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The Impact of Digital Trade Rules on Services Trade: An Empirical Investigation from the DVA Perspective

Yu Wang[1] | Bin Liu[1,2]

[1]China Institute for WTO Studies, University of International Business and Economics, Beijing, China | [2]School of Government, University of International Business and Economics, Beijing, China

Correspondence: Bin Liu (liubin@uibe.edu.cn)

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ABSTRACT

This paper explores the characteristics and trends of services trade from the perspective of domestic value added (DVA) and examines the impact of digital trade rules on it using bilateral sector-level panel data among 64 economies from 1996 to 2018. Our research reveals distinct trends of expansion, densification, and de-modularization of the international services trade relations among economies. Furthermore, leading services exporters basically maintain their dominant positions, demonstrating a clear first-mover advantage. We then investigated the impact of digital trade rules on the DVA of services trade using multiple empirical methods, which consistently show that the impact is positive. Based on the text analysis method, we find that improving the broadness and depth of digital trade rules can both enhance the DVA of services trade. Finally, the impact of digital trade rules on the DVA of services trade demonstrates heterogeneity, depending on sectoral, economy-specific, and agreement-specific characteristics.

1 | Introduction

The development of digital technology has been continuously facilitating the growth of trade in services. In 2023, services trade accounted for 24.8% of the total international trade.[1] This high proportion underscores the significant role of trade in services. Additionally, in recent years, trade in services demonstrated a higher growth rate compared to trade in goods (Bazaldúa 2021). Especially, despite high energy prices and inflation causing a 1.2% decline in global merchandise trade in 2023, trade in services showed strong resilience by growing 9%.[2] Given the increasing significance, many economies have placed greater emphasis on trade in services and implemented a series of liberalization measures to unleash its growth potential (Briggs and Sheehan 2019). However, as Koval and Levashenko (2020) demonstrated, restrictions in the digital field severely impede the growth of services trade. In this regard, collaborative efforts by both trading parties in the digital field are necessary to remove these restrictions and are expected to positively impact the services trade.

The digital trade rules discussed in this paper refer to free trade agreements (FTAs) signed by economies that contain digital trade chapters or sections.[3] Contents in these chapters or sections could have multiple promotional effects on services trade. Taking the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) as an example, its digital trade provisions can potentially promote services trade through the following channels: (1) Data flow channel: Article 14.11

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(Cross-Border Transfer of Information by Electronic Means) stipulates that "each Party shall allow the cross-border transfer of information by electronic means." Similarly, Article 14.13 (Location of Computing Facilities) mandates that "no Party shall require a covered person to use or locate computing facilities in that Party's territory as a condition for conducting business in that territory." These provisions aim to remove barriers to cross-border data flow. For the services trade, which now primarily relies on digital delivery mode, enhanced data mobility will significantly unlock its growth potential, (2) Trade facilitation channel: Article 14.6 (Electronic Authentication and Electronic Signatures) provides that "a Party shall not deny the legal validity of a signature solely on the basis that the signature is in electronic form." Article 14.9 (Paperless Trading) states that "each Party shall endeavour to make trade administration documents available to the public in electronic form." These provisions can increase the efficiency of services trade by shortening its intermediaries, ultimately promoting its growth, (3) Consumer protection channel: Article 14.7 (Online Consumer Protection) stipulates that "each Party shall adopt or maintain consumer protection laws to prohibit fraudulent and deceptive commercial activities that cause or potentially cause harm to consumers engaged in online commercial activities." Article 14.8 (Personal Information Protection) mandates that "each Party shall adopt or maintain a legal framework that provides for the protection of the personal information of users of electronic commerce." These provisions focus on addressing issues such as fraud and personal data breaches that are prevalent in online services trade, which can stimulate services trade from the demand side by enhancing consumer confidence, and (4) Intellectual property (IP) protection channel: Article 14.17 (Source Code) specifies that "no Party shall require the transfer of, or access to, source code of software owned by a person of another Party, as a condition for the import, distribution, sale, or use of such software, or of products containing such software, in its territory." In the trade of intangible services, especially those reliant on algorithms and software, IP provisions play a crucial role in safeguarding the business secrets of service providers. This protection fosters their confidence to engage in international markets, ultimately promoting services trade from the supply side.

In summary, digital trade rules can facilitate the growth of services trade through multiple channels. Existing academic research highlights that they can effectively reduce cross-border data flow costs and enhance innovative knowledge spillovers (Liu and Zhen 2022). Building on these, we empirically investigated the effect of digital trade rules on services trade from the DVA perspective. Additionally, this paper employs an innovative text analysis method that enables us to examine the impact of the degree of openness of digital trade rules on the DVA of services trade from both broadness and depth perspectives.

The total value of traded services consists of the domestic added value and the foreign added value (Francois et al. 2015). In this paper, we focus on the DVA of services trade for the following reasons: Firstly, the DVA of services trade holds economic significance for exporters, as it not only reflects an economy's ability to provide services to global markets but also closely ties to domestic employment and tax revenue (Jangam 2021). Secondly, the DVA of services trade constitutes the largest proportion of the total value of services trade, reaching up to 81.4% in 2018, making it highly representative. Thirdly, digital trade rules directly impact the domestically created or provided services. In contrast, the value generated from third parties (e.g., outsourced technical support such as data acquisition, storage, processing and maintenance) is not directly affected by digital trade rules between the two contracting parties.

We first referred to the network analysis method used by De Benedictis and Tajoli (2011) to examine the characteristics and evolutionary trends of the DVA of services trade. Subsequently, we referred to the method of Fagiolo (2010) and Blum and Goldfarb (2006) to conduct the empirical analysis on the impact of digital trade rules on the DVA of services trade. The empirical results reveal three main findings: (1) Digital trade rules exert a positive impact on the DVA of services trade (2) Increasing the broadness and depth of digital rules can enhance the growth of the DVA of services trade, and (3) The positive effect of digital trade rules on the DVA of services trade is heterogeneous, depending on sectoral, economy-specific, and agreement-specific characteristics.

This study holds both theoretical and practical significance. Theoretically, the gravity model of international trade has been continually developing and improving. This paper centers on a crucial new institutional factor—digital trade rules—and incorporates it into the trade gravity model. Beyond that, it differentiates the intensity of this new institutional factor through textual analysis methods. By doing so, this paper provides innovative applications of the trade gravity model and makes a certain contribution to the research on digital trade rules. From a practical perspective, digital technology has become integral to nearly all aspects of trade in services. As a result, the tradability of services has significantly increased (Lin 2015). However, some digital restrictions, initially implemented for security or other reasons, have severely impeded the growth of services trade. Consequently, many countries need solutions that can balance the growth of services trade with security and other objectives. To this end, this paper provides empirical evidence supporting the idea that actively participating in digital trade rules is a viable approach to achieving these goals.

The remaining sections of this paper are organized as follows: Section 2 presents the literature review. Section 3 explores the characteristics and changing trends of the DVA of services trade using network diagrams and indicators. Section 2 provides the empirical analysis, including the introduction of variables, empirical results, robustness tests, heterogeneity analysis, and corresponding discussions. Section 5 concludes the paper.

2 | Literature Review

2.1 | Literature on the Impact of FTAs on Trade and the Factors Affecting Services Trade

Existing literature on the impact of FTAs on trade usually employs the gravity model analysis framework, with the majority concentrating on goods trade. For example, Egger et al. (2022) applied the gravity model to analyze the effect of FTAs on trade and identified different impacts during the anticipation, growth, and maturity phases of the FTAs. Furthermore, the gravity model is also applicable for analyzing the effect of a specific chapter

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of the FTAs, such as Chung et al. (2022) adopting it to analyze the impact of the rules of origin on trade costs. Head and Mayer (2014) provided a comprehensive review of gravity model research in international trade. They recommended employing various forms of gravity models and incorporating specific factors to enhance robustness when applying this analytical framework to specific research questions. Therefore, the continuous development and extension of the gravity model are necessary to address diverse research questions effectively.

