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The Role of Digital Services Trade Restrictiveness in Exports: Before and During COVID–19

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Abstract

Digital technology has penetrated various fields, including international trade. This study aims to analyze how barriers/openness to trade in digital services affected exports before the COVID–19 pandemic (2015–2016) and during the pandemic (2019–2020). Based on the Gravity model, exports seem to be influenced by digital services trade restrictiveness, including infrastructure and connectivity restrictions (X1), electronic transaction restrictions (X2), and other restrictions (X3). The panel data regression equation was used to analyze data from various countries (European 17 countries, Asian 8 countries, and Latin American 3 countries) sourced from OECD Statistical Data. The selection of sample countries was based on data availability and homogeneity. The results showed that the effect of digital services trade restrictiveness on exports was low before the pandemic and increased during the pandemic era. Prior to the pandemic, restrictions on electronic transactions had a weak and negative impact on exports; meanwhile, during the pandemic, all restrictions impacted exports, except for other restrictions. In the pandemic era, restrictions on infrastructure & connectivity had a negative

impact, but restrictions on electronic transactions had a positive impact on exports due to a decline in global exports and several countries reducing restrictions on electronic transactions.

Keywords: digital services trade restrictiveness, exports, Gravity model, trade openness, COVID–19 pandemic

JEL: F010, F100, F140, F430

Introduction

The contraction of economic growth in 2020 compared to 2019 generally occurred due to the COVID–19 pandemic, where the component of exports of goods and services became the component with the deepest contraction. Low export performance impacts growth, and also reflects low competitiveness (Ruzekova, Kittova, and Steinhauser 2020). The World Trade Organization estimated that global trade contracted by 9.2 percent.

World trade performance in several countries improved slightly in 2021, as projected by the World Trade Organization. This was because several COVID–19 vaccines had been found to stop the pandemic, although other variants of the virus then emerged. However, the impact of the pandemic brought about new arrangements and procedures to support future global trade performance, namely the increasing role of digital technology in economic activities. The use of digital technology allows for the creation of new goods and services, which are ordered and delivered digitally, such as e-books, online education, or online banking services. Digitization is the process of turning the essence of an organization's products, services and processes into internet-compatible data packages that can be created, stored, and transferred in bits and bytes, along with the information associated with them, for marketing, sales, and distribution (Banalieva and Dhanaraj 2019).

International trade today, especially exports, depends on services. Services have long been perceived as playing a secondary role in world trade, and services account for about 50% of world trade in value-added terms (Roy 2019). According to Heuser and Mattoo (2017), three-quarters of the total services in trade are attached to merchandise rather than services traded directly. In the long term, the international trade in merchandise is declining, relatively speaking. However, trade in services, especially electronic services, is in a relatively long-term upward trend, including cross-border data flows, which are growing exponentially (Borchert et al. 2020). Trade in digital services in international trade is no doubt increasing, especially with the restrictions on the movement of people due to the 2019 COVID–19, because many trading activities use digital services.

Drake-Brockman et al. (2020) stated that the shift to the digital economy intensified during the COVID–19 pandemic as producers of goods and services connected with customers through online platforms. Digital technology can add value by increasing productivity and/or lowering costs and barriers associated with the flow of traditional

goods and services. With digitalization, the costs of engaging in international trade can be reduced, connecting businesses and consumers globally, helping to spread ideas and technology, and facilitating the coordination of global value chains (Brouthers, Geisser, and Rothlauf 2016). In international trade, Meltzer and Lovelock (2018) stated that increasing digital connectivity and global data flows around the world increase trade opportunities. González and Ferencz (2018) further stated that digital transformation increases economic openness. Several service trade transactions are also conducted online, such as health services, education services, and entertainment (Mackey and Nayyar 2017; Budd et al. 2020; Mao et al. 2020; Ratten 2020). Digitization creates new trade opportunities for companies to sell more products to more markets, resulting in countries diversifying their export products. In this digital era, connectivity infrastructure, as well as international flows of ICT goods, significantly affects services exports (Wajda-Lichy et al. 2022).

