yönetim ve ekonomi araştırmaları dergisi
journal of management and economics research

*Cilt/Volume: 22 Sayı/Issue: 2 Haziran/June 2024 ss. /pp. 1-13*
E. E. Akça http://dx.doi.org/10.11611/yead.1367503

# THE IMPACT OF DIGITAL SERVICES TRADE RESTRICTIVENESS ON TRADE IN TELECOMMUNICATIONS, COMPUTER, AND INFORMATION SERVICES: EVIDENCE FROM OECD COUNTRIES[1]

**Assoc. Prof. Emrah Eray AKÇA (Ph.D.)** *

## ABSTRACT

*This study analyzes the impact of digital services trade restrictiveness on trade in telecommunications, computer, and information services of Organisation for Economic and Co-operation Development countries by utilizing the Poisson Pseudo Maximum Likelihood method covering the period 2014-2022. The findings of the study statistically significantly confirm the disincentive impact of the higher degree of digital services trade restrictiveness on both exports and imports in telecommunications, computer, and information services. Therefore, less protectionist policies can most likely help to enhance the trade in this type of service due to mainly diminishing trade costs. Besides, to make use of more advantages of increasing digitalization, further cooperation and dialogue across countries, particularly with technologically advanced countries, is required. By this means, domestic services suppliers can attain foreign advanced knowledge and technology at relatively moderate costs, thus productivity can be improved, and eventually, more trade in services can be achieved.*

**Keywords:** *Digital Services Trade Restrictiveness, Trade in Telecommunications and Computer and Information Services, Poisson Pseudo Maximum Likelihood, OECD.*

**JEL Codes:** *C23, F14, F42.*

## 1. INTRODUCTION

The service sector, which is also called as tertiary sector of the economy, has been continuously increasing and contributing to not only domestic output but also trade and investment flows (Gupta et al., 2020). According to the World Bank-World Development Indicators (WB-WDI, 2023), the value

[1] This study was presented as an abstract in the 3rd International Congress on Digital Business, Management & Economics held on 8-10 September 2023.

* Bartın University, Faculty of Economics and Administrative Sciences, Department of Economics, Bartın/ Türkiye, E-mail: emrahakca@bartin.edu.tr.

**Makale Geçmişi/Article History**

Başvuru Tarihi / Date of Application : 27 Eylül / September 2023
Düzeltme Tarihi / Revision Date : 22 Mayıs / May 2024
Kabul Tarihi / Acceptance Date : 6 Haziran / June 2024

**Araştırma Makalesi/Research Article**

added of services reached the value of almost 62 trillion dollars in 2021 with an annual growth rate of 6.2%, corresponding to 64% of the world gross domestic product (GDP). Increasing value-added share of the service sector to economies brought with growing service trade between countries. In line with this development, post-1980s, international service trade has begun to grow faster than merchandise trade, and thus the need for putting general rules in international service business showed up, which was ignored in international trade negotiations and agreements pro-1980s. In this context, the issues concerning service trade were integrated into the last trade negotiation (Uruguay Round) of the General Agreement on Tariffs and Trade (Kandilov and Grennes, 2010; Appleyard and Field, 2014).

The value of international trade in services, which corresponds to 14.18% of GDP and 22.9% of trade in total goods and services, was 14.3 trillion dollars in 2022 with a growth rate of 15.3% from the previous year (WD-WDI, 2023; WTO, 2023). Although an important part of world service trade is carried out by developed countries, developing ones also draw attention to their increasing share in service trade. Table 1 presents the top 10 countries in the world in terms of service exports and imports as of 2022, accompanied by various statistics.

