The Impact of International Electronic Commerce on Export Trade: Evidence from China

Chenggang Wang¹, Tiansen Liu²,*, Duo Wen³, Dongrong Li¹, Galash Vladislav¹ and Yu Zhu²

1 School of Economics and Business Administration, Heilongjiang University, Harbin 150080, China; wangchenggang@hlju.edu.cn (C.W.); 20204422@hlju.edu.cn (D.L.); Y2095016@hlju.edu.cn (G.V.)
2 School of Economics and Management, Harbin Engineering University, Harbin 150001, China; drewyu@hrbeu.edu.cn
3 Business School, Leeds University, Leeds LS2 9JT, UK; ml20dw3@leeds.ac.uk
* Correspondence: tiansen0328@hrbeu.edu.cn; Tel.: +86-13845105537

Abstract: The impact of international electronic commerce (IEC) on export trade increases along with its expanding scale. Based on relevant data and the gravity model of China’s IEC export trade, this paper develops a theoretical model that can be used in IEC scenarios, applies regression equations, a Hausman test, and other empirical methods to verify relevant data, and performs a robustness test. The purpose of this paper is to explore the mechanism of IEC impact on China’s trade, and hopefully to study the temporal structural changes of the impact of IEC activities on China’s export trade based on the financial crisis and European debt crisis variables. The innovation of this paper is mainly reflected in the large sample of China’s trade selected in this paper. It can also determine the changes in the distance effect of international trade in the era of IEC, and reveal the mechanism by which IEC applications help foreign trade enterprises overcome economic crises. Four key conclusions are obtained as follows. First, the development of IEC has significantly promoted the expansion of China’s export trade scale. Second, in the context of the global financial crisis and European debt crisis, the positive promotion effect of IEC on exports is not significant. Third, the promotion effects of IEC on China’s exports to both developing and industrialized countries are significant, with the impact on developed country exports being slightly greater. Fourth, although the geographical distance for measuring transportation costs has a negative effect on China’s exports, such effect has been greatly weakened.

Keywords: international electronic commerce; export trade; gravity model; robustness test

1. Introduction

In 2020, international electronic commerce (IEC) platforms, such as Amazon, AliExpress, Wish, and eBay, have developed rapidly as their transaction volume continues to rise year after year. Data published by the WTO show that in 2020, the global IEC transaction volume has reached USD 1 trillion. Meanwhile, statistics from China Customs illustrate that the customs IEC management platform passed the inspection and release of 2.45 billion import and export tickets last year, representing annual growth of 63.3%. China’s IEC trade volume has also exceeded USD 200 billion in 2020, representing a 31.1% growth over the previous year. IEC is expanding its market shares at an unprecedented speed. Different from traditional trade methods, IEC has obvious advantages, such as less capital investment, short transaction time, few export links, lack of time and geographical restrictions, and high trade efficiency, thereby attracting the attention of foreign trade enterprises globally.

After the outbreak of the financial crisis, the overall international economic situation is not optimistic. China’s traditional foreign trade has been hit hard, but small and medium-sized foreign trade enterprises use cross-border e-commerce to carry out import and export transactions but buck the trend. According to data released by the National Bureau of
Statistics of China, from 2015 to 2020, China’s small and medium-sized foreign trade enterprises used cross-border e-commerce for import and export transactions to maintain an average annual growth rate of 30%. This is much higher than the 10% growth rate of offline traditional foreign trade transactions. Statistics from the Chinese Ministry of Commerce show that more than 500,000 enterprises in China are carrying out their import and export businesses via foreign trade IEC platforms.

IEC brings many benefits to international trading enterprises. For instance, eBay has conducted an investigation on small and medium enterprises (SME) in developing countries and found that 60 to 80% of international trading enterprises using IEC can survive the first year of their business, whereas traditional export enterprises only have a survival rate of 30 to 50%. In the era of IEC development, individual consumers are gradually participating in foreign trade business. At the same time, the function of IEC in stimulating foreign trade has attracted the attention of China’s government and enterprises. Statistics from the Chinese Ministry of Commerce show that the number of cities in China that have set up IEC test areas has reached 35, highlighting the continuously expanding application scope of IEC in China’s future foreign trade activities.

The research objectives of this paper are as follows: amid the rapid advancement of China’s IEC, this paper explores whether the application of IEC can promote China’s exports. Since the outbreak of the global economic crisis and the European debt crisis, did the influences of IEC activities on China’s exports change structurally over time? Discussing these issues has important theoretical significance for comprehensively and objectively evaluating the influences of IEC on China’s exports. The conclusions of this paper can also guide relevant management departments in formulating IEC management policies.

In terms of the scientific contribution of this paper, first, this paper uses a larger sample to measure the mechanism of China’s IEC on export trade. Second, this paper can judge the changes in the distance effect of international trade in the era of IEC. Third, this paper can reveal the internal mechanism of the application of IEC to help foreign trade enterprises tide over the economic crisis.

2. Literature Review

Some researchers have examined the issues associated with IEC and foreign trade relations, particularly in three aspects.

First, IEC greatly impacts foreign trade intermediaries. Related studies on IEC argue that the price and information of products have become much more transparent since the advent of the Internet, thereby reducing the arbitrage opportunities of trade intermediaries and eventually leading to their demise [1]. However, based on the transaction cost theory, the emergence of IEC changes the service mode of trade intermediaries but does not completely eliminate them. In other words, trade intermediaries transform themselves from providers of original information services to providers of comprehensive services, such as logistics and financing [2]. With the expanding influence of international IEC platforms, such as Amazon, AliExpress, eBay, and Wish, the services they provide to store sellers and platform buyers are also increasing. In addition to providing traditional product information, these platforms now recommend comparison products for buyers and provide discount information, high-quality platform logistics services, convenient settlement channels, and after-sales services [3]. Meanwhile, those IEC third-party service platforms that have recently emerged in China’s market, such as AliExpress, Alibaba International Station, Made-in-China.com, GlobalSources.com, and Light in the Box, verify the view of Camp’s trade intermediary transformation. These platforms not only provide a place for foreign trade enterprises to exchange information but also provide services, such as transaction supervision, financing, logistics, and even customs clearance, for SME in developing countries. From the perspective of the current development of foreign trade intermediaries, those intermediaries engaged in IEC include not only IEC platforms but also certain entities, such as payment platforms, logistics enterprises, and overseas
warehouse models [4]. Moreover, as the number of IEC platforms and stores continues to increase, the role of trade intermediaries in IEC also increases in significance, and the competition among these intermediaries becomes increasingly fierce [5].

Second, IEC greatly affects the international trade enterprise marketing model. The development of e-commerce activities has changed the development model of enterprises [6]. Specifically, IEC has elevated the international marketing capabilities of international trade enterprises, solidified their relationship with their partners [7], changed their business models from production design to after-sales service departments [8], and granted them a competitive advantage. IEC also helps international trade enterprises build a new business management model that integrates logistics, capital flow, and information flow [9]. Only large enterprises are strong enough to participate in traditional international trade. However, in IEC, even SME can smoothly participate in international trade activities. In the case of some SME with insufficient resources, when participating in IEC, if such enterprises can successfully select products and sell all the best-selling goods, then they also invest less to receive more benefits [10]. Meanwhile, enterprises participating in IEC should further improve their international logistics coordination capabilities. To serve orders from different countries, store sellers should choose safe and efficient international logistics enterprises, which are critical to enterprise management. Compared with domestic trade, in the marketing procedure of IEC, enterprises must actively improve their capabilities in responding to overseas buyers’ return of goods and product quality problems [11].

