table 5 Heterogeneous Effects: Independent Restaurants vs. Chains

	(1)	(2)	(3)
Dependent Variables	$log(TakeOut)$	$log(DineIn)$	$log(TotalFootfall)$
PostPolicy	-0.000	0.005	0.003
	(0.005)	(0.007)	(0.006)
NonPartnered#PostPolicy	0.029***	-0.050***	-0.017**
	(0.005)	(0.007)	(0.006)
NonPartnered#PostPolicy#ChainRestaurant	-0.004	0.079***	0.059**
	(0.016)	(0.022)	(0.019)
PostPolicy#ChainRestaurant	0.046***	-0.003	0.040**
	(0.010)	(0.014)	(0.012)
Constant	2.097***	2.796***	3.205***
	(0.003)	(0.003)	(0.003)
Observations	1,106,470	1,106,470	1,106,470
R^2	0.714	0.740	0.790
Restaurant FE	YES	YES	YES
Week Dummy	YES	YES	YES

Note. Standard errors clustered around restaurants in parentheses; *** p<0.001, ** p<0.01, * p<0.05

but cannibalize the $DineIn$ orders. Interestingly, such a substitution effect is only for independent restaurants, suggesting that policy changes need to be carefully evaluated to all types of stakeholders in the platform.

4.2. Impact of External Regulation to Delist Non-Partnered Restaurants

The outcomes so far suggest that being listed on a delivery platform has an overall negative outcome, especially for independent restaurants. This finding is consistent with some media reports that individual restaurants, facing an overall revenue and/or reputational losses, sued delivery platforms for losses after listing them on their platform without consent (Saxena 2020, Dowty 2021). Resultant media coverages promptly got lawmakers involved, and California became the first state to enact a law banning such growth strategies. However, no such regulation was enacted in neighboring states such as Oregon or Washington. We exploit this state-level differences in regulation enactment to study the effect of external regulation to counter platforms' aggressive growth strategy. As in the earlier section, we estimate the impact using PSM in conjunction with DiD, where the treated restaurants are nonpartnered and later delisted from the platform in California) and the control restaurants are similar restaurants that were not on the platform.

Estimation of model 2 is presented in Table 6. We focus on the coefficient δ, which captures the impact of regulation enactment in California that forced the platform to delist non-partnered restaurants. From column (1), we see that non-partnered restaurants in California experienced a 2.86% decrease in $TakeOut$ visits ($e^{-0.029}$-1)*100 = -2.86%). This result is consistent with our previous finding that non-partnered saw an increase in $TakeOut$ visits after being added to the platform. Delivery platforms benefit restaurants by increasing their take-out orders. However, $DineIn$ visits to these non-partnered restaurants did not recover from the level prior to being added to the platform (δ coefficient is insignificant in column (2)). This finding suggests that the California regulation had an overall negative effect on restaurants.

Heterogeneous Effects. To further investigate how such an external regulation helps(or hurts) chain versus independent restaurants, we performed sub-sample analysis. We estimated model 4 on two distinct sub-samples, one where treated-control pairs are independent restaurants and the other where the treated-control pairs are chain restaurants. The results are presented in Tables 7 and 8, respectively. The results suggest that retrospective external regulation did not have a statistically significant impact on chain restaurants in either $TakeOut$ or $DineIn$ (Table 8), whereas it actually hurts independent restaurants (Table 7). Coefficient δ in column (1) of Table 7 suggests that being delisted from the platform results in a drop in $TakeOut$ visits by 2.96 % ($e^{-0.029}$-1)*100 = -2.96%) while there is no change/improvement in the $DineIn$ visits that had dropped after the restaurant was listed on the platform without their consent.

5. Discussion and Conclusion

Our research is motivated by the increased relevance of food delivery platforms on restaurant businesses and the lack of empirical evidence linking these platforms' governance policies with restaurants' outcomes. The pandemic has accelerated the penetration of these platforms, which has consequently brought the attention of regulators in governing these platforms. We study one of the latest platform policies that attempt to grow the supply side of the platform inorganically: a controversial yet effective strategy to enlist thousands of restaurants on the platform without restaurants' consent. Our findings are summarized in Table 9.