**Table 1. Top 10 Countries with the Largest Share in World Service Trade (2022)**

| | Exports | | | Imports | | |
|---|---|---|---|---|---|---|
| **Rank** | **Countries** | **Value** | **Share (%)** | **Countries** | **Value** | **Share (%)** |
| **1** | United States | 926 | 12.9 | United States | 683 | 10.3 |
| **2** | United Kingdom | 490 | 6.8 | China | 465 | 7.1 |
| **3** | China | 424 | 5.9 | Germany | 440 | 6.6 |
| **4** | Germany | 400 | 5.5 | Ireland | 370 | 5.5 |
| **5** | Ireland | 354 | 4.9 | United Kingdom | 310 | 4.6 |
| **6** | France | 326 | 4.5 | France | 273 | 4.1 |
| **7** | India | 313 | 4.3 | Netherlands | 270 | 4.1 |
| **8** | Singapore | 291 | 4.1 | India | 263 | 3.9 |
| **9** | Netherlands | 276 | 3.8 | Singapore | 258 | 3.9 |
| **10** | Spain | 186 | 2.6 | Japan | 209 | 3.1 |

**Note:** Values in the table are expressed in US dollars (billion dollars) at current prices.
**Source:** WTO (2023). https://stats.wto.org/

The total service exports of the countries that are in the top 10 in the world in terms of service exports meet 55.7% of the world service exports as of 2022. In this respect, the United States ranks first in the world with a value of 926 billion dollars, followed by the United Kingdom with 490 billion dollars and China with 424 billion dollars. Again, the total service imports of the countries that are in the top 10 around the world in terms of services imports meet 53.5% of the world service imports as of 2022. In this respect, the United States ranks first in the world with 683 billion dollars, followed by China with 465 billion dollars and Germany with 440 billion dollars. It is noteworthy that the countries that play an important role in the world in terms of services exports are also important actors in the world in terms of services imports.

According to the International Standard Industrial Classification system, services are generally categorized into sub-components such as wholesale and retail trade, restaurants and hotels,

transportation, warehousing, communications, financial services, insurance, real estate, business services, individual services, community services, social services, and public services. Although international trade in services includes commercial services, investment income, and public services; services trade commonly refers to commercial services (Appleyard and Field, 2014). Commercial services are classified under the headings of goods-related services, transport, travel, and other commercial services.

Conventional services trade has been going through a transformation toward more digital ones due to overwhelming information and communications technology (ICT) improvements, more specifically the Internet. By this means, even during the period of the destructive coronavirus (COVID-19) pandemic leading to a serious decreasing trend in merchandise trade, service trade could maintain its position in the international area as much as it can. So, digital trade has been underpinning the sustainable trade system around the world, and digitally deliverable services account for almost 63% of total service exports in 2020. Digital service is mainly defined as a potentially ICT-enabled service, referring to technologies that attain and furnish information via Internet and telecommunication networks like broadcasting, wireless networks, mobile communication, and other digital media. Progress and adoption in ICTs probably help to decrease searching, communication, transaction, and transportation costs, which are associated with international trade in services (Yi et al., 2022).

Being one of the most important components; telecommunication, computer, and information (TCI) service exports reached the value of 968 billion dollars in 2022, which equals almost 14% of total commercial service exports. The value added of services in Organisation for Economic Co-operation and Development (OECD) countries was 41 trillion dollars in 2021 with an annual growth of 5.7%, equaling 70% of the total GDP of OECD members. Their commercial service exports were nearly 4.9 trillion dollars in 2022 while import values were 4.3 trillion dollars. On the other hand, OECD countries had the TCI service exports and imports at the values of 621 and 370 billion dollars, respectively, in 2022. In other words, TCI service exports and imports consist of 12.7% and 8.8% of total commercial service exports and imports, respectively (WTO, 2023). Table 2 presents some statistics regarding the commercial service exports and imports of OECD countries, together with sub-components of commercial services.

