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INFRASTRUCTURE AS A DETERMINANT OF NATIOANAL ADVANTAGE IN SERVICE EXPORT: THE CASE OF TÜRKİYE

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Abstract

Today, service sector is the dominating sector of especially developing and developed economies. Herein, gaining national advantage in international trade in services is critical for each country. Therefore, this research considers infrastructure as one of sources of national advantage and examines the impact of infrastructure (divided roads, railways, medical institutions, tourism operation certificated businesses, universities) on service export in Türkiye. In accordance with this purpose, cointegration analysis was carried out for the period of 1982-2020 by leveraging ARDL model. The results indicate that while divided roads, railways and the number of tourism operation certificated businesses have positive and significant impact on service export in Türkiye, the number of universities and medical institutions have negative and insignificant effect on service export in Türkiye. At the end of the research some recommendations for policymakers are provided.

Keywords: *National Advantage, Service Export, Infrastructure*
JEL Classification: *F14, F19, L90*

HİZMET İHRACATINDA ULUSAL AVANTAJ BELİRLEYİCİSİ OLARAK ALTYAPI: TÜRKİYE ÖRNEĞİ

Öz

Günümüzde hizmet sektörü özellikle gelişmiş ve gelişmekte olan ülke ekonomilerinde hakim sektör konumundadır. Bu noktada, uluslararası hizmet ticaretinde ulusal avantaj kazanmak her ülke için büyük bir öneme sahiptir. Buradan hareketle bu çalışma altyapıyı ulusal avantajın kaynağı olarak ele almakta ve altyapının hizmet ihracatı üzerindeki etkisini incelemektedir. Bu amaç doğrultusunda, ARDL modeli kullanılarak 1982-2020 dönemi için eşbütünleşme analizleri gerçekleştirilmiştir. Çalışmada alt yapının göstergeleri olarak bölünmüş yol uzunluğu, tren yolu uzunluğu, turizm işletme belgeli işletme sayısı, sağlık kuruluşu sayısı ve üniversite sayısı kullanılmıştır. Sonuçlar bölünmüş yol, tren yolu ve turizm işletme belgeli işletme sayısının hizmet ihracatını pozitif ve anlamlı şekilde etkilediğini ve üniversite ve sağlık kuruluşu sayısının ise negatif ve anlamsız olarak etkilediğini göstermiştir. Çalışmanın sonunda politika yapıcılara birtakım tavsiyelerde bulunulmuştur.

Anahtar Kelimeler: *Ulusal Avantaj, Hizmet İhracatı, Altyapı*
JEL Sınıflandırması: *F14, F19, L90*

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1. Introduction

The dominating sector in the composition of global economy has changed due to progress happened in various fields like technology, globalization, etc. The agricultural sector has lost its dominant position to the industrial and the service sectors especially in developing and developed countries (Situmorang and Agustina, 2021: 458). As of 2020, the service sector, in which approximately 16 million people are employed, is the sector that provides the most employment in Türkiye (Turkish Statistical Institute, 2020). According to data of World Bank (2022), from 1974 to 2019, the amount of service exports increased approximately 114 times in Türkiye and the service sector constitutes the highest part in GDP of Türkiye (2021).

The importance of the service sector for the economies of the World including Türkiye is a stubborn fact. Although it is critical to comprehend the determinants of service export for economic development, the efforts to understand these determinants is insufficient. Even there are many studies considering the determinants of international trade including both goods and services exports (Warner and Kreinin, 1983: 96-98; Bahmani-Oskooee, 1986: 107; Rose, 2004; Márquez-Ramos, 2007: 1-2), the number of research examining the determinants of only service export, which has different characteristics compared to goods export (Lennon, 2009: 2), is rare and have begun to be discussed over the last decade (Ahmad, Kaliappan and Ismail, 2017: 329; Matuszczak, 2019: 143; Situmorang and Agustina, 2021: 459). The situation is similar for Türkiye as well (Bilgiç, 2019a: 22; Bilgiç, 2019b: 144; Bilgiç, 2021: 1058; Yıldız, 2021: 1047; Koca and Yıldırım, 2021: 442; Tufan, 2021: 1).

Understanding the determinants of service export has critical role to find out the factors leading national advantage in service sector. Although industry and sector are different unit of analysis (Coşkun, 2021: 35), Porter's (1990: 12) diamond model provides a beneficial framework to analyze national advantages of service sector. According to the Porter (1990: 111) national advantage of a particular industry is determined by four factors: i) factor conditions, ii) demand conditions, iii) related and supporting industries, and iv) firm strategy, structure, and rivalry. Factor conditions refers to the nation's position in factors of production, such as skilled labor or infrastructure, necessary to compete in a given industry (Porter, 1990: 114). Infrastructure is an important ingredient of factor conditions and includes transportation system, the communications system, mail and parcel delivery, payments or funds transfer, health care, the housing stock and cultural institutions (Porter, 1990: 115-116).