The empirical findings suggest that listing restaurants as non-partners increases their $TakeOut$ visits but reduces their $DineIn$ visits. Taken together, these findings empirically suggest that

Table 6 Impact of Retrospective Regulation to Delist Non-Partnered Restaurants

	(1)	(2)	(3)
Dependent Variables	$log(TakeOut)$	$log(DineIn)$	$log(TotalFootfall)$
PostRegulation	0.346***	0.611***	0.562***
	(0.008)	(0.010)	(0.008)
NonPartnered #PostRegulation	0.025**	0.003	0.015
	(0.008)	(0.011)	(0.009)
NonPartnered #PostRegulation#State=California	-0.029**	0.007	-0.009
	(0.009)	(0.012)	(0.010)
PostRegulation #State=California	0.082***	0.091***	0.093***
	(0.007)	(0.009)	(0.007)
Constant	1.379***	1.430***	1.990***
	(0.004)	(0.005)	(0.004)
Observations	1,072,888	1,072,888	1,072,888
R-squared	0.695	0.668	0.758
Restaurant FE	YES	YES	YES
Week Dummy	YES	YES	YES

Note. Standard errors clustered around restaurants in parentheses; *** p<0.001, ** p<0.01, * p<0.05

Table 7 Impact of Retrospective Regulation: Independent Restaurants

	(1)	(2)	(3)
Dependent Variables	$log(TakeOut)$	$log(DineIn)$	$log(TotalFootfall)$
PostRegulation	0.323***	0.598***	0.546***
	(0.009)	(0.011)	(0.009)
NonPartnered#PostRegulation	0.030***	0.008	0.018
	(0.009)	(0.012)	(0.009)
NonPartnered#PostRegulation#State=California	-0.030**	0.008	-0.008
	(0.010)	(0.013)	(0.010)
PostRegulation#State=California	0.085***	0.091***	0.094***
	(0.007)	(0.009)	(0.007)
Constant	1.330***	1.402***	1.950***
	(0.004)	(0.005)	(0.004)
Observations	955,220	955,220	955,220
R-squared	0.669	0.659	0.745
Restaurant FE	YES	YES	YES
Week Dummy	YES	YES	YES

Note. Standard errors clustered around restaurants in parentheses; *** p<0.001, ** p<0.01, * p<0.05

being listed on the platform cannibalizes the $DineIn$ channel. In the past, the discussions on revenue losses have focused on drop in revenue per consumer (e.g., (Meyersohn 2018)). Our project empirically measures a drop in $DineIn$ footfall while the $TakeOut$ visits increase. Importantly, we find that the increase in $TakeOut$ visits do not compensate for a drop in $DineIn$ visits. This can be explained by the price-comparison mechanism of online platforms. Customers may prefer to order from a restaurant via a platform for convenience/cost reasons. Once they are on the platform, the consumer may find more-convenient partnered restaurants. Just being on the platform might drive

Table 8 Impact of Retrospective Regulation: Chain Restaurants

	(1)	(2)	(3)
Dependent Variables	$log(TakeOut)$	$log(DineIn)$	$log(TotalFootfall)$
PostRegulation	0.511***	0.711***	0.685***
	(0.023)	(0.029)	(0.022)
NonPartnered#PostRegulation	0.021	-0.028	0.009
	(0.028)	(0.037)	(0.029)
NonPartnered#PostRegulation#State=California	-0.041	0.002	-0.034
	(0.031)	(0.040)	(0.032)
PostRegulation#State=California	0.065***	0.089***	0.084***
	(0.018)	(0.024)	(0.018)
Constant	1.779***	1.658***	2.319***
	(0.011)	(0.014)	(0.011)
Observations	117,668	117,668	117,668
R-squared	0.776	0.703	0.798
Restaurant FE	YES	YES	YES
Week Dummy	YES	YES	YES

Note. Standard errors clustered around restaurants in parentheses; *** p<0.001, ** p<0.01, * p<0.05

substitutions from $DineIn$ to alternative restaurants. Additionally, we find that this dip in $DineIn$ visits are only for independent restaurants that were added to the platform as non-partners. Most chain restaurants are known to have standardized menus with competitive pricing. Therefore, being listed on the platform may cannibalize their $DineIn$ orders but most orders won't substitute out to a competitor. Conversely, independent restaurants see a substitution to competitor restaurants on the platform,, by virtue of their customized menu and comparatively more expensive prices.

