Predicted Electronic Commerce Helps China's Economic Resilient

--A Simulation-Based Analysis on COVID-19 Pandemic Outbreak

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Abstract: (1)Background: To perform a simulation-based analysis of 2019 COVID-19 outbreak and how would the electronic commerce indursty help China's economy resilient. (2)Methods: As the epidemic continues, it is possible to use Computable General Equilibrium model to simulate the economic consequences and analyse the role of electronic commerce industy in COVID-19 outbreak. (3)Results: Estimates and models produced at the time of the outbreak suggested that COVID-19 could have a catastrophic effect on China's economy. National statistics were examined for anomalies that corresponded to the timing of COVID-19 outbreak and, where possible, the size of any gain or loss found estimated. Our analysis suggests that the electronic commerce industry could help China's economy to recover by stimulating consumption, improving technological level and expanding investment. (4)Conclusions: This exercise holds important lessons for estimating the electronic commerce's role of similar events – such as pandemic influenza – and measures to recover the economy. We suggest that electronic commerce industry should be paid more attention in economic development, especially in epidemic time. The implications of our findings are discussed in the light of a prospective epidemic.

Keywords: Electronic Commerce Industry, Economic Impact, Computalble General Equilibrium Model, COVID-19

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1.Introduction

In the process of national economic development, there will always be some unexpected shocks, which will seriously affect the economic development in the place where they occur. How to recover after the shocks, which has derived two research topics of economic vulnerability and economic resilience. The economic resilience reflects the rebound ability of economies when faced a external shock. These shocks may be natural disasters (such as the Wenchuan earthquake in 2008, Hurricane Katrina in 2005), man-made catastrophes (such as 911 terrorism attacks in 2001, an explosion at BASF factory in Germany in 2016) or public health emergencies (such as SARS in 2002, Ebola virus in 2014). These low-frequency-high-impact shocks had a direct and severe impact on the economy in the short term. Furthermore, it produced a chain reaction on industry development, income level, and employment demand (Wan et al.,2020[1]; Ceylan et al.,2020[2]; Yu et al.,2019[3]).

Epidemic is a special kind of shock characterized by the following components :(1) long-term existence and unpredictable scale, (2) spreads rapidly and significant impact on labor supply and labor-intensive industries, and (3) simultaneously impacts supply, demand, and consumption. Recent epidemics include SARS, MERS, Avian flu, Ebola and COVID-19.

COVID-19 is a respiratory infection that spreads through the transmission of droplets and touching contaminated objects, which has suddenly outbreak in China in the end of 2019. COVID-19 is posing a considerable challenge to Chinese rapid developing economy. In order to prevent the spread of the pandemic, the Chinese government has formulated a rapid response mechanism, and the residents have been in self-quarantine at home for more than one month. Such measures across the whole country have had a substantial negative impact on the service industry, domestic and foreign trade and people's lives. The impact of the pandemic on China's economy has distinct structural characteristics, that is, the consquences on different industries may be great or less.

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In contrast to the impact of those highly influential industries, the electronic commerce industry has proliferated as residents choose to stay at a social distance. Online shopping, digital streaming media consumption, online exercise, online education, and video conferencing have overgrown during this period. In this context, China's economic development faced a series of questions that need to be answered: what impact will such an enormous pandemic have? Can electronic commerce help China to recover from severe economic shocks? How can electronic commerce help economic resilience (i.e., consumption boosting, technology enhancement, and investment increase)? This paper presents a Computable General Equilibrium(CGE) model to simulate how electronic commerce can help China's economic resilience under the influence of COVID-19.

The marginal contribution of this paper lies in the following two parts. First, this paper used a CGE model to simulate the multi-dimensional impact of COVID-19 on China's economy. Second, this paper simulated the promotion effect of developing the electronic commerce industry in three ways on China's economy. This analysis helps to identify the indispensable role of the electronic commerce industry in risk mitigation and economic resilience under COVID-19 outbreak. We carried out the combined experiments to test the stimulus degree of different development modes on improving the economy and provided references for policymakers.

The rest of this paper is organized as follows. Section 2 is the literature analysis of the epidemic situation and electronic commerce development. Section 3 is a description of the CGE model. Section 4 carries on the scene design and the experiment results. The paper is concluded in Section 5 by summarizing the most valuable insights, and Section 6 puts forward management suggestions and the prospect of future research.

