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EXPLORING THE DYNAMIC SPILLOVER EFFECTS BETWEEN AIR TRANSPORTATION AND DEVELOPMENT INDICATORS IN TURKEY

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ABSTRACT

Purpose: This study presents the relationship between air transportation and development indicators in Turkey covering the period from 1970 to 2017. The transportation sector tends to expand significantly in the 21st century compared to previous years. Nowadays, there are various transportation methods, especially by air, land, sea, railway, and pipeline. Although the reasons for being preferred in this sector where goods and services and passenger transportation are different, air transportation has come to the fore as the fastest and safest method.

Method: While air transportation depends on the economic level, it also has effects on development. In this context the objectives are twofold: the paper (i) investigates the relationship between air transportation measures and a wide variety of development indicators, and (ii) incorporates an empirical framework based on the dynamic connectedness approach. This method supplies net, pairwise, and total connectedness parameters, which form integral parts of a relational network among variables.

Findings: According to empirical findings, air passenger transportation, life expectancy, and infant mortality are net transmitters, where air freight transportation and other development indicators (urbanization, human capital index, CO_2 emissions, and GDP per capita) are net receivers.

Originality: The results obtained by the dynamic connectedness method differ from conventional methods in the plane of creating a relationship network within the variables. Through this paper, the relations between development indicators and air transportation in Turkey have been uncovered under the terms of the contribution to the literature, were revealed as part of a network system.

Keywords: Air transportation, Development indicators, Dynamic connectedness, Spillover effects

JEL Classification: L93, O10, R40

TÜRKİYE'DE HAVAYOLU TAŞIMACILIĞI VE KALKINMA GÖSTERGELERİ ARASINDAKİ DİNAMİK YAYILMA ETKİLERİNİN İNCELENMESİ

ÖZET

Amaç: Bu çalışma, 1970-2017 dönemini kapsayan Türkiye'deki havayolu taşımacılığı ile kalkınma göstergeleri arasındaki ilişkiyi ortaya koymaktadır. 21. yüzyılda ulaşım sektörü önceki yıllara göre önemli ölçüde genişleme eğilimindedir. Günümüzde taşımacılığın kapsamı havayolu, karayolu, denizyolu, demiryolu ve boru hatları çerçevesinde oluşmaktadır. Mal ve hizmetlerin ve yolcu taşımacılığının farklı olduğu bu sektörde tercih edilme nedenleri olsa da en hızlı ve güvenli yöntem olarak havayolu taşımacılığı ön plana çıkmıştır.

Yöntem: Havayolu taşımacılığı ekonomik düzeye bağlı olmakla birlikte kalkınmaya da etki etmektedir. Bu bağlamda hedefler iki yönlüdür: makale (i) havayolu taşımacılığı önlemleri ile çok çeşitli kalkınma göstergeleri arasındaki ilişkiyi araştırır ve (ii) dinamik bağlılık yaklaşımına dayalı ampirik bir çerçeve içerir. Bu yöntem, değişkenler arasında bir ilişkisel ağın ayrılmaz parçalarını oluşturan net, ikili ve toplam bağlantılılık parametreleri sağlamaktadır.

Bulgular: Ampirik bulgulara göre, havayolu taşımacılığı, beklenen yaşam süresi ve yeni doğan ölümleri net aktarıcı, havayolu taşımacılığı ve diğer kalkınma göstergelerinin (şehirleşme, insan sermayesi endeksi, CO_2 emisyonları ve kişi başına düşen GSYİH) net alıcılardır.

Özgünlük: Dinamik bağlantılılık yöntemiyle elde edilen sonuçlar değişkenler arasındaki ilişki ağının oluşturulması düzleminde konvansiyonel yöntemlerden ayrışmaktadır. Bu çalışma sayesinde, Türkiye kapsamında literatürde katkısı bakımından yeni olan kalkınma göstergeleri ve havayolu taşımacılığı ilişkileri, bir ağ sistemi çerçevesinde ortaya çıkarılmıştır.

