

ARTICLE

Online platform entry and food safety risk: Evidence from the Chinese restaurant industry

Baojie Ma¹ | Yuqing Zheng² | Shaosheng Jin³ | Bin Lyu⁴

¹College of Economics and Management, South China Agricultural University, Guangzhou, China

²Department of Agricultural Economics, University of Kentucky, Lexington, Kentucky, USA

³China Academy for Rural Development, Zhejiang University, Hangzhou, China

⁴School of Economics and Finance, Shanghai International Studies University, Shanghai, China

Correspondence

Shaosheng Jin, China Academy for Rural Development, Zhejiang University, Hangzhou 310058, China.
Email: ssjin@zju.edu.cn

Funding information

Natural Science Foundation of China, Grant/Award Number: 72273128

Abstract

The online food delivery (OFD) industry has witnessed substantial global expansion. In this study, we examine how OFD platforms in China affect the food safety conditions of restaurants. Given the difficulty quantifying food safety, we first propose a machine learning approach to construct a restaurant-specific food safety risk indicator based on online customer reviews. The approach features high-frequency continuous measurements with complete geographic coverage. We also conducted an event study and found that the food safety risk in restaurants decreased significantly in response to OFD platforms, with the effects concentrated in the five quarters including the entry period. Our mechanism analysis suggests that this improvement might come from extended market information, strengthened market competition, and heightened supervision and regulation. The impact is also more pronounced for chain restaurants, restaurants that are relatively popular and expensive, and restaurants offering low-risk food items.

KEYWORDS

food safety, machine learning, online food delivery, restaurant

JEL CLASSIFICATION

D22, L66, D82

1 | INTRODUCTION

In recent years, the online food delivery (OFD) industry has witnessed substantial global expansion and garnered considerable interest from researchers (Chen et al., 2022; Ding et al., 2022; Feldman et al., 2023; Meemken et al., 2022; Pingali & Abraham, 2022). With OFD, customers can

conveniently place digital food orders using various food service applications.¹ These platforms provide users with access to local restaurants and their menus. This enables consumers to enjoy meals without leaving their homes, leading to the emergence of OFD as a modern lifestyle choice that is gradually replacing traditional home catering practices (Babar et al., 2025). Revenue in the global OFD market is projected to reach US\$1.39 trillion in 2025 with an annual growth rate of 7.64% from 2025 to 2030, resulting in a projected market volume of US\$2.02 trillion by 2030 (Statista, 2023).

Given the surge in news reports about related food safety issues on OFD platforms, the rapid growth of OFD services has received heightened concerns regarding food safety in restaurants. Existing studies have focused on analyzing the influence of OFD platforms on operational dynamics and competitive strategies in the restaurant industry (Chen et al., 2022; Cui et al., 2022; Feldman et al., 2023), however, few of these studies have investigated the effects on product quality (i.e., food safety). Restaurants are associated with a high incidence of foodborne illnesses (ECDC, 2019; Zhao et al., 2021). With OFD, it is more challenging for consumers to access vital food safety information (such as physical conditions) about the restaurants they order from (Ding et al., 2022). This necessitates investigating the relationship between OFD services and restaurant food safety, which is the focus of this study.

Although recent studies suggest that the platform economy can enhance product quality (Bergemann & Bonatti, 2024), this has not yet been empirically validated within the restaurants industry. The effects of OFD on the food safety of restaurants are twofold. On the one hand, the emergence of OFD may have adverse effects on food safety in restaurants. As third-party OFD platforms charge a commission on each order, lower customer net prices and restaurant profits may follow (Feldman et al., 2023). Consequently, restaurant operators may resort to using lower-quality ingredients to manage costs.

On the other hand, OFD platforms may enhance the level of food safety in restaurants through various mechanisms, which we illustrate using the Chinese market as an example. First, OFD platforms have advantages in extending market information, thus alleviating food safety issues. Data reveal that over half of China's brick-and-mortar restaurants now provide OFD services. Many OFD platforms provide consumers with restaurant information to aid their selection, for example, with photos uploaded by the restaurants, or with information regarding any measures to regulate food safety and production. To some extent, this incentivizes restaurants to proactively implement food safety regulatory measures, thereby enhancing their food hygiene standards (Jin & Leslie, 2003, 2009). Another extended market information comes from a larger volume of consumer reviews on the OFD platforms, which is considered a pathway for enabling intertemporal information transmission, strengthening reputation mechanisms, and ultimately improving product quality (Bergemann & Bonatti, 2024).

Second, online platforms facilitate the entry of small or part-time producers into the market, which intensifies market competition (Barrios et al., 2022; Farronato & Fradkin, 2022). OFD platforms drop the entry costs for restaurants because restaurant location matters less. In a more competitive market environment, consumers can more easily obtain and compare product quality information. With a reduction in the degree of information asymmetry, producers have a stronger incentive to provide higher-quality products and services in order to gain a larger market share (Bennett & Yin, 2019; Fang et al., 2025; Gutt et al., 2019).

Third, OFD platforms may strengthen industry supervision by complementing government oversight. OFD platforms' interdependent accountability with restaurants compels platforms to constrain sellers' behaviors, which can improve food safety in situations where external regulations are insufficient (Lu et al., 2023).

Official statistics reveal a potential positive relationship between OFD platform entry and food safety in the restaurant industry. Figure 1 shows that OFD platforms expanded in cities across China

¹Example includes *UberEats* and *Doordash* in Europe and the United States, and *Grab*, *Deliveroo*, *Foodpanda*, and *Now* in Southeast Asia, and *Meituan* and *Eleme* in China.

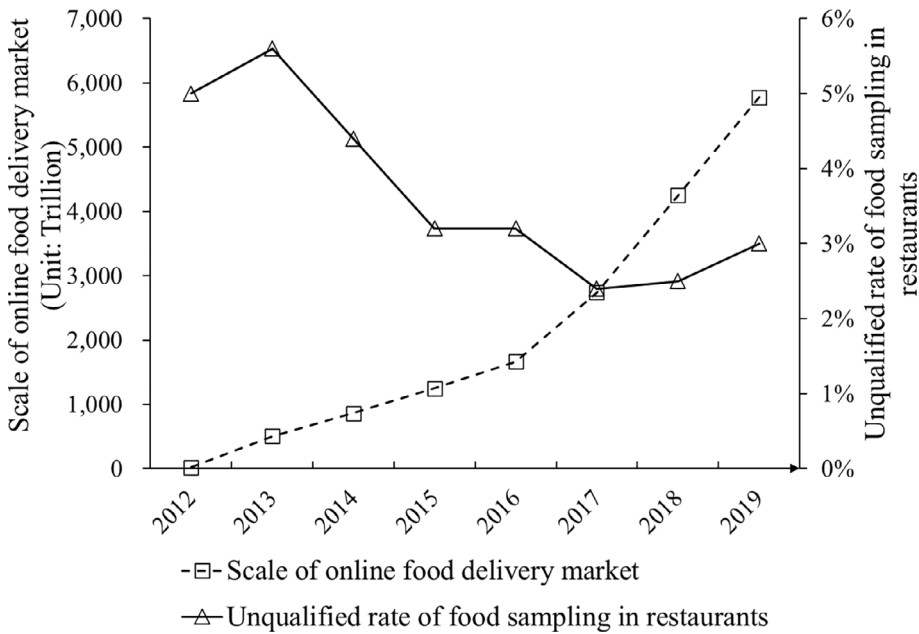


FIGURE 1 Unqualified rate of food sampling and scale of OFD market in China. Source: China Internet Network Information Center (CNNIC), China Health Statistics Yearbook.

after 2013, leading to a rapid expansion of the OFD market scale. At the same time, food safety conditions in restaurants improved significantly, as evidenced by the decline in the unqualified rate in food safety inspections from over 5% in 2013 to approximately 3% in 2019. However, the observed correlation between OFD platforms and restaurant food safety conditions does not necessarily imply a causal relationship. Establishing causality remains an empirical challenge due to the presence of various confounding factors.

The staggered entry of OFD platforms raises opportunity to use a fresh and economic lens through which to explore shifts in product quality within the restaurant industry following the online platform introduction. In this study, we focus on China and investigate how the entry of OFD platforms affects the food safety conditions of restaurants. Our focus on China stems from three considerations. First, the food safety problem in China is so serious that it has even affected social stability. It is regarded as the second most prominent risk in Chinese people's daily lives (Alcorn & Ouyang, 2012). Restaurants are where foodborne diseases occur most frequently in China. Specifically, it is reported that 74% of China's foodborne illnesses occur in restaurants.² Given the severity of the food safety issue in China and the high incidence of foodborne illnesses in restaurants, it is crucial to identify effective measures that can enhance food safety among restaurant operators. Second, China stands out as a rapidly growing market for OFD services. In 2019, the scale of China's OFD service market reached 577.9 billion yuan, an increase of 36.0% over the previous year (Ding et al., 2022; iiMediaReport, 2020). As the largest market in the world (Wang et al., 2022), China's OFD market has policy implications for other countries, especially for emerging markets that disproportionately suffer health burdens associated with food safety. Third, given that low- and middle-income countries collectively bear a staggering financial burden exceeding \$110 billion due to food safety issues (Jaffee et al., 2018), the lessons learned from China, the largest developing nation, are particularly useful.

²Data source: China Health Care Statistics Yearbook (2019).

We rely on an event study framework to explore the causal impact of OFD platforms development on restaurant food safety, using both Two-Way Fixed Effects (TWFE) and robust estimators for heterogeneous treatment effects. The identification comes from the entry of OFD platforms in cities as an exogenous shock. We offer three key contributions to the literature. First, this paper contributes to the literature on the role of market factors in food safety. Existing studies have explored how the market factors that influence food safety in terms of information disclosure (Heng et al., 2018; Lin et al., 2019; Ollinger & Bovay, 2020; Zhou et al., 2022) and inspection policy (Starbird, 2005). Against the backdrop of proliferating digital technologies in food markets, recent research has also investigated the effect of digital information disclosure on food safety (Dai & Luca, 2020). The emergence of OFD platforms has further changed the food market. Some scholars posit that platforms can improve product quality by expanding market information (Bergemann & Bonatti, 2024), but the empirical evidence is still limited. To the best of our knowledge, our study is the first to establish a connection between OFD and restaurant food safety.

Second, this paper extends the literature focusing on the impact of OFD platforms to a new perspective on food safety. Despite the worldwide expansion of OFD, its policy implications remain poorly understood (Meemken et al., 2022). Existing research examines effects of OFD from perspectives such as health (Babar et al., 2025; Stephens et al., 2020), consumer eating habits (Bates et al., 2020; Burtch et al., 2021), and food environment (Maimaiti et al., 2018). A few studies focus on the restaurant industry and discuss the impact of OFD on profits and revenue (Chen et al., 2022; Cui et al., 2022; Feldman et al., 2023). Given the food-focused nature of OFD platforms, product quality (i.e., food safety) is another noteworthy issue, yet widely ignored. Thus, we expand the research focus to food safety in the restaurant industry and our results can provide valuable insights for policymakers to make informed strategies to promote food safety amid the rapid expansion of OFD.