From our second research question, we find that the regulation that removes non-partnered restaurants hurts restaurants by reducing $TakeOut$ visits, while $DineIn$ visits do not recover. Once a customer is accustomed to ordering food via delivery platform, they may be less willing to switch back to $DineIn$ or restaurant's own $TakeOut$ channels. Therefore, regulation does not restore pre-listing $DineIn$ traffic. Finally, the negative impact of policy enactment on restaurants' $TakeOut$ orders is pronounced for independent restaurants. Conversely, chain restaurants usually have competitive pricing which drives consumers to have a strong preference to a particular chain (e.g., (Chung 2019)). Therefore, when such a restaurant gets de-listed from a platform, consumers are more likely to explore other channels (e.g., the restaurants' preferred delivery partner or restaurants' own $TakeOut$ service) than switch to a competitor restaurant.

5.1. Implications of Our Research

Our findings have both theoretical and practical implications, including public policy implications.

Table 9 Summary of Major Findings

Research Question	Major Findings
RQ1: What are the effects of restaurants' listing on a on-demand delivery platform?	- Restaurants' $TakeOut$ orders increase by 2.63% but at the cost of $DineIn$ visits (-4.3%) - The observed dip in $DineIn$ visit is pronounced only for independent restaurants (-4.88%)
RQ2: What are the effects of retrospective regulation that de-lists non-partnered restaurants from the platform?	- De-listing from the platform decreases the $TakeOut$ order by 2.86% - The $DineIn$ visits do not recover from the fall it witnessed after the platform listed it as a non-partnered restaurant - The fall in $TakeOut$ order is only for independent restaurants (-2.96%)

5.1.1. Theoretical Implications. The platform literature on growth strategies in two-sided networks (Rochet and Tirole 2003, Parker and Van Alstyne 2005, Boudreau 2010, Zhu and Iansiti 2012, Economides and Viard 2007) have demonstrated the importance of proactive platform growth strategies using various levers (such as price, quality, entry decisions, and platform openness). Growth strategies that involve adding participants to platforms without consent have not been well understood, because operating without suppliers' consent is a special form of business relationship. However, in multi-sided network, where there are dedicated sides (like deliverer) that enable the transaction by bypassing explicit contracts between buyers and sellers, we are in a unique position to study the impact of such strategies.

5.1.2. Practical Implications. Platforms' primary argument in adding restaurants without consent was that it would provide restaurants with free advertising and additional revenues. However, our finding suggests that the outcomes are heterogeneous, depending on whether the restaurant is a chain or independent, or whether the restaurant relies on $TakeOut$ or $DineIn$ orders. More importantly, once a restaurant of a specific type is on the platform, their $DineIn$ revenues are irreversibly affected even if the restaurant has been delisted. This finding cautions against under-tested growth strategies that may have reputational repercussions for the platforms.

Next, we note that retrospective policy enactment does more harm to the intended recipients than good. Policy makers often respond to concerns raised by businesses and media to try to mitigate the bad press coverage. However, our research joins prior research (e.g., Li and Wang (2021)) in showing that retrospective policy enforcement does not help. . Once the restaurant has been listed and orders have been placed via the platform, it may hurt a restaurant to put efforts to get delisted from the platform. They may be better off adapting their strategies for platform delivery. For instance, they may put standardized menu items on the platform and only serve elaborate ones via *DineIn*.