Even not taking Porter's framework as a base point but in line with the Porter's framework, there are research analyzing relationship between international trade and different dimensions of infrastructure (Nordås and Piermartini, 2004: 1; Francois and Manchin, 2013: 165; Celbis, Nijkamp and Poot, 2014: 25; Ismail and Mahyideen, 2015: 3-5; Şimdi, Şeker and Danacı, 2017: 254). By inspiring from these studies and moving forward from the thought that trade in services and goods are different phenomenon, the role of infrastructure in trade in service has begun to be discussed recently (Chen, Huang, Zheng and Zhang, 2019: 125-127; Chatti and Khoj, 2020: 259; Situmorang and Agustina, 2021: 458-462; Yingfei, Mengze, Zeyu, Ki-Hyung, Avotra and Nawaz, 2022: 1-2). Generally, the concepts discussed within this scope are internet infrastructure, communication facilities, and telecommunication infrastructure. In addition, it is observed that studies in Türkiye usually focus on the role of the internet in service trade within the scope of infrastructure (Bilgiç, 2021: 1056, Yıldız, 2021: 1046).

In line with the discussion above, this study aims to find out infrastructural determinants of service export in Türkiye. This study is important for two main reasons: i) since studies examining the role of infrastructure in service export are rare, especially in Türkiye, the findings of this study would enhance the current knowledge accumulation in the literature and ii) the results of this study would serve the understanding about the sources of national advantage in service sector of Türkiye and would provide beneficial policy recommendations for policymakers by indicating the critical points which should be invested in the scope of infrastructure.

To reach research objective, this research will adopt quantitative research method and use ARDL model. The research will include following parts: the literature that explain conceptual framework of the research, research method, and results and discussions.

2. Literature Review

2.1. Porter's Diamond Model and Infrastructure

Porter (1990: 12-14) problematizes the fact that while some nations' firms gain technological superiority, produce more differentiated / higher quality products, others are not able to do so. The fundamental question for Porter (1990: 1) is "why does a nation achieve international success in a particular industry?", in other words, "what are the sources of national advantage in a particular industry?". According to Porter (1990: 111), the answer is hidden in four inclusive and fundamental attributes of a nation that generate the environment in which local firms compete. These attributes are: i) factor conditions, ii) demand conditions, iii) related and supporting industries, and iv) firm strategy, structure, and rivalry. Also, he adds two additional variables to his explanation: i) chance and ii) government. The definition of each determinant of national advantage is provided in Table 1.

Table 1: **The Determinants of National Advantage**

THE DETERMINANTS	DEFINITION
Factor Conditions	"The nation's position in factors of production, such as skilled labor or infrastructure, necessary to compete in a given industry." (Porter, 1990: 111)
Demand Conditions	"The nature of home demand for the industry's product or service." (Porter, 1990: 111)
Related and Supporting Industries	"The presence or absence in the nation of supplier industries and related industries that are internationally competitive." (Porter, 1990: 111)
Firm Strategy, Structure and Rivalry	"The conditions in the nationgoverning how companies are created, organized, and managed, and the nature of domestic rivalry." (Porter, 1990: 111)
Chance	"Chance events are developments outside the control of firms" (Porter, 1990: 113)
Government	"This is related to how policies influence each of the determinants." (Porter, 1990: 113)

Factor conditions constitute the significant aspect of national advantage and are related with national factors of production which are nothing more than the inputs required to compete in any industry like arable land, labor, capital, natural resources, and infrastructure (Porter, 1990: 114-117). It is possible to define infrastructure as the basic physical systems and facilities serving a nation. In the scope of factor conditions, infrastructure refers to the type, quality, and user cost of infrastructure available that affects competition, including the transportation system, the communications system, mail and parcel delivery, payments or funds transfer, healthcare, housing stock and cultural institutions (Porter, 1990: 114-117). Porter (1990: 114-117) says that when a nation has low-cost or high-quality factors of production, which includes infrastructure as well and are significant to competition, the nation will gain competitive advantage. Also, he underlines that factor conditions including infrastructure is important for service-based industries as well. Therefore, as significant for many fields, it is important to analyze the impact of infrastructure on service trade.