Lastly, this paper proposes a novel evaluation index that reflects hygiene conditions at the individual restaurant level and can be applied to studies in related fields. Current research on restaurant food safety often relies on small-scale sampling data (Sarter & Sarter, 2012) or utilizes official data limited to specific local areas (Chen et al., 2022; Dominianni et al., 2018), which limits the generalization and accuracy of the research findings. Additionally, some studies employ product recalls or official reports of foodborne illnesses to assess food safety (Adalja et al., 2023). However, these are ex-post measures of response to serious food safety incidents. To fill the aforementioned research gap, we align with the prevailing methods in the literature and apply data mining as well as machine learning to online customer reviews and build a novel food safety risk (FSR) indicator at the restaurant level (Tao et al., 2020).

Taken together, our results show that OFD platforms improved the food safety level of restaurants, with a significant reduction in their FSR, as measured by our proposed FSR indicator. Possible explanations for this include extended market information, strengthened market competition, and improved supervision and regulation in the restaurant industry. These factors could collectively lead to heightened efforts by the restaurants to address food safety. Heterogeneity analysis at the restaurant level indicates that OFD platforms have a stronger effect on chain restaurants and relatively popular and expensive restaurants, as well as those with an initially lower FSR. We also found that OFD had a more pronounced effect in provinces with higher food safety expenditures and a higher incidence of foodborne illnesses.

The rest of this paper is organized as follows. In Section 2, we introduce the background. In Section 3, we discuss the empirical models and variables. In Section 4, the results of the empirical models are reported. In Section 5, we conclude and offer some policy implications.

2 | BACKGROUND

Although the concept of food delivery has been around for a long time, it was not until the advent and popularity of smartphones that OFD services began to be widely used by consumers. In China,

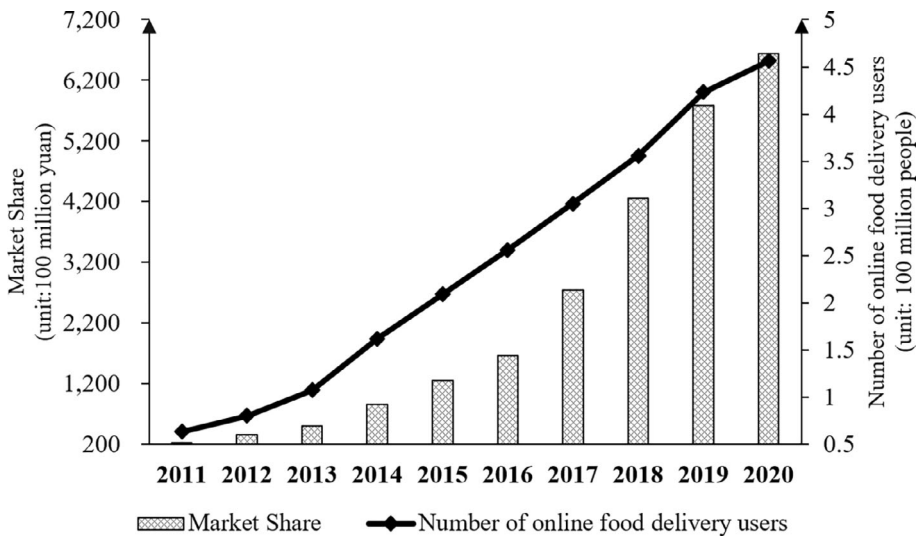


FIGURE 2 Development of online food delivery in China: 2011–2020. Source: China Internet Network Information Center (CNNIC).

the “Ele.me” platform was officially launched as an OFD in 2009, starting in a small number of cities with relatively low traffic. With the rapid popularity of smartphones and the establishment of the other two major OFD platforms (namely, Meituan and Baidu) in 2014, the market size of the OFD industry has been rapidly expanding.

These food delivery platforms connect consumers and restaurants through third-party applications. When a consumer orders food through a third-party application, the OFD platform sends the corresponding delivery driver an electronic order with the designated address filled in by the consumer. By 2015, the OFD market had doubled in size compared to 2014, and these platforms began to spread in various cities in China, at almost the same pace. In 2020, the market size of the OFD industry in China reached 664.6 billion yuan, with the number of OFD users exceeding 450 million (Figure 2). Currently, Meituan commands a substantial 62.7% share of the Chinese OFD market, while Ele.me holds a 16.2% market share.

3 | DATA AND EMPIRICAL METHODOLOGY

3.1 | Variable definition and data sources

Dependent variable: FSR of restaurants

Our dependent variable is the FSR of each restaurant. Obtaining a direct measure of the food safety of restaurants on a national scale in China is challenging, since only a few provinces, such as Gansu Province, publicly disclose the sanitary status of restaurants. However, the online reviews of restaurants can be regarded as an alternative data source that reflects perceived food safety conditions, as recommended by Farronato and Zervas (2022) and Zuo et al. (2022).

Dazhongdianping was founded in 2003 and is now the most popular site for in-person customers to review restaurants in China.³ These in-person consumers are encouraged to leave their comments

³Just like Yelp in the U.S., after consumers go to a restaurant, they can post comments and feelings about that restaurant. These reviews encompass various aspects of consumer perception, including the taste of the food, the attentiveness of the service, and the hygiene of the food.

on Dazhongdianping about the restaurants where they ate, and all reviews are publicly posted unless they violate some law or regulation. It is important to note that OFD customers' reviews are not provided in Dazhongdianping, thus all the reviews in our analysis are only based on in-person customers. An example of a review on Dazhongdianping is provided in Appendix Figure A1.

We used text mining to acquire online consumer reviews of select restaurants from Dazhongdianping.⁴ In a similar fashion, Lawani et al. (2019) acquired online reviews from Airbnb to analyze the impact of reviews on rental prices. Specifically, we randomly selected 40 cities in the east, central, west, and northeast of China. In each city, we selected the 80 most reviewed restaurants on Dazhongdianping.⁵ Subsequently, web crawler technology was used to obtain all non-five-star reviews of these restaurants, as well as other basic information about the restaurants (including location, type, per capita consumption, etc.). The rationale behind selecting only non-five-star reviews was to mitigate the potential influence of fake reviews. In addition, consumers need to first register an account with an authenticated real name before commenting on the Dazhongdianping website. Subsequently, their comments will go through a high-frequency review mechanism including manual and computer verification. Only legitimate and compliant comments checked through the platform are ultimately posted on the Dazhongdianping website. By focusing on these reviews, we aimed to ensure that our analysis was based on authentic customer experiences and feedback, free from artificially generated positive reviews.

To evaluate the effect of OFD on restaurants (the treatment), we removed restaurants that opened only after the city was enrolled in an OFD platform. We also removed the restaurants with fewer than 40 reviews in a quarter to ensure that the content of the reviews was sufficiently representative. Ultimately, we obtained 783,124 online reviews from 2036 restaurants in 40 cities across China, ranging from the 4th quarter of 2012 to the 4th quarter of 2018.

After obtaining the online reviews, we identified whether they pertained to food safety issues according to the criteria shown in Appendix Table A1. In early textual analysis research, the bag-of-words method was widely used to categorize words with the same stem into groups. However, this approach only considers the occurrence of phrases or words in text. It ignores the word order as well as grammatical details (Lu et al., 2022). For example, if we apply the bag-of-words method and regard the word "hen chou" ("很臭" in Chinese, meaning stinky) as one word to identify whether the text is related to a food safety issue, we may misclassify the review "fu wu yuan de tai du hen chou" ("服务员的态度很臭" in Chinese, meaning the waitress's attitude is stinky)" as a food safety-related review. To address the above issue, we applied supervised machine learning, which is one of the most advanced methods, to automatically classify reviews as either related or unrelated to food safety, as described below.

First, we randomly selected 10,000 reviews and assigned them equally to five professional researchers with at least 5 years' experience in the field of food safety. They were asked to identify whether the reviews are related to a food safety issue. If so, the review was labeled with a value of 1, and otherwise 0 (see Table A2 for specific examples). To ensure the accuracy of the results, each expert was assigned 4000 reviews, thus ensuring that each review received examination from two different experts. Second, we used the *Jieba* word segmentation tool for text tokenization. Third, any punctuation and stop words were removed (e.g., "I," "have," "it," "?," etc.) Fourth, we applied the Word2vec word embedding model to reduce the dimensionality and obtain a vector representation of low dimensionality.⁶ The different dimensions in the reduced dimensional vector are the features "X" in the machine learning model. Then, we used a text convolutional neural network (Text-CNN) model to establish the mapping relationship between the features "X" and whether the review is related to a food safety issue. See Zuo et al. (2022) for detailed information about this method. Our dependent variable, the FSR, was then defined as the fraction of the number of reviews related to

⁴Source: <https://www.dianping.com/>.

⁵Statistically, the monthly sales of these restaurants represent 80% of the total monthly sales of restaurants in these cities.

⁶The *Word2vec* algorithm is a word embedding model in natural language processing. Its core idea is to embed high-dimensional one-hot coding vectors into a low dimensional vector space, which is essentially a reduced dimension model.

food safety to the total number of reviews of a restaurant in a quarter. For example, if a restaurant had 200 non-five-star reviews in the first quarter of 2015, and 10 were related to food safety concerns, then the FSR of this restaurant in 2015 Q1 would be 0.05 (10/200). It is worth noting that a positive review of food safety practices, such as good sanitary conditions, will count toward the denominator in the calculation. The above process is summarized in Appendix Figure A2. A higher FSR indicates a lower food safety level in a restaurant and consequently a higher likelihood of food safety-related outbreak in the restaurant. Based on similar logic, Mejia et al. (2019) used consumer review data from various restaurants in New York to evaluate dynamic changes in restaurant food safety and validated the effectiveness of this method.

Table A3 demonstrates that the algorithm differentiates positive food safety and negative food safety content precisely. The precision rate was 0.9649, which means the probability that the model correctly identifies the sample is 96.49%. The recall rate was 0.9650, which means that when the sample is food safety-related reviews, the model has a 96.50% probability of accurately predicting it as food safety-related. Considering the sensitivity and accuracy of the model, the F1 rate of the model was 0.9649, which indicates that the model trained with big data exhibits a high prediction accuracy rate.

In comparison to traditional methods, which largely employ either small-scale sampling data (Sarter & Sarter, 2012), official data confined to specific geographical regions, or severe food safety incidents (Adalja et al., 2023; Chen et al., 2022; Dominianni et al., 2018), our proposed FSR index has several distinct features. First, our FSR index is based on consumer observations, experience, and perceptions of food safety conditions. It complements food safety measures from the government in terms of testing and sampling while offering a higher frequency and more complete geographic coverage. Second, the FSR index utilizes big data at low cost to assess micro-level restaurant FSR at a continuous level. This could not be achieved using food safety incident measures such as foodborne disease. Third, our approach facilitates timely monitoring and mass surveillance of the hygiene levels at restaurant establishments. It can thus reveal numerous food safety issues that may go undetected during routine hygiene inspections.

Key policy variable: Entry of OFD platforms

Our key independent variable is whether the OFD platform enters a city. Following Mo and Li (2022), we obtained the first posting time of jobs related to the “online food delivery” occupation in each city by keyword matching on three major Chinese job searching websites (Zhi Lian, MileagePlus, and Hire.com) to measure the rise of the OFD industry in each city.⁷ Table A4 in the appendix shows the time of the first food delivery-related job posting in some of the cities in our sample. Figure 3 provides quarterly statistics on when food delivery platforms were first available in each city. The peak of OFD platform entry was the third quarter of 2014, followed by a continued push between 2015 and 2017.