Finally, we also note that retrospective policy enactment does more harm to the intended Beneficiaries than good. Policy makers often passively respond to concerns raised by businesses and media to mitigate possible bad press coverage. However, our research joins prior research (e.g., Li and Zhu (2020)) in showing that retrospective policy enforcement may backfire. It may be beneficial for a policymaker to proactively anticipate platforms' moves and throttle any untested/under-tested strategies, which may create more social harm than good. It may also be beneficial for policy makers to nudge platform owners to self-regulate by credible threats of proactive regulations (Gawer and Srnicek 2021).

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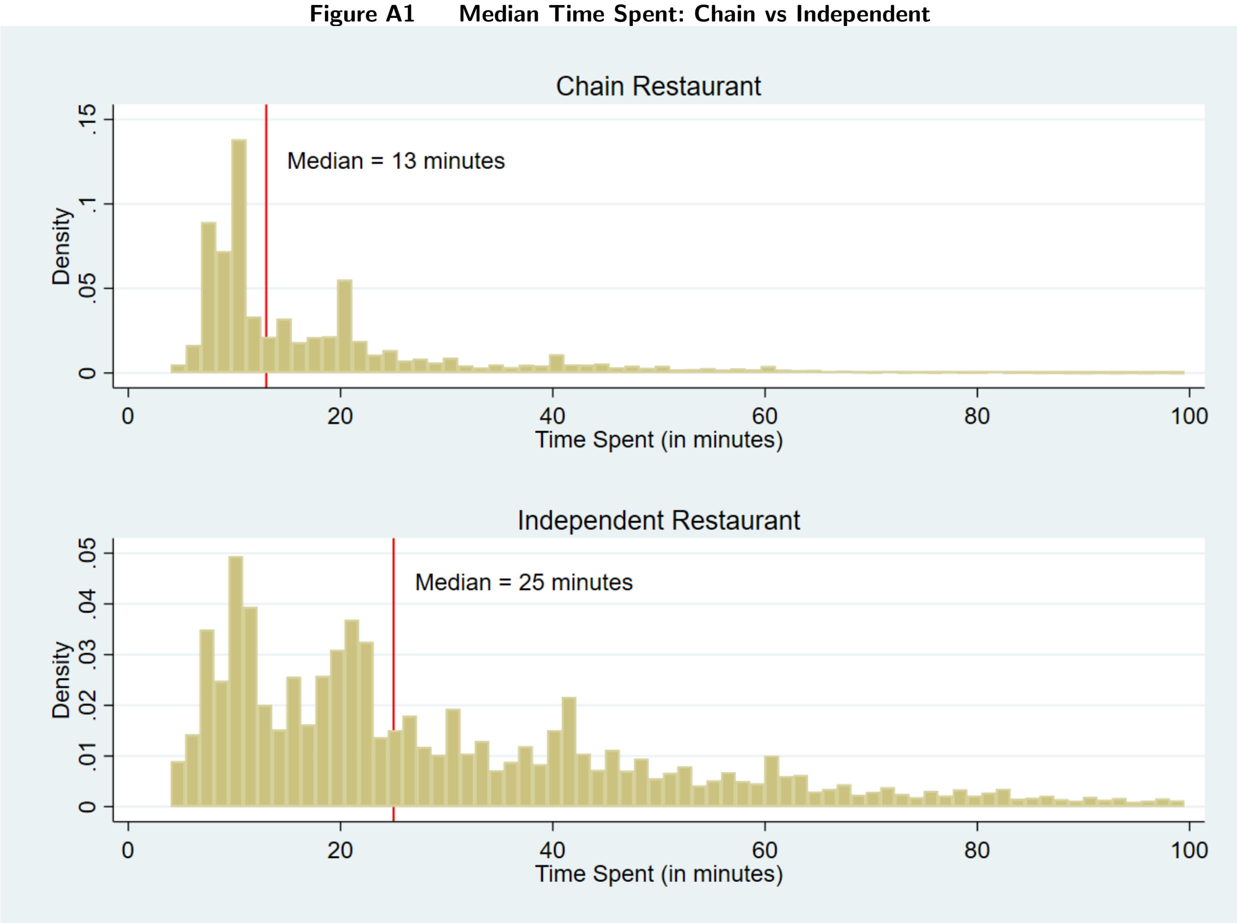
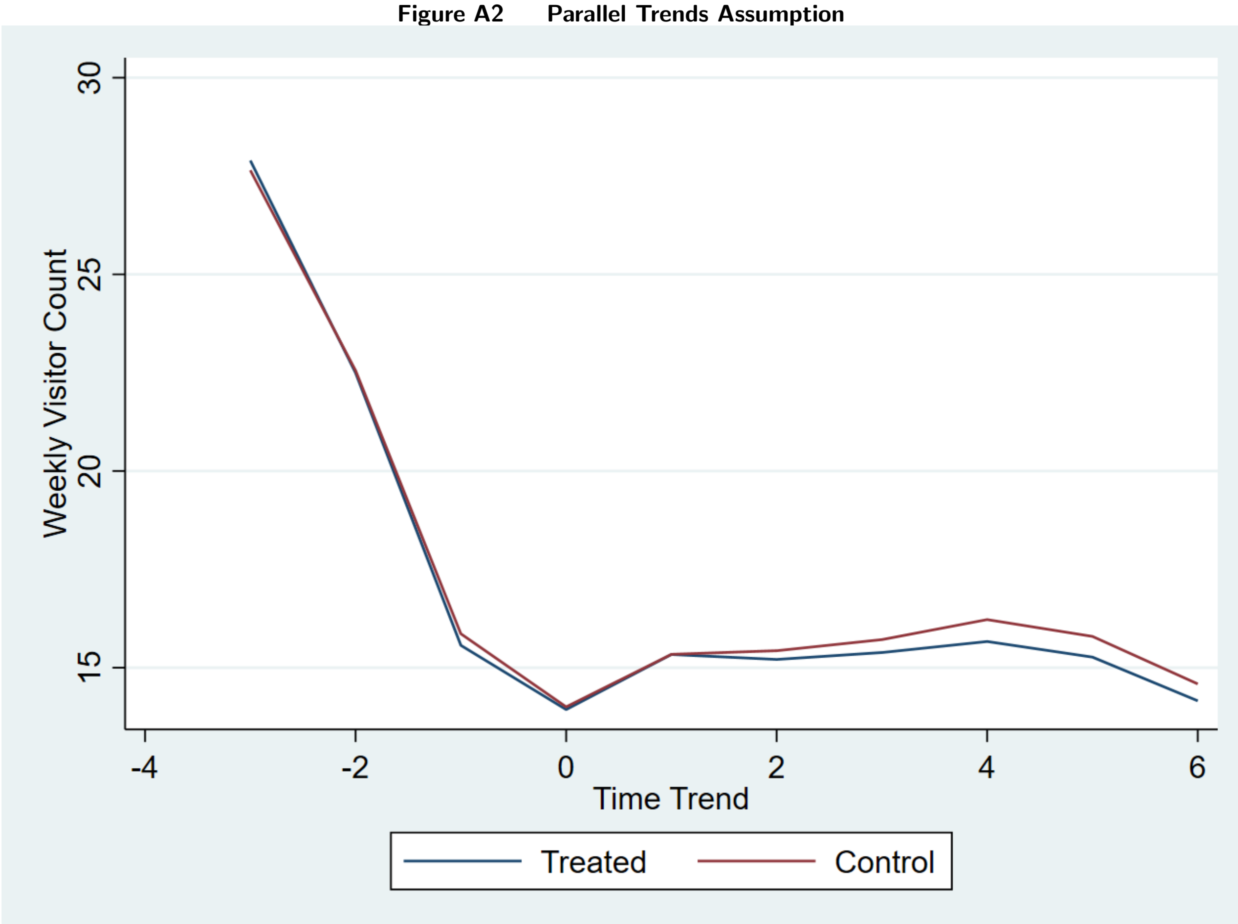
Appendix. Figures and Tables