Regarding trade in services, with the increase in data availability in recent years, the trade gravity model based on empirical methods has become increasingly applicable, especially in identifying the factors affecting services trade. A representative study by Francois and Hoekman (2010) found that the development of the domestic service industry and the openness of services trade policy are crucial factors in driving services exports. Jafari and Tarr (2017) calculated the ad valorem tariff equivalents for services trade restrictive measures at country and sector levels. Their research demonstrated that services trade in low-income countries and the professional service sectors is more heavily impacted by restrictive measures. Within a similar research topic, Benz and Jaax (2022) employed the Poisson Pseudo Maximum Likelihood (PPML) model to assess the negative impact of restrictive measures on trade in services. Their research reveals that removing these restrictive measures can significantly promote trade in services. Additionally, services embodied in exported goods can also be considered as a form of service provision to the overseas market, and Cernat and Kutlina-Dimitrova (2014) defined this as the "mode 5" of services trade, in addition to the four well-known modes. Antimiani and Cernat (2018) highlighted the substantial gains from liberalizing mode 5 of trade in services and emphasized the significant role of digital technologies, such as software and the Internet of Things, in advancing mode 5 services trade.

The existing literature contains relatively few studies on the impact of FTAs on services trade. Simultaneously, research on factors affecting services trade has gradually shifted from traditional gravity factors to new elements, such as domestic measures, which are closely related to FTAs. This paper contributes to the existing literature by incorporating digital trade rules within FTAs into the gravity model to examine their impact on services trade. This aspect deserves attention not only because it significantly affects the digitalization process of services trade but also because it offers insights into how modern trade agreements can influence trade dynamics.

2.2 | Literature on Digital Trade Policy and Rules

Existing studies reveal that many countries have adopted a range of measures to restrict digital trade, aiming to protect personal privacy, safeguard national security and political stability, and promote the growth of domestic digital industries (Meltzer 2019). These measures include restricting cross-border data flows, requiring data localization, and imposing digital service taxes (Kofler and Sinnig 2019). While such measures may assist economies in achieving their policy objectives, they can also have a substantial negative impact on international trade. For example, Meltzer (2019) found that data localization measures increase the cost of using data, thereby reducing the benefits of digital trade. Additionally, previous studies have shown that digital trade barriers have adverse effects on services trade, including hindering bilateral services trade flows and the import of service production factors (Van der Marel and Ferracane 2021).

The adverse effects of digital trade regulatory policies have increasingly captured the attention of many countries. In this context, digital trade rules have become a viable means to balance national interests and trade growth. The WTO's e-commerce work program,[4] launched in 1998, represents an early form of digital trade rules. This program includes trade facilitation provisions such as paperless trade, electronic signatures and electronic invoices, which have proven effective in reducing trade costs (Wilson et al. 2005). However, the progress of the WTO in the field of digital trade has faced significant challenges due to difficulties in reconciling the diverse demands of its members. Consequently, although the volume of digital trade and the number of digital trade policies implemented by countries have increased exponentially in recent years, the WTO's role in digital trade remains largely unchanged from the advent of the Internet (Burri 2015).

Given the contradiction between the urgency of establishing digital trade rules and the inefficiency of the WTO, many economies have turned to regional frameworks. These regional digital trade rules have indeed yielded several benefits for their participants, such as effectively offsetting the negative impacts of unilateral restrictive policies and promoting the bilateral digital trade flows (Suh and Roh 2023). Currently, there is limited literature on the impact of digital trade rules. Therefore, this study contributes to filling this gap by examining the effects of digital trade rules on trade in services. Additionally, we employed a textual analysis method to quantify the broadness and depth of digital trade rules, providing a valuable methodological reference for similar research.

3 | The DVA of Service Exports: Characteristics and Trends

3.1 | The DVA of Service Exports

Borin and Mancini (2019) decompose the gross export value into the following five components:

$$EXGR = DVA + FVA + DDC + FDC + taxsub \tag{1}$$

In formula (1), *EXGR* represents the gross export value; *DVA* denotes the domestic value added component; *FVA* is the foreign value added component; *DDC* and *FDC* refer to the domestic and foreign double-counted components, respectively; and taxsub represents the "taxes less subsidies" embodied in gross export. Based on our calculation, the proportion of the five components in total service exports for 2018 are as follows: DVA at 81.4%, FVA at 14.3%, DDC at 0.15%, FDC at 0.05%, and taxsub at 4.1%. Intuitively, DVA constitutes the largest component and is therefore highly significant, while the proportions of DDC and FDC are so small that they can be disregarded. In addition, there are two further reasons for choosing DVA as the sole research focus in this paper. Firstly, DVA holds greater economic significance because

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it more accurately reflects an economy's comparative advantage in services trade. It not only represents the development level of the economy's service industry but also contributes to employment and income for domestic residents and tax revenue for the government. Secondly, despite the substantial proportion of FVA, it needs to be excluded from our analysis. For example, the technical services (e.g., data support) provided by third parties, which are included in the FVA, are not directly affected by digital trade rules between two contracting economies.

The DVA data used in this paper is sourced from the UIBE GVC Database. This database provides reliable decomposed trade data that has been widely utilized in existing research (Davies and Studnicka 2018; Wang et al. 2022). The UIBE GVC database employs some commonly used methods to decompose many different versions of input–output tables. The version we choose to use is the OECD Inter-Country Input–Output (OECD-ICIO) table decomposed by the method of Borin and Mancini (2019) because it provides the DVA data required for our study and offers broader coverage in terms of years and economies.[5]

3.2 | Constructing the DVA Network of Services Trade

In this section, we draw on classic trade network literature, such as De Benedictis and Tajoli (2011), to construct the DVA network G as follows:

$$G = (V, D, \omega) \tag{2}$$

In expression (2), $V = (v_1, v_2, \ldots, v_n)$ represents the set of nodes, and $v_i \in V, i = 1, 2, \ldots, n$ denotes the node in the network, which represents economies in the network. $D = \{d_{ij}\}$ is the set of connections. We adopted a threshold value of 1 billion US dollars, as suggested by Cerina et al. (2015). In this case, $d_{ij} = 1$ indicates that the DVA of service exports form v_i to v_j exceeds 1 billion US dollars, and thus a connection exists; otherwise $d_{ij} = 0$. ω represents the weight (or thickness) of connections. Specifically, ω_{ij} denotes the value of DVA of service exports from v_i to v_j.

3.3 | Characteristics and Trends of the DVA of Services Trade

Figure 1 illustrates the international services trade for the years 2000 and 2018 in the form of a network diagram. According to our calculations, the connections shown in Figure 1 that exceed the threshold level account for more than 75% of the total value. This indicates that the DVA network of service exports, constructed using the threshold method, is highly representative. From the networks of these two periods, we observed the following trends:

Firstly, the number of nodes and connections in the network has increased significantly, indicating an expansion in the scale of the services trade network and deeper integration of economies into it. Secondly, the core circle of the network has expanded, reflecting a trend toward greater diversification. In 2000, the core circle comprised only three economies: the United States, the United Kingdom, and Germany. By 2018, economies such as Japan and France had joined this core circle. Thirdly, developing economies like China and India had become part of the core circle, underscoring the increasingly important roles of developing economies in global services trade.

Although several features of the DVA of service exports can be observed intuitively from the above diagram, quantitative indicators can provide a more in-depth and systematic presentation of these features. Therefore, we calculated a series of global and individual indicators for each year from 2000 to 2018. We focus on three main types of global indicators. The first type is scale indicators, including the number of nodes, the number of connections, and the network value[6]. The second type is tightness indicators, including the network density, average distance, average degree of nodes,[7] and clustering coefficient. The third type is modularity indicators, which reflect the network's community structure. At the individual level, we also focus on three types of

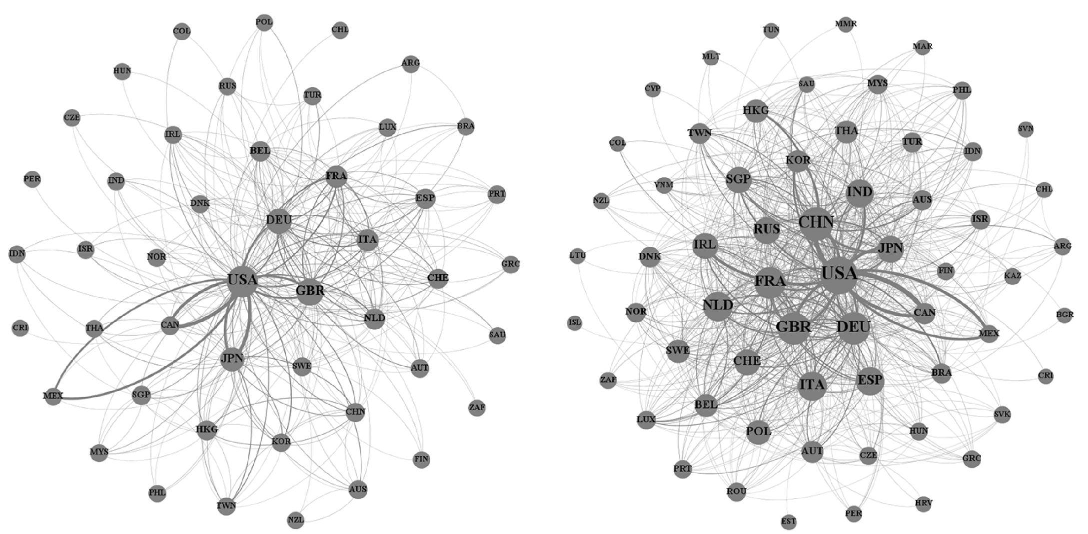

FIGURE 1 | The DVA network of services trade in 2000 (left) and 2018 (right). (i) The size of the nodes is weighted by the number of destination economies of the service exporters. (ii) The thickness of the lines is weighted by the value of DVA of service exports, and the direction of trade flows is shown in the clockwise direction. (iii) The data is sourced from the UIBE GVC Database, and the network diagram is drawn by the author.