Control variables

Referring to the definition of a “good” control variable by Cinelli et al. (2021), in the regression, we control for variables that may affect the FSR of restaurants as well as the entry period of OFD platforms in the regression.

The selection of control variables is mainly based on the following four aspects: economic development, population, service industry development, and internet development level. First, there is a

⁷Unfortunately, we could not obtain the number of OFD drivers in different cities at different times, so we could not verify the impact of OFD development on the outcomes over time.

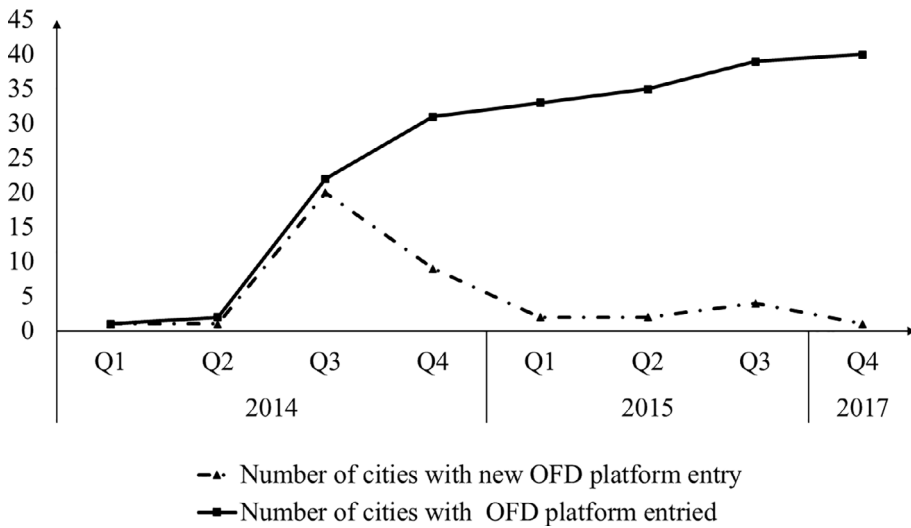


FIGURE 3 Number of cities with OFD platforms. Source: Zhi Lian, MileagePlus, and Hire.com.

correlation between economic growth, the regional FSR level, and safe production activity (Lam et al., 2013). Economic development also determines when OFD platforms enter the city. Therefore, we introduce the total gross domestic product (GDP) of a city into the model as a proxy variable for regional economic development. Second, population reflects market potential and could affect whether and when an OFD platform enters a city. By affecting both food demand and supply (e.g., through labor), population could also affect food safety. Third, the development of the service industry is conducive to attracting the entry of OFD platforms. The service industry also drives more refined consumption behavior and this may motivate restaurant operators to provide higher-quality food. Accordingly, we use the proportion of employment in the service (or tertiary) industry, as well as the number of restaurant workers in a city. Finally, the development of internet technology helps reduce information asymmetry in agriculture, and so may be beneficial for solving food safety problems. The development of the internet is also a determinant as to whether OFD platforms enter the market, since all online platforms rely on it for ordering food. We therefore control for the number of broadband users in each city. All of the above control variables were obtained from China City Statistical Yearbook for 2012–2018.

3.2 | Identification strategy

The primary goal of our study was to identify the causal impact of OFD platforms on the food safety level of restaurants. A naive correlation may be plagued by severe endogeneity concerns and therefore cannot credibly claim a causal interpretation. Examples of such endogeneity concerns include reverse causality (e.g., cities with higher levels of restaurant food safety are more likely to attract OFD platforms to enter) and omitted variable bias. To obtain estimates that can be more credibly interpreted as causal, we leverage the rollout of OFD platforms across cities in China from 2012 through 2018. We use a TWFE event-study method to investigate the dynamic effects of OFD platforms on food safety as this method has been commonly used in related literature.⁸ The model specification can be expressed as follows:

⁸For example, Burtch et al. (2018) used the staggered DID approach to estimate the impact of the entry of the OFD platform Postrates on the quantity and quality of entrepreneurial activities across the United States. Liu et al. (2024) used the staggered DID approach to analyze the impact of OFD platforms on employment rates among Korean women.

$$FSR_{ict} = \rho_0 + \sum_{j=-7}^7 \partial_j OFD_{c,t+j} + \mathbf{P}_{ct}^T \boldsymbol{\alpha} + \delta_i + \gamma_t + \varepsilon_{ict}, \quad (1)$$

where the subscript i denotes the restaurant, c denotes the city, and t denotes time (by annual quarter). Therefore, an observation is presented at the restaurant–city–quarter level. Our dependent variable is the FSR level of restaurant i in city c at time t . The key variables include a series of dummy variables where $OFD_{c,t+j}$ is a dummy variable for event time j , indicating that the event occurred j periods before this calendar time. When $j < 0$, ∂_j provides a test for the common trend in the FSR of restaurants between the treated and control cities. When $j \geq 0$, ∂_j measures the dynamic effects of OFD platforms over time. To illustrate, $OFD_{c,t-5}$ equals to 1 if time t is at least five quarters prior to the entry of an OFD platform in city c , and $OFD_{c,t+5}$ equals 1 if time t is five quarters following the entry of an OFD platform in city c . We focus on the common trends in seven quarters before the time when an OFD platform was first available, and the dynamic effects seven quarters after it was made available.

The parameter $\partial_j \partial_j$'s captures the causal effect of an OFD platform on the FSR of restaurants, which is the focus of our study. When $j < 0$, we expect ∂_j to be zero. Intuitively, this implies that there are no systematic differences in FSR between the treatment and control groups prior to the entry of an OFD platform, which underlies the validity of our identification strategy. $OFD_{c,t-1}$ is omitted from Equation (1) to avoid multicollinearity (i.e., $\partial_{-1} = 0$).

\mathbf{P}_{ct} represents the set of city-level time-varying control variables discussed in the previous subsection. δ_i accounts for restaurant fixed effects that capture the confounding effects of the time-invariant factors of the restaurant (e.g., location, brand, and type). γ_t denotes quarter-by-year fixed effects that reflect how macro-policies affect the outcome variable, such as adjustments in food safety law. ε_{ict} is the residual term.

Concerns may arise regarding the plausibility of the parallel trend assumption in our setting. Restaurants belonging to different OFD platform expansion groups might have different trends in terms of food safety, and the heterogeneity in treatment effects of the OFD platforms may lead to potential biases in estimating the two-way fixed-effect (TWFE) model (De Chaisemartin & d'Haultfoeuille, 2020; Goodman-Bacon, 2021). To address this concern, we explore the existence of pre-trends by estimating a fully dynamic version of the alternative estimators introduced by Sun and Abraham (2021).

A staggered difference-in-differences (DID, or static TWFE) model is also estimated for the ease of presenting the average treatment effect of treated groups (ATT). The DID model is expressed as follows:

$$FSR_{ict} = \beta_0 + \beta_1 OFD_{ct} + \mathbf{P}_{ct}^T \boldsymbol{\alpha} + \delta_i + \gamma_t + \varepsilon_{ict}, \quad (2)$$

where OFD_{ct} is a dummy variable that takes a value of one if the OFD platform entered city c at time t , and zero otherwise. Its associated coefficient β_1 is the DID parameter, showing the ATT of the introduction of OFD platforms on the FSR of restaurants.

We also employ a difference-in-differences-in-differences (DDD) model to examine the mechanisms and heterogeneity through which OFD affects food safety. Our empirical model is specified as follows:

$$FSR_{ict} = \beta_0 + \beta_1 OFD_{ct} + OFD_{ct} \times \mathbf{Z}_{ict}^T \boldsymbol{\varphi} + \mathbf{P}_{ct}^T \boldsymbol{\alpha} + \delta_i + \gamma_t + \varepsilon_{ict}, \quad (3)$$

where \mathbf{Z}_{ict} denotes a set of variables related to the mechanism and heterogeneity analysis. In the section Market information extending, we test the information extending mechanism (i.e., OFD platform entry improves food safety by reducing market asymmetry). Correspondingly, \mathbf{Z}_{ict} includes a set of information-related variables: (1) the restaurant's pre-entry review volume, (2) the city's

internet penetration rate, and (3) the city's resident education level. If OFD platforms entry improves food safety of restaurants by expanding market information, the coefficient β_2 is expected to be negative. The three equations share the same control variables and fixed effects. In a later analysis to examine the mechanism by which OFD affects food safety, our empirical model is based on city-time-level data as follows:

$$N_{ct} = \beta_0 + OFD_{ct}\beta_1 + \mathbf{P}_{ct}^T \boldsymbol{\pi} + \omega_c + \tau_t + \mu_{ct}, \quad (4)$$

where N_{ct} is the dependent variable measured in different ways in the mechanism analysis, \mathbf{P}_{ct} is the same set of control variables used in Equation (1), ω_c accounts for the city fixed effects, τ_t denotes time fixed effects, and μ_{ct} is the residual term. In the sections Market competition enhancing and Regulatory intensifying within the industry, we test the market competition and regulation mechanisms, respectively. The dependent variable for the market competition mechanism, N_{ct}^1 is the number of restaurants within a city or the Herfindahl–Hirschman (HHI) index. The dependent variable for regulation mechanism, N_{ct}^2 is the number of food safety sampling tests.

3.3 | Descriptive statistics

Validation for the dependent variable

Since the proposed FSR index is new, we wondered to what degree it reflects the actual food safety conditions of restaurants (see Farronato and Zervas (2022)). There could be some misjudgment insofar as our index is a consumer-perceived food safety index. For example, sometimes consumers experience diarrhea after meals due to some irritating foods such as cold drinks or chili peppers, instead of because of the food safety environment in the restaurant. To address this concern, we verified the validity of our FSR index through a series of methods.

As suggested by Woolley (2000), one validation method is to compare the online review-based data to another source, an approach that was used by Holtkamp et al. (2014). We collected the numbers of foodborne illnesses attributable to restaurants by province for the period from 2012 to 2018. Figure 4 shows a scatter plot between the government-released statistics of foodborne illness numbers and our constructed FSR, both at the provincial level. It shows a positive correlation between the two. Table A5 presents the results of a simple regression where we regressed the illness numbers on the FSR index with a two-way fixed-effect estimator. The results show a 4.18 increase in the number of illnesses associated with a 0.01 increase in the FSR index (statistically significant at the 1% level), with a high adjusted R^2 of 0.82.

To validate the effectiveness of our FSR index, we also compared it with official food safety inspection score data. In China, Market Supervision Bureaus routinely conduct food safety inspections and assign restaurants one of three ratings based on their performance: A-grade (good), B-grade (average), and C-grade (poor). In Shanghai, these inspection outcomes are publicly accessible and recorded in the enterprise registry associated with each restaurant's parent company. Using the restaurants in Shanghai from our sample as a case study, we investigated the correlation between the FSR index and these official food safety ratings. The results, presented in Table A6, demonstrate that the FSR index possesses strong predictive validity. Specifically, we found a clear inverse relationship: higher FSR index values were associated with lower official safety ratings. The regression model yielded an adjusted R^2 of around 0.6%.

