The Effect of Online Channel Addition on Store Performance: Empirical Evidence from Chinese Chain Retailers

Yixin WANG
School of Economics and Management, University of Chinese Academy of Sciences, Beijing 100190, China; Shanghai HEADING Information Engineering Co., Ltd, Shanghai 201112, China
E-mail: wangyixin@hd123.com

Qiguo GONG
School of Economics and Management, University of Chinese Academy of Sciences, Beijing 100190, China; Key Laboratory of Big Data Mining and Knowledge Managements, Chinese Academy of Sciences, Beijing 100190, China
E-mail: gongqg@ucas.ac.cn

Tingyan WANG*
Nuffield Department of Medicine, University of Oxford, South Parks Road, Oxford OX1 3SY, United Kingdom; NIHR Oxford Biomedical Research Centre, Big Data Institute, University of Oxford, Old Road Campus, Oxford OX3 7LF, United Kingdom
E-mail: tingyan.wang@ndm.ox.ac.uk

Xin TIAN
School of Economics and Management, University of Chinese Academy of Sciences, Beijing 100190, China; Key Laboratory of Big Data Mining and Knowledge Managements, Chinese Academy of Sciences, Beijing 100190, China; Research Center on Fictitious Economy & Data Science, Chinese Academy of Sciences, Beijing 100190, China
E-mail: tianx@ucas.ac.cn

Abstract With the rapid development of e-Commerce and takeaway platforms, retailers have gradually developed multi-channel operations. However, limited empirical studies explored the effects of an online channel offered by takeaway platforms on the store performance. Does an online channel addition have a synergy effect or a cannibalization effect on store performance? We empirically investigate these effects by analyzing a large dataset including diverse samples collected from multiple retailers across various regions. The dataset includes 2115 stores across 25 retailers for 10 months that includes two types of retail formats and covers 16 provinces and 21 cities of China. We study the impacts of the newly introduced online channel on the incumbent offline channel and the overall store performance. The empirical results reveal that the online channel addition mainly has a synergy effect. Specifically, for the overall store, it has a positive effect on the sales and product variety, whereas it has a negative
effect on the basket size. Surprisingly, an online channel addition also has a positive effect on the offline sales. Our study adds novel values to multi-channel retailing literature by empirically researching the cannibalization and synergy effect of a new type of online channel, offered by takeaway platforms. It can provide insights for retail enterprises who are interested in introducing O2O model.

**Keywords** online channel addition; cannibalization effect; synergy effect; propensity score matching (PSM); different-in-different (DID) method

1 Introduction

With the rapid growth of multi-channel retailing over the last few years, many retailers have extended their business from brick-and-mortar stores to the Internet, meanwhile e-retailers set up offline physical shops. For instance, Carrefour in China, has started an e-store (carrefour.cn) since 2015, and cooperated with several takeaway platforms meituan, ele.me etc. and then joined JD platform two years ago. To fulfill consumers’ needs for shopping anytime and anywhere, virtually most retailers have started to provide online shopping and door-to-door service, especially during the ongoing global pandemic of corona virus disease 2019 (COVID-19) (who.int). Online channel and door-to-door delivery service, if used properly, can significantly enhance consumers’ shopping experience[1].

Even though online channel and door-to-door delivery service has become critical components of retailing and anecdotal evidences suggest that online channel may probably increase revenues and profits for retailers, limited empirical studies quantify the economic impact of online channel on store performance. Most researchers to date have only focused on the case study of the O2O (online to offline) business model, (e.g., [2, 3]). Little is known by researchers and practitioners about whether the addition of online channel and door-to-door delivery service has an effect on the sales of the offline channel; and whether it affects the overall performance of the store. In this paper, we aim to address these largely ignored questions, specifically regarding the online channel offered by takeaway platforms.

There are several reasons for the lack of research on the relationship between online channel addition and store performance. First, it is difficult to collect both of offline and online data of multiple retailers. Commonly, multi-channel data of one retailer or one channel data of multiple retailers can be easily obtained, however, it is challenging to gather multi-channel data of multiple retailers and then match them on store level. Due to the limited availability of counterpart relationship, previous studies mainly considered the correlation on company level[4]. Second, the heterogeneity across stores is possibly one of confounding factors, that is, a correlation between online channel addition and the sales of stores may merely reflect the fact that stores are in different conditions. On the other hand, it has been argued by some researchers that an online channel addition of stores may indicate their bad performance of the offline channel[5]. In other words, stores with poor sales in the offline channel most likely to be self-selected to add an online channel. Therefore, to investigate the relationship between the introduction of online channel and the store performance, it is necessary to control for store heterogeneity and the possibility of self-selection. However, data regarding these features are generally difficult to obtain.

In this study, we overcome the above-mentioned challenges. Firstly, we directly obtained
offline sales and online sales of 25 retailers from one source. These data are provided by a company who is one of the leading retailing information technology system providers in China. It offers both of offline channel and online channel systems for retailers. Although transactions recorded in these systems using different store codes, the company supplies a lookup table for code transformation, which allows comparative analysis on store level. Secondly, our rich and unique dataset enables us to eliminate store heterogeneity as a confounding factor, ensuring the reliability of our empirical results. We considered 2115 different stores of 25 chain retailers which cover 21 cities of 16 provinces and 2 retail formats. Thirdly, to control for self-selection effect, we used the approach of propensity score matching (PSM)\cite{6} to create a sample of stores without online channel addition to match those with online channel addition.

We mainly examine the effect of online channel addition on store performance in this study. By comparing the store performance using propensity score matching and different-in-different (PSM-DID) method, our empirical research results show that the synergy effect dominates. After adding online channel, not only the sales and product variety of the store level increase but also the sales of offline channel rise significantly, although average basket size decreases in both of offline channel and overall store.

Understanding the effect of online channel addition on store performance has important managerial implications. Our study aims to fill the existing void with respect to research on the impact of online channels offered by takeaway platforms on store performance. With controlling for multiple confounding factors from both of company level and store level, we reveal the cannibalization effect and synergy effect of the multi-channel operation of retail stores. Our study results suggest that retailers should consider both offline and online channel when they develop store performance. Meanwhile, they need to plan or adjust category strategies of every single store based on consumers’ behaviors, and also put forward higher requirements for store managers to increase consumer unit price.

The rest of this paper is organized as follows. Section 2 is about the relevant literature review. We then describe our hypotheses and our research design in Section 3 and Section 4, respectively. In Section 5 we report the empirical results, and Section 6 is about validation of the robustness of our results. Finally, we discuss our findings and broader implications in Section 7.

