



A Data-Driven Research of Sales and Delivery on JD.Com Platform: Based on DID Model

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Abstract. E-commerce has become an integral part of people's lives and its ease and breadth have given great convenience. Price changes and platform activity are always points of concern in people's online purchases. This paper takes the JD.com platform as the research object to explore the impact of the Butterfly Festival on JD.com sales and delivery speed. Data from the database provided by JD.com are used for the analysis. Two time periods during and after the Butterfly Festival were selected, the parameters were estimated by linear regression based on the DID model, and the results obtained were representative and convincing because of the large data sample. By comparing the data during and after the Butterfly Festival, it was found that there was a decrease in the average sales per item and no significant impact on the delivery speed. For these phenomena, reasonable explanations and future predictions were made based on the characteristics of the JD.com platform and the industry. In conclusion, the Butterfly Festival must have been a success and made a significant contribution to JD.com's first-quarter sales in 2018, while it can be seen that JD.com is a mature platform in terms of logistics management. In the future, JD.com can launch strategies for different customer populations on a large scale to make JD.com a larger and more mature integrated e-commerce platform.

Keywords: E-commerce · Data-Driven · Sales · Delivery

1 Introduction

1.1 Objective

The E-commerce industry is increasingly becoming a hot spot in the current economy and is a new driving force for sustainable economic development. Now that the global economy has entered the Internet era, taking the initiative to integrate will enable us to gain a head start. The implementation of the Internet business strategy accelerates the promotion of cross-border integration of the development of the e-commerce industry and continuously improves the overall economic benefits of industrial development. In March 2018, Alibaba launched the Tmall Queen's Day campaign. It aims to divert consumers' fashion trends and create a city of Tmall fashion brands. A large number of goods on sale, plus a hundred million shopping allowance, big brand shopping coupons and other multiple benefits. The event runs from March 7 to March 9.

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The difference-in-differences (DID) model was used to estimate the impact effect of the policy. The study population is set and randomly divided into treatment and control groups according to the policy quasi-natural experiment, with the group affected by the policy called the treatment group and the opposite called the control group. To make accurate estimates of the policy effects, the changes in the treatment group before and after the occurrence of the policy are first specified, and the changes before and after the occurrence of the policy are measured using the control group, which represents the time effect. Excluding the change in the control group from the change in the treatment group yields an estimate of the policy effect without the time effect. This article formally uses the DID model to study the changes in sales and delivery times under the influence of the butterfly festival, a time effect.

1.2 Related Research

Hu studied JD.com from two aspects. Firstly, from the theories related to strategic management, Lu used various analysis tools of strategic management and a lot of data to analyze the B2C industry in-depth, so that people could understand the B2C industry more comprehensively. Secondly, the competitive strategy of JD.com Mall was studied, and SWOT analysis was used as the overall analysis framework to systematically analyze the B2C industry in China. After analyzing the internal strengths, weaknesses, external opportunities and threats of JD.com Mall, the SOWT analysis tool was applied to clarify the competitive strategy of JD.com Mall [1]. Chen et al. examined how wholesale pricing models or agency pricing models affected online retailers' profits, industry profits, consumer surplus, and social welfare. And this paper also shows that industry profits and social welfare increase when the pricing model is switched to agency pricing. Unless customer loyalty is high enough to choose the agency pricing model [2].

This paper was related to Business-to-Customer (B2C) e-commerce. The different roles assumed by agents in B2C e-commerce applications were analyzed by Palopoli et al. And they proposed a model of consumer buying behavior that took into account emerging issues. For example, the possibility of dealing with semantic heterogeneity and the adaptive presentation of online stores. Using such a model, they classified and compared a number of agent-based approaches to B2C e-commerce management that have been proposed in the literature over the last decade [3]. Boyd et al. examined the revenue management system as a successful e-business model. It can offer a wide range of inventory management models based on market demand and can be of great benefit to all users, no matter what they are. While there are challenges in current business operations, there is great potential for this model in the future [4]. Cross-border e-commerce has become increasingly popular recently and Yao and Bilegan compare the advantages and disadvantages of different business models. Giving advice on inventory, logistics, and strategy, enables Chinese cross-border e-commerce to find opportunities to grow [5].

