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THE BELT AND ROAD INITIATIVE'S IMPACT ON INCOME AND CONSUMPTION WITHIN THE ORGANIZATION OF TURKIC STATES

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Abstract

This study aims to investigate the interactions of per capita income and consumption of the Organization of Turkic States with each other and China based on the BRI framework. To this end, we construct our analysis on a data set that includes per capita of GDP and consumption across 6 countries (including China) covering the period 1990-2019. We utilize a time-varying vector autoregressive (TVP-VAR) dynamic connectedness. The analysis results: (i) while there is generally a more fluctuating relationship in both consumption and income variables of the countries pre-2010 period, there is a more regular relationship in the following period (ii) when China is included into the group, improvements are observed at almost all connectedness levels. The contribution of this article is being the first study to examine the impact of the BRI initiative on GDP and consumption expenditures in the Turkish States. While previous findings have mostly relied on studies from all BRI countries, this study has focused on a specific group of countries. In addition, the relationship between income and consumption between countries was examined using a unique empirical approach.

Keywords: *Belt and Road initiative, Organization of Turkic States, spillover effects, income, consumption*
JEL Classification: *F02, L91, O19, O40*

KUŞAK VE YOL GİRİŞİMİ'NİN TÜRK DEVLETLERİ TEŞKİLATI'NIN GELİR VE TÜKETİMİ ÜZERİNDEKİ ETKİSİ

Öz

Bu çalışmada, Türk Devletleri Teşkilatı'na üye ülkelerin kişi başına düşen gelir ve tüketimlerinin kendi aralarında ve Çin ile olan etkileşimlerinin ve yayılma etkilerinin BRI çerçevesine dayalı olarak araştırılması amaçlanmaktadır. Bu amaçla, çalışmanın analiz kısmı Çin dahil olmak üzere 6 ülkenin 1990-2019 arasındaki dönemi kapsayan kişi başına düşen gelir ve tüketimi içeren bir veri seti üzerinde kurgulanmaktadır. Zamanla değişen vektör otoregresif (TVP-VAR) dinamik bağlantılılık yaklaşımından yararlanılmaktadır. Analiz sonuçları: (a) 2010 öncesi dönemde üye ülkelerin hem tüketim hem de gelir değişkenlerinde genel olarak daha dalgalı bir etkileşim varken, sonraki dönemde daha düzenli bir ilişki gözlemlenmektedir (b) Çin'in analiz grubuna dahil edilmesiyle birlikte ise, neredeyse tüm bağlantılılık seviyelerinde iyileşmeler olduğu görülmektedir. Bu makalenin literatüre katkısı; BRI girişiminin Türk Devletleri Teşkilatı'na üye ülkelerin GSYİH ve tüketim harcamaları üzerindeki etkisini inceleyen ilk çalışma olmasıdır. Daha önceki bulgular çoğunlukla tüm BRI ülkelerinin çalışmalarına dayanmakta iken sadece belirli bir ülke grubuna odaklanan böyle bir çalışma ilk defa yapılmıştır. Ayrıca özgün bir ampirik yaklaşım kullanılarak ülkelerarası gelir ve tüketim ilişkisi incelenmiştir.

Anahtar Kelimeler: *Kuşak ve Yol Girişimi, Türk Devletleri Teşkilatı, yayılma etkileri, gelir, tüketim*
JEL Sınıflandırması: *F02, L91, O19, O40*

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1. Introduction

In September 2013, President Xi Jinping officially announced China's intention of constructing the "New Silk Road Economic Belt" during his first Central Asia tour which encompasses visits to Turkmenistan, Kazakhstan, Uzbekistan, and Kyrgyzstan. During his visit to Indonesia, Mr. Xi offered to build the "21st Century Maritime Silk Road". These two proposals were specified as the Belt and Road Initiative (Wang et al., 2020a: 289; Wang et al., 2020b: 190; Lam et al., 2018: 413; Li et al., 2020: 161; Zhang et al., 2020: 135). The fundamentals of this new economic belt strategy are fivefold: (i) increasing policy coordination, (ii) accelerating construction of infrastructure and connectivity of facilities, (iii) supporting barrier-free trade, (iv) enhancing financial integration, and (v) strengthening social interaction and connection between people. The Belt and Road Initiative (hereafter, BRI) is an overarching incentive program for constructing transportation infrastructure including airports, highways, seaports, and railways aimed at spurring economic development and leading massive multinational cooperation along the initiative's routes. According to Zhao Hong (2016: 30), the most important feature of the BRI, apart from other traditional regional cooperation, is that the BRI especially emphasizes transportation infrastructure connectivity between developing and developed countries instead of reducing institutional trade barriers. Logistics and transportation networks play an essential role to support the easier delivery of products to customers in different countries and regions and particularly in carrying out trade cooperation successfully (Yang et al., 2018: 193).

