Study on the Influence of Cross-border E-commerce on Import and Export Trade in Shandong Province
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Abstract. In recent years, cross-border e-commerce in Shandong province has been developing rapidly, and the development of cross-border e-commerce has raised the level of opening-up in Shandong province and has gradually become a new economic growth point in Shandong province. Firstly, this paper analyzes the research background and significance of cross-border e-commerce on the import and export trade of Shandong province. Then, empirical analysis is used to study the influence of cross-border e-commerce on the import and export trade of Shandong province. Finally, it draws a conclusion, and puts forward countermeasures and suggestions to promote the development of cross-border e-commerce in Shandong province, so as to maximize the role of cross-border e-commerce in promoting the economic growth of Shandong province.

Introduction
In recent years, shandong province attaches great importance to the development of new business forms represented by cross-border e-commerce, and takes the cultivation of cross-border e-commerce as the key to accelerate the transformation of old and new drivers of foreign trade and promote the transformation and upgrading of foreign trade [1]. The export of cross-border e-commerce in shandong province has maintained a rapid growth rate of more than 30% for three consecutive years [2]. Since Qingdao has been approved by the state council as a comprehensive test zone for cross-border e-commerce, shandong province has gradually carried out the practice of cross-border e-commerce and achieved rapid development [3]. Cross-border e-commerce is becoming a new engine for foreign trade growth, a new platform for industrial transformation and a new window for opening up. With the continuous development of cross-border e-commerce in shandong province, the import and export trade in shandong province has also had a profound impact. At present, most studies on the impact of cross-border e-commerce on shandong's import and export trade are based on theoretical descriptions, but few can verify the impact of cross-border e-commerce on shandong's import and export from an empirical perspective. Based on the cross-border e-commerce trade volume and import and export trade volume of shandong province from 2007 to 2017, this paper adopts empirical analysis method to study the impact of cross-border e-commerce on import and export trade of shandong province, and puts forward countermeasures and suggestions for promoting the development of cross-border e-commerce in shandong province. On the one hand, quantitative analysis is conducted on the impact of cross-border e-commerce on import and export trade, and the analysis results are conducive to improving the omission of previous studies by scholars. On the other hand, the conclusions drawn from the analysis are helpful for the government and enterprises to clarify the important position of cross-border e-commerce in foreign trade, provide basis for economic system reform and enterprise development direction, and further promote the steady improvement of import and export trade in shandong province [4].

Empirical Analysis of the Impact of Cross-border E-commerce on Shandong's Import and Export Trade
Model Design and Variable Selection
(1) Model Design
In order to quantitatively study the influence of cross-border e-commerce on import and export trade in Shandong province, this paper uses co-integration theory and Granger causality test to empirically analyze the relationship between cross-border e-commerce and import and export trade in Shandong province [5].

(2) Variable selection
This paper sets the total import and export trade of Shandong province as the explained variable \( Y \), and the total cross-border e-commerce trade of Shandong province as the explained variable \( X \). This paper tries to explore the relationship between the total import and export trade of Shandong province and the total cross-border e-commerce trade of Shandong province.

Data Source and Description
The purpose of this paper is to analyze the influence of cross-border e-commerce on the import and export trade of Shandong province. Therefore, the total amount of cross-border e-commerce trade of Shandong province and the total amount of import and export trade of Shandong province are selected as two major variables. The data are from Shandong Statistical Yearbook and China E-commerce Research Center. The sample range is from 2007 to 2017. Since there may be heteroscedasticity between data, log processing is carried out on the above data to achieve the stability of time series [6]. The natural logarithm of the explanatory variable \( X \) and the explanatory variable \( Y \) was respectively taken and expressed by \( \ln X \) and \( \ln Y \), so as to avoid drastic data fluctuations.

Model Inspection and Analysis
Stability Test
Using Eviews7.0 software, this paper first tested the stability of variable sequences before analyzing data with cointegration test. This paper uses ADF test to avoid the phenomenon of "false regression". The results of ADF test are shown in Table 1:

<table>
<thead>
<tr>
<th>Variable</th>
<th>validation form</th>
<th>ADF statistic</th>
<th>critical value (5%)</th>
<th>conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>( Y )</td>
<td>( (c, t, 2) )</td>
<td>-2.7433</td>
<td>-3.8732</td>
<td>non-stationary</td>
</tr>
<tr>
<td>( X )</td>
<td>( (c, t, 2) )</td>
<td>-2.7376</td>
<td>-3.8733</td>
<td>non-stationary</td>
</tr>
<tr>
<td>( \Delta Y )</td>
<td>( (c, t, 2) )</td>
<td>-1.1716</td>
<td>-3.9272</td>
<td>non-stationary</td>
</tr>
<tr>
<td>( \Delta X )</td>
<td>( (c, t, 2) )</td>
<td>-1.2018</td>
<td>-3.9272</td>
<td>non-stationary</td>
</tr>
<tr>
<td>( \Delta^2 Y )</td>
<td>( (c, 0, 1) )</td>
<td>-2.4622</td>
<td>-1.9756</td>
<td>stationary</td>
</tr>
<tr>
<td>( \Delta^2 X )</td>
<td>( (c, 0, 1) )</td>
<td>-2.7709</td>
<td>-1.9756</td>
<td>stationary</td>
</tr>
</tbody>
</table>

The \( \Delta Y \) said \( Y \) first-order difference in Table 1, \( \Delta^2 Y \) said \( Y \) second-order difference, similarly \( \Delta X \) and \( \Delta^2 X \) are respectively \( X \) first difference and second order difference. As can be seen from the above table, the \( Y \) statistic is obtained when the number of lag period is 1 and the significance level is 5%. The result shows that the significant level of 5% \( Y \), \( X \), \( \Delta Y \) and \( \Delta X \) is smooth, but their second order difference are stable, so they are both second order single whole I (2), that is to say, \( Y \) and \( X \) as shown in the table above, the whole order with same number, are the necessary conditions of cointegration.

Co-integration Test
This paper only analyzes two variables: total cross-border e-commerce trade in Shandong province \( X \) and total import and export trade in Shandong province \( Y \). The cointegration test is now used to verify this, that is, the long-term equilibrium relationship between two non-stationary time series. Firstly, the least square method is used to conduct regression test on the total amount of cross-border e-commerce and import and export trade. The results are shown in Table 2:
Table 2. Regression test results under least square method.

<table>
<thead>
<tr>
<th>Variable</th>
<th>coefficient</th>
<th>Error measure</th>
<th>t statistic</th>
<th>probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>8.510223</td>
<td>0.23419</td>
<td>0.825269</td>
<td>0.4113</td>
</tr>
<tr>
<td>X</td>
<td>0.438833</td>
<td>0.434611</td>
<td>12.07039</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

The estimated equation is:

\[ Y = 8.510223 + 0.425622 X \]

\[ (0.825269) \quad (12.07039) \]

\[ R^2 = 0.8156 \quad ADR^2 = 0.7324 \quad F = 43.4866 \]

As can be seen from the above equation, the model has a higher explanatory power, because \( ADR^2 = 0.7324 \). The T value of variable X is 12.07038, indicating that cross-border e-commerce plays a highly significant role in promoting the import and export trade of shandong province. As can be seen from \( Y=8.510221+0.425622X \), the elasticity coefficient of the total cross-border e-commerce volume to the total import and export volume of shandong province is 0.425622, that is, for every 1 unit of the total cross-border e-commerce volume of shandong province, the total import and export volume of shandong province will increase by 0.425622 units.

The part that cannot be explained by X is called the residual sequence, which is represented by E. Now the stationarity of the residual sequence is tested. If E is stable, then E does not have unit root, indicating that there is a co-integration relationship between the two variables; otherwise, there is no co-integration relationship. The results are shown in table 3:

Table 3. ADF test results of residual sequence E.

<table>
<thead>
<tr>
<th>variable</th>
<th>ADF statistics</th>
<th>(C,T,K)</th>
<th>1%</th>
<th>5%</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>-4.1515</td>
<td>(0, 0, 2)</td>
<td>-3.5212</td>
<td>-3.0422</td>
<td>-2.3423</td>
</tr>
</tbody>
</table>

The ADF test statistic of E is -4.1515 less than the threshold value of -3.5212 at 1% significance level. Since -4.1515 takes less than -3.5212, the hypothesis of unit root is rejected. Similarly, at the significance level of 5%, the critical value is -3.0422, greater than -4.1515; at the significance level of 10%, the critical value -2.3423 is also greater than -4.1515; the statistical values of E are all < the critical value, and the unit root hypothesis is rejected. In other words, the second order co-integration of Y and X, there is a long-term stable relationship between them.