**Table 2. Composition of Sub-Components of Trade in Commercial Services in OECD Countries**

| Services | Exports | | | Imports | | |
|---|---|---|---|---|---|---|
| | **2005** | **2015** | **2022** | **2005** | **2015** | **2022** |
| **Commercial services*** | 1.936 | 3.525 | 4.902 | 1.761 | 3.035 | 4.300 |
| **Goods-related services** | 44 (2.2) | 112 (3.2) | 163 (3.3) | 30 (1.7) | 91 (2.9) | 142 (3.3) |
| **Transport** | 362 (18.6) | 592 (16.8) | 911 (18.6) | 380 (21.6) | 583 (19.2) | 933 (21.7) |
| **Travel** | 436 (22.5) | 763 (21.6) | 742 (15.1) | 440 (24.9) | 614 (20.2) | 613 (14.3) |
| **Other commercial services** | 829 (42.8) | 2.058 (58.4) | 3.082 (62.8) | 647 (36.7) | 1.747 (57.5) | 2.610 (60.7) |
| - Construction | 25 (1.2) | 59 (1.7) | 48 (0.9) | 14 (0.8) | 36 (1.2) | 37 (0.8) |
| - Insurance and pension services | 46 (2.4) | 94 (2.6) | 127 (2.5) | 56 (3.2) | 111 (3.6) | 159 (3.7) |
| - Financial services | 194 (10.1) | 385 (10.9) | 505 (10.3) | 85 (4.8) | 183 (6.1) | 264 (6.2) |
| - Charges for the use of intellectual property | 131 (6.7) | 314 (8.9) | 404 (8.2) | 97 (5.5) | 297 (9.8) | 429 (9.9) |
| - Telecommunications, computer, and information services | 89 (4.6) | 338 (9.6) | 621 (12.7) | 81 (4.6) | 257 (8.5) | 378 (8.8) |
| - Other business services | 312 (16.1) | 809 (22.9) | 1.213 (24.7) | 290 (16.5) | 805 (26.5) | 1.228 (28.6) |
| - Personal, cultural, and recreational services | 26 (1.3) | 51 (1.4) | 73 (1.5) | 21 (1.2) | 51 (1.7) | 82 (1.9) |

**Note:** Values in the table are in US dollars (billion dollars) at current prices. Values in parentheses show the percentage shares of various services trade in total services trade. The sum of the subcomponents may not equal the total trade values due to rounding or missing component identification.
**Source:** WTO (2023). https://stats.wto.org/

One of the main distinguishing features of the service sector is that it is generally exposed to domestic regulatory barriers in contrast to the merchandise trade in which protectionist policies are applied through mostly tariffs and non-tariff tools. The importance of regulatory measures such as licensing and qualification requirements; data protection legislation; standards; codes of conduct; and registration, approval, and authorization requirements in international trade in services has been highlighted (Gupta et al., 2020). Protectionist policies pose an obstacle to further trade in services. OECD developed an index entitled the Digital Services Trade Restrictiveness Index (DSTRI) to measure the degree of protectionism in services traded digitally among countries since 2014. Digital services cater to both critical intermediate inputs for manufacturing and affect the presence of other potential information and communications technology-enabled high-quality services as intermediate inputs (Yang et al., 2023). As e new concept in international trade, trade in digital services is different from e-commerce trade in goods and utilizes digital technologies to facilitate the transactions in services. It is defined as a trade where services can be remotely delivered through information and communications technology networks (Zheng and Sun, 2023). The DSTRI indicates globally a various and complex regulatory environment affecting services traded digitally (Ferencz, 2019). The DSTRI measures cross-cutting barriers that inhibit or completely prohibit firms' ability to supply services using electronic networks, regardless of the sector in which they operate. It includes five measures: 1) infrastructure and

connectivity, 2) electronic transactions, 3) e-payment systems, 4) intellectual property rights, and 5) other barriers to trade in digitally enabled services. The DSTRI is a composite index that takes values between zero and one, where zero indicates an open regulatory environment for digitally enabled trade and one indicates a completely closed regime (OECD-GDT, 2023).

When looking at the course of DSTRI in OECD countries, an increasing trend has been seen until 2019 and then a relatively stationary state. At this point, the question what is the impact of DSTRI on services trade in OECD countries comes to mind. Any type of protectionist policies, at first, are implemented possibly to protect the domestic market against foreign ones, and hence inhibit the imports. Khachaturian (2015) reached the finding indicating that trade barriers on telecommunications inflate the relevant companies' profits. Nevertheless, they may generate a negative impact on exports too due to principally feedback effect, i.e., retaliation effect. Therefore, this study deals with not only service imports but also exports. Moreover, the study only focuses on trade in TCI services to get more specific results. This is owing to mainly an intuitional approach that the DSTRI may be closely associated with trade in TCI services. All in all, this study aims to establish the effectiveness of the restrictive policies on the trade in TCI services for OECD countries. In the remaining part of the study, firstly, a brief literature review is carried out, and then the data, models, and analysis results are demonstrated. The study ends up with the conclusion part.