Anahtar Kelimeler: Havayolu taşımacılığı, Kalkınma indikatörleri, Dinamik bağlantılılık, Yayılma etkileri

JEL Sınıflandırması: L93, O10, R40

INTRODUCTION

Research on the role of transportation has become more popular with its effect on the economies of developing and changing countries. Accordingly, the importance of air transportation in the transportation economy has started to attract more attention in academic fields with relations such as economic growth and development. The contribution of this paper is to reveal the dynamic relationship of air transportation with development indicators. Our empirical research covers the connectedness approach for the period between 1970 and 2017 in Turkey. A simple definition of air transportation would be the rapid transportation of passengers and cargo between two airports. The advantages, in terms of passengers, of air transportation can provide time-saving, comfortable, safe, and rapid travel opportunities along with distant places. Especially in the field of tourism, it is difficult to consider the preferences of passengers without the type of transportation activity and accessibility to the destination. When considered in terms of firms and states, air transportation provides economic advantages in terms of growth, production, services, development of sectors such as tourism, access to production factors, reduction of transportation costs, distribution of processed products to markets, and geographic accessibility.

Also, it has social and environmental impacts on areas such as employment, mobilization of the workforce, human resources, factor productivity, education, and CO_2 emissions. Considering all direct and indirect effects, air transportation provides a comparative advantage in the global economy. Advantages also affect the quality of life according to the development levels of countries. In this sense, our study constitutes a reference to the developing and developed countries, by using a Turkey-based analysis. There are also the negative aspects of air transportation, especially the noise near the airport, the air transportation phobias of the passengers, and the CO_2 emission are a few of these issues (Button and Taylor, 2000; Mammadov, 2012; Schäfer and Waitz, 2014; Beyzatlar, 2020; International Air Transport Association, 2021).

The importance attributed to air transportation has become even more apparent within-country connections, i.e., increasing trade volumes and tourism mobility. The interaction between development levels of air transportation and economies constructs a diversity of research on transportation economics literature. Therefore, these studies present different results on whether there is a link between air transportation and development indicators, if there is a relationship, what is the direction of the relationship.

This paper aims to obtain the spillover effects of air transportation in Turkey among development indicators by using an improved version of the Diebold and Yilmaz (2012) framework. By using this framework, which is presented in the work of Antonakakis and Gabauer (2017), we are aiming to bring a unique perspective to the transportation economics literature, as a relieved contribution, in terms of air transportation. In this context, it is possible to understand the spread originating from and to air transportation in the context of GDP, urbanization, index of human capital, life expectancy, infant mortality, and CO_2 emissions. The empirical method used offers some technical innovations as a different perspective as well.

The remainder of this study is shaped as follows: next part covers the literature review within the context of air transportation and development indicators, the data and methodology used to observe dynamic spillover between transportation and development indicators in Turkey are presented as the third section, the empirical results are discussed in fourth part and followed by concluding remarks as the last section.

LITERATURE REVIEW

Leading studies demonstrate the existence of a correlation between the aviation industry and economic processes. If air transportation is considered as a normal good, the increase in the income of the units in the economic cycle increases the demand for faster transportation types, consequently, increases the demand for air transportation. Depend on the demand for air transportation, the aviation industry provides employment and creates wider benefits. Considering the scope of all these benefits, air transportation functions contribute to the economic cycle positively. (Kasarda and Green, 2005; Ishutkina and Hansman, 2008; Karlaftis, 2008;). Kasarda and Green (2005) drew attention to aviation liberalization and showed that the liberalization correlated with air cargo (freight) and GDP for 63 countries. While these correlations support the idea that aviation liberalization entails higher air transportation with economic development, they also said that there is a possible mutual (two-way) causal relationship, such as the relationship between air transportation (freight) and GDP. Ishutkina and Hansman (2008) examined the nature of air transportation and shaped the demand for the aviation industry and indicated the employment and economic benefits that occurred accordingly for UAE, Jamaica, China, and India. Karlaftis (2008) investigated the demand factors which affecting air transportation on a basis passenger in Greece with dynamic Tobit models and the GARCH errors/disturbances method. Depending on the results, said that income affects domestic passenger traffic.

