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The COVID-19 shock and the ownership of store Chain：Evidence from China's express delivery industry

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ABSTRACT

Utilizing stock market data of express delivery companies that have been listed on the stock market of China, this paper intends to examine the two alternative store chain ownership, namely corporate–owned versus franchised, which is more resilient to external shocks. Based on the price data of 1034 trading days from December 2, 2019, to September 30, 2022, the Quandt-Andrews method is used to compare the companies of corporate-owned store chain with those of franchised store chain. The results reveal that the stock market performance of the express delivery industry underwent a huge structural change during the COVID-19 epidemic. Moreover, because of the stringent pandemic control measures, there are significant differences in structural changes between the two types of express delivery companies, corporate-owned store chain as opposed to franchised store chain. The structural changes occurred earlier for the former, which suggests that the companies of corporate-owned store chain are more resilient to recovery. This study can provide helpful insight into better risk control for companies managing retail stores and choosing "rainy day assets" portfolios for investors in times of financial uncertainty.

1. Introduction

As an important component of modern logistics services, the express delivery industry promotes the development of the regional economy and increases employment opportunities [1]. Along with the advancement of Internet technology and the transformation of consumption patterns, the express delivery industry has been developing rapidly. However, the outbreak of the epidemic exerts a complex influence on this industry. On the one hand, the epidemic has greatly reduced the operational efficiency of express delivery networks, but on the other hand, it has made online business develop rapidly, resulting in a sharp decrease in offline consumption [2]. This change has brought impetus to the development of the express delivery industry [3]. The express delivery companies in China can be divided into two types in terms of the ownership of store chain: namely corporate-owned store chain and franchised store chain. The former represented by SF Express refers to the companies which own and operate the store chain. The latter one means franchised terminal outlets and STO Express represents this type [4].

This paper intends to compare the difference in resilience to the COVID-19 shock between two business models in the express delivery industry, namely corporate-owned store chain versus franchised store chain. In addition, the express delivery industry has involved a number of industries and fields with the rise of e-commerce, its response to the epidemic indirectly reflects the state of China's economy. Therefore, it is very obvious that choosing the express industry as the research object is a better choice.

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In this paper, the Quandt-Andrews method is used to test and compare the structural changes[1] of express delivery companies to explore the heterogeneous influence of the epidemic. Different from previous studies on the impact of the epidemic on overall express delivery companies, this paper studies the heterogeneous impact based on the fluctuation of the stock price, and examines the differences in the resistance of express delivery companies with different business models to external risks. In addition, this paper also provides indirect evidence for the view that the COVID-19 epidemic has accelerated the formation of online shopping consumer behavior patterns based on the performance of express companies in the stock market. The Quandt-Andrews method is used to test and compare the stock price fluctuations of the two types of express companies. This method can compensate for the shortcomings of the Chow test, and capture the location of structural changes in stock prices quickly and accurately, resulting in more reliable results and higher test validity.

This paper is organized as follows: In section 2, we review the relevant literature. Thereafter, section 3 describes model construction and data selection. Section 4 analyzes the results and section 5 explores the significance and implications of the findings and the limitations of the paper.

2. Literature review

Scholars have provided their views on the influence of the pandemic on the express delivery industry from different perspectives. Akhtaruzzaman (2021) believed that the ongoing epidemic had led to rising fuel prices and driver wages, which had significantly increased costs of the logistics transportation [5]. From the perspective of the industry chain, Notteboom (2021) argued that the manufacturing sector performed poorly during the COVID-19 epidemic, which reduced the demand for logistics [6]. Jebabli et al. (2021) suggested that the uncertainty in the financial markets during the epidemic tends to diminish the revenue of the transportation economy [7]. Zhang and Zhu (2021) used the multi-phase difference-in-differences analysis method and found that the epidemic gave impetus to the development of the express delivery industry [8]. Liu et al. (2022) discovered that the epidemic did not take a heavy toll on the express delivery industry, but promoted the development of the industry in the short term [9]. Milewski and Milewska (2021) noted that the COVID-19 epidemic has boosted the delivery industry in Poland, with a 20%–100 % increase in the number of packages delivered during the containment period [10].

In addition, some scholars have conducted related studies from a national policy perspective. Utilizing high-frequency data, Fang and Guo (2022) quantified the combined influence of the epidemic on transportation [11]. The epidemic led to a 0.67 % decrease in average daily freight volume. Meanwhile, the free highway policy was of great significance in reducing the costs of express delivery companies. Yang et al. (2021) showed that typical prevention and control policies impact express logistics negatively in the short term [12]. In contrast, in the long run, the restart of production policies stimulated the demand for express logistics. It attenuated the negative impact of the COVID-19 epidemic on the express delivery industry. Liu et al. (2022) argued that stringent control policies are detrimental to the express delivery industry's development rate and service quality [9].