Third, IEC greatly impacts international trade practices. Along with the expansion of global IEC transactions, IEC promotes a continuous expansion of international trade in various countries [12]. IEC activities are owing to internet information technology, which significantly reduces the transaction costs of international trade enterprises. IEC activities also improve the operating efficiency of foreign trade enterprises, and IEC offers these enterprises with new business chances for expanding their foreign trade scale [13]. Therefore, IEC can influence a country’s export and import trade activities, and its continuous expansion will increase the export volumes of developing countries to industrialized countries. However, the resulting change in export value among developing countries is relatively small [14]. Specifically, some developing countries with relatively weak export capabilities can expand their export scale and enhance their export capabilities by participating in IEC activities. Micro-data of enterprises show that IEC can increase the possibility for enterprises to participate in exports [15]. In addition, expanding the scale of IEC promotes a continuous increase in the trade volume of some small commodities in international trade, encourages the development of an international small package business logistics industry, and triggers a continuous expansion in the scale of international logistics service trade [16].

Previous studies have examined issues regarding IEC and laid out an important foundation for future research. However, these studies have several shortcomings [17–19]. For example, these studies are mainly qualitative in nature, focusing on IEC in industrialized countries while ignoring developing countries such as China, and examine macro-level issues while ignoring micro-level ones, especially IEC export activities in China [20].

To compensate for these flaws, this paper focuses on the following areas. Based on China’s IEC practice, this paper expands its sample size and utilizes panel data on the trade between China and 178 trading partners from 2006 to 2019. This paper also considers a longer period in measuring the influence of IEC on exports and avoids the estimation bias caused by small sample selection. This paper also modifies the traditional gravity model by introducing IEC, examines whether the distance effect of foreign trade in the era of IEC is weakened by the introduction, and adds new FDI variables to offset the defects of the traditional trade model. Given the relatively long span of its data, this paper covers both the global economic crisis and the European debt crisis and analyzes whether the application of IEC can help foreign trade enterprises tide over economic crises.

The rest of the research structure of this paper is as follows: Section 2 mainly introduces the methodology and data. Section 3 checks the model and estimation results. Section 4
performs robustness checks. Section 5 concludes this paper and therefore proposes some recommendations for future research.

3. Materials and Methods

3.1. Theoretical Model

This paper draws on the theoretical model of Freund and Weinhold [13], which assumes that each country has \( m \) enterprises producing homogeneous products and characterizes the market competition as a Cournot competition [21]. The market is in a state of fragmentation and is not perfectly competitive.

This paper draws on the theoretical model of Freund and Weinhold [13]. Freund and Weinhold were the first scholars to study the impact of the Internet on international trade. They built a theoretical model of the influence of the Internet on international trade based on traditional theories such as international trade theory and marketing theory, and combined time and cross-sectional data tests to find the positive influence of the Internet on international trade. At the same time, they also believe that the specific coefficient of the impact of the number of Internet hosts on export trade is 0.2%. This model first established a quantitative relationship between the Internet and international trade [21]. This will help future scholars’ in-depth research on the Internet and international trade relations. Since Freund and Weinhold, a large amount of the literature has relied on the gravity model and based itself on cross-border macro data to deeply explore the impact of the Internet on international trade. For example, Moaniba uses 64 countries as a sample, selects Internet data from 1985 to 2005, and takes the time before and after commercialization to empirically study the impact of commercial Internet on international trade, and compare the base before and after commercialization [22]. The commercialization of the Internet has a positive impact on international trade. Based on the research of Freund and Weinhold, Alsaad (2015) continued to convert the proxy variable of the Internet from the number of hosts to the number of people who can access the world network per 100 people [23]. Using data from nearly 200 countries from 1990 to 2006, and adding different fixed effects, it is concluded that every 10% increase in Internet use intensity will drive a 0.7% increase in exports and a 0.3% increase in imports. This result is significantly higher than the result of Freund and Weinhold. On this basis, combined with the theoretical model proposed by Freund and Weinhold, this paper further expands the scope of application of the theoretical model, and deeply studies the influence process of cross-border e-commerce on export trade.

Based on the Freund and Weinhold model, it is assumed that there are \( n \) countries, each country has \( m \) enterprises, which produce homogeneous products, and the market competition is Cournot competition. The market is in a state of fragmentation, which is imperfect competition. The demand function of imperfectly competitive products in country \( j \) is:

\[
P_j = K_j - Q_j
\]

where \( P_j \) is the product price in country \( j \), and \( K_j \) is a constant number. Suppose that the marginal cost of production \( c \) of each firm remains unchanged and that the transportation cost \( t \) increases along with the distance \( d \) from the target market, that is, \( t_{ij} = wd_{ij} \), where \( w \) is a constant term.

3.1.1. Without IEC

Enterprises entering various markets have different fixed costs [24], which include the cost of searching for market information, promoting products, and establishing distribution channels [25]. The fixed costs of enterprises in country \( i \) entering the market of country \( j \) are also assumed to follow the uniform distribution of \( \{0 \sim F_{ij}^{\max}\} \). The problem of maximizing profits for enterprises can be formulated as

\[
\max_{q_{ij}} \pi = q_{ij}(K_j - q_i - q_{ij} - c - wd_{ij}) - F_{ij}
\]
where $\pi$ is the profit of the enterprise, $q_{ij}$ is the export volume of the enterprises in country $i$ to the market of the country $j$, and $q_{ij}^*$ is the sale volume of other enterprises in the market of country $j$. Through first-order derivation, the export volume of enterprises in country $i$ to the market of country $j$ is calculated as

$$q_{ij} = \frac{K_j - c - wd_{ij} - q_{ij}^*}{2}$$  \(3\)

In the Cournot equilibrium state, each firm assumes that the output of the other firm maximizes its own profits under the given circumstances [26–28]. According to Formula (3), the optimal output of firm $i$ is

$$\begin{align*}
q_{ij}^* &= \frac{1}{2} \left[ K_j - c - wd_{ij} - (q_{ij1}^* + q_{ij2}^* + \cdots + q_{ij n_j}^*) \right]
\end{align*}$$  \(4\)

Assuming that $n_j$ enterprises are operating in the market of country $j$, adding the left and right sides of the above $q_{ij1}^* + q_{ij2} + \cdots + q_{ij n_j}^*$ yields

$$q_{ij1}^* + q_{ij2}^* + \cdots + q_{ij n_j}^* = n_j K_j - n_j c - w(d_{ij1} + \cdots + d_{ijn_j}) - q_{ij}^*$$  \(5\)

Substituting Formula (5) into Formula (4) yields the following optimal equilibrium solution to the profit maximization problem:

$$q_{ij} = \frac{K_j - c - (n_j wd_{ij} + w \sum_{k \neq i} d_{ij})}{n_j + 1} = \frac{K_j - c - w d_{ij}}{n_j + 1} + \frac{n_j w (d_j - d_{ij})}{n_j + 1}$$  \(6\)

In Formula (6), $d_j$ is the average distance from the exporting enterprise to country $j$, and $\sum_{k \neq i} d_{ij} \approx (n_j - 1)d_j$. Formula (6) shows that enterprises with relatively low transportation costs will export more products. $\frac{K_j - c - w d_{ij}}{n_j + 1}$ represents the quantity that firm $i$ will export if all firms are symmetric and shows that a larger target market corresponds to a greater output, whereas a smaller cost and fewer enterprises in the target market correspond to a smaller output [29]. $\frac{n_j w (d_j - d_{ij})}{n_j + 1}$ indicates that a different relative transportation cost yields a different export degree. If the distance between firm $i$ and market $j$ is lower (or higher) than the average distance, then the firm’s export volume will also be lower (or higher) than the average export volume.

