Bring me my Meal on your Wheel
An Empirical Analysis of the Impact of Food Delivery Platforms on Local Restaurant Employment

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Abstract

Food delivery platforms have become an established part of the urban dining culture, but their success is reliant upon gig workers. While prior research has uncovered substantial socioeconomic consequences associated with the platform economy, little is known about how delivery platforms affect local employment. Using a quasi-experimental research design, this paper explores the impact of the spatiotemporal market entry of Grubhub, Postmates, DoorDash, and UberEats on local restaurant employment. Expanding upon prior theoretical work, our analysis suggests that the entry of delivery platforms does not affect restaurants' demand, as the number of food preparation-related workers remain unchanged. However, as those platforms fundamentally reduce the number of dine-in service workers, we find an overall negative impact on local restaurant employment, which is only partially compensated for by an increase in gig workers (i.e., delivery drivers). Our findings inform policy makers and the restaurant industry on the macroeconomic impact of such platforms.

Keywords: Platform Economy, Food Delivery Platforms, Restaurant Employment, Quasi-Experiment.

1. Introduction

In recent years, one of the most impressive transformations brought about by the gig economy has been the emergence of on-demand food delivery platforms. Delivery services like Grubhub, Postmates, UberEats, and DoorDash have become a large and rapidly growing segment of the restaurant industry (Chen et al., 2022; Feldman et al., 2022). Connecting restaurants with customers via a smartphone app, these on-demand platforms have established a comfortable and easy service for customers to get food delivered directly to their door (Chen et al., 2022). Delivery platforms collect orders, transmit them to participating restaurants, where the food is prepared before it is delivered to the customer by gig workers fulfilling the role of delivery drivers. The worldwide food delivery app market is expected to grow from $140 billion in 2022 to $320 billion in 2029, and has seen the largest growth rate during the COVID-19 pandemic in 2020 (Business of Apps, 2022).

For consumers, delivery platforms create value by expanding options for food consumption whilst, crucially for some, obviating the time spent travelling to restaurants and waiting to be served (Chen et al., 2022; Feldman et al., 2022). For restaurants, these platforms provide an easy way to access an additional distribution channel for their business and to enter the delivery market without investing in delivery vehicles and staff (Li & Wang, 2020a; Meyerson, 2018). Without these delivery platforms fulfilling the role as a third-party delivery service provider, some restaurant owners claim that they wouldn't have offered any delivery service at all (Feldman et al., 2022). For the labor market, the trend of emerging food delivery platforms thus may also be beneficial. Apart from the gig workers (i.e., delivery drivers) needed for the operational business of food delivery, restaurants may also hire additional employees (i.e., for food preparation) to satisfy the potentially increased demand for take-away services resulting from food delivery platforms.

However, both anecdotal (Hadfield, 2020; Meyerson, 2018) and scholarly evidence (Feldman et al., 2022; Li & Wang, 2020a) points towards adverse effects of food delivery platforms on the restaurant industry. Although delivery platforms often promote themselves for providing a supplemental consumer base for restaurants, they demand high commission fees of between 15% and 30% of the meal price and additional fees for the delivery driver, which arguably limits the profitability of such orders for restaurants (Hadfield, 2020). Anecdotal evidence from a restaurant owner describes the situation as follows: "We know for a fact that as delivery increases, our profitability decreases. […] Sometimes it seems like we're making food to make [delivery platforms] profitable" (Dunn, 2018). Additionally, as restaurants

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need to manage orders from multiple customer streams, a large volume of delivery orders may hinder restaurant workers to perform their service operations within the restaurant, creating congestion and lowered service quality that may negatively affect dine-in customers (Feldman et al., 2022). Reduced restaurant profitability and reduced dine-in sales caused by delivery platforms would, as a result, entail negative macroeconomic consequences, such as a reduction in employment in the restaurant sector (i.e., dine-in related workers like waiters or hosts) and in overall local earnings as a consequence of well-trained restaurant personnel being substituted for low-wage delivery drivers. For instance, a recent study has shown that median wages for delivery drivers in NYC are substantially lower than minimum wage (Mulvaney, 2021). Moreover, there is evidence from various countries that delivery drivers in the gig economy are facing difficult working conditions such as a lack of accident insurance and time pressure (e.g., no time and not allowed to use restrooms at restaurants) (Mulvaney, 2021; Shigong, 2020)

Given the potential range of both positive and negative implications of food delivery platforms on local economies, it is surprising that scholars have paid scant attention to the macroeconomic outcomes of food delivery platforms for the labor market in the restaurant industry. Naturally, one can expect that changes to employment patterns accompany platform entries, but it remains unclear how these changes might manifest. On the one hand, the potential rise in demand resulting from food delivery platforms may require additional workers— gig workers (i.e., delivery drivers) and restaurant employees— while, on the other, food delivery platforms may cause a reduced demand for dine-in sales and, hence, the profitability of restaurants, which in turn would be associated with a decrease in local employment rates, at least in the restaurant sector.