In the current era of digitalization, the export of goods and services includes the export of digital products. Digital products refer to digital goods and digital services. The trade in digital services in international trade has increased, especially since the restrictions on the movement of people due to COVID–19, so many trading activities use digital services. Digitization has transformed international trade and provides an estimate of the impact of increased digital connectivity on trade. Digitization is critical to the trade in more complex manufactured goods and services that can be delivered digitally. Services are not only traded directly but also indirectly manifested in manufacturing exports (Drake-Brockman et al. 2020). In gross terms, trade in services accounts for a quarter of global trade in goods and services (WTO 2019). However, in 2020, the World Bank noted that the contribution of service exports to GDP was 10.58, a decrease of 3% compared to the previous year.

Trade in digital goods and services has been significant in the last decade. However, not all countries have open trade in digital services in global trade. In general, there are striking differences in the trade openness of digital services in developed countries in Europe and developing countries in Asia. Based on data from the OECD, the Digital Services Trade Restrictiveness (DSTR) in Asian countries is higher than in some European countries, meaning that there are more barriers to digital trade in Asian countries than in European countries. As the example explanation, Figure 1 describes the Digital Services Trade Restrictiveness Index (DSTRI) in seventeen European countries, eight Asian countries, and three Latin American countries in The figure shows that all DSTRIs (Digital Services Trade Restrictiveness Indices) in European countries are less than By contrast, the majority of DSTRIs in Asian and Latin American countries are greater than 0.15, meaning that European countries have greater openness in trading digital services.
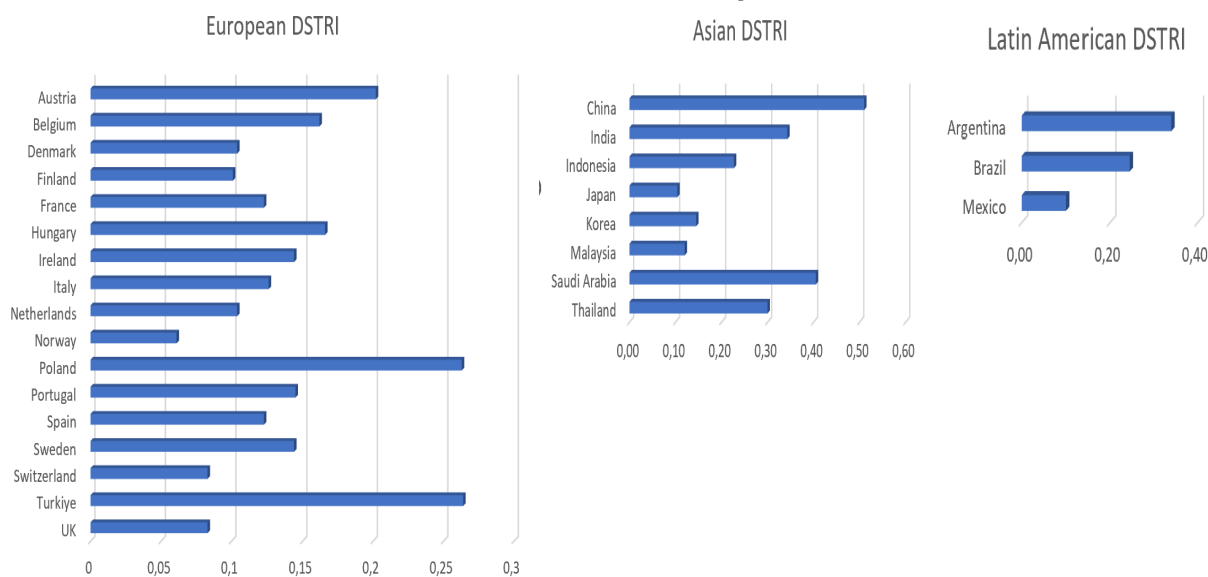
Figure 1. DSTRI in Europe, Asia, and Latin America

Source: OECD (n.d.).

There are several studies on barriers to trade in digital services, but not many compared the periods before and during the COVID–19 pandemic. This study compares the effect of several components of DSTR on exports. The component studied is an index that tends to change in the pre-pandemic period (2015–2016) and during the COVID–19 pandemic (2019–2020). It comprises infrastructure and connectivity barriers, electronic transactions, and other barriers in European, Asian, and Latin American countries. DSTRIs that tend to remain unchanged, are not included in this analysis, for example, barriers in the payment system and barriers to intellectual property rights. Export performance is determined by the role of digital services, as well as other factors, such as the number of goods produced. The Gravity model is used as a control (Abeliansky and Hilbert 2017). Therefore, the number of goods produced is included as a variable, because the number of goods produced determines a country's production capacity and will affect exports. This is evident when production capacity increases, so exports also increase (Gay 2016; Shiferaw 2017; Gnangnon 2018). This variable will be the control variable in this study, because, without it, trade through digital services is meaningless.