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indicators: degree centrality, betweenness centrality, and closeness centrality. Table A1 provides explanations of the calculation methods and meanings for some of these indicators.

3.3.1 | Global Characteristics and Trends of the DVA of Services Trade

Figure 2 illustrates the changes in global indicators of the DVA of services trade from 2000 to 2018, reflecting several key features. Firstly, the scale indicators increased significantly: the number of connections grew from 313 to 822, the number of nodes increased from 47 to 62, and the network value increased from 2209 to 3844. This indicates substantial growth in both the number of participants in services trade and their interconnections.

Secondly, regarding tightness indicators, both the average degree of nodes and network density increased, suggesting a closer services trade relationship among economies. The average shortest path and clustering coefficient remained relatively stable. According to Watts and Strogatz (1998), a small average shortest path combined with a high clustering coefficient is indicative of a "small world" network, meaning that economies are highly interconnected in terms of services trade.

Thirdly, the modularity indicator, calculated using the optimal community algorithm[8], decreased significantly. This trend indicates that the boundaries between groups with intense internal services trade connections have become less distinct. In other words, there is now more inter-group services trade occurring among economies that previously belonged to different groups.[9]

3.3.2 | Individual Characteristics and Trends of the DVA of Services Trade

By referring to the standard method[10], we calculated three individual indicators—degree centrality, closeness centrality, and betweenness centrality—for major economies from 2000 to 2018. The degree centrality, specifically the out-degree[11], is one of the most important indicators for measuring the export competitiveness of services trade. Figure 3 displays the changes in out-degree for major economies using a ranking chart, from which several conclusions can be drawn. Firstly, the major services exporters have generally maintained a stable top ranking, with eight economies consistently in the top ten. In particular, the United States, Germany, and the United Kingdom consistently rank in the top four. Although there are a few cases of latecomers catching up, such as China and India, the first-mover advantage in services trade exports exists to a certain extent. Meanwhile, significant internal gaps exist among the major services exporters. For example, in 2018, among the 62 economies with services trade connections (exceeding the threshold of 1 billion US dollars), 52 are destination economies for the United States, whereas only 27 are destination economies for Japan.

The rankings for closeness centrality and betweenness centrality are presented in Figures A2 and A3, respectively. Closeness centrality measures an economy's accessibility to other economies in terms of services trade, while betweenness centrality reflects the extent to which an economy functions as a "bridge" within the network. According to Figure A2, major services exporters have maintained high rankings, indicating they have more connections with other economies and are therefore less dependent

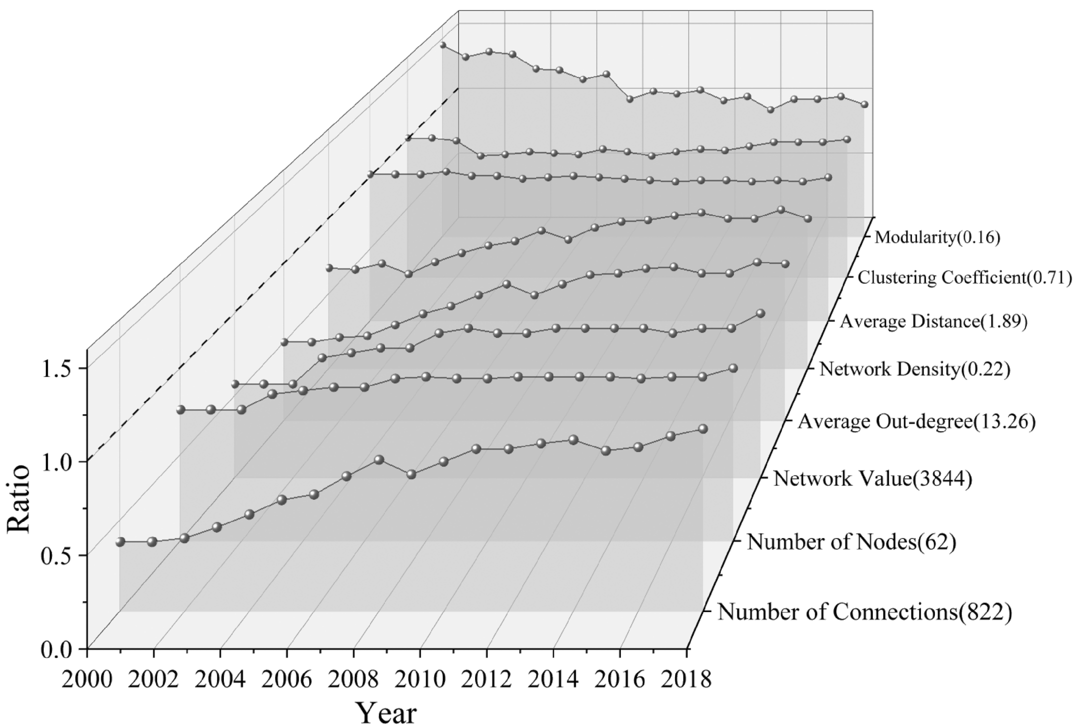

FIGURE 2 | The waterfall chart of global indicators of the network (ratio to 2018 level). (i) The waterfall chart illustrates the changing trends of various global indicators of the network. For better readability, 2018 is used as the base period (values in 2018 are shown in parentheses) to standardize the values of various indicators across different years. (ii) The data is sourced from the UIBE GVC database and calculated by the authors.

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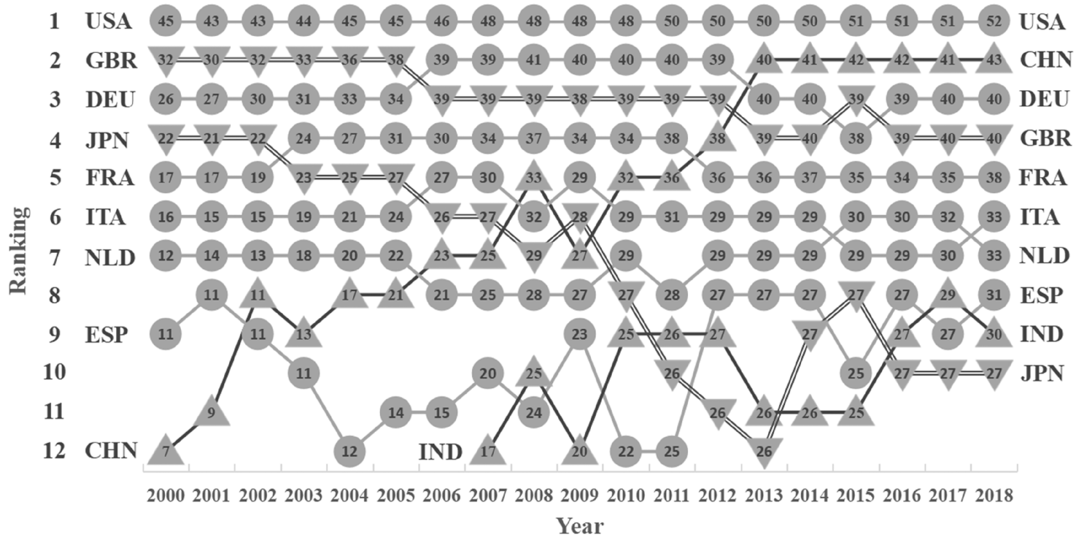

FIGURE 3 | Ranking chart of major economies' out-degree. (i) The number in the chart represents the number of export destination economies where export values exceed the threshold. (ii) Triangles, inverted triangles, and circles indicate whether an economy's ranking increased, decreased, or remained unchanged, respectively, from 2000 to 2018. (iii) Early data are not shown for economies that were initially ranked very low (e.g., India's initial out-degree was 3, ranking 27th). (iv) The data is sourced from the UIBE GVC Database and have been calculated by the authors.

on any single one. Regarding betweenness centrality, as shown in Figure A3, the only two developing economies in the top ten—China and Russia—were ranked 2nd and 5th in 2018, respectively. This suggests that developing economies have started to play an important "bridge" role among economies.

