Analysis of Political Economy on the Influential Factors of Digital Trade Restrictions

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Abstract. Digital trade is an important part of today's world economy, and the resulting issue of digital trade restrictions has become the focus of attention in international trade negotiations. Studying the influential factors of digital trade restrictions can help to understand the inherent reasons for the differences in digital trade policies across countries. From the perspective of political economy, this paper establishes a government objective function that pays special attention to the welfare of digital trade-related interest groups based on the protection for sale model, and analyzes the endogenous influencing factors of digital trade policy. In this paper, the QCA method is also applied to analyze the configuration of different influencing factors, and finally two paths leading to high digital trade restrictions and three paths leading to non-high digital trade restrictions are found. The research findings have significant implications both theoretically and practically for revealing the factors and internal mechanisms that affect digital trade restrictions.

1 Introduction

With the advancement of the new generation of digital technologies such as the Internet, big data and cloud computing, digital payment means have been upgraded, and digital trade has gradually become an important part of today's world economy. At the same time, new concepts such as digital sovereignty and new issues such as citizen privacy security are also emerging. Countries around the world have adopted a series of restrictive measures on digital trade to regulate and sanction digital trade in the name of protecting national digital security and citizens’ privacy. Why do countries choose more stringent or less restrictive measures when formulating digital trade-related policies? Based on the political economy of trade policy, this paper analyzes the influential factors of digital trade restrictions, and innovatively introduces qualitative comparative analysis (QCA) into the analytical framework to reveal the different configurations of these factors to explain the complex causal relationship between the political and economical status of a country's digital industry and the extent of digital trade restrictions. This study provides important theoretical guiding significance for China to adjust digital trade policy according to the development of digital industry and digital trade.

2 Literature review

Digital trade is a general term for a new trade pattern and trade content developed by digital technology and traditional industries since the emergence of the Internet. Specifically, it includes physical goods traded across borders through digital means, as well as transactions of products and services, digital products and information that are digitized based on Internet technology.[1] Most scholars refer to the restrictive policies and measures adopted by a country on digital trade as digital trade barriers or digital trade restrictions. Relevant research focuses on the measurement of the degree of digital trade restrictions and the economic effects of digital trade restrictions. At present, the widely recognized frameworks for measuring digital barriers include OECD-DSTRI and ECIP-E-DTRI. There are abundant domestic studies on the economic effects of digital trade restrictions, Ferracane et al. (2020) measured the level of digital trade restrictions in 15 East Asian countries in different periods and found that restrictive digital policies inhibited the innovation ability of enterprises. Qi’s (2021) and Zhou’s(2021) research demonstrates the inhibitory effect of digital trade restrictions on the improvement of export product quality and technical complexity. The conclusions drawn from the above studies all point to the negative impact of digital trade restrictions on export trade.

The research on the influential factors of digital trade restrictions is mainly based on the motivation of a country to formulate restrictive policies on digital trade. Wang Yan(2022) points out that the differences in digital trade governance modes among countries stem from the differences in national information and data acquisition ability, digital security technology control ability, digital trade profitability and national choice of different values. Huang Ning believes that the differences in the regulation of cross-border data flow are the result of the maximization of the regulatory net benefits of various
economies based on their information technology level and privacy protection awareness. However, such analysis is only an additional explanation to the research on other topics, and there are few in-depth studies on the endogenous causes of the differences in the degree of digital trade restrictions among countries.

Through the review of the above literature, it can be found that there are sufficient studies on the concept, measurement and economic effects of digital trade restrictions. Some scholars have also explored the motivations of countries to adopt digital trade restrictions, and simply analyzed the objective reasons for the differences in regulations among countries. However, few scholars have explored the endogenous influencing factors of the level of digital trade restrictions in more depth. Compared with the previous studies, the marginal contributions of this paper may be as follows: firstly, this paper analyzes the influencing factors of digital trade barriers and theoretically supplements the research on digital trade. Secondly, in order to study the different influence states brought by different combinations of complex influencing factors, this paper introduces the QCA method into the research. This expands the application field of QCA method.

3 The Theoretical mechanism analysis

This section resets the government objective function based on previous studies, then analyse the influential factors of digital trade restrictions through mathematical derivation, finally find three different kinds of factors. Together, these three factors determine digital trade restrictions, and the relationship between them is shown in Figure I.