The rest of the paper is structured as follows. The next section describes the research methodology. Section 3 contains the results and discussion, while the conclusions and recommendations are in Section 4.

Methodology

The Gravity model is used as the basis for the equation in this study. This model was first introduced by Tinbergen in 1962 (Tayyab, Tarar, and Riaz 2012; Chaney 2018; Guðjonsson et al. 2021), who showed that international trade flows are influenced by the size of the economy and distance. Furthermore, in 1980, Krugman stated that distance can be approached by the presence of barriers in international trade (Chaney 2008; 2018; Serrano and Pinilla 2012). This study focuses on trade barriers in the context of digital services trade restrictiveness, while the size of each country's economy is determined by the number of products they produce.

Quantitative research using an ex post facto approach was chosen to test the hypotheses proposed in this study. Export performance is measured by the total real value of overseas sales, which in this study uses US dollars based on present values, collected from World Bank data. Manufactured products are measured by the value of the total number of goods produced by the processing industry, in US dollars, again collected from the World Bank.

Digital Services Trade in this study is measured by DSTRIs as measured by the OECD. The DSTRIs in this study use three restrictions: the index of restrictions to infrastructure and connectivity, the index of restrictions to electronic transactions, and other indices of restrictions, for data for the year before (2015–2016) and the period of the COVID–19 pandemic (2019–2020). The reason for using these two periods is because the OECD's DSTRI calculations only started in 2014, and in 2015, world trade conditions had started to rise after the 2008 financial crisis (Figueira 2017; Nikensari et al. 2021). Another reason is that the barriers to digitalization in trade in all the countries studied did not change much from 2014 to As for the data during the pandemic, data from 2019 and 2020 were used, arguing that the COVID–19 pandemic began in the final quarter of 2019.

Considering the availability of the OECD's DSTRI data and considering the homogeneity of the data, the scope of the research covers eight countries in Asia (India, Indonesia, Japan, Kazakhstan, Malaysia, Saudi Arabia, South Korea, and Thailand), three Latin American countries (Argentina, Brazil, and Mexico), as well as 17 OECD countries (Austria, Belgium, Denmark, Finland, France, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Türkiye, and the UK). Germany and China are not included, because their exports are very large compared to other countries.

By considering the Gravity model, the constellation of the relationship between the independent variables and export performance is shown in the following equation:

$$EX = f \text{ (Economic Size, Distance).} \tag{1}$$

$$EX = f \text{ (DST, Manf).} \tag{2}$$

Exports are influenced by the implementation of trade in digital services, where *EX* is export performance, *DST* is digital services trade (measured by restrictions on trade in digital services), and *Manf* is the availability of manufactured products. The DST in this study only includes three of the previously mentioned five criteria: infrastructure and connectivity (*Infr*), electronic transactions (*Elect*), and other digital barriers (*Oth*). Other restrictions, such as payment systems and intellectual property rights barriers, are not examined, because most of the countries studied have low (zero) barriers. Then the equation becomes:

$$EX = f \text{ (Infr, Elect, Oth, Manf).} \tag{3}$$

Using the panel data regression method, separate analyses were carried out for the periods before and during the COVID–19 pandemic. The research equation is formulated as follows:

$$\ln EX_{it} = \alpha_{it} + \beta 1 \, Infr_{it} + \beta 2 \, Elect_{it} + \beta 3 \, Oth_{it} + \beta 4 \, Manf_{it} + \varepsilon_{it}, \tag{4}$$

where:

$\ln EX_{it}$ – exports of country i, year t,

$Infr_{it}$ – infrastructure and connectivity barrier of country i, year t,

$Elect_{it}$ – electronic transactions barrier of country i, year t,

Oth_{it} – others barrier of country i, year t,

$Manf_{it}$ – manufacture product of country i, year t,

α_i – constant,

β – regression coefficient.

The stages of analysis using the panel data regression equation were preceded by selecting the best model, normality test and detection of classic multicollinearity symptoms, and hypothesis testing.