2.Literature Review

2.1 Economic Impact of Emergent Epidemic

In the past 20 years, many emergent epidemics have caused severe economic consequences, which also provides massive materials for academic research. From the

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economic impact to the choice of improvement paths, much literature have emerged. Such as Min et al.[4] analyzed the structural impact of Taiwanese inbound tourism market. They found that SARS had caused a temporary reduction of tourists in main inbound tourism countries. Kostova et al.[5] explored the link between global public health events and U.S. economic outcomes by assessing the role of the 2014 West Africa Ebola outbreak in U.S. exports and exports-supported U.S. jobs in the time of 2005-2016. In terms of evaluating the economic impact of the emergent epidemics. Anu et al.[6] taken Toronto as an example, found that the economic cost of timely quarantine after the outbreak of SARS was much lower than the follow-up medical services provided. Fan[7] concluded a similar opinion in studying the spread of SARS information. Rodriguez et al. [8]used a CGE model to simulate the need for Filipino workers to disinfect their work environment and ensure personal hygiene during avian influenza. Cakir et al.[9] applied a partial equilibrium model of the meat and poultry industry to investigate the economic impact of the 2015 HPAI pandemic on Minnesota and US turkey producers, and it was found that the economic cost of turkey producers was $225m, of which $207m was due to export losses.

2.2 Research on the Impact of Consumption

Scholars have studied the impact of consumption of different commodities or industries on the economy. Oken et al. (2012)[10] studied the economic impact of fish consumption, and it was found that clear policies and fisheries management interventions were needed to stimulate fish consumption to achieve the changes expected by the fisheries sector and enterprises. Yamada et al. (2015)[11] employed the input-output analysis to explore the economic impact of consumer spending in Japan's healthcare industry, and they found that the production incentives for healthcare consumption were comparable to those in the highly influential industrial sectors. Allan et al. (2017)[12] used a multi-cycle Scottish CGE model to estimate the system-wide impact of temporary travel spending associated with the Glasgow 2014 Commonwealth Games, with particular attention to how spending decisions shift over time to accommodate temporary travel shocks.

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In the study of electronic commerce and consumption, more scholars studied micro consumption willingness and consumption behavior. Such as Dabbous(2019)[13] adopted a socio-technological framework to analyze and assess the impact of the economic benefits of knowledge and perception on the intention to achieve sustainable consumption through sharing. Li(2014)[14] applied the consumption multiplier method and found that electronic commerce transaction volume, especially online retail sales volume, has a significant effect on consumption and can promote economic growth through the consumption multiplier effect. Agag and El-Masry[15] selected the data of 1,431 online travel website users and analyzed them through structural equation modeling. The results showed that trust affected consumer attitudes, perceived risk, and online payment intention.

In essence, electronic commerce is an innovation of circulation mode. Its core function is to promote consumption. The driven chain of consumer demand is expanding consumer demand -- economic growth-- expanding consumer demand (Hong, 2013[16]). Because the electronic commerce reduces consumers' transaction costs, makes consumption more and more convenient, and improves consumers' control over the transaction process, the electronic commerce plays an increasingly important role in stimulating consumption.

2.3 Research on the Impact of Technology

Electronic commerce is the test field of new technologies and has a strong ability to integrate new technologies. Especially during the epidemic, it is necessary to reduce human-contact and optimize the efficiency of resource allocation. Through the electronic commerce, new technologies represented by blockchain, 5G and artificial intelligence have played an important role in production and distribution. Scholars have done much research on new technologies in industrial development. Evangelista and Vezzani (2010)[17] explored the relationship between technological innovation and non-technological innovation in a comparative framework between the manufacturing and service industries. These two innovation types all have a significant correlation in the manufacturing industry and service industry but have different influences on enterprise performance and strategies. Dai et al. (2016)[18] adopted a dynamic

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computable general equilibrium model to evaluate the economic impact and environmental co-benefits of large-scale development of renewable energy in China in 2050. They also found that new energy technology has a significant green growth effect, which is conducive to the growth of the upstream industry, reshapes the energy industrial structure, and brought substantial environmental co-benefits.

2.4 Research on the Impact of Investment

Due to the rapid development of Internet technology and mobile terminals, electronic commerce users snowballed. United Nations Conference on Trade and Development(UNCTAD) released the *"UNCTAD Estimates of Global Electronic commerce 2018" on April 27th, 2020*. This document showed that more than 1.4 billion people had shopping activities on the Internet, global electronic commerce payment scale reached $25.6 trillion in 2018. The rapid development of the electronic commerce consumer market has attracted more and more investment. Expanding investment is the most direct way to promote economic development. The modes, effect, and efficiency of investment have become hot research topics. Artal-Tur et al. (2016)[19] used regional input-output tables to estimate the economic impact of the Port of Cartagena to the Murcia region. The study found that port investment was the most feasible way to promote the local economy. Weisbrod et al. (2016)[20] used the economic impact analysis method as a supplement of the cost-benefit method to make a more comprehensive analysis of the investment in the Bus Rapid Transit system in Sydney. Bravo-Ureta et al. (2011)[21] found that the investments promoted by the MARENA program in Honduras had a significant impact on the gross agricultural product of its beneficiaries.