2.2. Infrastructure and International Trade

Since infrastructure is important for national advantage, its relationship with international trade have studied by researchers. In Table 2, some studies examining this relationship for both trade and only trade in services are summarized. As seen, almost all results indicate that infrastructure affects international trade and trade in services positively and significantly. However, there are research concluding negative relationship between trade and infrastructure. These results point to a clue for a need to examine this relationship in a country specific context.

Also, trade in services and infrastructure relationship seems like an up-to-date research topic over the last five years.

Table 2: **Empirical Studies on the Effects of Infrastructure on Trade**

SOURCE	INDICATORS OF INFRASTRUCTURE	IMPACT IN EXPORTER	IMPACT IN IMPORTER	METHOD
Effects on Trade				
Nordås and Piermartini (2004)	Paved Roads	Pos. & Sig.	Pos. & Sig.	OLS Regression
	Airport	Pos. & Sig.	Pos. & Sig.	
	Port	Pos. & Sig.	Pos. & Sig.	
	Telecommunication	Neg. & Sig.	Pos. & InSig.	
Francois and Manchin (2013)	Paved Roads	Pos. & Sig.	Pos. & Sig.	Baier and Berstrand method
	Mixed and Mobile Phone Subscribers	Pos. & Sig.	Pos. & Sig.	
	The Number of Telephone Mainlines	Pos. & Sig.	Pos. & Sig.	
	Freight of Air Transport	Pos. & Sig.	Pos. & Sig.	
Celbis, Nijkamp and Poot (2014)	Land Transport	Pos. & Sig.	Pos. & Sig.	Meta Analysis
	Maritime or Air	Pos. & InSig.	Pos. & Sig.	
	Communication	Pos. & InSig.	Pos. & Sig.	
	Air Transport	Pos. & InSig	Pos. & Sig.	
Ismail and Mahyideen (2015)	Paved Roads	Pos. & Sig.	Pos. & Sig.	Augmented Gravity Model
	Railway	Neg. & Sig.	Neg. & Sig.	
	Container Port Traffic	Pos. & Sig.	Pos. & Sig.	
	Telephone Lines	Pos. & Sig.	Pos. & Sig.	
	Mobile Phone	Pos. & Sig.	Pos. & Sig.	
	Broadband	Pos. & Sig.	Pos. & Sig.	
	Internet Users	Pos. & InSig.	Pos. & Sig.	
	Secure Internet Server	Pos. & Sig.	Pos. & Sig.	
Effects on Trade in Services				
Situmorang and Agustina (2021)	Communication Facilities	Pos. & Sig.	-	Panel Data Analysis
Ahmad, Kaliappan and Ismail (2017)	Communication Facilities	Pos. & Sig.	-	Panel Data Analysis
Yingfei, Mengze, Zeyu, Ki-Hyung, Avotra and Nawaz (2022)	Infrastructure (Five-Item Scale)	Pos. & Sig.	-	PLS-SEM
Chen, Huang, Zheng and Zhang (2019)	Fixed Telephone Subscription	Pos. & Sig.	-	Panel Data Analysis
Chatti & Khoj (2020)	Individuals Using the Internet	Pos. & Sig.	-	Panel Data Analysis
Aijaz, Bano and Lodhi (2022)	Fixed Telephone Subscription	Neg. & InSig	-	Time-Series Analysis
	Internet Users	Neg. & Sig.	-	
Kang (2020)	Internet Users	Pos. & Sig.	Pos. & Sig.	Modified Gravity Model
	Mobile Cellular	Pos. & Sig.	Pos. & Sig.	

Note: Pos: Positive, Neg: Negative, Sig: Significant, InSig: Insignificant

In addition, as obvious in Table 2, infrastructure is a concept tried to be measured by using different indicators. Herein, paved roads, airport, port, phone subscription, internet users, and railway are among mainly used indicators of infrastructure. However, it takes attention that although there are various infrastructure indicators which was considered in the scope of trade, only the impact of communication related indicators was considered in the scope of trade in service. Therefore, it seems as a gap in the literature to examine the relationship between other indicators of infrastructure and trade in services. Moreover, panel data analysis appears as frequently used method to examine the relationship between infrastructure and trade in services. Hence, it would be beneficial to carry out research using methods analyzing a single country to see contextual differences.

2.3. Emprical Studies in Türkiye

In line with the international literature, there are studies focusing on the effects of infrastructure on trade in Türkiye. Although these studies are rare in Turkish literature, their results are usually parallel with the international literature. When Table 3 examined, it takes attention that although there are different indicators to measure infrastructure in the scope of international trade, the only indicator considered to measure infrastructure in the scope of trade in service is internet. Therefore, in order to contribute to current understanding about the relationship between trade in services and infrastructure in the context of Türkiye, it is important to include other indicators of infrastructure into analyses. Also, it is possible to state that infrastructural determinants of trade in services is an important and up-to-date research topic in Türkiye.