Results and discussion

Based on the pre-pandemic data, the mean export of the 28 countries in 2015/2016 was USD 242.74 billion; the highest exports amounted to USD 635.82 billion, while the lowest

amounted to USD 35.49 billion. The average restrictiveness in infrastructure and connectivity was still quite high before the pandemic, with the highest restrictiveness index of However, there were countries without restrictiveness in digital services trade. The average restrictiveness in electronic transactions and other digital barriers is quite low. Factors other than restrictiveness, namely manufactured products, had a mean of USD 170.14 billion, with the highest production value of USD 1268.00 billion and the lowest of USD 19.44 billion.

In the pandemic era, the average export of the 28 countries in 2019–2020 was USD 270.24 billion; the highest was USD 697.48 billion, and the lowest was USD 46.71 billion. The average restrictiveness in infrastructure and connectivity is still quite high in the pandemic era, with the highest restrictiveness index of 0.48 and the lowest of The average restrictiveness in electronic transactions and other digital barriers was quite low and slightly decreased compared to before the pandemic. Factors other than restrictiveness, namely manufactured products, had an average of USD 185.08 billion, with the highest production value of USD 1275.48 billion and the lowest of USD 23.22 billion.

Table 1. Data summary before and during the pandemic

Before	Exports	INFRS	ELECTR	OTHERS	MANUFAC
Mean	242.7385	0.107625	0.033125	0.036500	179.1432
Median	193.2925	0.079000	0.032000	0.022000	95.52700
Maximum	635.8210	0.790000	0.064000	0.109000	1268.000
Minimum	35.48600	0.000000	0.021000	0.000000	19.44100
In era					
Mean	270.2379	0.112768	0.033107	0.036107	185.0850
Median	234.7055	0.079000	0.021000	0.022000	113.8415
Maximum	697.4806	0.476000	0.064000	0.109000	1275.477
Minimum	46.71400	0.040000	0.021000	0.000000	23.21600

Source: authors' compilation using Eviews.

Average exports and average manufactured products during the pandemic increased slightly compared to the pre-pandemic period. However, this increase seems to be influenced more by exports and the amount of production before the end of 2019, when the COVID–19 issue had not yet emerged and infected the population. After the pandemic began to spread at the end of 2019, average exports and manufactured products began to decline, experiencing the deepest contraction in Q2 However, in the following quarters, there was a slight recovery, in exports, in particular. Even though, exports were still much lower than before COVID–19.

The average restrictiveness in infrastructure and connectivity is the highest compared to the other two restrictiveness factors in this study, both before and during the pandemic. However, during the pandemic, this restrictiveness increased, meaning that there were higher barriers than before the pandemic. In 2019–2020, the restrictiveness in infrastructure and connectivity increased in several countries, including Argentina, Austria, Kazakhstan, Poland, Saudi Arabia, Turkey, and even Japan. Meanwhile, the restrictiveness in electronic transactions was quite low. It decreased slightly during the pandemic, because Indonesia and Denmark decreased their transparency in digital services trade by reducing restrictiveness in electronic transactions. The restrictiveness in electronic transactions did not change much before and during the pandemic.

Furthermore, based on the data and using multiple regression analysis techniques, Table 2 shows the results before and during the COVID–Based on the best model selection test, the Random Effect Model is a panel data regression model that was selected as the analysis tool, with data from the 28 countries. The table also shows that in the pre-pandemic period, there were only two variables that affected export performance: manufactured products as the control variable, and barriers to trade in digital services from electronic transactions as the main variables studied. However, the effect was less significant. During the COVID–19 period, all the variables studied, both the main and control variables, had a significant effect on export performance, except for the other restrictiveness variables.

Simultaneously, the proposed variables influenced exports, showing an increase before and during the pandemic. If the magnitude of the simultaneous influence of independent variables on exports was only 36% before the pandemic, during the pandemic, it increased by 58.49%. If the restrictiveness in infrastructure and connectivity had no effect on exports before the pandemic, then during the pandemic, the opposite happened. The restrictiveness in infrastructure and connectivity had a negative effect on exports; in other words, if the restrictiveness goes up, exports go down, and vice versa. The data showed that during the pandemic, global exports declined sharply, especially in 2020, and during the same period, restrictiveness in infrastructure and connectivity increased in several countries. This result is in line with Nordås and Rouzet (2017; Yang, Wang, and Whang 2023) which states that if the restrictiveness in digital services trade increases, it will reduce exports and imports, and vice versa.