2 Related Work

2.1 Multi-Channel Retailing

Our paper is related to the literature on multi-channel retailing. Recent years, lots of retail enterprises have launched multi-channel even omni-channel strategy to satisfy consumers’ needs\cite{7}. When implementing a multi-channel strategy, they need to consider whether to add a new channel to the incumbent channel portfolio. For instance, is it valuable to add an e-commerce channel to the store channel (e.g., \cite{8, 9}), or add an offline channel to the e-commerce channel (e.g., \cite{4}). Neslin, et al.\cite{10} formally defined the multi-channel strategy as enhancing customer value through the design, deployment, coordination and evaluation of channels to achieve effective customer acquisition, retention and development. Here the channel is considered as a contact point or a medium for companies to interact with their consumers, but
rather than the traditional one-way mass media (e.g., TV ads) due to emphasizing interactivity.

Previously multi-channel researches focused on the interactions among direct-sale channels (e.g., catalog sale), offline channels (e.g., brick and mortar stores), or online channels (e.g., e-commerce). Some scholars have studied how consumers migrate from offline channels to online channels, and the impacts of online channel addition on shareholder value, store sales, customer purchasing behaviors, customer profitability and loyalty[8, 11, 12].

With the rapid development of mobile technology, consumers increasingly rely on mobile devices for communication and shopping activities, leading to another disruptive change in the retail environment[13]. Some researchers have studied the influence of mobile channel, especially mobile application (APP), on retail performance[14]. This new channel will probably break the old barriers, such as physical distance and information asymmetry, therefore it is important for retailers to reconsider the layout of various channels when a new channel appears.

Consumers’ consumption motivation can be generally divided into utilitarian-oriented and hedonic-oriented[15]. Utilitarian-oriented consumers are those who pursue shopping in the shortest time and at the lowest cost, while hedonic-oriented consumers pay more attention to the needs of entertainment, emotion, and leisure experience during shopping. With the advancement of urbanization and the accelerating pace of life, the proportion of utilitarian-oriented consumers has gradually increased. Door-to-door delivery service has been increasingly popular due to its time-saving and labor-saving features[1] and has flourished in the past three years. Consequently, online channel offered by takeaway platforms is seen as a part of multi-channel strategy by more and more retail companies.

O2O model is a new e-business model which can serve consumers better based on local market by combining offline stores and consumers’ location and internet together[16]. The existing studies on O2O model have mainly focused on the marketing model, two-sided platform, or consumer behaviors[17]. Limited literature focused on the retailers which is another important participant in the O2O model. In this paper, we aim to investigate how the addition of online channel offered by third-party platforms affects the offline channel and overall store performance.

2.2 Cross-Channel Effects

Typically, there are two different types of effects between channels in multi-channel retailing: Cannibalization effect and synergy effect. On the one hand, the performance of the incumbent channels may be partially or completely eroded by the new channel, which is called the cannibalization effect[9]. Every channel provides a unique service for consumers but also has its own limitations[18]. Consumers choose among these channels to maximize their utility[19] or pursue their specific shopping goals[20]. When the new channel is more attractive than the existing one, the cannibalization effect occurs. Some researchers have further examined the cannibalization effect is likely to occur, if the newly established channel has the same commonalities as the incumbent channel[4].

Alternatively, some researchers point out that the introduction of the new channel may make the incumbent channel sale growing. One of the reasons is that more channels can increase information release. Consumers who use more than one channel have more chance to know about retailer’s promotion information which may lead to more purchases[21]. From the
perspective of retailers, they can interact with their consumers through the new channel, which is called the ‘usability effect’ proposed by Neslin, et al.[10]. Another reason is that consumers can switch among various channels for purchasing more flexibly depending on their situations if retailers provide products or services via multiple channels[22]. With the unique characteristics of each channel, consumers who can switch among multiple channels to maximize their utilities are more likely to complete the shopping process than a single channel situation, which is called the ‘fitness effect’[23]. As Neslin and Shankar[24] pointed out, when a retailer is able to interact with their consumers through two different channels, marketing efforts from one channel may enhance purchases from the other channel. The ‘usability effect’ and ‘fitness effect’, called ‘synergy effect’ collectively, can both enhance the performance of the incumbent channels which thereby can improve the overall performance of a retail store.

Researchers have various views on cannibalization effect and synergy effect. Van Nierop, et al.[25] found that most website consumers spent less in all product categories after the introduction of an informational website. Neslin, et al.[10] stated that multi-channel strategy is ‘a type of extended distribution’ to increase sales. Also, Pauwels and Neslin[21] showed that adding brick-and-mortar stores to the existing catalog channel and internet channel results in a cannibalization effect in the catalog channel, but no such effect for internet channel. However, Coelho[26] pointed out the sale of the incumbent channel increased at first but ceased later if a company introduces a new channel.

Verhoef, et al.[7] divided the impacts of channels on performance into three types: (a) Retail firm/store level (e.g., [8, 12]), (b) retail channel level (e.g., [4, 27]), and (c) consumer level (e.g., [11, 28]). We focus on the impact of online channel offered by takeaway platforms on store performance. On the one hand, we study the effect on the channel level, i.e., the newly introduced online channel’s influence on the incumbent brick-and-mortar store (the offline channel). Meanwhile, we study the effect on the store level, i.e., the online channel’s influence on the whole store performance. In our study, we measure store performance by sales, basket size and product variety.

3 Hypotheses Development

3.1 The Effect of an Online Channel Addition on Store Sales

New shopping channel provides a different shopping experience for consumers. The literature supporting the cannibalization effect believes that if the experience in the new channel is better than that in the original one, the consumers will migrate to the new channel[29]. The takeaway platforms allow consumers to learn about all products that may meet their needs by simply searching, comparing, and purchasing. Therefore, consumers who used to shop in the brick-and-mortar stores can now try online channels, which means that the offline channel has been cannibalized. Especially if retailers supply the same products and services both in the offline store and takeaway platforms, the online channel has superior advantages for consumers to go to the offline store, i.e., the cannibalization effect would be more obvious.

According to the synergy effect, the introduction of an online channel has a positive effect on the offline channel’s sales. By releasing information about the store and its products on takeaway platforms, retailers can make more consumers know about the store and make pur-
chases. Besides, people who used to shopping in the store will learn more information about the store promotion activities and maybe consume again.

In addition, the online channel might have an integrated effect (cannibalization effect and synergy effect) on the store. Most existing literature supports that the introduction of new channel would cannibalize the sales of the incumbent channel (e.g., [21, 30]). Taking into account the convenience of an online channel and the publicity of takeaway platforms, we suppose that the cannibalization effect would be stronger than the synergy effect on the sales of the offline channel after introducing an online channel.

Hypothesis 1 (H1) An online channel addition has a negative effect on the sales of the offline channel.