This lack of knowledge presents a challenge for local governments, platform owners, and customers, who are concerned with major societal challenges caused by unemployment. According to the National Restaurant Association, the restaurant industry is the second largest private-sector employer with 15.3 million workers in the US in 2019 (National Restaurant Association, 2019). Moreover, as 80% of the people surveyed from the National Restaurant Association reported that their first paid job was in a restaurant, the industry is crucial for young people wanting to gain their first experience in the world of labor (Adams, 2018). If the restaurant workforce declines as a result of emerging food delivery platforms, problems associated with unemployment might occur more frequently, especially among younger people, such as higher levels of poverty, criminality, and social injustice (Jawadi et al., 2021; Raphael & Winter-Ebmer, 2001).

To this end, the empirical investigation of the macroeconomic effects of food delivery platforms on employment rates across different jobs in the restaurant industry would imply either a stronger need for platform regulation (in case of increasing unemployment) or for platform subsidization (in case of decreasing unemployment). To address this knowledge gap on the macroeconomic consequences of food delivery platforms, we pose the following research question: *What effect does the entry of food delivery platforms have on employment rates across different job types in the restaurant industry?*

Prior theoretical work suggests that the introduction of food delivery platforms does not increase demand for restaurants, but just changes the composition of customers, with an increased demand for take-away orders and fewer dine-in customers (Chen et al., 2022). To empirically test the suggested relationship and its impact on employment rates, we analyze the stepwise rollout of the four largest food delivery platforms in US-based metropolitan areas: Grubhub, Postmates, UberEats, and DoorDash (Carson, 2019). Applying a *quasi-experimental research* approach by combining the spatiotemporal market entries of the gig economy-based delivery platforms with an employment dataset from the Current Population Survey (CPS IPUMS, 2021), our empirical results suggest that, consistent with prior theoretical work, the entry of food delivery platforms does not change the restaurants' demand, as the number of workers in food preparation (i.e., chefs and food preparers) remains unchanged after the entry of food delivery platforms. However, we see a decrease in the number of dine-in related workers (i.e., food hosts and food waiters), suggesting that dine-in customers are partly replaced by food delivery customers. Moreover, we show that the overall negative effect on restaurant employment is only partially compensated for by an increase in gig workers (i.e., delivery drivers).

This paper makes several contributions to the literature. First, our research findings contribute to the small but growing stream of literature investigating the socioeconomic impact of on-demand food delivery platforms by demonstrating how such food delivery apps influence the labor market (Babar et al. 2021; Chen et al. 2022). Second, our research informs restaurant providers about the possible downsides of cooperating with food delivery platforms. And third, our results provide new insights for both delivery platform providers and municipal governments, calling for a regulatory framework for on-demand

food delivery platforms to protect employment in the restaurant industry.

2. Related Literature

This research is related to two streams of literature, namely (1) studies investigating the impact of gig economy platforms on employment, and (2) studies investigating the effects of food delivery platforms on the restaurant industry.

Concerning the first stream of literature, one research study has shown that the entry of the gig economy platform UberX significantly reduces entrepreneurial activity in terms of self-employment rates, because of the viable employment such platforms offer for the unemployed and underemployed (Burtch et al., 2018). This relationship is strengthened by another study demonstrating that local unemployment is associated with an increase in the volume of humans actively working on online freelancer platforms (Huang et al., 2020). On-demand platforms like UberX can be particularly valuable for workers as they both offer real-time flexibility and a source of additional income (Hall & Krueger, 2018). We add to this stream of literature by investigating another type of on-demand platform, namely food delivery platforms. We provide evidence that gig economy platforms may cause major structural employment shifts, with a positive impact on working positions that are associated with such platforms and a negative impact on rather traditional working positions like dine-in service personnel.

Moreover, a growing stream of literature has explored how digital platforms affect traditional businesses, for example, home sharing platforms like AirBnb disrupting the hotel industry (e.g., Zervas et al., 2017), or ride hailing platforms like Uber impacting transportation businesses (e.g., Babar & Burtch, 2020). With regards to the relationship between food delivery platforms and restaurants, prior theoretical work has already examined how different types of contracts between these two parties affect restaurant revenues (Feldman et al., 2022). They found that the predominant industry contract, where the food delivery platform takes a commission for each delivery order, even reduces the restaurant's margins. Instead, restaurants should pay the platform a percentage revenue share and a fixed fee. According to the proposed theoretical model, such a contract could effectively coordinate the system by ensuring both restaurant and platform profitability. However, an empirical investigation of the relationship between food delivery platforms and the restaurant industry contradicts these results, as it has been shown that restaurants in Chicago, that signed up to a one-way revenue sharing contract with delivery platforms, overall benefit from on-demand delivery services due to an increase in takeout sales, while creating positive spillover effects for dine-in visits (Li & Wang, 2020a). This positive effect is estimated to be four times larger for fast food chains than for independent restaurants. Furthermore, empirical research also demonstrates that during a crisis like the COVID-19 pandemic, independent restaurants that participate on on-demand delivery platforms are less negatively affected by the pandemic and can thus increase their survival rate (Li & Wang, 2020b; Raj et al., 2021). Still, there are also negative effects of on-demand delivery apps for individual restaurants, due to increased competition between restaurants (Chen et al., 2022; Raj et al., 2021). Especially for higher priced restaurants, food delivery platforms hinder the possibility to differentiate from other competitors with characteristics like an outstanding atmosphere and high-quality service (Chen et al., 2022). On a societal level, food delivery platforms are associated with negative health issues such as an increase in the average BMI, as the most frequently ordered food items are often high in calories (Babar et al., 2021). Taken together, despite the adverse economic and societal consequences of food delivery platforms that prior literature has found, empirical research on the relationship between food delivery platforms and macroeconomic outcomes (i.e., restaurant employment rates) remains scant. In particular, the relationship between delivery platforms and the restaurant industry being complementary represents a unique setup when compared to previously platform cases such as UberX and Airbnb being substitutes for the taxi and hotel industry, respectively. To address this gap, we (1) study how the entry of delivery platforms into local markets transposes employment rates in the restaurant industry and (2) analyze which types of restaurant workers are influenced the most by such on-demand platforms.