The DID model was used here and there were related models used in the following articles. The paper by Zhou et al., which investigated the impact of the policy, used a double-difference approach (DID), with green firms as the treatment group and polluting firms as the control group, to study the impact of the green credit policy on firms, both in terms of the amount of credit received and the financing costs. The results show that, for firms of different ownership, the impact of green credit policies was more pronounced

for non-state-owned firms than for state-owned firms. For firms in different regions, the impact of green credit policies was more significant for firms in regions with a relatively backward level of economic development than for firms in regions with a relatively high level of economic development [6]. Based on the DID model, Wang Y & J empirically tested whether the business tax to VAT policy had an impact on the bargaining power of restructured industry firms using A-share firms listed on the Shanghai Stock Exchange and Shenzhen Stock Exchange as research subjects. The results of the study showed that the policy does have an impact on the bargaining power of firms in the restructuring industry [7].

Pourhejazy's study found that e-commerce would account for a quarter of global retailing. It showed that competitive factors, such as the presence of alternative products and strategic partnerships were high, could help make informed inventory destruction decisions. The results showed that the decision factors studied were appropriate and could be applied to the general e-commerce decision environment [8].

Harish et al. found that online retailers are facing inventory management problems. To mitigate these risks, online retailers were given business strategies. For example, inventory sorting strategy, and hybrid strategy. The study also revealed that better inventory management played an important role in improving customer satisfaction and enhancing customer loyalty. All these strategies helped the company in the long run for the future [9].

Zmirli et al. investigated inventory sharing policies for sustainable omnichannel e-commerce supply network design using a simulation modeling approach. Comparing policy results based on optimal levels of total network costs, total shipments completed from the main warehouse, and total lost sales costs, demonstrates that the implementation of inventory sharing can provide a more efficient, sustainable, and green supply chain system [10].

1.3 Objective

Previous papers on e-commerce are well researched and the use of DID models is very common. However, research for the Jingdong platform is very scarce, especially for the conclusions obtained by data-driven. This paper investigates sales and delivery times during the Butterfly Festival for the Jingdong platform. The data is first observed, and then linear regressions are made based on the DID model to study the results and obtain preliminary conclusions.

2 Method

2.1 Model

2.1.1 Sales and JD Plus

In the DID regression made by sales and JDplus, the treatment group of JD plus users was set to 1 and the control group of normal users was set to 0. At the same time, the treated period from March 1 to March 8 was set to 1 and the control period from March 9 to March 31 was set to 0. Sales it represents the average sales generated per order,

i represents JDplus, t represents the Butterfly Festival (from 3.1 to 3.8), and e it is the error term:

$$\begin{aligned} \text{Sales}_{it} = & c + \text{Treated}_i + \text{Treated Period}_t \\ & + \beta \text{Treated}_i \times \text{Treated Period}_t + e_{it} \end{aligned} \quad (1)$$

2.1.2 Sales and SKU Type

This set of linear regression equations was similar to Eq. (1). The SKU 1p was set to 1 and the treated period from March 1 to March 8 was set to 1. However, in this session, i represents SKU 1 and t still represents the date of the Butterfly Festival.

2.1.3 Delivery Time and JD Plus

In the DID regression for delivery time and JD plus, the treatment group for JD plus users was set to 1 and the control group for normal users was set to 0; also, the treatment period from March 1 to 8 was set to 1 and the control period from March 9 to 31 was set to 0. Delivery it represents the actual delivery time, i represents JDplus, t represents the butterfly segment (from 3.1 to 3.8), and e it is the error term.

$$\begin{aligned} \text{Delivery}_{it} = & c + \text{Treated}_i + \text{Treated Period}_t \\ & + \beta \text{Treated}_i \times \text{Treated Period}_t + e_{it} \end{aligned} \quad (2)$$

2.1.4 Delivery Time and SKU Type

This set of linear regressions was also similar to Eq. (2). The SKU 1p was set to 1 and the treated period from March 1 to March 8 was set to 1, i represents SKU 1 and t represents the date of the Butterfly Festival.