## 2. LITERATURE REVIEW

There are a few studies investigating the impact of barriers in services trade on their trade developments using the digital service trade restrictiveness index since it was developed in 2014. Possibly one of the first studies using this trade restrictiveness index of OECD belongs to Nordås and Rouzet (2015), who analyzed the impact of services trade restrictions on both trade in services and manufacturing trade employing cross-section analysis with data of the year 2014 for OECD countries. The findings from the standard gravity model strongly prove the negative association between the higher restrictions on exports and imports in services and cross-border services trade as well as its negative impact on merchandise exports, imports, and intra-industry trade. Additionally, service trade restrictions have different effects on trade flows depending on the sector types. Doty (2015) used the services trade restrictiveness index while investigating the determinants of imports in telecommunication services in the framework of cross-section analysis for a wide country sample in the year 2011. Getting results from the gravity model proved the negative relationship between service trade restrictiveness and imports in telecommunication services. In another study, utilizing the panel data from 2014 to 2016 for a group country, Benz et al. (2020) established the negative impact of the higher restrictiveness of trade in services on total trade flows in services.

Investigating the response of Chinese manufacturing exports to destination countries' digital barriers using OECD's DSTRI from 2014 to 2018, Jiang et al. (2022) concluded that Chinese

manufacturing exports dropped at the rate of 2.32% owing to the tightening restrictiveness in digital services trade. The finding of the study showed that the negative impact of DSTRI on manufacturing exports happened in not only existing traded products but also products that have the potential to trade. Based on the findings from heterogeneity analysis, the study recommended that a favorable environment helps to alleviate this negative impact, and exports of high-tech products are less sensitive to obstacles in digital trade. Zhang and Wang (2022) analyzed the nexus between digital technologies, digital services trade, and policy restrictions on digital services trade using 2014-2020 panel data for 40 countries and/or regions. According to the findings, an improvement in digital technology gives rise to more exports and imports in digital services and the higher restrictive policies hinder exports in digital services. Gupta et al. (2022) developed a market data restrictions index, which measures the data restrictions that exporter countries encounter from their trade partners and analyzed its impact on exports in information technology services of 60 countries using panel data from the period of 2006-2017. According to the results, the higher market data restrictions constitute an impediment against export flows in information technology services.

Jiang et al. (2023) questioned the impact of digital trade rules on digital trade exports for 143 countries for the period 2005-2019 and reached the evidence that digital trade rules have a significant role in promoting digital services exports. Accordingly, digital trade rules enhance digital service exports by reducing trade costs. Using bilateral export data from 15 manufacturing sectors of 54 countries over the period 2014-2018, Yang et al. (2023) examined the impact of digital services trade policy restrictions on manufacturing exports. Getting results of the study mostly suggest that the higher restrictive policies on services trade are related to downward manufacturing exports though this finding is not found for all the manufacturing sectors. Furthermore, different regulations on digital service industries among countries affect negatively the export performance of manufacturing industries.

## 3. EMPIRICAL SETTING: DATA, MODEL, AND ANALYSIS RESULTS

The study is in pursuit of establishing the effectiveness of digital services trade restrictiveness applied by OECD countries in terms of its impact on their trade in TCI services. For this purpose, the following econometric models are constructed in panel data forms. These models are two main pillars of trade flows, i.e., exports and imports flows, respectively. By following this type of analysis strategy, the impact of DSTRI on trade in TCI services can be estimated from the point of view of not only imports but also exports of these services products.

$$TCISEXP_{i,t} = \alpha_0 + \alpha_1 \ln DSTRI_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t} \quad (1)$$

$$TCISIMP_{i,t} = \beta_0 + \beta_1 \ln DSTRI_{i,t} + \mu_i + \lambda_t + \omega_{i,t} \quad (2)$$

In the equations above, i and t show the cross-section (35) and time (8) dimensions, respectively. While *ln* represents the natural logarithmic operator, α and β are the parameter coefficients to be

estimated. Because of the panel data's nature, unobserved cross-section- ($\mu_i$) and time-specific ($\lambda_t$) effects are considered. The rest of the random errors are modeled into ($\varepsilon_{i,t}$) and ($\omega_{i,t}$).

