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The Gravity Effect of Digital Trade Rules in FTAs

- Cases of China, Japan, and South Korea -

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Abstract

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As a product of the fourth industrial revolution, digital trade has emerged as a key driver of global trade growth. Digital trade is not only an evolutionary direction of global trade patterns, but also an important position for the competition of emerging trade rules. As multilateral trade agreements failed to adapt to the rapid changes brought about by digital trade, the global governance of digital trade has gradually transitioned to bilateral and regional trade agreements. At present, the digital trade rules at the FTA level are “fragmented”, with obvious heterogeneity among the rules led by the US, the EU, and other major economies. However, it is worth noting that, in addition to North America and Europe, East Asia, which ranks third, is also experiencing rapid development of regional economic integration and digital trade. Economies such as China, Japan and South Korea are actively outputting digital trade rules that suit the development characteristics of East Asia, expecting to form a valuable complement to the world’s trade rules system. What effect do these digital trade rules have on digital trade? This research seeks to provide an empirical study-based response to that query.

The study proposes three impact hypotheses based on a classification of FTA digital trade rules into three categories: trade promotion rules, data flow rules, and privacy protection rules. Because specific provisions in each category have different attributes, six explanatory variables,

including WTO complement, trade facilitation, cross-border data flow, data flow condition, personal data protection, and online consumer protection provisions, are further constructed and quantified using the TAPED dataset after reliability testing. Using the digital trade export data of China, Japan, and South Korea from 2005-2019 to 65 economies with which they have signed FTAs as a sample, this study empirically tests the impact of FTA digital trade rules on digital trade exports using the gravity model.

The estimation results show that trade facilitation, cross-border data flow, and online consumer protection provisions have a significant positive effect on digital trade exports. There is no statistical evidence showing that WTO complement, data flow condition, and personal data protection provisions have an impact on digital trade exports. In addition, the effect of economic size in traditional gravity model still works, but the effect of geographical distance is not confirmed. According to the findings of country-specific analysis, China tends to sign WTO supplement provisions with developing countries while Japan tends to sign WTO supplement provisions with developed countries in order to increase their digital trade exports. South Korea usually signs data flow condition provisions with developing countries, as well as data flow rules and online consumer protection provisions with developed countries. Although signing high-standard FTA digital trade rules is the way forward for each country to participate in global digital trade rulemaking, the level of rules and the choice of provisions involved in FTA negotiations should vary from one trading partner to another and from one provision to another.

Keyword : digital trade, free trade agreement, digital trade rules, gravity model, East Asia

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Chapter 1. Introduction

1.1. Background

Each of the industrial revolutions in history has triggered major changes in the pattern of international trade through significant increase in labor productivity, with technological development from steam to electricity, then to electronic information technology. The fourth industrial revolution has emerged since the 21st century. A new generation of information technologies like mobile internet, big data, cloud computing, artificial intelligence and the Internet of Things are overturning the way that traditional manufacturing industry is organized, further deepening the international division of labor, and driving a deep restructuring of the global value chain. Globalization has entered a new era of "Digitally Enabled Trade". As a product from the rapid development of digital technology, digital trade is not only an evolutionary direction of global trade pattern, but also an important position for the competition of emerging international trade rules. Measuring the scale of digital trade is critical for understanding the macroeconomic environment, developing relevant policies and regulations, and thus integrating deeply into the global value chain.

Approximately half of the world's population is now connected to the internet, and the creation of data is leading economy and trade to be digitalized. Traditional trade in goods has slowed or even stopped growing in recent years, while global digital trade has grown quickly and steadily to take its place as a new engine for economic growth. The COVID-19 in 2020 has had a significant impact on the world economy and international trade, yet digital trade has demonstrated its unique strengths in this pandemic. When compared to traditional trade forms, digital trade can overcome the restrictions of "face-to-face" trade, which is unaffected by border isolation. Digital trade will obviously move onto the fast track of development after the pandemic.

Based on the digital trade measurement method[1] released by OECD, IMF and WTO, global digital service export reached $3 trillion in 2020, accounting for nearly 50% of global service trade export. It shows that digital service export has already become an important engine driving the growth of global trade.

The fourth industrial revolution, also known as the digitalization of the economy, is a relatively new phenomenon that predates the Uruguay Round (1994). Although digital economy is altering production and trade patterns, WTO multilateral trade rules are lagging far behind practice and have yet to fully address digital trade issues. At this moment, the only thing we have in the WTO is a tariff moratorium for digitally exchanged goods and services (Janow and Mavroidis, 2019). However, the lack of multilateral movement does not mean that countries have given up on negotiating. In fact, there is a growing call for the establishment of a rule framework to adapt to the new development of digital trade, especially under the current trend of anti-globalization, protectionism, and unilateralism. Digital trade rules are widely emerging in a variety of frameworks, most notably regional ones. The number of free trade agreements continues to grow, and digital trade remains consistent among the subjects of these negotiations, with varying degrees of specificity and coverage.

Now, international trade rules are undergoing reconstruction, and the competition for the right to speak about international trade rules in the 21st century will intensify. How to better design international trade rules that take into account global value chain has emerged as the core issue facing the world. The world is witnessing the emergence of several different digital trade regimes, particularly in the US, the EU, and China (Janow and Mavroidis, 2019). For both China and the US, digital trade is a booming business. In terms of digital economy size, the US leads the world with $13.1 trillion in 2019, or 61% of its GDP. China comes in second with $5.2 trillion,

[1] Service categories include insurance and pension services, financial services, charges for the use of intellectual property, telecommunications, computer and information services, other business services, personal cultural and recreational services.

or 36.2% of its GDP. But China's digital economy has enormous potential with 15.6% growth in 2019[1]. COVID-19 pandemic further emphasizes the importance of digital economy, and in result, China has developed a strong interest in influencing digital trade rules. In 2017, the US withdrew from the Trans-Pacific Partnership (TPP), a 12-nation FTA aimed at establishing 21st century standards for international trade in the Asia-Pacific region, including digital trade. It is estimated that China may fill the void left by the US in establishing international trade standards (Huang, 2017). In this context, it is necessary to investigate the development of a post-TPP digital trade rules framework in the Asia-Pacific region.

According to the World Bank, East Asia has been dubbed the "East Asian Miracle" because it is one of the most dynamic regions in the postwar economic development history[2]. As interest in regional economicism surging in East Asian countries, FTAs have proliferated rapidly in this region. The successful conclusion of the Regional Comprehensive Economic Partnership Agreement (RCEPT) has led to significant progress in East Asian regional economic integration. For the first time, China, Japan, and South Korea have entered a common FTA framework, paving the way for the advancement of FTA negotiations among these three countries. East Asia's increasing share of global trade flows best exemplifies the region's remarkable economic rise. According to the Global Digital Trade Facilitation Index Report 2020, North America, Europe and developed East Asian countries continue to be the top economies referring to the Global Digital Trade Facilitation Index[3]. The rapid development of East Asian regional economic integration and digital trade has highlighted the necessity and importance of formulating regional digital trade rules. As regional economic powers and advanced countries in digital development, China, Japan and South Korea have already made many explorations on digital trade rules in their

[1] 中国信息通信研究院. (2020). *全球数字经济新图景(2020) ——大变局下的可持续发展新动能*.

[2] World Bank. (1993). *The East Asian miracle: Economic growth and public policy*. World Bank. http://documents.worldbank.org/curated/en/975081468244550798/pdf/multi-page.pdf

[3] 沈玉良, 彭羽, 高疆, & 陈历幸. (2021). 数字贸易发展新动力: RTA 数字贸易规则方兴未艾——全球数字贸易促进指数分析报告(2020). *世界经济研究*, *1*, 3-16.

FTA negotiation practices.

1.2. Research Plan

This research aims to analyze the effect of heterogeneous FTA digital trade rules on digital trade exports in East Asia through quantitative methods, then propose future policy recommendations accordingly. The strengths of this study are as follows. First, the academic community is already very familiar with American and European mode of digital trade rules and their trade effects but lacks a gaze on the third-ranked East Asian economies. This research can help to deepen the understanding of digital trade rules in China, Japan and South Korea, as well as empirically test the trade effects of digital trade rules on these economies, making it a valuable supplement to digital trade research. Second, digital trade is a significant evolutionary direction of global trade patterns, as well as a significant stage for the competition of emerging international trade rules. By measuring different aspects of digital trade rules, this study can provide policy recommendations to more emerging digital economies and help them better integrate into the global value chain.

This study is organized into seven chapters.

Chapter 1 introduces the emergence and development of digital trade and highlights its importance as a new competitive advantage in the current growth of global trade. This study focuses on the global governance of digital trade and describes its gradual transfer to the level of regional governance. The importance of this study is illustrated by analyzing the take-off of digital trade in East Asia and the development of digital trade rules in the region, taking three countries, China, Japan and South Korea, as examples.

Chapter 2 provides a theoretical background for this study through literature review. The chapter first clarifies the definition of digital trade among many ambiguous concepts, and finally focusing on the “narrow version” concept and its statistical standard. It then introduces the

transition of multilateral agreements to bilateral and regional trade agreements in digital trade governance, showing the characteristics of different modes of digital trade rules led by major countries in the world. Finally, it introduces the theoretical underpinning of this empirical study, the gravity model, and discusses the principles and today's threats to the traditional gravity model.

Chapter 3 first summarizes the development of digital trade in China, Japan and South Korea. Using a data visualization method, this section shows the changes in the scale and share of digital services trade in China, Japan and South Korea from 2005 to 2019, and describes the characteristics of the FTA digital trade rules in which China, Japan and South Korea participate and develop. Then it classifies the FTA digital trade rules based on the existing literature, which mainly contains three types of rules: trade promotion, data flow, and privacy protection. By summarizing theoretical and empirical experiences, this study constructs the influence mechanism of the three types of digital trade rules on digital trade and puts forward three hypotheses based on it.

Chapter 4 evaluates the volume of digital trade exports from China, Japan and South Korea to 65 importing economies with which they have FTAs during the period 2005-2019. This chapter develops a classification of digital trade rules for heterogeneity consideration and uses the TAPED dataset to measure digital trade rules according to their "extent of legalization". Finally, a trade gravity model is developed for empirical analysis based on the hypotheses presented in the previous chapter.

Chapter 5 performs regression analysis using a two-way fixed effects model. The estimation results show that the verification results of the three hypotheses presented in the previous chapter are all mixed. Trade facilitation, cross-border data flow and online consumer protection provisions have a significant positive effect on digital trade exports. There is no statistical evidence showing that WTO complement, data flow condition, and personal data protection provisions have an impact on digital trade exports.

Chapter 6 again summarizes the research results of this study and suggests policy implications for different countries accordingly. Signing high-standard FTA digital trade rules is an important way forward for countries to participate in global digital trade rulemaking, but the level of rules and the choice of provisions involved in FTA negotiations vary from one trading partner to another and from one provision to another. The evaluation of the impact of digital trade rules on digital trade is still a topic for future research.

Chapter 2. Literature Review

2.1. The Concept of Digital Trade

According to Richard Baldwin's theory (2016), the evolution of international trade has likely gone through three stages: first, the emergence of traditional trade, followed by the second, global value chain (GVC) trade based on the reduction of costs in various aspects such as transportation. With the digital trend that the world is now experiencing, the way of communication and transmission has become faster and easier, and the costs are becoming cheaper, thus give rise to digital trade. Weber (2010) firstly proposed the concept of "digital trade", which refers to the commercial activity of transmitting valuable goods or services across electronic channels such as the Internet.