Figure A1 Median Time Spent: Chain vs Independent



Note: A delivery person typically stands in line to pick up the chain restaurant order especially when the chain restaurant is not partnered. In case of an independent restaurant, they can place the order over phone and pick it up later

Figure A2 Parallel Trends Assumption



Note: The treatment (restaurant listed as non-partnered restaurant) happens at t=0

Table A1 Relative Time Model

	(1)	(2)	(3)
Dependent Variables	$log(TakeOut)$	$log(DineIn)$	$log(TotalFootfall)$
$NonPartnered_i Xtime_{t-6}$	0.003	0.000	-0.008
	(0.012)	(0.011)	(0.011)
$NonPartnered_i Xtime_{t-5}$	-0.005	-0.001	0.002
	(0.012)	(0.011)	(0.011)
$NonPartnered_i Xtime_{t-4}$	0.002	0.000	-0.002
	(0.012)	(0.011)	(0.011)
$NonPartnered_i Xtime_{t-3}$	0.004	0.003	0.006
	(0.012)	(0.011)	(0.011)
$NonPartnered_i Xtime_{t-2}$	-0.018	-0.013	0.000
	(0.012)	(0.011)	(0.011)
$NonPartnered_i Xtime_{t-1}$	-0.011	-0.000	0.005
	(0.012)	(0.011)	(0.011)
$NonPartnered_i Xtime_t$		(Omitted)	
$NonPartnered_i Xtime_{t+1}$	-0.015	0.011	0.046**
	(0.017)	(0.016)	(0.016)
$NonPartnered_i Xtime_{t+2}$	-0.072***	-0.078***	-0.073***
	(0.019)	(0.017)	(0.017)
Constant	1.405***	1.965***	1.375***
	(0.007)	(0.006)	(0.006)
Observations	510,529	510,529	510,529
R-squared	0.218	0.203	0.070
Restaurant FE	YES	YES	YES
Month Dummy	YES	YES	YES

Note: Standard errors clustered around restaurants in parentheses
*** p<0.001, ** p<0.01, * p<0.05
We collapse the dataset to month level for this analysis

Table A2 Median Time Spent

Restaurant	Median Time Spent (Minutes)	Exclusive Partnership
Starbucks	11	UberEats
Subway	14	DoorDash, Grubhub, Postmates, UberEats
McDonald's	9	UberEats (2017), DoorDash (2019)
Domino's Pizza	20	ShopRunner, Own Fleet
Jack in the Box	9	Own Fleet, DoorDash (for some time), Grubhub

Note. If a chain has not partnered with a platform, deliverer would manually place the order by standing in a line

Table A3 Impact of Retrospective Regulation: Independent Restaurants

	(1)	(2)	(3)
Dependent Variables	$log(TakeOut)$	$log(DineIn)$	$log(TotalFootfall)$
PostRegulation	0.344***	0.625***	0.572***
	(0.009)	(0.012)	(0.009)
NonPartnered#PostRegulation	0.028**	0.007	0.018
	(0.011)	(0.014)	(0.011)
PostRegulation#California	0.084***	0.077***	0.083***
	(0.008)	(0.011)	(0.009)
PostRegulation#Oregon	0.004	-0.037*	-0.025*
	(0.012)	(0.016)	(0.013)
PostRegulation#Washington		(Omitted)	
NonPartnered#PostRegulation#California	-0.031**	0.003	-0.012
	(0.012)	(0.015)	(0.012)
NonPartnered#PostRegulation#Oregon	-0.007	-0.011	-0.008
	(0.017)	(0.022)	(0.018)
NonPartnered#PostRegulation#Washington		(Omitted)	
Constant	1.379***	1.430***	1.990***
	(0.004)	(0.005)	(0.004)
Observations	1,072,888	1,072,888	1,072,888
R-squared	0.695	0.668	0.758
Restaurant FE	YES	YES	YES
Week Dummy	YES	YES	YES

Note.Standard errors clustered around restaurants in parentheses; *** p<0.001, ** p<0.01, * p<0.05