3. Theoretical Background

This research builds on prior theoretical work that analyzes the long-term impact of food delivery platforms on the restaurant industry (Chen et al., 2022). Similar to prior research building on such models (Gutt et al., 2019; Müller et al., 2022), we aim to contribute to theory by providing empirical support for predictions derived from the analytical model. Chen et al. chose to model restaurant services as a stylized service chain with a first-in-first-out principle, where two customer streams need to be served by restaurants: the tech-savvy customers with access to food delivery platforms, and traditional customers that

cannot use food delivery platforms (i.e., due to a lower level of digital readiness) and thus prefer to dine-in. In their theoretical model, restaurants, customers, and food delivery platforms participate in a Stackelberg game. In a decentralized system, where the restaurant and the food delivery platform maximize their profits independently from each other, the restaurant first sets a profit-maximizing food price and then the food delivery platform sets its profit-maximizing delivery fee and gig-worker wages. Finally, customers have the choice to either walk-in to the restaurant, to balk, or, in case of a tech-savvy customer, to use a food delivery platform. The model assumes that dine-in, take-out, and food delivery orders generate the same service reward for the customer, that customers have linear waiting time for food which can be used more efficiently when waiting at home (i.e., when using food delivery platforms), and that the food price is the same for walk-in and food delivery customers. Using backward induction to derive equilibrium food prices, delivery fees, and arrival rates to the system, the theoretical model proposes that, if the base of traditional customers is sufficiently large or the food delivery platform is not sufficiently convenient, then the restaurant will not respond to the introduction of the food delivery platform and will operate as in a delivery-irrelevant manner. As the number of tech-savvy customers increase, both the profit of the platform and social welfare weakly increase. However, the demand for the restaurant does not increase in such a situation but merely changes the composition of the restaurant's customers, as the segment of tech-savvy customers grows. These tech-savvy customers were traditional dine-in customers prior to the entry of food delivery platforms and now ask for less profitable food delivery orders instead. Hence, if restaurants pay the platform to bring in customers, cooperating with the platform will reduce the restaurants' profitability.

Transferring these theoretical insights to derive the long-term impact of food delivery platforms on the restaurant labor market, we expect that the segment of traditional customers is sufficiently large in the US, i.e., in 2019, 28.9% of the population used food delivery platforms (Samsukha, 2022). In this case, the theoretical model predicts that the restaurant's demand is not increased by food delivery platforms but just changes the composition of the orders (i.e., dine-in and delivery orders). As all of these orders need to be prepared and cooked regardless of the order type, we expect that food preparation-related workers (i.e., chefs or food preparators) are not significantly affected by food delivery platforms:

Hypothesis 1: The introduction of food delivery platforms does not affect the number of food preparation-related workers.

However, the theoretical model also states that the composition of the food orders will change after the introduction of food delivery platforms. As it is now possible to order food online, some tech-savvy customers will now prefer to order food via the delivery platform instead of dining in the restaurant. Thus, there will be an increasing rate of delivery orders and a decreasing number of dine-in customers. With regards to the restaurant workers that take care of dine-in related services (i.e., food hosts and food waiters), we formulate the following hypothesis:

Hypothesis 2: The introduction of food delivery platforms is associated with a decrease in dine-in related restaurant workers.

Taken together, given that the number of dine-in related workers will decrease and that the commission fees asked by delivery platforms arguably limit the profitability of such orders (Hadfield, 2020) which could cause restaurants to further reduce their staff, we expect to find an overall negative relationship between the entry of food delivery platforms on the general restaurant employment:

Hypothesis 3: The introduction of food delivery platforms is associated with a decrease in the number of workers in the restaurant industry.

4. Empirical Analysis

4.1. Research Setup and Data

To empirically test our hypotheses, we analyze the spatiotemporal rollout of the four largest food delivery platforms into US-based metropolitan areas: Grubhub, Postmates, UberEats, and DoorDash (Carson, 2019). All of these firms share similar business models: they operate as a multi-sided platform that connects local restaurants with customers and deliver the meals to the customer's doorstep with the aid of gig workers as delivery drivers (DoorDash, 2022; Grubhub, 2022; Postmates, 2022; UberEats, 2022). Even though the popularity of each platform differs per metropolitan area, together they held more than 95% of the food delivery market share of the US in March 2018 (Molla, 2018).