In the recent literature, some research methodologies have been concentrated on a causal relationship. While these studies are examining the long and short-term effects within these relations, they also differentiated in the direction of causality (Chang and Chang, 2009; Chi and Baek, 2013; Mukkala and Tervo, 2013; Hakim and Merkert, 2016). Chang and Chang (2009) argued that phenomenon by applying Granger causality and cointegration tests, they support the existence of long-term balance and reciprocal Granger causality among expansion of air transportation in terms of cargo and growth in terms of GDP for Taiwan. According to the findings which they examined; air transportation has crucial importance in terms of economic growth. Chi and Baek (2013) argued that air transportation in terms of carried passenger and freight, in trend to increase with economic growth in the long- and short-run for the US, growth -in terms of real income- only affects the air passenger service. Mukkala and Tervo (2013), in their study for multiple regions and countries from Europe, found causality from air traffic in terms of passenger and accessibility to airports, to growth in terms of GDP and employment, they also emphasized causality is less prominent in the core regions. Hakim and Merkert (2016) investigated the short- and long-run Granger causality among air transportation and economic growth by applying for South Asian countries. According to their results, they only found long-term unilateral Granger causality running from GDP growth to air (freight and passenger) transportation.

In addition to the articles that examine air transportation, some articles analyze the causal relationships with growth by passenger and freight-based separation for air transportation demand (Fernandes and Pacheco, 2010; Marazzo et al., 2010; Arvin et al., 2015). For example, Marazzo et al. (2010) examined the interrelation among demand for air transportation and growth as a function of GDP for Brazil, they found the integration between GDP and air transportation. As a result, in the impulse-response analysis, the reaction to the demand due to a change in growth was positive, while the reaction of growth more slowly to demand. According to the Granger test results, they found a unilateral causality, from growth to air transportation, and confirmed their findings with robust analysis. Likewise, Fernandes and Pacheco (2010) analyzed the causality among growth as function GDP and passenger who carried domestically using Granger's causality test for Brazil. They found a unilateral causality from growth to air transportation.

The interaction between transportation and development indicators has yielded controversial results for different regions. Regarding development indicators, when energy demand and urbanization are evaluated as a whole, it is associated with economic growth (Abdallah et al., 2013; Arvin et al., 2015; Shahbaz et al., 2017). Abdallah et al. (2013) In their research obtained a bidirectional causality among transportation infrastructure and consumption of energy which is used transportation, also CO_2 emissions which caused by transportation and transportation infrastructure for Tunisia. Arvin et al. (2015) in their research about transportation density in G-20 countries with implementation Granger causality. They found bidirectional causality among air transportation (passenger) and growth as a function of GDP, air transportation (passenger) and CO_2 emissions, urbanization, and air transportation (both passenger and freight) also unilateral causality running from growth to air transportation (freight), CO_2 emissions, and urbanization, from urbanization to CO_2 emission and they did not find a causality among CO_2 emission and air transportation (freight). Shahbaz et al. (2017) investigated whether urbanization caused increasing energy demand in Pakistan with Granger causality. They found, unilateral causality from energy consumption to urbanization, from urbanization to growth as a function of GDP, from transportation to technology. According to the results, also bidirectional causality among technology and transportation, and growth and transportation. Maparu and Mazumder (2017) contrary to current literature did not find any Granger causality between air freight and urbanization, air passenger, and urbanization in the context of India.

DATA AND METHODOLOGY

Data

This study aims to inquire about the connectedness between air transportation and development indicators in Turkey between the years 1970-2017. The data which is used in this research consists of two groups of variables as air transportation measures and development indicators. The first group of variables represents air freight transportation per capita in ton-km (FREpc, hereafter) and air passenger transportation per capita in pas-km (PASpc, hereafter), which are both acquired from the Worldbank World Development Indicators. The second group of variables represents development indicators, urbanization % of total population (URB, hereafter), human capital index based on years of schooling and returns to education (IHC, hereafter), life expectancy at birth total years (LE, hereafter), the infant mortality rate per 1,000 live births (IM, hereafter), CO_2 emissions per capita in ton (COpc, hereafter), and GDP per capita in constant 2010 USD (GDPpc, hereafter). URB, LE, IM, and GDPpc were also obtained from the Worldbank World Development Indicators. IHC and COpc were gathered from Penn World Tables and Our World in Data sources, respectively. Table 1 shows the descriptive statistics of the variables used in this study.