2.5 Review

Consumption, technology, and investment are the critical drive forces of economic development, which have been recognized by many scholars. Under the impact of public health incidents such as COVID-19, economic development is severely restricted, the local economy can recover with consumption stimulating, technology involvement, and investment expanding.

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3.Model Setting

When examining the intersectoral spillover effects caused by external shocks, the computable general equilibrium(CGE) model is generally adopted. It is different from the econometric model which only examines the relationship between selected independent variables and dependent variables. Due to these characteristics, we implied the CGE model for examing the economic consquences and recover ways under COVID-19.

3.1 Social Accounting Matrix

Social accounting matrix(SAM) is the data basis of CGE model. Since China does not release the social accounting matrix, this paper used the latest input-output table (released every five years, the latest is 2017), the statistical and financial yearbook to compile the 2017 SAM of China.

Referring to the proportion of electronic commerce transaction activities of enterprises in different industries in the statistical yearbook "Enterprise Informatization and Electronic commerce by Industry (2017)", we separated a “virtual” electronic commerce industry from the industrial sector.

3.2 Structure of CGE Model

For the study of electronic commerce industry in the pandemic situation to stabilize the economy, this paper set up a multi-sectoral CGE model including 10 industries(agriculture, mining, labor-intensive manufacturing, capital-intensive manufacturing, technology-intensive manufacturing, construction, producer service, life service, public service and electronic commerce), capital sector, labor sector, residents sector, government sector ,enterprises sector and foreign sector based on the IFPRI model(Lofgren, 2002[22]) and Chang (2017)[23]. The model mainly included production block, trade block, resident block, government block, balance block and macro closure block.

3.2.1 Production Block

The production block describes the input-output relationship of labor, capital and intermediate products in the production process and uses a two-layer nested CES

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function to describe it. The first layer is the total output of the market jointly formed by synthetic products of labor-capital and intermediate products, as shown in equations (1), (2) and (3). The second layer is the synthetic product of labor and capital elements, as shown in equations (4), (5) and (6).

$$\mathrm{QA}_a = (1+tec_a)\alpha_a^A \left[\delta_a^A QVA_a^{-\rho_a^A} + (1-\delta_a^A) QINTA_a^{-\rho_a^A}\right]^{\frac{-1}{\rho_a^A}} \qquad a \in A \qquad (1)$$

$$\frac{PVA_a}{PINTA_a} = \frac{\delta_a^A}{1-\delta_a^A}\left(\frac{QINTA_a}{QVA_a}\right)^{1+\rho_a^A} \qquad a \in A \qquad (2)$$

$$PA_a \bullet QA_a = (1+tprd_a)\left(PVA_a \bullet QVA_a + PINTA_a \bullet QINTA_a\right) \qquad a \in A \qquad (3)$$

$$\mathrm{QVA}_a = \alpha_a^{va}\left[\delta_{La}^{va} QLD_a^{-\rho_a^{va}} + (1-\delta_{La}^{va}) QKD_a^{-\rho_a^{va}}\right]^{\frac{-1}{\rho_a^{va}}} \qquad a \in A \qquad (4)$$

$$\frac{WL}{WK} = \frac{\delta_{La}^{va}}{1-\delta_{La}^{va}}\left(\frac{QKD_a}{QLD_a}\right)^{1+\rho_a^{va}} \qquad a \in A \qquad (5)$$

$$PVA_a \bullet QVA_a = WL \bullet QLD_a + WK \bullet QKD_a \qquad a \in A \qquad (6)$$

QA represents the total output of the industry. *tec* represents different technology parameters of the industry. α and δ are the scale and share parameters, respectively. *QVA* represents elements synthetic products and *PVA* is its price. *QINTA* is the industrial intermediate product volume, and *PINTA* represents its price. ρ represents the elasticity of substitution parameters. *tprd* is the production tax rate. *QLD* and *QKD* represent the number of labor and capital demand, respectively. Moreover, *WL* and *WK* represent the labor price and capital price, respectively.

3.2.2 Trade Block

The import part of the model is set in accordance with the Armington hypothesis, and the domestic goods are the synthetic goods of domestic production and domestic-use-foreign-import. The export part conforms to the fixed conversion elasticity hypothesis. That is, the total domestic output is divided into domestic use and export parts with incomplete substitution relationship. The functional relationship of import and export is shown in equation (7) ~ (12).

