Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Marine Policy 133 (2021) 104768

Contents lists available at ScienceDirect

Marine Policy

journal homepage: www.elsevier.com/locate/marpol

Estimating the effect of COVID-19 epidemic on shipping trade: An empirical analysis using panel data

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ARTICLE INFO

Keywords:
COVID-19 epidemic
Panel data
Shipping trade
Empirical analysis

ABSTRACT

The unexpected outbreak of COVID-19 epidemic is an unpredictable event in shipping trade. In this paper, we mainly investigate the gaps that occur in the shipping trade between China and different regions during the period February-October 2020 and to provide useful information for operation management of shipping industry. The data include a panel obtained from the National Statistics Institute to analyze the gap where a selected group of shipping trade in three regions are considered: European Union, North America, and Southeast Asia. On this basis, a dynamic panel data model is proposed to estimate the trend. We observe that government prevention and control measures have a negative impact on export trade, while import trade increases accordingly.

1. Introduction

The COVID-19 epidemic broke out in early 2020 and quickly spread throughout the world. In order to avoid the emergence of large-scale cross-infection, governments worldwide have adopted various levels of prevention and control measures, such as work stoppage and restrictions on travel [24,36]. The world economy inevitably suffered a huge blow, which directly led to a cliff-like decrease in international trade. As the main undertaker of international trade, the shipping industry bore the brunt of this health emergency. Faced with weak transportation demand, liner companies cancelled some routes to reduce costs [25,28,55,57]. Additionally, the effect of shipping transportation, as one of the significant assistor of COVID-19, made this event into a hinge of historical dimension [5,30,63]. Although there have been successes in resisting COVID-19-induced impact, such as rebound of production by China to recover the economic and society developments, the shipping trade continues to be constrained by a weak global economy since the outbreak in other trading partners escalated in European Union, North America, and Southeast Asia [39,54,56]. Under such circumstances, shipping companies prolong their capacity reduction plans, which causes a rise in idle capacity.

Due to the reduction of effective transport capacity, port quarantine, and shortage of personnel, efficiency of cargo handling has decreased, and freight rates have risen sharply [25,38,58]. By early 2020, freight rates on China-North America routes may increase nearly three times. Repeated outbreak in Europe has stimulated local import demand for epidemic prevention materials, and shipping trade remains high. The capacity constraint of shipping line is increasing, and the contradiction between supply and demand cannot be alleviated. However, although Southeast Asia was heavily affected in the early of COVID-19 epidemic, the market performance is stable, and the demand is always balanced, which indicates the shipping capacity is controlled with a relatively reasonable range [31,34,52]. Because the severity of epidemic, medical emergency level, and industrial structure in different regions are not the same [10,39], the performance of their shipping industry after the impact of the epidemic shows heterogeneity (Fig. 1). With this motivation, this research focuses on understanding the role of COVID-19 on different shipping routes by considering multiple factors.

We first divide the global shipping market into different regions based on geographic location, economic level, and the number of confirmed cases of COVID-19. Then, we model this research not only by considering a quantifiable variable for exogenous event but by introducing additional variables that act as proxies for the import and export trade of shipping routes. The control variables include the impact of household consumption, industry, and government control measures on shipping. On this basis, we first use the basic panel data regression model to study from a macro perspective the factors that have an important impact on the shipping routes during the COVID-19 epidemic. The basic model is then optimized to explore the gaps in the impact of the COVID-19 pandemic on regions from a more microscopic

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https://doi.org/10.1016/j.marpol.2021.104768
Received 30 January 2021; Received in revised form 15 August 2021; Accepted 31 August 2021
Available online 3 September 2021
0308-597X/

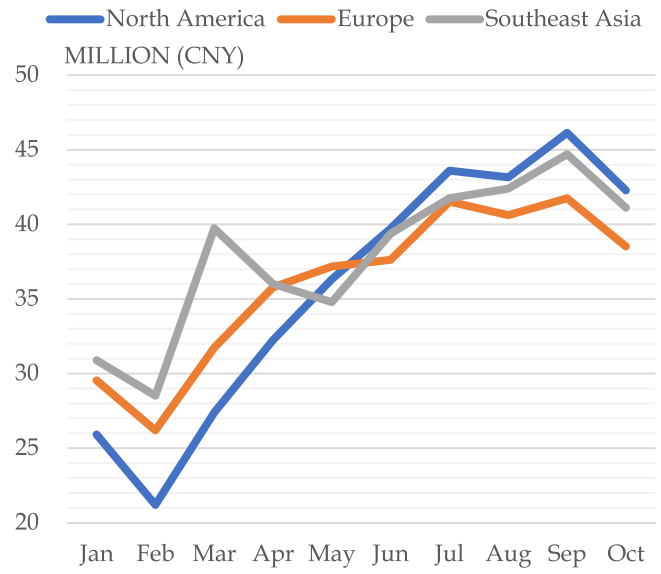

Fig. 1. Trade volume of imports and exports between China and different regions.