Table 1. Descriptive Statistics

Variables	# of Obs.	Mean	Median	Minimum	Maximum
FREpc	48	7.822	3.169	0.132	59.188
PASpc	48	0.269	0.113	0.029	1.331
URB	48	58.281	61.323	38.234	74.644
IHC	48	1.841	1.839	1.311	2.444
LE	48	65.842	66.096	52.286	77.161
IM	48	54.410	46.350	9.800	126.700
COpc	48	3.035	2.979	1.221	5.243
GDPpc	48	7818.725	7123.760	4221.154	14874.780

Note: FREpc is air freight transportation (Ton-km); PASpc is air passenger transport; URB is urban population (% of total population); IHC is human capital index based on years of schooling and returns to education; LE is life expectancy at birth (total years); IM is infant mortality rate (per 1,000 live births); COpc is CO_2 emissions per capita (ton); GDPpc is GDP per capita (constant 2010 USD).

Methodology

The time-varying vector autoregressive (TVP-VAR) dynamic connectedness approach used in this study follows the methodology conceptualized by Antonakakis and Gabauer (2017), which is the improved version of Diebold and Yilmaz (2012).

$$Y_t = \beta_t Y_{t-1} + \varepsilon_t \quad \varepsilon_t \sim N(0, S_t) \tag{1}$$

$$\beta_t = \beta_{t-1} + v_t \quad v_t \sim N(0, R_t) \tag{2}$$

$$Y_t = A_t \varepsilon_{t-1} + \varepsilon_t \tag{3}$$

Where Y_t, ε_t and v_t are $N \times 1$ vectors and A_t, S_t, β_t, and R_t are $N \times N$ matrices.

$$\tilde{\varphi}_{ij,t}^{g}(h) = \frac{\sum_{t=1}^{h-1} \psi_{ij,t}^{2,g}}{\sum_{i=1}^{N} \sum_{t=1}^{h-1} \psi_{ij,t}^{2,g}} \tag{4}$$

$\tilde{\varphi}_{ij,t}^{g}(h)$ denotes the h-step ahead generalized forecast error variance decompositions (GFEVD), $\psi_{ij,t}^{g}(h) = S_{ij,t}^{-\frac{1}{2}} A_{h,t} \sum_t \varepsilon_{ij,t}$, Σ_t the covariance matrix for the error $\varepsilon_{ij,t}$ and $\sum_{j=1}^{N} \tilde{\varphi}_{ij,t}^{g}(h) = 1$, $\sum_{i,j=1}^{N} \tilde{\varphi}_{ij,t}^{N}(h) = N$.

The total connectedness index (TCI), which is based on GFEVD can be formulated by

$$C_t^{g}(h) = \frac{\sum_{i,j=1, i \neq j}^{N} \tilde{\varphi}_{ij,t}^{g}(h)}{\sum_{j=1}^{N} \tilde{\varphi}_{ij,t}^{g}(h)} \times 100 \tag{5}$$

The total directional connectedness (the spillover of variable i) TO all other variables (j) can be formulated by

$$C_{i \to j,t}^{g}(h) = \frac{\sum_{j=1, i \neq j}^{N} \tilde{\varphi}_{ji,t}^{g}(h)}{\sum_{j=1}^{N} \tilde{\varphi}_{ji,t}^{g}(h)} \times 100 \tag{6}$$

The total directional connectedness (the spillover of variable i) FROM all other variables (j) can be formulated by

$$C_{i \leftarrow j,t}^{g}(h) = \frac{\sum_{j=1, i \neq j}^{N} \tilde{\varphi}_{ij,t}^{g}(h)}{\sum_{i=1}^{N} \tilde{\varphi}_{ij,t}^{g}(h)} \times 100 \tag{7}$$