There are also two possibilities for the total sales of stores after an online channel addition. On the one hand, if the cannibalization effect of an online channel is stronger that means the offline sales would be cannibalized, we should compare the increment of the new channel to the reduction of the incumbent channel. On the other hand, if the synergy effect of an online channel is stronger, and the offline sales are the same as before or even increase, we can deduce that the total sales of the store are enhanced. Based on the findings from the existing literature, the increment of a new channel is commonly larger than the reduction of the incumbent channel[30], therefore we make the similar hypothesis.

Hypothesis 2 (H2) An online channel addition has a positive effect on the overall sales of store.

3.2 The Effect of an Online Channel Addition on the Store Basket Size

Typically, the monetary amount that customers pay is used to measure a store basket size, which is determined by two factors: The price and quantity of commodities in customers’ baskets. Introducing an online channel may influence both factors. Previous studies suggested that there is a positive correlation between search capability and product price if there are a variety of similar products[31, 32]. With the rapid development in e-commerce websites and mobile applications, consumers may use online channels to get more product information including prices, which make retailers reconsider product pricing after an online channel is added.

On the other hand, the number of commodities in the basket depends on the real-time demand, environmental impact, and expectation for the future for a consumer[15]. If consumers are informed that the store has offered an online channel, the consumers would rather not buy when they face fewer urgent products in the store. In other words, the online channel has a cannibalization effect on the offline channel’s basket size. There may be synergy effects in some scenarios, for instance, the consumers put commodities into their shopping baskets when they see them in the store if they recall the description and recommendation displayed on a takeaway platform before. But the possibility is very small. Therefore, we suppose that the cannibalization effect is larger than the synergy effect on the offline channel basket size.

Hypothesis 3 (H3) An online channel addition has a negative effect on the offline channel basket size.

When the consumers choose products on a takeaway platform, they would prefer to buy more products for several reasons: No carry trouble; maybe get distribution discount or total discount; platforms recommend many related products. It is a reasonable hypothesis that
online channel’s basket size is larger than the offline channel. It in turn will influence the overall average basket size. Therefore, we hypothesize the following:

**Hypothesis 4 (H4)** An online channel addition has a positive effect on the overall basket size of a store.

### 3.3 The Effect of an Online Channel Addition on the Store Product Variety

We measure product variety by the number of sold stock-keeping units (SKUs), which is also one of the key performance index of retail enterprises. Product variety is defined as a collection of various products in a particular class of the same general kind\(^{[33]}\). Most stores operate SKUs ranging from several hundred to thousand, but only 40%~60% of them sell well. Consumers’ perceived needs vary according to different scenarios, constraints, social values\(^{[33]}\). Similar to reasons for the effect of online channel on basket size, some low-frequency commodities would suffer a greater hit after introducing an online channel. In this study, we assume that an online channel has a cannibalization effect on the offline channel’s product variety.

**Hypothesis 5 (H5)** An online channel addition has a negative effect on the offline channel product variety.

A company-level online channel, e.g., e-commerce website, often adopts the long-tail strategy that means the online channel sells a larger number of items than the offline channel. However, with the aim of fast door-to-door delivery, an online channel offered by takeaway platforms and the offline channel share the same stock of the store. Nevertheless, we still believe that an online channel can expand a store’s overall product variety with several reasonable assumptions. First, retailers can make low-frequency commodities more attractive on the online channel to promote consumers purchases. Second, some big or heavy goods are no longer a burden by the door-to-door delivery. Third, the delivery threshold or promotion threshold of the online channel may make consumers choose more SKUs. Therefore, we believe that an online channel has a synergy effect on the store’s overall product variety.

**Hypothesis 6 (H6)** An online channel addition has a positive effect on the overall product variety of a store.

### 4 Research Design

#### 4.1 Data

The data of 25 retailers for our study were collected from a leading retail IT system provider in China. These retailers are across 16 provinces or municipalities such as Shanghai, Beijing, Guangdong, Fujian, Zhejiang, Hebei, Jiangxi, Anhui, Jilin and Shandong. Among them, 21 retailers are chain convenience stores and 4 are chain specialty stores. Some of these enterprises have introduced an online channel offered by takeaway platforms as a supplement of their offline channels. Their products displayed on the takeaway platforms are a subset of the store’s SKUs, which are mostly delivered from door to door within 3 kilometers around the store. Therefore, the consumer groups of the online channel and the offline channel overlap by a certain proportion. In other words, the online channel may expand the service area of the store or may switch the consumers from going to store to waiting at home.

With the quick development of takeaway platforms and O2O model widely accepted by
consumers since 2018, more and more retail companies have cooperated with takeaway platforms such as ele.me and meituan gradually. Additionally, considering some stores closed during the Chinese Spring Festival, we selected the stores without adjusting for other channels between April 2018 and January 2019 so as to exclude abnormal data. Due to several stores with missing data, we finally included 2115 stores for analysis. Our dataset contains three parts of data: Transaction flow of offline channel, transaction flow of online channel, and store characteristics.

4.2 Main Variables

We focus on addressing the research question: How the store performance changes after introducing a new channel, especially when the new channel service scope is very similar to the incumbent channel. To answer this question, it is essential to compare offline sale volume, offline basket size, offline product variety, overall sales volume, overall basket size and overall product variety before and after introducing online channel. In addition, we also need the average daily value to eliminate the influence due to different days between months. We then consider several variables related to performance as controls for store heterogeneity, including retail format, enterprise scale, city grade and store management. All the variables used for analysis are defined in Table 1.

| Variable            | Unit   | Definition                                                                 |
|---------------------|--------|-----------------------------------------------------------------------------|
| OfflineVolume       | ITEM   | Daily transaction quantity of offline channel per month                      |
| OverallVolume       | ITEM   | Daily transaction quantity of overall store per month                        |
| OfflineSize         | RMB    | Average order price of offline channel per month                            |
| OverallSize         | RMB    | Average order price of overall store per month                              |
| OfflineVariety      | SKU    | Sold SKU number of offline channel per month                                |
| OverallVariety      | SKU    | Sold SKU number of overall store per month                                  |
| PreOfflineVolume    | ITEM   | Daily order number of offline channel before introducing O2O model per month |
| PreOfflineSize      | RMB    | Average order price of offline channel before introducing O2O model per month |
| BusinessFormat      | Is     | Chain convenience store or not                                              |
| CityGrade           | Is     | First-tier city or not according to city rank published by CBNDATA in 2018  |
| EnterpriseScale     | STORE  | Quantity of stores of same brand                                            |
| PosQty              | SET    | Quantity of cash register in using                                          |
| WorkHour            | HOUR   | Daily hours in business                                                     |

As the performance of stores with various retail formats differ greatly, we set a variable BusinessFormat to indicate if the retail format of a retailer is chain convenience store. We use a variable EnterpriseScale to reflect the brand awareness and market acceptance, which may also influence store’s performance. Given stores in different cities have different commercial background, we use variable CityGrade to indicate if the city where the store located is fist-tier city.
based on economic ranking published by CBNDATA in 2018. Considering store performance of an identical brand depends on the store management\textsuperscript{15}, we used four variables to reflect store’s historic management: Basket size, sales volume, work hour and cash register quantity.