The BRI is one of the most ambitious enterprises of China and has a substantial potential to stimulate regional growth in Asia, Europe, and Africa regions through a transportation infrastructure network. These transportation infrastructure network comprises six international economic corridors: China-Mongolia-Russia Economic Corridor, New Eurasian Land Bridge, China-Central Asia-West Asia Economic Corridor, China-Indochina Peninsula Economic Corridor, China-Pakistan Economic Corridor, and Bangladesh-China-India-Myanmar Economic Corridor. The main aim behind the initiative is to foster regional economic integration by focusing on transportation. It is expected to enhance industrial capacity, investment, cooperation and therefore trade between countries along the route of the initiative. Unprecedented investments have been made in this transport infrastructure network. According to Belt and Road Portal (2021), China's direct investment in the BRI countries exceeded 90 billion USD from the inception of the BRI to 2018. The BRI adopts a new set of investment risk assessment standards that are more appropriate for emerging markets and developing countries whose rules and norms do not match with developed countries (Hong, 2016: 10). Many projects in these countries face high financing costs and cannot find sufficient financing from the existing financing system due to this incompatibility. The BRI offers opportunities to these countries for their projects worth investing in.

One of the objectives of the BRI is to increase trade connectivity between developed and developing countries by improving a strong logistics and transportation network via trade corridors. Physical connectivity is especially important for developing countries with weak infrastructure. The reason is that improvements in transportation infrastructure bring benefits in respect of many economic activities, such as reducing costs, increasing productivity and efficiency, creating new markets, reducing unemployment, supporting trade, and ultimately increasing the level of per capita income steadily (Beyzatlar, 2020: 2). In this regard, the Belt and Road Initiative plays a quite essential role in promoting the economic growth of countries along the road (Wang et al., 2020a: 195).

In this study, we aim to investigate the interactions of per capita income and consumption per capita of member countries of the Organization of Turkic States with each other and with China based on the BRI framework. The Organization of Turkic States was launched in 2009 as an intergovernmental organization established to carry out policies aimed at developing cooperation and effectiveness in many fields (economy, politics, tourism, education, culture, sports, etc.) between the Turkic-speaking countries and other countries in the region. The name of the

organization was changed to Organization of Turkic States on November 12, 2021, which was previously named the Turkic Council. The Organization consists of five official member states (Azerbaijan, Kazakhstan, Kyrgyzstan, Turkey, and Uzbekistan) and two observer states (Hungary and Turkmenistan). One of the attempts made in this study is to determine whether the GDP per capita and consumption per capita of these countries have spillover effects on each other. Another attempt is to ascertain these countries' connectedness with China as they have a significant impact on the building process of the BRI, which forms the basis of our study. To this end, we conduct our analysis on a dataset that involves GDP per capita and consumption per capita in real terms across 6 countries (including China) and the period spanning 1990 to 2019. Especially, the period after 2009 (the beginning of the Organization of Turkish States) and 2013 (the beginning of the Belt and Road Initiative) is very important in terms of the interconnectedness of these countries. Because it is necessary to observe the movements of the economic growth indicators over the years in order to determine whether these two organizations, one of the most important goals of which is to develop international connectivity, serve their purposes. For this reason, we paid close attention to making our analysis comparatively, before and after these periods. As an empirical approach, we utilize a time-varying vector autoregressive (TVP-VAR) dynamic connectedness. This approach is conceptualized by Antonakakis et al. (2020), which is also the improved version of Diebold and Yılmaz (2012 and 2014).