Following the example of Babar et al. (2021), we identify local areas where Grubhub, Postmates, UberEats, and DoorDash have already been launched, by collecting a list of cities where gig workers can sign up as delivery drivers from the platforms' websites.

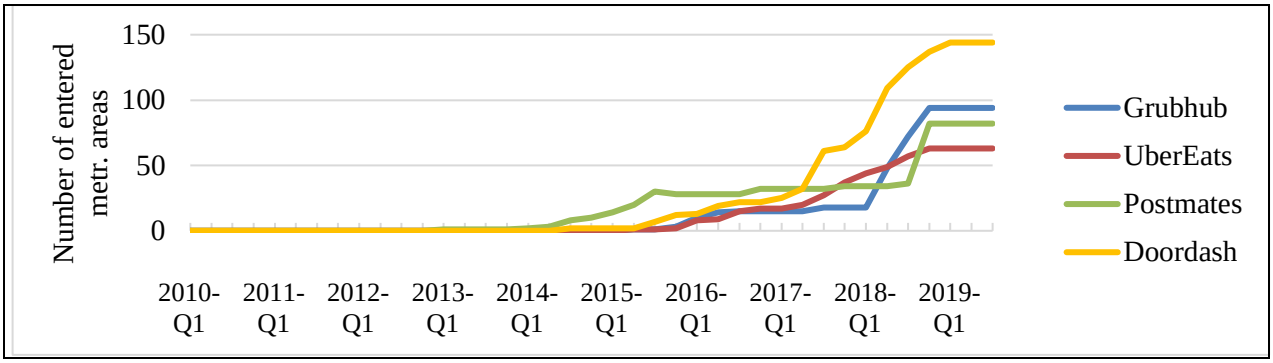

Figure 1. Number of Metropolitan Areas where Food Delivery Services are Available over Time.

Afterwards, we searched for the exact entry dates of each platform into these markets by investigating related press releases and news reports. Up to the end of 2019, the four food delivery platforms together have entered at least 322 US-based metropolitan areas. An overview of the number of metropolitan areas by platform by the end of 2019 as well as the number of metropolitan areas for which we have identified an exact entry date can be found in Table 1.

Table 1. Number of Entered Metropolitan Areas with an Exact Entry Date.

Food Delivery Platform	Number of entered metr. areas by the end of 2019	Number of metr. areas with an exact entry date
Grubhub	285	94
UberEats	219	63
DoorDash	303	144
Postmates	317	82

To rule out any distortions created by metropolitan areas for which we cannot obtain any entry date, we removed these 107 areas from our dataset. Consequently, we only include the remaining 215 metropolitan areas with an entry date for at least one of these platforms in our dataset. Figure 1 displays the stepwise rollout of the four food delivery platforms into these metropolitan areas over time. Starting on 30th March 2013, the platform Postmates was first available for food delivery in New York City, NY. From 2014 onwards, Postmates expanded its operations to other metropolitan areas, followed by DoorDash, Grubhub and UberEats, which started their gig worker business in 2015. Since 2017, all of the platforms have grown considerably, with DoorDash having entered the most metropolitan areas by the end of 2019.

For our empirical analysis, we computed the quarter in which the first of the four delivery platforms was available ($EARLIEST\_ENTRY\_QUARTER$) for each metropolitan area of our dataset.

Table 2 presents a sorted excerpt of the earliest entry quarters for the metropolitan areas. One can observe that food delivery platforms are likely to enter larger metropolitan areas (e.g., New York, NY; Los Angeles, CA) at an earlier quarter compared to smaller areas (e.g., Billings, MT).

Table 2. Excerpt of First Entry Quarters of Metropolitan Areas.

No.	Metr. area	First Entry Quarter
1	new york-northern new jersey-long island, ny-nj-pa	Q1/2013
2	los angeles-long beach-santa ana, ca	Q1/2014
3	los angeles-long beach-anaheim, ca	Q1/2014
4	boston-cambridge-quincy, ma-nh	Q3/2014
5	boston-cambridge-newton, ma-nh	Q3/2014
6	san diego-carlsbad-san marcos, ca	Q3/2014
7	las vegas-paradise, nv	Q3/2014
8	denver-aurora, co	Q3/2014
9	san francisco-oakland-fremont, ca	Q4/2014
10	chicago-naperville-joliet, il-in-wi	Q4/2014
…	…	…
215	billings, mt	Q1/2019

In order to measure how the phase rollout of food delivery platforms into metropolitan areas affects local restaurant employment across different job positions, we leverage the count of workers employed in any position in the restaurant industry by using publicly available data from the Current Population Survey (CPS) on a metropolitan area level (CPS IPUMS, 2021) which is frequently used in empirical work studying local employment (e.g., Burtch et al., 2018).