2.2 Data Features

Table 1 shows the data used in the Sales. In this part, adding sales as a new dummy variable:

$$\text{Sales} = \text{quantity} \times \text{original_unit_price} \quad (3)$$

Table 2 shows the data used in the delivery time. In this part, adding delivery time as a new dummy variable:

$$\text{Delivery} = \text{arrive time} - \text{ship out time} \quad (4)$$

Table 1. Sales and independent variables Data feature

Variable	Description
Order_ID	Order ID for each item
Quantity	Number of orders per item
Original_unit_price	Original price per item
Sales	Sales per item

Table 2. Delivery time and independent variables

Variable	Description
Ship out time	The time when the goods start to be shipped
Arrive time	Time of arrival of goods at the destination
Delivery time	Actual delivery time of goods

Table 3. Sales: DID for plus and date

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	98.322	0.470		209.290	0.000
	plus	16.021	1.131	0.026	14.162	0.000
	date	-2.726	0.846	-0.005	-3.223	0.001
	plus*date	-5.703	1.865	-0.006	-3.058	0.002

a. Dependent Variable: Sales

Table 4. Sales: DID for type and date

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	91.225	0.609		149.716	0.000
	type	19.396	0.855	0.040	22.696	0.000
	date	4.343	1.277	0.009	3.401	0.001
	type*date	-16.020	1.594	-0.028	-10.051	0.000

a. Dependent Variable: Sales

Table 5. Delivery time: DID for plus and date

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error			
1	(Constant)	1.233	0.003		442.192	0.000
	plus	-0.185	0.006	-0.073	-30.643	0.000
	date	0.058	0.005	0.026	12.474	0.000
	plus*date	0.039	0.010	0.011	4.122	0.000

a. Dependent Variable: delivery_time

3 Results and Analysis

The results of the DID regression analysis for Sales part are shown in Tables 3 and 4, and the results of the did regression analyses for the Delivery time part are shown in Tables 5 and 6.

In this data set, the p-value is less than 0.05, so the data results are significant. And the results of the regression equation lead to the following two linear regression equations.

$$\begin{aligned} \text{Sales}_{it} = & 98.322 + 16.021 \times \text{Plus}_i - 2.726 \times (\text{date } 3.1 - 3.8)_t \\ & - 5.703 \times \text{Plus}_i \times (\text{date } 3.1 - 3.8)_t \end{aligned} \tag{5}$$

$$\begin{aligned} \text{Sales}_{it} = & 91.225 + 19.396 \times \text{Plus}_i + 4.343 \times (\text{date } 3.1 - 3.8)_t \\ & - 16.020 \times \text{Plus}_i \times (\text{date } 3.1 - 3.8)_t \end{aligned} \tag{6}$$

In the regression equation results of sales vs. JDplus, it can be seen that during the Butterfly Festival, the average sales per order for both JDplus and regular users did not increase, but rather decreased. At the same time, the average sales per order for JDplus users is greater than that of regular users. In the regression equation of sales and SKU types, the following results can be obtained: the average sales per order of 1p are greater than that of 3p; during the Butterfly Festival, the average sales per order of 1p have decreased and the average sales per order of 3p have increased.

In this dataset, the p-value is less than 0.05, so the results are significant. And the regression equation results in the following two linear regression equations.

$$\begin{aligned} \text{Delivery}_{it} = & 1.233 - 0.185 \times \text{Plus}_i + 0.58 \times (\text{date } 3.1 - 3.8)_t \\ & + 0.39 \times \text{Plus}_i \times (\text{date } 3.1 - 3.8)_t \end{aligned} \tag{7}$$

$$\begin{aligned} \text{Delivery}_{it} = & 2.067 - 1.087 \times \text{Plus}_i + 0.362 \times (\text{date } 3.1 - 3.8)_t \\ & - 0.242 \times \text{Plus}_i \times (\text{date } 3.1 - 3.8)_t \end{aligned} \tag{8}$$

In the regression equation results, whether using JDplus or SKU type as the independent variable, the results show that there is no significant change in the delivery time during the butterfly festival. However, SKU 1p generally has a faster delivery time than SKU 3p. 1p is faster because JD has warehouses in every city for its own products.