The contribution of this paper to the related literature is two-fold. First, this is the first study that examines the impact of the BRI on the connectedness of GDP per capita and consumption per capita among the Turkic States and China. Previous reports are mostly based on studies of all BRI countries (see Wang et al., 2020a). There is a need for such a study, which focuses particularly on the BRI's contributions to specific countries. Second, the study applies a unique empirical approach, a time-varying vector autoregressive (TVP-VAR) dynamic connectedness, when examining the BRI's contributions.

The remainder of the paper is structured as follows: the literature review of the study is represented in Section 2. The data and methodology used to observe both dynamic spillover of Turkic States within themselves and with China in terms of income and consumption variables are presented in Section 3, the empirical findings are discussed in Section 4, followed by conclusions in Section 5.

2. Literature Review

Recently in the literature studying the "Belt and Road Initiative" has been a topic of great interest. The BRI's primary aim is to increase regional and global connectivity, and to this end, it provides a massive development program for transport infrastructure that will link China with the rest of the world. Therefore, numerous scholars have been investigating the motivation, opportunities, and challenges of the initiative since its inception (Huang, 2016: 315; Lam et al., 2018: 413; Kadılar and Ergüney, 2017: 86). While the BRI is one of China's most important ventures to spur regional growth in Asia, Europe, and Africa, some policymakers are concerned that the BRI may worsen countries' economic growth as it builds massive transport infrastructures. So, it is important to assess the possible macro-level economic impacts of participation in the BRI as a policy purpose. The results of some studies have shown that the transport infrastructure (rail and road) in the BRI countries has a substantial impact on stimulating economic growth (Wang et al., 2020a: 195). Most countries along the BRI routes make benefit from Chinese investments and perform well in the assessment of commercial maritime power. These countries' commercial maritime powers have become stronger than before, which can lead to meeting basic demands and accumulating wealth, and indirectly fostering economic growth (Li et al., 2020: 161).

The role of developments in transportation infrastructure within economic growth has been considerably discussed in the literature previously (Arbués et al., 2015: 167; Fedderke et al., 2006: 1038; Wang et al., 2021: 50; Kuzu and Onder, 2014: 12; Hayaloğlu, 2015: 524; Beyzatlar et al., 2014: 44). From a theoretical point of view, Aschauer (1989) argued that the presence of public capital

in transportation infrastructure had a considerable effect on the output growth of the private sector in the US economy. The main reason for this increase in productivity is that improvements in services offered by transportation infrastructure reduce time and transport costs. As a result of a decrease in time and transport costs, improvements in transportation infrastructure may reduce costs of production factors (Forkenbrock and Foster, 1990: 309), enlarge the market potential of businesses (Arbués et al., 2015: 166) and of the different locations (Niebuhr, 2006: 330), enhance labor mobility and employment opportunity (Li et al., 2017: 2), facilitate trade (Aschauer, 1989: 178), improve intercity accessibility (Zhao et al., 2017: 65). Perkins et al. (2005) assert that infrastructure investments have an augmentative role in gross domestic product. Especially, improvements in transportation infrastructure are a key trigger for a country's economy because they enable countries to exchange goods and services for consumption as well as inputs for the production process. Furthermore, developments in transportation infrastructure reinforce the geographical quality of a particular region by making it attractive and increasing its accessibility (Aarhaug and Gundersen, 2017: 190).

The benefits of transportation infrastructure are not limited to the region where the project is located. These benefits can expand beyond the invested region since economic activities in different regions are spatially linked and economic associations occur in different ways across a transport network (Arbués et al., 2015: 167). Transportation projects also create other spatial location services besides lowering costs of travel and logistics (Beyzatlar et al., 2014: 44). Therefore, in the related literature, the spillover effects of transportation infrastructure on economic growth have become under considerable research (Xu et al., 2017: 3; Tong et al., 2013: 48; Yu et al., 2013: 57; Zhang, 2008: 586). The results of some of these studies have indicated that road infrastructure (Del Bo and Florio, 2012: 1401) and maritime ports (Bottasso et al., 2014: 44) have positive spillover effects by exploiting the data from EU member regions.