Table 3: **Empirical Studies on the Effects of Infrastructure on Trade in Türkiye**

SOURCE	INDICATORS OF INFRASTUCTURE	IMPACT IN EXPORTER	IMPACT IN IMPORTER	METHOD
Effects on Trade				
Şimdi, Şeker and Danacı (2017)	Paved Road	Neg. & InSig	Neg. & InSig.	ARDL Model
	Divided Road	Pos. & InSig	Pos. & InSig	
	Highway	Neg. & InSig	Neg. & InSig.	
Korkut, Yavuz and Zeren (2021)	Road Infrastructure Expenditures	Pos. & InSig	-	Westerlund Eşbütünleşme Testi
	Railway Infrastructure Expenditures	Pos. & Sigç	-	
	Airway Infrastructure Expenditures	Pos. & InSig	-	
	Maritime Line Infrastructure Expenditures	Pos. & InSig	-	
Effects on Trade in Services				
Bilgiç (2021)	Internet	Pos. & Sig.	-	ARDL Model
Bilgiç (2019a)	Internet	Pos. & Sig.	-	Linear Regression Analysis
Yıldız (2021)	Internet	Pos. & Sig.	Neg. & InSig.	FE GMM

It is important to emphasize that there are additional studies which focus on service trade from different perspectives in Türkiye. In this sense, the impact of macroeconomic indicators on service export have been examined (Çelik and Tufan, 2021: 2875; Koca and Yıldırım, 2021: 441). In addition to studies taking service trade into account as a dependent variable, there are research which evaluate service trade as independent variable in Turkish literature. Herein, the impact of service trade on economic growth (İşleyen, Altun and Görür, 2018: 953) and employment (Çitil, 2021; 763) have been analyzed. In the light of literature review, it can be said that examining not only the relationship between service exports and infrastructure, but also service exports from different perspectives is a fairly new and up-to-date field of study in Türkiye.

3. Research Hypotheses

As literature review above indicates, trade in services and infrastructure relationship is an up-to-date research topic. In the case of Türkiye, studies examining this relationship is rare and these studies consider only one indicator (internet) related with infrastructure. Therefore, analyzing the impact of infrastructure on service export in Türkiye by considering different indicators of infrastructure is significant for Turkish literature. Herein, this study will consider following indicators to measure infrastructure: divided road, railway, number of medical institutions, businesses with tourism operation certificate, the number of university. Although this research includes divided road and railway as parallel to the literature, it includes additional variables such as number of medical institutions, businesses with tourism operation certificate, the number of university. Since these indicators are considered as an indicator of infrastructure in different studies (Jensen and Zhang, 2013: 398; Tahir, 2020: 322) and tourism, healthcare and education sectors are important service-based sectors, it is logical to include these indicators into analyses. Also, due to reason that GDP per capita is an important economic indicator and considered in many studies examining the determinants of service trade (Situmorang and Agustina, 2021: 463), this study includes GDP per capita into analysis as well. In the light of literature discussion above, the research hypotheses are constructed as follows:

H1: There is a significant and positive relationship between service export and divided roads in Türkiye.

H2. There is a significant and positive relationship between service export and railway in Türkiye.

H3: There is a significant and positive relationship between service export and the number of medical institutions in Türkiye.

H4: There is a significant and positive relationship between service export and the number of businesses with tourism operation certificate in Türkiye.

H5: There is a significant and positive relationship between service export and the number of universities in Türkiye.

H6: There is a significant and positive relationship between service export and GDP per capita in Türkiye.

4. Research Method

4.1. Data

This research uses secondary data. These secondary data were collected from reputable institutions like Turkish Statistical Institute and World Bank, and data covers the period of 1982 – 2020. In the scope of this research, service export and GDP per capita is calculated in American dollars, divided road is calculated as total kilometers of divided road lengths, railway is calculated as total kilometers of railway lengths, and other indicators are calculated as exact number of institutions operating in each year.

4.2. ARDL Model of the Research

Cointegration analyses are usually preferred to test long-term relationships. In the literature, different cointegration analyses are leveraged by scholars. As to this study adopts ARDL cointegration analysis. There are several reason to prefer ARDL model such as ability to use unrestricted error correction model, applicability without checking whether variables are I(0) or I(1), applicability for small samples (Pesaran, Shin, and Smith, 2001: 315; Narayan and Narayan; 2005: 424-425; Narayan and Smyth, 2005: 102-104; Bilgiç, 2021: 1066). In addition, ARDL models largely eliminate problems arising from non-stationary series, provide different lag lengths for

variables in the analysis and estimate short- and long-term parameters together (Esen and Özate, 2017: 48). Therefore, ARDL cointegration analysis was used in this research.