3.1 Setting government targets

Baldwin(1982) was the first to introduce the political economy method of public choice into trade theory and analyze the "endogenous" process and results of trade policy decision by grasping the characteristics of trade policy as a "public good" which is a non-market collective decision. Starting from the competition of different interest groups and different preferences of government objectives, scholars expanded the theory of political economy of trade policy, among which the protection-for-sale model proposed by Grossman and Helpman(1992) were the most influential. In this model, interest groups composed of individuals with the same special factors provide political contributions to the government to seek tariff concessions or export subsidies for their industries. Different amounts of political contributions are provided according to different tariff rates or subsidy rates, forming a "contribution schedule". The government's aim is to maximise the sum of political contributions and social welfare. In the two-stage non-cooperative game between interest groups and the government, interest groups first reach a Nash equilibrium about political contribution on the "contribution schedule", and then the government decides the optimal tariff or subsidy equilibrium based on the given political funds.

When setting the objective function of the government in the protection for sale model, it is believed that the government pursues the maximization of the sum of the whole social welfare and its own political contribution. However, in the real economy, the political system of many countries is not completely democratic, and political donations are not obvious in all economies. In recent years, many scholars have extended their research on the basis of G-H's protection for sale model. For example, in the government objective function set up by Sheng Bin, the goal of the government is to maximize the sum of the labor and factor remuneration of the factor owner as a producer and the welfare of the consumer. Tang Yihong assumed that a government paid great attention to the income status of import-competing groups when formulating trade policies, and set the government's objective function as the weighted sum of the whole social welfare and the welfare of import-competing groups.

On this basis, this paper assumes that a government will pay special attention to the income status of domestic interest groups related to digital trade in addition to paying attention to the welfare of the whole society when formulating trade policies. The government's objective function is set as the weighted sum of the whole social welfare and the welfare of digital trade-related interest groups.

3.2 Mathematical derivation

This paper establishes a small country with specific factors model. First, from the perspective of demand, A small economy is populated by individuals with identical preferences but different factor endowments. And the pseudo-utility function of each individual is:

\[ u = x_0 + \sum_{i=1}^{n} u_i(x_i) \quad (1) \]

Where, \( x_0 \) Represents the consumption of the benchmark commodity 0, whose domestic and foreign prices are both 1, \( x_i \) is the consumption of the \( i \)th good, \( i=1,2,...,n \). It is assumed that the quasi-utility function is a strictly concave function that can be incrementally increased. The demand function for the \( i \)th good is \( x_i=d(p) \), \( p_i \) Is its domestic price, and the consumption expenditure of a single individual is \( E \), then:

\[ E = x_0 + \sum_{i=1}^{n} p_i d_i(p_i) \quad (2) \]

Substituting (2) into (1) yields the indirect utility function:

\[ u(x)=V(p,E)=E+s(p)=E+\sum_{i=1}^{n} u_i d_i(p_i)+\sum_i p_i d_i(p_i) \quad (3) \]

Where \( s(p) \) is the consumer surplus, \( s(p)=\sum_{i=1}^{n} u_i d_i(p_i)+\sum_i p_i d_i(p_i) \quad (4) \)

On the supply side, assuming that the input-output coefficient is 1 and the wage rate is fixed at 1, the
production of one unit of benchmark commodity requires only one unit of labor, while the production of other non-benchmark commodities requires labor and the input of a special factor. When the wage rate is 1, the total compensation of the special factor for producing good i depends only on the domestic price of that good i, that is, the domestic output of the ith good is. \( \pi_i \). \( \pi_i(p_i) \). \( y(p_i) \) 

The domestic supply and demand for goods are not always in balance, so there is international trade to make up for the demand gap. \( M = (N - \pi(p_i)) \cdot y(p_i) \). \( M \) represents the net imports of the good i. Suppose the government redistributes net revenue from taxes and subsidies uniformly to all people in the economy (the quantity is \( N \)). Therefore, the redistributed tariff income obtained by a single individual is:

\[
\pi_i^* = \frac{1}{N} \sum_{i=1}^{n} (p_i - p_i^*) M_i = \frac{1}{N} \sum_{i=1}^{n} (p_i - p_i^*) (d_i(p_i) - \frac{1}{N} y(p_i)) \tag{5}
\]