The study utilizes annual panel data from 2014 through 2022 for 35 OECD countries[2]. Nowadays, the OECD officially consists of 38 members, however, in an attempt to build balanced panel data, Canada, Israel, and Mexico are excluded from the sample based on the data availability. In Equations 1 and 2, dependent variables TCISEXP and TCISIMP denote the exports and imports in TCI services, respectively. These data are in current US dollars and retrieved from the World Trade Organisation database (WTO, 2023). Total TCI service exports of the countries handled in the study were approximately 605 billion dollars in 2022 and 12.3 billion dollars on average in the study period. From this window, Ireland takes the lead among these countries with a value of 118 billion dollars, almost consisting of 20% of the total TCI exports of these countries in 2022. The United States (51 billion dollars), United Kingdom (35 billion dollars), Germany (33 billion dollars), and Netherlands (30 billion dollars) follow Ireland, respectively. New Zealand, Latvia, Lithuania, Slovenia, Colombia, Chile, and Iceland rank at the bottom of the heap with TCI exports of less than 1 billion dollars, respectively. On the other side, these countries imported TCI service products worth of almost 368 billion dollars in 2022 and 8.2 billion dollars, on average, in the study period. United States (54 billion dollars), Germany (53 billion dollars), France (32 billion dollars), Netherlands (25 billion dollars), and Japan (22 billion dollars) are among the first five countries concerning TCI imports, respectively, in 2022. On the contrary, Greece, Lithuania, Slovenia, Latvia, Costa Rica, and Iceland had imports in the value of less than 1 billion dollars in the same year. The countries in the study consist of 62.4% of total TCI exports and 38.2% of total TCI imports around the world in 2022.

The explanatory variable of the study is DSTRI, which is measured through an index produced by OECD (2023), taking the value from zero to one. Complete openness to trade gives a score of zero while being completely closed to foreign service providers yields a score of one. This index identifies, catalogs, and quantifies barriers that affect trade in digitally enabled services across 85 countries and provides policymakers with an evidence-based tool that helps to identify regulatory bottlenecks, design policies that foster more competitive and diversified markets for digital trade, and analyze the impact of policy reforms. Concisely, it captures cross-cutting impediments that affect all types of services traded digitally. The mean value of this variable is 0.131 in the study period. Being an increasing trend from 2014 to 2022, this index reached the value of 0.144, on average, in 2022, referring to more closed market conditions, in time, in services traded digitally. In this regard, among OECD countries, Poland (0.303), Colombia (0.299), Iceland (0.267), Türkiye (0.264), and Chile (0.263) are among the countries that implemented the most restrictive policies in services traded digitally. On the other hand, Norway

[2] Australia, Austria, Belgium, Chile, Colombia, Costa Rica, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Türkiye, the United Kingdom, and the United States.

(0.061), Switzerland (0.061), the United Kingdom (0.061), the United States (0.061), and Costa Rica (0.042) are ranked as the most open countries to services traded digitally among OECD members, respectively.

Equations 1 and 2 are here estimated via the Poisson Pseudo Maximum Likelihood (PPML) method yielded originally by Gourieroux et al. (1984) and gained popularity following Santos Silva and Tenreyro (2006) who provided a strong theoretical background. PPML method has recently been widely used in international trade analysis (see., Egger et al., 2011; Westerlund and Wilhelmsson, 2011; Sukanuntathum, 2012; Martin and Pham, 2015). Santos Silva and Tenreyro's (2006) main criticism of the relevant empirical literature is that, under the presence of heteroskedasticity, parameter coefficients obtained from log-linearized models estimated with ordinary least squares (OLS) could be pretty biased. Starting from this critical point, Santos Silva and Tenreyro (2006) proved how the bias in parameter estimates occurs in international trade analysis. Besides, drawing attention to the problems resulting from trade data in the value of zero, Santos Silva and Tenreyro (2006) suggested that econometric models with fixed elasticity should be estimated in multiplicative form[3].