In addition, food safety conditions in restaurants depend on temperature (Dominianni et al., 2018). Conceptually speaking, restaurant FSR should be higher in the second and third quarters, when average temperatures are higher and food is more prone to contamination. We plotted the average temperature by quarters in China against the average restaurant FSR index, as shown in Figure 5, to examine whether our proposed FSR index captures this pattern. The figure shows the



FIGURE 4 Correlation between the proposed FSR index and reported foodborne illness. *Source:* China Health Statistical Yearbook.

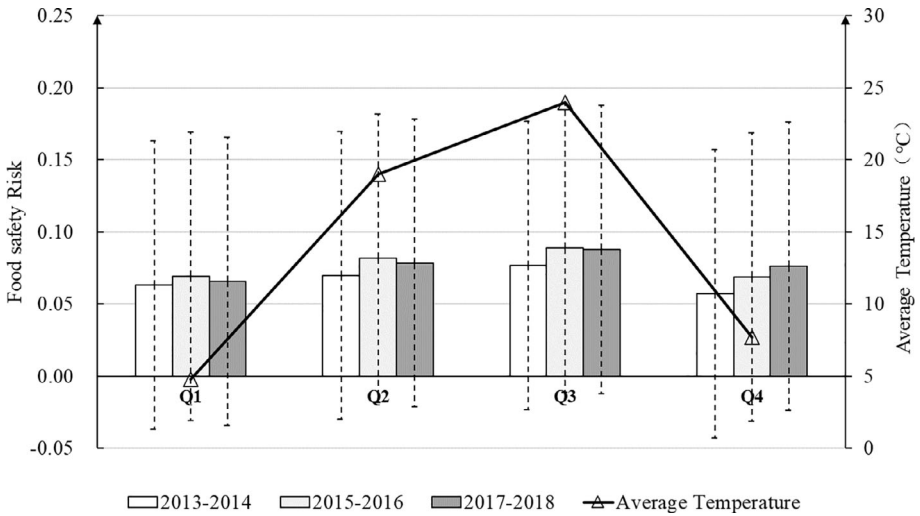


FIGURE 5 Average temperature and proposed restaurant FSR index. *Source:* China Meteorological Administration. The dotted line represents the mean \pm 1.96 standard deviation.

FSR index reflects the aforementioned seasonal pattern well: the highest FSR occurred in the third quarter, followed by the second quarter. This lends further credibility to using the FSR index to measure restaurant food safety.

TABLE 1 Descriptive statistics.

Variable type	Variable name	Mean	SD	Min	Max
Dependent variable	Food safety risk (FSR)	0.068	0.094	0	1
Independent variable	OFD	0.730	0.444	0	1
Control variables	GDP (Unit: trillion yuan)	0.895	0.832	0.019	3.268
	Population of the city (Unit: million)	6.662	4.082	0.494	14.760
	Proportion of employees in the tertiary industry	0.538	0.140	0.210	0.831
	Proportion of employees in accommodation and catering industry	0.076	0.105	0.001	0.460
	Number of Internet broadband subscribers (Unit: million households)	2.850	3.386	0.170	51.740

Descriptive statistics

Table 1 presents summary statistics of the main variables used in the model. The average restaurant FSR index is about 0.07, indicating that about 7% of the reviews cite concerns with food safety. A total of 2220 restaurants were reviewed, with the average restaurant receiving 350 non-five-star reviews; however, some small restaurants may have reviews showing no food safety-related concerns or only food safety-related concerns. The frequency distribution of reviews is shown in Figure A3.

4 | EMPIRICAL RESULTS

4.1 | Baseline results

Table 2 reports the estimation results for the event study model presented in Equation (1). Standard errors are clustered at the city-quarter level and the platform-entry level to allow for within-city correlations and account for heteroskedasticity across cities (Cameron & Miller, 2015).

In column 1, we present the unweighted event study estimates. In column 2, we re-estimate the regression models using a weighted least squares (WLS) approach, based on the event study model, where the number of restaurant reviews serves as the weight. We prefer the WLS over unweighted regression because using WLS assigns greater influence to observations with richer information and reduces the impact of estimates based on sparse data. Our key parameter of interest in the WLS regression, ∂_j , is estimated to be in the range of -0.0084 to -0.0150 for $j \geq 0$, and is statistically significant at the 10% default level or better for up to four quarters.⁹ This demonstrates that OFD platforms have a dynamic effect on restaurant food safety: they lead to improved food safety conditions after the platform is made available in the city. When $j < 0$ (before OFD platforms are available), there is no statistically significant difference in the restaurant FSR index between the treatment and control cities. This is consistent with the exogeneity of OFD platforms.

In addition, the treatment effect estimated in our event study model uses a TWFE estimator, which is considered consistent only when the impact is homogeneous (Sun & Abraham 2021). To account for potentially heterogeneous treatment effects across units or periods, we also present event study results generated using a recently proposed estimator that is robust to treatment effect heterogeneity (Sun & Abraham, 2021). The results are in columns 3 and 4. Whereas our event study shows

⁹The economic meaning of coefficients ∂_j can be interpreted in two ways: a $\frac{|\partial_j|}{FSR_{average}} \times 100\%$ decrease in a food safety risk index, or $\frac{|\partial_j|}{1-FSR_{average}} \times 100\%$ improvement in a food safety index or hygiene index.

TABLE 2 Impact of online food delivery platforms on restaurant FSR.

Dependent variable [mean]	FSR [0.0675]			
	Event study [unweighted]	Event study [weighted]	Sun and Abraham [unweighted]	Sun and Abraham [weighted]
	(1)	(2)	(3)	(4)
$OFD_{c,t-7}$	0.0142 (0.0090)	-0.0036 (0.0079)	0.0003 (0.0027)	0.0001 (0.0026)
$OFD_{c,t-6}$	0.0050 (0.0083)	0.0023 (0.0082)	0.0009 (0.0030)	0.0005 (0.0030)
$OFD_{c,t-5}$	0.0068 (0.0071)	-0.0004 (0.0065)	0.0027 (0.0031)	0.0020 (0.0029)
$OFD_{c,t-4}$	0.0050 (0.0062)	-0.0024 (0.0054)	0.0008 (0.0057)	-0.0001 (0.0055)
$OFD_{c,t-3}$	0.0071 (0.0052)	0.0016 (0.0045)	0.0038 (0.0061)	0.0019 (0.0038)
$OFD_{c,t-2}$	0.0005 (0.0044)	-0.0044 (0.0041)	-0.0066 (0.0046)	-0.0070 (0.0043)
$OFD_{c,t+0}$	-0.0049 (0.0045)	-0.0084** (0.0040)	-0.0111*** (0.0043)	-0.0113*** (0.0042)
$OFD_{c,t+1}$	-0.0088* (0.0049)	-0.0124*** (0.0044)	-0.0031 (0.0048)	-0.0044 (0.0046)
$OFD_{c,t+2}$	-0.0102* (0.0055)	-0.0111** (0.0052)	0.0031 (0.0059)	0.0010 (0.0036)
$OFD_{c,t+3}$	-0.0129** (0.0063)	-0.0150** (0.0060)	-0.0093* (0.0050)	-0.0092* (0.0049)
$OFD_{c,t+4}$	-0.0127* (0.0070)	-0.0114* (0.0069)	-0.0125** (0.0052)	-0.0119** (0.0051)
$OFD_{c,t+5}$	-0.0103 (0.0078)	-0.0096 (0.0078)	-0.0089** (0.0045)	-0.0093** (0.0044)
$OFD_{c,t+6}$	-0.0111 (0.0086)	-0.0086 (0.0086)	-0.0106** (0.0045)	-0.0112*** (0.0043)
$OFD_{c,t+7}$	-0.0036 (0.0098)	-0.0052 (0.0097)	-0.0099** (0.0044)	-0.0099** (0.0042)
Control variables	Yes	Yes	Yes	Yes
Restaurant FE	Yes	Yes	Yes	Yes
Quarter-by-year FE	Yes	Yes	Yes	Yes
Obs.	22,712	22,712	22,712	22,712

Note: Estimates are based on the model in Equation (1), using restaurant-quarter observations. The dependent variables of all regressions here are the restaurants' food safety risk (FSR), defined in the section Dependent variable: FSR of restaurants. The standard errors are in parentheses. The weighted least squares estimation is used, and restaurants weights are according to their total review amounts. Standard errors are clustered at the city-quarter level.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

that OFD affects food safety the first quarter that it is available, as well as the following four quarters, Sun and Abraham's (2021) estimates show these effects for the first quarter that OFD is available, as well as the remaining quarters starting from the third quarter.

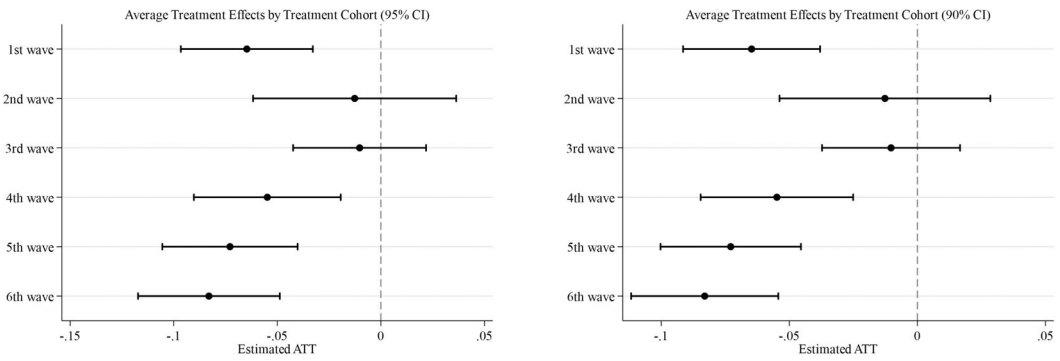


FIGURE 6 Heterogeneous treatment effects by OFD entry time. Never-treated cities are used as the control group. Since the OFD platform entered all cities eventually, we selected samples before the last entry city (Lhasa) during *csdid* regression. Therefore, the never-treated city is Lhasa. The Callaway and Sant’Anna’s model only covers observations through 2017 Q3. A version of the baseline specifications that covers the same time period as the Callaway-Sant’Anna regressions in our Appendix Table A7.

Based on Equation (2), we also report the ATT of OFD platform entry on FSR in Appendix Table A8. The ATT is estimated to be in the range of -0.0078 to -0.0077 and is statistically significant at the 1% level.

4.2 | Robustness check

Callaway and Sant’Anna’s (2021) approach

We used the method (*csdid* in Stata 17) proposed by Callaway and Sant’Anna (2021) as an alternative to directly estimate the potentially heterogeneous impact by entry times of OFD. We excluded the early treatment group from the control group (using these variations may bias the treatment effect; see Callaway and Sant’Anna (2021)) and only used the never-treated cities as the control group. There are seven waves of OFD entry in our data period, depending on when OFD was first available (details are in Table A4). We plot the treatment effects for the respective waves in Figure 6. The results show that all six treatment effects are negative,¹⁰ and most coefficients are statistically significant.

Several points can be made from the estimation results in Figure 6. First, the impact of OFD platforms on FSR is negative across different entry waves, consistent with the results of the previous regressions. Second, although the direction of the effects is uniform, the magnitudes vary, with the entry waves of 1, 4, 5, and 6 showing statistically significant effects. A possible explanation for this is that the early-stage development of OFD platforms in waves 2 and 3 may have lacked sufficient market penetration and operational maturity to exert a sustained influence on restaurant practices. During these periods, platform coverage was limited, consumer adoption rates were relatively low, and platform regulations or incentive mechanisms for food safety compliance were not yet well established. By contrast, later waves were marked by rapid user growth, improved technological infrastructure, and more stringent platform oversight, which collectively enhanced their ability to influence food safety standards.