4.2.1. Specification Tests

To conduct ARDL analysis, there are particular tests required to be checked before starting ARDL analysis. These tests are unit root tests, CUSUM test, CUSUMSQ test, autocorrelation test, normal distribution test and heteroscedasticity test. As a first step, Augmented Dickey Fuller (ADF) test was conducted to determine whether data are stationary. The results of ADF test are shared in Table 4. According to the table, all variables except divided roads are stationary at first difference and divided roads variable is stationary at second difference. Next, Breusch-Godfrey Serial Correlation LM Test and Breusch-Pagan-Godfrey Heteroskedasticity Test was done to control whether there is an autocorrelation and heteroscedasticity problems. The results of these tests are provided in Table 5, and it is seen that there is no problem of autocorrelation and heteroscedasticity. Moreover, data were checked to determine whether data are normally distributed. In Table 6, descriptive statistics, skewness, and kurtosis values and jarque-bera results are shared. According to results in the table, it is possible to say that data are normally distributed. Finally, CUSUM and CUSUMSQ tests was shared in Figure 1 and 2 respectivelly, and it was observed that stability exist. Therefore, it was demonstrated that ARDL analysis is applicable in the scope of this study.

Table 4: **ADF Unit Root Test**

VARIABLES	T STATISTIC "INTERCEPT & TREND" AT FIRST DIFFERENCE	ADF UNIT ROOT TEST			
		Test Critical Values		P Values	Decision
Railways	-5.070002	%1 %5 %10	-4.234972 -3.540328 -3.202445	0.0012	Stationary at all critical values
Number of Medical Institutions	-5.809846	%1 %5 %10	-4.234972 -3.540328 -3.202445	0.0002	Stationary at all critical values
Number of Businesses with Tourism Operation Certificate	-3.530152	%1 %5 %10	-4.234972 -3.540328 -3.202445	0.0511	Stationary at %10
Number of Universities	-5.165226	%1 %5 %10	-4.226815 -3.536601 -3.200320	0.0009	Stationary at all critical values
GDP per Capita	-5.355748	%1 %5 %10	-4.226815 -3.536601 -3.200320	0.0005	Stationary at all critical values
Service Export	-3.995003	%1 %5 %10	-4.226815 -3.536601 -3.200320	0.0176	Stationary at %5 and %10
VARIABLES	**T STATISTIC "INTERCEPT" AT SECOND DIFFERENCE**	**ADF UNIT ROOT TEST**			
		Test Critical Values		**P Values**	**Decision**
Divided Roads	-5,219041	%1 %5 %10	-3.670170 -2.933972 -2.621007	0.0002	Stationary at all critical values

Table 5: **Autocorrelation and Heteroskedasticity Tests**

BREUSCH-GODFREY SERIAL CORRELATION LM TEST			
F Statistic	2.528436	Prob. F (2, 14)	0.1155
BREUSCH-PAGAN-GODFREY HETEROSKEDASTICITY TEST			
F Statistic	0701004	Prob. F (14, 16)	0.7451

Table 6: **Descriptive Statistics**

Mean	-6.62e-12
Median	94.15371
Maximum	3200.213
Minimum	-4679.104
Standard Deviation	1781.641
Skewness	-0.696623
Kurtosis	3.547974
Jarque-Bera	2.895157
Probability	0.235139