The net total directional connectedness, which is the difference between the total directional connectedness to and from, can be formulated by

$$C_{i,t}^{g}(h) = C_{i \to j,t}^{g}(h) - C_{i \leftarrow j,t}^{g}(h) \tag{8}$$

The sign of the net total directional connectedness illustrates if variable i is driving the network ($C_{i,t}^{g}(h) > 0$) or driven by the network ($C_{i,t}^{g}(h) < 0$). Finally, we break down the net total directional connectedness to examine the bidirectional relationships by computing the net pairwise directional connectedness (NPDC) can be formulated by

$$NPDC_{ij}(h) = \frac{\tilde{\varphi}_{ji,t}^{g}(h) - \tilde{\varphi}_{ij,t}^{g}(h)}{N} \times 100 \tag{9}$$

EMPIRICAL RESULTS

An important step before dynamic connectedness is to check the stationary properties of the variables. To check the stationary properties, the Dickey-Fuller generalized least squares (DF-GLS) unit-root test, which is proposed by Elliot et al. (1996), is performed. Variables with large time dimensions usually suffer from external shocks as structural breaks that may be due to economic, political, and fiscal crisis, etc. The traditional unit-root tests ignore such structural breaks and hence the results may be misleading. To overcome this, the DF-GLS test is supported by the break test, which is developed by Perron (1997), considering structural breaks. The results of these unit-root tests are presented in Table 2.

Table 2. Unit-root Tests

Variables	DF-GLS	Break Test	
	t-Stat	**t-Stat**	**Break Date**
FREpc	-7.828***	-8.232***	1980
PASpc	-7.638***	-10.988***	1980
URB	-8.677***	-21.514***	2003
IHC	-8.130***	-17.662***	2005
LE	-6.046***	-5.782***	1994
IM	-6.027***	-8.255***	2006
COpc	-7.789***	-9.616***	2006
GDPpc	-6.677***	-7.144***	2009

Note: Both tests are applied to the logarithmic return series. The null hypothesis of both tests is that the series contains a unit root. *** denotes the rejection of the null hypothesis of the series at a 1% level of significance. Critical values for DF-GLS and asymptotic one-sided p-values for Break Test are gathered from Elliott, Rothenberg, and Stock (1996) and Vogelsang (1993), respectively.

According to the DF-GLS and break test results, all variables are found non-stationary at level but stationary at first difference. Therefore, it is appropriate to use the logarithmic return series of all variables. Lastly, Table 3 depicts the results of the dynamic connectedness between air transportation and development indicators in Turkey. Considering the overall results, the Total Connectedness Index (TCI) is estimated as 46.5 percent that indicates an average interdependence among air transportation measures and development indicators. Figure 1 shows the fluctuations of the TCI over the sample period of 1970-2017, varying between 42 and 49 percent. The TCI escalates up to 49.16 percent in the middle of the 1980s and is followed by a decade of reduction through 46 percent level just after 1995. Despite some increases over 47 percent after 2005, the TCI maintains its stability until the end of the sample period with a slight v-type switch.

Further, appraise the reciprocal connectedness, the pairwise spillover from air passenger to air freight transportation is 31.35 percent and from air freight to air passenger transportation is 27.35 percent. The largest pairwise spillovers are located within the development indicators, in between infant mortality and life expectancy, 39.91 percent from IM to LE, and 38.09 percent from LE to IM. The highest pairwise spillover ranking followed by human capital index and urbanization (IHC to URB 27.21%; URB to IHC 25.38%), carbon dioxide emissions and GDP per capita (COpc to GDPpc 21.09%; GDPpc to COpc 20.08%), infant mortality, and urbanization (IM to URB 9.89%; URB to IM 9.56%), and life expectancy and urbanization (LE to URB 9.99%; URB to LE 6.81%).

Among the air transportation measures, the largest contribution to development indicators is from air passenger transportation to GDPpc and COpc with 11.85 and 8.40 percent, respectively. Moreover, a remarkable contribution from air freight transportation is counted for the carbon dioxide emissions with 5.50 percent. On the other hand, the largest pairwise spillover from development indicators to air transportation measures are detected from GDP per capita and carbon dioxide emissions to air passenger transportation with 10.15 and 6.31 percent, respectively, and from carbon dioxide emissions to air freight transportation with 4.74 percent. The pairwise spillover results demonstrate that the transmissions between development indicators and air transportation measures are well balanced, parallel to reciprocal connectedness in development indicators' and air transportation measures' entirety. This is consistent with the net spillover results that air passenger transportation, life expectancy, and infant mortality are net transmitters, where air freight transportation and other development indicators that net receivers.