As noted above, both global and individual indicators of the services trade DVA network have experienced significant changes. This prompts the question of what factors have driven these shifts. The gravity factors that existing research typically focuses on do not appear to account for these rapid changes, as they have remained relatively stable in recent years. Given that these changes coincide with the digital transformation of services trade, we believe that digital-related factors—such as the digital trade rules we focus on—are significant drivers of these effects. To investigate this, we employ a series of empirical methods to examine the impact of digital trade rules on the DVA of services trade.

4 | Empirical Analysis

4.1 | Empirical Model Design

To examine the impact of digital trade rules on the DVA of services trade, we constructed the following baseline model:

$$DVA_{i,j,s,t} = \beta_0 + \beta_1 DTR_{i,j,t} + \beta Controls_{i,t\&j,t} + \gamma_{i,j} + \gamma_{s,t} + \varepsilon_{i,j,s,t} \tag{3}$$

In Equation (3), i and j represent the exporting and importing economies respectively, s represents the service sector, and t corresponds to the specific year. $DVA_{i,j,s,t}$ denotes the domestic value added of services trade of sector s, exported by economy i to economy j in year t. $DTR_{i,j,t}$ refers to the status of digital trade rules between economy i and economy j in year t. $Controls_{i,t\&j,t}$ refer to several time-varying unilateral characteristics of both trading economies. $\gamma_{i,j}$ and $\gamma_{s,t}$ denote economy-pair and sector-year joint fixed effects, respectively. $\varepsilon_{i,j,s,t}$ stands for the residual term.

4.2 | Description of Variables and Data

4.2.1 | The DVA of Services Trade

The DVA of services trade data is derived from the UIBE GVC database. Specifically, it is obtained by decomposing the OECD-ICIO table using the method outlined by Borin and Mancini (2019), as described in Section 3.1. To ensure accuracy in the empirical analysis part, we utilized the more detailed sector-level data from this database. It covers the period from 1996 to 2018, including information for 64 exporting economies, 64 importing economies, and 19 service sectors under the ISIC 4 classification.

4.2.2 | Digital Trade Rules

In this paper, digital trade rules are initially defined as the existence of at least one valid (in-force) FTA between two economies that includes chapters or sections on digital trade. Information on the members, date of entry into force, and contents of these FTAs is sourced from the WTO RTAs database.[12] This database provides the information on digital trade rules required for our analysis, covering the period from 1997 to 2018, beginning with the Canada-Israel agreement, which was signed and came into force in 1997.

Figure 4 illustrates the status of digital trade rules and barriers among 20 major economies in 2018.[13] Notably, Canada had established digital trade rules with 12 partners, the highest among the group, and faced the fewest digital trade barriers. In contrast, Brazil, India, and Russia lacked digital trade rules with

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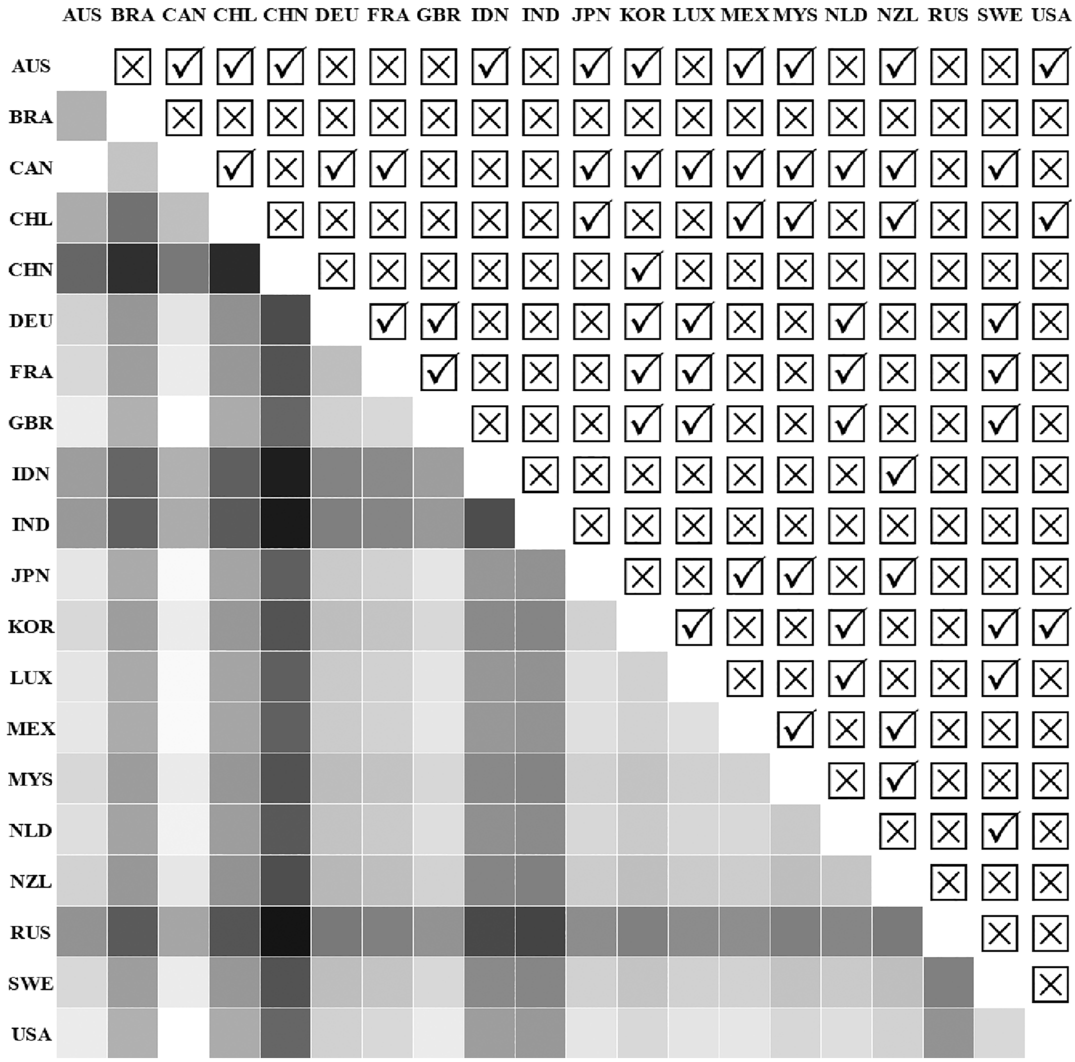

FIGURE 4 | Bilateral digital trade rules and digital trade barriers of major economies in 2018. (i) The lower left section presents a heat map of digital trade barriers, which is calculated as the average of the digital services trade restrictive index of two economies, and the data come from the OECD-DSTRI database. Darker cells in the heat map indicate higher digital trade barriers. (ii) The upper right section shows the status of digital trade rules between two economies. "$\surd$" denotes that the two economies have at least one valid FTA containing digital trade chapters or sections, while "×" indicates that no such agreement exists.

other major economies and had relatively high digital trade barriers. This observation suggests a potential inverse relationship between the existence of digital trade rules and the extent of digital trade barriers. Such a correlation implies that digital trade rules may play a significant role in reducing barriers, thereby fostering an environment conducive to the growth of services trade.

Furthermore, it is important to acknowledge that the degree of openness can differ substantially among various digital trade rules. For example, the Japan –Switzerland FTA includes more detailed commitments on the free flow of cross-border data and e-commerce support measures for SMEs. As a result, it is more advanced in terms of openness in these areas compared to other FTAs, such as the EU –South Korea FTA, which lacks these contents. This implies that a further assessment of the openness of digital trade rules is necessary for better identification. In this paper, we use text analysis methods to achieve this. We focus on two aspects: first, broadness, which measures the range of topics covered in the digital trade rules; and second, depth, which measures how detailed those rules are.

For implementing textual analysis, it is essential to have a reliable reference. The CPTPP is a representative of a high-level international trade agreement in the digital trade field, as we have already detailed in the first section of this paper. We took the e-commerce chapter of the CPTPP as a reference and calculated the textual similarity between the e-commerce chapters or sections in each of the other FTAs and the one in the CPTPP.