As the first organization to propose the concept of digital trade, the US International Trade Commission (USITC) released three studies in 2013, 2014 and 2017. The 2013 report[1] used a "narrow version" definition of digital trade that indicates "products and services delivered over fixed lines or wireless digital networks". The 2014 report[2] proposed a "broad version" definition of digital trade that indicates "products and services ordered, produced or delivered via the Internet and Internet technologies", incorporating the concept of e-commerce. Ultimately, however, the USITC chose to stick with the "narrower version" definition in its 2017 report[3]. The USITC's repeated changes to the scope of digital trade reflect the fact that the perception of digital trade is largely influenced by different starting points of interest. Jia (2019) infers that the

[1] USITC. (2013). *Digital Trade in the U.S. and Global Economies, Part 1*. USITC. https://usitc.gov/publications/332/pub4415.pdf

[2] USITC. (2014). *Digital Trade in the U.S. and Global Economies, Part 2*. USITC. https://www.usitc.gov/publications/332/pub4485.pdf

[3] USITC. (2017). *Digital Trade 1: Market Opportunities and Key Foreign Trade Restrictions*. USITC. https://www.usitc.gov/publications/332/pub4716.pdf

competitive advantage of the US lies in the cross-border flow of digital content and digital services, which is the main reason why USITC narrows the concept of digital trade.

The position of international organizations like OECD and WTO differs from that of the USITC, which defines digital trade in a relatively broad way from an academic perspective, aiming to capture the areas that are not covered by current e-commerce indicators. The OECD, WTO, and IMF published the Handbook on Measuring Digital Trade in March 2020[1], which defines digital trade in three dimensions: the nature of the transaction, the product, and the partners involved. The transaction is classified as digital trade if one of the three conditions listed below is met: First is digitally ordered transaction, meaning the sale and purchase by placing and receiving orders on the Internet, mainly including e-commerce in the traditional sense. Second is digitally delivered transaction, meaning the cross-border trade delivered remotely via the Internet in downloadable format, mainly including digitizable services. Third is digitally enabled/facilitated transaction, or platform enabled/facilitated transaction, meaning the act of providing trading platforms and intermediary services for buyers and sellers on the Internet, which is the main business of Amazon and Alibaba nowadays.

The WTO pointed out in the World Trade Statistics Review 2017[2] that international trade is facing a new challenge in digital trade measurement, namely, how to calculate the total scale of digital trade. Currently, the measurements of digital trade by research institutions are generally divided into two categories: One is a direct method, which is based on the existing conceptual framework to estimate the amount of digital trade within or between economies, such as the method of United States Bureau of Economic Analysis (USBEA, 2016) and the United Nations Conference on Trade and Development (UNCTAD, 2018) to measure the amount of trade in

[1] OECD, WTO, & IMF. (2020). *Handbook on Measuring Digital Trade, Version1*. OECD. https://www.oecd.org/sdd/its/Handbook-on-Measuring-Digital-Trade-Version-1.pdf

[2] WTO. (2017). *World Trade Statistical Review 2017*. WTO. https://www.wto.org/english/res_e/statis_e/wts2017_e/wts2017_e.pdf

digitizable services. The other type is a comparative method, which uses a multi-dimensional horizontal comparison to "score" the level of digital trade development of different economies, such as the global Digital Trade Restriction Index (DTRI)[1] published by the European Centre for International Political Economy (ECIPE, 2015). This research takes the "narrow version" of the digital trade concept and employs a single-dimensional approach to measure it in order to perform an empirical study of the impact of digital trade rules on digital trade exports. This is determined by the availability of data and the accuracy of the indicator measurement.

2.2. The Evolution of Digital Trade Rules

The old trade norms of national economic sovereignty and global value chain theory supporting free trade have been rocked by the expanding digital trade, and they have gradually changed into a game between the concepts of data sovereignty and data value chain (Zhang, 2022). Most nations are positioned as data producers in the global data value chain, but only a few numbers of platforms and nations that receive the majority of the data can monetize it by turning it into value-added data products, and the direction of this raw data flow is more "south to north"[2]. According to Neeraj (2017), the absence of a legal framework to regulate digital trade creates anti-competitive digital markets dominated by a few companies, particularly Amazon, Apple, Facebook, Microsoft, and Alibaba. The oligopolistic power of these companies in the digital economy prevents new companies, primarily SMEs of developing countries, from entering the market. As a result, WTO members are becoming more aware of the impact of lacking digital trade rules on their fast-growing digital trade.

2.2.1. Digital trade rules at the WTO level

[1] ECIPE. (2018). *Digital Trade Restrictiveness Index*. OECD. https://ecipe.org/wp-content/uploads/2018/05/DTRI_FINAL.pdf

[2] UNCTAD. (2019). *Digital Economy Report 2019*. UNCTAD. https://unctad.org/system/files/official-document/der2019_en.pdf

It has been argued that the WTO's digital trade-related rules are incomplete and outdated. Constrained by the efficiency of the Doha Round negotiations, the WTO's ability to address the opportunities and challenges presented by digital trade is limited. However, the multilateral organization will continue to be the one most capable of harmonizing the regulations governing digital trade. The 1998 Global Declaration on Electronic Commerce was the first official document on electronic commerce under the WTO framework, where member countries agreed not to impose tariffs on electronic transmission. In 2019, 76 WTO member states issued a Joint Declaration on Electronic Commerce in an effort to establish a high-level multilateral system of digital trade rules based on existing WTO agreements. After near two years of negotiations, 86 member states finally signed the Consolidated Text of the WTO Plurilateral Negotiations on Electronic Commerce in December 2020, which covers a much broader range of topics than the existing agreements and represents an important step forward in the WTO framework for negotiating digital trade rules.

The rules governing digital trade are mostly dispersed across several major agreement texts and their annexes within the WTO framework. The General Agreement on Tariffs and Trade (GATT) mainly address the classification of e-commerce and IT products. The General Agreement on Trade in Services (GATS) provides principal provisions on "access to public telecommunications networks", "cross-border data transmission", and "data localization measures". Despite the fact that both agreements contain the core non-discrimination principles of most-favored-nation (MFN) and national treatment (NT), the latter is more liberal in terms of market access, as Meltzer (2019) points out the GATS' advanced nature in digital trade rulemaking. The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIP) can be applied to intellectual property issues in digital trade.

The Trade Facilitation Agreement (TFA) supports e-commerce sales of goods by lowering the cost of goods passing through Customs procedures, which is especially important for low-

value and low-volume digital trade. The Information Technology Agreement (ITA) members have held several rounds of negotiations and have made significant progress on “tariff reduction on information technology products”. The commitment in the Agreement on Technical Barriers to Trade (TBT) to develop domestic technical regulations based on existing international standards will have an impact on the development of digital trade rules in terms of network standards, data privacy, and data storage.

2.2.2. American and European mode of digital trade rules

The failure of WTO to make progress in developing rules for digital trade has reignited the interest of developing such rules in bilateral and regional trade agreement. According to Hodson (2019), the shift to regionalism has increased the likelihood of agreement on issues that have remained unresolved in multilateral negotiations, including digital trade issues. Bown (2017) refers FTA as “law-making laboratory” because the experimental provisions in FTAs are likely to establish legal precedents, which in turn have spillover effects on contracting countries. As economies at the forefront of digital trade development, the US and the EU must also be leaders in the development of digital trade rules in order to maintain their positions in global digital trade.

For the US, since the US-Jordan Free Trade Agreement first involved e-commerce in 2000, the “American mode” of digital trade rules continue to move forward in an orderly way. The US-South Korea Free Trade Agreement for the first time proposed the “free flow of cross-border data”, which is a representative American digital trade rule. The US-Mexico-Canada Agreement (USMCA) for the first time appeared the “digital trade chapter”, and the US-Japan Digital Trade Agreement (UJDTA) further expands and deepens the digital trade rules. Among them, TPP is an aggregation of trade rules formulated by developed countries and represents the highest level of digital trade liberalization, which can be used as a template for future regulations because of its high standards and stringent restrictions.

As for the EU, it has followed many core provisions of the TPP’s digital trade rules and

gradually developed a “European mode” on the basis of fully integrating its own development characteristics, starting with the first appearance of e-commerce provisions in the EU-Chile Free Trade Agreement, and continuing with the first introduction of e-commerce chapter in the EU-Canada Free Trade Agreement. Furthermore, with the signing of the Regional Comprehensive Economic Partnership (RCEP) and Digital Economy Partnership Agreement (DEPA), the “Chinese mode” and “Singapore mode” have also emerged as new powers in international digital trade rules.

In the area of cross-border data flows, the US advocates for the free flow of data, opposes server and data localization requirements, and places greater emphasis on the benefits of cross-border data flows. The EU lacks globally competitive digital platforms and thus emphasizes individual privacy protection by allowing necessary restrictions on the free flow of data across borders, and this is also reflected in the General Data Protection Regulation (GDPR) philosophy which allows for the localization of computing facilities. In the field of cultural products, due to the status of the US as a cultural power, it does not make exceptions for digital trade in cultural products. While the EU advocates exceptions for cultural products in digital trade in order to protect local cultural industries.

In comparison to the more offensive “American mode”, the “European mode” digital trade rules are more conservative and lack a comprehensive and independent system. According to Gao (2018), these proposals actually reflect differences in digital technologies and trade interests in different economies. International digital trade rules at the regional level, driven by the US and the EU, have formed two camps, the “American mode” and the “European mode”, and have continued to extend their influence to other trade agreements. As a result, digital trade rules at the FTA level are “fragmented”, particularly by seeing the heterogeneity of digital trade rules led by major economies such as the US and the EU.

2.2.3. Digital trade rules in East Asia

The US and the EU initially suggested digital trade standards, and by including them in regional trade agreements, they have gradually developed "American mode" and "European mode" digital trade rules that have been tailored to their own development through practice. East Asia's progress on digital trade rules has been slower, and the signing of the Regional Comprehensive Economic Partnership Agreement (RCEP) has fueled academic debate on the "East Asian mode" of digital trade rules. The RCEP marks the first time that East Asia's major economies, China, Japan, and South Korea, have reached a basic consensus on the rules of digital trade, and the emerging trade rules involved are a bold attempt by East Asia to the field of global digital trade.

As of 2021, 8 FTAs include digital trade provisions among the 15 FTAs signed by China. The digital trade provisions are mainly distributed in the FTAs signed with developed economies, with a preference for cooperation in market access and trade facilitation. The two FTAs with the highest depth of rules are China-Korea and China-Australia FTAs. But due to the lack of mature international law norms and the involvement of domestic policy adjustments, the agreements provide that disputes arising from digital trade shall not resort to dispute settlement mechanism. The RCEP, which went into effect in 2022, represents the highest standard of digital trade provisions in China's FTAs. It creatively proposes a digital trade dispute settlement mechanism. The RCEPT reflects China's and other developing countries' core interests in focusing on data security and establishing an open and inclusive digital trade system. In comparison to other agreements like CPTPP, RCEP establishes exception clauses on topics such as cross-border data flow, personal information protection, and computing facility location, as well as a transition period for the least developed countries (LDCs).

Japan has signed 18 FTAs, 10 of which include digital trade provisions. Even though Japan is not a great digital trade power like the US and EU, it has promoted its digital trade rules through two channels: the US withdrawal from the TPP and the Japan-Europe Economic Partnership Agreement (EPA) signed with the EU. Japan has always maintained a high level in the

development of digital trade rules, with a similar philosophy to the US, but supporting the adoption of open regionalism to establish international service trade rules and build trust among different sovereign regimes through technical and economic cooperation. The CPTPP, led by Japan, retains the TPP's core rules on digital trade, but the terms are more flexible than the USMCA. In 2019, Japan finally reached a Digital Trade Agreement (DTA) with the US and started to adopt binding regulations on digital trade terms in general.

South Korea has signed 16 FTAs, 10 of which include digital trade provisions. The US-Korea FTA, while widely considered to contain one of the most ambitious e-commerce chapters, is actually an old bilateral agreement signed by South Korea. South Korea's more recent digital trade agreements have all provided less substantive coverage than the US-Korea FTA. This trend suggests that even though South Korea's e-commerce chapter covers a wide range of topics, the overall coverage has not increased over time. Kim (2019) discusses the e-commerce chapter in South Korea's FTA and argues that issues arising in areas such as digital protection can be addressed as a priority.