This dataset comprises a statistically representative sample of individuals from households living in these areas. We have information on how many of these individuals are working as a delivery driver (*NUM_DELIVERYDRIVERS*) or in any position in the restaurant industry (*NUM_RESTAURANT_EMPLOYEES*). The dataset also contains information for selected working positions within the restaurant industry, including the number of food preparation workers (i.e., chefs or food preparers) (*NUM_FOODPREP_REL_WORKERS*) and the number of dine-in service workers (i.e., waiters and hosts) (*NUM_DINEIN_SERVCIE_WORKERS*). Chefs directly participate in the preparation, seasoning, and cooking of meals and additionally plan and price menu items, whereas food preparation workers perform routine tasks under the direction of chefs (Bureau of Labor Statistics, 2021). Waiters take orders and serve food and beverages to customers, and hosts/hostesses greet guests and seat them at tables (Bureau of Labor Statistics, 2021). Additionally, we obtain a set of time-varying control variables for each metropolitan area from the CPS, including population size (i.e., a categorial variable spanning from 0: 0 – 100,000 to 6: 5,000,000 or more), general unemployment rates, annual family income, age, and dummies for gender, race, marital status and educational status. Table 3 presents summary statistics of our dataset, which can be interpreted as quarterly metropolitan area averages weighted by mean individual population weights from our panel dataset spanning the period from 2010 to 2019.

Table 3. Summary Statistics.

Variable	Mean	Std. Dev.
NUM_RESTAURANT_EMPLOYEES	31,649	49,800
NUM_DELIVERYDRIVERS	13,076	22,140
NUM_FOODPREP_REL_WORKERS	14,630	24,138
NUM_DINEIN_SERVCIE_WORKERS	10,781	17,863
INCOME ($ per year)	73,124	15,597
AGE	37.96	3.49
IS_MALE	0.49	0.03
IS_AFROAMERICAN	0.12	0.12
IS_MARRIED	0.40	0.05
HAS_BACHELOR_DEGREE	0.15	0.04
POPULATION_SIZE	2.69	1.34
UNEMPLOYMENT_RATE	0.08	0.03

Note: Due to space limitations, we only include the summary statistics of one dummy variable for gender, race, marital status, and educational status. However, in our empirical analysis, we do include all of the dummies.

4.2. Empirical Model

To investigate the effect of food delivery platform entrance onto local restaurant employment, we employ a difference-in-differences specification with time leads and lags (Autor, 2003). This specification allows us to carry out a *quasi-experimental research design*, as the entry of food delivery platforms happened at different time points for each metropolitan area (Burtch et al., 2018). Thus, we use untreated metropolitan areas (i.e., areas in which food delivery platforms have not yet entered) as controls for treated metropolitan areas (i.e., areas in which food delivery platforms have already entered). The corresponding regression equation is depicted in equation 1:

$$Y_{it} = \sum_{j} \beta_j \cdot \varphi_{it} + X_{it} + \tau_t + \delta_i + \varepsilon_{it} \qquad (1)$$

Here, Y_{it} is the number of employees working in a specific position within the restaurant industry (i.e., *NUM_FOODPREP_REL_WORKERS*, *NUM_DINEIN_SERVCIE_WORKERS*) in metropolitan area i at time t (quarter-year combination). In further models, Y_{it} is replaced by the number of total workers employed in the restaurant industry (i.e., *NUM_RESTAURANT_EMPLOYEES*) and by the number of delivery drivers (i.e., *NUM_DELIVERY_DRIVERS*). Then, φ_{it} represents a vector of relative time dummies. These dummies indicate the relative time distance of quarter t to the quarter where the first of the four delivery platforms was available in metropolitan area i (i.e., time distance to *EARLIEST_ENTRY_QUARTER*). Note that we collapse all pre- and post-treatment periods that are equal or greater to six quarters prior to or following treatment (Burtch et al., 2018). Even though the market share of each delivery platform differs per metropolitan area (Molla, 2018), we used the entry of the first delivery platform as the treatment, because every food delivery platform that enters a metropolitan area afterwards should even increase the estimated effects, given that all of the four delivery platforms under investigation operate in a similar manner.

To account for the non-random assignment of food delivery platforms in metropolitan areas at different time points (e.g., due to location-specific characteristics), we assign a vector of time-varying control variables X_{it}, which includes population size, family income, age, unemployment rates and dummies for gender, race, marital- and educational status. Moreover, we include time-fixed effects τ_t (i.e., quarter-year combinations) in our model to control for unobserved time-specific restaurant employment

patterns. Finally, δ_i are metropolitan area fixed effects to control for any time-invariant metropolitan area-specific characteristics (e.g., geographic location), and ε_{it} represents the random error term. In our empirical analysis, we weight all observations by mean individual population weights.

4.3. Results and Discussion

Table 4 reports our empirical results when estimating equation 1. The variable "1 quarter before first entry" is omitted such that it serves as a reference point for prior and subsequent interpretations of the coefficients in the model. First, we find insignificant coefficients in the quarters before the first food delivery platform has entered a market in all models. This means that the untreated metropolitan areas (i.e., areas in which food delivery platforms have not yet entered) and treated metropolitan areas (i.e., areas in which food delivery platforms have already entered) followed the same restaurant employment patterns prior to the entry of the first food delivery platform, conditional on all the covariates used in our empirical specification. Thus, we find support for the common trends assumption (Autor, 2003).