As we focused on the influence of online channel on the incumbent offline channel and store systematically, we classify all stores into two groups by whether they introduced online channel during treatment period. There are 537 stores with dual channels (online channel and offline channel) and 1578 stores with single channel (offline channel only). Each store has 10-month records with one record per month. Comparison of these two groups of stores are provided in Table 2. On the index of sales volume of offline channel, the stores with introducing online channel have obviously higher offline sales volume (OfflineVolume: 330.9 vs. 276.7, \textit{p}<0.001), but significantly smaller offline basket size (OfflineSize: 16.4 vs. 28.4, \textit{p}<0.001), compared to those without introducing online channel.

The correlation coefficients of all variables are provided in Table 3. It shows that there is a strong correlation between the daily average sales volume of the overall store (OverallVolume) and that of the offline channel (OfflineVolume), also between the overall store basket size (OverallSize) and offline channel basket size (OfflineSize), and overall store product variety (OverallVariety) and offline channel product variety (OfflineVariety). This demonstrates that the transactions from the online channel occupy a small part of the store overall transactions. We further test the variance inflation factor, which shows that both the maximum value (3.92) and the average value (1.94) are far from 10, therefore there is no multiple mutual linear problem existing in these variables and can be simultaneously used for modeling.

| Variable               | Records for stores with online and offline channels (\textit{n} = 5370) | Records for stores with offline channel only (\textit{n} = 15780) | \textit{p}-value |
|-----------------------|--------------------------------------------------|-------------------------------------------------|------------------|
| OfflineVolume         | 330.9 (227.0)                                    | 276.7 (248.8)                                   | <0.001           |
| OverallVolume         | 332.4 (227.2)                                    | 276.7 (248.8)                                   | <0.001           |
| OfflineSize           | 16.4 (14.4)                                      | 28.4 (35.2)                                     | <0.001           |
| OverallSize           | 16.4 (14.0)                                      | 28.4 (35.2)                                     | <0.001           |
| OfflineVariety        | 1593.2 (729.4)                                   | 1382.2 (644.8)                                  | <0.001           |
| OverallVariety        | 1669.0 (763.6)                                   | 1382.2 (644.8)                                  | <0.001           |
| PreOfflineVolume      | 315.3 (210.5)                                    | 260.0 (239.3)                                   | <0.001           |
| PreOfflineSize        | 16.2 (14.1)                                      | 28.8 (36.6)                                     | <0.001           |
| BusinessFormat        | 1.0 (0.1)                                        | 0.9 (0.4)                                       | <0.001           |
| CityGrade             | 0.1 (0.3)                                        | 0.4 (0.5)                                       | <0.001           |
| EnterpriseScale       | 759.1 (467.3)                                    | 591.9 (449.4)                                   | <0.001           |
| PosQty                | 1.3 (0.7)                                        | 1.4 (0.6)                                       | <0.001           |
| WorkHour              | 23.4 (2.0)                                       | 22.1 (3.8)                                      | <0.001           |
Table 3  Correlation coefficient matrix of variables

|     | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   |
|-----|------|------|------|------|------|------|------|------|------|------|------|
| 1   | 1.000|      |      |      |      |      |      |      |      |      |      |
| 2   | 1.000| 1.000|      |      |      |      |      |      |      |      |      |
| 3   | -0.540*** | -0.540*** | 1.000|      |      |      |      |      |      |      |      |
| 4   | -0.540*** | -0.540*** | 1.000*** | 1.000|      |      |      |      |      |      |      |
| 5   | 0.497*** | 0.497*** | 0.025*** | 0.025*** | 1.000|      |      |      |      |      |      |
| 6   | 0.497*** | 0.497*** | 0.024*** | 0.024*** | 0.999*** | 1.000|      |      |      |      |      |
| 7   | 0.923*** | 0.923*** | -0.512*** | -0.512*** | 0.465*** | 0.465*** | 1.000|      |      |      |      |
| 8   | -0.488*** | -0.488*** | 0.958*** | 0.958*** | 0.041*** | 0.041*** | -0.501*** | 1.000|      |      |      |
| 9   | -0.010 | -0.010 | -0.232*** | -0.232*** | -0.262*** | -0.262*** | 0.021*** | -0.248*** | 1.000|      |      |
| 10  | 0.244*** | 0.244*** | 0.190*** | 0.190*** | 0.466*** | 0.466*** | 0.218*** | 0.205*** | -0.391*** | 1.000|      |
| 11  | 0.265*** | 0.265*** | -0.567*** | -0.567*** | -0.174*** | -0.173*** | 0.274*** | -0.590*** | 0.326*** | -0.280*** | 1.000|

Note: *** p<0.01, ** p<0.05, * p<0.1
4.3 Empirical Model

We conducted an empirical study using original transaction data of multiple retailers. Some of them have introduced online channel while others have not. Given that an enterprise’s choice may be affected by many factors, it is difficult to guarantee the randomness of the distribution of the treatment group and the control group, that is, there may be a self-selection bias that can cause an endogeneity problem. Therefore, it is necessary to reduce this kind of interference in the analysis. Firstly, we matched the samples from the treatment group and the control group at the store level to contrast the influence of online channel. Then we adopted a different-in-different (DID) approach to compare changes on the store performance. These two steps are detailed as follows:

(a) Match samples in the treatment group and the control group using PSM

We used PSM approach to reduce the self-selection bias. The covariates used for matching including cash register quantity, operating hours, average daily sales volume, the square of average daily sales volume, basket size, the square of basket size, enterprise scale, city grade and retail format. By using the propensity score for matching, the common value range of the treatment group and the control group was determined. We performed the PSM process using kernel matching method.

(b) Compare changes on the store performance between groups using DID model

We used the DID model to eliminate permanent differences and temporary biases between the treatment group and the control group. This DID model can be represented as following:

\[
\text{diff} = E(y_{it} | S_{it} = 1) - E(y_{it} | S_{it} = 0) - (E(y_{it} | S_{it} = 1) - E(y_{it} | S_{it} = 0)), \tag{1}
\]

where \(i\) denotes a particular store, \(t\) denotes the number of months since the beginning of the observation period, \(S_{it}\) represents if the store \(i\) introduces online channel at month \(t\), \(y_{it}\) denotes dependent variables (i.e., sales volume of offline channel, sales volume of overall store, basket size of offline, basket size of overall store, product variety of offline channel or product variety of overall store). \((y_{it}^1 | S_{it} = 0)\) and \((y_{it}^0 | S_{it} = 0)\) is the performance of store before introducing online channel in treatment group and control group, respectively; while \((y_{it}^1 | S_{it} = 1)\) and \((y_{it}^0 | S_{it} = 1)\) is the performance of store after introducing online channel in the treatment group and the control group, respectively.