Some scholars have explored the differences in the performance of different types of express delivery companies during major social events. Aybike and Erkan (2021) applied the FIPIA methodology and found that after the COVID-19 epidemic outbreak, customers preferred companies that could "handle customer complaints in a short time" and "fast delivery" [13]. Peng (2020) argued that with a standard delivery process and highly centralized control, companies with corporate-owned store chain ownership can maintain stable operation quality and service quality in the impact of the epidemic [14]. Kim et al. (2017) believed the brand effect generated by the brand awareness of JDL Express, SF Express, and other express delivery companies of corporate-owned store chain relieves the pressure because customers with higher incomes are more willing to choose the companies with delivery time advantages and low surcharges [15]. Wang (2020) pointed out that sufficient cash reserves allow corporate-owned store chain to continue to increase capital investment and R&D investment during the epidemic and achieve market share gains [16]. Wang (2021) argued in the face of the epidemic, YTO Express, which adopts the franchised model, is under great repayment pressure, resulting in increased credit risk and external financing costs [17]. Cai et al. (2021) used financial indicators from the first three quarters of 2020 and found that both the revenue and net profit of SF Express were much higher than other express delivery companies, which was directly related to its asset-heavy model [18].

The stock price is a signal that truly reflects a company's past operating history and prospects. By comparing the structural changes in stock prices, we can determine which type of corporate–owned or franchise express delivery company has stronger resilience in the face of public health events.

3. Data and methodology

To recognize and compare the structural change points of corporate-owned and franchised store chain during the COVID-19 epidemic, this paper utilizes the time series of daily average stock prices of representative express companies in China's express delivery industry from 2019 to 2022.

The first COVID-19 patient had been confirmed in China on December 1, 2019 [19]. Therefore, the period of 1034 days from December 2, 2019, to September 30, 2022, is selected. Express delivery companies that have adopted the corporate–owned model in

1 Structural change refers to the fact that with significant changes in economic conditions, like policy transitions, natural disasters (e.g., SARS, new crowns, earthquakes, etc.), oil crises, etc., the parameters associated with economic variables tend to change. If an external shock is sufficient to change the series' trajectory from one trend to another, this structural shift is called a structural mutation. Same below.

China mainly include SF Express, China Post (EMS), Jingdong Express, and Deppon Express. Among them, EMS is a state-owned enterprise and has not been independently listed. Jingdong Express mainly provides services for Jingdong Mall, and its listing date does not meet the research requirements of this paper. So, SF Express and Deppon Express are selected as representatives of the corporate-owned type. YTO Express, STO Exand press, Yunda Express all operate through franchised type. They have all been listed in China in terms of scale and strength. Therefore, they are selected as representatives of the franchised type. The stock prices of the five express companies are obtained from the Wind database.

In the field of economic and financial research, the Chow test is well known because it can test whether an econometric model undergoes structural changes at a given time point [20]. Nevertheless, when the change point is unknown, it is difficult for this method to locate the point in the model. When this happens, the test results are likely to be biased.

To find the location of changes in model parameters quickly and accurately, Quandt and Andrews put forward a new test. In the Quandt-Andrews test, two constrained statistics obtained from the Chow test are important: The Likelihood Ratio F-Statistic and the Wald F-Statistic. The former statistic is based on the comparison of the sum of squares of the residuals of the constrained and unconstrained models. At the same time, the latter statistic is calculated based on the standard Wald test, which restricts the coefficients of the model parameters to be the same in all sub-samples. The individual Chow test statistics can be aggregated into three different statistics: The Maximum Statistic, the Exp statistic, and the Ave statistic [21,22].

The maximum statistic is a statistic obtained by taking the maximum value of a single statistic obtained from the Chow test, i.e.

$$\max F = \max_{\tau_1 \le \tau \le \tau_2} F(\tau) \tag{1}$$

The form of the Exp statistic is as follows.

$$\exp F = \ln\left(\frac{1}{k}\sum_{\tau=\tau_1}^{\tau_2} \exp\left(\frac{1}{2}F(\tau)\right)\right) \tag{2}$$

The Ave statistic is a simple mean of the individual statistics obtained from the Chow test.

$$AveF = \frac{1}{k}\sum_{\tau=\tau_1}^{\tau_2} F(\tau) \tag{3}$$

in particular, it should be pointed out that these three statistics are generated between starting point τ1 and ending point τ2 of the sample, which means their distributions are non-standard. So, Andrews derived their real distributions and Hansen gave approximate asymptotic p-values for the three statistics [23]. To obtain more accurate estimation results, a common practice is to remove 15 % of

Table 1
Results of Quandt -Andrews stability test.