Figure 1: **CUSUM Test**

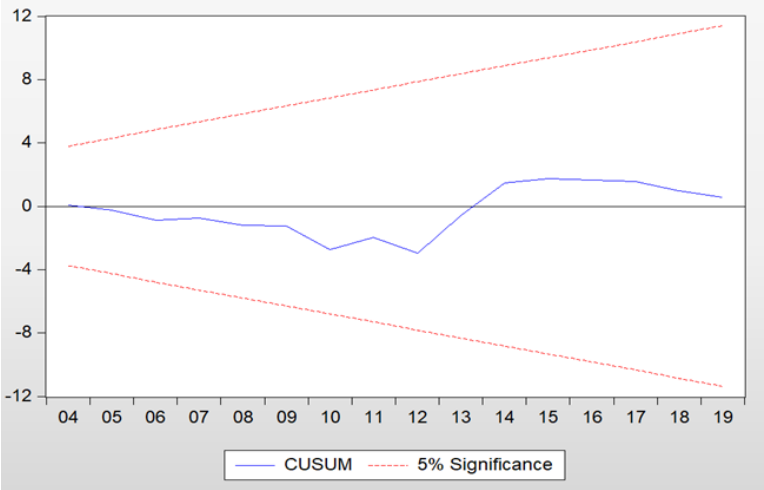
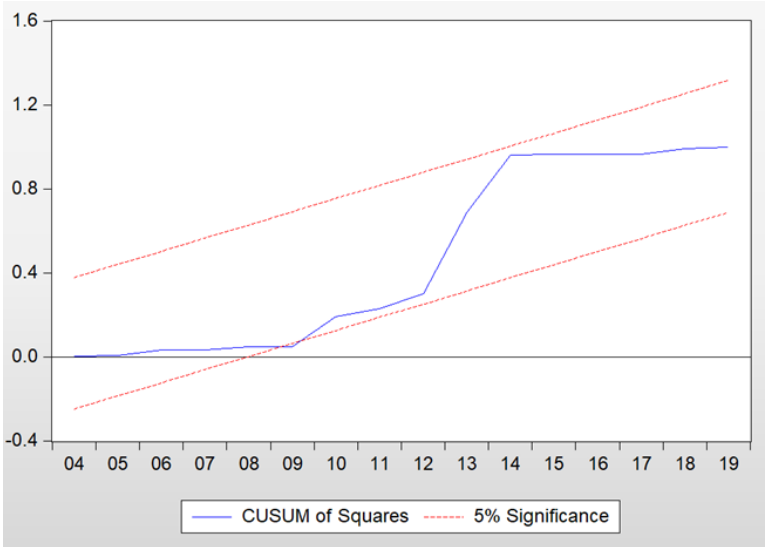


Figure 2: **CUSUMSQ Test**



4.2.2. ARDL (Autoregressive Distributed Lag Bound) Model

ARDL models make estimation over the lagged values of both independent and dependent variables. A general ARDL (p, q) regression model is constructed as in Equation 1:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \cdots + \beta_k Y_{t-p} + \alpha_0 X_t + \alpha_1 X_{t-1} + \cdots + \alpha_q X_{t-q} + \varepsilon_t \quad (1)$$

" ε_t " in the model is the error term.

ARDL boundary test approach is used to determine the cointegration relationship between variables. This approach was developed by Pesaran, Shin and Smith (2001). To that end, unrestricted error correction model presented in Equation 2 is defined. (3, 0, 1, 0, 2, 0, 2) model wash chosen in this study.

$$\Delta S.EXPORT_t = a_0 + \sum_{i=1}^{q} a_{1i} \Delta S.EXPORT_{t-i} + \sum_{i=1}^{p} a_{2i} \Delta DIVR_{t-1} + \sum_{i=1}^{p} a_{3i} \Delta RW_{t-1} + \sum_{i=1}^{p} a_{4i} \Delta MI_{t-1} + \sum_{i=1}^{p} a_{5i} \Delta TOC_{t-1} + \sum_{i=1}^{p} a_{6i} \Delta NU_{t-1} + \sum_{i=1}^{p} a_{7i} \Delta GDPC_{t-1} \beta_1 S.EXPORT_{t-1} + \beta_2 DIVR_{t-1} + \beta_3 RW_{t-1} + \beta_4 MI_{t-1} + \beta_5 TOC_{t-1} + \beta_6 NU_{t-1} + \beta_7 GDPC_{t-1} + u_t \quad (2)$$

The equation provided in Equation 2 is constructed based on the research hypotheses. Each of abbreviations' meanings are:

- S.EXPORT => Turkish Service Export
- DIVR => Divided Roads
- RW => Railways
- MI => Medical Institutions
- TOC => Tourism Operation Certificated Businesses
- NU => Number of Universities
- GDPC => GDP per capita

The unrestricted error correction model is constructed to examine whether there is a cointegration relationship. The null hypothesis indicating "no cointegration in long-term" is formed as in Equation 3:

$$H_0 = \beta_1 = \beta_2 = 0 \quad (3)$$

Wald test is done to decide between null and alternative hypotheses. Herein, the calculated F statistic values are evaluated based on the upper and lower critical values (Pesaran, Shin and Smith, 2001). In case of that the the upper value is below the F statistic, it might be stated that there is a cointegration relationship between variables. When the lower value is above the F Statistics, it is stated that cointegration relationship between variables does not exist. If the F statistic is between the lower and upper critical values, no interpretation can be made. In this research, the F statistic was found as 9.096760 and I0 and I1 bound values are provided in Table 7. According to Table 7, it is possible to say that cointegration relationship between variables exist.