Singapore, the only developed economy of ASEAN, is home to a large number of high-quality digital startups and has signed Digital Economy Partnership Agreement (DEPA) and Digital Economy Agreement (SADEA) with New Zealand, Chile, Australia and other countries to establish a benchmark for digital trade rules in the region. South Korea has also announced that it will launch the Korea-Singapore Digital Partnership Agreement based on DEPA. Despite being proposed by small countries, the DEPA has become another important mode of digital trade rules around the world. The majority of the topics covered by DEPA are benchmarked to the highest standards of CPTPP, including trade facilitation, data concerns, business and consumer trust. DEPA is open to all countries who wish to participate and contains various modules that can be individually "picked up" as "purely digital" trade arrangements that can be placed in their ongoing trade agreement negotiations to better match the comfort level of participating countries.

Table 1. Number of RTAs including digital trade rules signed by China, Japan and South Korea

Category	Sub-category	China	Japan	South Korea
Liberal Open Rules	Electronic Transmission Tariff	2FTA、RCEP	4FTA、CPTPP、UJDTA、RCEP	11FTA、RCEP
	Non-Discriminatory Treatment of Digital Products	/	3FTA、CPTPP、UJDTA	3FTA
	Dispute Settlement	2FTA、RCEP	CPTPP、RCEP	1FTA、RCEP
Environment Facilitation Rules	Paperless Trade	3FTA、RCEP	7FTA、CPTPP、UJDTA、RCEP	11FTA、RCEP
	Electronic Signature and Authentication	4FTA、RCEP	4FTA、CPTPP、UJDTA、RCEP	7FTA、RCEP
	Domestic Regulatory Framework	1 FTA、RCEP	4 FTA、UJDTA、RCEP	3 FTA、RCEP
	E-commerce Cooperation	4 FTA、RCEP	4FTA、RCEP	7FTA、RCEP
Balance Protection Rules	Online Consumer Protection	1FTA、RCEP	3FTA、CPTPP、UJDTA、RCEP	9FTA、RCEP
	Personal Data and Information Protection	2FTA、RCEP	2FTA、CPTPP、UJDTA、RCEP	8FTA、RCEP

Source: WTO Regional Trade Agreements Database.

According to Cui and Du (2021), the rules governing digital trade cover a wide range of topics, but they can be broadly categorized into 9 kinds of provisions[1]: electronic transmission, non-discriminatory treatment of digital products, dispute settlement, paperless trade, electronic signature and authentication, domestic regulatory framework, e-commerce cooperation, online consumer protection, personal data and information protection. Drawing on the classification method[2] of Peng et al. (2021), the above nine provisions are divided into 3 major categories: the first category is liberal open rules, which primarily includes provision about data flow, data preservation, and data confidentiality. The second is environment facilitation rules, which refers to a set of rules that, in some contexts of international trade, treat digital information identically to paper documents. The third is balance protection rules, which is done by regulating the environment for digital trade to protect personal information security and privacy.

Table 1 shows the bilateral and multilateral RTAs signed by the three countries China, Japan and South Korea with the 9 provisions related to digital trade mentioned above. A categorization according to liberal open rules, environment facilitation rules and balance protection rules is also made, from which not only the scope of digital trade rules for the three countries can be seen, but also differences for digital rules development can be found. From the prospective of digital trade rules implementation region, Japan and South Korea surpass China, in that South Korea takes an approach to sign bilateral FTAs and Japan relies on participating in the formulating of digital trade rules by signing multilateral agreements and focuses more on liberal open rules and environment facilitation rules. China pays more attention on environment facilitation rules and is on a preliminary phase regarding regional and global trade rules.

[1] 崔岩, & 杜明威. (2021). “东亚模板”数字贸易规则相关问题探析——基于中日韩合作的视角. 日本学刊, *4*, 62-82.

[2] 彭羽, 杨碧舟, & 沈玉良. (2021). RTA 数字贸易规则如何影响数字服务出口——基于协定条款异质性视角. *国际贸易问题*, *4*, 110-126.

2.3. Application of the Gravity Model

The gravity model has been proved to have a theoretical basis in international trade theory. The gravity model is the most important and widely used analytical framework in international trade research, and it is usually used in evaluating factors influencing bilateral trade and measuring trade barriers. Tinberger (1962) and Poyhonen (1963) developed the gravity model independently. It is named after the structure of the standardized equation, which is similar to the "law of gravity" in physics, in that bilateral trade volume is positively related to the economic size of both importing and exporting countries, and negatively related to the trade distance. The gravity model has the advantage of including several explanatory variables that may affect bilateral trade, and the coefficients of these explanatory variables' have reached a certain level of agreement in previous empirical studies, so they can be used as criteria for examining model setting and data quality.

Baier et al. (2014) argue that trade agreements are the main policy source of trade cost changes, where trade costs are tariff and non-tariff costs. FTAs not only increase exports of existing homogeneous firms by reducing trade costs, but also allow members to start trading goods that did not have trade possibilities before the agreement was signed. In short, FTA affects trade from two margins of intensification and expansion by influencing trade costs.

Several studies were conducted in the 1970s and 1980s to assess the impact of major regional trade agreements such as the EEC, EFTA and LAFTA on trade flows by adding a dummy variable to the standard gravity model. Given the rapid expansion of FTAs since the 1990s, an increasing number of studies have attempted to use the gravity model to test the impact of various FTAs. Considering improving the estimation methods, Baier and Bergstrand (2002) treated the FTA dummy variable as endogenous variable and found that the effect of FTA on trade flows is four times greater than before. Although the trade creation effect of FTA has been discovered in many cases, many studies have shown that the magnitude of the effect varies with time and industry.

The traditional gravity model is primarily based on the perspective of manufactured goods, where economic scale as capacity constraints and geographical distance as transportation constraints have a significant effect on trade scale. Under the impact of digital economy, the subject matter of international trade activities, transaction objects, transaction methods and even the production organization behind it have undergone significant changes, thus forming a huge and even disruptive impact on the international trade theory in the traditional sense (Zhang and Jiang, 2021). It is questionable that whether the traditional gravity model still applies in the context of digital economy.

On the one hand, from the perspective of geographical distance, the near-zero transportation cost makes the influence of geographical factors on digital trade significantly reduced, and it can even be removed from the gravity model. For example, Lendle et al. (2016) find that the limiting effect of geographic distance on trade on the eBay platform is only 35% of that of traditional trade. Gomez-Herrera et al. (2014) also find that the costs associated with geographic distance are significantly reduced in online transactions compared to offline transactions. On the other hand, from the perspective of economic scale, although the scale of digital trade will still be constrained by the size of the economy, the cost constraint will be mainly reflected in one-time fixed cost due to the key digital factors of digital products with near-zero marginal costs (Zhang and Jiang, 2021). The capacity constraint effect of the total economic scale on digital-based firms will be greatly reduced. However, this does not mean a complete overturning of the gravity model by digital trade, but more of a change in its connotation.

2.4. Statistics on Digital Trade and Rules

Given the significance of policy factors in digital trade, empirical research on the effectiveness of these policy factors on digital trade is lacking. One of the main reasons for this situation is their challenging data requirement. First, digital trade policy information requires in-

depth analysis of a large number of relevant domestic policies and trade agreements for each country. Second, data on digital trade flows are difficult to collect because of the uncommon definition of digital trade. Even if some definitions exist, the lack of uniform standards across countries limits the accessibility of data.

Significant efforts have recently been made to remove these barriers, but they are used separately for their own purposes. In terms of digital trade rules, The Trade Agreements Provisions on Electronic-commerce and Data (TAPED) dataset[1] developed by Burri et al. (2019) determines whether the trade agreements signed so far include provisions related to digital trade, and whether digital trade provisions are included in the separate chapters or as part of other chapters. It is only used to describe how to categorize agreements based on their "extend of legalization". In terms of digital trade, there is still no data to directly measure digital trade flows, but new methods to measure it using existing data have been developed (OECD-WTO-IMF, 2020). As a typical example, the Balanced Trade in Services Dataset (BaTiS)[2], established by the WTO-OECD, provides statistics on trade in services by 11 main EBOPS 2002 service categories.

The current definition of digital trade is divided into two categories: wide and narrow. International organizations generally use the broad definition, whereas the US use the narrow definition. In this study, narrow definition is used that digital trade is defined as "the exchange of goods and services using digital technology". This study believes that even purchasing physical goods online is a form of service trade because the purpose is to take use of the convenient service of buying products provided by e-commerce platforms. Therefore, digital trade is essentially a branch of trade in services and can be considered as trade in digitalized services. According to UNCTAD's statistical experience, using the cross-border services supply statistics (called "Mode

[1] Mira Burri, Maria Vasquez Callo-Müller and Kholofelo Kugler, TAPED: Trade Agreement Provisions on Electronic Commerce and Data, available at: https://unilu.ch/taped with the date of retrieval

[2] OECD and WTO, BaTiS: Balanced Trade in Services Dataset, available at: https://stats.oecd.org/Index.aspx?DataSetCode=BATIS_EBOPS2010#

1" trade in GATS) including 6-11 categories in the BaTiS dataset is a good measure of digital trade when we define it as "trade in digitally-deliverable services". These newly developed datasets are used in this study to conduct an exploratory analysis of the development of digital trade and rules in China, Japan and South Korea.

2.5. Research Gap

Currently, policy analysis and qualitative studies on digital trade rules are more common, focusing primarily on the characteristics of important digital trade rules and major countries' demands, but few studies empirically analyze their trade effects and whether they affect trade through linkage with other issues. Most existing empirical studies examine its impact on digital trade from the perspective of the FTA as a whole, but few articles investigate the depth of digital trade rules, and even fewer investigate the depth of heterogeneous digital trade rules. The main reasons may as follow. First, there are limitations in the measurement of digital trade flow and problems of "unclean identification" in the econometric analysis. In addition, there are few literatures on the classification and quantification of digital trade rules.

Based on previous research, the innovations of this study are as follows. First, by quantifying the depth of FTA digital trade rules and conducting empirical analysis on their impact on digital trade exports, it can overcome the shortcomings of using dummy variables so that improve the accuracy of regression results. Second, based on the TAPED dataset published by the University of Lucerne, a heterogeneous classification of trade promotion rules, data flow rules and privacy protection rules is built based on the characteristics of different rules. This a useful attempt to expand the current research on the economic effects of FTAs to the specific division of digital trade rules.

Chapter 3. Digital Trade and Rules in East Asia

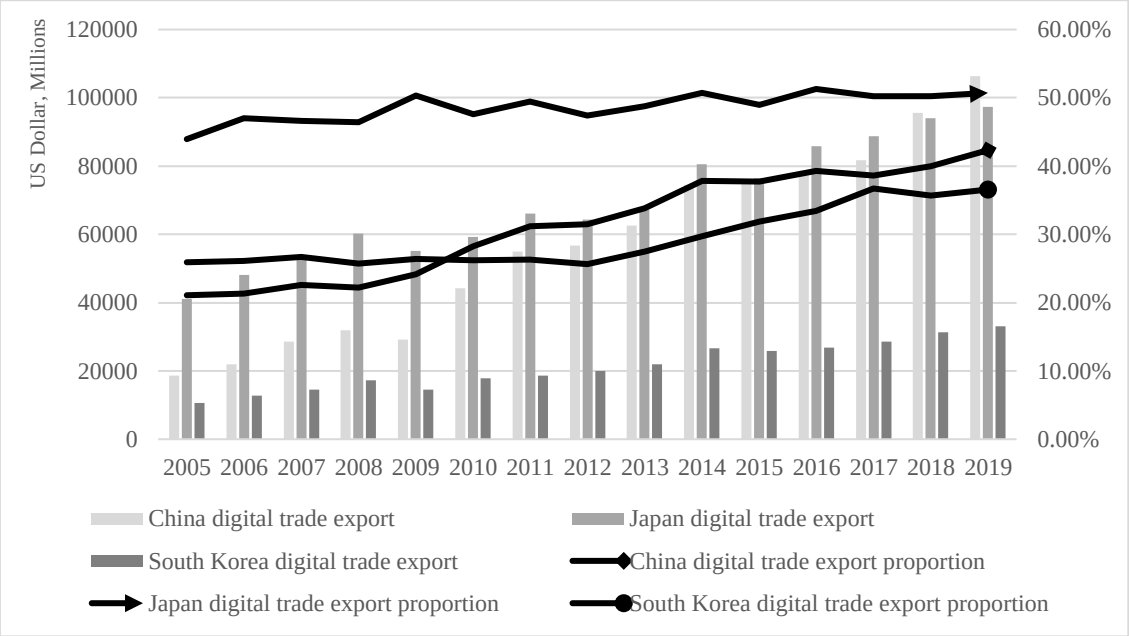
3.1. Digital Trade in China, Japan and South Korea

Digital trade is different from traditional trade in goods and services in that it is deeply related to digital technology and digital infrastructure, which brings various changes to the counterparts of trade and the way of trade as time goes by. At present, although the global network system for the development of digital trade is rather uniform, there is still an obvious gap between countries in different positions. Emerging economies often have a less well-structured digital trade system and occupy a more marginal position due to the features of their industrial structures. The UK, the US, and other European and American countries have the first-mover advantage of being at the heart of the digital trade network, with advanced technologies, perfect institutional facilities, and widespread acceptance of online transactions. In comparison with Europe and North America, East Asia has a relatively slow pace in the development of digital technology. However, thanks to the scale effect of East Asian production network in manufacturing industry, Easter Asia has witnessed the booming of digital commodity exchange. Digital trade mainly includes commodity-exchange-based cross-border E-commerce, supply chain digitalization, and service-trade-based digital service trade, with the last one being the main topic of this study.