Table 2. Test summary of the export model

LExports_before pandemic		LExports_during pandemic	
Chow test:		Chow test:	
– prob. c-s F	0.0000	– prob. c-s F	0.0000
– prob. Chi-square	0.0000	– prob. Chi-square	0.0000
Hausman test: – prob. c-s random	0.4107	Hausman test: – prob. c-s random	0.0448
LM-test: prob. B-P	0.0000	LM-test: prob. B-P	0.0000
Conclusion: The best model is REM		Conclusion: The best model is REM	
Normality test: Jaeque Bera prob.	2.2313	Normality test: – Jaeque Bera	2.5259
	0.3277	– prob.	0.2828
Multicollinearity test: Centered VIF	< 5.0000	Multicollinearity test: Centered VIF	< 5.0000
REM: LExports before the pandemic		**REM: LExports during the pandemic**	
Variables	**Fixed Effects Model**	**Variables**	**Random Effect Model**
Constanta	5.1677	Constanta	5.0929
t-stat	(26.3514)***	t-stat	(28.8544)***
Infrastructure & Connectivity t-stat	– 0.3625 (–0.9137)	Infrastructure & Connectivity t-stat	– 1.5456 (–2.2096)***
Electronic transaction t-stat	– 4.0570 (–1.3066)*	Electronic transaction t-stat	9.3707 (2.8672)***
Other Restrictiveness	– 1.5021	Other Restrictiveness	– 1.8652
t-stat	(–05638)	t-stat	(–0.8522)
Manufacture goods	0.0017	Manufacture goods t-stat	0.0011
t-stat	(3.3852)***		(4.3558)***
R2	0.3619	R2	0.5849
Adj. R2	0.1407	Adj. R2	0.2902
F-stat	3.2506	F-stat	5.1959

Note: *** sig. 5%, ** sig. 10%, * sig. 20%.
Source: authors' compilation using Eviews.

According to the OECD, the main contributors to the calculation of the restrictiveness index in infrastructure and connectivity are policies that affect connectivity, such as actions on cross-border data flows and data localization (Ferencz and Gonzales 2018). Additionally, it takes into account actions that limit or block the use of communication services, and maps the extent to which best practice regulations

on interconnection between network operators are implemented to ensure smooth communication. The tendency of some countries to increase restrictiveness in infrastructure and connectivity is in line with the policy of limiting the import of digital services in destination countries, because the internet is very limited and regulated, requiring data to be localized. Thus, there is a restrictiveness in accessing online information that can be accessed from outside. The country concerned has limited the use of digital services that can be accessed from outside, but at the same time, its exports have not decreased. Maybe this is what China is doing that creates barriers to trade in digital services in the international market (Meltezer 2020). It has the power to develop a digital economy and is the second-largest digital economy player after the United States, controlling 40% of global e-commerce transactions (Woetzel et al. 2017). Additionally, if the goods being exported are high-tech products, as is the case in China, trade barriers in digital services are less sensitive to exports (Gupta, Ghosh, and Sridhar 2022). This is why China is not included in this research sample, because the data from that country are very different from most other countries, both in exports and in their DSTRI.

Meanwhile, restrictiveness in electronic transactions includes discriminatory conditions for issuing licenses for e-commerce activities, the possibility of online tax registration and declaration for non-resident companies, deviations from internationally accepted rules regarding electronic contracts, actions that hinder the use of authentication in e-commerce, and the lack of effective dispute resolution mechanisms. The positive effect of restrictiveness in electronic transactions on export performance during the pandemic was due more to the fact that in 2020 exports experienced a global contraction, while restrictiveness in electronic transactions was already quite low in many countries. This restrictiveness even fell in Saudi Arabia and India. The low restrictiveness in electronic transactions reflects the openness of digital services trade in these countries, and this is good for increasing exports. However, due to the global situation that was hit by the pandemic shock, the low restrictiveness in electronic transactions was powerless to increase exports.

Other restrictiveness describes other barriers to digital commerce. They include, among others: performance requirements that affect cross-border digital commerce (for example, mandatory use of software and local encryption or mandatory technology transfer); download and streaming restrictions; restrictions on online advertising; commercial or local presence requirements; and the lack of effective redress mechanisms against online anti-competitive practices. This restrictiveness is quite low in almost all the countries studied, but has no effect on exports, as the value of the measured indicator did not change in the two years before or during the pandemic.