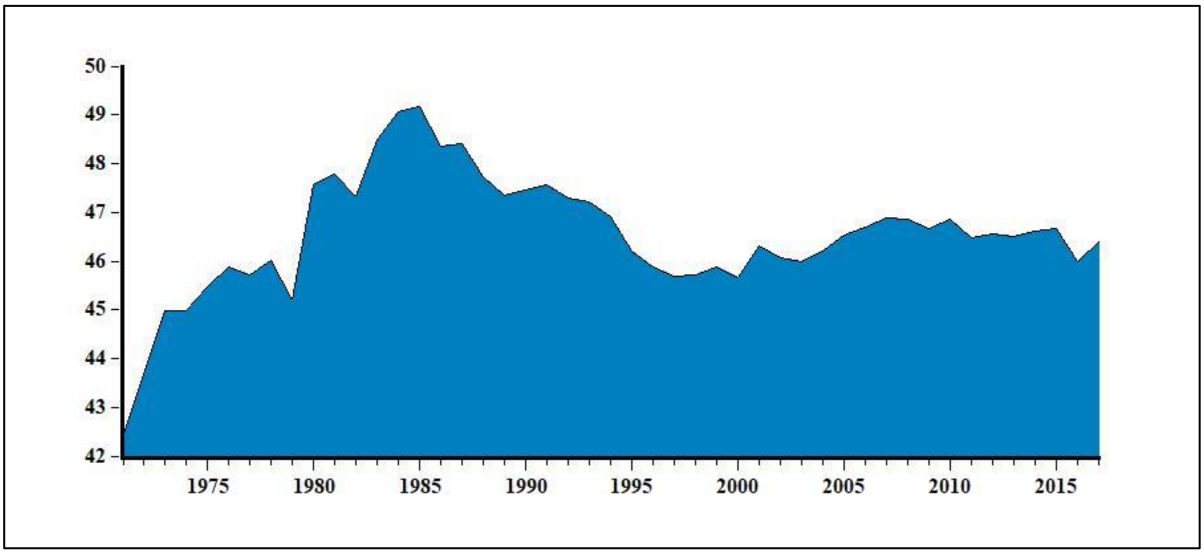

Figure 1. Total Connectedness Index

Figure 2 shows the net directional connectedness, in other words, transmitters and receivers for the period 1970-2017. Combining, with Table 3, the net spillover results showed that air freight transportation is a net receiver with -3.86 percent, but air passenger transportation is a net transmitter with 5.42 percent. When discussing air passenger transportation, it is purely a transmitter for the whole period, where air freight transportation is almost purely receiver except the beginning of the 1980s. The Aviation Law was enacted in 1983 to improve, and to create competition for the air transportation market. However, this period is also remarkable in having the highest net directional connectedness of air passenger transportation. Interestingly, net directional connectedness measures for both indicators were decreased, after the 2008 global economic crisis. This is below the level before the 1980s, the introduction of aviation policies.

Table 3. Dynamic Connectedness

	FREpc	PASpc	COpc	GDPpc	FROM
FREpc	58.634	31.355	4.742	1.489	41.366
PASpc	27.346	49.376	6.311	10.153	50.624
URB	1.124	0.569	2.057	0.957	51.802
IHC	1.367	1.377	0.807	0.874	42.041
LE	0.669	1.596	0.615	1.413	52.333
IM	0.139	0.903	2.039	0.589	51.666
COpc	5.496	8.396	56.611	20.082	43.389
GDPpc	1.365	11.849	21.094	60.916	39.084
TO	37.506	56.045	37.665	35.557	372.304
OWN	96.140	105.421	94.276	96.473	**TCI**
NET	-3.860	5.421	-5.724	-3.527	**46.538**
	URB	**IHC**	**LE**	**IM**	**FROM**
FREpc	1.852	0.511	1.114	0.304	41.366
PASpc	0.978	0.684	2.912	2.242	50.624
URB	48.198	27.211	9.991	9.892	51.802
IHC	25.376	57.959	8.438	3.803	42.041
LE	6.811	1.324	47.667	39.905	52.333
IM	9.560	0.347	38.088	48.334	51.666
COpc	5.475	0.930	0.744	2.267	43.389
GDPpc	0.378	0.315	2.784	1.298	39.084
TO	50.429	31.322	64.071	59.711	372.304
OWN	98.627	89.280	111.738	108.045	**TCI**
NET	-1.373	-10.720	11.738	8.045	**46.538**