Figure 1 demonstrates the changes of digital service trade and digital service trade to service trade ratio for China, Japan and South Korea during 2005-2019. From an overall export scale prospective, digital service trade export experienced a growing trend for the three countries, with a growth rate of 471.2%, 136.3% and 213.2% for China, Japan and South Korea respectively during the 15 years. To compare the three countries, Japan surpassed the other two countries significantly since 2005 in the prospective of digital service trade scale. Since 2010, digital service trade scale for China developed rapidly and surpassed that of Japan in 2018, and that of Korea

grew steadily. From digital service trade to service trade ratio's prospective, during 2005-2019, the ratio for Japan reached 50%, and that for China and Korea grew to about 40% from 20%. In 2010, the ratio for China surpassed that for Korea and kept the trend ever after.

Figure 1. Scale of Digital Service Trade and Digital Service Trade to Service Trade Ratio for China, Japan and South Korea



Source: OECD-WTO Balanced Trade in Services Dataset (BaTiS).

For Japan, through signing bilateral FTAs, participating in the formulation and implementation of global trade rules from an early state, and in recent years, leading negotiations for CPTPP digital trade core rules, its digital service trade export scale topped the list amongst East Asian countries, with an ever-lasting ratio of 50% ever since and developed steadily. Despite that South Korea has signed various bilateral or multilateral FTAs regarding digital trade rules, the clauses are relatively conservative. For instance, in the US-South Korea Free Trade Agreement, there are chapters relating to E-commerce which were once thought as ambitious. In fact, such agreement was a relatively early agreement signed between the two countries, and the trade

agreements signed by South Korea recently cover even less substantive content then the US-South Korea Free Trade Agreement, which leads to the slow development of the overall scale for digital service trade and offers little space for further development. China, as the largest economy, however, shows a pleasant growing trend with a rapid growing scale of digital service trade and a growing digital service trade to service trade ratio through continuing opening up and merging into the global economy. China's digital trade rules are mainly found in FTAs signed with developed economies, with an emphasis on cooperation in market access and trade facilitation.

3.2. Classification of FTA Digital Trade Rules

The WTO e-commerce negotiation is an important forum for developing e-commerce or digital trade rules at the plurilateral level. In January 2019, 76 WTO members signed the Joint Declaration on Electronic Commerce, confirming the start of e-commerce negotiations. After nearly two years, the "Consolidated Text"[1] of the WTO e-commerce negotiations was released in December 2020, which summarizes members' proposals and provides direction for the WTO's substantive negotiation on e-commerce issues. The Consolidated Text addresses seven major issues: enabling electronic commerce, openness and electronic commerce, trust and electronic commerce, cross-cutting issues, telecommunications services, market access, and mechanism setting. In terms of significance, all parties share common concerns about enabling, openness and trust topics.

Referring to the study of Peng et al. (2021), this study divides the FTA digital trade rules into 3 aspects: trade promotion rules, data flow rules, and privacy protection rules, which are well echoed by the three main topics of enabling, openness, and trust in the WTO Consolidated Text. According to the description of digital trade rules covered by FTA in the available literature, China

[1] WTO. (2020). *WTO E-Commerce negotiations consolidated negotiating text*. WTO. https://www.bilaterals.org/IMG/pdf/wto_plurilateral_ecommerce_draft_consolidated_text.pdf

and Japan focus on topics such as cross-border data and information flow, prohibition of data localization, prohibition of disclosure of source code, tariff suspension of electronic transmission, consumer privacy and data protection (Abendin and Duan, 2021), while Korea focuses on topics such as non-discrimination, regulatory framework, electronic authentication and signature, paperless trade and online consumer protection, and personal information protection (Kim, 2019). Thus, the 3 aspects of trade promotion rules, data flow rules, and privacy protection rules have been able to cover the main digital trade rules of China, Japan, and South Korea at this stage in a relatively comprehensive manner (Table 2). Although new topics such as intellectual property rights, open Internet access, and regulatory cooperation are also mentioned with increasing frequency, due to the availability of the data in TAPED dataset, this study proceeds to examine the effect of the three main categories of digital trade rules on digital trade exports for the time being.

Table 2. Classification of FTA digital trade rules

Provisions	Sub-Provisions	Topic
Trade Promotion	WTO Rules Application	Enabling
	Tariff	
	Non-discrimination	
	Regulatory Framework	
	Paperless Trade	
	Electronic Authentication	
Data Flow	Cross-border Data Flow	Trust
	Data Localization	
	Disclosure of Software Source Code	
Privacy Protection	Online Consumer Protection	Openness
	Personal Data Protection	
	Intermediary Platform Responsibility	
	Unsolicited Electronic Messages	

Countries around the world signing the FTA digital trade rules intend to promote the long-term development of digital trade by liberalizing market access and creating a facilitated development environment. As a result, the higher the level of digital trade rules, the better it is to promote digital trade exports. However, because different types of digital trade rules have a different focus, the impact on digital trade exports varies.

3.3. Influence Mechanism

3.3.1. Trade Promotion Rules

Trade promotion rules belong to the "enabling" topic. These digital trade giants like China, Japan and South Korea are committed to creating a comprehensive environment that supports the growth of digital trade. Since the nature of cross-border digital trade operations is underpinned by a complex set of transaction-related trade measures (González and Ferencz, 2018), the implementation of tariff suspension, paperless trade, and the establishment of a domestic regulatory framework in line with international standards can effectively reduce the border barriers, and thus improve the overall facilitation of digital trade.

The empirical analysis by Duval et al. (2018) shows that the full implementation of paperless trade and other digital trade facilitation provisions in the WTO-TFA would contribute to a 26% reduction in trade costs for Asia-Pacific countries. Trade facilitation rules can increase the liberalization level of digital trade businesses both online and offline, lowering the overall costs of digital trade enterprises and promoting digital trade exports.

3.3.2. Data Flow Rules

Data flow rules belong to the "openness" topic. Japan and South Korea support the free flow of data across borders and cite legitimate public policy objectives (personal data protection and cybersecurity) as exceptions that may limit cross-border data flows. China, however, is skeptical of the free flow of cross-border data and suggests that such kind of rules must reflect the security

needs of its members. Data flow rules are intended to cover topics that have not yet been discussed by the WTO Working Group on Electronic Commerce and to focus more on controversial and cutting-edge areas such as cross-border data flows, prohibition on data localization, non-disclosure of software source code, and so on. Many digital services are data-intensive because they use large amounts of electronic data in their production process, which crosses national borders many times before the services are used. The free cross-border data flow facilitates trade in services over the Internet.

The virtual, borderless, and open nature of the data determines the breakthrough of data sovereignty from traditional sovereignty's absolute and indivisible nature. Out of concern that large amounts of information are collected and used without the knowledge of the data subject, many countries restrict the cross-border transfer of data, which is expected to increase the cost of online services transaction and thus negatively affect digital trade. The empirical analysis by Cory (2017) shows that data localization requirements may impose significant economic costs on multinational companies in the ICT industry. Based on cross-country panel data for 64 countries from 2006 to 2016, Ferracane and Marel (2019) confirm the negative correlation between data restriction policies and digital service exports.

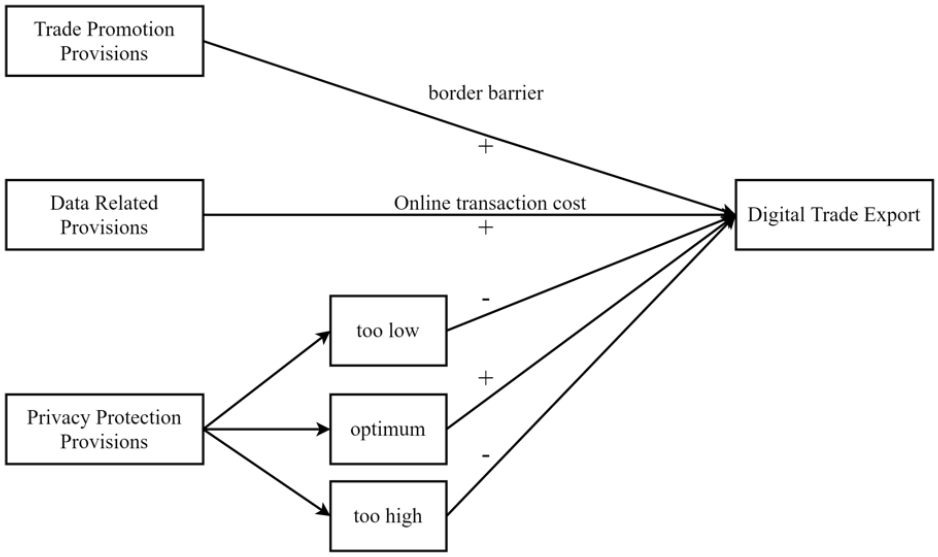
3.3.3. Privacy Protection Rules

Privacy protection rules belong to the "trust" topic. China, Japan and South Korea all seem to stand on the side of the EU, providing strong protection for consumers engaged in digital transactions. Privacy protection rules address some of the most politically sensitive and technically difficult issues, such as online consumer protection, personal information protection, online intermediary platform responsibility, and the reduction of unsolicited commercial spam. States are learning to address state responsibility for any behavior that violates their borders while still allowing for 21st-century commerce to develop (Wolfe, 2019).

There is an "inverse effect" (Figure 2) of privacy protection rules on digital trade exports.

Low level of privacy protection lower consumer and business confidence in the digital economy, which is bad for exports. However, high level of privacy protection increases operational costs and disadvantage digital firms when competing with businesses abroad, which is also bad for exports (Guellec and Paunov, 2018). The optimal level of privacy protection should be based on a trade-off between the benefits of data innovation and the harm caused by violating consumers' privacy rights (Goldfarb, 2012).

Figure 2. Influence Mechanism of FTA digital trade rules



Much of the existing literature support the conclusion that high levels of privacy protection limit the competitiveness of digital firms. For example, Goldberg et al. (2020) use firm-level data analysis to show that the implementation of the EU's GDPR reduced both website visits and online platform revenues by about 12% for EU users. Similarly, Goldfarb and Tucker (2011) show that the implementation of a European privacy regulation in 2004 made it more difficult for European Internet companies to collect data about their online customers, leading to a reduction in the effectiveness of online advertising by about 65%. However, this study argues that for developing countries, in the long run, privacy protection rules can develop safe and healthy

consumer habits by regulating the international digital trade environment, which in turn can facilitate global trade development.

3.4. Research Hypotheses

H1 (Trade Promotion Hypothesis): The trade promotion aspect of FTA digital trade rules has a positive effect on participating countries' digital trade exports.

H2 (Data Flow Hypothesis): The data flow aspect of FTA digital trade rules has a positive effect on participating countries' digital trade exports.