¹⁰Never-treated cities are used as the control group. Since OFD platforms entered all cities eventually, we dropped the last wave and only selected samples before the last entry city (Lhasa) during the regression. Therefore, the never-treated city is Lhasa.

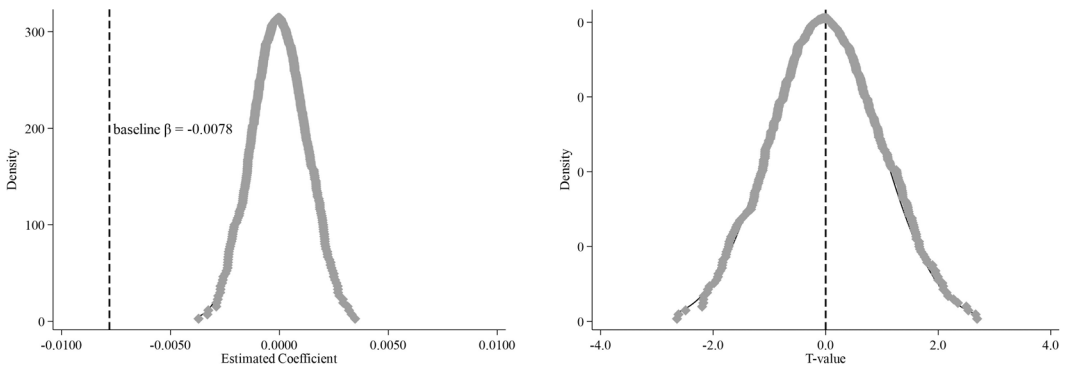


FIGURE 7 Placebo test results by randomly shuffling entry times. The diagram displays the distribution of the treatment effect from the placebo test. The vertical line to the left of the dashed line corresponds to the average treatment effect from Equation (2).

Placebo test

As a placebo test, we randomly shuffled the OFD entry time for each city and re-estimated the ATT of OFD platform entry on FSR. We repeated this process 500 times and present the distribution of the ATT, as well as the corresponding t -value, in Figure 7. The figure shows that the pseudo-DID estimate seems distributed with a close to zero mean. The estimated ATT (-0.0078) in Appendix Table A8 is outside the 95% confidence interval of the pseudo-estimates, and the t -values are concentrated around 0, showing a clear normal distribution. Our placebo test suggests that the impact of OFD platforms is not random.

Reverse causality

If OFD platforms first enter cities where restaurants have better food safety levels, and only later enter (or even skip) cities with restaurants that have worse food safety levels, this will lead to biased estimates of the average treatment effect. To address this concern of reverse-causality-induced endogeneity, we used a simple logit model to regress OFD platform entry on the city's average FSR index (including several lags). The results are provided in Appendix Table A9, showing that the lagged (historical) FSR coefficients are all statistically insignificant, alleviating the concern of reverse causality.

Other robustness checks

We also conducted another set of robustness checks for ease of illustration. First, our dependent variable, the FSR index, is bounded in the range of $[0,1]$. A limitation of applying the ordinary least squares is that the predicted probability values will exceed this range. The fractional logit model proposed by Papke and Wooldridge (1996) has better fitness when the dependent variable is a fractional variable. Accordingly, the fractional logit model results are reported in column 2 of Table 3. We found that the average marginal effect of OFD platforms on FSR in restaurants was -0.007 and so robust. Second, we controlled for city-specific linear time trends. The new regression results in column 3 of Table 3 remain robust.

Third, we redefined the FSR index. The modified index, which included five-star reviews (denoted FSR_5star), served as the new dependent variable. The regression results, presented in column

TABLE 3 Other robustness checks.

Dependent variable	FSR	FSR	FSR	FSR_5star	Log (number of food safety certifications)
Method	TWFE	Fractional logit	Add city-specific time trend	Redefine the FSR	Change dependent variable
[Mean]	[0.0675]	[0.0675]	[0.0675]	[0.0245]	[0.0027]
	(1)	(2)	(3)	(4)	(5)
OFD	-0.0078*** (0.0021)	-0.0070** (0.0030)	-0.0085*** (0.0023)	-0.0027** (0.0011)	0.0019** (0.0008)
Control variables	Yes	Yes	Yes	Yes	Yes
City FE	No	No	No	No	Yes
Restaurant FE	Yes	Yes	Yes	Yes	No
Quarter-by-year FE	Yes	Yes	Yes	Yes	Yes
City-specific year trend	No	No	Yes	No	No
Obs.	22,712	22,712	22,712	44,884	19,500

Note: The estimates in column (2) are based on Equation (2), using a fractional logit model with restaurant-quarter observations. The reported coefficient represents the average marginal effect (AME). The estimates in column (3) are based on Equation (2), with the inclusion of a city-specific linear time trend. The estimates in column (4) are based on Equation (2), while the dependent variable is new constructed FSR index, which includes five-star reviews. The estimates in column (5) are based on Equation (4), while the dependent variables are the number of food safety certifications (log form); the data are at city-month level. The standard errors are in parentheses. Standard errors are clustered at the city-quarter (year) level. From column (1)–(3), the weighted least squares estimation is used, and restaurants' weights are according to their total review amounts.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

4 of Table 3, indicated that the coefficient of OFD remained statistically significant and negative, though its magnitude decreased compared to those in Table A8. This reduction aligned with the relatively lower average value of FSR_5star.

Fourth, considering that an increasing number of food production-related entities are distinguishing themselves from lower-quality businesses through food safety certification (Hu et al., 2023), we used the national business registration database to compile the number of food service enterprises that obtained food safety certifications in each city. We investigated the changes in the number of food safety certifications by enterprises following the entry of OFD platforms. The results are shown in column 5 of Table 3. As shown in the table, the number of food and beverage enterprises with food safety certifications in each city increased significantly by 0.19% after OFD platforms became available. This is consistent with the conclusion that restaurant FSR decreased in the baseline regression of our study.

Finally, we conduct robustness checks to address potential concerns regarding “ghost kitchens” or “shadow restaurants,” with detailed results presented in Appendix Figure A4.

4.3 | Mechanism analysis

Market information extending

Asymmetric information is the main cause of food safety issues (Lin et al., 2024; Zheng & Bar, 2023). OFD platforms may lead to improved restaurant food safety by reducing information asymmetry during food consumption.

First, OFD platforms introduce an additional information flow to the food market. As more consumers participate in food evaluation, the increased volume of reviews strengthens the reputation mechanism by enabling intertemporal information transmission. This process is a key pathway through which platforms can improve product quality (Bergemann & Bonatti, 2024). Second, OFD platforms mandate the public disclosure of restaurant food safety information, which is regarded as an effective tool to improve hygiene quality (Jin & Leslie, 2003; Jin & Leslie, 2009). Restaurants that want to join OFD platforms are required to provide pictures of their shops, lobbies, kitchen areas, and storage spaces for ingredients. Additionally, merchants must submit information such as business licenses and food business permits, which the platforms will disclose to all consumers after reviewing and verifying the authenticity of the information (e.g., Figure A5).

Due to the lack of data to measure consumer information acquisition directly, we investigated the above mechanism through an indirect approach, as shown in Equation (3). Specifically, we examined the heterogeneous effects of OFD platforms on food safety across restaurants characterized by varying levels of market information availability and differing efficiencies in information transmission. The logic behind this was that if OFD platforms improve food safety by extending market information (i.e., reducing information asymmetry), this effect should be more pronounced in restaurants that already possess a higher volume of available information and greater information transmission efficiency. We tested this mechanism in Table 4.

First, we use the total volume of reviews a restaurant had prior to platforms entry as a proxy variable for the market information increment possibly induced by OFD platforms. Conceptually, the market information increment (i.e., the increase in review volume) generated by OFD platforms entry is expected to be greater for restaurants that already had a higher review volume. Therefore, if OFD platforms improve food safety by enriching market information, we should find that this food-safety improvement effect is more significant in restaurants with a higher initial number of reviews. We therefore interact the total amount of reviews of restaurants with OFD dummy variable, based on Equation (3). The results are reported in column 2 of Table 4, showing that the coefficient is

TABLE 4 Mechanism 1: Market information extending.

Dependent variable	FSR			
	[0.0675]			
[Mean]	(1)	(2)	(3)	(4)
<i>OFD</i>	-0.0078*** (0.0021)	-0.0072*** (0.0023)	-0.0020 (0.0033)	0.0371 (0.0238)
<i>OFD</i> × <i>Number of reviews</i>		-0.0009** (0.0003)		
<i>OFD</i> × <i>Internet penetration</i>			-0.0088** (0.0039)	
<i>OFD</i> × <i>Education year</i>				-0.0041* (0.0022)
Control variables	Yes	Yes	Yes	Yes
Restaurant FE	Yes	Yes	Yes	Yes
Quarter-by-year FE	Yes	Yes	Yes	Yes
Obs.	22,712	22,712	22,712	22,712

Note: Estimates are based on the model in Equation (3), using restaurant-quarter observations. The dependent variables of all regressions here are the restaurants' food safety risk (FSR), defined in the section. Dependent variable: FSR of restaurants. The standard errors are in parentheses. Standard errors are clustered at the city-quarter level. From column (1)–(4), the weighted least squares estimation is used, and restaurant weights are according to their total review amounts.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

negative and statistically significant at the 1% level. These results thus support our hypothesis on information provision. It should be noted that we cannot disentangle the specific effect of increasing reviews from the OFD platforms entry due to data limitation. Therefore, a more precise statement about our findings is that OFD platforms and food reviews jointly contribute to improved food safety outcomes.

Second, we used the internet penetration rate and average years of education of urban consumers as proxy variables for information transmission efficiency (Carrieri & Principe, 2022). We then used the internet penetration rate and average years of education of urban consumers to interact with the OFD dummy variable. The results in columns 3 and 4 of Table 4 show that the entry of OFD platforms had a greater impact on food safety in cities with higher levels of information transmission efficiency, which further supports our hypothesis.¹¹

Market competition enhancing

OFD platforms may also improve food safety by enhancing market competition in the restaurant industry. On the one hand, studies have shown that the emergence of online platforms facilitates the entry of small or part-time producers into the market. This leads to increased competition in the industry (Barrios et al., 2022). Specifically, parallel to the transformative impact of e-commerce on the retail markets, the emergence of OFD platforms significantly lowered the entry barrier for entrepreneurship and fostered a proliferation of small-scale dining establishments. This intensified market competition within the restaurant industry (Barrios et al., 2022). On the other hand, while the impact of competition on quality is generally ambiguous (Chesnes et al., 2017; Dorfman & Steiner, 1954), theoretical models suggest that the incentive for producers to provide high-quality products in a fiercely competitive market is stronger as the quality signal in the market becomes more precise and the level of information asymmetry declines (Bennett & Yin, 2019; Fang et al., 2025; Gutt et al., 2019).