perspective. This research mainly contributes to the existing research in various ways. First, the use of two-dimensional data can reduce the bias of estimated parameters and more accurately analyze the impact of various factors on shipping routes in the context of the epidemic. Through a separate research study on the influencing factors of different shipping routes, we can discover the differences and relationships between them. Beyond that, because of the existence of short cycles in the shipping industry, we introduce time dummy variables into the original model to explore the changes caused by epidemic to the traditional shipping cycle. In addition, by the optimization model, we try to compare the impact of the COVID-19 epidemic on the shipping routes of different countries in the same region from a micro perspective.

The observations of managerial insight are significant for both academics and practice, as it sheds light on how the COVID-19 pandemic affected the import and export trade as well as the regional variation in the impact. First, we found that the influence of the COVID-19 pandemic on shipping routes has two sides. The shutdown and production reduction caused by the pandemic can hinder the development of shipping trade. The substantial rise in the demand of epidemic prevention material drives the shipping trade. On the other hand, the government prevention and control generally stimulates the import of shipping trade, which has an opposite effect on the export trade. Furthermore, the key factors affecting the shipping trade in different regions are quite different.

The remainder of this research can be summarized as follows: Section 2 reviews the related literature. We describe the data and variable in Section 3. In addition, we provide the methodology in Section 4 and demonstrate the empirical results in Section 5. Section 6 concludes on the managerial insights.

2. Literature review

The world is experiencing an unprecedented turbulence due to the novel coronavirus outbreak, also known as COVID-19 which was declared a pandemic by the Director-General of the World Health Organization (WHO) on March 11th 2020 [44]. According to WHO [50], as of October 25, 2020, there are 43,341,451confirmed cases and 1157,509 deaths around the world [50]. Because of the high transportation connectivity, the COVID-19 epidemic spread faster than previous diseases and has already affected many aspects of economic activity. The national economy bore the brunt [11,33,45]. In the second quarter of 2020, global GDP fell by more than 4.9%, and the decline in trade in goods and services may be higher than during the 2007–08 global financial crisis [17]. Because of the new coronavirus pneumonia, various economies have blocked international trade, which disrupted the global supply chain and reduced total demand [26,61]. In addition, due to the sharp decline in income and weak consumer confidence, the consumption of goods and services dropped significantly. Similarly, consumers are reluctant to consume certain goods and services due to concerns about the spread of the new coronavirus [12]. For financial market, many studies examined the impact of COVID-19 on stock market returns and volatility [1,7,8], currencies [4,49] and supply chain [16,51]. Al-Awadhi et al., [3] used panel data model to analyze the impact of the COVID-19 pandemic on the Chinese stock market to indicate that both the daily growth in total confirmed cases and of death caused by COVID-19 have significant negative effects on stock returns across companies. Yarovaya et al. [60] suggested that COVID-19 pandemic might have a huge impact on the functioning of financial sector and is a promising research domain. In response to COVID-19, governments scrambled with emergency actions, such as lockdown, travel restriction, testing and quarantining, and economic package [2]. These measures caused huge influences on peoples' daily life, such as tourism [14,19,43,48], psychological condition [22,29], and commute [20,47].

As a derivative demand of economic activity, the rise and decline of the transportation is closely related to economic development [6,37,41,62]. When the global economy is affected by exogenous event, as the main undertaker of international trade, ocean transportation bears the brunt [9,13,32]. In the first six months of the crisis alone, the rate of containers shipped around the world declined by close to 16%, which caused huge losses to the shipping market [18]. Another example is trade conflicts between the US and China which started in early 2018; the conflicts have hurt both economies and shipping industry of US and China [15,23]. Currently, the pandemic has considerably impacted the shipping industry. Since the beginning of the COVID-19 pandemic the maritime industry faced many and varied challenges which are affecting the health and welfare of seafarers and may threaten the global supply chain of essential goods [21,40]. Michail and Melas [27] confirmed the outbreak of COVID-19 had a negative impact on dry bulk carriers and crude oil ships, and the Baltic Dry Bulk Freight Index and the Product Tanker Index are highly affected by economic demand. Moreover, some scholars have separately studied the influencing factors of transportation capacity and shipping volume. Other research studies have focused on analyzing the spillover effects of financial markets on freight rates and making short-term forecasts.