H3 (Privacy Protection Hypothesis): The privacy protection aspect of FTA digital trade rules has a positive effect on participating countries' digital trade exports.

Chapter 4. Methodology and Data

4.1. Explained Variable

This study uses the gravity model to conduct a regression analysis of the factors influencing bilateral digital trade, with the goal of illustrating how digital trade rules covered in FTAs have an effect on digital trade exports. The digital trade exports of 3 exporting economies to 65 importing economies with which they have signed FTAs between 2005 and 2019 are examined (Table 3). The following factors were mostly taken into account when choosing these economies for observation: First, the 3 exporting economies are among the top digital trade powers, implying that they are large and influential in global digital trade. Second, in order to objectively evaluate the trade effects of digital trade rules, the sample includes both the FTAs signed by the 3 exporting economies that cover and not cover digital trade rules.

This study refers to the statistic specification of UNCTAD on "international trade in digitally-deliverable services" to measure the digital trade export (EXP_{ijt}) as the explained variable. The value of digital trade export, whose unit is in millions of dollars, is calculated by aggregating trade data from 6 service sectors in the WTO-OECD BaTiS dataset: "insurance and pension services", "financial services", "charges for the use of intellectual property", "telecommunications, computer and information services", "other business services", and "personal, cultural and recreational services".

Table 3. FTAs concluded by China, Japan and South Korea

	FTAs including digital trade	FTAs excluding digital trade
China	China - Chile China - Korea, Republic of China - Australia China - Georgia China - Singapore China - Mauritius China - Hong Kong, China China - Macao, China	China - Pakistan China - ASEAN China - New Zealand China - Peru China - Costa Rica China - Iceland China - Switzerland
South Korea	Korea, Republic of - Singapore Korea, Republic of - US Korea, Republic of - EU Korea, Republic of - Peru Korea, Republic of - Colombia Korea, Republic of - Australia Korea, Republic of - Canada Korea, Republic of - Vietnam Korea, Republic of - Central America Korea, Republic of - UK	Korea, Republic of – Chile Korea, Republic of – EFTA Korea, Republic of – India Korea, Republic of - ASEAN Korea, Republic of - Turkiey Korea, Republic of - New Zealand
Japan	Japan - Singapore Japan - Thailand Japan - Switzerland Japan -Australia Japan - Mongolia Japan - EU Japan - US Japan - UK	Japan - Mexico Japan - Malaysia Japan - Philippines Japan - Chile Japan - Brunei Japan - Indonesia Japan - ASEAN Japan - Vietnam Japan - India Japan - Peru

Source: WTO Regional Trade Agreements Database.

4.2. Core Explanatory Variables

The data of FTA digital trade rule comes from the Trade Agreements Provisions on Electronic-commerce and Data Dataset (TAPED). This dataset is designed to comprehensively

track developments in the field of digital trade governance and includes RTAs from 2000 onwards that cover chapters and provisions that directly or indirectly regulate digital trade worldwide. It was first released in 2019 and updated regularly by a team led by Mira Burri and Manfred Elsig from University of Lucerne. This study uses the 2022/01/25 version of the dataset.

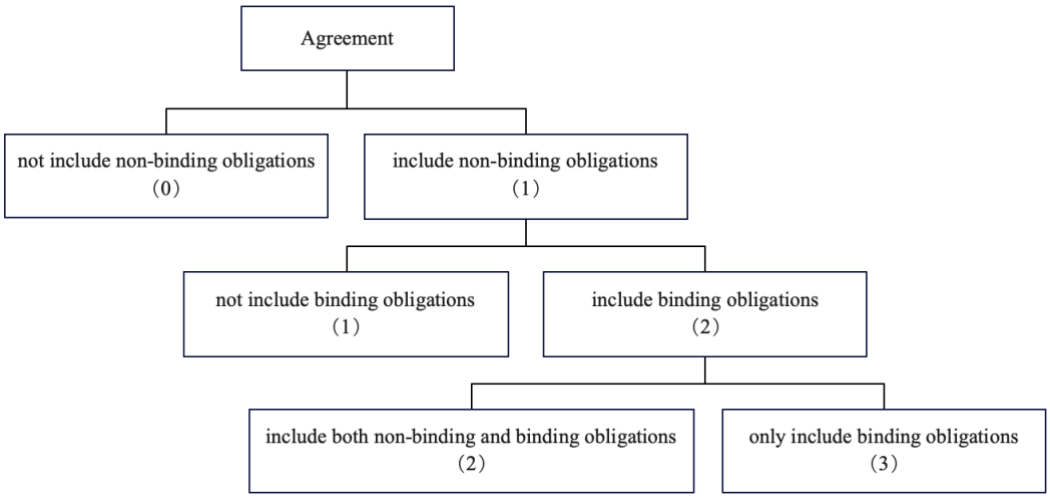
According to the impact mechanisms in Chapter 3, there are roughly 3 levels of FTA digital trade rules in trade promotion, data flow, and privacy protection that can have an impact on bilateral digital trade. However, due to the large number of specific digital trade provisions in the TAPED database, it is discovered that each level of rules contains provisions with different focuses. To avoid statistical errors caused by using too broad independent variables, this study further divides trade promotion, data flow, and privacy protection rules according to different focuses. Thus, it constructs WTO supplement, trade facilitation, cross-border data flow, data flow condition, personal data protection, online consumer protection as 6 core explanatory variables.

There is no agreement on the optimum way to evaluate digital trade rules because there are so many diverse channels. Ideally, to test the hypothesis, researchers should be able to examine how the presence or absence of FTA digital trade rules and the extent to which it is effective affects digital trade exchanges between signatory countries. And fortunately, the textual quantification approach for FTA digital trade rules in the TAPED database can mainly meet the need to test the hypotheses, hence it was used in this work. The dataset evaluates and assigns values to all coded clauses based on their "extent of legalization"[1], distinguishing between "soft", "mixed legalization", and "hard". The specific method is as follow (Figure 3): First, whether the agreement includes non-binding obligations? If the answer is no, the value is 0; if the answer is yes, the value is 1. Second, if the agreement includes non-binding obligations, then whether it

[1] Mira Burri, Maria Vasquez Callo-Müller, & Kholofelo Kugler. (2022). *TAPED codebook*. University of Lucerne.
https://www.unilu.ch/fileadmin/fakultaeten/rf/burri/TAPED/Codebook_TAPED_Burri_Vasquez_Polanco_Jan2022.pdf

includes binding obligations? If the answer is no, the value is 1; if the answer is yes, the value is 2. Third, in the case that the agreement includes binding obligations, whether all the obligations are binding? If both binding and non-binding obligations are included, the value is 2; If only binding obligations are included, the value is 3.

Figure 3. Quantification of FTA digital trade rules



Source: TAPED Dataset Codebook (2022/01/25).

This study firstly constructs 3 first-level indicators, which represent the basic FTA digital trade rules of three levels. The 6 second-level indicators are further subdivided, and important terms in the TAPED dataset are classified into the second-level indicators in order according to their different focuses (Table 4). After the classification is completed, the values of the 6 core explanatory variables are acquired by calculating the arithmetic average of the quantitative terms assigned to the same level of indicators.

For any year in the sample period, if there is no FTA in force between the exporting and importing countries, the indicator takes the value of 0. If there is an FTA in force between the two countries, the corresponding indicator is calculated as above, but the indicator takes the value of 0 in the year when the FTA comes into force. If there are more than one FTA in force between the two countries, the maximum value is taken among all FTAs.

Table 4. Measurement of FTA digital trade rules

1st Indicator	2nd Indicator	Clause
Trade Promotion	WTO Supplement	(1) [ec_wto_1_1_4] Does the agreement mention the applicability of WTO rules to e-commerce? (2) [ec_non_imposition_duty_1_4_1] Is there a provision on the non-imposition of custom duties? (3) [ec_duty_custom_value_1_4_2] Does the agreement include a provision on custom value of carrier mediums? (4) [ec_nt_1_2_1] Does the agreement provide for national treatment (NT) in e-commerce? (5) [ec_mfn_1_2_2] Does the agreement provide for most-favored-nation (MFN) treatment in e-commerce? (6) [ec_ser_ma_nt_crs_1_2_3_1] Are there services (and investment) market access (MA) and NT commitments for the computer and related services (CRS) sector needed for e-commerce? (7) [ec_ser_ma_nt_tel_1_2_3_2] Are there services (and investment) market access (MA) and NT commitments for the telecommunications sector needed for e-commerce? (8) [ec_ser_ma_nt_fin_1_2_3_3] Are there services (and investment) market access (MA) and NT commitments for the financial services sector needed for e-commerce? (9) [ec_ds_yes_1_14_1]Does the dispute settlement mechanism apply to e-commerce/digital trade provisions and in particular the core provisions on non-discrimination and customs duties?
	Trade Facilitation	(1) [ec__consistency_uncitral_1_5_1] Does the agreement include a provision on the consistency of the domestic legal framework with the UNCITRAL MLEC 1996? (2) [ec__consistency_unecc_1_5_2] Does the agreement include a provision on the consistency of the domestic legal framework with the UNECC? (3) [ec_paperless_trade_1_6_1] Does the agreement include a provision on paperless trading? (4) [ec_signatures_certificates_1_5_5] Does the agreement include provisions on electronic authentication, electronic signatures or digital certificates? (5) [ec_barriers_1_5_6] Does the agreement mention avoiding unnecessary barriers to e-commerce, or to minimize the regulatory burden on e-commerce (usually under Domestic Electronic Transaction Framework)? (6) [ec_custom_automat_1_6_3] Does the agreement contain a provision on customs procedures automatization?

Data Flow	Cross-border Data Flow	(1) [data_free_flow_prov_2_2_1] Does the e-commerce/digital trade chapter include a provision on the free movement of data? (2) [data_flo_mech_barrier_2_2_2] Does the e-commerce chapter contain a mechanism to address barriers to data flows? (3) [data_flow_free_mov_outside2_3_1] Does the agreement include a provision on the free movement of data outside the dedicated e-commerce/digital trade chapter? (4) [data_flow_mech_barr_outside_2_3_2] Does the agreement include a mechanism to address barriers to data flows outside the dedicated e-commerce/digital trade chapter? (5) [data_flow_telco_2_4_1] Is there any reference to the transfer of data or data flows in the telecommunications chapter/provisions? (6) [data_flow_crs_2_4_2] Is there any reference to the transfer of data or data flows in computer and related services (CRS) chapter/provisions? (7) [data_flow_audiovisual_2_4_3] Is there any reference to the transfer of data or data flows in audiovisual chapter/provisions? (8) [data_flow_fin_ser_2_4_4] Is there any reference to the transfer of data or data flows in the financial services chapter/provisions? (9) [ip_data_flows_5_20] Does the agreement include provisions on data flows in the IP chapter?
	Data Flow Condition	(1) [data_flow_proh_loc_2_2_3] Does the e-commerce chapter contain a provision banning or limiting data localization requirements? (2) [data_flo_lim_proh_loc_2_3_3] Does the agreement include a provision banning or limiting data localization requirements outside the dedicated ecommerce/digital trade chapter? (3) [ec_source_code_1_9_1] Does the agreement include prohibitions to require the transfer of, or access to, source code of software owned by a person, as a condition for the import, distribution, sale or use of such software? (4) [ec_prov_cybersec_1_10_1] Does the agreement include provisions on cybersecurity? (5) [data_egov_open_data_2_5_2] Does the agreement include a provision on open government data or open data? (6) [data_innovation_2_6_1] Does the agreement contain a provision referring to data innovation, allowing data to be shared and reused?