As a control variable, manufactured products have a positive influence on exports in the pre-pandemic and pandemic periods. This is because, based on the data studied,

the average number of manufactured and exported products increased in the periods before and during the pandemic. Thus, when manufactured products increased, exports also increased. This finding is in line with several studies that state the relationship between manufactured products and exports (Gay 2016; Shiferaw 2017; Gnangnon 2018). The increase in exports and manufactured products in the pandemic period was higher than the average before the pandemic, which was due to the high exports and manufactured products in 2020, by comparison, although the value experienced a decline compared to 2019, it was still higher than the pre-pandemic period.

Research limitations

This research has limitations due to data availability related to restrictiveness in the digital service trade. Most of the data are from Europe with only a few countries in Asia and Latin America. In European countries, the majority of restrictiveness in digital trade is low, or openness is high, while many countries outside Europe are high in digital trade barriers. It would be interesting to discuss the restrictiveness of digital services trade in countries outside Europe, and how they have adapted to the evolving landscape of digital transactions over time.

Conclusion

The openness of trade in digital services in several Asian and Latin American countries is still low compared to several countries in Europe. The findings of this study indicate that before the COVID–19 pandemic, only restrictiveness in electronic transactions and control variables affected export performance, while restrictiveness in infrastructure and connectivity, as well as other digital restrictiveness, had no effect on export performance. In the era of the pandemic, all the variables studied affected export performance, except for other restrictiveness. Restrictiveness in infrastructure and connectivity negatively impacted exports. This is because in 2020, when exports contracted/fell, several countries increased restrictiveness in infrastructure and connectivity. On the other hand, electronic transaction barriers positively affected exports. This occurred because when the majority of countries had low restrictions on electronic transactions, there were instances when some countries further reduced these restrictions. During this period, global export conditions were undergoing a significant contraction, making it appear as if the restrictiveness of electronic transactions had a minimal effect on increasing exports.

Based on the phenomenon of reduced on digital services trade restrictions during the COVID–19 pandemic, in the future, digitalization will encourage countries outside the European Union and China to further reduce barriers to trade in digital services to increase their exports.

Recommendations

To increase exports, several countries in Asia and Latin America in this study reduced restrictiveness in digital services trade, which was previously still high. For this reason, it is necessary to review for countries that otherwise increased their restrictiveness, or decreased trade openness in digital services, because openness in digital services trade can increase exports if there are no extreme conditions due to the pandemic.

Regarding the limited data on trade in digital services, the United Nations and the World Bank should also measure the openness of trade in digital services in all countries, because this is the era of digital trade.

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Wpływ ograniczeń w handlu usługami cyfrowymi na eksport przed i w trakcie pandemii COVID–19

Technologia cyfrowa przeniknęła do różnych dziedzin, w tym handlu międzynarodowego. Niniejsze opracowanie ma na celu analizę wpływu barier w handlu usługami cyfrowymi/otwartości na handel tymi usługami na eksport przed pandemią COVID–19 (2015–2016) i w czasie pandemii (2019–2020). Na podstawie modelu Gravity wydaje się, że na eksport wpływa restrykcyjność handlu usługami cyfrowymi, w tym ograniczenia dotyczące infrastruktury i łączności (X1), ograniczenia dotyczące transakcji elektronicznych (X2) i pozostałe ograniczenia (X3). Do analizy danych z różnych krajów (17 krajów europejskich, 8 krajów azjatyckich i 3 krajów Ameryki Łacińskiej) pochodzących z baz danych statystycznych OECD wykorzystano równanie regresji danych panelowych. Wyboru krajów dokonano, opierając się na dostępności i jednorodności danych. Wyniki pokazały, że wpływ restrykcyjności handlu usługami cyfrowymi na eksport był niski przed pandemią i wzrósł w dobie pandemii. Przed pandemią obostrzenia w transakcjach elektronicznych miały słaby i negatywny wpływ na eksport, tymczasem w czasie pandemii wszystkie obostrzenia miały wpływ na eksport, z wyjątkiem pozostałych ograniczeń. W czasie pandemii ograniczenia dotyczące infrastruktury i łączności miały negatywny wpływ na ekstort. Natomiast ograniczenia dotyczące transakcji elektronicznych miały pozytywny wpływ na eksport ze względu na spadek globalnego eksportu i zmniejszenie przez kilka krajów ograniczeń dotyczących transakcji elektronicznych.

Słowa kluczowe: ograniczenia w handlu usługami cyfrowymi, eksport, model grawitacyjny, otwartość na handel, pandemia COVID–19