In order to further examine the explanatory power of the model, multiple control variables are gradually added to the above model, and the goodness-of-fit value of the model are observed.

\[
y_{it} = \beta_0 + \beta_1 G_i \times D_t + \beta_2 G_i + \gamma D_t + \delta Z_i + \varepsilon_{it}, \tag{2}
\]

where \(i\) denotes a particular store, \(t\) denotes the number of month since the beginning of the observation period, and \(y_{it}\) denotes dependent variables (i.e., sales volume of offline channel, sales volume of overall store, basket size of offline, basket size of overall store, product variety of offline channel or product variety of overall store). \(G_i\) is a group dummy variable that denotes if the store belongs to the treatment group or not, \(D_t\) is a time dummy variable that denotes if it is in the treatment period or not, the interaction item \(G_i \times D_t\) is the main observation index. \(Z_i\) represents the control variables vector in PSM method, and \(\varepsilon_{it}\) denotes the random error.
5 Empirical Analyses

5.1 PSM Model

537 stores in the treatment group and 1578 stores in the control group were finally matched. Figure 1 shows the results of PSM. Obviously, the standardized deviations of all variables are <10% for matched groups, which is a sign of good balance between treatment and control groups after matching. Moreover, Figure 2 shows that most of the observations in two matched groups are within the common value range, i.e., 87.5% (470/537) of stores in the treatment group and 96.1% (1516/1578) in the control group, respectively.

![Figure 1 Standardized deviation diagram](image1)

![Figure 2 Common value range of propensity scores](image2)
5.2 DID Model

We used DID model to compare the average differences of dependent variables between before and after online channel addition of the matched treatment group and control group. We divided samples into 4 groups: Transaction records of treatment group before the treatment period (Treated=1, TreatedPeriod=0), transaction records of treatment group within the treatment period (Treated=1, TreatedPeriod=1), transaction records of control group before the treatment period (Treated=0, TreatedPeriod=0), and transaction records of control group within the treatment period (Treated=0, TreatedPeriod=1).

|                         | Treatment Group | Control Group | Differences | DID |
|-------------------------|-----------------|---------------|-------------|-----|
| OfflineVolume           | 293.243         | 228.149       | 65.093      | 25.397 |
| OverallVolume           | 293.243         | 228.149       | 65.093      | 27.263 |
| OfflineSize             | 14.865          | 17.357        | −2.492      | −0.617 |
| OverallSize             | 14.865          | 17.357        | −2.492      | −0.558 |
| OfflineVariety          | 1288.198        | 1298.545      | −10.347     | 5.787 |
| OverallVariety          | 1288.198        | 1298.545      | −10.347     | 77.235 |

Due to the data aggregated monthly, some stores introduced online channel in the middle of the month, resulting in single-channel and dual-channel operations might exist in a month. Given that, we considered the month before introducing the online channel as ‘before’ (TreatedPeriod=0) and the month after the online channel introduced as ‘after’ (TreatedPeriod=1). For example, a store introduced an online channel in May 2018, April 2018 is considered as ‘before’ while June 2018 as ‘after’. Table 4 shows that most DID values of the dependent variables are positive, including sales volume of offline channel and overall store, (OfflineVolume, OverallVolume), product variety of offline channel and overall store (OfflineVariety, OverallVariety). However, DID values of basket size of both offline channel and overall store are negative, which indicates the cannibalization effect is stronger than the synergy effect in terms of basket size (OfflineSize, OverallSize).

We then added variables including retail format, enterprise scale, city grade and store management to DID regression. The estimation results of DID model are provided in Table 5. Columns (1), (2) and (6) show that the online channel addition has a significantly positive effect on the sales volume of the offline channel, the sales volume and the product variety of overall store, which indicates the synergy effect is highly remarkable. Meanwhile, columns (3) and (4) of Table 5 show the online channel addition has a significantly negative effect on the basket size of both offline channel and overall store. Finally, the results reveal some surprising outcomes which summarized in Table 6.
Table 5 DID model estimation results

|                          | Offline-Volume | Overall-Volume | Offline-Size | Overall-Size | Offline-Variety | Overall-Variety |
|--------------------------|----------------|---------------|--------------|--------------|-----------------|-----------------|
|                          | (1)            | (2)           | (3)          | (4)          | (5)             | (6)             |
| Treated × TreatedPeriod  | 0.093***       | 0.099***      | −0.043***    | −0.033***    | 0.005           | 0.051***        |
|                          | (0.000)        | (0.000)       | (0.000)      | (0.002)      | (0.718)         | (0.001)         |
| Treated                  | −0.027**       | −0.027**      | 0.000        | −0.005       | 0.082***        | 0.084***        |
|                          | (0.043)        | (0.046)       | (0.956)      | (0.513)      | (0.000)         | (0.000)         |
| TreatedPeriod            | −0.037***      | −0.037***     | 0.025***     | 0.025***     | −0.008***       | −0.008***       |
|                          | (0.000)        | (0.000)       | (0.000)      | (0.000)      | (0.009)         | (0.009)         |
| PreStoreSize             | −0.130         | −0.132        | 0.487***     | 0.731***     | 1.078***        | 1.067***        |
|                          | (0.167)        | (0.161)       | (0.000)      | (0.000)      | (0.000)         | (0.000)         |
| PreStoreSize²            | 0.011          | 0.012         | 0.029***     | 0.002        | −0.101***       | −0.099***       |
|                          | (0.256)        | (0.248)       | (0.000)      | (0.801)      | (0.000)         | (0.000)         |
| PreStoreVolume           | 1.247***       | 1.246***      | −0.371***    | −0.318***    | 0.794***        | 0.792***        |
|                          | (0.000)        | (0.000)       | (0.000)      | (0.000)      | (0.000)         | (0.000)         |
| PreStoreVolume²          | −0.035***      | −0.035***     | 0.021***     | 0.021***     | −0.048***       | −0.048***       |
|                          | (0.000)        | (0.000)       | (0.000)      | (0.000)      | (0.000)         | (0.000)         |
| PosQty                   | 0.107***       | 0.107***      | 0.000        | 0.004        | 0.127***        | 0.127***        |
|                          | (0.000)        | (0.000)       | (0.000)      | (0.105)      | (0.000)         | (0.000)         |
| WorkHour                 | −0.003***      | −0.003***     | 0.004***     | 0.004***     | −0.011***       | −0.011***       |
|                          | (0.000)        | (0.000)       | (0.000)      | (0.000)      | (0.000)         | (0.000)         |
| EnterpriseScale          | −0.021***      | −0.021***     | 0.016***     | 0.016***     | −0.038***       | −0.038***       |
|                          | (0.000)        | (0.000)       | (0.000)      | (0.000)      | (0.000)         | (0.000)         |
| BusinessFarmat           | 0.297***       | 0.299***      | −0.193***    | −0.250***    | 0.092           | 0.098           |
|                          | (0.000)        | (0.000)       | (0.000)      | (0.000)      | (0.335)         | (0.310)         |
| CityGrade                | 0.468***       | 0.470***      | 0.319***     | 0.316***     | 0.257***        | 0.255***        |
|                          | (0.000)        | (0.000)       | (0.000)      | (0.000)      | (0.236)         | (0.210)         |
| Intercept                | −0.150         | −0.145        | 1.884***     | 1.391***     | 2.263***        | 2.290***        |
|                          | (0.565)        | (0.579)       | (0.000)      | (0.000)      | (0.000)         | (0.000)         |
| Sample Size              | 26260          | 26260         | 26260        | 26260        | 26260           | 26260           |
| $R^2$                    | 0.835          | 0.835         | 0.826        | 0.801        | 0.658           | 0.658           |