However, most relevant research studies aimed at the impact of the COVID-19 pandemic on the financial market, and few studies have analyzed the shipping trade under the pandemic. Taking China as an example, we introduce the panel data models to explore key factors affecting the shipping trade in different regions under the COVID-19 pandemic to reveal the outcomes of government prevention and control measures on shipping trade. Our research fills the gap in the existing literature and helps the shipping companies to make strategic decisions.

3. Data

According to the National Bureau of Statistics, China's shipping trade with the European Union, North America, and Southeast Asia accounts for more than 50% of the total trade. Among the top five countries in terms of import and export trade volume with China, ASEAN, the European Union and the United States accounted for 85% of the import and export trade volume. Therefore, selecting the shipping trade volume between China and ASEAN, EU and North America as the research object is representative and can reflect the overall situation of China's shipping trade (Fig. 2). Yet, due to the economic development and pandemic severity, the key factors influencing shipping trade from regions are significantly different. Hence, samples of trading regions within the same population may overlook the deviation, resulting in loss of accuracy. As shown in Fig. 3, North America is the region most affected by

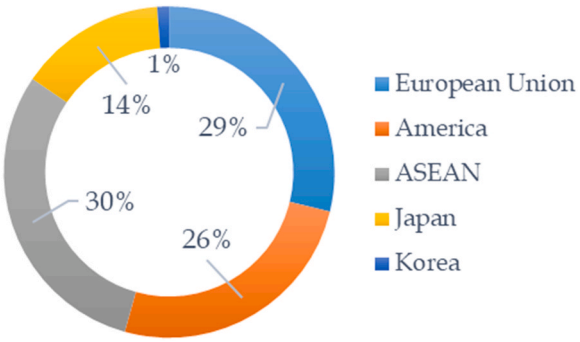

Fig. 2. The proportion of the import and export trade volume between China and counties in 2020 (RMB).

the COVID-19 pandemic, followed by Europe. Until December 15, the cumulative number of confirmed cases in the United States exceeded 16.5 million, and the number of new cases is still around 200 thousands in a single day. Although the epidemic in Europe has improved, it's not brought under control, with more than half a million deaths. In contrast, the confirmed cases in Southeast Asia only covers 1.4% of total population, even the mortality rate below the global average.

In this paper, the dependent variables are export trade volume (ExV) and import trade volume (ImV) for each region, from February to October. Constrained by data acquisition, 6 independent variables, which can be classified into three categories, are carefully selected as follows:

(a) PMI characteristics: Export trade PMI (ExPMI) and Import trade PMI (ImPMI). ExPMI is an index to measure the trends of manufacturing and service for export trade, whereas ImPMI is used to measure that of import trade, which has a high correlation with GDP and can reflect the region's macroeconomic development [42].

(b) *Confirmed case characteristics*: *Export trade confirmed case* (ExCase) and *Import trade confirmed case* (ImCase). We choose the number of confirmed cases per month to measure the severity of COVID-19 pandemic in the region [2].

(c) Stringency index characteristics: Export trade stringency index (ExStri) and Import trade stringency index (ImStri). Stringency index is published by Oxford COVID-19 Government Response Tracker (OxCGRT) database. It records information on social distancing, which is a lagging indicator on subsequent economic activity. Thus, we use the first-order lag of stringency index as independent variable.

Although we understand the COVID-19 pandemic in each region or country exerts great influence on the shipping trade growth, *ExV* and *ImV* do not depend on region scale since variables in this study are unit indicators. Therefore, we select thirteen countries (*Austria*, *Belgium*, *Denmark*, *Dutch*, *Germany*, *Greece*, *France*, *Hungary*, *Ireland*, *Italy*, *Poland*, *Spain* and *Sweden*) belonging to European Union, two countries (*Canada* and *United States*) belonging to North America, and seven countries (*Burma*, *Indonesia*, *Malaysia*, *Philippines*, *Singapore*, *Thailand*, and *Vietnam*) belonging to Southeast Asia.

Before we proceed, one thing should be addressed that January as the base month to make adjustment for inflation in terms of economic attributes. By collecting the indicators of above countries from January 2020 to October on macroeconomic, COVID-19 pandemic, and government prevention and control policies, we have constructed panel data to study the various branch markets of China's shipping routes in the context of the COVID-19 pandemic.