When processing the text content, we first imported all the words from the e-commerce chapters or sections, including terms such as "cross-border," "location," "paperless," and "discriminatory," into the word set. Next, we removed those words of little practical meaning, such as ordinal words, numerals, prepositions, articles, and some verbs—using a combined method of regular expressions and a stop word list. Finally, we referred to Peacock

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et al. (2019) to calculate Jaccard Similarity (JS) and Cosine Similarity (CS) by using the overlapping word set approach. The specific calculation formulas for these two similarity indices are as follows:

$$JS = \frac{\boldsymbol{a} \cap \boldsymbol{b}}{\boldsymbol{a} \cup \boldsymbol{b}} = \frac{(a_1, a_2, \cdots, a_n) \cap (b_1, b_2, \cdots, b_m)}{(a_1, a_2, \cdots, a_n) \cup (b_1, b_2, \cdots, b_m)} \tag{4}$$

$$CS = \frac{\boldsymbol{\alpha} \times \boldsymbol{\beta}}{\| \boldsymbol{\alpha} \| \times \| \boldsymbol{\beta} \|} = \frac{(\alpha_1, \alpha_2, \cdots, \alpha_n) \times (\beta_1, \beta_2, \cdots, \beta_n)}{\sqrt{\alpha_1^2 + \alpha_2^2 + \cdots + \alpha_n^2} \times \sqrt{\beta_1^2 + \beta_2^2 + \cdots + \beta_n^2}} = \frac{\sum_{i=1}^{n} \alpha_i \beta_i}{\sqrt{\sum_{i=1}^{n} \alpha_i^2} \times \sqrt{\sum_{i=1}^{n} \beta_1^2}} \tag{5}$$

In formula (4), $\boldsymbol{a}$ represents the word set extracted from the e-commerce chapter or section of specific FTAs while $\boldsymbol{b}$ represents the corresponding word set from the CPTPP. JS measures the degree of overlap between the word sets. A higher JS signifies that the content coverage of the FTA's digital trade rules aligns more closely with that of the CPTPP, reflecting greater broadness in these digital trade rules. In formula (5), $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ represent word vectors that captures both the coverage and frequency of the word sets. A higher CS indicates the FTA is as detailed as CPTPP, reflecting a greater depth of digital trade rules. In situations where multiple FTAs exist simultaneously between two economies, the highest values for both JS and CS were selected for use.

4.2.3 | Other Variables

In the baseline model, we control for economy-pair and sector-year joint fixed effects. The former captures common gravity variables (e.g., distance, language, and adjacency) as well as the characteristics of the economies themselves. The latter accounts for sectoral shocks that vary over time, such as input tariffs, costs, and industry technology breakthroughs Additionally, we included some time-varying unilateral characteristics of the trading economies, including GDP, Internet Coverage (percentage of internet users), and Regulatory Quality (Fagiolo 2010; Blum and Goldfarb 2006). Data sources include the World Bank's WDI database for GDP, GDP per Capita and Internet Coverage, and the World Bank's WGI database for Regulatory Quality.

4.2.4 | Descriptive Statistics

The dataset used for baseline regression spans the period from 1996 to 2018, encompassing data for 64 exporting and importing economies across 19 service sectors[14], with a total of 1,559,026 observations. Table 1 shows the summary statistics of the main variables. Among these variables, Digital Trade Rules (in its simple form) is a dummy (0–1) variable. Digital Trade Rules (measured by two similarity indicators), DVA of Service Exports, GDP, and Internet Coverage are used in their logarithmic forms.

4.3 | Results Analysis

4.3.1 | Correlation Test

Before proceeding with the regression analysis, we first conducted a correlation test. As shown in Table 2, the Pearson correlation coefficients between dependent variables and the key independent variables are all significantly positive at the 1% statistical level, providing a foundation for the subsequent regression analysis.[15]

TABLE 1 | Summary statistics of main variables.

Variables	*N*	Mean	SD	Min	Max
DVA of service exports (million US$)	1,559,026	1.372	1.637	0	6.629
Digital trade ules	1,559,026	0.143	0.350	0	1
Digital trade rules (JS)	1,559,026	0.391	0.970	0	3.270
Digital trade rules (CS)	1,559,026	0.580	1.422	0	4.324
GDP (US$)	1,559,026	26.04	1.755	20.97	30.66
GDP per capita (US$)	1,559,026	9.437	1.292	5.081	11.685
Internet Coverage (%)	1,559,026	47.97	30.37	0	99.01
Regulatory quality	1,559,026	0.772	0.831	−2.349	2.252

TABLE 2 | Correlation test of key variables.

	DVA of service exports	Digital trade rules	Digital trade rules (JS)	Digital trade rules (CS)
DVA of service exports	1			
Digital trade rules	0.146***	1		
Digital trade rules (JS)	0.150***	0.988***	1	
Digital trade rules (CS)	0.148***	0.999***	0.993***	1

Note: (i) *, ** and *** indicate the statistical significance at the 10%, 5% and 1% levels, respectively. The same notation applies to the following tables.

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TABLE 3 | Baseline regressions.

Variables	(1)	(2)	(3)	(4)
Digital trade rules	0.092*** (0.010)	0.125*** (0.010)		
Digital trade rules (JS)			0.047*** (0.004)	
Digital trade rules (CS)				0.031*** (0.003)
Constant	1.359*** (0.001)	−8.988*** (1.404)	−9.313** (1.416)	−9.073*** (1.406)
Control variables	No	Yes	Yes	Yes
Economy-pair fixed effect	Yes	Yes	Yes	Yes
sector-year fixed effect	Yes	Yes	Yes	Yes
R-squared	0.776	0.777	0.777	0.777
Observations	1,559,026	1,559,026	1,559,026	1,559,026

Note: The values in parentheses are the standard errors. Same as the following tables. The standard errors are clustered at economy-pair level. Same as the following tables.

TABLE 4 | Robustness test by using a subsample of highly digitalized service sectors.

Variables	(1)	(2)	(3)	(4)
Digital trade rules	0.102*** (0.011)	0.133*** (0.012)		
Digital trade rules (JS)			0.050*** (0.004)	
Digital trade rules (CS)				0.033*** (0.003)
Constant	1.440*** (0.002)	−8.758*** (1.551)	−9.057*** (1.569)	−8.831*** (1.555)
Control variables	No	Yes	Yes	Yes
Economy-pair fixed effect	Yes	Yes	Yes	Yes
Sector-year fixed effect	Yes	Yes	Yes	Yes
R-squared	0.783	0.784	0.784	0.784
Observations	820,540	820,540	820,540	820,540

4.3.2 | Baseline Regression Results

Table 3 demonstrates the results of the baseline regression. In columns (1) and (2), we used dummy variables, according to the existence of digital trade rules, as the key independent variables. Column (1) presents the results without accounting for control variables, and Column (2) incorporates them into the model. The results show that the coefficients for Digital Trade Rules are significantly positive, suggesting that digital trade rules have a significant positive impact on the DVA of service exports. Columns (3) and (4) focus on the broadness and depth of digital trade rules, respectively, as the key independent variables. Both coefficients are significantly positive, demonstrating that greater broadness and depth in digital trade rules contribute to an increase in the DVA of service exports.

In addition, we re-estimated the baseline regression using the PPML model to better address estimation bias caused by heteroskedasticity (Gourieroux et al. 1984). The results indicate that the coefficients of the key independent variables remain significantly positive.[16]

4.4 | Robustness Test

4.4.1 | Robustness Test by Using a Subsample of Highly Digitalized Service Sectors

Considering that service sectors are differently affected by digital factors, including the digital trade rules that we focus on, we believe that narrowing the sample to highly digitalized service sectors can obtain a more precise identification, thereby better supporting the logical argument. Calvino et al. (2018) classified all sectors into four categories (low, low-medium, medium-high, and high) based on their digital intensity.[17] We defined the 10 service sectors with medium-high or high digital intensity under their criteria as "high digitalized" service sectors[18] and conducted subsequent robustness tests.

In this robustness test, aside from using a sub-sample, other model settings are consistent with the baseline regression. As the results shown in Table 4, the coefficients of key independent variables remain significantly positive in each test, indicating that the conclusions exhibit robustness.