\( P_i^* \) denote the world price of good i. The income of the owner of the special factor endowment in each industry can be divided into four parts: wage income, profit, redistributed tariff income, and consumer surplus. Therefore, the welfare function of the individual is:

\[
V(p, E) = 1 + \sum_{i=1}^{n} s_i \pi_i(p_i) + \sum_{i=1}^{n} (p_i - p_i^*) d_i(p_i) - \frac{1}{N} y(p_i) \tag{6}
\]

Where \( s_i \) is the share of a single individual in the distribution of special factor profits in the production of the good i. Therefore, the welfare function of industry i is the sum of the welfare of all individuals in industry i. If the population of industry i is \( L_i \), the welfare function is \( W_i \):

\[
W_i = L + \pi_i(p_i) + \sum_{i=1}^{n} (p_i - p_i^*) [L d_i(p_i) - \frac{L}{N} y(p_i)] \tag{7}
\]

Total social welfare \( W \) is the sum of the welfare of all individuals in society:

\[
W = N + \sum_{i=1}^{n} \pi_i(p_i) + \sum_{i=1}^{n} (p_i - p_i^*) [N d_i(p_i) - y(p_i)] \tag{8}
\]

It is assumed that when a government makes trade policy, it will not only pay attention to the total social welfare, but also pay great attention to the income of domestic digital trade-related interest groups, so the government's objective function is:

\[
G = W + A \cdot W_i \tag{9}
\]

Where \( W_i \) is the welfare function of the interest group related to digital trade, and the parameter \( A \) is the relative proportion of the weight of the income granted by the government to the welfare weight of the whole society, in general, \( A \geq 0 \). Under the condition of maximizing the government's objective, the equilibrium trade policy should meet the first-order condition:

\[
\frac{2G}{\partial t_i} = 0 \quad (t_i = p_i - p_i^*) \tag{10}
\]

\( B_i \) is the proportion of digital trade-related interest groups in the total population \( N \), then the equilibrium trade policy of the country is expressed as follows:

\[
t_i M_i + A[(1 - B_i) y_i + B_i t_i] = 0 \tag{11}
\]

The equilibrium tariff is obtained as follows:

\[
t_i = \frac{A \cdot (1 - B_i)}{1 + A \cdot B_i} \tag{12}
\]

Where \( M_i \) denotes the responsiveness of import of commodity i to price, \( M_i < 0 \).

According to Equation (11), it can be intuitively found that whether a country protects digital trade and the level of protection are directly related to the proportion of domestic digital trade-related interest groups in the total population, the government's attention to the welfare of digital trade-related interest groups, the domestic output of digital products and the price elasticity of imports. These factors will be analysed in detail below.

### 3.3 The Influential factors of digital trade restrictions

#### 3.3.1 Government's attention

According to the formula, the government's attention about the welfare of interest groups related to digital trade will affect the degree of restrictions on digital trade. Domestic producers of digital industries always want to limit imports and expand exports of their own products. If a country's economy is highly dependent on imports of digital products, policy makers will formulate corresponding measures to restrict imports and create import barriers. If the export competitive advantage of the domestic digital industry is low, the government will formulate stricter restrictive measures on digital trade. To ensure that the domestic digital industry can get sufficient development. The domestic output of the digital industry has a positive impact on the digital trade protection.

#### 3.3.2 Size of interest group

According to the derived results, the smaller the proportion of the population of digital trade-related interest groups in the total population is, the government will tend to formulate more restrictive policies on digital trade. The collective action theory of Olsen (1983) explains this, if an industry is small, it can overcome free riding and organize more effectively to lobby and exert political pressure on lawmakers. All in all, what can be determined is that the size of digital trade-related interest groups does have a large impact on the ultimate extent of digital trade restrictions. The proportion of the number of employees in the digital industry in the total population of a country can intuitively reflect the scale of interest groups related to digital trade.