Business model	Express company	Structural change	Statistics		p-value
Corporate -owned	SF Express	**6/15/2020**	Maximum LR F-statistic	413.4892	0.000
			Maximum Wald F-statistic	413.4892	0.000
			Exp LR F-statistic	202.6969	0.000
			Exp Wald F-statistic	202.6969	0.000
			Ave LR F-statistic	162.1077	0.000
			Ave Wald F-statistic	162.1077	0.000
	Deppon Express	**5/25/2020**	Maximum LR F-statistic	177.0112	0.000
			Maximum Wald F-statistic	177.0112	0.000
			Exp LR F-statistic	84.00607	0.000
			Exp Wald F-statistic	84.00607	0.000
			Ave LR F-statistic	38.15892	0.000
			Ave Wald F-statistic	38.15892	0.000
Franchised	YTO Express	**11/18/2021**	Maximum LR F-statistic	1162.06	0.000
			Maximum Wald F-statistic	1162.06	0.000
			Exp LR F-statistic	575.1459	0.000
			Exp Wald F-statistic	575.1459	0.000
			Ave LR F-statistic	399.0474	0.000
			Ave Wald F-statistic	399.0474	0.000
	STO Express	**12/10/2020**	Maximum LR F-statistic	2383.501	0.000
			Maximum Wald F-statistic	2383.501	0.000
			Exp LR F-statistic	1186.24	0.000
			Exp Wald F-statistic	1186.24	0.000
			Ave LR F-statistic	801.1997	0.000
			Ave Wald F-statistic	801.1997	0.000
	Yunda Express	**8/25/2020**	Maximum LR F-statistic	2883.914	0.000
			Maximum Wald F-statistic	2883.914	0.000
			Exp LR F-statistic	1436.151	0.000
			Exp Wald F-statistic	1436.151	0.000
			Ave LR F-statistic	867.886	0.000
			Ave Wald F-statistic	867.886	0.000

the samples, which means eliminating 7.5 % of the samples before and after the observation values.

4. Empirical results

Based on time series data of stock prices, we use the Quandt-Andrews test to attain the structural change points of corporate-owned express delivery companies and franchised ones in China. During the implementation of the test process, 15 % of the sample observations are first symmetrically removed, and the Hansen P-value is used for analysis. The test results are presented in Table 1.

According to the data in Tables 1 and it can be seen that the maximum value statistic, Exp statistic, and Ave statistic of each express company passed the test at a 1 % significance level. The result shows that stock price structural changes took place in all express companies, and the order of the three test statistics is characterized by maximum statistic > Exp statistic > Ave statistic. As for the sequence of changes, there are obvious differences among different express delivery companies. Express delivery companies of corporate-owned store chain reacted more quickly to the COVID-19 shock, and their structural changes appeared earlier. While franchised companies ranged about 3–6 months later. The reason for the difference is that the express delivery company of corporate–owned store chain has absolute control over all aspects, which helps the efficient implementation of the company's instructions and ensures the robustness of the company's operation after the outbreak of the epidemic. Therefore, they can restart their business faster.

We can still find out that the shock of the epidemic on express delivery companies of corporate-owned store chain is relatively consistent, while the shock on franchised companies is different. As shown in Fig. 1, the dark-shaded part with a small span is the interval where the change points of the express companies of corporate-owned store chain occur, while the light-shaded part with a large span is the interval where the change points of the franchised companies occur. Because the corporate–owned management model is relatively similar, its response to the shock is consistent. However, franchised management is more decentralized, so there are obvious differences between them. In addition, the structural change also presents a certain difference within the same model, and the reason for this difference mainly comes from the unique events of the companies themselves. For instance, Deppon Express company and SF Express improved their operation strength by increasing investment in mid-2020. In contrast, the change period of different franchised express companies was quite different. The main reason may be that Yunda Express and STO Express achieved service technology and model upgrades in August, improving the customer service experience. However, the relationship between YTO headquarters and franchisees is relatively rigid, and its supply chain has not yet completed the intelligent transformation. Therefore, it was not until December 2021 that YTO Express fully restored the supply chain.