Burger et al. (2009) stated that even in the presence of heteroskedasticity, quite efficient and consistent findings can be obtained from the PPML method and more generally from Poisson regression estimations. Expanding the simulation results of Santos Silva and Tenreyro (2006) and taking the focus on the trade flows in zero values, Santos Silva and Tenreyro (2011) inferred that the PPML is a robust method even in the case of the existence of trade flows with zero value. Hence, trade data with zero values provide an additional rationale for employing the PPML method in the model estimation. Examining the impact of trade flows with zero values on the estimation process of the econometric models, Westerlund and Wilhelmsson (2011) concluded that traditional estimation techniques like OLS have yielded biased and inefficient parameter coefficients. Therefore, Westerlund and Wilhelmsson (2011) stated that the proper estimator to be utilized in this situation is the Poisson fixed effects, which can eliminate the problems stemming from trade flows with values of zero and control the heterogeneity across countries. They also highlighted that the PPML performs more strongly in the small samples. One of the advantages of the application of the PPML method is that it naturally complies with the counterfactual simulations that overcome some important empirical constraints (Shepherd, 2016). Arvis and Shepherd (2013), as a distinguishing feature of the PPML method, provide evidence that the trade flows estimated by this method are equivalent to the actual trade flows. On the other side, Egger and Tarlea (2015) state that, in contrast to the potential endogeneity problem seen in the estimation of linear logarithmic models by using OLS, such a problem is not encountered in the PPML method. Shepherd

[3] The interpretation of the coefficients obtained from the PPML estimator is similar to that of the OLS method. Although the dependent variable is defined in the level form in the equation, the parameter coefficients can be interpreted as simple elasticity, in case of the independent variables are in the logarithmic form. In case the independent variables are in the level forms, parameter coefficients are interpreted as semi-elasticities (Shepherd, 2016).

(2016) expressed that, as an unusual feature of nonlinear maximum likelihood estimators, the PPML method has produced consistent findings even in the presence of fixed effects represented by dummy variables in OLS methods. In addition to all these, Yotov et al. (2016) suggested that the PPML estimator could be used to compute the theoretically consistent general equilibrium effects of trade policy shifts. All these explanations provide a strong basis for employing the PPML method in the estimation process of Equations 1 and 2. In the PPML method, econometric models are in the exponential forms:

$$TCISEXP_{it} = \exp(\alpha_0 + \alpha_1 \ln DSTRI_{it})\, \varepsilon_{it} \quad (3)$$

$$TCISIMP_{it} = \exp(\beta_0 + \beta_1 \ln DSTRI_{it})\, \omega_{it} \quad (4)$$

While the symbol *exp* in Equations 3 and 4 refers to the exponential function, all the remaining terms are as defined above. Herewith, Table 3 gives the place findings obtained from the estimation of Equations 1 and 2 via the PPML method.

**Table 3. Estimation Results of the Exports and Imports in TCI Services**

| | TCISEXP | | | TCISIMP | | |
|---|---|---|---|---|---|---|
| **Predictor** | **Coefficient** | **Robust Std. Err.** | **Prob.** | **Coefficient** | **Robust Std. Err.** | **Prob.** |
| DSTRI | -0.635*** | 0.349 | 0.068 | -1.369* | 0.279 | 0.000 |
| Cons. | 8.808* | 0.399 | 0.000 | 7.673* | 0.275 | 0.000 |
| Wald $X^2$ | 3.32*** | | | 23.97* | | |
| No of Obs. | 315 | | | 315 | | |

**Note:** * and *** indicate the statistical significance at 1% and 10%, respectively.

Wald $X^2$ test results refer to the significance of the econometric models. According to the estimation results, DSTRI affects both TCISEXP and TCISIMP statistically significantly and negatively, which meets theoretical expectations. Yet, the disincentive impact of DSTRI on trade flows is more powerful in TCISIMP than that in TCISEXP. While the model of TCISEXP is found as significant at the level of 10%, the model of TCISIMP is found as significant at the level of 1%. When looking at the magnitudes of parameter coefficients, a 1% increase in DSTRI gives rise to a 0.635% decrease in TCISEXP while its negative impact on TCISIMP is 1.369%. These results are considerably expected since any protectionist policies principally build a barrier against import flows. However, because of a significant part of the trade in TCI services are between each other of OECD countries, tightening protectionist policies may most likely cause a fall in exports of TCI services, due to the possible retaliation effect. In general, the results prove the effectiveness of applying protectionist policies concerning the direction of trade flows in TCI services.