Model 1 shows the coefficients for the number of food preparation workers as the dependent variable. We find insignificant coefficients after the first delivery platform has started to enter metropolitan areas, meaning that the number of food preparation-related workers does not significantly change when food delivery platforms enter local markets, compared to the number of food preparation workers one quarter before the first entry of a food delivery platform. Thus, we find support for *Hypothesis 1*.

In Model 2, we estimate our regression equation with the number of dine-in related service workers as the dependent variable. We find a significant decrease of about 1,518 dine-in service workers (-14.1%, calculated by dividing the regression coefficient by the mean of the dependent variable from Table 3) half a year after the first food delivery platform has entered a metropolitan area, compared to the number of dine-in workers one quarter before the first entry of a food delivery platform. This decrease also stays significant three quarters after the first entry of a food delivery platform and five quarters after the first entry. After six or more quarters, we find a decrease of about 1,973 dine-in related service workers (-18.3%). As we generally observe a decrease in the number of dine-in workers, we also find support for *Hypothesis 2*.

Model 3 shows the results of equation 1 with the total number of restaurant employees as the dependent variable. Here, too, we observe a decreasing number of restaurant employees. For example, one quarter after the first food delivery platform has entered metropolitan areas, we observe a decrease in the total number of restaurant employees by about 2,473 (-7.8%), rising to 3,763 (-11.9%) fewer restaurant employees after one year, compared to the number of restaurant workers one quarter before the first entry of a food delivery platform. Consequently, we also find support for *Hypothesis 3*. Lastly, we estimate equation 1 with the number of delivery drivers as the dependent variable. Six quarters or more after the first food delivery platform has entered local markets, we find a significant increase in the number of delivery drivers by about 1,790 (13.7%).

Taken together, the results suggest that the entry of food delivery platforms that are realized via gig workers negatively affects local restaurant employment. Consistent with prior theoretical work (Chen et al., 2022), our results indicate that the general demand for restaurants is likely to be unaffected by the entry of food delivery platforms, as the number of food preparation-related workers stays constant over time. However, as we find a negative relationship between the entry of food delivery platforms and the number of workers employed in serving-related positions, our results indicate a substitution effect of food delivery services on restaurant dine-in orders. As take-away orders stemming from food delivery platforms are less profitable for restaurants due to the high commission fees for each order, we overall find a negative relationship between the entry of food delivery platforms and restaurant employment. Our results further suggest that the decrease in the number of workers in the restaurant industry is only partially compensated for by an increased demand for gig workers (i.e., delivery drivers).

4.4 Robustness Checks

One potential bias could arise from the fact that we restrict our dataset only to those areas for which, based on public press releases and news reports, we found at least one entry date of food delivery platforms. Although limiting the dataset only to areas that have received the treatment within the observation period is currently common practice in difference-in-differences models (Burtch et al., 2018), we took the following steps to mitigate this potential bias: (1) We included in our dataset also the metropolitan areas without a known entry date, and (2) we restricted our dataset to the third quarter of 2018 (i.e., the 75% quartile of all the delivery entry dates), such that the metropolitan areas that received the treatment afterwards form our control group. For both of these robustness checks, we find qualitatively unchanged results.

Table 4. Relative Time Model of the Effect of Food Delivery Platform's First Entry on Local Restaurant Employment.

Model	(1)	(2)	(3)	(4)
DV	*NUM FOODPREP_ REL_WORKERS*	*NUM DINEIN_ SERV_WORKERS*	*NUM RESTAURANT_ EMPLOYEES*	*NUM_ DELIVERY DRIVERS*
6 quarters before first entry	-695.176 (898.280)	288.858 (672.586)	-1,452.259 (1,476.636)	-581.840 (729.049)
5 quarters before first entry	-864.680 (880.804)	-803.738 (703.449)	-2,444.145* (1,366.455)	-835.213 (708.134)
4 quarters before first entry	-1,209.508 (777.301)	-469.908 (648.047)	-1,977.070 (1,316.939)	290.231 (663.756)
3 quarters before first entry	-278.602 (837.538)	-404.911 (664.590	-1,505.724 (1,300.896)	-227.246 (679.087)
2 quarters before first entry	-458.877 (757.139)	-686.346 (605.469)	-1,645.161 (1,212.789)	-734.243 (619.400)
1 quarter before first entry	*omitted*			
0 quarters since first entry	-365.050 (825.161)	-918.638 (678.171)	-1,848.218 (1,387.123)	468.965 (652.483)
1 quarter since first entry	-966.255 (755.612)	-1,091.281* (642.579)	**-2,472.782**** **(1,251.381)**	635.086 (676.290)
2 quarters since first entry	-954.780 (926.362)	**-1,517.992**** **(619.745)**	-2,393.441* (1,423.993)	-277.943 (738.327)
3 quarters since first entry	-742.783 (953.561)	**-1,634.299**** **(700.662)**	-2,365.538 (1,604.258)	131.467 (769.532)
4 quarters since first entry	-1,297.194 (1,143.726)	-1,599.974* (856.086)	**-3,762.871**** **(1,845.735)**	628.573 (809.103)
5 quarters since first entry	-582.922 (1,256.998)	**-2,015.385**** **(883.806)**	-2,875.890 (1,898.344)	1,810.835* (1,027.417)
6 + quarters since first entry	567.805 (1,036.148)	**-1,973.118**** **(782.644)**	-1,732.346 (1,779.409)	**1,789.605**** **(893.241)**
Metarea Controls	✓	✓	✓	✓
Metarea FE	✓	✓	✓	✓
Quarter FE	✓	✓	✓	✓
N	7,558	7,558	7,558	7,558
R^2	0.909	0.897	0.946	0.917