Granger Causality Test

Based on the above definition, granger causality test was used to establish the model between \( \ln Y_t \) and \( \ln X_t \) as follows:

\[ \ln Y_t = C_1 + \sum_{i=1}^{P} \alpha \ln Y_{t-i} + \sum_{i=1}^{Q} \beta \ln X_{t-i} + U_{1t} \]
\[ \ln X_t = C_2 + \sum_{i=1}^{P} \gamma \ln X_{t-i} + \sum_{i=1}^{Q} \delta \ln Y_{t-i} + U_{2t} \]

In this case, U1t and U2t are error terms, C1 and C2 are constant terms, and for E (U1t, U2t) = 0, \( \ln Y_t \) and \( \ln X_t \), the maximum lag periods are P and Q, respectively. In the above equations, there are 4 causal relationships between \( \ln Y_t \) and \( \ln X_t \), where i = 1... The relationship is shown in table 4:
### Table 4. Causality between LnX<sub>t</sub> and LnY<sub>t</sub>.

<table>
<thead>
<tr>
<th>β&lt;sub&gt;i&lt;/sub&gt;值</th>
<th>δ&lt;sub&gt;i&lt;/sub&gt;值</th>
<th>conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>There is no causal relationship</td>
</tr>
<tr>
<td>0</td>
<td>≠0</td>
<td>LnY&lt;sub&gt;t&lt;/sub&gt; is the causality of LnX&lt;sub&gt;t&lt;/sub&gt;</td>
</tr>
<tr>
<td>≠0</td>
<td>0</td>
<td>LnX&lt;sub&gt;t&lt;/sub&gt; is the causality of LnY&lt;sub&gt;t&lt;/sub&gt;</td>
</tr>
<tr>
<td>≠0</td>
<td>≠0</td>
<td>Two-way causality</td>
</tr>
</tbody>
</table>

Although there are 4 causal relationships between X and Y, this paper only studies whether X is the causal cause of Y. The results are shown in table 5:

### Table 5. Granger causality test results.

<table>
<thead>
<tr>
<th>hypothesis</th>
<th>number</th>
<th>F statistic</th>
<th>probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>LX does not Granger Cause LY</td>
<td>13</td>
<td>4.11239</td>
<td>0.43246</td>
</tr>
</tbody>
</table>

As can be seen from table 5, the probability of rejecting the null hypothesis is 0.43246, and a higher probability means that the null hypothesis is not valid. That is to say, cross-border e-commerce is the cause-and-effect relationship in granger sense of import and export trade in shandong province. To be precise, cross-border e-commerce is the Granger cause of shandong's import and export trade.

### Conclusion and Countermeasures

#### Conclusion

In this paper, using the ADF test, granger causality test and cointegration test to analyze the cross-border e-commerce impact on import and export trade in shandong province, analysis is as follows: LY and LX time series as I(2) the second order of the single whole, namely the cross-border e-commerce with a cointegration relationship between import and export trade in shandong province, and the cointegration relationship is stable over a long period of time. The regression test of Y and X by the least square method shows that cross-border e-commerce can promote the import and export trade of shandong province, that is, for every 1 unit of X increase, Y increases by 0.425622 units. The verification of granger causality shows that, at 95% confidence level, cross-border e-commerce is the granger reason of shandong province's import and export, that is, cross-border e-commerce promotes the growth of shandong province's import and export trade.

#### Countermeasures and Suggestions

Governments, enterprises, individuals and universities should cooperate with each other to achieve mutual benefit and win-win results, so as to add bricks and tiles to the rapid development of cross-border e-commerce in shandong province [7].

1. **Suggestions for the government**
   - The government should start with the current development of cross-border e-commerce in shandong province and study the problems of cross-border e-commerce in shandong province. Through the study of the causes of these problems, reasonable solutions are found [8]. The government should build infrastructure related to problems in cross-border e-commerce logistics, such as the establishment of cross-border e-commerce industrial park.

2. **Suggestions for enterprises**
   - Cross-border e-commerce enterprises should strengthen the study of legal knowledge, enhance the legal awareness of enterprises, establish brand awareness, strengthen the quality inspection of products, avoid the infringement of intellectual property rights and counterfeit and shoddy situations, gradually establish the trust between buyers and sellers, and establish a good image for enterprises [9].
(3) Suggestions for colleges and universities

Colleges and universities in Shandong Province should study the current situation of cross-border e-commerce in our province and intensify efforts to cultivate professional talents suitable for the needs of cross-border e-commerce [10]. Colleges and universities should also learn from each other's experience and summarize reasonable and effective methods of talent cultivation. Universities and social cross-border e-commerce enterprises cooperate with each other to provide more internship opportunities for students.

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Reference