Combining Formula (6) and Formula (2) yields the following expression for the total profit of the enterprise:

$$\pi_{ij} = q_{ij}^2$$  \(7\)

When its profits exceed its fixed cost of export, the enterprise chooses to export [30]. $F_{ij}^*$ is calculated as the fixed cost threshold value of each country’s enterprises that are willing to export to foreign markets. When the net profit is 0, that is, $\pi_{ij} - F_{ij}^* = 0$, an export behavior is observed. Therefore, the total exports from countries $i$ to $j$ are

$$X_{ij} = \frac{\pi_{ij}}{\pi_{ij}^{\max}} q_{ij} m_i = \frac{q_{ij}^3}{\pi_{ij}^{\max}} m_i$$  \(8\)

3.1.2. With IEC

Assume that the submission of IEC reduces the fixed costs of international trade enterprises [31–33]. For example, IEC facilitates the collection of shared information through the application of Internet technologies, such as email, which reduces communication costs [34]. Define the network connection between countries $i$ and $j$ as $x_{ij}(0 < x_{ij} < 1)$,
which is used as a proxy variable for IEC and reflects that the fixed cost of an enterprise is inversely proportional to the amount of information obtained [35]. In other words, the fixed cost of an enterprise in country \( i \) entering country \( j \) is \( x_{ij} F_{ij} \), and the proportion of the number of enterprises in country \( i \) entering market \( j \) is \( \pi_{ij} x_{ij} F_{ij} \). In the case of IEC represented by the application of Internet technology, the total export volume from countries \( i \) to \( j \) is

\[
X_{ij} = \frac{q_{ij}^3}{x_{ij} F_{ij}^\text{max}} m_i \tag{9}
\]

With the other conditions being the same, a lower fixed cost and closer network connection between two countries correspond to a larger export volume [36–38]. Given that \( m_i \) is fixed, the two sides of Equation (9) are differentiated, thereby yielding

\[
\frac{dX_{ij}}{X_{ij}} = \frac{dx_{ij}}{x_{ij}} + 3 \frac{dq_{ij}}{q_{ij}} \tag{10}
\]

where \( \frac{dx_{ij}}{x_{ij}} \) indicates that a high network penetration rate reduces fixed costs and expands the export scale from countries \( i \) to \( j \), whereas \( \frac{dq_{ij}}{q_{ij}} \) reflects the change in the optimal export volume of each enterprise to cause export growth. From Formula (6), the export volume of each enterprise changes as follows:

\[
dq_{ij} = \frac{1}{n_{ij} + 1} dK_j + \left[ \frac{-(K_j - c - w d_{ij})}{(n_{ij} + 1)^2} + \frac{w(d_{ij} - d_{ij})}{(n_{ij} + 1)^2} \right] d n_{ij} + \frac{w(n_{ij} - 1)}{n_{ij} + 1} d d_{ij} \tag{11}
\]

where \( \frac{1}{n_{ij} + 1} dK_j \) reflects that the expansion of the import market increases the number of exports, indicating the expansion of the export market. Meanwhile, \( \left[ \frac{-(K_j - c - w d_{ij})}{(n_{ij} + 1)^2} + \frac{w(d_{ij} - d_{ij})}{(n_{ij} + 1)^2} \right] d n_{ij} \) illustrates the export changes caused by enhanced market competition, and \( \frac{w(n_{ij} - 1)}{n_{ij} + 1} d d_{ij} \) reflects the change in export volume caused by changes in average export distance. Therefore, increasing both the number of enterprises and total exports will reduce the equilibrium export volume of each enterprise [39]. In addition, enterprises located far away reduce their exports more than enterprises located nearby. Therefore, a higher Internet penetration rate of importing countries corresponds to a greater number of entrants [40]. Given that the model does not directly estimate the influences of IEC on the relationship between trade and distance, the market approximation is ignored [41]. The influences of IEC technology on trade as reflected in Equation (10) are the same. Only the IEC variable can represent the influence of distance [42]. Only by reducing fixed costs can we predict whether IEC reduces the distance effect of trade [45]. Equations (10) and (11) show that bilateral export growth is a function of the evolution of IEC, the market size of importing countries, the degree of competition, the average distance between exporters, and the relative similarity of two markets.

\[
\frac{dX_{ij}}{X_{ij}} = F(- \frac{dX_{ij}}{X_{ij}}, \frac{dK_j}{K_j}, - \frac{d n_{ij}}{n_{ij}}, \frac{d d_{ij}}{d_{ij}}, \pm d_{ij}) \tag{12}
\]

which shows that the evolution of IEC (or the reduction in fixed costs), the increase in the size of the import market, and the increase in the average distance between trade partners can promote exports, whereas an increase in the number of exporters will reduce exports. The distance \( d_{ij} \) of the exporting enterprise to the target market will also affect export growth, but the direction is not clear. In the following sections, we use China’s data to verify the theoretical model.
3.2. Empirical Model

To test whether IEC can facilitate the growth of China’s export scale, in view of the previous theoretical framework, the paper selects the gravity model to construct the benchmark measurement model as follows:

\[
\ln(C\text{EXPORT}_{ijt}) = \beta_0 + \beta_1 \ln(C\text{BEC}_i C\text{BEC}_j) + \beta_2 \ln(GDP_i GDP_j) \\
+ \beta_3 \text{FTA}_{ijt} + \beta_4 \ln(R\text{EX}_{ijt}) + \beta_5 \ln(\text{PER}_i \text{PER}_j) + \beta_6 \ln(F\text{DI}_{ijt}) + \beta_7 \ln(D\text{E}_{ij}) + c_i + c_j + \delta_t + \epsilon_{ijt} \tag{13}
\]

where \(j\) represents China, and the dependent variable \(C\text{EXPORT}_{ijt}\) represents China’s total exports to country (or region) in year \(t\). \(\delta_t\) is the time effect, \(c_i\) and \(c_j\) are the regional individual effects, and \(\epsilon_{ijt}\) is the disturbance term.