Note: TCI is Total Connectedness Index, TO is the contribution of variable to others, OWN is the contribution of variable including own, FROM is the contribution of variable from others, and NET is the net spillover (TO-FROM

Furthermore, development indicators exhibit different characteristics of net spillover; urbanization (-1.37%), human capital index (-10.72%), carbon dioxide emissions (-5.72%), and GDP per capita (-3.53%) are net receivers, where life expectancy (11.74%) and infant mortality (8.05%) are net transmitters. The Human capital index is the largest receiver, with a net spillover of 10.72 percent, followed by carbon dioxide emissions (5.72%), air freight transportation (3.86%), GDP per capita (3.53%), and urbanization (1.37%). Life expectancy is the largest transmitter, with a net spillover of 11.74 percent, followed by infant mortality (8.05%), and air passenger transportation (5.42%).

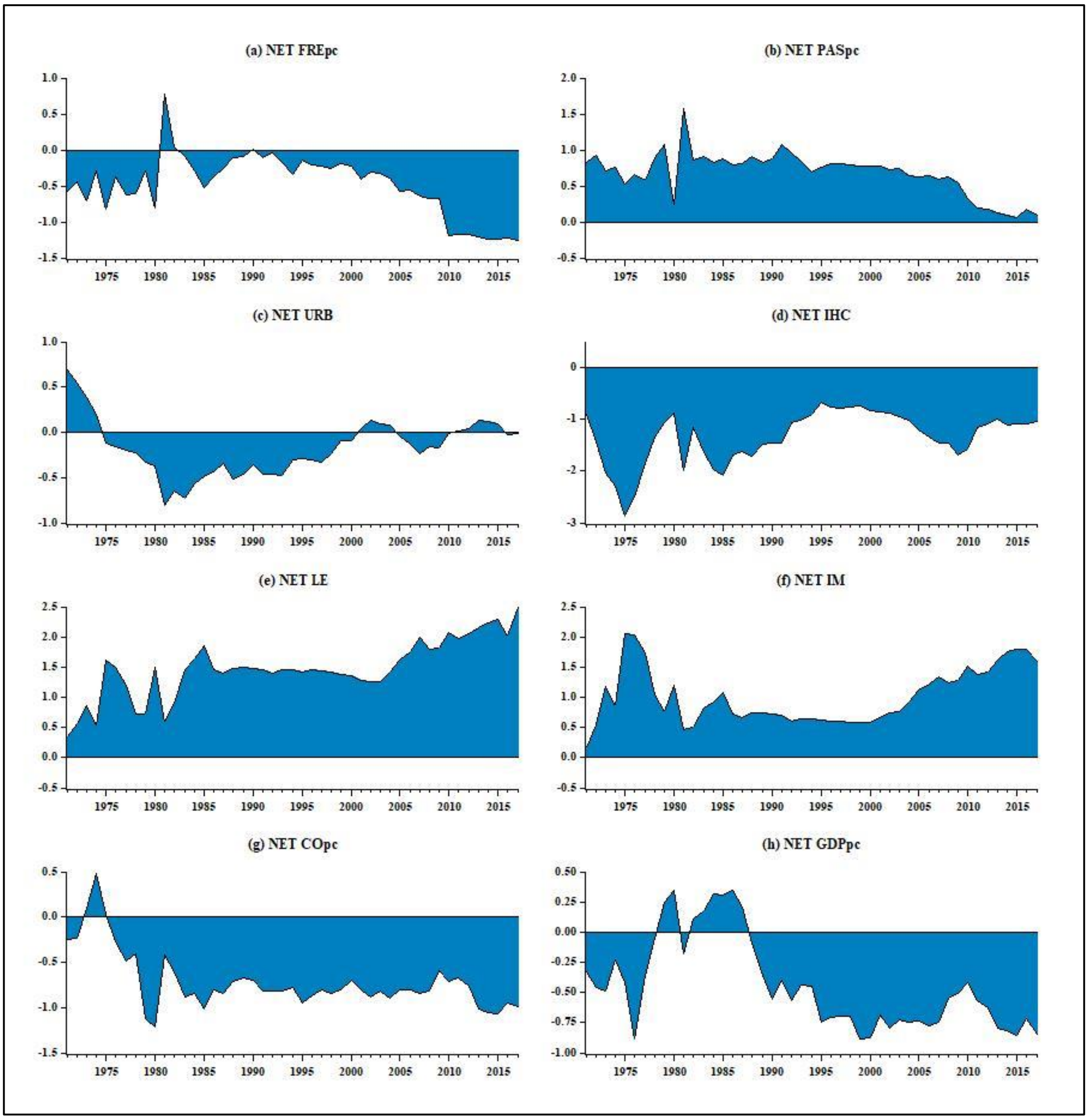

Figure 2. Net Directional Connectedness

CONCLUSION

This study, in which we used dynamic spillover effects, both brought innovation to our point of view on the subject and contributed to the literature. The results of our study to show the dynamic spillover effects of air transportation and development indicators are explained and tabulated in the previous section. It will be useful to make a general summary to evaluate the impact and scope of our results. Thanks to the methodology, firstly we found a significant connectedness by using TCI among air transportation and development indicators. Secondly, we found net directional connectedness as receivers and transmitters. In the case of air transportation, air freight (cargo) is a net receiver and air passenger carried is net transmitter where LE and IM are net transmitter and URB, GDP per capita, CO_2 emission are net receiver as part of development indicators. Thirdly, we demonstrate the numerical contribution of variables between each other as which affected from, which affect to and net spillover. There are some fluctuations in both the total connectedness index and net directional connectedness analysis. Reasons for these fluctuations can be better understood by referring to the historical development of air transportation in Turkey.