Note: *** $p<0.01$, ** $p<0.05$, * $p<0.1$; standard errors are in parentheses.
Table 6 Summary of results

| Hypothesis | Result          |
|------------|----------------|
| H1: Online channel addition has a negative effect on sales of offline channel | Not Supported |
| H2: Online channel addition has a positive effect on overall sales of store | Supported |
| H3: Online channel addition has a negative effect on basket size of offline channel | Supported |
| H4: Online channel addition has a positive effect on overall basket size of store | Not Supported |
| H5: Online channel addition has a negative effect on product variety of offline channel | Not Supported |
| H6: Online channel addition has a positive effect on overall product variety of store | Supported |

5.3 Interpretation of Results

1) The Effect of an Online Channel Addition on Store Sales

In the previous literature, most researchers support that new channels cannibalize the sales of incumbent channels. For instance, Deleersnyder, et al.\cite{9} believe if the new channel (an internet channel) is too imitative of the incumbent channel, the probability of cannibalization effect can be very high. Pauwels and Neslin\cite{21} agree that the store channel cannibalizes the sales of category-sale channel after implementing the multi-channel strategy. Huang, et al.\cite{30} conducted an empirical study to verify that the introduction of a mobile commerce channel has a certain cannibalization effect on an existing e-commerce channel (PC end). As for the impact on the overall store sales, all of the above-mentioned studies believe that the new channel introduction has a positive effect.

In our study, we show a consistent conclusion regarding the sales of overall store with the existing literature. After introducing online channel, store’s overall sales volume increases. Surprisingly, our study show that online channel offered by takeaway platforms has a positive effect on the sales volume of the offline channel, which reveals that synergy effect dominates.

We further find that a large-scale customer channel migration has not happened. There might be several reasons accounted for this. First, the new online channel has a higher threshold than the incumbent offline channel, i.e., the online channel generally only serves an order that is above 20 yuan which is higher than the offline unit price, and meanwhile an online order needs extra 5 yuan as delivery fee which is about 1/3 of the offline unit price. Also, with the chain convenience stores and chain specialty stores open intensively, most of the consumers are around a store within 1 kilometer, so the online channel does not play its advantage in many cases. Another reason may be that the display and promotion on new online channel will enhance the exposure of stores and products, which in turn increases the transaction frequency in the incumbent offline channel. For example, some enterprises even carry out marketing activities and send the messages to consumers via e-mail, APPs, etc., for introducing online channel, which increases their brand exposure and then may attract consumers to their offline stores.

Therefore, Hypothesis 1 is not supported and Hypothesis 2 is supported.
2) The Effect of an Online Channel Addition on Basket Size

The existing literature shows debated findings on how the introduction of new channel influence the basket size of incumbent channel. On the one hand, some researchers think that a new channel has no influence on the incumbent channel’s basket size. For instance, Pauwels and Neslin\cite{21} reported that the original category-sale channel and e-commerce channel’s basket size has no obvious changes after introducing store channel. On the other hand, some studies believe that a new channel has a negative effect on the incumbent channel’s basket size, that is, the new channel’s cannibalization effect is stronger. For example, Van Nierop, et al.\cite{25} observed that most consumers spend less on categories after introducing the store information website. Huang, et al.\cite{30} also pointed out that the original e-commerce channel’s basket size is cannibalized a lot after introducing a mobile-commerce channel.

The results of our study on a large dataset collected from multiple retailers further support the opinion that, a new channel would cannibalize the incumbent channel’s basket size, which means that offline channel’s basket size significantly changes after introducing an online channel. It may have a relationship with our research objectives. Most of consumers shopping in chain convenience stores or chain specialty stores pursue convenience, so they focus on their current requirements but do not consider future possible needs especially when they are informed that a new online channel is offered. Although the online channel’s average basket size is larger than the offline channel, it has very little impact on the overall store basket size due to its small percentage. Therefore, Hypothesis 3 is supported and Hypothesis 4 is not supported.

3) The Effect of an Online Channel Addition on Product Variety

The Pareto Principle, also known as 80/20 rule, describes the common pattern of a store’s product variety and long tail theory is more precise for e-commerce channel’s product variety. Brynjolfsson, et al.\cite{34} empirically validated that the Internet channels exhibit a significantly less concentrated sales distribution than traditional channels even when both the Internet and traditional channels share exactly the same products and prices. Consumers’ usage of the Internet search and recommendation engine that costs less is associated with an increase of the share of niche products. However, as far as we know, there is no literature about the impact of the new channel addition on the incumbent channel’s product variety.

We make the same hypotheses as existing theories. Through the empirical research, we find that the overall product variety of store obviously enlarged after introducing the online channel, which is consistent with previous literature\cite{34}. However, as to the effect of an online channel addition on offline channel’s product variety, the effect is also positive, but not significant. In summary, Hypothesis 5 is not supported and Hypothesis 6 is supported.