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$$\mathrm{QX}_c = \alpha_c^t \left[\delta_c^t QD_c^{\rho_c^A} + (1-\delta_c^t) QE_c^{\rho_c^t} \right]^{\frac{1}{\rho_c^t}} \tag{7}$$

$$\frac{PD_c}{PE_c} = \frac{\delta_c^t}{1-\delta_c^t} \left(\frac{QE_c}{QD_c} \right)^{1-\rho_c^t} \tag{8}$$

$$PX_c \bullet QX_c = PD_c \bullet QD_c + PE_c \bullet QE_c \tag{9}$$

$$QQ_c = \alpha_c^q \left[\delta_c^q QD_c^{-\rho_c^q} + (1-\delta_c^q) QM_c^{-\rho_c^q} \right]^{\frac{-1}{\rho_c^q}} \tag{10}$$

$$\frac{PD_c}{PM_c} = \frac{\delta_c^q}{1-\delta_c^q} \left(\frac{QM_c}{QD_c} \right)^{1+\rho_c^q} \tag{11}$$

$$PQ_c \bullet QQ_c = PD_c \bullet QD_c + PM_c \bullet QM_c \tag{12}$$

QX represents the sum of domestic production. α and δ are the scale and share parameters, respectively. *QD* represents the production volume of domestic-production-domestic-use, *PD* is its price. *QE* represents the production volume of domestic-production-but-export, *PE* is its price. ρ represents the substitution elasticity of domestic production and import. *QM* represents the number of imported goods, *PM* is the price of imported goods.

3.2.3 Resident Block

This block divides the residential sector into urban residents and rural residents and describes the income and expenditure of the residents. Residents' income comes from labor remuneration, capital income and transfer payments from enterprises, governments and foreign departments, as shown in equation (13). Residents' expenditure adopts LES (linear expenditure system) function, which can more accurately reflect residents' minimum living guarantee consumption, as shown in equation (14).

$$YH_h = WL \bullet shif_{hl} \bullet QLSAGG + WK \bullet shif_{hk} \bullet QKSAGG + YEH_h + YGH_h + YWH_h \bullet EXR \tag{13}$$

$$PQ_c \bullet QH_{c,h} = PQ_c \bullet \gamma_{c,h} + \beta_{c,h} (EH_h - \sum PQ_c \bullet \gamma_{c,h}) \tag{14}$$

YH represents residents' income, *shif* represents residents' share parameter of income from labor and capital endowment. *QLSAGG* represents total supply of labor,

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QKSAGG represents total supply of capital. *YEH*, *YGH* and *YWH* represent transfer payments to residents by enterprises, government and foreign sectors respectively. *EXR* represents the exchange rate.

3.2.4 Enterprise Block

The enterprise sector obtains income mainly through capital factors, as shown in equation (15).In addition to the enterprise income tax and the transfer payment to the resident sector, the enterprise gains capital accumulation through savings, as shown in equation (15).

$$YENT = shif_{entk} \bullet WK \bullet QKSAGG \tag{15}$$

$$SE = \left(1 - ti_{ent}\right) YENT - \sum_{h} YEH_{h} \tag{16}$$

YENT is the total income of the enterprise, *SE* is the savings of the enterprise ,and *ti* is the income tax of the enterprise.

3.2.5 Government Block

Government block mainly includes government revenue and government expenditure. Government revenue includes production tax, resident income tax, enterprise income tax, tariff and income from foreign aid or bond interest, as shown in equation (17). The government expenditure includes the government's commodity consumption expenditure, the transfer payment to residents and the foreign aid or bond interest expenditure, as shown in equation (18).

$$YG = \sum_{a} tprd_{a} \bullet \left(PINTA_{a} \bullet QINTA_{a} + PVA_{a} \bullet QVA_{a}\right) + \sum_{h} ti_{h} \bullet YH_{h} + ti_{ent} \bullet YENT + \sum_{c} tm_{c} \bullet pwm_{c} \bullet QM_{c} \bullet EXR + YWG \bullet EXR$$

(17)

$$EG = \sum_{c} PQ_{c} \bullet GD_{c} + \sum_{h} YGH_{h} + YGW$$

(18)

YG stands for government revenue. *ti* stands for the income tax rate of residents. *tm* stands for the rate of tariff. *pwm* stands for the price of imported goods before tariff in foreign currency. *EG* stands for government expenditure.