#### 3.3.3 Participation in digital trade agreements

In recent years, various RTAs involving digital trade have been launched, negotiated and even signed like rain
after rain, such as DEPA, USMCA, CPTPP and RCEP with far-reaching influence. These agreements aim to promote digital trade facilitation, promote the free transfer of data across borders, build a broader environment of trust, and increase the digital participation of small and medium-sized enterprises and the public. We can infer that a regional trade agreement signed by a country with other countries that contains provisions on digital trade will make a country have a more open tendency in the formulation of digital trade policy in accordance with its commitment on digital trade control in the agreement.

FIG.1 Interaction of factors affecting digital trade restrictions

4 Empirical analysis based on fsQCA

The above derivation demonstrated that the government's attention, the size of digital trade-related interest groups and the participation in digital trade agreements jointly determine the level of digital trade restrictions in a country. However, these three factors are not independent of each other. For example, the size of a country's digital trade-related interest groups will inevitably affect the government's attention about its welfare level. When participating in the negotiations of digital trade-related international trade agreements, it will also influence the attitude of the government and lead to whether the trade agreements can be reached.

The endogenous complex relationship among the influencing factors is difficult to be reflected by the traditional causal Analysis method. Therefore, this paper introduces qualitative comparative analysis into the analysis framework to better reveal the complex causal relationship between these influencing factors and digital trade restrictions. (Rihoux and Ragin, 2009)

4.1 Description of variables

Degree of digital trade restrictions. The outcome variable selected in this paper, namely the degree of a country's digital trade restrictions, is based on the Global Digital Trade Restrictions Index (DTRI) report released by ECPIE in 2018.

Interest group size. This paper selects three digital trade-related industries classified according to ISIC standards for research, namely, computer, electronic and optical product manufacturing (D26); Telecommunications industry (D61); IT and information Services (D62T63). The ratio of the number of employees in these three industries to the total population in 2017 is used to represent the scale of digital trade-related interest groups in each country.

Government's attention. Three variables, including import dependence, revealed comparative advantage and the proportion of trade value added in GDP, are selected to measure the government's attention to the welfare of digital trade-related interest groups. The import and export volume data of digital products/services are from the UN Comtrade database. The data of digital industry trade value added come from UIBE GVC Indicator database of the University of International Business and Economics.

Participation in digital trade agreements. In this paper, the number of regional agreements with digital trade provisions signed by a country is filtered to obtain the digital trade agreement participation data from the University of Lucerne's TAPED database.

Based on the grasp of the current development of the world's digital economy, as well as the availability of data, this paper regards the 27 EU countries among the 64 economies as a whole (the UK is still in the EU in 2017). Finally, the data of 19 economies, including China, Indonesia, Vietnam, Brazil, Turkey, Thailand, South Korea, Mexico, Brunei, the United States, Switzerland, the Philippines, the European Union, Lithuania, Israel, Japan, Peru, Costa Rica, and Iceland, are screened for analysis.

4.2 Result analysis

This paper uses fsQCA3.0 software to analyze the configurations leading to high and non-high digital trade restrictions separately. Finally, the following results are obtained.

In Table 1, we find that there are two paths that drive high digital trade restrictions. There are three paths that drive it to generate non-high digital trade restrictions. The specific implications of each path are as follows.

4.2.1 Analysis of configurations leading to high digital trade restrictions

1. Small-scale and inward oriented

\[ H1 \sim emp \times \sim add \times \sim dep \times \sim rca \times \sim rtg. \]

This configuration indicates that a country has a small scale of interest groups related to digital trade, a low growth ratio of digital industry trade and a weak import dependence on digital products and an explicit competitive advantage in export, and its participation in digital trade agreements is not high. This configuration is named Small-scale and inward oriented. The core conditions of this configuration are non-high digital employment ratio, non-high digital products export revealed competitive advantage and non-high digital trade agreement participation. These conditions show that the development of the country's digital industry is relatively backward, and it does not actively participate in the international digital trade agreement. The country tends to set high barriers to digital trade to resist the impact of foreign digital products and
protect the development of its digital industry. This configuration corresponds to Brazil and Indonesia.

Table 1. Analysis of solutions.