We first examined the impact of OFD platforms on market competition in the restaurant industry. The results are shown in columns 1–4 of Table 5. Referring to Gutt et al. (2019), we used the number of restaurants in a city as a proxy variable for the level of competition in the restaurant industry.¹² Columns 1 and 2 in Table 5 indicate that OFD platforms lead to an increase in the number of restaurants in each city.¹³ Furthermore, the Herfindahl–Hirschman Index (HHI) is a valuable tool for assessing the market competition level. Its practical application is often constrained by the unavailability of reliable market share data. To address this limitation, we followed Gutt et al. (2019) to construct an HHI-like measure that regards the number of online reviews of restaurants as a proxy for market share. We calculated the HHI of the restaurant industry by city. It is reasonable to posit that the volume of online reviews a restaurant receives is positively correlated with its market share. Utilizing the HHI we constructed, we examined the effect of OFD platforms on market concentration in the restaurant industry. The results, presented in columns 3 and 4 of Table 5, demonstrate a decrease in the restaurant industry's HHI following the entry of an OFD platform, suggesting a pro-competition effect.

¹¹In the absence of the interaction term, the effect of OFD on FSR is statistically significant. However, once the interaction term is included, its coefficient becomes significant, while the base effect of OFD loses statistical significance. On one hand, our results indicate that the OFD effect could be driven by asymmetric information reduction. On the other hand, an explanation of the finding of an insignificant base effect of OFD is potential multicollinearity introduced by the inclusion of the interaction term.

¹²The data utilized in this study were sourced from the Point of Interest (POI) dataset provided by Amap.com (also known as Gaode Maps), one of China's leading digital mapping software platforms.

¹³As shown in Table 5, the number of registered restaurant enterprises exhibits no significant change. This is understandable because the underlying data for Table 5 originated from China's industrial and commercial enterprise registration database, which primarily records larger, formally established businesses. By contrast, the points of interest (POIs) extracted from Gaode Maps provide information on a broader range of dining establishments, including many of these smaller, individually operated ventures.

TABLE 5 Mechanism 2: Market competition enhancement.

Panel A: Dependent variable	Log (number of restaurant)		1/HHI		
	[6.9929]		[161.2241]		
[Mean]	(1)	(2)	(3)	(4)	
OFD	0.2995*	0.2983*	82.9855*	88.1056**	
	(0.1641)	(0.1639)	(47.7617)	(42.8294)	
Control variables	No	Yes	No	Yes	
City FE	Yes	Yes	Yes	Yes	
Year FE	Yes	Yes	Yes	Yes	
Restaurant FE	No	No	No	No	
Quarter-by-year FE	No	No	No	No	
Obs.	340	340	340	340	
Panel B: Dependent variable	FSR				
	[0.0675]				
[Mean]	(5)	(6)	(7)	(8)	(9)
OFD	-0.0078***				
	(0.0021)				
$\log(\text{number of restaurant})$		0.0006	0.0024		
		(0.0013)	(0.0019)		
$\log(\text{number of restaurant}) \times \text{OFD}$			-0.0012**		
			(0.0005)		
$1/(\text{HHI} \times 100)$				-0.0009	0.0039
				(0.0015)	(0.0028)
$1/(\text{HHI} \times 100) \times \text{OFD}$					-0.0029*
					(0.0015)
Control variables	Yes	Yes	Yes	Yes	Yes
Restaurant FE	Yes	Yes	Yes	Yes	Yes
Quarter-by-year FE	Yes	Yes	Yes	Yes	Yes
Obs.	22,712	22,712	22,712	22,712	22,712

Note: The standard errors are in parentheses. The estimates from column (1)–(4) are based on Equation (4) with city-year observations, and the dependent variable is market competition level. Standard errors are clustered at the city-year level. The estimates from column (5)–(9) are based on Equation (3) with restaurant-quarter observations. The weighted least squares estimation is used, and restaurant weights are according to their total review amounts. Standard errors are clustered at the city-quarter level.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Subsequently, we investigated the impact of market competition on food safety. The results are presented in columns 6–9 of Table 5. Columns 6 and 8 indicate that market competition does not directly exert an impact on restaurant FSR, which aligns with the theoretical prediction that the effect of competition on product quality is often ambiguous (Bennett & Yin, 2019; Chesnes et al., 2017; Gutt et al., 2019). We then introduced an interaction term between the availability of an OFD platform and market competition measures. Columns 7 and 9 show that the OFD effect is more pronounced in a more competitive market. Given that OFD platforms can significantly reduce information asymmetry in the food market (as mentioned in the section Market information extending), our finding aligns with the theory positing that the incentive for producers to offer high-quality products in a highly competitive market strengthens as market information asymmetry declines.

The above results suggest that OFD platforms intensify competition in the restaurant industry (more like an indirect effect). This intensified competition, coupled with the reduction in information asymmetry brought about by OFD platforms (a direct effect), ultimately incentivizes producers to enhance product quality and improve food safety conditions.

Regulatory intensifying within the industry

The entry of an OFD platform may also help strengthen supervision over the restaurant industry. On one hand, OFD platforms and restaurants have established an interdependent relationship regarding food safety accountability. Food safety incidents not only affect the specific restaurants involved but also damage the reputation of the entire OFD platform. This dynamic compels platforms to complement the regulatory role of the government and invest resources in constraining the production behaviors of sellers, which can improve food safety in situations where external regulations are insufficient (Lu et al., 2023). On the other hand, a large number of Chinese consumers expressed food safety concerns when OFD platforms were first available. The Baidu index for the keyword search of “food safety” rose sharply in 2012 and 2013 (see Appendix Figure A6), which coincides with the early period of OFD services in China. The growing public concern for food safety can pressure government agencies to take a more proactive role in food safety supervision (Garcia Martinez et al., 2007), resulting in improved food safety conditions in restaurants.

Empirically, we employed the Baidu Search Index for food safety as a proxy for public concern regarding food safety issues. The results in columns 1 and 2 of Table 6 indicate that public attention to food safety increased significantly following the entry of OFD platforms. Then, we used the number of monthly random sampling tests for restaurant enterprises in a city as a proxy variable for the intensity of supervision over the restaurant industry. This is the first N_{ct} used in Equation (4) as the dependent variable. Based on the specification with full control variables, Table 6 (column 4) demonstrates that the occurrence of OFD platforms led to a 2.47% increase in the number of

TABLE 6 Mechanism 3: Regulatory intensity increase.

Dependent variable	Baidu search index		Log (number of food safety sampling tests)		FSR		
	[0.18101]		[0.0195]		[0.0675]		
[Mean]	(1)	(2)	(3)	(4)	(5)	(6)	(7)
OFD	1.2794*** (0.1481)	1.2380*** (0.1295)	0.0343*** (0.0091)	0.0247*** (0.0088)	-0.0078*** (0.0021)		
\log (Number of food safety sampling tests)						-0.0091*** (0.0010)	-0.0096*** (0.0011)
Control variables	No	Yes	No	Yes	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	No	No	No
Restaurant FE	No	No	No	No	Yes	Yes	Yes
Month-by-year FE	Yes	Yes	Yes	Yes	No	No	No
Quarter-by-year FE	No	No	No	No	Yes	Yes	Yes
Obs.	10,140	10,140	10,140	10,140	22,712	22,712	22,712

Note: The standard errors are in parentheses. The estimates from column (1)–(4) are based on Equation (4) with city-month observations. The dependent variables here are the Baidu search index of food safety and number of food safety sampling tests, respectively. The estimates from column (5)–(7) are based on Equation (2) with restaurants-quarter observations, and the independent variable is the number of food safety sampling tests within a city (log-form). Standard errors are clustered at the city-quarter level.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

monthly random sampling tests for restaurant enterprises, supporting our argument of changing government regulations and oversight due to OFD.

To confirm that increased regulatory enforcement can improve food safety standards in restaurants, we applied the same model to examine the effect of intensified regulations on restaurant FSR. Columns 6 and 7 in Table 6 show that regulation intensity reduced FSR.

As a result, the aforementioned mechanism can be expressed as Figure A7. The availability of an OFD platform provides consumers with comprehensive restaurant information, strengthens the market competition in the restaurant industry, and increases regulatory intensity among overall restaurants. Given the environment changing to more transparent disclosure of food safety and hygiene conditions, online restaurants and brick-and-mortar ones (particularly those that have decided to join or are considering joining OFD platforms) could become more motivated to take measures to improve their food safety conditions. This could be the mechanism explaining why FSR decreased following the availability of OFD platforms.

Heterogeneity analysis by restaurant characteristics

In this subsection, we extend the main analysis of the ATT to explore the possibility of heterogeneous effects from six restaurant characteristics, based on Equation (3). Such analysis could allow us to gain insight into what types of restaurants are more responsive to OFD. The first four characteristics are defined depending on whether a restaurant is (1) a chain restaurant, (2) relatively more expensive than median restaurant prices in the corresponding city in a given year, (3) receiving an above-median number of reviews in the corresponding city in a certain year (popularity), and (4) with a below-average FSR value in the corresponding city in a certain year.

We created four dummy variables capturing these characteristics and report the results in columns 2–5 of Table 7 where OFD interacts with the dummy variables based on Equation (3). Chain restaurants deserve special consideration because food safety and incident/scandal can spill over to other restaurants under the same chain, resulting in larger costs. We hypothesized that the interaction of OFD and chain restaurants should be negative. This is supported by the results shown in column 1 of Table 7. The next three columns show that the effects of OFD are more pronounced for expensive restaurants, popular restaurants, and restaurants with a lower FSR (statistically significant at the 1% level). This indicates that high-end, popular, and safer restaurants may feel more competitive pressure to improve their food safety conditions in the face of OFD platforms. More resourceful and competent firms are more likely to make efforts to distinguish themselves from inept firms (Höner, 2002; Mailath & Samuelson, 2001). In addition, the potential cost of a food safety incident is higher in successful restaurants with a lower FSR. As a result, restaurant operators are more responsive to the entry of OFD platforms.

We next examined heterogeneous effects from the locations of restaurants. As the government plays the most critical role in the food safety regulation in China (Zhang et al., 2015), we assessed the relevance of a restaurant located in a province with above-median fiscal expenditure on food safety (*high fiscal expenditure* equals one if the fiscal expenditure on food safety in 2018 is above the median). Column 6 in Table 7 shows a negative interaction between OFD and *high fiscal expenditure* (statistically significant at the 5% level), indicating that the effects of OFD are higher in those provinces with higher fiscal expenditure on food safety. In other words, OFD platforms and government regulation may play a complementary role in addressing the food safety issues of restaurants, with the former's effectiveness depending on government financial support for food safety issues.

Market awareness and attention to food safety issues could also introduce heterogeneous effects for OFD. We used the case of foodborne diseases in each province to reflect market awareness, as food safety incidents in China have induced consumers to become more aware of food safety (Liu & Niyongira, 2017). The average incidence of foodborne diseases in the sample is used as a cutoff point for generating a dummy variable of *high prevalence* to reflect whether a province is a high-risk

TABLE 7 Heterogeneous effects of OFD by restaurant and regional characteristics.