6 Robustness Check

Someone argues, however, that stores’ revenues may not increase because the retailers need pay certain proportions of rebates to takeaway platforms, even bear parts of promotion or distribution costs sometimes. And another one may also argue that whether the synergy effect would continue. Further analyses demonstrate that our results are robust after considering the real earnings and sustainability.
6.1 Using Sales Revenue Instead of Sales Volume

To validate the robustness of our findings, we alternatively use the real revenue as the measure of performance. We let OfflineRevenue denote the sales of the offline channel, and OverallRevenue denote the total sales of the offline channel and the online channel. As the online channel relies on the takeaway platforms to display products, receive orders, and deliver commodities, the retailer should pay a certain proportion of rebates to takeaway platforms, and sometimes bear a part of promotion or distribution costs. Given that, we take the final settlement amount from third-party platforms as the actual revenue of the stores’ online channel and calculate the average daily value. Table 7 shows that the online channel significantly has a positive effect on the offline revenue and the overall revenue, which indicates the synergy effect is very strong, even when the basket sizes of the offline channel and the overall store decreased. Therefore, Hypothesis 2 is still supported.

6.2 Sustainable Effect

We then verify the effect of adding an online channel by comparing the month before and 3 months after the treatment month. Generally, chain retailers would take some promotion activities such as post in store, and message to consumers at the early period that bring extraordinary orders. Therefore, one may doubt if the findings are robust after a period of time. Will the online channel’s synergy effect on sales volume and revenue and the cannibalization effect on basket size continue? To verify this, we test the DID model using the data one month before and three months after the introduction of newly online channel. The results are summarized in Table 8.

In Table 8, Columns (1), (2), (7), and (8) show that the online channel addition still has a significantly positive effect on the sales volume and revenue either single offline channel or overall store. Hence, we assert that Hypothesis 1 is not supported and Hypothesis 2 is supported.

Meanwhile, columns (3) and (4) display that the online channel addition has a negative effect on basket size, and the cannibalization effect is even stronger than that in the first month, therefore we further confirm that Hypothesis 3 is supported again and Hypothesis 4 is not supported.

In terms of product variety, the online channel addition still has a significantly positive effect on the overall store and the synergy effect on the offline channel is not notable, shown in columns (5) and (6) which is consistent with the results of our main model, i.e., Hypothesis 5 is not supported and Hypothesis 6 is supported.
|                       | OfflineRevenue |                        | OverallRevenue |                        |
|-----------------------|----------------|------------------------|----------------|------------------------|
|                       | (1)            | (2)                    | (3)            | (1)                    | (2)                    | (3)            |
| Treated × TreatedPeriod | 0.051          | 0.051***               | 0.051***       | 0.063                  | 0.063***               | 0.063***       |
|                       | (0.202)        | (0.001)                | (0.001)        | (0.113)                | (0.000)                | (0.000)        |
| Treated               | 0.180***       | −0.024**               | −0.027**       | 0.180***               | −0.024**               | −0.026**       |
|                       | (0.000)        | (0.031)                | (0.022)        | (0.000)                | (0.036)                | (0.025)        |
| Treated Period        | (0.012)        | −0.012***              | −0.012***      | (0.012)                | −0.012***              | −0.012***      |
|                       | (0.163)        | (0.002)                | (0.001)        | (0.163)                | (0.002)                | (0.001)        |
| PreStoreSize          | 0.173**        | 0.356***               | 0.171**        | 0.353***               |                        |                |
|                       | (0.023)        | (0.000)                | (0.025)        | (0.000)                |                        |                |
| PreStoreSize$^2$      | 0.043***       | 0.040***               | 0.043***       | 0.040***               |                        |                |
|                       | (0.000)        | (0.000)                | (0.000)        | (0.000)                |                        |                |
| PreStoreVolume        | 0.573***       | 0.876***               | 0.571***       | 0.874***               |                        |                |
|                       | (0.000)        | (0.000)                | (0.000)        | (0.000)                |                        |                |
| PreStoreVolume$^2$    | 0.007**        | −0.014***              | 0.008**        | −0.014***              |                        |                |
|                       | (0.043)        | (0.000)                | (0.041)        | (0.000)                |                        |                |
| PosQty                | 0.107***       |                        | 0.107***       |                        |                        |                |
|                       | (0.000)        |                        | (0.000)        |                        |                        |                |
| WorkHour              | 0.001          |                        | 0.001          |                        |                        |                |
|                       | (0.475)        |                        | (0.484)        |                        |                        |                |
| EnterpriseScale       | −0.001         |                        | −0.001         |                        |                        |                |
|                       | (0.735)        |                        | (0.736)        |                        |                        |                |
| BusinessFormat        | 0.105***       |                        | 0.107***       |                        |                        |                |
|                       | (0.001)        |                        | (0.001)        |                        |                        |                |
| CityGrade             | 0.225***       |                        | 0.227***       |                        |                        |                |
|                       | (0.000)        |                        | (0.000)        |                        |                        |                |
| Intercept             | 8.667***       | 2.822***               | 1.734***       | 8.667***               | 2.831***               | 1.745***       |
|                       | (0.000)        | (0.000)                | (0.000)        | (0.000)                | (0.000)                | (0.000)        |
| Sample size           | 26260          | 26260                  | 26260          | 26260                  | 26260                  | 26260          |
| $R^2$                 | 0.070          | 0.820                  | 0.825          | 0.070                  | 0.820                  | 0.825          |

Note: *** $p<0.01$, ** $p<0.05$, * $p<0.1$; standard errors are in parentheses.
Table 8  Estimation results of sustainable effect