Based on the structural change dates, the magnitude of stock price changes was compared. According to the data in Table 2, it can be found that the average stock price before structural changes of express delivery companies of corporate-owned store chain are all lower than the post ones, and the standard deviations have all increased. As for franchised companies, their average stock prices pre-structural change are higher than the post ones, and their volatility has decreased. The difference indicates that after the outbreak of the epidemic, express delivery companies of the owned corporate–owned store chain, relying on timely and safe services, good reputation, and ample cash reserves, achieved a contrary-trend growth in market share and corporate value. On the contrary, due to the lack of control over various express outlets, franchised express delivery companies cannot guarantee the continuity and controllability of their operations in the event of an emergency such as an epidemic. This is clearly reflected in the stock market.

5. Discussion

This paper investigates the heterogeneity in the shock of the COVID-19 epidemic on different types of companies using the daily stock market data of express delivery companies of corporate-owned and franchised store chain. Firstly, the conclusion shows that the Quandt-Andrews method for the selected five express delivery companies passed the significance test at 1 % level. Secondly, the structural change points of express delivery companies of corporate-owned store chain affected by the epidemic are much earlier than that of franchised express delivery companies. The change points of different franchised express delivery companies also differ

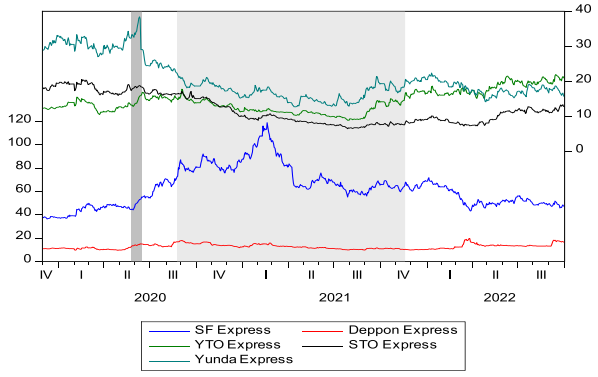

Fig. 1. Stock price trend and structural change range.

Table 2
Descriptive statistics of stock prices during the structural changes.

Variable		Before the structural change point			After the structural change point			Percentage change
		Obs	Mean	SD	Obs	Mean	SD	
corporate-owned	SF Express	141	43.95	4.77	599	67.20	15.36	52.9
	Deppon Express	126	10.82	0.71	614	12.98	2.08	20.0
Franchised	YTO Express	514	12.69	1.87	226	18.26	1.77	43.9
	STO Express	269	16.94	1.98	471	9.14	1.61	−46.0
	Yunda Express	192	29.33	3.39	548	17.34	2.21	−40.9

significantly. In addition, we find that through structural changes, the average stock prices of corporate-owned store chains have risen. By contrast, stock prices of franchised store chain show the opposite pattern. Moreover, it should be pointed out that although franchised express delivery companies have not performed as well as the companies of corporate-owned in response to the epidemic, their lower cost in transport and franchise are taken into consideration by many consumers and franchisees. By contrast, franchised express companies with a good network in the collection, transfer, delivery, and other links, serve as the main logistics suppliers of Taobao merchants. Therefore, as the epidemic fades, the market share and operating revenue of franchised express delivery companies will also be restored.

To better respond to sudden public health events, the express delivery industry should enhance its emergency management capabilities. Specifically, express companies of corporate-owned store chain should build emergency material logistics support databases. Similarly, franchised express delivery companies should strive to better control transfer centers. To cope with sudden risks by improving their financial resilience, high-quality franchised express delivery companies should gradually develop their supply chain finance business by obtaining licenses such as financial leasing and insurance brokerage.

The measures taken by the express delivery industry, such as establishing disaster management procedures can be valuable attempts to other industries. Meanwhile, attention should be paid to the constraints that exist when leveraging the advantages of the corporate–owned type. Although the outbreak of the epidemic cast a shadow on the express delivery industry, the increase in online consumer demand has enabled firms such as SF Express and China Post to give full play to their advantages of corporate-owned type and demonstrate stronger impact resistance.

There are some limitations to this study. Firstly, the number of companies selected in the empirical analysis is relatively small due to the limited number of express delivery companies in China. Secondly, this paper uses stock prices to measure the response of the express delivery industry to the impact of the epidemic. Alterations in the number of employees, income, and cost of express delivery companies need to be considered in the future to enrich relevant evidence. All the above are topics for further research and improvement in the future.

Data availability statement

Data will be made available on request.

CRediT authorship contribution statement

Lin Shang: Conceptualization, Data curation, Formal analysis, Supervision, Writing – original draft, Writing – review & editing. **Yifan Liu:** Formal analysis, Writing – original draft, Writing – review & editing, Data curation. **Pingxiang Xu:** Formal analysis, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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