Turkey has started in aviation for military purposes during the Ottoman Empire in 1910-14. After the establishment of the Republic of Turkey in 1923, the civil aviation infrastructure was created and in 1933, the State Enterprise of Airlines and Turkish Airlines (THY) was established under the Ministry of National Defense, and passenger transportation began. Between 1933-56, technical, infrastructural, and institutional transformations were carried out for civilians. The number of aircraft used, and seat capacity fluctuated until 1970 but increased from 1970 until 2017. Civil Aviation Law was enacted in 1983 to improve air transportation, to create competition. With the entry of private airline companies into the aviation industry, seat capacities and aircraft numbers have increased. In 2001, Turkey was faced with difficult challenges (ie, economic crisis and terrorist attacks), which affected the aviation sector negatively. In order to promote air transportation, the Ministry of Transport made some regulations in 2003, such as reductions in transportation fees and legal arrangements (Bakırcı, 2012; Bahar, 2018; General Directorate of State Airports Authority, 2021; Turkish Airlines, 2021; Turkish Statistical Institute, 2021).

The purpose of this research is to explore the dynamic spillover effects between air transportation and development indicators in Turkey. To sum up, the findings of the study showed that the spillover effects within air transportation and development indicators have been proceeding with the progress of Turkey. Despite the limited time frame and data unavailability, the actors in the economy should focus on the air transportation infrastructure, legal regulations to protect the aviation sector, effects of air transportation on sectors, training of qualified air transportation staff, employment in air transportation, promote air transportation expansion, effects of air transportation on social and environmental issues.

Future studies may want to consider the efficiency of transportation, in a broad sense, by using, (i) different modes of transportation such as rail, road, and maritime, (ii) transportation infrastructure, (iii) transportation capacity, and (iv) investment in transportation as relevant variables within the context of connectedness approach. Development indicators may also be changed with different variables in (i) macro or micro level, (ii) national, regional, and even city level proxies. Future alternative studies might also use the same or various determinants of (air) transportation and (development) indicators for an alternative time and cross-sectional dimensions as a longitudinal investigation due to the nature of the transportation. Lastly, data availability is a challenging task of transportation economics especially in accessing high-frequency data to be compatible with not only transportation data but also many other measures.

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