4.4.2 | Robustness Test by Using Alternative Measurements of Digital Trade Rules

In the baseline regression, digital trade rules are measured using three approaches: the existence of a valid FTA with digital trade chapters or sections, and the broadness and depth of the digital trade rules. To ensure robustness, we further employed four alternative measurements of digital trade rules: (1) the existence of a valid FTA with digital trade provisions; (2) the word count of digital trade chapters or sections, taking the maximum if multiple agreements exist; (3) the number of valid FTAs with digital trade chapters or sections between two economies; and (4) the number of valid FTAs with digital trade provisions between two economies. These alternative indicators capture various

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TABLE 5 | Robustness tests by using alternative measurements of digital trade rules.

Variables	(1)	(2)	(3)	(4)
Digital trade rules	0.115*** (0.011)	0.217*** (0.015)	0.026*** (0.002)	0.025*** (0.002)
Constant	−6.847*** (1.364)	−0.687*** (0.142)	−11.595*** (1.489)	−12.337*** (1.496)
Control variables	Yes	Yes	Yes	Yes
Economy-pair fixed effect	Yes	Yes	Yes	Yes
Sector-year fixed effect	Yes	Yes	Yes	Yes
R-squared	0.777	0.777	0.777	0.777
Observations	1,559,026	1,559,026	1,559,026	1,559,026

TABLE 6 | Robustness test using instrumental variable model.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Sum of digital trade rules with third parties	0.005*** (3.093)		0.009** (2.019)		0.017*** (2.705)	
Digital trade rules		1.022** (2.335)				
Digital trade rules (JS)				0.554* (1.793)		
Digital trade rules (CS)						0.286** (2.170)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Economy-pair fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Sector-year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,559,026	1,559,026	1,559,026	1,559,026	1,559,026	1,559,026

characteristics of digital trade rules. The regression results for the four indicators are shown in Columns (1) to (4) of Table 5, respectively, and consistently show that the coefficients of digital trade rules remain significantly positive.

4.4.3 | Robustness Test by Using Instrumental Variable Model

In the regression analysis of this paper, the issue of endogeneity due to reverse causality warrants attention. Specifically, services trade itself may drive the negotiation and signing of digital trade agreements, potentially leading to estimation bias. To address this issue, we re-estimate the baseline model using a two-stage instrumental variable (IV) approach.

We first collected data on the number of digital trade rules that each economy has in each year,[19] and then followed Hou et al. (2023) to use the sum of the number of digital trade rules between two of the trading economies and third economies as the IV. This IV reflects the experience of the trading economies in negotiating digital trade rules and is therefore directly relevant to the likelihood of them having digital trade rules. On the other hand, experience in negotiating digital trade rules does not directly impact the services trade. Thus, this instrumental variable satisfies the relevance requirement with the key independent variable and the exogeneity requirement with the dependent variable. Additionally, this IV passes the under-identification and weak-identification tests, indicating its good availability. In Table 6, columns (1), (3) and (5) display the results of the first-stage estimations, where the dependent variable is Digital Trade Rules in three forms, with the IV serving as the independent variable. The results indicate that negotiating experience in digital trade helps two economies establish digital trade rules and contributes to enhancing the broadness and depth of the digital trade rules. Columns (2), (4) and (6) present the results of the second-stage estimations, where the predicted values from the previous stage are used as the key independent variable, with the remaining model settings consistent with the baseline regression. The estimation results of the IV model support that, after addressing reverse causality, digital trade rules continue to have a significant positive effect on the DVA of services trade.

4.5 | Heterogeneous Analysis

In this section, we conducted heterogeneity analyses, focusing on sectoral, economy-specific, and agreement-specific differences, with the results presented in Table 7.

For the sectoral heterogeneity, we hypothesized that the degree of digitalization of the service sectors could be a source of heterogeneity. The rationale is that when digital trade rules affect factors such as the use of data elements or the convenience of intermediate trade processes, highly digitalized service sectors—those with greater reliance on digital elements—should exhibit higher sensitivity to these rules. We employed two methods to test this hypothesis. First, we included an interaction term between Digital Trade Rules and the grouping variable of highly digitalized service sector (Sec_HD), introduced in Section 4.4.1, in the model. The result in Column (1) shows that the coefficients for both digital trade rules and their interaction term are significantly positive. This suggests that digital trade rules promote the DVA of services trade in both low and high digital intensity sectors, with

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TABLE 7 | Heterogeneity analysis.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Digital trade rules	0.057*** (0.011)	−0.009 (0.017)	0.000 (0.008)	0.021 (0.015)	0.118*** (0.011)	
Digital trade rules × Sec_HD	0.129*** (0.015)					
Digital trade rules × Sec_DI		0.055*** (0.006)				
Digital trade rules × Im_DSTRI			0.112** (0.046)			
Digital trade rules × Im_RL				0.110*** (0.011)		
Digital trade rules × Agr_BI					0.117*** (0.043)	
Digital trade rules ($N = 0$)						−0.092*** (0.010)
Digital trade rules ($N \geq 2$)						0.092*** (0.011)
Constant	−8.988*** (1.404)	−8.988*** (1.404)	−4.680*** (1.742)	−9.860*** (1.404)	−8.542*** (1.405)	−11.421*** (1.484)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Economy-pair fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Sector-year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.777	0.777	0.799	0.778	0.777	0.777
Observations	1,559,026	1,559,026	260,623	1,534,877	1,559,026	1,559,026

Note: (i) In the heterogeneous analysis, all the Digital Trade Rules are dummy variables.

a stronger effect observed in the latter. Second, we directly interacted the sectoral digital intensity (Sec_DI = 1, 2, 3, or 4), as classified by Calvino et al. (2018), with Digital Trade Rules. In Column (2), the significant positive coefficient of the interaction term suggests that digital trade rules have a more pronounced positive impact on the DVA of services trade in highly digitalized service sectors, yielding consistent and expected findings with the other method.

For the economy-specific heterogeneity, we considered two factors: the digital trade barriers and the rule of law of the importing economies. Firstly, reducing digital trade barriers of the importing economy is the primary objective and direct target of designing digital trade rules. In economies with lower digital trade barriers, many obligations under digital trade rules are already well fulfilled, which could result in a smaller additional impact from these rules. In contrast, economies with higher digital trade barriers are likely to experience a stronger impact from digital trade rules. To test this, we included an interaction term between the importing country's digital trade barriers (Im_DSTRI) and Digital Trade Rules in the model for re-estimation. The result in Column (3) indicates that while the coefficient of Digital Trade Rules is not significant, the interaction term is significantly positive. It suggests that digital trade rules have no significant effect on the DVA of services trade when the importing economy has very low digital trade barriers. However, as these barriers increase, a progressively stronger positive effect emerges, which aligns with expectations. Secondly, even if digital trade rules are signed, their impact may be nullified if the obligations are not genuinely implemented. To account for this, we incorporate an interaction term between Digital Trade Rules and the rule of law index (Im_RL), which reflects the degree of trust and adherence to rules of an economy (Kaufmann et al. 2010), into the model for re-estimation. In Column (4), the coefficient of digital trade rules alone is insignificant, but its interaction term with Im_RL shows a significant positive coefficient. This indicates that when the rule of law of the importing economy is weak, digital trade rules have no significant impact on the DVA of services trade. However, as the rule of law improves, the positive effect of digital trade rules becomes increasingly evident.

For agreement-specific heterogeneity, we considered the type of agreements (whether they are bilateral or regional, i.e., involving more than two members), as well as the "first agreement" effect. Regarding the type of agreement, we hypothesized that the effects of digital trade rules would be more pronounced in bilateral agreements due to the more targeted rules and the greater negotiation flexibility under the bilateral framework. In Column (5), both the coefficient of Digital Trade Rules and its interaction term with the bilateral agreement grouping variable are significantly positive, indicating that digital trade rules in both bilateral and regional agreements can promote the DVA of services trade, while the effect is stronger for the former. On the other hand, to test the "first agreement" effect, we replaced the variable Digital Trade Rules with two dummy variables: one for no agreement ($N = 0$) and the other for multiple agreements ($N \geq 2$). In this case, the estimated coefficients reflect differences relative to the first agreement ($N = 1$). In Column (6), the coefficient of multiple agreements is significantly positive. This can be interpreted as multiple agreements representing upgraded rules or, at the very least, a greater interest from the two economies in engaging in digital trade cooperation, thereby leading to a more substantial effect compared to a single agreement. In addition, by comparing the two coefficients in column (6), we can see that the difference between the first agreement and no agreement is equal to the difference between the multiple agreements and the first agreement.

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Given that the latter could be the cumulative effect of more than two agreements, if we consider only the marginal effect, the first agreement exhibits a stronger marginal positive impact on the DVA of services trade than that of subsequent agreements.