Basic descriptive statistics are summarized in Table 1. We describe the standard error and mean for the whole countries as well as for three categories of sub-samples to help us strength the later research where the variables is sufficient variability. The import trade and export trade

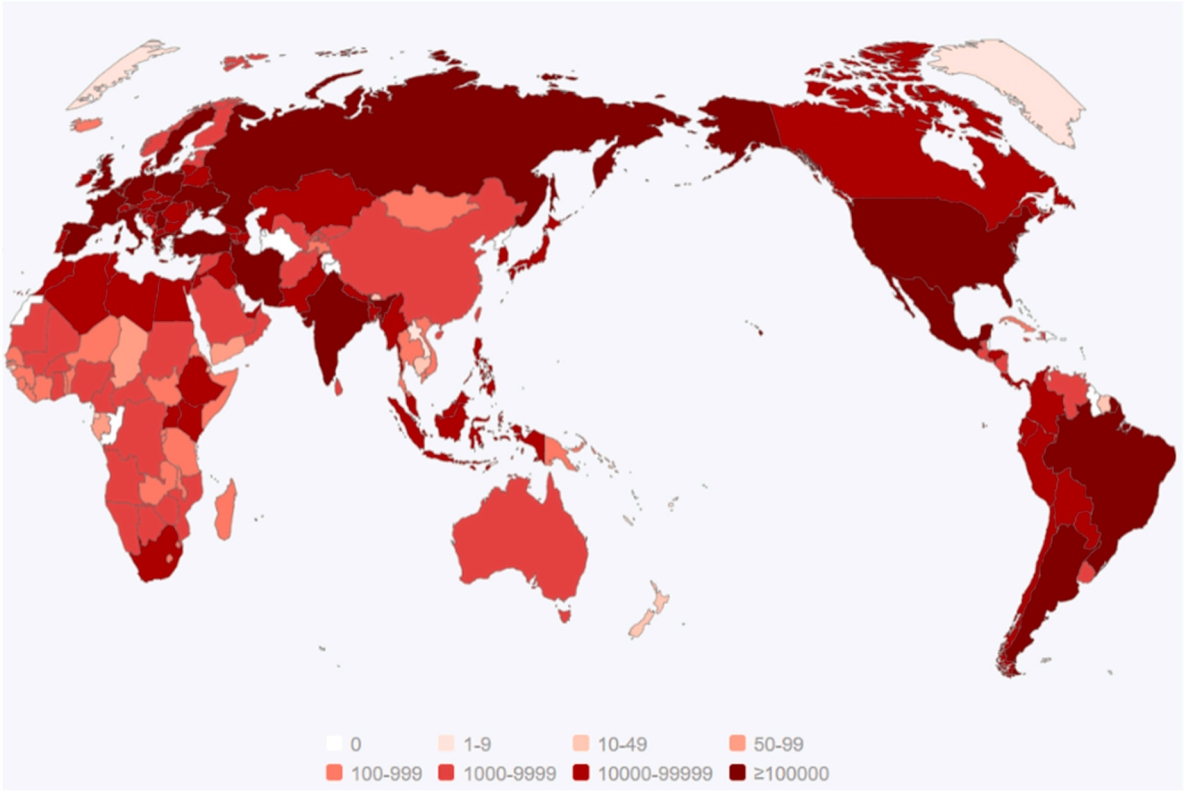

Fig. 3. Distribution of cumulative COVID-19 confirmed cases.[11]

Table 1
Descriptive statistics.

Variable	Description	Unit	SD	Mean	Median
ImTrade	Trade volume	RMB	1936094.20	1582028.76	515313.93
ExTrade			5047574.40	2804270.20	1704228.06
ImPMI	PMI	%	4.63	6.80	50.95
ExPMI			6.80	47.39	49.85
ImCase	Confirmed		20327.66	9189.30	2127.50
ExCase	cases		230765.40	63698.05	7880.50
ImStri	Stringency		25.16	48.72	60.85
ExStri	index		27.96	47.08	49.51

for China with European Union, North America and Southeast Asia are taken as the dependent variables; thus, they are both the exporters and importers. For simplicity, the first column of descriptive statistics is the statistical data of China in Table 1, correspondingly the second column is the statistical data of trading countries. To avoid the effect of historical factors on model, we consider the export trade and import trade for China with the above-mentioned country from January to October in 2019 as the control variables.