3.2.6 Balance Block

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The general equilibrium theory requires the model to balance in production market, factor market and international payments. The production market balance is that the total supply of the industry is equal to the total demand (including intermediate demand of production, household consumption demand, government consumption demand, investment and deposit demand), as shown in equations (19) and (20). Factor market balance refers to the total factors demand is equal to the total supply of factors. The factor market assumes the Keynesian situation, and factor demand determines the actual supply of factors, as shown in equations (21) and (22). The balance of international payments is import equals export, as shown in equation (22). Investment-savings balance means that all the funds in the model can be fully applied, as shown in equation (23).

$$QQ_c = \sum_a QINT_{ca} + \sum_h QH_{c,h} + \overline{QINV_c} + \overline{GD_c} + \overline{STO_c} \quad (19)$$

$$PQ_c\left(STO_c + QINV_c\right) = \sum_h mps_h \bullet \left(1 - ti_h\right) \bullet YH_h + SE + SG + EXR \bullet FSAV \quad (20)$$

$$\sum_a QLD_a = QLSAGG \quad (21)$$

$$\sum_a QKD_a = QKSAGG \quad (22)$$

$$\sum_c pwm_c \bullet QM_c + YWK + YGW = \sum_a pwe_c \bullet QE_c + \sum_h YWH_h + YWG + FSAV \quad (23)$$

QINT is the intermediate input matrix. *GD* represents the production-consumption of government. *STO* stands for inventory volume. *YWK* is the foreign capital interest income. *pwe* is the FOB price in foreign currency. *FSAV* is foreign net saving. *mps* is the residents' marginal propensity to save. *SE* and *SG* respectively represent enterprises and the government's savings.

3.2.7 Macro-closure

Macro-closure is the economic assumption of the current economic system situation, which is reflected by the setting of endogenous and exogenous functions in the model design. Considering that China's economic situation under COVID-19 is relatively negative, the macro-closure in this paper adopts Keynesian closure. We make the following assumptions for the model refers to Chen et al.(2010)[24].

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A. Considering the severe impact of COVID-19 on manufacturing and service industies, many enterprises are facing bankruptcy due to capital chain rupture or market shrinkage, resulting in mass unemployment. Labor wage *WL* is rigid, and the labor supply is endogenous, so the unemployment in the market can be investigated.

B.Although the capital supply is short, it is still flexible. Refer to Chang(2017)[23], we set a capital supply function $K=kW^{\varepsilon}$. Capital price *WK* and capital supply *QKSAGG* are endogenous in the system, which can be observed through the model.

C.The investment in each sector is affected by capital prices, so the model does not fix the amount of investment in each sector, but adopts the proportion of total investment to simplify.

D.As a developing country, China is in a passive follower position in the international market, and its exchange rate does not change much, so it is fixed in the model.

4.Empirical analysis

4.1 Scene Design

Due to the possibility of data acquisition and the relative stability of China's economic structure, this paper used China's economic data in 2017 to simulate the economic scenario in 2019. According to the website of the National Bureau of Statistics[1], the scenario of the impact of the pandemic was set as a 5% drop in investment, a 5% drop in consumer consumption (including a 10% drop in consumer services) and a 5% drop in labor-intensive manufacturing output.

4.2 Economic Impact of Pandemic Shock

This part used CGE model to simulate the economic impact of the pandemic scenario. In the context of the epidemic, China's economy was temporarily in a macroeconomic depression, with limited production capacity and exogenous investment, which conforms to the Keynesian theory.

[1] http://www.stats.gov.cn/tjsj/zxfb/202004/t20200419_1739666.html

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The simulation results of the impact of the simulated epidemic show that China's economy has been severely affected. The simulation results of the specific impact are shown in **Table 1**. Compared with the initial state, China's GDP has decreased by 5.448%, and the consumer price index has increased by 0.571%. Therefore, the development of the national economy and household consumption has been significantly negatively affected.

Table 1. Simulation results of China's economic impact under COVID-19 pandemic

	GDP	CPI	Urban residents income	Rural residents income	Enterprise income	Government revenue
Before	823215.706	1	410778.045	102179.096	293572.635	142826.794
After	778368.784	1.006	385840.035	95655.464	247346.310	130514.074
Difference	-44846.922	0.006	-24938.01	-6523.632	-46226.325	-12312.72
Δ %	-5.448	0.571	-6.071	-6.385	-15.746	-8.621
	Government spending	**Total investment**	**Total labor demand**	**Total capital demand**	**Total exports**	**Total imports**
Before	154803.762	364460.266	423268.028	304969.074	163846.824	149268.383
After	142491.042	347053.617	396629.083	285990.759	158929.901	144250.687
Difference	-12312.72	-17406.649	-26638.945	-18978.315	-4916.922	-5017.696
Δ %	-7.954	-4.776	-6.294	-6.223	-3.000	-3.361

The impact of the epidemic on incomes is clear. The income of urban residents decreased by 6.071%, while that of rural residents decreased by 6.385%. The pandemic has resulted in a significant decrease in operating income in the income structure of residents[2], resulting in a decrease in their income. The impact of the epidemic on enterprises is the most obvious. The revenue of enterprises has dropped by 15.746%, which is also consistent with the plight of enterprises in reality. Government revenue also decreased by 8.621% from 14.3 trillion to 13.1 trillion RMB, and the decrease in income also contributed to the decrease in government expenditure, which decreased by 7.954%.