5 | Conclusions

From the perspective of DVA, trade in services is experiencing expansion, intensification, and de-modularization. Major services exporters with first-mover advantages continue to dominate; however, some latecomers, such as China, demonstrate strong and consistent growth in services trade, leading to their increasing influence in this field.

From the results of the empirical model, digital trade rules have a positive effect on the DVA of service exports, and the increase in both the broadness and depth of digital trade rules can strengthen this effect. Consistent results from multiple models and methods support the robustness of this conclusion. Regarding sectoral heterogeneity, this positive effect is stronger in highly digitalized service sectors. From the perspective of economy-specific heterogeneity, this positive effect is more pronounced when the importing economy has higher digital trade barriers and a stronger rule of law. In terms of agreement-specific heterogeneity, digital trade rules under bilateral frameworks have a more noticeable positive impact than those under regional frameworks. The first digital trade agreement demonstrates a stronger marginal effect, and continuing to have more digital trade agreements still yields additional positive effects.

To summarize, as the digitization of services trade continues to advance, the importance of digital trade rules is becoming increasingly prominent. Actively engaging in dialogues on digital trade with other economies has already become an important foundation for fully unlocking the growth potential of services exports.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are originally from the following resources available in the public domain: UIBE Global Value Chain (GVC) Database; WTO Regional Trade Agreements (RTAs) Database; World Bank World Development Indicators (WDI) Database; and World Bank Worldwide Governance Indicators (WGI) Database. Links are as follows:UIBE GVC database (http://gvcdb.uibe.edu.cn/B/B2.EXin4VA(Borin)_OECD2021/). WTO RTAs Database (https://rtais.wto.org/UI/PublicSearchByCr.aspx) World Bank WDI Database (https://databank.worldbank.org/source/world-development-indicators). World Bank WGI Database (https://databank.worldbank.org/source/worldwide%E2%80%90governance%E2%80%90indicators).

Endnotes

[1] According to WTO STATS (https://stats.wto.org), in 2023, the global export value of services trade and goods trade was US$ 7.84 trillion and US$ 23.78 trillion respectively.

[2] https://www.wto.org/english/res_e/booksp_e/trade_outlook24_e.pdf.

[3] Consistent with existing research (Burri and Polanco 2020), we also regard chapters or sections such as e-commerce and digital economy, which have the similar content, as digital trade rules.

[4] WTO, Work Programme on Electronic Commerce, WT/L/274, 1998. (https://www.wto.org/english/tratop_e/ecom_e/ecom_work_programme_e.htm).

[5] http://gvcdb.uibe.edu.cn/B/B2.EXin4VA(Borin)_OECD2021/.

[6] The network value is calculated as the square of the number of nodes in the network. According to Metcalfe's Law, the network value grows proportionally to the square of the number of nodes, reflecting the network's externality. In other words, as the number of individuals in the network grows, each participant can reap greater benefits from being part of it.

[7] The degree of a node is the number of connections to that node. In directed networks, the degree of node can be further categorized into in-degree and out-degree.

[8] The optimal community algorithm is developed by Blondel et al. (2008). It is a simplified method to extract the community structure of large networks with good community identification quality.

[9] For the network of 2018, we set the resolution parameter to 1 and get the Asia-Pacific community (including the United States, China, India, Singapore, Japan, etc.) and the European community (including the United Kingdom, Germany, France, the Netherlands, Italy, etc.). See Figure A1 for details.

[10] See Table A1 for details.

[11] The out-degree is the number of export destinations for an economy, where the export value exceeds a specified threshold.

[12] The WTO RTAs database lists all agreements containing digital trade provisions. Each of these agreements was reviewed by authors to check whether it contains a standalone chapter or section on digital trade, and these contents were subsequently used for text analysis.

[13] Among the five subcategories classified by Ferencz (2019), China scored high in "infrastructure and connectivity" (e.g., measures affecting cross-border data flows) and "other barriers" (e.g., limitations on downloading and streaming, or restrictions on online advertising), resulting in the highest digital trade barrier score in 2018.

[14] 19 service sectors, classified under ISIC 4, are selected based on Nayyar et al. (2021). See Table A2 for details.

[15] The result of correlation analysis with all variables can be obtained by contacting the author.

[16] To streamline the main text, the results of PPML estimation are presented in Table A3.

[17] Calvino et al. (2018) ranked all sectors based on seven digital intensity indicators (i.e., investment in ICT equipment, investment in software and databases, consumption of intermediate ICT goods, consumption of intermediate ICT services, robot use, revenues from online sales and ICT specialists). By calculating the average rank of a specific sector, they categorize the sector as having high, medium-high, medium-low, or low digital intensity based on whether its average rank falls into the first, second, third, or fourth quartile, respectively.

[18] See Table A2.

[19] This number refers to the total number of agreements, not the number of partners, as a single agreement can involve multiple members.

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Appendix A

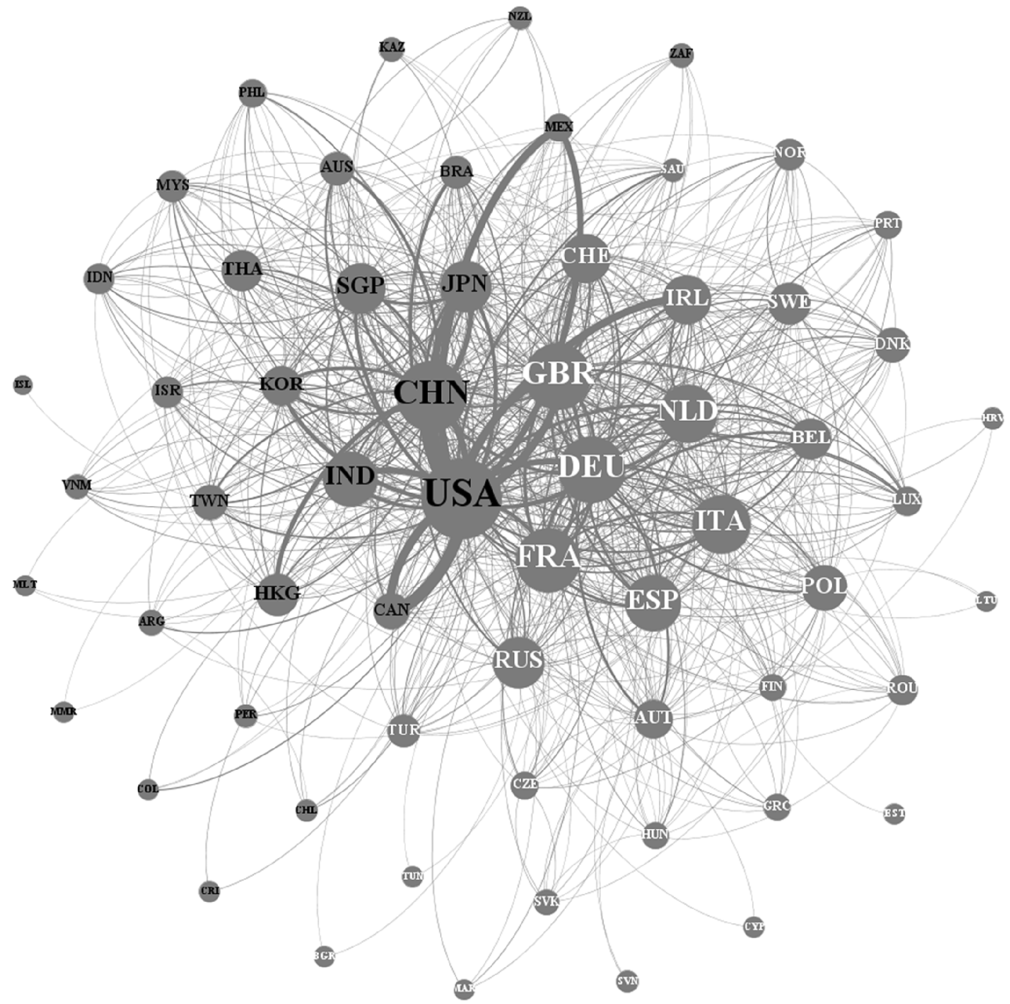

FIGURE A1 | Community division of the network in services trade. (i) According to the optimal community algorithm, the network is divided into the Asia-Pacific community and the European community. (ii) The data is sourced from the OECD-ICIO database and calculated by the authors.