4. Methodology

In this section, we employ two conventional approaches (*linear regression* and *seemingly unrelated regression*) to capture the heterogeneity in different regions. The reasons for adopting linear regression model of panel data are summarized as follows. First, compared to cross-section or time series model, the panel data model contains more degrees of freedom and sample variability. Second, the regression model of basic panel data can be expanded as a variable coefficient regression model to explore the impact of key variables on different countries. Third, control variables are added to the model to exclude the influence of other factors [42].

For the linear regression model, the unobserved individual effects are correlated with regressors and allows each observation to process the intercept by modeling a set of dummy variables, while the seemingly unrelated regression model can systematically estimate each variable in the equation requires calculation of more parameters and loss of freedom. Further, the seemingly unrelated regression model ensures that the unobserved effects have the same intercept to be independent from regressors [53]. Generally speaking, they are estimated by standard and generalized least squares procedures, respectively.

Because the sample is relatively small, most of the country-level effect factor remains fixed; thus, we assume the month-level effect factor as dummy variables to effectively control for all factors, which remains in the period but differs across samples [3]. Beyond that, affected by events (*monetary policy* and *traditional festival*), the shipping trade is usually closely related to time. For the two approaches, the cluster-robust standard error to estimate *p*-value in regressions is consider to prevent unstable regression caused by heteroscedasticity and serial correlation [35]. Thus, the linear regression model with shipping trade as individual can be constructed as

$$\begin{aligned} Y_{i,t,k} &= \beta_0 + \beta_1 ImPMI_{i,t,k} + \beta_2 ExPMI_{i,t,k} + \beta_3 ImCase_{i,t,k} + \beta_4 ExCase_{i,t,k} \\ &+\beta_5 ImStri_{i,t-1,k} + \beta_6 ExStri_{i,t-1,k} + \sum_{i=2}^{I} \alpha_i Country_i \\ &+\sum_{t=2}^{T} \theta_t Month_t + \varepsilon_{i,t,k} \end{aligned} \quad (1)$$

where subscript *k* means the region index, subscript *i* shows the country index, and *t* is the temporal index. $Y_{i,t,k}$ is a dependent variable and represents the import/export trade with country i of region k in month t. β can be understood as the vectors of independent variables. Because industrial structure tends to vary across countries, the response of shipping trade to similar event changes depending on the specific institutional background [1]. Further, $\varepsilon_{i,t,k} \sim IID(0, \sigma^2_{i,t,k})$ is the error term. When the individual specific constants ($Country_i$ and $Month_t$) are considered as the randomly distributed terms, the formulation of seemingly unrelated regression model can be described as

$$\begin{aligned} Y_{i,t,k} &= \beta_0 + \beta_1 ImPMI_{i,t,k} + \beta_2 ExPMI_{i,t,k} + \beta_{3,i} ImCase_{i,t,k} \\ &+\beta_{4,i}\left(ExCase_{i,t,k} \times Country_i\right) + \beta_5\left(ImStri_{i,t-1,k} \times Country_i\right) \\ &+\beta_6 ExStri_{i,t-1,k} + \sum_{t=2}^{T} \theta_t Month_t + \varepsilon_{i,t,k} \end{aligned} \quad (2)$$

where $\beta_{3,i}$ and $\beta_{4,i}$ are the coefficients of ImCase and ExCasecorresponding to Country *i*. Therefore, $ExCase_{i,t,k} \times Country_i$ indicates the interaction term between the explanatory variable and individual dummy variable. Other variables remain the same as the above-defined.

5. Empirical results and analysis

In this section, we first analyze the entire sample and discuss whether the situation differs across subgroup. For investigating the difference of characteristics presented by the previous, we divide the whole sample into 3 subgroups based on region. Specifically, one sub-sample refers to the shipping trade of China with the countries located in European Union, and the remaining two sub-samples included the countries in North America and Southeast Asia. Hence, the estimation results are presented in Tables 2 and 3 with specification for linear regression and seemingly unrelated regression models respectively.

From Table 2, China's PMI index and confirmed cases have a relatively large impact on shipping trade of China with European Union. In addition, the prevention and control measures of the governments of both sides of the trade also have a certain impact on the shipping market. Among them, the quarantine measures adopted by China have more obvious positive effects on import trade. Specifically, from a macro perspective, China's national economy plays an important role in promoting Sino-European shipping trade. In this case, the coefficient of confirmed cases is less than zero, reflecting the negative impact of the new crown pneumonia pandemic on China's export trade. However, it is interesting that the number of confirmed cases in China is positively correlated with the volume of import trade. Part of the reason may be that the stay-at-home order has increased residents' purchases of consumer electronics. Beyond that, government intervention also has different effect on the volumes of export trade and import trade. By comparison, it can be concluded that if the government takes more stringent prevention and control measure to manage the epidemic, the volume of export trade drops sharply whereas that of import trade declines.