The variables \(C\text{BEC}_i\) and \(C\text{BEC}_j\) represent the use of IEC in the country \(i\) and China in the year \(t\), respectively, whereas the coefficient \(\beta_1\) is viewed as the estimator. In view of the transaction cost theory, the application of IEC by enterprises could decrease the trade cost, including contact costs, office costs, and search costs, and the threshold for enterprises to enter overseas markets. Therefore, this paper speculates that the variable IEC is positively correlated with the explained variable.

The other variables are treated as control variables. \(F\text{DI}_{ijt}\) reflects the amount of direct investment in China from country \(i\) in year \(t\). FDI plays a vital role in promoting China’s foreign trade. According to endogenous growth theory, the technology spillover and technology transfer effects of FDI play critical roles in promoting trade added value. Therefore, this paper speculates that FDI is positively correlated with the trade volume variable.

The variable \(D\text{E}_{ij}\) represents the level of transportation cost, which has become a main factor that hinders trade. However, given that the application of IEC may weaken the influence of distance, the sign of the coefficient is uncertain. The demographic variables \((\text{PER}_i \text{PER}_j)\) and GDP \((GDP_i GDP_j)\) in China and other countries can be used to measure the market potential of a country. A huge market potential corresponds to an increased trade volume. Therefore, this paper speculates that the demographic variable and GDP are positively correlated with the dependent variable.

The variable \(F\text{TA}_{ijt}\) indicates whether China and country \(i\) have signed a free trade agreement. Many studies have confirmed that signing free trade agreements can lower trade barriers and expand trade volume between parties. Therefore, this paper assumes that FTA is positively correlated with the dependent variable. \(R\text{EX}_{ijt}\) represents the currency exchange rate between RMB and trading currencies. Generally, the appreciation of RMB will reduce China’s exports. Therefore, \(R\text{EX}_{ijt}\) is speculated to be positively correlated with the dependent variable.

3.3. Data

This paper selects 178 countries that have trade relations with China from 2006 to 2019 as samples. The foreign trade data are taken from the UNCOMTRADE database, the GDP, population, and exchange rate data are taken from the UNCTAD database, and the exchange rates are calculated based on 1 RMB to the currency of country \(i\).

IEC is treated as a key variable. Given that Internet technology is at the core of using IEC, the Internet is used as a proxy variable for IEC [44]. Previous studies have mainly adopted two methods to measure the degree of Internet application. First, they calculate lots of virtual hosts allocated to countries based on the top-level host domain name from the Internet Software Alliance Organization (ISC) website [45–47]. Second, they measure Internet application level based on the number of Internet users [48–50]. However, using top-level domain names to measure the application of Internet technology in a country encounters certain problems. Specifically, domain name is not necessarily related to the location of an enterprise. For example, ISC data identify the host of the “UK” domain name as the United Kingdom, but some enterprises using this domain may be located in other countries [51]. Therefore, to accurately reflect the degree of application of
Internet technology, a lot of Internet users in various countries should be calculated. This number covers a wide range \([52,53]\), including the Internet application in foreign trade enterprises and individual consumers who use the Internet for importing and exporting commodities. Therefore, following previous studies, this paper uses the number of netizens per 100 people to measure Internet application. The relevant data are collected by World Bank database.

The FDI data are taken from the China Statistical Yearbook. Given the difficulty in obtaining bilateral FDI data and considering that foreign enterprises represent vital forces in China’s foreign trade, this paper only uses the amount of FDI flowing into China as a measure of FDI, and these data do not have much impact on the regression results.

Distance data are collected from the French International Economic Research Center and are measured by the actual distance between the capitals of two countries \([54]\). FTA is treated as a dummy variable. If China has signed FTA with any country, then FTA value is 1; otherwise, FTA value is 0. The FTA data are taken from the free trade zone service network of the Chinese Ministry of Commerce. The GDP, FDI, and foreign trade data are all adjusted according to the 2019 exchange rates to be denominated in 2019 constant US dollars. The core variables are described in Table 1 as the following.

| Explanatory Variables | Min. | Max. | Mean | Standard Deviation | Observation | Expected Symbol |
|-----------------------|------|------|------|--------------------|-------------|-----------------|
| IEC (per 100 people)  | 0.001| 97   | 41.76| 39.21              | 2589        | +               |
| GDP (USD 100 million) | 0.22 | 214,000| 30,439| 51,774             | 2571        | +               |
| Population (10,000 people) | 0.9 | 140,005| 2117 | 3094              | 2583        | +               |
| FDI (million USD)     | 0    | 57,831| 463.22| 1896              | 2580        | +               |
| FTA (dummy variable)  | 0    | 1    | 0.04 | 0.17              | 2576        | +               |
| Exchange rate (foreign currency / RMB) | 0.9 | 1432.68| 28.43 | 109.32              | 2581        | –               |
| Distance (km)         | 804.27| 27,975.6| 7458 | 1055.32          | 2572        | +/-             |

### 4. Model Checking and Estimation

#### 4.1. Multicollinearity Test

In order to be able to fully and scientifically determine whether there is multicollinearity among the variables in the correlation model, the results of various correlation development matrices between the calculated variables are shown in Table 2. From the data in Table 2, it can be seen that the different coefficients of the correlation between the various variables are all less than 0.7, so there is no obvious multicollinearity between the variables. Therefore, the indicators of the various influencing factors in this paper can scientifically explain the IEC. The impact on China’s export trade means that the research conclusions of this paper are scientific and reasonable.

| lnCBEC | lnGDP | lnPER | lnFDI | lnREX | FTA | lnDE |
|--------|-------|-------|-------|-------|-----|------|
| 1.000000 | 0.409326 | 0.283945 | 0.617436 | 0.320435 | 0.690432 | 0.490832 |
| lnGDP  | 0.409326 | 1.000000 | 0.443072 | 0.597347 | 0.453264 | 0.354837 | 0.587118 |
| lnPER  | 0.283945 | 0.443072 | 1.000000 | 0.443736 | 0.674274 | 0.290341 | 0.309547 |
| lnFDI  | 0.617436 | 0.597347 | 0.443736 | 1.000000 | 0.209438 | 0.487953 | 0.448732 |
| lnREX  | 0.320435 | 0.453264 | 0.674274 | 0.209438 | 1.000000 | 0.299843 | 0.220947 |
| FTA    | 0.690432 | 0.354837 | 0.290341 | 0.487953 | 0.299843 | 1.000000 | 0.388746 |
| lnDE   | 0.490832 | 0.587118 | 0.309547 | 0.448732 | 0.220947 | 0.388746 | 1.000000 |
4.2. Hausman Test

Each type of panel data is estimated using a different method [55]. Therefore, this paper initially performs a Hausman test to check whether establishing an individual fixed-effects model is reasonable. Given that the distance variable does not change with time, this paper is based on a fixed-effect regression and a random-effect regression. This paper aims to investigate the influence of IEC applications on export activities. The regression analysis results of the model are in Table 3.