Dependent variable	FSR						
	[0.0675]						
[Mean]	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>OFD</i>	−0.0078*** (0.0021)	−0.0074** (0.0031)	−0.0038 (0.0026)	−0.0046** (0.0022)	−0.0530*** (0.0038)	−0.0045* (0.0027)	−0.0056** (0.0027)
<i>OFD × Chain</i>		−0.0104** (0.0051)					
<i>OFD × High-price</i>			−0.0065*** (0.0017)				
<i>OFD × Popular</i>				−0.0047*** (0.0017)			
<i>OFD × Low-FSR</i>					−0.0738*** (0.0047)		
<i>OFD × high fiscal expenditure</i>						−0.0048** (0.0023)	
<i>OFD × high prevalence</i>							−0.0072** (0.0033)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Restaurant FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter-by-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	22,712	22,712	22,712	22,712	22,712	22,712	22,712

Note: Estimates are based on the model in Equation (3), using restaurant-quarter observations. The dependent variables of all regressions here are the restaurants' food safety risk (FSR), defined in the section Dependent variable: FSR of restaurants. The standard errors are in parentheses. Standard errors are clustered at the city-quarter level. From column (1)–(7), the weighted least squares estimation is used, and restaurants' weights are according to their total review amounts.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

province for food safety incidents. The last column of Table 7 shows that the effects of OFD platforms are more pronounced in regions with a high prevalence of foodborne diseases. One reason for this result is that people in such regions are more likely to have experience with foodborne diseases, and thus are more sensitive to food safety hazards (Kariuki & Hoffmann, 2022). Therefore, restaurant managers may have a stronger motivation to improve food safety following the introduction of an OFD platform.

Quantifying the economic benefits of OFD

Drawing upon our estimation results in Table A5 and supporting evidence from the existing literature, we estimated the extent to which OFD platforms induce a decrease in FSR may contribute to a reduction in foodborne illness cases. We also attempted to quantify the associated direct economic benefits.

The estimated ATT in Appendix Table A8 indicates that OFD platforms led to a reduction in the FSR value of 0.0078. Table A5 shows that for one unit increase in the FSR index, the number of foodborne illness cases reported in food service establishments across provinces increases from approximately 418 to 670 cases. Accordingly, the availability of OFD is expected to reduce foodborne

illness cases by approximately 3.26 (calculated as 0.0078×418) to 5.23 per province. Given that the data in Table A5 encompasses all 31 provinces of China, this implies a nationwide reduction of approximately 101–162 cases. However, due to systematic underreporting of foodborne illnesses, these figures likely underestimate the true effect. Prior studies indicate that foodborne illness underreporting rates can reach up to 90% in developed countries and up to 95% in developing countries (Odeyemi, 2016; Vishram et al., 2020). Assuming a similar underreporting rate in China, the actual nationwide reduction in foodborne illness cases could range from 1010 to 1620 (at a 90% underreporting rate), and from 2020 to 3240 (at a 95% underreporting rate). Given that the estimated direct economic loss per foodborne illness case in China is approximately 648.29 yuan (Yang et al., 2025), the potential economic benefits from a reduction in illnesses due to an improved FSR value is estimated to be between 654,773 yuan and 2,100,459 yuan, equivalent to approximately 92,102 dollars to 295,455 dollars.

5 | CONCLUSION AND POLICY IMPLICATIONS

Our study explored the influence of OFD on the food safety conditions of restaurants. OFD has important food safety implications given the global market transformation (Unnevehr, 2022). Given the difficulty of measuring food safety, we applied a machine learning approach to construct a restaurant FSR indicator based on 783,124 online reviews for 2036 restaurants in 40 Chinese cities. Our proposed FSR indicator is a low-cost alternative to government measures of food safety (such as sampling tests and foodborne illness numbers), and it features high-frequency continuous measurements with complete geographic coverage.

Based on the results of our study, we draw the following conclusions. First, OFD platforms have had a positive and dynamic effect on the food safety conditions of restaurants. Specifically, there was a significant reduction in restaurant FSR (11.4%, calculated as $0.0078/0.068$) in response to the emergence of OFD platforms. Our event study results showed that these effects occurred immediately following the entry of OFD and throughout the following four quarters. The alternative estimator by Sun and Abraham (2021) suggested that these effects occurred during the entry quarter and the remaining quarters starting from the third quarter.

Second, the improved food safety conditions in restaurants can be partly attributed to extended market information, strengthened market competition, and strengthened surveillance efforts in the restaurant industry after the introduction of OFD platforms. Importantly, since we cannot disentangle the specific effect of increasing reviews from the overall platform effect, we should be more cautious about the results that OFD platforms can bring to improve restaurants' food safety. Strictly speaking, our findings suggest that OFD platforms and food reviews jointly contribute to improved food safety outcomes.

Third, at the restaurant level, OFD has had a greater impact on chain restaurants, those that are relatively expensive and popular, as well as restaurants with an initially lower FSR. At the regional level, the impact of OFD was greater in provinces with higher food safety fiscal expenditure and in provinces with a higher incidence of foodborne illnesses.

Several policy implications emerge from our findings. First, considering the rising importance of OFD to China's economy (Meemken et al., 2022), it is advantageous that OFD served as a catalyst to improve the food safety conditions of restaurants. As many other developing countries are still in the early stages or lagging behind China in adopting OFD, expectations can be optimistic regarding how the roll-out of OFD will affect restaurant food safety conditions. Second, our mechanism and heterogeneous impact analysis suggested that improvements in restaurant food safety conditions might come from improved government supervision and regulation and/or a restaurant industry that is more proactive toward food safety. This highlights the importance of government to ensure food safety. The heterogeneity analysis also suggested that more resourceful and competent restaurants (more expensive, more popular, and with a low safety risk) are more responsive to enhancing

food safety conditions in the face of OFD. Nonetheless, the proliferation of so-called shadow restaurants in China has emerged with the expansion of the OFD industry. These establishments are typically characterized by their small-scale operations, substandard food safety practices, and competitive pricing. As such, they may require more food safety oversight from policymakers.

Our study has limitations. First, our dependent variable was measured by the proportion of food safety-related comments to total comments. That is, we treated all food safety-related evaluations with equal weight. In reality, different food safety-related comments reflect different degrees of the food safety problem. Second, due to the requirements of the study design, our study only focused on restaurants that existed before the entry of OFD platforms. We ignored restaurants that opened after the emergence of OFD platforms. Actually, the emergence of online platforms has given rise to a large number of restaurants without brick-and-mortar stores, so-called shadow restaurants. Therefore, the net impact of OFD remains to be explored.

ACKNOWLEDGMENTS

We thank H. Holly Wang and participants at the conference in 2020 CES conference for helpful comments. We also thank Shuai Chen, Wen Lin, Xin Jin, Zhen Yan, Zekuan Dong, Satoru SHIMOKWA for helpful comments. Shaosheng Jin acknowledges the financial support from the Natural Science Foundation of China (No. 72273128). We also thank the editor Christian Langpap and three anonymous reviewers for their insightful comments and constructive suggestions, which have significantly improved the quality of this article. All remaining errors are our own.

REFERENCES

- Adalja, Aaron, Erik Lichtenberg, and Elina T. Page. 2023. "Collective Investment in a Common Pool Resource: Grower Associations and Food Safety Guidelines." *American Journal of Agricultural Economics* 105(1): 144–173.
- Alcorn, Ted, and Yadan Ouyang. 2012. "China's Invisible Burden of Foodborne Illness." *Lancet* 379(9818): 789–790.
- Babar, Yash, Ali M. Adeli, and Brad N. Greenwood. 2025. "Cooking or Clicking: The Impact of Online Food Delivery Platforms on Domestic Food Preparation." *Management Science* 70. <https://doi.org/10.1287/mnsc.2023.02636>.
- Barrios, John M., Yael V. Hochberg, and Hanyi Yi. 2022. "Launching with a Parachute: The Gig Economy and New Business Formation." *Journal of Financial Economics* 144(1): 22–43.
- Bates, Sarah, Belinda Reeve, and Helen Trevena. 2020. "A Narrative Review of Online Food Delivery in Australia: Challenges and Opportunities for Public Health Nutrition Policy." *Public Health Nutrition* 26(1): 11.
- Bennett, Daniel, and Wesley Yin. 2019. "The Market for High-Quality Medicine: Retail Chain Entry and Drug Quality in India." *Review of Economics and Statistics* 101(1): 76–90.
- Bergemann, Dirk, and Alessandro Bonatti. 2024. "Data, Competition, and Digital Platforms." *American Economic Review* 114(8): 2553–95.
- Burch, Gordon, Seth Carnahan, and Brad N. Greenwood. 2018. "Can You Gig It? An Empirical Examination of the Gig Economy and Entrepreneurial Activity." *Management Science* 64(12): 5497–5520.
- Burch, Gordon, Brad N. Greenwood, and Jeffrey S. McCullough. 2021. "Ride-Hailing Services and Alcohol Consumption: Longitudinal Analysis." *Journal of Medical Internet Research* 23(1): e15402.
- Callaway, Brantly, and Pedro H. C. Sant'Anna. 2021. "Difference-In-Differences With Multiple Time Periods." *Journal of Econometrics* 225(2): 200–230.
- Cameron, A. Colin, and Douglas L. Miller. 2015. "A Practitioner's Guide to Cluster-Robust Inference." *Journal of Human Resources* 50(2): 317–372.
- Carrieri, Vincenzo, and Francesco Principe. 2022. "WHO and for How Long? An Empirical Analysis of the Consumers' Response to Red Meat Warning." *Food Policy* 108: 102231.
- Chen, Manlu, Ming Hu, and Jianfu Wang. 2022. "Food Delivery Service and Restaurant: Friend or Foe?" *Management Science* 68(9): 6539–51.
- Chesnes, Matthew, Weijia Dai, and Ginger Zhe Jin. 2017. "Banning Foreign Pharmacies From Sponsored Search: The Online Consumer Response." *Marketing Science* 36(6): 879–907.
- Cinelli, Carlos, Andrew Forney, and Judea Pearl. 2021. "A Crash Course in Good and Bad Controls." *Sociological Methods & Research* 53: 00491241221099552.
- Cui, Hailong, Rui Niu, and Xin Tong. 2022. "Food in the Time of Covid: Estimating the Effects of Delivery Platforms on Small-Business Restaurants in California." Available at SSRN 4219542.
- Dai, Weijia, and Michael Luca. 2020. "Digitizing Disclosure: The Case of Restaurant Hygiene Scores." *American Economic Journal. Microeconomics* 12(2): 41–59.
- De Chaisemartin, Clément, and Xavier d'Haultfoeuille. 2020. "Two-Way Fixed Effects Estimators With Heterogeneous Treatment Effects." *American Economic Review* 110(9): 2964–96.