Table 6. Delivery time: DID for type and date

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.067	0.005		403.836	0.000
	type	-1.087	0.006	0.381	-190.374	0.000
	date	0.362	0.010	0.165	35.892	0.000
	type*date	-0.242	0.011	-0.107	-22.285	0.000

a. Dependent Variable: delivery_time

4 Discussion

4.1 Sales

The average sales per sale of JDplus users were larger than that of ordinary users, which also represents the higher consumption level of plus users. The average sales per SKU 1p were larger than that of SKU 3p, which could reflect the higher price of Jingdong's own products.

During Butterfly Day, because it was Women's Day, sales of relatively low-priced items, such as beauty products and trendy accessories, increase significantly, and women spent more than men during this period. In addition, expensive products were not discounted during the Butterfly Festival, so the average sales per order were reduced. For Plus users, the average order sales per order were higher than that of regular users because of the higher spending level of Plus users. For SKU 1p and 3p items, the data showed that the price of the same item 1p would be higher than 3p, so the average order sales per 1p item would be higher than 3p. But more importantly, perhaps customers usually bought only very low-priced 3p items, the price of 3p items with quality assurance during the Butterfly Festival was more competitive with 1p items. Therefore, the average order sales per 3p product increased.

4.2 Delivery Time

Delivery times as a whole have not changed much. Even during the Butterfly Festival, Jingdong's delivery was not lagging behind. However, generally speaking Jingdong's own delivery time was faster than that of third parties.

Jingdong's express system is already very sound, especially the supply chain management system. Jingdong's warehouse set up in each city is very sound in corresponding to the logistics management of buyers. The entire logistics service network is built to cover almost all regions of China. This is also the concept of Jingdong logistics service.

4.3 Recommendations

For Jingdong, events like the Butterfly Festival will bring it a rise in sales. In terms of publicly available data, Jingdong's net revenue for the first quarter of 2018 was 10.01

billion yuan, up 33.1% year-on-year. Net profit for the first quarter was 1524.9 billion yuan, which was the eighth consecutive quarter of profit. However, the research from this paper shows that Jingdong has mainly launched its activities with women as the main sales target this time. Jingdong can still increase sales by giving discounts on high-value products during this period and will be able to increase the number of sales of both small value products and large value durable products.

For the platform and the user, it can form a win-win situation. The platform increases the advertising effect and promotes the promotion; investigates the price acceptance range of users and offers in a reasonable range. Both the platform and the customer can get the desired result.

5 Conclusion

This paper focuses on the impact of the Butterfly Festival on sales and delivery time based on a DID model and linear regression. The first concern is the average sales per item, which is a bit higher for JDPlus and SKU 1p. However, during the Butterfly Festival, the average sales per item decreased. The second concern is the speed of delivery, which did not change much during the Butterfly Festival, and JDplus users did not get their deliveries any faster than regular users. However, it should be emphasized that the delivery speed of SKU 1p was roughly one day earlier than SKU 3p.

In addition to product pricing and offers, customer feedback is equally important. It is important to focus on price-sensitive and logistics speed-sensitive customers, as it would not be worthwhile to lose consumers due to negative customer feedback. Through questionnaires and customer feedback on the platform, the company can make effective corrections that will maximize customer loyalty.

The platform can also carry out campaigns to anticipate the order volume by delivering a deposit in advance to prepare the inventory. During the year, different timelines are identified to open big promotions for different groups of people. In addition to female users, will Jingdong is not just an e-commerce platform that mainly sells 3C home appliances, but will become a more mature and comprehensive e-commerce platform in the future.

However, this article is also purely in the place of flaws. Only the linear regression method was used for the data. In the future, when there is an opportunity, more generalized methods such as nonlinear regression, machine learning, decision trees, etc. will be used.

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