<table>
<thead>
<tr>
<th>Condition variables</th>
<th>High digital trade restrictions (H1)</th>
<th>Non-high digital trade restrictions (H2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital industry employment ratio</td>
<td>emp</td>
<td>rta</td>
</tr>
<tr>
<td>Digital trade value added ratio</td>
<td>add</td>
<td></td>
</tr>
<tr>
<td>Ratio of Import Dependence</td>
<td>dep</td>
<td></td>
</tr>
<tr>
<td>reveals competitive advantage</td>
<td>rca</td>
<td></td>
</tr>
<tr>
<td>Participation/Digital trade agreement</td>
<td>rta</td>
<td></td>
</tr>
</tbody>
</table>

Note: Large circles (●) indicate the existence of "core conditions" and small circles indicate the existence of "edge conditions" (○); A circle with crosses means that the condition does not exist, a large one means that the "core condition" does not exist (●), and a small circle means that the "edge condition" does not exist (○); A blank space means that the condition variable has little effect on the result.

2. Small-scale and outward oriented

H2 (~emp × add × dep × rca × rta). This configuration indicates that if the domestic digital trade-related interest groups are small in scale, the digital industry trade increases relatively high, the export has a strong explicit competitive advantage, but the domestic digital product import dependence is low, the domestic digital product import dependence is adopted by the digital trade restrictive policies and actively participate in the conclusion of the digital trade agreement. This configuration is therefore named Small-scale and outward oriented. Compared with configuration H1, countries in this configuration have higher digital trade increase ratio and export explicit competitive advantage, indicating that these countries actively participate in digital trade and their digital products have certain international competitiveness. The core conditions of configuration H2 are high digital employment ratio, high digital products export revealed competitive advantage and high participation in digital trade agreements. The countries in this configuration are China and Mexico.

4.2.2 Analysis of configurations leading to high digital trade restrictions

1. Developed industries and outward oriented

NH1 (emp × add × ~dep × rca). The configuration indicates that there is a large scale of digital trade-related interest groups in the country, a high increase ratio of digital industry trade and a high dependence on the import of digital products, but a weak dominant competitive advantage of the country's export. In this case, the country's government will adopt a relatively high level of digital trade restrictive policies. The difference between NH2 (emp × add × ~dep × rta) and NH1 is that rta (high digital trade agreement participation) in NH1 is non-necessary condition, and rca (high digital products export revealed competitive advantage) in NH2 is non-necessary condition. The two configurations are named as developed industries and outward oriented. The configuration of NH1 corresponds to the United States, and the configuration of NH2 corresponds to Japan and the European Union.

2. Developed industries and inward oriented

NH3 (emp × add × dep × ~rca × ~rta). The configuration indicates that the combination of high digital industry employment ratio, high digital trade value added ratio, high import dependence, non-high export revealed comparative advantage and non-high participation in digital trade agreements will lead to non-high digital trade restrictions. It can be found that the country in this configuration has a relatively developed digital industry, but the country is very dependent on the import of digital products, and does not have a high participation in the formulation of international digital trade rules. The core conditions of this configuration are high digital industry employment ratio and non-high export revealed comparative advantage. This configuration is named developed industries and inward oriented, and this configuration corresponds to Iceland.

5 Conclusions

The results show that there are various configurations that bring about high and non-high digital trade restrictions, and the process of a country forming digital trade policy is vitally complex and has inexhaustible influencing factors. No matter the configuration that leads to high digital trade restrictions or high digital trade restrictions is an objective state in the real economy, it does not matter whether it is good or not, and only the level of digital trade restrictions that is most suitable for the development state of the country. But the digital industry and economy within a country will change, and as it develops, the current level of restrictions should be adjusted accordingly.

As the ECIPE-DTRI reported, China is the country with the highest restrictions on digital trade. According to the calculations in this paper, the proportion of employment in digital industries in China is relatively low, but with the acceleration of industrial digitalization and the popularization of digital payment methods, this proportion will only rise, and China's situation will gradually approach the path of "NH1" and "H2" represented by the US and Europe which lead to non-high digital trade restrictions. In fact, China is committed to gradually reaching principled consensus with most economies, especially developed economies, on issues such as free cross-border data flow and localized data storage, so as to reduce digital trade barriers, which is consistent with the inferences of this study. This paper provides theoretical support for the adjustment of China's digital trade policy to a certain extent.
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