Table 7: **Critical Value Bounds**

SINGIFICANCE	I0 BOUND	I1 BOUND
%10	2.457	3.797
%5	2.97	4.499
%1	4.27	6.211

Following the designation of the long-term cointegration relationship, the short-term and long-term coefficients are predicted by using the ARDL model shared in Equation 1. The long-term model is as in Equation 4:

$$\Delta S.EXPORT_t = \boldsymbol{a_0^*} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{q}} \boldsymbol{a_{1i}^*} \Delta S.EXPORT_{t-1} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{p}} \boldsymbol{a_{2i}^*} \Delta DIVR_{t-1} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{p}} \boldsymbol{a_{3i}^*} \Delta RW_{t-1} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{p}} \boldsymbol{a_{4i}^*} \Delta MI_{t-1} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{p}} \boldsymbol{a_{5i}^*} \Delta TOC_{t-1} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{p}} \boldsymbol{a_{6i}^*} \Delta NU_{t-1} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{p}} \boldsymbol{a_{7i}^*} \Delta GDPC_{t-1} + u_t^* \quad (4)$$

The equation 4 was constructed based on the research hypotheses. The " * " sign above the coefficients refers to the long-term coefficients calculated from the ARDL model.

Since there is cointegration relationship between variables, short-term error correction mechanism should exist. Therefore, the short-term error correction model is as in Equation 5:

$$\Delta S.EXPORT_t = \boldsymbol{a_0} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{q}} \boldsymbol{a_{1i}} \Delta S.EXPORT_{t-1} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{p}} a_{2i} \Delta DIVR_{t-1} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{p}} a_{3i} \Delta RW_{t-1} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{p}} a_{4i} \Delta MI_{t-1} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{p}} a_{5i} \Delta TOC_{t-1} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{p}} a_{6i} \Delta NU_{t-1} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{p}} a_{7i} \Delta GDPC_{t-1} + u_t \quad (5)$$

The Equation 5 is established by considering the hypotheses. a_0 refers to error correction coefficient in the model and the error correction term indicates long-term equilibrium rate that emerges in short-term after a shock (Bilgiç, 2021: 1070). When the term of error is negative and statistically significant, it is possible to say that there is a convergence towards the long-term equilibrium point (Bilgiç, 2021: 1070).

5. Results

To test research hypotheses, cointegration analysis was carried out by leveraging ARDL model described. The results for both long and short-term are provided in Table 10 and Table 11 respectively. Also, ARDL results and regressions statistics are presented in Table 8 and Table 9 respectively. In the tables, while the sign of coefficients represents the direction of the relationship between the service export and related variable, the p-value shows whether this relationship is statistically significant. When all tables considered together, all hypotheses except third and fifth hypotheses are approved.

Table 8: **ARDL Results**

VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTIC	PROB.*
LOG (S.EXPORT(-1))	0.202329	0.125528	1.611821	0.1265
LOG (S.EXPORT(-2))	-0.495548	0.102740	-4.823331	0.0002
LOG (S.EXPORT(-3))	-0.371409	0.181297	-2.048618	0.0573
LOG (NU)	-95.41321	82.21400	-1.160547	0.2629
LOG (TOC)	-8.903738	9.431610	-0.944032	0.3592
LOG (TOC(-1))	21.93857	6.997211	3.135331	0.0064
LOG (RW)	12.44324	5.855622	2.125008	0.0495
LOG (MI)	0.092248	0.356907	0.258466	0.7993
LOG (MI(-1))	0.346970	0.370572	0.936311	0.3630
LOG (MI(-2))	-0.807538	0.491476	-1.643086	0.1199
LOG (GDPC)	3.009564	0.807285	3.728005	0.0018
LOG (DIVR)	-1.356229	1.680847	-0.806873	0.4316
LOG (DIVR(-1))	-6.036752	4.937113	-1.222729	0.2391
LOG (DIVR(-2))	9.001548	4.194802	2.145882	0.0476
Constant	-112462.8	51304.17	-2.192080	0.0435

Table 9: **Regression Statistics of the Model**

R-SQUARED	0.991553	**MEAN DEPENDENT VAR**	28110.48
ADJUSTED R-SQUARED	0.984161	**S.D. DEPENDENT VAR**	19384.70
S.E. OF REGRESSION	2439.613	**AKAIKE INFO CRITERION**	18.74341
SUM SQUARED RESID	95227384	**SCHWARZ CRITERION**	19.43727
LOG LIKELIHOOD	-275.5229	**HANNAN-QUINN CRITER.**	18.96959
F-STATISTIC	134.1484	**DURBIN-WATSON STAT**	2.482555
PROB(F-STATISTIC)	0.000000		