- Ding, Ye, Rodolfo M. Nayga, Jr., Yinchu Zeng, Wei Yang, and Heather Arielle Snell. 2022. "Consumers' Valuation of a Live Video Feed in Restaurant Kitchens for Online Food Delivery Service." *Food Policy* 112: 102373.
- Dominianni, Christine, Kathryn Lane, Munerah Ahmed, Sarah Johnson, W. E. N. D. Y. Mckelvey, and Kazuhiko Ito. 2018. "Hot Weather Impacts on New York City Restaurant Food Safety Violations and Operations." *Journal of Food Protection* 81(7): 1048–54.
- Dorfman, Robert, and Peter O. Steiner. 1954. "Optimal Advertising and Optimal Quality." *The American Economic Review* 44(5): 826–836.
- European Centre for Disease Prevention and Control (ECDC). 2019. "Mumps." In *Annual Epidemiological Report for 2017*. Stockholm: ECDC.
- Fang, Hanming, Long Wang, and Yang Yang. 2025. "Competition and Quality: Evidence From High-Speed Railways and Airlines." *Review of Economics and Statistics* 107(2): 494–509.
- Farronato, Chiara, and Andrey Fradkin. 2022. "The Welfare Effects of Peer Entry: The Case of Airbnb and the Accommodation Industry." *American Economic Review* 112(6): 1782–1817.
- Farronato, Chiara, and Georgios Zervas. 2022. *Consumer Reviews and Regulation: Evidence From NYC Restaurants*. Cambridge: National Bureau of Economic Research.
- Feldman, Pnina, Andrew E. Frazelle, and Robert Swinney. 2023. "Managing Relationships Between Restaurants and Food Delivery Platforms: Conflict, Contracts, and Coordination." *Management Science* 69(2): 812–823.
- Garcia Martinez, Marian, Andrew Fearn, Julie A. Caswell, and Spencer Henson. 2007. "Co-Regulation as a Possible Model for Food Safety Governance: Opportunities for Public–Private Partnerships." *Food Policy* 32(3): 299–314.
- Goodman-Bacon, Andrew. 2021. "Difference-In-Differences With Variation in Treatment Timing." *Journal of Econometrics* 225(2): 254–277.
- Gutt, Dominik, Philipp Herrmann, and Mohammad S. Rahman. 2019. "Crowd-Driven Competitive Intelligence: Understanding the Relationship Between Local Market Competition and Online Rating Distributions." *Information Systems Research* 30(3): 980–994.
- Heng, Yan, Zhifeng Gao, Yuan Jiang, and Xuqi Chen. 2018. "Exploring Hidden Factors Behind Online Food Shopping From Amazon Reviews: A Topic Mining Approach." *Journal of Retailing and Consumer Services* 42: 161–68.
- Holtkamp, Nicholas, Peng Liu, and William McGuire. 2014. "Regional Patterns of Food Safety in China: What Can We Learn From Media Data?" *China Economic Review* 30: 459–468.
- Höner, Johannes. 2002. "Reputation and Competition." *American Economic Review* 92(3): 644–663.
- Hu, Lijiao, Yuqing Zheng, Timothy A. Woods, Yoko Kusunose, and Steven Buck. 2023. "The Market for Private Food Safety Certifications: Conceptual Framework, Review, and Future Research Directions." *Applied Economic Perspectives and Policy* 45(1): 197–220.
- iiMediaReport. 2020. Research Report on the Operation and Innovation of Catering Industry During the COVID-19. <https://report.iiimedia.cn/repo17-0/39080.html>.
- Jaffee, Steven, Spencer Henson, Laurian Unnevehr, Delia Grace, and Emilie Cassou. 2018. *The Safe Food Imperative: Accelerating Progress in Low- and Middle-Income Countries*. Washington, DC: World Bank Publications.
- Jin, Ginger Zhe, and Phillip Leslie. 2003. "The Effect of Information on Product Quality: Evidence From Restaurant Hygiene Grade Cards." *The Quarterly Journal of Economics* 118(2): 409–451.
- Jin, Ginger Zhe, and Phillip Leslie. 2009. "Reputational Incentives for Restaurant Hygiene." *American Economic Journal: Microeconomics* 1(1): 237–267.
- Kariuki, Sarah Wairimu, and Vivian Hoffmann. 2022. "Can Information Drive Demand for Safer Food? Impact of Brand-Specific Recommendations and Test Results on Product Choice." *Agricultural Economics* 53(3): 454–467.
- Lam, Hon-Ming, Justin Remais, Ming-Chiu Fung, Liqing Xu, and Samuel Sai-Ming Sun. 2013. "Food Supply and Food Safety Issues in China." *The Lancet* 381(9882): 2044–53.
- Lawani, Abdelaziz, Michael R. Reed, Tyler Mark, and Yuqing Zheng. 2019. "Reviews and Price on Online Platforms: Evidence from Sentiment Analysis of Airbnb Reviews in Boston." *Regional Science and Urban Economics* 75: 22–34.
- Lin, Wen, Baojie Ma, Jianguan Liang, and Shaosheng Jin. 2024. "Price Response to Government Disclosure of Food Safety Information in Developing Markets." *Food Policy* 123: 102602.
- Lin, Wen, David L. Ortega, and Vincenzina Caputo. 2019. "Are Ex-Ante Hypothetical Bias Calibration Methods Context Dependent? Evidence From Online Food Shoppers in China." *Journal of Consumer Affairs* 53(2): 520–544.
- Liu, A., and R. Niyongira. 2017. "Chinese Consumers Food Purchasing Behaviors and Awareness of Food Safety." *Food Control* 79: 185–191.
- Liu, Jialu, Siqi Pei, and Xiaoquan Zhang. 2024. "Online Food Delivery Platforms and Female Labor Force Participation." *Information Systems Research* 35(3): 1074–91.
- Lu, Liang, Guang Tian, and Patrick Hatzenbuehler. 2022. "How Agricultural Economists Are Using Big Data: A Review." *China Agricultural Economic Review* 14(3): 494–508.
- Lu, Peng, Lvjun Zhou, and Xiaoguang Fan. 2023. "Platform Governance and Sociological Participation." *The Journal of Chinese Sociology* 10(1): 3.
- Mailath, George J., and Larry Samuelson. 2001. "Who Wants a Good Reputation?" *The Review of Economic Studies* 68(2): 415–441.
- Maimaiti, Mayila, Xueyin Zhao, Menghan Jia, Yuan Ru, and Shankuan Zhu. 2018. "How We Eat Determines What We Become: Opportunities and Challenges Brought by Food Delivery Industry in a Changing World in China." *European Journal of Clinical Nutrition* 72(9): 1282–86.

- Meemken, Eva-Marie, Marc F. Bellemare, Thomas Reardon, and Carolina M. Vargas. 2022. "Research and Policy for the Food-Delivery Revolution." *Science* 377(6608): 810–13.
- Mejia, Jorge, Shawn Mankad, and Anandasivam Gopal. 2019. "A for Effort? Using the Crowd to Identify Moral Hazard in New York City Restaurant Hygiene Inspections." *Information Systems Research* 30(4): 1363–86.
- Mo, Yiqing, and Lixing Li. 2022. "Gig Economy and Entrepreneurship: Evidence From the Entry of Food Delivery Platforms (in Chinese)." *Management World* 38(2): 31–45.
- Odeyemi, Olumide A. 2016. "Public Health Implications of Microbial Food Safety and Foodborne Diseases in Developing Countries." *Food & Nutrition Research* 60(1): 29819.
- Ollinger, Michael, and John Bovay. 2020. "Producer Response to Public Disclosure of Food-Safety Information." *American Journal of Agricultural Economics* 102(1): 186–201.
- Papke, Leslie E., and Jeffrey M. Wooldridge. 1996. "Econometric Methods for Fractional Response Variables With an Application to 401 (k) Plan Participation Rates." *Journal of Applied Econometrics* 11(6): 619–632.
- Pingali, Prabhu, and Mathew Abraham. 2022. "Food Systems Transformation in Asia—A Brief Economic History." *Agricultural Economics* 53(6): 895–910.
- Sarter, Gilles, and Samira Sarter. 2012. "Promoting a Culture of Food Safety to Improve Hygiene in Small Restaurants in Madagascar." *Food Control* 25(1): 165–171.
- Starbird, S. Andrew. 2005. "Moral Hazard, Inspection Policy, and Food Safety." *American Journal of Agricultural Economics* 87(1): 15–27.
- Statista. 2023. Available at: <https://www.statista.com/outlook/dmo/online-food-delivery/worldwide>.
- Stephens, Janna, Hailey Miller, and Lisa Militello. 2020. "Food Delivery Apps and the Negative Health Impacts for Americans." *Frontiers in Nutrition* 7: 14.
- Sun, Liyang, and Sarah Abraham. 2021. "Estimating Dynamic Treatment Effects in Event Studies With Heterogeneous Treatment Effects." *Journal of Econometrics* 225(2): 175–199.
- Tao, Dandan, Pengkun Yang, and Hao Feng. 2020. "Utilization of Text Mining as a Big Data Analysis Tool for Food Science and Nutrition." *Comprehensive Reviews in Food Science and Food Safety* 19(2): 875–894.
- Unnevehr, Laurian J. 2022. "Addressing Food Safety Challenges in Rapidly Developing Food Systems." *Agricultural Economics* 53(4): 529–539.
- Vishram, Bhavita, Ameze Simbo, R. Harris, N. Pearce-Smith, R. Elson, and L. Byrne. 2020. *To Compare the Methodologies Used to Estimate Foodborne Disease in the UK to Those Used in Other Countries*. London: Public Health England.
- Wang, Xiaobing, Fangxiao Zhao, Xu Tian, Shi Min, Stephan von Cramon-Taubadel, Jikun Huang, and Shenggen Fan. 2022. "How Online Food Delivery Platforms Contributed to the Resilience of the Urban Food System in China During the COVID-19 Pandemic." *Global Food Security* 35: 100658.
- Woolley, John T. 2000. "Using Media-Based Data in Studies of Politics." *American Journal of Political Science* 44: 156–173.
- Yang, Yang, Fang-Rong Xu, Yi-Bo Zhou, Li-Qing Hu, Wei Lu, Su-Hua Zhang, Han Hu, and Xin-Er Huang. 2025. "Epidemiological Characteristics of Foodborne Disease Outbreaks in a Hospital: A 5-Year Retrospective Study." *International Journal of General Medicine* 18: 1529–42.
- Zhang, Man, Hui Qiao, Xu Wang, Ming-zhe Pu, Zhi-jun Yu, and Feng-tian Zheng. 2015. "The Third-Party Regulation on Food Safety in China: A Review." *Journal of Integrative Agriculture* 14(11): 2176–88.
- Zhao, Xueyin, Wenhui Lin, Shuyi Cen, Haoyu Zhu, Meng Duan, Wei Li, and Shankuan Zhu. 2021. "The Online-To-Offline (O2O) Food Delivery Industry and Its Recent Development in China." *European Journal of Clinical Nutrition* 75(2): 232–37.
- Zheng, Yuqing, and Talia Bar. 2023. "Certifier Competition and Audit Grades: An Empirical Examination Using Food Safety Certification." *Applied Economic Perspectives and Policy* 45(1): 182–196.
- Zhou, Jiehong, Yu Jin, and Qiao Liang. 2022. "Effects of Regulatory Policy Mixes on Traceability Adoption in Wholesale Markets: Food Safety Inspection and Information Disclosure." *Food Policy* 107: 102218.
- Zuo, Enguang, Alimjan Aysa, Mahpirat Muhammad, Yuxia Zhao, Bing Chen, and Kurban Ubul. 2022. "A Food Safety Prescreening Method With Domain-Specific Information Using Online Reviews." *Journal of Consumer Protection and Food Safety* 17: 1–13.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Ma, Baojie, Yuqing Zheng, Shaosheng Jin, and Bin Lyu. 2026. "Online Platform Entry and Food Safety Risk: Evidence from the Chinese Restaurant Industry." *American Journal of Agricultural Economics* 1–26. <https://doi.org/10.1002/ajae.70058>