Compared with European Union, the factor affecting the shipping trade of China with North America is different. For the export trade, except for confirmed cases, the influence of PMI index is not statistically significant. The coefficient of confirmed cases is positive, indicating that the shipping trade increases with the increase in confirmed case. Affected by the new coronavirus pneumonia epidemic, home office and home consumption in North America have gradually become the norm, and it has led to a strong recovery in China's exports of furniture, home entertainment facilities, electromechanical and high-end manufacturing equipment. In addition, data show that epidemic prevention materials account for 21% of the total value of China's exports to the United States, which has stimulated the growth of shipping trade between China and the United States. Interestingly, the results of time dummy variables show that the shipping trade of China with North America has an obvious trend over time change. This is mainly because loose monetary policy boosts the consumption, and firms restock the goods to Christmas.

We also observe the influence on the shipping trade of China with Southeast Asian. In Table 2, the volume of export trade is positively correlated with PMI index. The severity of the COVID-19 pandemic in

[1] https://voice.baidu.com/act/newpneumonia/newpneumonia#tab4

Table 2
Regression results for shipping trade (Model 1).

Variable	China-European Union		China-North America		China-Southeast Asia	
	Export Trade	Import Trade	Export Trade	Import Trade	Export Trade	Import Trade
ImPMI	-10751.03	3140441**	35198.75	1402894**	27079.07*	29363.14**
	(0.395)	(0.005)	(0.317)	(0.019)	(0.078)	(0.027)
ExPMI	1242752**	20724.81	-353581.2	-62243.1	40121.77**	18339.08
	(0.007)	(0.190)	(0.912)	(0.153)	(0.013)	(0.206)
ImCase	0.172	836.251**	-33.074	218.709**	-0.402	-4.607**
	(0.640)	(0.005)	(0.470)	(0.025)	(0.906)	(0.049)
ExCase	-43.705**	0.333**	8.796***	1.073	-15.35**	-5.307
	(0.003)	(0.022)	(0.000)	(0.214)	(0.011)	(0.227)
ImStri (−1)	4752.615*	-59690.95**	-74098.56	-1448.354	1509.788	-305.127
	(0.096)	(0.005)	(0.540)	(0.906)	(0.688)	(0.964)
ExStri (−1)	-15763.9*	2937.66	150561.6	25479.93*	-6966.295	2697.95
	(0.051)	(0.373)	(0.380)	(0.086)	(0.227)	(0.575)
Time Dummies						
February	-9718794***	-1.20e+07**	23987	-672370*	-579203**	-187439.32
	(0.000)	(0.004)	(0.378)	(0.071)	(0.023)	(0.467)
March	-2767420**	-6570607**	-93423	-1247395*	-892371**	-2103837
	(0.006)	(0.004)	(0.571)	(0.021)	(0.072)	(0.195)
April	-397591.6	-672722.7**	-963826	-1703334	26980.71	-178298.64
	(0.168)	(0.005)	(0.351)	(0.295)	(0.864)	(0.771)
May	1380882*	3810549**	-738209	715939.2	-2526.646	-233149.2
	(0.063)	(0.006)	(0.285)	(0.462)	(0.988)	(0.188)
June	713036.9*	1977735**	-1221853	937286.3	23894.97	-374046
	(0.078)	(0.005)	(0.740)	(0.372)	(0.728)	(0.219)
July	94830.4**	874922**	-8345186	1477481	503545.5**	-55771.9
	(0.048)	(0.028)	(0.243)	(0.406)	(0.001)	(0.669)
August	-178373.4	1038743*	-6298145	1115084	287190.1**	128668.4**
	(0.269)	(0.060)	(0.350)	(0.512)	(0.001)	(0.017)
September	-298179.3	991838	-4865972	2060470	297460.5**	592635.9***
	(0.185)	(0.129)	(0.433)	(0.221)	(0.008)	(0.000)
October	50284*	1184730*	11693982	1869129	328771.7*	170530
	(0.088)	(0.066)	(0.234)	(0.436)	(0.099)	(0.370)
Constant	-6.43e^7	-1.59e^8	-3098800	-8880526	-3098800	-8880526
Observations	130	130	140	140	140	140
R-square	0.5001	0.3329	0.6349	0.4375	0.6349	0.4375

Note: ***, ** and * indicate standard error the point of 1%, 5%, and 10%, respectively. Table in brackets (·) shows lagged values, where (−n) is the nth month before the day examined.