Table 3. Impact of IEC on China’s total exports.

| Explanatory Variables | Explained Variable: China’s Total Exports |
|-----------------------|------------------------------------------|
|                       | (1) Random Effect | (2) Fixed Effect | (3) Random Effect | (4) Random Effect | (5) Fixed Effect |
| lnCBEC                | 0.299 **          | 0.281 **          | 0.216             | 0.287 **          | 0.291 ***        |
|                       | (0.021)           | (0.029)           | (0.093)           | (0.026)           | (0.024)          |
| lnGDP                 | 0.217 **          | 0.244 **          | 0.253 **          | 0.236 **          | 0.397 **         |
|                       | (0.025)           | (0.072)           | (0.041)           | (0.039)           | (0.088)          |
| lnPER                 | 0.442 **          | 0.871 **          | 0.549 ***         | 0.653 **          | 0.731 ***        |
|                       | (0.032)           | (0.338)           | (0.0331)          | (0.026)           | (0.204)          |
| lnFDI                 | 0.287 **          | 0.0902 **         | 0.390 **          | 0.247 **          | 0.0552 ***       |
|                       | (0.020)           | (0.031)           | (0.026)           | (0.033)           | (0.064)          |
| lnREX                 | −0.017 *          | −0.0733 *         | −0.056 *          | −0.076 **         | −0.056 ***       |
|                       | (0.026)           | (0.032)           | (0.020)           | (0.025)           | (0.011)          |
| FTA                   | −0.229 *          | −0.093 ***        | −0.065            | −0.278            | −0.173 **        |
|                       | (0.057)           | (0.092)           | (0.0612)          | (0.064)           | (0.042)          |
| lnDE                  | −0.549 **         | −0.693 ***        | −0.804 **         |                  |                 |
|                       | (0.224)           | (0.224)           | (0.274)           |                  |                 |
| lnCBEC × lnDE         | 0.017 *           |                  |                  |                  |                 |
|                       | (0.009)           |                  |                  |                  |                 |
| d’reCBEC              | −0.035 **         |                  |                  |                  | −0.061 ***       |
|                       | (0.021)           |                  |                  |                  | (0.024)          |
| d’reGDP               | 0.024 ***         |                  |                  |                  | 0.015 *          |
|                       | (0.004)           |                  |                  |                  | (0.003)          |
| d’reFDI               | −0.016 **         |                  |                  |                  | −0.019 **        |
|                       | (0.004)           |                  |                  |                  | (0.013)          |
| d’reREX               | −0.012            |                  |                  |                  | −0.011           |
|                       | (0.031)           |                  |                  |                  | (0.024)          |
| Constant term         | −18.338 **        | −19.032 ***       | −12.873 **        | −11.662 **        | −15.439 **       |
|                       | (3.217)           | (8.439)           | (4.309)           | (3.094)           | (9.204)          |
| Adjusted R²           | 0.549             |                  |                  |                  | 0.558            |
| Observations          | 2571              | 2571              | 2571              | 2571              | 2571             |

Note: The values in parentheses are robust standard errors; the fixed effect regressions are all estimated via a robustness test; ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

Columns (1) and (2) in Table 3 are the regressions performed on the benchmark model equation (12). The results of the fixed effects regression in column (2) show that from 2006 to 2019, the sign of the coefficient of the IEC variable is significantly positive, which is positively correlated with China’s exports. In other words, every 1% increase in the number of netizens in China’s trading partners will increase China’s exports to the country by 0.28%. The factors that promote China’s exports also include demographic variables, market potential, and bilateral investment in the country and its trading partners [56]. The free trade agreement variables play significant roles in hindering China’s exports [57] possibly due to the fact that the trade diversion effect caused by signing free trade agreements with China exceeds the trade expansion effect. At the same time, under the influence of free trade agreements, many exported goods can be sent out through traditional trade, which will reduce the trade scale of IEC and consequently lower its impact on China’s exports [58]. For the effects of distance on foreign trade, the parameter of the distance (DE)
A variable in the random effect regression result of column (1) is estimated to be $-0.549$ and statistically significant, thereby suggesting that the distance for measuring transportation cost directly hinders China’s export activities. To investigate whether the application of IEC will indirectly affect the function of geographic distance, this paper treats the IEC and geographic distance variables as interaction terms and conducts a random effects analysis after controlling for the other variables. The analysis results are shown in column (3) of Table 3. If the application of IEC weakens the influences of distance on exports, then the interaction coefficient is positive. If IEC applications enhance the effect of distance on China’s exports, then the interaction coefficient is negative. Results show that the sign of the $\ln\text{CBEC} \times \ln\text{DE}$ coefficient is significantly positive, that is, 0.017 in column (3), indicating that Internet penetration makes product information transparent and easy to obtain. Using email saves both communication and office costs and offsets the negative impact of transportation costs on China’s exports.

The global economic crisis and European debt crisis in 2008 and 2009, respectively, greatly impacted global trade, including that of China. Given that the sample data cover these two crises, a structural mutation test was performed to determine whether IEC could still facilitate the increasing of foreign trade amid crises. Let 2008 and 2009 be represented by dummy variable $d$ whose value is 1 in 2008 and 2009 and 0 for the other years. The variables CBEC, GDP, FDI, and REX, all of which may be affected by the crisis, were processed by using interaction terms and by conducting regression. Results are displayed in the columns (4) and (5) of Table 3. A joint hypothesis testing of the coefficients of the four variables and four interaction terms revealed that both the global financial crisis and European debt crisis influenced the effects of IEC and GDP, indicating the presence of structural mutation. The coefficient of the IEC interaction term ($d'\ln\text{CBEC}$) is significantly negative at $-0.061$ in column (5), indicating that the global financial crisis has weakened the function of IEC in promoting exports activities. Meanwhile, the coefficient of the market potential interaction term ($d'\ln\text{GDP}$) remains significantly positive, indicating that the market potential of a country under the global financial crisis is the main factor determining the growth of China’s export volume. Governments at all levels and third-party foreign trade platforms generally believe that IEC methods can help small and medium foreign trade enterprises overcome crises. Local governments are striving to build foreign trade IEC platforms to help local enterprises go overseas [59]. This view should be treated calmly and objectively.

Many scholars have pointed out that IEC, represented by Internet technology, has different effects on the mutual foreign trade of countries with different economic development levels [60,61]. Therefore, in reference to UNDP’s Human Development Report 2019, the sample is divided into 43 industrialized countries and 149 developing countries. A group regression is performed to check whether IEC has the different effects on China’s export trade to these two groups of countries. Table 4 has presented all the regression results.