## 4. CONCLUSION

This study analyzes the nexus between digital service trade restrictiveness and trade in telecommunication, computer, and information services in 35 OECD countries over the period 2014-2022. In this context, constructing exports and imports models were estimated through the Poisson Pseudo Maximum Likelihood method. The findings refer to a negative association between digital

services trade restrictiveness and trade in telecommunication, computer, and information services. This negative association overweighs for import flows than for exports as expected. Accordingly, the higher restrictive policies on trade in telecommunication, computer, and information services bring about downward in imports of these services as well as discouraging exports of these products. From these results, protectionist policies, which are implemented principally to protect domestic suppliers against foreign ones, yield as expected. However, they also give rise to a decrease in exports of these services owing to the most likely retaliation effect.

Thanks to the consistently improving digitalization around the world, some non-tradeable services have been transformed into tradeable ones at present. Yet, restrictive policies on the trade in services inhibit achieving the targeting increase in these trade flows. Therefore, less protectionist policies can most likely help to enhance the trade in this type of service due to mainly diminishing trade costs. Besides, to make use of more advantages of increasing digitalization at the point of enhancing trade in telecommunication, computer, and information services, further cooperation and dialogue across countries, particularly technologically advanced countries, is required. By this means, domestic services suppliers can attain foreign advanced knowledge and technology at relatively moderate costs, thus productivity can be improved, and eventually, more trade in TCI services can be achieved.

This study has some limitations. First, the study could not cover a long period since the digital service trade restrictiveness index was constructed a relatively short time ago. Similarly, a few countries could not be included in the analysis due to data unavailability. Last but not least, other potential determinants of trade in telecommunication, computer, and information services were not considered in the empirical setting of the study. Therefore, the next studies may build their empirical settings in a more robust structure by including several control variables in the econometric models and estimating them hierarchically. On the other hand, protectionist policies in trade in telecommunication, computer, and information services can be measured with indicators other than the digital service trade restrictiveness index to make a more robust inference concerning the efficiency of protectionist policies on trade in services.

## REFERENCES

Appleyard, D. R. and Field, A. J. (2014) “International Economics”, 8th Edition, New York: McGraw-Hill.

Arvis, J. F. and Shepherd, B. (2013) “The Poisson Quasi-Maximum Likelihood Estimator: A Solution to the ‘Adding Up' Problem in Gravity models”, Applied Economics Letters, 20(6): 515-519.

Benz, S., Ferencz, J. and Nordås, H. K. (2020) “Regulatory Barriers to Trade in Services: A New Database and Composite Indices, The World Economy, 43(11): 2860-2879.

Burger, M., Van Oort, F. and Linders, G. J. (2009) "On the Specification of the Gravity Model of Trade: Zeros, Excess Zeros, And Zero-Inflated Estimation", Spatial Economic Analysis, 4(2): 167-190.

Doty, J. C. (2015) "International Trade in Telecommunication Services: A Cross-Sectional Gravity Regression", Undergraduate Economic Review, 12(1): 1-16.

Egger, P., Larch, M., Staub, K. E. and Winkelmann, R. (2011) "The Trade Effects of Endogenous Preferential Trade Agreements", American Economic Journal: Economic Policy, 3(3): 113-43.

Egger, P. H. and Tarlea, F. (2015) "Multi-way Clustering Estimation of Standard Errors in Gravity Models", Economics Letters, 134: 144-147.

Ferencz, J. (2019) "The OECD Digital Services Trade Restrictiveness Index", OECD Trade Policy Papers, No. 221, Paris: OECD Publishing.

Gourieroux, C., Monfort, A. and Trognon, A. (1984) "Pseudo Maximum Likelihood Methods: Applications to Poisson Models", Econometrica, 52(3): 701-720.