The main purpose of the BRI is to improve transport infrastructure and increase connectivity between regions. Investments for the construction of airports, railways, roads, and other types of infrastructure ventures are on the BRI's agenda. In this process, the Turkish states have the potential to become China's most critical partners due to their geopolitical position. For example, Turkey is centrally located in the BRI in terms of land, sea, and air transportation and energy pipelines (Kulaksız, 2019: 49). The BRI line passing through Turkey would enable Chinese exports to have easier access to the Balkans and the countries bordering the Black Sea (Kadılar and Ergüney, 2017: 89). Furthermore, Turkey has the great potential to become an energy hub for BRI as it shares borders with oil and gas-rich countries (Kulaksız, 2019: 60) plus it has a comparatively safer and more stable environment for investments unlike other possible countries (Kadılar and Ergüney, 2017: 89). Even recently, Iran, Turkey, and Central Asian countries (within the Central Asia-West Asia (CAWA) corridor) have gained more salience in terms of becoming a central route toward the European market for China because of the war between Ukraine and Russia. On the other hand, the political and economic ties between Turkey and Central Asian states such as Kazakhstan, Turkmenistan, Kyrgyzstan, and Uzbekistan (which are also members and observer states of the Organization of Turkic States) would be revitalized by the BRI line. Azerbaijan is an ideal partner for the construction of the BRI since the Azerbaijan-located Caspian rim area is becoming a new joint zone of East Asian, European, and Russian economic interest (Lianlei, 2016: 27). Kazakhstan is also located in the Caspian rim area, and it is seen as a bridge for Azerbaijan to access Central Asia and China, while Azerbaijan offers Kazakhstan routes to Turkey and Europe (Huseynov, 2017: 139). Kazakhstan had already become a prime partner for China in Eurasia before the BRI as they have signed plenty of bilateral trade agreements since the China-Kazakhstan border agreement in April 1994 to increase trade and improve transport communications (Kembayev, 2020: 205; Kassenova, 2017: 111; Liu et al, 2019: 271). So, we can say that the rhetoric and statements indicate that participating in the BRI will bring win-win cooperation among these countries.

Considering the literature discussed above, we believe that research on the regional spillover effects of gross domestic product, and especially consumption, under the BRI framework is worth investigating as it has rarely been studied before. The Belt and Road Initiative has mostly been addressed with an overall perspective of opportunities and challenges. However, this study focuses on more specific point of view such as the effect of the BRI on the connectedness level of income and consumption of Turkic States. We analyze the spillover effect of per capita income and consumption within the Turkic States and China. Furthermore, the study utilizes a unique approach when addressing this issue, which can be specified time-varying vector autoregressive (TVP-VAR) dynamic connectedness. Thus, we believe in that this study differs from the existing literature in these ways. In Section 3, detailed explanations of methodology and data are presented.

3. Data and methodology

3.1. Data

In this section, the dataset consists of six countries covering the 1990-2019 period to observe the spillover effect of the BRI between the Turkic States and China, and within the Turkic States. The corresponding variables are real GDP per capita (GDPpc) and real consumption per capita (CONpc). Table 1 presents descriptive statistics of variables.

The data is compiled from the Penn World Table 10.0 database and is up to 2019 due to the Penn World Table data presence. Real GDP per capita is calculated by dividing real gross domestic product at constant 2017 national prices (in million 2017 USD) by population (in millions). Real consumption per capita is calculated by dividing the real consumption of households and government at constant 2017 national prices (in million 2017 USD) by population (in millions).

Table 1: **Descritive Statistics**

VARIABLES	# OF OBS.	MEAN	STD. DEV.	MINIMUM	MAXIMUM
		GDP per capita (GDPpc)			
AZ	30	8893.63	4770.50	2983.37	14876.97
CH	30	7597.41	3991.00	2689.54	14348.47
KA	30	17365.74	6530.58	8976.57	27642.66
KR	30	4665.94	1020.75	3002.68	6314.33
TU	30	17858.13	4955.67	11915.57	26991.43
UZ	30	6762.94	2563.50	4115.66	11992.23
		Consumption per capita (CONpc)			
AZ	30	6809.50	3308.85	3004.48	12211.73
CH	30	3534.35	2361.84	852.59	8600.41
KA	30	12777.57	4879.42	6691.02	20971.02
KR	30	4848.72	1342.61	2935.80	8724.91
TU	30	12790.32	3149.94	8967.44	18471.95
UZ	30	6062.44	1921.99	4134.06	10428.98