Privacy Protection	Personal Data Protection	(1) [data_prot_prov_2_1_1] Does the agreement include provisions on data protection? (2) [data_prot_no_qualifications_2_1_2] Does the agreement include provisions on data protection with no qualifications? (3) [data_prot_domestic_law_2_1_3] Does the agreement include provisions on data protection according to domestic law? (4) [data_prot_princ_2_1_4] Does the agreement include provisions on data protection recognizing certain key principles? (5) [data_prot_int_standards_2_1_5] Does the agreement include provisions on data protection recognizing certain international standards? (6) [data_prot_least_rest_meas_2_1_6] Does the agreement include provisions on data protection as a least restrictive measure?
	Online Consumer Protection	(1) [ec_consumer_protection_1_7_1] Does the agreement include provisions on consumer protection? (2) [ip_liability_isp_5_13] Does the agreement include provisions on the liability of Internet Service Providers (ISP)? (3) [ec_spam_1_7_2] Does the agreement include provisions on Unsolicited Commercial Electronic Messages? (4) [ec_internet_principles_1_8_1] Does the agreement include Principles on Access to and Use of the Internet for e-commerce? (5) [ec_net_neutral_1_8_2] Does the agreement include provisions on net neutrality? (6) [ec_ip_1_3_4] Does the agreement include provisions that reconcile e-commerce with intellectual property (IP)?

Note: [ ] shows the specific code of the clause in TAPED dataset.
Source: TAPED Dataset (2022/01/25).

In order to assure the accuracy of the independent variable measurement, the reliability of the clauses under each indicator was next tested using Cronbach's alpha method, and the results are shown in Table 5. Cronbach's alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. After reliability test, some of the clauses are remained as follows when the Cronbach's Alpha no longer becomes larger after deleting any clause. These retained clauses are considered to collectively represent the core explanatory variables at the same level and thus can perform further analysis.

Table 5. Reliability Test

1st Indicator	2nd Indicator	Clause Code	Cronbach's Alpha
Trade Promotion	WTO Supplement	ec_wto_1_1_4 ec_non_imposition_duty_1_4_1 ec_ser_ma_nt_tel_1_2_3_2 ec_ser_ma_nt_fin_1_2_3_3 ec_ds_yes_1_14_1	0.978
	Trade Facilitation	ec__consistency_uncitral_1_5_1 ec_paperless_trade_1_6_1 ec_signatures_certificates_1_5_5 ec_barriers_1_5_6 ec_custom_automat_1_6_3	0.879
Data Flow	Cross-border Data Flow	data_flow_free_mov_outside2_3_1 data_flow_telco_2_4_1 data_flow_crs_2_4_2 data_flow_audiovisual_2_4_3 data_flow_fin_ser_2_4_4	0.93
	Data Flow Condition	data_flow_proh_loc_2_2_3 data_flo_lim_proh_loc_2_3_3 ec_source_code_1_9_1 ec_prov_cybersec_1_10_1	0.932
Consumer Protection	Personal Data Protection	data_prot_prov_2_1_1 data_prot_domestic_law_2_1_3 data_prot_int_standards_2_1_5 data_prot_least_rest_meas_2_1_6	0.854
	Online Consumer Protection	ec_consumer_protection_1_7_1 ip_liability_isp_5_13 ec_spam_1_7_2	0.82

4.3. Control Variables

Several variables are included to control for GDP, trade distance, common borders, common language, and the impact of digital infrastructure.

GDP_{it} and GDP_{jt} represent the GDP of the export and import country respectively to control the economic size of the two countries, using real GDP in current US dollars from the World Bank

database. GDP is an essential key variable in the gravity model, which means that two wealthy countries may have stronger trade exchanges with each other.

$Distwces_{ij}$ uses the population-weighted geographic distance provided by CEPII, which is particularly applicable to the trade gravity model. According to the new economic geography theory, the "iceberg transportation cost" is directly related to the geographical distance. The closer the geographical distance, the lower the iceberg transportation cost, which means that bilateral geographical distance can hinder international trade.

$Contig_{ij}$ is a dummy variable indicating whether the country shares a common border with its trading partner, which takes the value of 1 if the two countries share a border and 0 otherwise. Whether two countries share a border illustrates not only their physical separation but also their cultural separation. Two countries that are spatially and culturally close are more likely to agree to trade.

$Comlang_{ij}$ is a dummy variable indicating whether the country and its trading partner have a common official language, which takes the value of 1 if the two countries have the same official language and 0 otherwise. A common language will lower the communication costs of micro-participants in digital trade, such as businesses and users, and facilitate the growth of digital trade.

ICT_{it} and ICT_{jt} use the data of Fixed broadband subscriptions per 100 inhabitants from ITU to show the digital infrastructure condition of export and import countries. Digital infrastructure is a requirement for digital trade, and the availability of the Internet may affect digital trade by influencing its transmission medium.

4.4. Model Construction

Based on the gravity model and the characteristics of digital trade, the empirical model is constructed as follow:

$$lnEXP_{ijt}=\beta_0+\beta_1 \underset{\text{Data Flow Condition, Personal Data Protection, Online Consumer Protection）}}{\textbf{FTA（WTO Supplement, Trade Facilitation, Cross border Data Flow,}}_{ijt}$$
$$+\beta_2 lnGDP_{it}+\beta_3 lnGDP_{jt}+\beta_4 lnDistwes_{ij}+\beta_5 Contig_{ij}+\beta_6 Comlang_{ij}+\beta_7 ICT_{it}+\beta_8 ICT_{jt}$$
$$+\lambda_i+\lambda_j+\lambda_t+\varepsilon_{ijt}$$

The variable subscripts i, j, t represent the export country, import country, and year. The explained variable $lnEXP_{ijt}$ represents the logged value of digital trade export from country i to country j in year t. $WTO\ Supplement_{ijt}$, $Trade\ Facilitation_{ijt}$, $Cross\ border\ Data\ Flow_{ijt}$, $Data\ Flow\ Condition_{ijt}$, $Personal\ Data\ Protection_{ijt}$, $Online\ Consumer\ Protection_{ijt}$ are the core explanatory variable reflecting the depth of heterogeneous FTA digital trade rules between countries. $lnGDP_{it}$, $lnGDP_{jt}$ are the logged real GDP of the export country and the import country in year t, working as the control variables for the market size of the two countries. $lnDistwces_{ij}$ is the logged weighted geographical distance between the two countries. $Contig_{ij}$ is a dummy variable that indicates whether the two countries share a border. $Comlang_{ij}$ is a dummy variable that indicates whether the two countries' official languages are the same. These three are used to capture the direct costs of bilateral trade and are the main control variables in the traditional gravity model. In addition, the control variables ICT_{it}, ICT_{jt} are added to reflect the digital infrastructure of the export country and the import country in year t. β_0, β_1, β_2, β_3, β_4, β_5, β_6, β_7, β_8 are the estimated parameters. λ_i, λ_j, λ_t are the exporting country, importing country, and year fixed effects. ε_{ijt} is the stochastic disturbance.

4.5. Descriptive Statistics

The sample size for this study is 1890, except for the importing countries' digital infrastructure data. Table 6 shows the descriptive statistics of the variables in the model. Due to the presence of 0 values for $Contig_{ij}$, $Comlang_{ij}$, $WTO\ Supplement_{ijt}$, $Trade\ Facilitation_{ijt}$, $Cross\ border\ Data\ Flow_{ijt}$, $Data\ Flow\ Condition_{ijt}$, $Personal\ Data\ Protection_{ijt}$, $Online\ Consumer\ Protection_{ijt}$, and the small values for ICT_{it} and ICT_{jt}, only variables other than common border,

common official languages, digital infrastructure, and core explanatory variables are logged in the regression.

Table 6. Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Max	Min
$lnEXP_{ijt}$	1890	4.565	2.094	10.160	0.114
$WTO\_Supplement_{ijt}$	1890	0.577	1.136	3.000	0.000
$Trade\_Facilitation_{ijt}$	1890	0.214	0.440	2.000	0.000
$Cross\_border\_Data\_Flow_{ijt}$	1890	2.606	0.884	3.000	0.000
$Data\_Flow\_Condition_{ijt}$	1890	0.019	0.193	2.500	0.000
$Personal\_Data\_Protection_{ijt}$	1890	0.311	0.711	2.750	0.000
$Online\_Consumer\_Protection_{ijt}$	1890	0.257	0.601	2.667	0.000
$lnGDP_{it}$	1890	28.700	0.804	30.290	27.564
$lnGDP_{jt}$	1890	25.884	1.749	30.342	22.487
$lnDistwces_{ij}$	1890	8.844	0.577	9.811	6.907
$Contig_{ij}$	1890	0.586	0.493	1.000	0.000
$Comlang_{ij}$	1890	0.048	0.213	1.000	0.000
ICT_{it}	1890	28.923	9.644	42.008	2.862
ICT_{jt}	1868	18.441	13.279	44.683	0.013

Chapter 5. Empirical Results

5.1. Regression Method

Three types of models are often used in empirical studies of panel data, including mixed-effects models, fixed-effects models, and random-effects models. The F-test is usually used to determine the choice of mixed-effects model or fixed-effects model, and then the Hausman test is used to determine the choice of fixed-effects model or random-effects model.

According to the F test results shown in Table 7, the P-value of the F test for all variables is less than 0.01, and the original hypothesis that the mixed-effects model is superior to the fixed-effects model is rejected at the 1% significance level, indicating that the fixed-effects model should be used.

According to the results of the Hausman test shown in Table 7, the P-value of the Hausman test for all variables is less than 0.01, rejecting the original hypothesis that the fixed-effects model is not significantly different from the random-effects model at the 1% significance level. The conclusion obtained from the estimation using the random-effects model in this case may be biased, so the fixed-effects model should be used.

Table 7. F test and Hausman test

	Stats	P value
F test	223.97	0.0000
Hausman test	88.72	0.0000

5.2. Baseline Results

Table 8. Regression results of two-way fixed effect model

		(1)	(2)	(3)	(4)
	$WTO\_Supplement_{ijt}$	0.038	0.034	0.034	0.028
Trade		(0.044)	(0.044)	(0.045)	(0.046)
Promotion	$Trade\_Facilitation_{ijt}$	0.245***	0.256***	0.239**	0.229**
		(0.094)	(0.094)	(0.097)	(0.100)
	$Cross\_border\_Data\_Flow_{ijt}$	0.143***	0.133***	0.144***	0.160***
Data		(0.049)	(0.049)	(0.051)	(0.053)
Flow	$Data\_Flow\_Condition_{ijt}$	-0.077	-0.075	-0.029	-0.021
		(0.056)	(0.056)	(0.057)	(0.058)
	$Personal\_Data\_Protection_{ijt}$	-0.016	-0.029	-0.019	0.004
Privacy		(0.061)	(0.061)	(0.062)	(0.065)
Protection	$Online\_Consumer\_Protection_{ijt}$	0.098**	0.102**	0.088*	0.078
		(0.046)	(0.046)	(0.047)	(0.049)
	$lnGDP_{it}$	0.482***	0.475***	0.454***	0.415***
		(0.053)	(0.053)	(0.064)	(0.074)
	$lnGDP_{jt}$	0.525***	0.550***	0.530***	0.488***
		(0.055)	(0.056)	(0.061)	(0.068)
	$lnDistwces_{ij}$	0.193	0.172	0.114	0.038
		(0.212)	(0.215)	(0.225)	(0.236)
	$Contig_{ij}$	-0.303***	-0.301***	-0.319***	-0.337***
		(0.027)	(0.027)	(0.028)	(0.029)
	$Comlang_{ij}$	0.145	0.137	0.124	0.103
		(0.098)	(0.098)	(0.103)	(0.107)
	ICT_{it}	0.006	0.005	0.012**	0.021***
		(0.005)	(0.005)	(0.006)	(0.006)
	ICT_{jt}	0.000	-0.001	-0.001	-0.003
		(0.003)	(0.003)	(0.004)	(0.005)
	Constant	-25.019***	-25.224***	-23.865***	-21.319***
		(2.732)	(2.749)	(3.000)	(3.277)
	i fixed	Yes	Yes	Yes	Yes
	j fixed	Yes	Yes	Yes	Yes
	year fixed	Yes	Yes	Yes	Yes
	N	1868	1868	1743	1618
	R^2	0.277	0.039	0.398	0.0478

Note: Values in parentheses are standard errors. *, **, *** represent statistical significance at the 10%, 5% and 1% level. Where not otherwise specified, the explanatory variable is $lnEXP_{ijt}$.