|                                | Offline-Volume | Overall-Volume | Offline-Size | Overall-Size | Offline-Variety | Overall-Variety | Offline-Revenue | Overall-Revenue |
|--------------------------------|----------------|----------------|--------------|--------------|-----------------|-----------------|-----------------|-----------------|
|                                | (1)           | (2)            | (3)          | (4)          | (5)             | (6)             | (7)             | (8)             |
| Treated x TreatedPeriod        | 0.100***      | 0.199***       | -0.063***    | -0.056***    | 0.013           | 0.076***        | 0.037***        | 0.055***        |
|                                | (0.000)       | (0.000)        | (0.000)      | (0.000)      | (0.402)         | (0.000)         | (0.025)         | (0.001)         |
| Treated                        | -0.023*       | -0.023*        | 0.003        | 0.003        | 0.079***        | 0.082***        | -0.021*         | -0.019*         |
|                                | (0.092)       | (0.099)        | (0.731)      | (0.687)      | (0.000)         | (0.000)         | (0.080)         | (0.098)         |
| TreatedPeriod                  | -0.121***     | -0.121***      | 0.063***     | 0.063***     | -0.025***       | -0.025***       | -0.050***       | -0.059***       |
|                                | (0.000)       | (0.000)        | (0.000)      | (0.000)      | (0.000)         | (0.000)         | (0.000)         | (0.000)         |
| PreStoreSize                   | -0.274*       | -0.274*        | 0.755***     | 0.752***     | 1.101***        | 1.086***        | 0.481***        | 0.478***        |
|                                | (0.084)       | (0.085)        | (0.000)      | (0.000)      | (0.000)         | (0.000)         | (0.002)         | (0.002)         |
| PreStoreSize²                  | 0.20          | 0.20           | -0.001       | -0.001       | -0.103***       | -0.101***       | 0.019           | 0.020           |
|                                | (0.258)       | (0.264)        | (0.940)      | (0.960)      | (0.000)         | (0.000)         | (0.236)         | (0.237)         |
| PreStoreVolume                 | 1.145***      | 1.143***       | -0.307***    | -0.308***    | 0.796***        | 0.794***        | 0.838***        | 0.835***        |
|                                | (0.000)       | (0.000)        | (0.000)      | (0.000)      | (0.000)         | (0.000)         | (0.000)         | (0.000)         |
| PreStoreVolume²                | -0.031***     | -0.031***      | 0.020***     | 0.020***     | -0.048***       | -0.048***       | -0.011**        | -0.010**        |
|                                | (0.000)       | (0.000)        | (0.000)      | (0.000)      | (0.000)         | (0.000)         | (0.031)         | (0.034)         |
| PosQty                         | 0.100***      | 0.100***       | 0.004        | 0.004        | 0.124***        | 0.124***        | 0.104***        | 0.104***        |
|                                | (0.000)       | (0.000)        | (0.168)      | (0.167)      | (0.000)         | (0.000)         | (0.000)         | (0.000)         |
| WorkHour                       | -0.003***     | -0.003***      | 0.004***     | 0.004***     | -0.011***       | -0.011***       | 0.001           | 0.001           |
|                                | (0.004)       | (0.004)        | (0.000)      | (0.000)      | (0.000)         | (0.000)         | (0.378)         | (0.400)         |
| EnterpriseScale                | -0.034***     | -0.034***      | 0.019***     | 0.019***     | -0.041***       | -0.042***       | -0.016***       | -0.016***       |
|                                | (0.000)       | (0.000)        | (0.000)      | (0.000)      | (0.000)         | (0.000)         | (0.008)         | (0.008)         |
| BusinessFormat                 | 0.261*        | 0.257*         | -0.268***    | -0.266***    | 0.107           | 0.112           | -0.007          | -0.010          |
|                                | (0.083)       | (0.096)        | (0.000)      | (0.000)      | (0.355)         | (0.335)         | (0.952)         | (0.934)         |
| CityGrade                      | 0.458***      | 0.450***       | 0.339***     | 0.336***     | 0.217***        | 0.215***        | 0.348***        | 0.346***        |
|                                | (0.000)       | (0.000)        | (0.000)      | (0.000)      | (0.236)         | (0.210)         | (0.000)         | (0.000)         |
| Intercept                      | 0.440         | 0.446          | 1.305***     | 1.316***     | 2.253***        | 2.287***        | 1.746***        | 1.761***        |
|                                | (0.215)       | (0.211)        | (0.000)      | (0.000)      | (0.000)         | (0.000)         | (0.000)         | (0.000)         |
| N                              | 18784         | 18784          | 18784        | 18784        | 18784           | 18784           | 18784           | 18784           |
| $R^2$                          | 0.837         | 0.837          | 0.803        | 0.803        | 0.655           | 0.654           | 0.822           | 0.821           |

Note: *** $p<0.01$, ** $p<0.05$, * $p<0.1$; standard errors are in parentheses.
7 Conclusions and Discussions

With the acceleration of the pace of life, more and more consumers are accustomed to the easy and convenient door-to-door delivery shopping experience, and the takeaway platforms are developing rapidly. However, there has been very little empirical research on the effect of an online channel offered by takeaway platforms on a retailer’s store performance. This study aims to fill this gap in the literature by analyzing a large dataset including transaction records of multiple retailers. Our analysis results reveal that the synergy effect of an online channel addition on the store performance is stronger than the cannibalization effect. Specifically, the online channel addition has a significantly positive effect on sales of both the offline channel and the overall store, as well as on the product variety of the overall store. Even after three months, the synergy effect is still obvious. Meanwhile, it has a negative effect on the average basket size either offline channel or overall store with being more intense over time. These findings have novel implications for theory and practice.

7.1 Theoretical Implications

This study adds three key theoretical insights into the literature:

1) We investigated the impact of an additional online channel offered by takeaway platforms on store performance, which is a new subject in the field of multi-channel retailing that has been rarely explored previously. The online channel offered by takeaway platforms, which also serves as the solution for the last-mile logistics, has a more direct influence on store performance, while most existing studies of retail channel have focused on channels such as e-commerce channel and mobile channel.

2) For the cannibalization and synergy effects in multi-channel operations of retail stores, our study investigates the association between the introduced online channel and the offline channel from the store level that means the inventory and consumers almost the same for both channels, which is different from previous studies that explored the effects between channels from the company level.

3) To our knowledge, this is the first study to control the confounding factors from the store level including POS quantity, operation hours, and historical operations, as well as the interference factors from the company level including retail format, enterprise scale, and city grade. We used a large dataset including diverse samples collected from multiple retailers across various regions, i.e., 2115 stores across 25 retailers for 10 months that includes two types of retail formats and covers 16 provinces and 21 cities of China, therefore we ensure the universality and robustness of our results.

7.2 Practical Implications

Our study has several important practical implications. First, multi-channel strategy can help chain retailers to improve store performance. We find that an online channel addition not only enhances the store overall performance but also has a positive effect on the offline channel’s performance. Our study shows that the total store revenue still increases after introducing an online channel offered by take away platforms, even there is a commission for platform services. These findings can enhance the confidence of retailers to cooperate with takeaway platforms.

Second, our study suggests that the retailers need to plan or adjust the category strategies
of a store according to consumer behavior data. Our study shows that after adding an online channel to the incumbent offline channel, the stores’ category sales significantly change. Therefore, preparations of some goods that might be neglected in the offline channel but popular in the online channel, will bring promising benefits.

Finally, our study reveals that multi-channel operations with an introduced online channel also put forward higher requirements for store managers to increase consumer unit price. An online channel addition might have a negative effect on the offline channel basket size. Therefore, it requires retailers to adopt better marketing and promotion strategies for the offline channel when they implement multi-channel operations.

7.3 Caveats and Limitations

In this paper, we focus on a new type of online channel on the performance both of the incumbent offline channel and the overall store via an empirical study. To avoid possible human interference and ensure that the analysis results are closer to the real environment, we performed econometric modeling based on hundreds of millions of transaction records of multiple chain retail companies, which is different from those studies based on interviews and experiments. The findings in this study are robust and have survived robustness checks. Nevertheless, our study is not without limitations. We are unable to extrapolate our results to stores of other retail formats because various types of stores have different scenarios and features. To bolster our findings, future research could collect data focusing on the other retail formats. Another promising research topic would be to take into account the user preference information of commodity in various channels.

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