From the perspective of capital supply and demand, the pandemic has also had a significant impact on economic development. Total social investment dropped by

[2] http://www.stats.gov.cn/tjsj/zxfb/202004/t20200417_1739334.html

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4.776%, total capital demand also dropped by 6.233%, the economy was in the depression period, lack of vitality.

In an extreme depression like COVID-19 situation, the impact on employment is also harmful. According to SAM table and China Statistical Yearbook, in 2017, the total consumption of labor factors was 42326.8 billion RMB yuan and the actual number of employed people was 806.86 million RMB yuan, about 52,459 RMB yuan to create a job. Calculated in this way, the pandemic will reduce 50.78 million jobs. In terms of sectors, the pandemic will have the most severe impact on the service sector, with producer services, consumer services and public services losing 7.162%, 7.487% and 8.023%, respectively.

The impact of the pandemic on production has also led to a decline in China's import and export trade, with total exports and imports dropping by 3% and 3.361% respectively, and the trade surplus rised from 14.578 billion to 14.679 billion RMB yuan, indicating that foreign goods were replacing domestic goods.

Table 2. Simulation results of sectoral impact under COVID-19 (change ratio)

	Agriculture	Mining	Labor-intensive manufacturing	Capital-intensive manufacturing	Technology-intensive manufacturing	Construction	Producer service	Life service	Public service	Electronic commerce
Output	-5.387	0.588	-5.000	-2.565	-2.042	-5.027	-3.844	-4.888	-6.645	-3.507
labor demand	-5.456	-2.333	-5.860	-5.079	-4.033	-5.638	-7.162	-7.487	-8.023	-5.529
Import %	-4.687	-11.628	-64.845	-11.730	-7.621	-4.171	-15.057	-13.583	-11.697	-8.668
Export %	-5.374	-0.379	-0.465	-3.439	-3.271	-5.021	-4.485	5.954	-6.662	-4.335

The impact of the pandemic on the industrial sector is also direct and negative. See **Table 2** for the specific simulation results. Under the impact of the pandemic, the output of all industries had dropped more than 2%, especially the labor-intensive agriculture, labor-intensive manufacturing industry, construction industry and public service industry. All industries' output had dropped more than 5%. This industrial depression was due to the shutdown factories and stop production caused by the pandemic. The output of the life service industry was reduced because of residents choose to stay at home for long periods and reduce social gathering. However, capital-intensive

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manufacturing, technology-intensive manufacturing, production service industry and electronic commerce industry had relatively low impact, which was related to high technological involvement and relatively low human participation. The relative stability of these sectors provided a guarantee for the resilience of China's economy. In contrast, the output of the mining industry was not decreased. This paradox was due to the high tax rate of the mining industry. Under the only market economy dominant condition, the high tax rate would attract government resources to the mining industry. However, in reality, the government would be more likely to take preventing the pandemic spread and safeguarding people's living standards as the top priority, but that is not in the research scope of this paper.

4.3 The Role of Electronic Commerce Industry under the Impact of COVID-19

Under COVID-19 pandemic situation, electronic commerce industry played a very important role when consumption was restrained due to the isolation of social distance and the adoption of Internet. This part simulated the response of electronic commerce industry in the pandemic situation in three ways and tested the effectiveness of electronic commerce industry in stabilizing the economy.

4.3.1 Stimulate Electronic Commerce Industry Consumption

Under COVID-19 pandemic, while maintaining social distance and reducing travel, online shopping became the popular option of most residents. According to the National Bureau of Statistics, physical goods online retail sales had increased 3.0% in January and February 2020. We simulated the residents' consumption of electronic commerce industry grew by 5%, 10%, 20%, 30%, 40%, and 50% to explore the impact of the economy, as shown in **Table 3**.

Table 3. Simulation results of stimulating electronic commerce industry consumption (change ratio compare with COVID-19 scenario)

	Increased consumption of electronic commerce industry (%)					
	5	**10**	**20**	**30**	**40**	**50**
GDP	0.43	0.64	1.07	1.50	1.93	4.09
CPI	-0.01	-0.01	-0.03	-0.05	-0.08	-0.37
Income of urban resident	0.38	0.56	0.94	1.33	1.71	3.69
Income of rural resident	0.40	0.60	1.00	1.40	1.80	3.90