The result estimated by fixed-effects model is shown in column (1) of Table 8. According to the regression result of core explanatory variables, the coefficients of *Trade Facilitation*$_{ijt}$ and *Cross-border Data Flow*$_{ijt}$ are significantly positive at 1% level, whereas that of *Online Consumer Protection*$_{ijt}$ is significantly positive at 5% level. However, the coefficients for *WTO Supplement*$_{ijt}$, *Data Flow Condition*$_{ijt}$, *Personal Data Protection*$_{ijt}$ are found insignificant.

Thus, Hypothesis 1 (Trade Promotion Hypothesis) listed in this research shows both satisfactory and frustrating verification results. One the one hand, the significant positive effect of the trade facilitation provisions in digital trade rules to digital trade export is strongly supported. As is shown in the regression result, provided other variables stay the same, digital trade export can increase 0.245 units on average as trade facilitation rises 1 unit. Same with other forms of trade, trade facilitation measures like paperless trade, electronic certification and automatic Customs procedures can remove trade barriers and thus stimulate trade exports. On the other hand, no statistical evidence shows that the WTO supplement provisions in digital trade rules could bring positive effect to digital trade export. Although such provisions are included in FTA, they are substantially a continuing and deepening of the multilateral rules at the WTO level. Temporary tariff suspension measure is largely accepted by member states since it is confirmed by WTO. The principles of market access, national treatment and dispute settlement are also the basic principles of international trade agreed upon by all the member states. Thus, as basic policy condition shared by trading partners, WTO supplement provision may not have a statistical impact on the change of actual trade volume.

The verification results of Hypothesis 2 (Data Flow Hypothesis) in this research are mixed. On the one hand, the significant positive effect of cross-border data flow provisions in data flow rules on digital trade export is strongly supported. As is shown in the regression result, when other variables remain unchanged, every 1 unit increase of cross-border data flow will increase digital trade export by 0.143 units on average. Cross-border data flow is crucial to digital trade by playing

a role of prerequisite. By providing policy basis for safeguarding free cross-border data transmission for digital trade-related industries including telecommunication, computer and related services, audio-visual and financial services with FTA digital trade rules, digital trade export can be enhanced as the competitiveness of digital trade is highlighted. On the other hand, no statistical evidence shows that data flow condition provisions in data flow rules have an effect on digital trade export. This is because of the different positions on data localization and disclosure of source code measures between developed and developing countries. Developed countries are trying to reduce the economic costs of multinational enterprises in ICT industry by making data localization and source code disclosure prohibitions mandatory for digital trade with trading partners. In contrast to the position of developed countries, developing countries support necessary data localization and original code disclosure measures under public policy targets in order to keep the interests of domestic companies. Therefore, it is not clear how the improved data flow condition provisions will affect digital trade export among trading partners with different levels of economic development due to their different positions.

The verification results of Hypothesis 3 (Privacy Protection Hypothesis) in this research are also both satisfactory and frustrating. On the one hand, the significant positive effect of online consumer protection provisions in privacy protection rules on digital trade export is strongly supported. As is show in the regression results, when other variables remain unchanged, digital trade export will increase by 0.098 units on average for every 1 unit increase in online consumer protection. By protecting personal information through solving the problem of improper collection and use of consumer information by companies with FTA digital trade rules, the market will have stronger belief and thus digital trade export can be enhanced. On the other hand, no statistical evidence shows that the personal data protection provisions in privacy protection rules have an effect on digital trade export. Personal data is seen as relevant to human rights issue but at the same time is an essential resource element for the operation of digital trade. While

improving consumer trust, personal data protection may also increase costs for enterprises, thus reducing their competitive advantage. Therefore, the impact of the personal data protection provisions on digital trade export can be clear only when we can actually compare the gains and losses of both consumers and enterprises.

When we further study the regression results of control variables, the statistical supports of control variables are also mixed. The coefficient of $lnGDP_{it}$ and $lnGDP_{jt}$ are both significantly positive, which shows that the market size of trading participants has significant enhancing effect to bilateral digital trade, supporting the Gravity Model of international trade. When other variables remain unchanged, digital trade export will increase by 0.482 units on average for every 1 unit increase in the lnGDP of the exporting country and 0.525 units for every 1 unit increase in the lnGDP of the importing country. The result shows that richer countries tend to have digital trade frequently. The coefficients of $lnDistwces_{ij}$, $Comlang_{ij}$, ICT_{it}, ICT_{jt} are all insignificant. No statistical evidence shows that geographical distance, common official language, and digital infrastructure are related to bilateral digital trade. Negative coefficient of $Contig_{ij}$ shows that whether the exporting country and the importing country share a common border has a significant inhibitory effect on bilateral digital trade, and countries are more inclined to conduct digital trade with partners that are not geographically and culturally adjacent.

It can be found that except economic scale, the regression results of other control variables are different from the theoretical prediction of the traditional Gravity Model, which may be because digital trade relies more on emerging information and communication technologies such as artificial intelligence than traditional trade. The growing popularity of the Internet can help people overcome physical distance, facilitate communication channels, and reduce transaction costs. Thus, distance, language and network will no longer be the negative factors to trade. The traditional mode of border trade will also change. Because for digital trade, consumers are more willing to buy goods which cannot be bought in normal border trade through the Internet.

5.3. Robustness Test

5.3.1. Top and bottom 1% shrinkage

This study further considers the effect of outliers due to the serious interference that data outliers may have on the estimation results. Specifically, this study shrinks all continuous variables except for common border and common official language who are dummy variables at the 1% and 99% quartiles, and then re-estimates them with the shrunken sample. The regression results are reported in column (2) of Table 8, and a comparison with the baseline regression results reveals that the regression results remain consistent after the 1% shrinkage.

The coefficients of $Trade\ Facilitation_{ijt}$, $Cross\ border\ Data\ Flow_{ijt}$ are significantly positive at 1% level, while the coefficient of $Online\ Consumer\ Protection_{ijt}$ is significantly positive at 5% level, and the coefficients do not vary much in magnitude. It indicates that trade facilitation, cross-border data flow, and online consumer protection provisions still have a significant positive effect on digital trade export. The coefficients of $WTO\ Supplement_{ijt}$, $Data\ Flow\ Condition_{ijt}$, $Personal\ Data\ Protection_{ijt}$ are all insignificant. This indicates that there is still no statistical evidence showing that WTO supplement, data flow condition and personal data protection provisions have an impact on digital trade export. Therefore, the regression results are not affected by outliers and the model is robust.

5.3.2. Reclassify sample period

Implementing relevant provisions in FTAs is a time-consuming process, which needs to influence bilateral trade by changing the trade conditions. Therefore, there may be a time lag in the response of trade flows to trade policies. For example, trade in services cannot fully adjust to the implementation of FTA within one year (Cheng and Wall, 2005). In order to exclude the influence of time lag, this study treats the sample period with a one-period lag and re-conduct regression based on them. The regression results are reported in column (3) of Table 8.

The coefficients of *Trade Facilitation*$_{ijt}$, *Cross border Data Flow*$_{ijt}$ and *Online Consumer Protection*$_{ijt}$ are significantly positive, and the coefficients do not vary much in magnitude. It indicates that trade facilitation, cross-border data flow, and online consumer protection provisions still have a significant positive effect on digital trade export. The coefficients of *WTO Supplement*$_{ijt}$, *Data Flow Condition*$_{ijt}$ and *Personal Data Protection*$_{ijt}$ are all insignificant. This indicates that there is still no statistical evidence showing that WTO supplement, data flow condition and personal data protection provisions have an impact on digital trade export. Therefore, the regression results of the model are robust.

The increase of FTA digital trade rules depth promotes digital trade, and the increase of digital trade in turn influences the evolution of FTA digital trade rules. That is, the greater the trade flow between countries, the easier it may be to sign an agreement. In order to avoid the bias caused by such reverse causality, this study treats the sample period with a two-period lag and re-conduct regression based on them. The regression results are reported in column (4) of Table 8.

The coefficients of *Trade Facilitation*$_{ijt}$, *Cross border Data Flow*$_{ijt}$ are significantly positive, and the coefficients do not vary much in magnitude. It indicates that trade facilitation and cross-border data flow provisions still have a significant positive effect on digital trade export. The coefficients of *WTO Supplement*$_{ijt}$, *Data Flow Condition*$_{ijt}$ and *Personal Data Protection*$_{ijt}$ are all insignificant. This indicates that there is still no statistical evidence showing that WTO supplement, data flow condition and personal data protection provisions have an impact on digital trade export. It is noteworthy that the coefficient of *Online Consumer Protection*$_{ijt}$ changes from significant to insignificant after a two-period lag. However, by observing the baseline regression results, the significance of the coefficient of *Online Consumer Protection*$_{ijt}$ is inherently much weaker than the other core explanatory variables. Therefore, the insignificance after reclassifying the sample period is also acceptable. In general, the regression results of the model are robust.

5.4. Heterogeneity Analysis

This study empirically analyzed the effect of digital trade rules on the digital trade export based on baseline regression and robustness test, and amongst which, trade facilitation, cross-border data flow and online consumer protection provisions can significantly improve the export scale of digital trade in China, Japan and South Korea, while the effects of WTO supplementary, data flow condition and personal data protection provisions are not significant. Hereafter, the study will explore the heterogeneous effect of three levels and six specific types of digital trade rules in FTA on the digital trade export of China, Japan and South Korea from the perspective of countries or regions.

In order to further analyze the heterogeneous effect of digital trade rules in FTA signed by China, Japan and South Korea, this study divides the trading partners of the three countries into developed countries and developing countries, then verifies the heterogeneous effect of the digital trade rules in FTA on the digital trade export of developed countries and developing countries. As is shown in the regression results in Table 9, in the FTAs signed by China, only the WTO supplement provisions can significantly increase its scale of digital trade export to developing countries. Whereas in the FTA signed by Japan, only the WTO supplement provisions can significantly increase the scale of its digital trade export to developed countries, and the personal data protection provisions can on the 10% significance level inhibit its export to developed countries. Regarding the FTAs signed by South Korea, when the counterpart is a developed country, cross-border data flow, data flow condition and online consumer protection provisions significantly increase its digital trade export to developed countries. Whereas when the counterpart is a developing country, only data flow condition provisions significantly increase its export to those countries, and the online consumer protection provision shows its inhibitory effect on developing country digital trade exports at the significance level of 5%.

Table 9. Regression results of heterogeneity analysis

	China-developing	China-developed	Korea-developing	Korea-developed	Japan-developing	Japan-developed
$WTO\_Supplement_{ijt}$	0.073**	0.000	0.552	0.110	-0.124	0.154**
	(0.037)	(.)	(0.385)	(0.073)	(0.147)	(0.078)
$Trade\_Facilitation_{ijt}$	0.000	0.000	-1.114	0.000	0.332	0.000
	(.)	(.)	(0.767)	(.)	(0.613)	(.)
$Cross\_border\_Data\_Flow_{ijt}$	0.051	0.000	0.436	0.766***	-0.170	0.000
	(0.189)	(.)	(0.384)	(0.206)	(0.199)	(.)
$Data\_Flow\_Condition_{ijt}$	0.000	0.000	2.726**	4.231***	0.432	0.026
	(.)	(.)	(1.093)	(1.500)	(0.289)	(0.136)
$Personal\_Data\_Protection_{ijt}$	-0.096	0.000	0.134	0.002	-0.713	-0.199*
	(0.180)	(.)	(0.233)	(0.129)	(0.661)	(0.114)
$Online\_Consumer\_Protection_{ijt}$	0.329	0.172	-1.116**	0.849***	0.032	0.008
	(0.411)	(0.115)	(0.545)	(0.191)	(0.087)	(0.161)
$lnGDP_{it}$	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)
$lnGDP_{jt}$	0.216**	0.090	0.191**	0.401***	0.142	0.798***
	(0.087)	(0.319)	(0.077)	(0.131)	(0.089)	(0.111)
$lnDistwces_{ij}$	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)
$Contig_{ij}$	-0.151*	0.002	0.067	0.164*	0.022	-0.004
	(0.078)	(0.146)	(0.068)	(0.092)	(0.049)	(0.111)
$Comlang_{ij}$	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)
ICT_{it}	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)
ICT_{jt}	0.013**	0.095***	0.012*	0.014**	-0.017**	0.003
	(0.006)	(0.019)	(0.007)	(0.006)	(0.009)	(0.005)
Constant	-0.844	-0.248	-2.923	-8.823**	2.109	-15.953***
	(2.295)	(8.126)	(2.029)	(3.447)	(2.353)	(2.940)
i fixed	Yes	Yes	Yes	Yes	Yes	Yes
j fixed	Yes	Yes	Yes	Yes	Yes	Yes
year fixed	Yes	Yes	Yes	Yes	Yes	Yes
N	281	59	319	524	221	464
R^2	0.0728	0.4704	0.139	0.0752	0.0735	0.1298

Note: Values in parentheses are standard errors. *, **, *** represent statistical significance at the 10%, 5% and 1% level. Where not otherwise specified, the explanatory variable is $lnEXP_{ijt}$.