As shown in Table 4, IEC activities boost China’s export trade to both developed and developing countries, with export trade to industrialized countries bearing a greater promotion effect mainly because the import capacity of IEC with industrialized countries is significantly stronger than that of developing countries. Meanwhile, the expansion status of e-commerce and the Internet in industrialized countries is significantly better than that in developing countries. Therefore, the influences of IEC on the import trade of developing countries from China is relatively small [62]. These results are consistent with those of Clarke and Wallsten.
Table 4. Grouped regression results of developed and developing countries.

| Explained Variables         | Industrialized Countries | Developing Countries |
|----------------------------|--------------------------|----------------------|
|                            | (1)                      | (2)                  | (4)                  | (5)                  |
| lnCBEC                     | Random Effect            | Fixed Effect         | Random Effect        | FIXED Effect         |
| 0.447 ** (0.022)           | 0.402 *** (0.017)        | 0.386 *** (0.015)    | 0.399 ** (0.011)     |
| lnGDP                      | −0.752 (0.044)           | −0.094 (0.041)       | 0.363 ** (0.022)     | 0.083 ** (0.036)     |
| lnPER                      | 0.874 ** (0.091)         | 0.792 *** (0.088)    | 0.382 ** (0.021)     | −0.059 (0.033)       |
| lnFDI                      | 0.239 *** (0.037)        | 0.019 ** (0.036)     | 0.204 ** (0.015)     | 0.013 * (0.031)      |
| lnREX                      | −0.065 ** (0.036)        | −0.042 *** (0.045)   | −0.032 *** (0.021)   | −0.037 * (0.026)     |
| FTA                        | 0.042 (0.095)            | 0.071 (0.034)        | −0.088 *** (0.072)   | −0.063 ** (0.027)    |
| lnDE                       | −0.254 ** (0.048)        |                     | −0.663 ** (0.072)    |                     |
| Adjusted R²                | 18.094 ** (1.773)        | 6.715 (4.329)        | 9.037 ** (0.719)     | 4.624 (5.339)        |
| Observations               | 673                      | 673                  | 1769                 | 1769                 |
| Number of countries        | 51                       | 51                   | 132                  | 132                  |

Note: The values in parentheses are robust standard errors; the fixed effect regressions are all estimated via a robustness test; ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

4.3. Robustness Test

To further check the reliability of the above regression analysis results, the robustness tests are carried out from two aspects. The relative results are shown in Table 5.

Table 5. Robustness test results.

| Explained Variables         | (1) Number of Website Hosts Used | (2) Use Instrumental Variables |
|----------------------------|----------------------------------|--------------------------------|
| lnCBEC                     | 0.233 ** (0.028)                 | 0.283 ** (0.022)               |
| lnGDP                      | 0.290 (0.185)                    | 0.065 * (0.034)                |
| lnFDI                      | 0.026 ** (0.018)                 | 0.054 *** (0.039)              |
| lnREX                      | −0.055 *** (0.026)               | −0.088 ** (0.026)              |
| FTA                        | −0.209 * (0.172)                 | −0.237 (0.084)                 |
| lnPER                      | 0.386 *** (0.553)                | 0.549 ** (0.114)               |
| Constant term              | −29.077 ** (17.326)              | −13.285 ** (6.337)             |
| Adjusted R²                | 0.738                            |                                |
| Observations               | 2142                             | 2231                           |
| Number of countries        | 154                              | 173                            |

Note: The values in parentheses are robust standard errors; the fixed effect regressions are all estimated via a robustness test; ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

(1) Measure IEC by the number of website hosts

IEC is the key variable of this paper. To test whether using the number of netizens in a country for measuring the influence of IEC activities on China’s export trade is robust, this paper adopts the number of hosts on national websites as an important indicator that has been widely used in previous studies for measuring IEC applications [63]. Number of network base stations in a country has been proven to have a significant positive relationship with the number of Internet users in the same country [64]. In other words, a large number of web stations in a country corresponds to a greater number of Internet users [65]. The data on the number of website hosts in the sample of 154 countries are collected from the ISC. Column (1) of Table 5 indicates the relative results of the estimation using the fixed effects model. These results do not change significantly in response to changes in the core explanatory variable measurement indicators and confirm that IEC has a certain influence on China’s export trade.
(2) Use instrumental variables

As revealed in previous studies, some endogenous problems may exist in IEC variables [66], a two-way causal relationship may be observed between export value and GDP, and an alternative relationship may exist between export trade and horizontal FDI. Endogenous problems caused by these variables can lead to estimation bias. This paper then uses the lags of IEC, GDP, and FDI as instrumental variables in a Gaussian Mixture Model (GMM) regression. Results show that the basic conclusion remains the same as the previous results, with the only difference being the insignificant FTA estimation coefficient as shown in column (2) in Table 5.

5. Conclusions

On the basis of relevant research conclusions of previous scholars, this paper further deepens the research of previous scholars. On one hand, based on the traditional gravity model, this paper further introduces the important variable of IEC, and analyzes the impact of IEC on the development of China’s export trade. On the other hand, in the process of studying the impact of IEC on export trade, this paper further introduces the moderating variable financial crisis, thus strengthening the comprehensiveness and in-depthness of related research.

Results show that for every 1% increase in the number of Internet users among China and its export partners, China’s export scale increases by 0.28%. In addition, given that the data used in this paper cover both the global economic crisis and European debt crisis, the results offer solid proof that IEC can boost the spread of exports in poor economic environments. Such effect has been relatively ignored in the previous literature. The relative empirical analysis reveals that the growth of China’s export scale mainly depends on the global economic situation. If the overall economic situation is optimistic, then IEC plays a key role in expanding China’s export scale. However, when the external market demand weakens and the economic situation deteriorates, the role of IEC becomes limited. Since 2008, export based on IEC has maintained rapid growth. This conclusion seems to contrast the observed phenomenon probably due to the fact that this paper uses macro foreign trade data, which include both online and offline foreign trade volume. Marketing channels developed through the Internet have replaced some of the traditional marketing channels, and reduced traditional foreign trade volume is replaced by increased online foreign trade business. This paper also discusses the influence of IEC on China’s exports, and the results point out that IEC has an insignificant impact on export growth during a crisis. Future research can determine whether the application of IEC can help enterprises engaged in exports tide over economic crises by collecting micro-level enterprise data.

The main conclusions of this paper are as follows:

First, the development of IEC has played a significant role in promoting the growth of the export scale of countries similar to China’s development, which reflects that the current decision of China and other countries to promote the construction of comprehensive cross-border e-commerce pilot zones is correct.

Second, the test of structural mutations shows that under the financial crisis or the European debt crisis, IEC has not significantly promoted the export trade of China and other similar countries, and the level of economic development is the main factor that promotes the development of export trade.

Third, the regression results of the grouping by the economic development of countries (regions) show that the application of IEC has a significant positive impact on the export trade of countries similar to China to developed and developing countries. The impact of developed countries’ exports is slightly greater.

Fourth, under the application of IEC, although the negative impact of the geographical distance variable measuring transportation cost on the export trade of similar countries such as China exists, it has been greatly weakened.

Based on these conclusions, the following policy recommendations are put forward.
First, the Chinese government should actively develop IEC. However, building many third-party platforms for IEC is unnecessary; instead, the government should focus on building a superior business environment for enterprises to execute foreign trade IEC. Industrialized countries, such as European countries and the US, have comprehensive legal protections, such as the IEC law and consumer online privacy protection, whereas China is relatively lagging behind this area. Meanwhile, in terms of international settlement, international logistics and transportation, and customs clearance procedures, China should further improve its related management capabilities and optimize its business environment.

Second, the application of IEC for exports depends on the degree of growth of IEC in the focal country and its trading partners. Therefore, the Chinese government should actively participate in bilateral and multilateral IEC negotiations, strive for the right to speak in formulating international IEC rules, and provide sufficient support for China’s enterprises to participate in international competition.