*Note: First entry represents the market entry of the first of the four food delivery services under investigation. Robust standard errors are in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.*

5. Conclusion

With regards to the growing popularity of app-based food delivery platforms among consumers, this paper is, to the best of our knowledge, the first to empirically examine the relationship between the availability of on-demand food delivery platforms and local restaurant employment. Consistent with prior theoretical models (Chen et al., 2022), our empirical findings support the statement that food delivery platforms neither increase nor decrease the demand for restaurants, which results in an unchanged number of food preparation-related workers after the entry of such platforms. However, as food delivery platforms are likely to substitute dine-in orders with less profitable take-away orders, we find an overall decrease in the number of workers in the restaurant industry, and primarily of dine-in related service personnel. We also demonstrate that this decrease in restaurant employment is partially compensated for by an increase in delivery drivers.

Our results have important implications for both research and practice. In contrast to the positive spillover effects on restaurant dine-in orders found by prior empirical research (Li & Wang, 2020a), we present evidence for a negative spillover effect of food

delivery platforms on a macroeconomic level, supporting anecdotal evidence from restaurant owners who state that food delivery platforms do more harm than good (Hadfield, 2020; Meyerson, 2018). Our study also contributes to theory by being the first to apply the model by Chen et al. (2022) to employment data and to provide empirical support for the model's predictions. From a practical perspective, based on our results one could argue that the significant effect of delivery platforms on the restaurant labor market may call for policymakers to consider regulating on-demand food delivery platforms in order to protect employment in the restaurant industry and act against a shift towards more employment in a low-wage sector with poor working conditions. A possible approach to solve macroeconomic problems associated with food delivery platforms could be limiting the number of delivery workers available to the platform, as suggested by prior theoretical work (Chen et al., 2022). A more limited availability of on-demand food delivery platforms could protect restaurant workers by enhancing the appeal of restaurant dine-ins through good service, reduced waiting times, and fresh food without delivery costs.

Naturally, this research is subject to limitations, which, at the same time, offer great opportunities for future research. First, as we do not have complete information about all entry dates for each metropolitan area, the earliest entry quarter of some of the metropolitan areas used in our empirical analysis might be even earlier because another platform might have entered earlier without releasing online information. Nonetheless, given that food delivery platforms tend to publish their entry into major metropolitan areas to signal their success, we believe that our results are at least suggestive for these areas. Second, as we only investigate the effect of the first entry of a food delivery platform into metropolitan areas, future research could extend our analysis by also considering market shares of the different food delivery platforms in a specific area. In addition to that, it might be interesting to study whether there exists a heterogeneity amongst entries by different platforms. Third, as we only observe the macroeconomic effects of the entry of food delivery platforms, future research could analyze in more detail how food delivery platforms influence the demand patterns of different types of restaurants to further explore the underlying theoretical mechanisms underpinning our empirical findings. And fourth, our data does not cover observations from the time of the COVID-19 pandemic, which naturally had substantial effects on our research environment. On the one hand, this supports the generalizability of our results because they are not confounded by such an event. On the other hand, the impact of the pandemic's impact remains an open avenue for future research.

Overall, this study advances our understanding of the platform economy by shining light on its potential negative macroeconomic impact. It demonstrates that the demand effects of food delivery platforms postulated by prior theoretical work empirically translate into detrimental effects on employment in the local restaurant industry.

6. References

Adams, E. (2018). The Restaurant Industry is Losing its Young Workforce. https://table.skift.com/2018/10/02/the-restaurant-industry-is-losing-its-young-workforce/

Autor, D. H. (2003). Outsourcing at Will: The Contribution of Unjust Dismissal Doctrine to the Growth of Employment Outsourcing. Journal of Labor Economics, 21(1), 1–42.

Babar, Y., Adeli, A., & Greenwood, B. (2021). *Cooking or Clicking: The Impact of Online Food Delivery Platforms on Domestic Food Preparation.* Available at SSRN: https://ssrn.com/abstract=3833938.

Babar, Y., & Burtch, G. (2020). Examining the Heterogeneous Impact of Ride-Hailing Services on Public Transit Use. Information Systems Research, 31(3), 820–834.

Bureau of Labor Statistics. (2021). Occupational Outlook Handbook. https://www.bls.gov/ooh/

Burtch, G., Carnahan, S., & Greenwood, B. N. (2018). Can You Gig It? An Empirical Examination of the Gig Economy and Entrepreneurial Activity. Management Science, 64(12), 5497–5520.