Southeast Asia is lighter than that in European Union and North America, which indicates the confirmed cases and stringency index in Southeast Asian are not statistically significant and make the coefficient insignificant. We find that the coefficient of the PMI index of Southeast Asian countries is positive and has a large magnitude. As we all know, ASEAN is one of the fastest growing economies in recent years. The prosperous domestic economy has promoted the growth of shipping trade demand. However, the confirmed cases in China have a slight negative impact on shipping trade. Beyond that, similar to European Union, the export trade also has a significant trend over time, whereas the import trade is not obvious.

Next, we use the seemingly unrelated regression model (Model 2) to deeply explore the impact of the COVID-19 epidemic on shipping trade in different countries. Generally speaking, the shipping trade volume is relatively small from January to May, and July to September is the peak season for shipping. Through the estimation results of time dummy variables, we found that the shipping trade between China and the EU still follows this rule. Beyond that, the influence of COVID-19 has a slightly different on shipping trade in European Union where Germany, Ireland, Netherland, and Sweden are most affected.

Interestingly, for North America, we observe that the effect of COVID-19 on export trade of China with Canada and United States is completely opposite. The mainly reason is the epidemic severity in United States, which required o import a large number of anti-epidemic materials from China to control.

On the other hand, impacted by the global epidemic, the home-based office gradually becomes normal, which leads to a strong recovery in the export trades. Moreover, although the stringency index was not statistically significant, the coefficients respond that government intervention affects the volume of export trade. Further, The result of the time dummy variable shows that the shipping trade between China and the United States no longer has an obvious time due to the interference of the COVID-19 epidemic.

Beyond that, for Southeast Asian countries, the negative impact of the epidemic on China's export trade with them is more serious than that of import trade. Among them, the shipping trade of Malaysia, Singapore, and Vietnam is the most severely affected by the epidemic. However, with the increase in confirmed cases, the volume of seaborne trade between China and Myanmar has also increased. Surprisingly, thanks to the effective government control, the small number of confirmed cases in Southeast Asia has almost no impact on the volume of import and export trade.

6. Conclusion

Ocean transportation is the vital backbone of global economy and international trade where is affected by the outbreak of COVID-19. Weak demand due to the spread of global epidemic and government control have also hit the shipping trade. In order to study the major factors influencing in context of COVID-19 pandemic, we take China as an example to collect the relevant data like the total volume of shipping trade, the confirmed case and the government prevention from January to October 2020 to analyze the trend of shipping trade with linear regression model and seemingly unrelated regression model. Through the analysis, we find the following results:

First, the impact of COVID-19 pandemic on the shipping trade has two sides. On the one hand, the pandemic has a significant influence on the global economy in the short term. As consumption decreases, the

Table 3
Regression results for shipping trade (Model 2).

Country	Affiliated region	Dependent variable: Export Trade		Dependent variable: Import Trade	
		Excase	Imcase	Excase	Imcase
Belgium	European Union	25.173	-0.176	-0.079	-11.913
		(0.299)	(0.831)	(0.776)	(0.444)
Denmark		5.373	-1.018	-14.476*	4.557
		(0.331)	(0.947)	(0.096)	(0.200)
Germany		-29.183***	-1.598	-0.559	-26.987***
		(0.000)	(0.284)	(0.200)	(0.000)
France		-6.210*	-0.145	0.299	-2.607*
		(0.055)	(0.870)	(0.170)	(0.051)
Ireland		7.969	-0.915	-4.026**	-0.0492
		(0.140)	(0.927)	(0.041)	(0.743)
Italy		-2.829	-0.306	-0.218	-3.029*
		(0.606)	(0.791)	(0.296)	(0.080)
Dutch		-22.381***	0.474	-1.05***	-0.751
		(0.000)	(0.742)	(0.000)	(0.764)
Greece		9.306*	-5.033	-6.061	1.305
		(0.094)	(0.715)	(0.127)	(0.314)
Spain		0.901	0.556	0.021	0.716
		(0.871)	(0.579)	(0.847)	(0.719)
Austria		8.905	1.216	-1.642	2.410
		(0.102)	(0.803)	(0.229)	(0.147)
Sweden		5.402	-4.776	-7.429**	-1.305**
		(0.337)	(0.566)	(0.043)	(0.042)
Hungary		7.277	-0.923	-1.199*	1.802
		(0.181)	(0.859)	(0.087)	(0.265)
Poland		-0.445**	0.889	-0.102	3.700
		(0.036)	(0.505)	(0.193)	(0.226)
America	North America	6.928**	-514.443	0.902	215.796*
		(0.005)	(0.483)	(0.173)	(0.086)
Canada		-62.376*	128.236**	1.338	19.521**
		0.084	(0.033)	(0.555)	(0.042)
Burma	Southeast Asia	95.334**	-2.082	7.316	41.046
		(0.003)	(0.826)	(0.583)	(0.436)
Indonesia		-7.164	-0.649	-9.127	-5.815
		(0.110)	(0.948)	(0.519)	(0.539)
Malaysia		− 15.72448**	18.324	-22.823	-16.908*
		(0.018)	(0.346)	(0.403)	(0.066)
Philippines		-4.748729	9.090	-7.957	-4.259
		(0.340)	(0.358)	(0.565)	(0.644)
Singapore		-9.661255**	29.762	-24.737	-4.540*
		(0.047)	(0.158)	(0.399)	(0.063)
Thailand		-14.13883**	70.464	-22.026	-15.859*
		(0.032)	(0.710)	(0.934)	(0.083)
Vietnam		-48.09839***	315.901	-697.34	-28.0113**
		(0.000)	(0.636)	(0.457)	(0.003)