Third, the Chinese government and firms should consider the fact that under a poor global economic situation, relying on IEC is not the only solution to their foreign trade difficulties. Enterprises should still transform and upgrade, such as by increasing the added value of their products, creating their own brands, and strengthening their competitiveness. In this way, we will fundamentally promote the sustainable growth of China’s exports.

Research limitations and prospects: due to the length of the paper and the time of the author, the research in this paper still has certain limitations. First of all, this paper only studies the impact of IEC on export trade, but does not study the process of IEC on import trade. Secondly, this paper only studies China’s IEC and export trade relations separately, but does not compare China’s IEC and export trade issues with other countries. Therefore, in the process of future research, researchers can further enrich the relevant research content and in-depth study of the influence process of IEC on a country’s import trade. At the same time, it is possible to further compare and study the IEC and export trade issues between China and other countries, so as to explore general laws on a global scale.

Author Contributions: Conceptualization and discussion were elaborated by C.W. and D.L.; methodology and results were elaborated by T.L. and D.W.; theoretical background was elaborated by G.V. and Y.Z. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Basic Research Business Expenses Research Project of Provincial Colleges and Universities in the Heilongjiang Province (No. HDJW201907), Key Project of Heilongjiang Professional Education Science Planning (No. GJB130264), Fundamental Research Funds for the Central Universities (No. 3072021CFW0912; No. 3072021CFW0910), Humanities and Social Science Project of the Ministry of Education of China (No. 20YJC790082), Chinese Postdoctoral Science Foundation (No. 2020M681537), and Philosophy and Social Science Research Planning Project of Heilongjiang Province (No. 19JLC117).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available in the article.

Acknowledgments: The authors greatly appreciated the comments of reviewers to improve this research.

Conflicts of Interest: The authors declare no conflict of interest.

References
1. Evans, P.; Wurster, T.-S. Getting real about virtual commerce. Harv. Bus. Rev. 1999, 77, 84–94.
2. Camp, J.; Andersen, M. Bridging the 49th parallel-issues in cross-border class actions. Briefing 2005, 4, 45–51.
3. Guo, A. International electronic ecommerce as the main force to stabilize foreign trade. Chinas Foreign Trade 2020, 581, 53–55.
4. Giuffrida, M.; Mangiaracina, R.; Perego, A. Cross-border B2C e-commerce to China: An evaluation of different logistics solutions under uncertainty. Int. J. Phys. Distrib. Logist. Manag. 2020, 7, 12–22. [CrossRef]
5. Luo, L.; Ma, X.; Wang, Z. The moderate-reputation trap: Evidence from a Chinese cross-border business-to-business e-commerce portal. Asia Pac. J. Manag. 2020, 1, 1–38. [CrossRef]

6. Kurniawati, E.; Siddiq, I.A.; Idris, I. E-commerce opportunities in the 4.0 era innovative entrepreneurship management development. Pol. J. Manag. Stud. 2020, 21, 199–210. [CrossRef]

7. Gregory, W. Soybean production and trade policy changes in Argentina and Brazil: Implications for the competitive position of the United States. Agribusiness 2007, 7, 89–93.

8. Schulz, A.; Hennawi, J.; White, M. Characterizing the shapes of galaxy clusters using moments of the gravitational lensing shear. Astropart. Phys. 2005, 24, 409–419. [CrossRef]

9. Yang, J.; Duan, Y. Research on my country’s international e-commerce development strategy. World Econ. Res. 2008, 10, 39–43.

10. Shen, S.; Lee, M.; Lin, C. The influence of brand image and perceived value of international e-commerce businesses on consumer purchase intention with Thailand’s Baggo serving as the study object. Int. J. Uncert. Innov. Res. 2020, 2, 57–71.

11. Taylor, R. “Data localization”: The internet in the balance. Commun. Policy 2020, 44, 102–103. [CrossRef]

12. Muangmee, C.; Kot, S.; Meekaevkunchorn, N.; Kassakorn, N.; Khalid, B. Factors determining the behavioral intention of using food delivery apps during covid-19 pandemics. J. Theor. Appl. Electron. Commer. Res. 2021, 16, 1297–1310. [CrossRef]

13. Freund, C.; Weinhold, D. On the effect of the internet on international trade. J. Int. Econ. 2004, 62, 171–189. [CrossRef]

14. Nuray, T. The impact of e-commerce on international trade and employment. Procedia Soc. Behav. Sci. 2011, 24, 745–753. [CrossRef]

15. Imran, M.; Jian, Z.; Haque, A.; Urbanski, M.; Nair, S. Determinants of firm’s export performance in China’s automobile industry. Sustainability 2018, 10, 4078. [CrossRef]

16. Swain, M.; Rogerson, C. Addressing legal issues in cross-border gestational surrogacy: Current topics and trends. Fertil. Steril. 2021, 115, 268–273. [CrossRef] [PubMed]

17. Wen, J.; Wang, J.; You, H. Can e-commerce promote the growth of foreign trade. Int. Trade Issues 2015, 6, 43–52.

18. Qing, H.; Zheng, G.; Fu, D. Risk data analysis of cross-border e-commerce transactions based on data mining. J. Phys. Conf. Ser. 2021, 3, 32–39.

19. Pan, C.-L.; Niu, J.; Luo, T. Explore the research fronts of international electronic commerce. J. Phys. Conf. Ser. 2020, 16, 12–39.

20. Cao, Y.; Cheng, Y.; Yang, C. Double chain blockchain based on improved Virginia algorithm. J. Phys. Conf. Ser. 2021, 18, 12–18.

21. Moaniba, I.-M.; Lee, P.-C.; Su, H.-N. How does external knowledge sourcing enhance product development? Evidence from drug commercialization. Technol. Soc. 2020, 63, 101414. [CrossRef]

22. Alsaaad, A.; Taamneh, A. The effect of international pressures on the cross-national diffusion of business-to-business e-commerce. Technol. Soc. 2019, 59, 101158. [CrossRef]

23. Xu, X.; Wang, F.; Chen, X. Does managerial ability matter for cross-border M&As: Evidence from Chinese listed firms. J. Asian Econ. 2021, 1, 101–112.

24. Gelen, D. E-commerce: The role of familiarity and trust. Omega 2000, 28, 725–737. [CrossRef]

25. Devaraj, S.; Ming, F.; Kohli, R. Antecedents of B2C channel satisfaction and preference: Validating e-commerce metrics. Inf. Syst. Res. 2002, 13, 316–333. [CrossRef]

26. Oppong, S.-A.; Yen, D.-C.; Merhout, J.-W. A new strategy for harnessing knowledge management in e-commerce. Technol. Soc. 2005, 27, 413–435. [CrossRef]

27. Zhan, C.; Dubinsky, A.-J. A conceptual model of perceived customer value in e-commerce: A preliminary investigation. Psychol. Mark. 2010, 20, 323–347.

28. McKnight, D.; Chervany, N. What trust means in e-commerce customer relationships: An interdisciplin ary conceptual of electronic commerce. Int. J. Electron. Commer. 2002, 6, 35–59. [CrossRef]

29. Gordijn, J.; Akkermans, J.-M. Value-based requirements engineering: Exploring innovative e-commerce ideas. Requir. Eng. 2003, 8, 114–134.