Table 10: **Long-Term Results**

VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTIC	PROB.
NU	-57.31805	43.26499	-1.324814	0.2038
TOC	7.830482	1.103973	7.092999	0.0000
RW	7.475092	2.816497	2.654039	0.0173
MI	-0.221262	0.207964	-1.063948	0.3031
GDPC	1.807950	0.286043	6.320563	0.0000
DIVR	0.966322	0.439417	2.199102	0.0429

Table 11: **Short-Term Results**

VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTIC	PROB.
C	-112462.8	12304.37	-9.140073	0.0000
DLOG (S.EXPORT(-1))	0.866957	0.134387	6.451196	0.0000
DLOG(S.EXPORT(-2))	0.371409	0.126897	2.926856	0.0099
DLOG(TOC)	-8.903738	5.844862	-1.523344	0.1472
DLOG(MI)	0.092248	0.195313	0.472309	0.6431
DLOG(MI(-1))	0.807538	0.227576	3.548433	0.0027
D(DIVR)	-1.356229	1.249638	-1.085298	0.2939
D(DIVR(-1))	-9.001548	1.870377	-4.812691	0.0002
CointEq	-1.664628	0.177899	-9.357153	0.0000

Cointeq = LOG (S.EXPORT) - 57.31805 * LOG (NU) + 7.830482 * LOG (TOC) + 7.475092 * LOG (RW) - 0.221262 * LOG (MI) + 1.807950 * LOG (GDPC) + 0.966322 * LOG (DIVR)

6. Conclusion

According to the results, it can be stated that as divided roads length increases, the service export increases in Türkiye. Therefore, it might be recommended to policymakers to upgrade and/or build divided roads to increase service exports. However, it is a strategic decision to choose where to build divided roads. In this sense, it is required to determine which regions in the country have potential for service export. Hence, it would be beneficial to conduct region or city-based SWOT analysis or other types of analyses examining advantages and disadvantages of these regions or cities.

Similar to divided roads, the results indicate that railway length enhances the service export in Türkiye. It can be advised to policymakers to build and upgrade railways especially in areas having potential. In addition, when the result indicating that the coefficients of railways is higher than divided roads, and the fact that the length of the railway is shorter than the length of the road in Türkiye are considered together, it might be meaningful to more concentrate on construction and/or upgrade of railways in Türkiye.

The results show that as the number of businesses with tourism operation certificate raises, service export of Türkiye increases. When data of that the number of total arrivals in Türkiye is 51,747 (in thousands) and the number of hotels and similar establishments guests is 38,102 (in thousands) for 2019 are considered (UNWTO, 2022), it is possible to say that tourism is one of significant sectors in the economy of Türkiye. Therefore, it might be recommended to policymakers to support the stakeholders operating in tourism sector, to provide incentives to attract foreign tourist and investors, to carry out promotion activities abroad, and to enlarge mutual visa exemption agreements.

On the contrary of research hypotheses, it was found out that there is a negative and insignificant relationship between service export and the number of medical institutions and the number of universities. Although the sectors of education and health are important in the economy of Türkiye, this finding can be considered as an inadequacy of these sectors in international competition. Therefore, policymakers should adapt policies that will gain competitive advantage

to these sectors in international competition. Herein, SWOT analyses of these sectors in international competition might be conducted and steps can be taken to enhance the advantages and eliminate disadvantages based on these analyses. However, it should be kept in mind that the results are not statistically significant and additional analyses are required to support these policy recomendations.

When all results are taken together, it is plausible to say that infrastructure is one of drivers of national advantage in service export. It seems that Türkiye has advantage in highways, railways, and tourism. So that, these advantages must be leveraged and sustained, accordingly, modernized consistently. Although the results might be evaluated as a clue for that Türkiye do not have national advantage in health and education, weaknesses in these areas must be determined and removed. Thus, national advantage in these fields can be obtained. Herein, next research may focus on industry-oriented data and may analyzed industry level advantages and disadvantages. Also, in further studies, other indicators of infrastructure may be included into analyses like ports, airports, etc. Therefore, more comprehensive understanding of national advantages in service export can be obtained.

Since there is no completely perfect study, this research includes some limitations as well. The first limitation is about variables included into the analyses. Although other indicators of infrastructure such as number of planes, number of aviation passenger, number of mobile telephone subscribers etc., these indicators were not included in analyses because there are missing data which have possibility to negatively affect results. The lack of industry-oriented analyzes is the second limitation of this study. Industry oriented analyses have higher potential to determine valuable points which should be leveraged to enhance service export. However, since reaching to industry level data is relatively hard, this research couldn't conduct industry-oriented analyses.

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