Gupta, P., Maryam, J., Sasmal, S. and Singh, S. (2020) "Improving the OECD Services Trade Restrictiveness Index, Working Paper, No. CWS/WP/200/58, Delhi: Centre for WTO Studies.

Gupta, S., Ghosh, P. and Sridhar, V. (2022) "Impact of Data Trade Restrictions On IT Services Export: A Cross-Country Analysis", Telecommunications Policy, 46(9): 1-14.

Jiang, L., Liu, S. and Zhang, G. (2022) "Digital Trade Barriers and Export Performance: Evidence from China", Southern Economic Journal, 88(4): 1401-1430.

Jiang, T., Hu, Y., Haleem, F. and Zeng, S. (2023) "Do Digital Trade Rules Matter? Empirical Evidence from TAPED", Sustainability, 15(11): 1-19.

Kandilov, I. T. and Grennes, T. (2010) "The Determinants of Service Exports from Central and Eastern Europe", Economics of Transition, 18(4): 763-794.

Khachaturian, T. (2015) "Services Trade Restrictions and Company Profits: Telecommunications", US International Trade Commission: Office of Industries, Working Paper ID-042.

Martin, W. J. and Pham, C. S. (2015) "Estimating the Gravity Model When Zero Trade Flows Are Frequent and Economically Determined", World Bank Group Policy Research Working Paper, No. 7308.

Nordås, H. K. and Rouzet, D. (2015) "The Impact of Services Trade Restrictiveness On Trade Flows: First Estimates", OECD Trade Policy Papers, No. 178, Paris: OECD Publishing.

OECD (2023) https://stats.oecd.org/Index.aspx?DataSetCode=STRI_DIGITAL, (14.06.2023)

OECD-GDT (2023) https://goingdigital.oecd.org/en/indicator/73, (20.06.2023)

Santos Silva, J. and Tenreyro, S. (2006) "The Log of Gravity", The Review of Economics and Statistics, 88(4): 641-658.

Santos Silva, J. and Tenreyro, S. (2011) "Further Simulation Evidence On the Performance of the Poisson Pseudo-Maximum Likelihood Estimator", Economics Letters, 112(2): 220-222.

Shepherd, B. (2016) "The Gravity Model of International Trade: A User Guide (An Updated Version)", ARTNeT United Nations Publications, 1-58.

Sukanuntathum, A. (2012) "Robust Estimation of Gravity Models Under Heteroskedasticity and Data Censoring", Procedia-Social and Behavioral Sciences, 40: 731-735.

Westerlund, J. and Wilhelmsson, F. (2011) "Estimating the Gravity Model Without Gravity Using Panel Data", Applied Economics, 43(6): 641-649.

WB-WDI (2023) https://databank.worldbank.org/source/world-development-indicators, (14.06.2023)

WTO (2023) https://stats.wto.org/, (14.06.2023)

Yang, F., Wang, Y. and Whang, U. (2023) "Trade Restrictions On Digital Services and The Impact On Manufacturing Exports", The Journal of International Trade & Economic Development, 1-28.

Yi, Z., Wei, L. and Huang, X. (2022) "Does Information-and-Communication-Technology Market Openness Promote Digital Service Exports?", Sustainability, 14(9): 1-19.

Yotov, Y. V., Piermartini, R., Monteiro, J. A. and Larch, M. (2016) "An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model, Geneva: World Trade Organization.

Zhang, X. and Wang, Y. (2022) "Research on the Influence of Digital Technology and Policy Restrictions on the Development of Digital Service Trade", Sustainability, 14(16): 1-16.

Zheng, X. and Sun, A. (2023) "Digital Services Trade between China and V4 Countries–A Study of Trade Complementarity and Regulatory Restrictiveness", Journal of Economics, 71(2): 139-154.

**Hakem Değerlendirmesi:** Dış bağımsız.
**Çıkar Çatışması:** Yazar çıkar çatışması bildirmemiştir.
**Finansal Destek:** Yazar bu çalışma için finansal destek almadığını beyan etmiştir.
**Teşekkür:** -

**Peer-review:** Externally peer-reviewed.
**Conflict of Interest:** The author has no conflict of interest to declare.
**Grant Support:** The author declared that this study has received no financial support.
**Acknowledgement:** -