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Enterprise income	1.13	1.70	2.85	4.02	5.20	11.41
Total labor demand	0.39	0.58	0.97	1.37	1.76	3.79
Total capital demand	0.42	0.63	1.06	1.49	1.92	4.13
Export	0.25	0.38	0.63	0.88	1.12	2.29
Import	0.28	0.43	0.71	0.99	1.26	2.57

A summary of the results of the most interesting simulation runs is presented in **Table 3**. After the residents' consumption of electronic commerce industry gradually increased, the economy is in the trend of improvement. Especially when the residents' consumption of electronic commerce industry increased by 50%, economic indicators appeared a significant positive effect, GDP grow by 4.09%, price index fell by 0.37%, the income of urban resident increased by 3.69%, the income of rural resident increased by 3.90%, the enterprise income increased by 11.41%, employment increased by 3.79%, export growth of 2.29%, and import growth of 2.57%. This shows that stimulated consumption in electronic commerce can make conducive to the improvement of the economy.

4.3.2 Improve the Technological Level of Electronic Commerce Industry

New technologies have developed rapidly in the pandemic period. Blockchain technology, 5G and artificial intelligence have been widely applied in fields related to electronic commerce, which can effectively reduce human participation and improve production efficiency. This part simulated the economic consequences after the technological level of the electronic commerce industry increases by 10%-50%. **Table 4** presents a summary of the results of the simulation.

Table 4. Simulation results of improving the technological level of electronic commerce industry (change ratio compare with COVID-19 scenario)

	Improvement of electronic commerce industrial Technology level (%)				
	10	**20**	**30**	**40**	**50**
GDP	0.33	0.66	0.99	1.32	1.66
CPI	0.12	0.18	0.17	0.11	-0.02
Income of urban resident	1.41	2.85	4.34	5.86	7.44
Income of rural resident	1.48	3.01	4.57	6.18	7.85
Enterprise income	4.28	8.77	13.48	18.43	23.65
Total labor demand	1.45	2.93	4.44	5.99	7.59
Total capital demand	1.58	3.20	4.86	6.55	8.29

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Export	0.77	1.45	2.08	2.65	3.17
Import	0.86	1.64	2.34	2.98	3.56

After the improvement of the technological level of electronic commerce industry, it has a positive impact on the development of Chinese economy, and the improvement of various economic indicators is more significant than other simulation ways. The growth rate of GDP after improving the technological level of electronic commerce industry is rising steadily, but it is less compared with the effect of stimulating electronic commerce consumption. In addition to the electronic commerce industry technological level to increase to 50%, the CPI starts to decline yet. Income has actively be stimulated, the income of urban residents has increased from 1.41% to 7.44%, and the income of rural residents has increased from 1.48% to 7.85%. The income of enterprise is most positively influenced which has increased from 4.28% to 23.65%.

The improvement of the technological level of electronic commerce industry has a positive effect on the import and export, but the trade surplus is on the decline, from 1467.9 billion RMB yuan to 1465.4 billion RMB yuan, 1463.2 billion RMB yuan, 1461.1 billion RMB yuan, 1459.3 billion RMB yuan and 1457.6 billion RMB yuan respectively. The declined trade surplus is due to the relatively higher market prices of other industries. After a 50% increase in the technological level of the electronic commerce industry, household income, enterprise income, total labor and capital demand, and total import and export have all exceeded the normal level before the COVID-19 shock. Upgrading the technological level of the electronic commerce industry will undoubtedly help to improve income, employment, and international trade.

4.3.3 Increase Electronic Commerce Industry Investment

In pandemic situations, each industry investment limited, according to the National Bureau of Statistics[3], from January to April 2020, the national investment in fixed assets (excluding farmers) fell 10.3% year on year, except the novel and high technology investment. So in this part, we designed the electronic commerce industry

[3] http://www.stats.gov.cn/tjsj/sjjd/202005/t20200515_1745757.html

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investment growth of 10%, 20%, 30%, 40% and 50% and used to simulate the economic effects of investment strengthening in the COVID-19 scenario. A summary of the results of the most interesting simulation runs is presented in **Table 5**.

Table 5. Simulation results of increasing investment in electronic commerce industry (change ratio compare with COVID-19 scenario)

	Increase of investment in electronic commerce industry (%)				
	10	**20**	**30**	**40**	**50**
GDP	0.54	0.90	1.26	1.62	1.98
CPI	-0.01	-0.02	-0.04	-0.06	-0.08
Income of urban residents	0.48	0.79	1.12	1.44	1.76
Income of rural residents	0.50	0.84	1.18	1.52	1.86
Enterprise income	1.43	2.40	3.37	4.36	5.36
Total labor demand	0.49	0.82	1.15	1.48	1.81
Total capital demand	0.53	0.89	1.25	1.61	1.98
Export	0.32	0.53	0.74	0.95	1.15
Import	0.36	0.60	0.83	1.07	1.30