Note: AZ: Azerbaijan, CH: China, KA: Kazakhstan, KR: Kyrgyzstan, TU: Turkey, UZ: Uzbekistan

3.2. Methodology

In this study, a time-varying vector autoregressive (TVP-VAR) dynamic connectedness approach is used. This methodology, which is the improved version of Diebold and Yılmaz (2012 and 2014), is conceptualized by Antonakakis et al. (2020). Their method overcomes the burden of the often

arbitrarily chosen rolling-window size, that could lead to very erratic or flattened parameters, and avoids the loss of valuable observations. The methodology enables the examination of dynamic connectedness at lower frequencies and limited time series data (Antonakakis et al., 2020:13). Some equations (15 to 19) of the latter study are used to determine connectedness parameters.

In line with the equation (15) in the study, the total connectedness index (TCI) based on generalized forecast error variance decompositions (GFEVD) is formulated as follows:

$$TCI_t(H) = \frac{\sum_{i,j=1,i\neq j}^{m} \tilde{\varphi}_{ij,t}(H)}{\sum_{i,j=1}^{m} \tilde{\varphi}_{ij,t}(H)} \times 100 \quad (1)$$

Total transferred directional connectedness (TO others), which is equation (16) in the study, as the spread of each variable over all other variables (from i to j's) is formulated as follows:

$$TO_{i\rightarrow j,t}(H) = \frac{\sum_{j=1,i\neq j}^{m} \tilde{\varphi}_{ji,t}(H)}{\sum_{j=1}^{m} \tilde{\varphi}_{ji,t}(H)} \times 100 \quad (2)$$

Total inbound directional connectedness (FROM others), which is equation (17) in the study, as the spread from all other variables to each variable (from j's to i) is formulated as follows:

$$FROM_{i\leftarrow j,t}(H) = \frac{\sum_{j=1,i\neq j}^{m} \tilde{\varphi}_{ij,t}(H)}{\sum_{i=1}^{m} \tilde{\varphi}_{ij,t}(H)} \times 100 \quad (3)$$

Net total directional connectedness (NET), which is equation (18) in the study, as the difference between transferred and inbound connectedness parameters (TO - FROM) is formulated as follows:

$$NET_{i,t} = TO_{i\rightarrow j,t}(H) - FROM_{i\leftarrow j,t}(H) \quad (4)$$

If the variable i affect more than it is affected, the variable is driving the network and NET is positive, and if it is affected more than it affects, the variable is driven by the network and NET is negative.

Finally, to examine the bilateral relations between all variables, the net pairwise directional connectedness (PAIR), which is equation (19) in the study, is formulated as follows:

$$PAIR_{ij}(H) = \left(\tilde{\varphi}_{jit}(H) - \tilde{\varphi}_{ijt}(H)\right) x100 \quad (5)$$

Here, if PAIR takes a positive value, the variable i is dominant over j, and if PAIR takes a negative value, the variable j is dominant over i.

4. Empirical results

The analyses in this section, which are based on the methodology provided in the previous part, cover three subsections as unit root testing, income, and consumption connectedness. To compute our results, we employ the Antonakakis et al. (2020) strategy for revealing the connectedness parameters of income and consumption.

4.1. Unit root test

In this subsection, we report the results of the unit root properties for six countries' macroeconomic time series using annual data. All variables are extracted from Penn World Tables and converted into natural logs. The sample period for each variable starts from 1990 and finishes in 2019 depending on data availability. Before performing connectedness analysis, a stationarity process is carried out. Unit root test results are presented in Table 2.

The unit root test, which is developed by Perron (1997) and takes structural breaks into account, is applied to check stationarity. Variables with large time dimensions are usually caused by economic, political, and financial crises, etc. It can be exposed to external shocks in the form of structural breaks that may occur due to reasons. Traditional unit root tests ignore such structural

breaks and therefore results can be misleading. The structural break unit root test is performed to overcome this situation and both variables of all countries are found stationary at the first difference, in other words, integrated of order one.