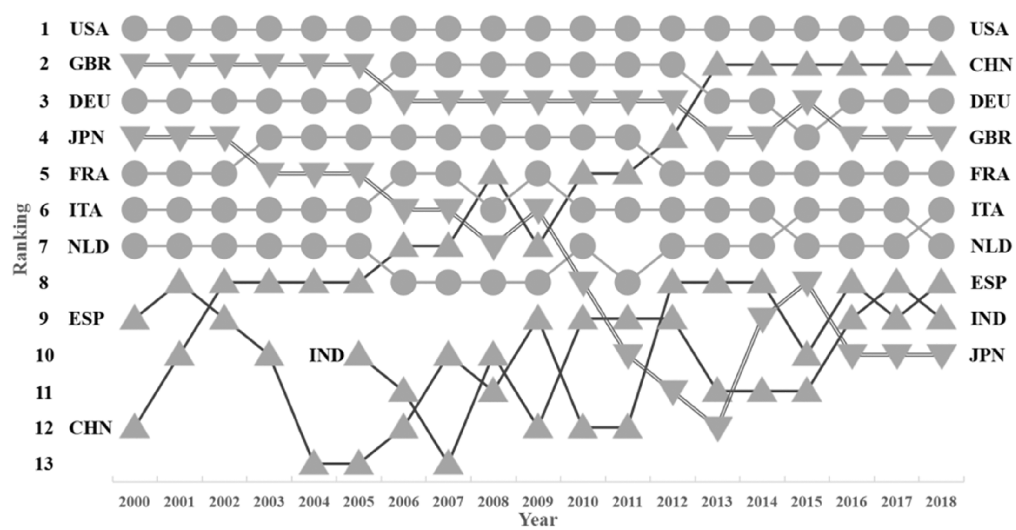

FIGURE A2 | Ranking diagram of the closeness centrality. (i) Upright triangles, inverted triangles, or circles indicate that the country's ranking has risen, fallen, or remained the same during the sample period, respectively. (ii) Economies with very low initial rankings; their earlier data is not shown. (iii) The data is sourced from the OECD-ICIO database and calculated by the authors.

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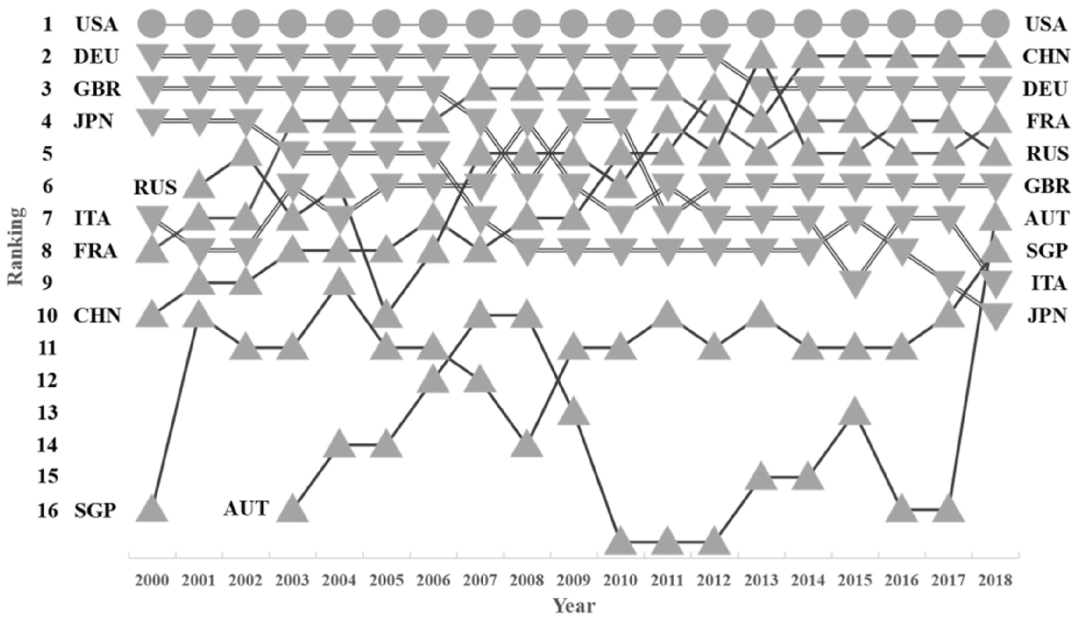

FIGURE A3 | Ranking diagram of the betweenness centrality. (i) Upright triangles, inverted triangles, or circles indicate that the country's ranking has risen, fallen, or remained the same during the sample period, respectively. (ii) Economies with very low initial rankings; their earlier data is not shown. (iii) The data is sourced from the OECD-ICIO database and calculated by the authors.

TABLE A1 | Calculation formula and description of network indicators.

	Calculation formula	Description
Global indicators		
Network density	$ND = \frac{M}{N(N-1)}$ M indicates the number of connections in the network; N indicates the number of nodes.	Network density describes the density of the connections between nodes in the network.
Average distance	$AD = \frac{\sum_i^n \sum_j^n d_{ij}}{N(N-1)}, i > j$ d_{ij} is the shortest distance between nodes i and j.	Average distance describes the connectivity between nodes in the network.
Clustering coefficient	$CC = \frac{Number\ of\ closed\ triplets}{Sum\ of\ the\ number\ of\ closed\ and\ open\ triplets}$ A closed triplet is a closed triangle formed by three nodes connected to each other; An open triplet lacks a connection compared to a closed triplet.	Clustering coefficient is a measure of the degree to which nodes in a graph tend to cluster together.
Modularity	$Mod = \frac{1}{M} * \sum_{ij}\left[A_{ij} - \frac{OutDeg_i * InDeg_j}{M}\right]\delta\left(C_i, C_j\right)$ *OutDeg* and *InDeg* are the out-degree and the in-degree of node; A_{ij} is the dummy variable of the node-pair connection; $\delta\left(C_i, C_j\right)$ is the dummy variable of the node-pair to the same community.	Modularity measures the strength of division of a network into modules. Networks with high modularity have dense connections between the nodes within modules but sparse connections between nodes in different modules.
Individual indicators		
Degree centrality	$DC_i = \sum_j^n x_{ij}, i \neq j$	Degree centrality indicates the number of connections of a node, which can be divided into out-degree and in-degree. Note: In this paper, we mainly focus on the out-degree.
Closeness Centrality	$CC_i = \frac{1}{\sum_j^n d_{ij}}, i \neq j$ d_{ij} is the distance between nodes i and j.	Closeness centrality refers to the reciprocal of the sum of distances between the node and other nodes. A large closeness centrality indicates low dependence on other nodes.
Betweenness Centrality	$BC_i = \sum_j^n \sum_k^n d_{jk}(i)/d_{jk}, i \neq j \neq k, j > k$ d_{jk} represents the number of shortest paths between nodes j and k; $d_{jk}(i)$ indicates the quantity of shortest paths between nodes j and k passing through node i.	Betweenness centrality represents the ability of a node to control the relationship between other nodes.

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TABLE A2 | Digital intensity by service sector (ISIC 4).

ISIC 4 code	Service sector	Digital intensity
D49	Land transport and transport via pipelines	1
D50	Water transport	1
D51	Air transport	1
D52	Warehousing and support activities for transportation	1
D53	Postal and courier activities	1
D55T56	Accommodation and food service activities	1
D68	Real estate activities	1
D85	Education	2
D86T88	Human health and social work activities	2
D45T47	Wholesale and retail trade; repair of motor vehicles	3
D58T60	Publishing, audiovisual and broadcasting activities	3
D84	Public administration and defense; compulsory social security	3
D90T93	Arts, entertainment and recreation	3
D61	Telecommunications	4
D62T63	IT and other information services	4
D64T66	Financial and insurance activities	4
D69T75	Professional, scientific and technical activities	4
D77T82	Administrative and support services	4
D94T96	Other service activities	4

TABLE A3 | Baseline regression based on PPML model.

Variables	(1)	(2)	(3)
Digital trade rules	0.044*** (0.007)		
Digital trade rules (JS)		0.015*** (0.003)	
Digital trade rules (CS)			0.011*** (0.002)
Constant	−8.985*** (1.031)	−9.026*** (1.052)	−8.961*** (1.036)
Unilateral control variables	Yes	Yes	Yes
Bilateral control variables	Yes	Yes	Yes
Economy-pair fixed effect	Yes	Yes	Yes
Sector-year fixed effect	Yes	Yes	Yes
Pseudo R-squared	0.424	0.424	0.424
Observations	1,559,026	1,559,026	1,559,026

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