It can be seen from **Table 5** that the economic effect of increasing investment is weaker than that of stimulating consumption and improving technology. From the perspective of income effect, the increase of investment has limited impact on the improvement of residents' income(from 0.48% to 1.86%), and its impact on enterprise income is greater than that of residents' income(from 1.43% to 5.36%). The increase of investment will not only directly affect the amount of capital obtained by enterprises, but also stimulate enterprises to expand production, thus increasing income. From the perspective of economic effect, increasing investment in electronic commerce industry has a positive impact on GDP (improved from 0.54% to 1.98%) and will promote the slow decline of CPI (from -0.01% to -0.08%). To expand production, businesses need more labor and create more jobs(employment increased from 0.49% to 1.81%).

5.Conclusion

Under the impact of such an irresistible public health event as COVID-19, China's economy has been shocked by an unprecedented negative impact. Under the negative economic scenario of reduced consumption and investment, all industries have experienced a decrease in output and employment. In order to explore how electronic

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commerce can help China's economic recovery under such an impact, this paper designs three ways to stimulate consumption, the technological level and increase investment in electronic commerce industry for simulation, and draws the following conclusions.

1. Stimulate electronic commerce industry in terms of consumption, technological level, and investment will play a positive role in economic recovery in the pandemic situation. These three ways indicate that developing electronic commerce industry in COVID-19 situation is not only a challenge of lifestyle changes but also a chance of seeking a new driving force for China's economic development.

2. The effect of stimulating electronic commerce consumption and increasing investment in electronic commerce industry is similar. But the effect of increasing consumption is slightly greater than that of expanding investment. The economy would be effectively improved when the consumption of electronic commerce has grown 50%, this indicates that encouraging residents to apply electronic commerce in the pandemic period is a possible measure.

3. The improvement of the electronic commerce industry’s technological level leads to the increased demand for capital, a large amount of idle capital flows into the production process. In the fixed consumption level scenario, the relative price of electronic commerce decreases will lead to price of other industry products rise. When the negative effect of electronic commerce product decrease to CPI is higher than the positive effects of other industry product's price increase, the results of CPI will fall.

4. The ascension of electronic commerce industry technology level is the most obvious option to increase the income effect, especially in the electronic commerce industry. The income of residents and enterprises has significantly increased, especially the enterprise is the most active. Through the spillover effects of electronic commerce industry, output in other sectors is pulled. Technological level ascension in electronic commerce industry provides an effective choice to improve enterprise income and household income in the pandemic.

6.Suggestions

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The simulation in this paper provided reference for the maintenance of economic resilience in the electronic commerce industry, and put forward the following suggestions.

1. In the new pandemic under the impact of the public health event, it has been proved that the best prevention and control measures is to social isolation, but this will reduce the residents' consumption, on the real economy is a huge blow, By the electronic commerce industry, people can meet consumer demand.For pandemic prevention and control managers, unified management of express delivery and distribution can effectively prevent crowd gathering and spread of the virus. Therefore, the government and enterprises should actively promote the development of the electronic commerce industry, standardize electronic commerce logistics, cash flow and information flow, to encourage residents consumption, Through transfer consumption from offline to online, the electronic commerce industry's pull function ensures a sustainable consumption of China's economy.

2. Accelerate the application of high and new technologies in the electronic commerce industry. Block chain, 5G technology and artificial intelligence are all important tools to drive economic innovation and development. Blockchain is the core independent innovation technology mentioned by General Secretary Xi Jinping. Governments and enterprises at all levels should take advantage of policy support and the favorable opportunity of pandemic development to accelerate the implementation of blockchain technology in the field of electronic commerce.5G technology was officially commercialized in China in 2019, accelerating the application of 5G technology in the field of electronic commerce, which will help consumers get more valuable use experience and develop more business models.The application of artificial intelligence has provided important decision support for transportation, crowd control and information acquisition during the pandemic period. In order to reduce personnel contact while allowing consumers to have better experience, more artificial intelligence technologies should be applied to electronic commerce.

3. Under the influence of COVID-19, this kind of virus will coexist with mankind for a long time. For investors, the rapid development of electronic commerce under the

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pandemic will provide them with suitable investment objects.Increasing investment in the electronic commerce industry is conducive to the rapid development of electronic commerce enterprises and the development of new products and technologies, thus forming an interactive development loop. The accumulation of capital into the electronic commerce industry will drive the concentration of human resources, technological resources and policy resources in the market to the electronic commerce industry and expand the competitive advantages of China's electronic commerce industry. At the same time, regions with different resource endowments should identify investment subjects when they develop electronic commerce and make more efficient use of the development dividends brought by investment.

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