The digital trade rules in the FTAs signed by China bring minimal level of impact to digital trade export, which also confirms the conclusion mentioned above that China is just taking the first step in the participation in regional and global digital trade rules. The fact that its digital industry structure is weak, the digital trade system structure is unreasonable, and there is a lack of perfect digital supervision mechanism in China renders the signing of high-level digital trade rules not functional to the promotion of bilateral digital trade. It is worthy to mention that WTO supplement provisions can significantly increase the scale of China's digital trade export to developing countries, which shows that WTO E-commerce negotiations are still an effective way for developing countries to participate in the formulation of international digital trade rules, which is also fully proved by the empirical results of the WTO supplement provisions included in the FTA signed by Japan.

Developed countries are in a leading position in the formulation of global digital trade rules, and due to the sound digital infrastructure and industrial regulatory environment of developed countries, digital trade rules can more promote the flow of digital trade among developed countries. South Korea started the construction of digital infrastructure earlier and has the highest degree of digitalization. In 2000, the Internet usage rate of China, Japan and South Korea was 1.8%, 30% and 44.7% respectively (Wang et al., 2022). This can also explain that the data flow rules involved in the FTA signed by South Korea promoted South Korea's digital trade export significantly. When it comes to privacy protection rules, personal data protection provisions could have a negative impact on the ability for developed countries to obtain data, and thus brings negative effect to the digital trade export of Japan to developed countries. South Korea has been implementing relatively strict online consumer protection provisions, which will boost consumer's confidence for developed countries and thus promote digital trade exports, while for developing countries, it may increase the cost of data resources and thus reduce digital trade exports.

Chapter 6. Conclusion and Policy Recommendation

6.1. Conclusion

The study develops a classification system for FTA digital trade rules and proposes three hypotheses regarding the impact of each of 3 major categories, including trade promotion, data flow, and privacy protection, of digital trade rules on digital trade exports. For the actual measurement, as the specific provisions in each category of digital trade rules possess different attributes, 6 digital trade provision indicators are further constructed after conducting the reliability test, including WTO supplement, trade facilitation, cross-border data flow, data flow condition, personal data protection, and online consumer protection, who are quantified based on the TAPED dataset. This study empirically evaluates the effect of FTA digital trade rules on digital trade exports using data on China, Japan, and South Korea's digital trade exports to 65 economies whose FTAs were signed from 2005 to 2019 through a gravity model.

The estimation results of the control variables reveal that, first, the trading country's economic size has a significant positive effect on bilateral digital trade. This is the same conclusion reached by the traditional gravity model, which has not failed. The possible reason is that, while economic size has less influence on digital trade, digital trade may face another type of size constraint, namely the degree of digital equipment in trade participating countries. On the production side, digital trade is free of physical factor constraints, but it has more stringent requirements for digital infrastructure such as Internet and cloud platforms. On the demand side, the development of digital trade is heavily reliant on the local penetration of the Internet, and thus on the total number of Internet users in the economy.

Second, there is insufficient evidence to suggest that geographical distance and common language are related to bilateral digital trade, and that common borders have a significant negative

effect on bilateral digital trade. This contrasts with the traditional gravity model's conclusion, which may fail. Geographical distance represents the actual transportation distance between countries, whereas common border and language represent the implicit cultural distance between them. Because of zero transportation costs, digital trade can get rid of geographical distance limitations and change the global layout of digital trade. Digital trade may also prevent consumers from seeking common ground when purchasing from countries with similar cultures, leading them to prefer digital products from different cultures.

The estimation results of the core explanatory variables reveal that the verification results of all three hypothesis in this study are mixed. Trade facilitation, cross-border data flow, and online consumer protection provisions have a significant positive effect on digital trade export. There is no statistical evidence showing that WTO complementation, data flow condition, and personal data protection provisions have an impact on digital trade export.

Following the results of heterogeneity analysis, it is discovered that among the FTAs signed by China, only the WTO supplement provisions can significantly increase its exports of digital services to developing countries. Among the FTAs signed by Japan, only the WTO supplement provisions can significantly increase its exports of digital services to developed countries, and the personal data protection provisions show their inhibiting effects on its exports to developed countries. In the FTA signed by South Korea, the data flow rules significantly increase its exports to both developed and developing countries. The online consumer protection provisions have a promoting effect on South Korea's exports to developed countries, but has an inhibiting effect on its exports to developing countries. It shows that, despite the higher standard of the US template, it does not promote digital trade as strongly as the Asian template in East Asia area.

6.2. Policy Recommendation

In theory, the ideal FTA digital trade rules should meet the following criteria. First, creating

a digital trade facilitation environment and ensuring the security of personal privacy to increase the confidence of micro-entities in digital trade. Second, on the premise of ensuring national economic security, removing trade barriers such as mandatory data localization to promote the free flow of data across the borders. Third, because the Internet is both a global public good and subject to national sovereignty, global digital trade rules should effectively reduce the negative spillover for domestic regulation by encouraging regulatory cooperation among sovereign states. However, the high-level digital trade rules have a dual impact on many issues. On the one hand, high level rules facilitate intra-regional trade and aid in the process of regional economic integration. On the other hand, some high-level rules extend their tentacles to the parties' domestic governance, which have an impact on a country's domestic economic policies. Therefore, the direction and magnitude of the impact of high-level digital trade rules on digital trade remains to be tested in the data.

Although signing high-standard FTA digital trade rules is an important step for each country to participate in the formulation of global digital trade norms, the level of rules included in FTA negotiations should vary according to the trading partner countries and the attributes of the provisions. Countries should continue to improve the depth of all digital trade rules, including trade promotion, data flow, and privacy protection rules, to promote digital trade exports. China should actively participate in WTO e-commerce discussions, advance the growth of the multilateral trading system, and pay closer attention to the concerns of developing countries in digital trade while strengthening the "East Asian mode" digital trade rules. Japan should actively pursue digital trade rules cooperation with developed countries, while remaining cautious in signing personal data protection provisions. South Korea should continue to promote the development of data flow rules with both developed and developing countries, as well as strengthen the study of online consumer protection provisions, in order to improve the comprehensiveness of digital trade rules.

Multilateral trade negotiations are currently struggling, and digital trade negotiations are one of the few multilateral negotiations still ongoing in the WTO. On the one hand, countries should strive for regulatory convergence and lower digital trade barriers as much as possible through multilateral or plurilateral channels. On the other hand, they should also present their fundamental interests based on their national circumstances, such as maintaining domestic cyber security, protecting personal privacy, and safeguarding developing countries' interests. At the regional and bilateral levels, countries can actively promote the completion of digital trade chapters in ongoing FTA negotiations, as well as include this issue in upgrading negotiations for FTAs that have already been signed but do not include digital trade.

Again, international policy coordination on global cross-border data flow should be strengthened, and multi-channel coordination efforts to promote cross-border data flow should be made. Although digital trade requires a global trade rules framework to be regulated, trade agreements are not always the best platform for regulatory convergence. Exploring new digital trade rules and models that serve global SMEs through private sector-driven platforms such as the World Electronic Trade Platform can also assist developing countries and other stakeholders in more easily accessing global markets and participating in the global economy. Furthermore, the internal regulatory convergence of private business-driven platforms has the potential to reverse the trend of promoting digital trade agreements. So, the key to achieve digital trade rules convergence are reconciling contradictory differences among different subjects and countries on the basis of promoting trade liberalization and safeguarding cybersecurity.

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국문초록

The Gravity Effect of Digital Trade Rules in FTAs

Cases of China, Japan, and South Korea

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글로벌행정전공

디지털무역은 4 차 산업혁명의 산물로서 세계무역 성장의 핵심동력으로 떠올랐다. 디지털무역은 세계무역패턴의 중요한 진화방향일 뿐만 아니라 신흥무역 규칙의 경쟁에서 중요한 위치를 차지한다. 다자간 무역협정이 디지털무역의 급격한 변화에 적응하지 못하면서 디지털무역의 글로벌 거버넌스는 점차 양자 및 지역 간 무역협정으로 전환되고 있다. 현재 FTA 수준의 디지털무역 규칙은 미국, EU 를 비롯한 주요 경제국이 주도하는 규칙들 사이에서 이질성이 뚜렷이 나타나는 “파편화” 상태이다. 다만 북미와 유럽 외에 3 위를 차지하는 동아시아에서도 지역경제 통합과 디지털무역이 빠르게 발전하고 있다는 점은 주목할 필요가 있다. 중국, 일본, 한국 등의 경제국들은 동아시아의 개발특성에 맞는 디지털무역 규칙 템플릿을 적극적으로 생산하고 있어 세계 무역규칙 체계에 보완점을 형성할 것으로 기대하고 있다. 따라서, 본 연구에서는 이러한 디지털무역 규칙이 구체적으로 디지털무역에 어떤 영향을 미치는지 경험적 연구로 살펴보았다.

본 연구는 FTA 디지털무역 규칙을 무역촉진규칙, 데이터 흐름규칙, 프라이버시 보호규칙의 3 가지 범주로 분류하여 3 가지 영향가설을 제시한다. 각 범주의 특정조항은 속성이 다르기 때문에 신뢰성 테스트 후 TAPED 데이터 세트를 사용하여 WTO 보완, 무역 원활화, 국경 간 데이터 흐름, 데이터 흐름 조건, 개인

데이터 보호, 온라인 소비자 보호 6 가지 설명 변수를 추가로 구성하여 정량화한다. 본 연구는 2005-2019 년에 FTA 체결한 65 개 국가와 지역에 대한 중국, 일본, 한국의 디지털무역 수출액을 표본으로 하여 디지털무역 규칙이 디지털무역 수출에 미치는 영향을 중력모형을 이용하여 실증적으로 검증하였다.

추정 결과 무역 원활화, 국경 간 데이터흐름, 온라인 소비자 보호조항이 디지털무역 수출에 통계적으로 긍정적 영향을 미치는 것으로 나타났으나, WTO 보완, 데이터흐름 조건 및 개인데이터 보호조항이 디지털무역 수출에 영향을 미친다는 통계적 증거는 없다. 또한, 전통적인 중력모형에서 경제적 크기의 효과는 여전히 작용하지만, 지리적 거리의 효과는 확인되지 않았다. 국가별 분석 결과를 보면, 디지털무역 수출을 늘리기 위해 중국은 개발도상국과 WTO 보완조항을 체결하는 경향이 있는 반면, 일본은 선진국과 WTO 보완조항을 체결하는 경향이 있는 것으로 나타났다. 한편, 한국은 주로 개발도상국과 데이터흐름 조건조항을 체결하고, 선진국과 데이터흐름 규칙 및 온라인 소비자 보호조항을 체결하는 것으로 나타났다. 높은 수준의 FTA 디지털무역 규칙을 체결하는 것은 각국이 글로벌 디지털무역 규칙 제정에 참여하는 방향이지만, FTA 협상에 수반되는 규칙의 수준과 조항의 선택은 무역 상대국마다 조항마다 차이가 있을 것으로 사료된다.

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