Note: ***, ** and * indicate significance at the1%, 5%and 10% significance levels, respectively. Table in brackets (·) shows lagged values, where (−n) is the nth month before the day examined.

commodity demand plummets correspondingly. For the shipping companies, they have to reduce capacity to save costs, which directly affects the global shipping trade. On the other hand, the export of a large number of anti-epidemic material stimulates the growth of shipping trade, especially for countries with more severe pandemics. The volume of export trade in the anti-epidemic materials to the United States always maintains a rapid growth.

Second, the government prevention and national macroeconomic situation are closely related to shipping trade. The restrictive policies have different effects on the volumes of export trade and import trade. The results indicate the strictness of government prevention is positively correlated with import trade but negatively correlated with export trade. Part of the reasons may be the restrictive policies that gradually make home working and home consumption increasingly normal and drives a rebound in the relevant industry. In addition, the macroeconomics development contributes to the recovery of shipping trade, especially in the fast-growing countries in Southeast Asian.

Finally, by adding dummy variables, we observe that the different regions vary from the effect of COVID-19 pandemic. Generally speaking, the shipping trades of China with European Union and the United State are greatly impacted by pandemic, while Southeast Asian is slightly affected. Beyond that, the results indicate that the shipping trades of China with European Union and Southeast Asia have a significant trend over time. One reason is because the consumption explosion and monetary policy can create huge supplementary demand. In addition, the traditional festivals making the peak season of shipping trade in the second half of this year.

We focus our research on evaluating the overall impact of the COVID-19 epidemic, government prevention and control measures, and macroeconomics on shipping trade in 2020. However, as time progresses, the impact of the epidemic on shipping trade will gradually change. The sudden outbreak of the epidemic has led to a decline in consumer demand and the closure of ports. Shipping trade has been hit hard. Later, as the epidemic is brought under certain control, the consumption of epidemic prevention materials and household goods will actually stimulate the growth of shipping trade. In addition, the government's prevention measure has led to a decline in shipping trade in the short term. However, in the long run, reducing the spread of the new coronavirus pneumonia epidemic will help restore economic development and indirectly benefit shipping trade. In further research, we will consider examining the impact of the COVID-19 epidemic, the government's prevention and control measures, and macro economy on

shipping trade in stages. By comparing the heterogeneity in key influencing factors in different time periods and analyzing the reasons, the study will provide guidance and suggestions for the government and shipping companies.

CRediT authorship contribution statement

Lang Xu: Methodology, Writing – original draft, Validation, Resources, **Jia Shi** : Methodology, Writing – original draft, Data calculation, Formal analysis, Software, **Jihong Chen** : Conceptualization, Investigation, editing, Validation, Funding acquisition, Supervision, Project administration, **Li Li**: Formal analysis, Writing – review & editing.

Acknowledgement

The authors thank the editor, the anonymous reviewers, and the seminar participants at University of Toronto and York University for thoughtful comments, which have helped us significantly improve the quality. Financial support was provided by National Natural Science Foundation of China (Grant 51879156), High-level talent project funding plan of transportation industry by the Ministry of Transport of the People's Republic of China (Grant 2019-012), Shanghai Pujiang Program (Grant 17PJC053) and Shanghai Soft Science Key Project (Grant 21692106400, 20692192800).

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