30. Abumalloh, R.-A.; Ibrahim, O.; Nilashi, M. Loyalty of young female Arabic customers towards recommendation agents: A new model for B2C E-commerce. Technol. Soc. 2020, 61, 101253. [CrossRef]

31. Mahfouz, A.-Y.; Joonas, K.; Opara, E.U. An overview of and factor analytic approach to flow theory in online contexts. Technol. Soc. 2020, 61, 101228. [CrossRef]

32. Olsen, O.-E.; Engen, O.-A. Technological change as a trade-off between social construction and technological paradigms. Technol. Soc. 2007, 29, 456–468. [CrossRef]

33. Myoint, S. Test and extension of technology acceptance model on electronic commerce. Ind. Organ. Syntel. 2001, 14, 77–100.

34. Saetra, H.-S. The foundations of a policy for the use of social robots in care. Technol. Soc. 2020, 63, 101383. [CrossRef]

35. Waggoner, P.-E. Agricultural technology and its societal implications. Technol. Soc. 2004, 26, 123–136. [CrossRef]

36. Siemoneit, A. An offer you can’t refuse: Enhancing personal productivity through ‘efficiency consumption’. Technol. Soc. 2019, 59, 101181. [CrossRef]

37. Aggarwal, N.; Albert, L.J.; Hill, T.-R. Risk knowledge and concern as influences of purchase intention for internet of things devices. Technol. Soc. 2020, 62, 101311. [CrossRef]

38. Dennis, M.-J. Consider potential impact on enrollment of U.S. trade war. Enroll. Manag. Rep. 2020, 23, 1–3. [CrossRef]

39. Burnson, P. Trade war truce with China leaves shippers in ‘purgatory’. Logist. Manag. 2019, 58, 64.

40. Harabi, N. Introduction and Diffusion of Electronic Commerce—What is Switzerland’s position in an international comparison? Results of an empirical study. MPRA Pap. 2001, 4, 2203–2214.
41. Asosheh, A.; Shahidi-Nejad, H.; Khodkari, H. A Model of a Localized international electronic commerce. *Ibusiness* 2012, 4, 136–145. [CrossRef]

42. Chen, Z.; Li, H.; Kong, S. Process simulation for e-commerce systems: A case study of a sustainable construction industry. *Science* 2006, 290, 1779–1782.

43. Yang, J.; Yang, N.; Yang, L. The factors affecting international electronic commerce development of SMEs—An empirical study. *Bioresour. Technol.* 2014, 102, 3322–3329.

44. Schaefer, J.-B.; Konstan, J.; Riedl, J. Recommender systems in e-commerce. *Proc. ACM Conf. Electron. Commer.* 1999, 43, 158–166.

45. Kraemer, Z. Measuring e-commerce in net-enabled organizations for net-enhanced organizations: Assessing the value of e-commerce to firm performance in the manufacturing sector. *Inf. Syst. Res.* 2002, 13, 275–295.

46. Hsiao, Y.-H.; Chen, M.-C.; Liao, W.-C. Logistics service design for international electronic commerce using Kansei engineering with text-mining-based online content analysis. *Telemat. Inform.* 2017, 34, 284–302. [CrossRef]

47. Gefen, D.; Straub, D.-W. Consumer trust in B2C e-Commerce and the importance of social presence: Experiments in e-Products and e-Services. *Omega* 2004, 32, 407–424. [CrossRef]

48. Zhu, K. E-Commerce Metrics for Net-Enhanced Organizations: Assessing the Value of e-Commerce to Firm Performance in the Manufacturing Sector. *Inf. Syst. Res.* 2002, 18, 71–94. [CrossRef]

49. Azam, R. Global Taxation of Cross Border E-Commerce Income. *Soc. Sci. Electron. Publ.* 2013, 31, 32–46.

50. Corbitt, B.-J.; Thanasankit, T.; Yi, H. Trust and e-commerce: A study of consumer perceptions. *Electron. Commer. Res. Appl.* 2004, 2, 203–215. [CrossRef]

51. Bhattacherjee, A. Acceptance of e-commerce services: The case of electronic brokerage. *IEEE Trans. Syst.* 2000, 30, 411–420. [CrossRef]

52. Da, N.-J.; Song, Y.-I.; Braynov, S.-B. A multidimensional trust formation model in B-to-C e-commerce: A conceptual framework and content analyses of academia/practitioner perspectives. *Decis. Support Syst.* 2005, 40, 143–165.

53. Schafer, J.-B.; Konstan, J.-A.; Riedl, J. E-Commerce Recommendation Applications. *Data Min. Knowl. Discov.* 2001, 5, 115–153. [CrossRef]

54. Zhao, H.; Benyoucef, M. From e-commerce to social commerce: A close look at design features. *Electron. Commer. Res. Appl.* 2013, 12, 246–259.

55. Moe, W.-W.; Fader, P.-S. Dynamic conversion behavior at e-commerce sites. *Manag. Sci.* 2004, 50, 326–335. [CrossRef]

56. Cardona, M. Geo-blocking in international electronic commerce in the EU digital single market. *JRC Work. Pap. Digit. Econ.* 2016, 19, 45–72.

57. Dan, J.-K.; Ferrin, D.-L.; Rao, H.-R. Trust and Satisfaction, Two Stepping Stones for Successful E-Commerce Relationships: A Longitudinal Exploration. *Inf. Syst. Res.* 2009, 20, 237–257.

58. Aghamirian, B.; Dorri, B. Customer knowledge management application in gaining organization’s competitive advantage in electronic commerce. *J. Theor. Appl. Electron. Commer. Res.* 2015, 10, 43–56. [CrossRef]

59. Zwass, V. E-Commerce: Structures and issues. *Int. J. Electron. Commer.* 1996, 1, 3–23.

60. Yang, N.; Wang, C.; Fu, Y. Research on construction of industrial environment system of international electronic ecommerce in free trade zone based on geological environment assessment method. *IOP Conf. Ser. Earth Environ. Sci.* 2021, 632, 022031. [CrossRef]

61. Teo, T.; Jing, L. Consumer trust in e-commerce in the United States, Singapore and China. *Omega* 2007, 35, 22–38. [CrossRef]

62. Yuan, Y.; Ruohomaa, S.; Fe, N.-X. Addressing common vulnerabilities of reputation systems for electronic commerce. *J. Theor. Appl. Electron. Commer. Res.* 2012, 7, 21–33.

63. Yan, Y.-U. Adjusting the Business English Training Program for the Needs of IEC Innovation and Entrepreneurship. *J. Hubei Open Vocat. Coll.* 2019, 14, 76–89.

64. Liu, C.; Liu, R. Application of BP neural network in IEC web pages quality evaluation. *J. Phys. Conf. Ser.* 2021, 1774, 012015. [CrossRef]

65. Zhang, F.; Yang, Y. Trust model simulation of cross border e-commerce based on machine learning and Bayesian network. *J. Ambient Intell. Humaniz. Comput.* 2021, 11, 76–88.

66. Chen, X. Analysis on Operating Model of Overseas Warehousing and Its Influential Factors in the Context of IEC. *J. Panzhihua Univ.* 2019, 22, 76–89.