Business of Apps. (2022). Food Delivery App Revenue and Usage Statistics 2022. https://www.businessofapps.com/data/food-delivery-app-market/

Carson, B. (2019). Uber's Secret Gold Mine: How Uber Eats Is Turning Into A Billion-Dollar Business To Rival Grubhub. https://www.forbes.com/sites/bizcarson/2019/02/06/ubers-secret-gold-mine-how-uber-eats-is-turning-into-a-billion-dollar-business-to-rival-grubhub/?sh=4e7c8a621fa9

Chen, M., Hu, M., & Wang, J. (2022). Food Delivery Service and Restaurant: Friend or Foe? Management Science (Forthcoming).

CPS IPUMS. (2021). Current Population Survey Data for Social, Economic and Health Research. https://cps.ipums.org/cps/

DoorDash. (2022). DoorDash: About Us. https://www.doordash.com/en-US/about/

Dunn, E. (2018). How Delivery Apps Like Seamless and Uber Eats May Put Your Favorite Restaurant Out of Business. https://www.newyorker.com/culture/annals-of-gastronomy/are-delivery-apps-killing-restaurants

Feldman, P., Frazelle, A. E., & Swinney, R. (2022). Managing Relationships Between Restaurants and Food Delivery Platforms: Conflict, Contracts, and Coordination. Management Science (Forthcoming).

Grubhub. (2022). Grubhub: About Us. Grubhub History. https://about.grubhub.com/about-us/company-timeline/

Gutt, D., Herrmann, P., & Rahman, M. S. (2019). Crowd-Driven Competitive Intelligence: Understanding the Relationship Between Local Market Competition and Online Rating Distributions. Information Systems Research, 30(3), 980–994.

Hadfield, P. (2020). Why Food Delivery Companies May Be Doing More Harm Than Good, And How Restaurants Can Fix It. https://www.forbes.com/sites/forbesfinancecouncil/2020/05/04/why-food-delivery-companies-may-be-doing-more-harm-than-good-and-how-restaurants-can-fix-it/?sh=1c7b833b1b3b

Hall, J. V., & Krueger, A. B. (2018). An Analysis of the Labor Market for Uber's Driver-Partners in the United States. ILR Review, 71(3), 705–732.

Huang, N., Burtch, G., Hong, Y., & Pavlou, P. A. (2020). Unemployment and Worker Participation in the Gig Economy: Evidence from an Online Labor Market. Information Systems Research, 31(2), 431–448.

Jawadi, F., Mallick, S. K., Idi Cheffou, A., & Augustine, A. (2021). Does Higher Unemployment Lead to Greater Criminality? Revisiting the Debate over the Business Cycle. Journal of Economic Behavior & Organization, 182, 448–471.

Li, Z., & Wang, G. (2020a). *The Role of On-Demand Delivery Platforms in Restaurants.* Available at SSRN: https://ssrn.com/abstract=3813891.

Li, Z., & Wang, G. (2020b). *The Role of On-Demand Delivery Platforms in Restaurants during Disruption: Evidence from the Coronavirus Pandemic.* Available at SSRN: https://ssrn.com/abstract=3665798.

Meyerson, N. (2018). Why Uber Eats and GrubHub Partnerships are Risky for Restaurants. https://money.cnn.com/2018/03/28/news/companies/uber-eats-grubhub-delivery-apps/index.html.

Molla, R. (2018). Uber Eats is the Fastest-Growing Meal Delivery Service in the U.S. - But GrubHub is Still by Far the Biggest Food Delivery Company. https://www.vox.com/2018/4/18/17242262/uber-eats-grubhub-food-delivery-startup

Müller, M., Neumann, J., & Kundisch, D. (2022). Peer-To-Peer Rentals, Regulatory Policies, And Hosts' Cost Pass-Throughs. Journal of Management Information Systems, 39(3), 834–864.

Mulvaney, E. (2021). NYC Poised to Improve Food-Delivery Driver Working Conditions. https://www.bnnbloomberg.ca/nyc-poised-to-improve-food-delivery-driver-working-conditions-1.1656512

National Restaurant Association. (2019). National Restaurant Association Releases 2019 "State of the Restaurant Industry" Report. https://www.ramw.org/blog/national-restaurant-association-releases-2019-state-restaurant-industry-report

Postmates. (2022). Postmates: Food Delivery, Groceries, Alcohol - Anything from Anywhere. https://postmates.com/

Raj, M., Sundararajan, A., & You, C. (2021). *COVID-19 and Digital Resilience: Evidence from Uber Eats.* Available at SSRN: https://ssrn.com/abstract=3625638.

Raphael, S., & Winter-Ebmer, R. (2001). Identifying the Effect of Unemployment on Crime. Journal of Law and Economics, 44(1), 259–283.

Samsukha, A. (2022). On-Demand Food Delivery App Market Stats 2022. https://www.emizentech.com/blog/food-delivery-app-market-stats.html

Shigong, L. (2020). How Can Food Delivery People's Working Conditions Be Improved? http://www.bjreview.com/Opinion/202009/t20200925_800221941.html

UberEats. (2022). UberEats: About Us. https://about.ubereats.com/de/en/

Zervas, G., Proserpio, D., & Byers, J. W. (2017). The Rise of the Sharing Economy: Estimating the Impact of Airbnb on the Hotel Industry. Journal of Marketing Research, 54(5), 687–705.