Table 2: **Unit Root Test Results**

VARIABLES	AZ	CH	KA	KR	TU	UZ
			GDP per capita			
	-12.348 ***	-5.578 **	-5.302 **	-9.264 ***	-5.832 ***	-9.581 ***
			Consumption per capita			
	-5.559 **	-5.959 ***	-6.226 ***	-6.672 ***	-5.606 **	-12.552 ***

Note: AZ: Azerbaijan, CH: China, KA: Kazakhstan, KR: Kyrgyzstan, TU: Turkey, UZ: Uzbekistan. The null hypothesis of the test is that the series contains a unit root. *** and ** denote the rejection of the null hypothesis of the series at 1 and 5 percent levels of significance, respectively. Asymptotic one-sided p-values for the test are gathered from Vogelsang (1993).

4.2. Income Connectedness

This part covers the income connectedness within the Turkic States merely and including China, through various parameters (Tables 3 and 4) and graphical analyses (Figures 1 to 3). The connectedness parameters in these tables and figures are calculated based on the equations (1) to (5) in the Methodology subsection. The graphical analyses also provide the opportunity to make a time-based analysis through the period 1990 to 2019.

Table 3: **GDP Per Capita Connectedness within the Turkic States**

	AZ	KA	KR	TU	UZ	FROM
AZ	36.72	19.84	20.31	0.76	22.36	63.28
KA	29.60	30.37	20.93	1.32	17.78	69.63
KR	24.93	17.96	31.85	3.34	21.92	68.15
TU	5.38	6.59	6.22	77.02	4.80	22.98
UZ	27.92	16.80	21.68	1.20	32.40	67.60
TO	87.83	61.18	69.13	6.62	66.86	**TCI**
NET	24.55	-8.44	0.98	-16.36	-0.73	58.33

Note: TCI is the Total Connectedness Index, TO is the contribution of a variable to others, FROM is the contribution of a variable from others, and NET is the net connectedness (TO-FROM). AZ: Azerbaijan, CH: China, KA: Kazakhstan, KR: Kyrgyzstan, TU: Turkey, UZ: Uzbekistan.

The total connectedness index (TCI) is over 58 percent within the Turkic States (in Table 3) but decreased to 55 percent with the inclusion of China (in Table 4). Graphical analyses and the comparison of the TCI parameters of income and consumption connectedness can also be seen in Figure 7 in the next subsection.

To assess the NET connectedness parameters, Table 3 indicates that GDPpc of AZ and KR are net transmitters with 24.55 and 0.98 percent, respectively. In addition, GDPpc of TU, KA, and UZ are net receivers with 16.36, 8.44, and 0.73 percent, respectively. Nextly, pairwise connectedness parameters are read from column to row, i.e., the highest is 29.60 percent from AZ to KA and the lowest is 0.76 percent from TU to AZ, in Table 3. Most notable in this regard is the diagonal of TU (77.02 percent) representing the intersection point of column and row of TU. This parameter is not

only the highest level of pairwise connectedness but also the common point of the lowest row-column combination. Pairwise connectedness parameters from TU to others and from others to TU correspond to the lowest levels (between 0.76 and 6.59). When this and other pairwise parameters are examined in detail, the income connectedness is higher within the Turkic States except for Turkey.

Table 4: **GDP Per Capita Connectedness within the Turkic States (incl. China)**

	AZ	KA	KR	TU	UZ	CH	FROM
AZ	37.11	20.18	19.03	0.57	21.93	1.17	62.89
KA	28.70	29.86	21.32	1.34	17.67	1.12	70.14
KR	25.57	17.73	31.01	2.63	21.09	1.97	68.99
TU	5.05	6.19	5.94	66.79	4.55	11.49	33.21
UZ	27.39	16.54	21.66	1.14	32.66	0.62	67.34
CH	4.62	4.39	6.89	6.54	4.90	72.67	27.33
TO	91.32	65.03	74.83	12.22	70.13	16.37	**TCI**
NET	28.43	-5.11	5.83	-20.99	2.79	-10.96	54.98

Note: TCI is the Total Connectedness Index, TO is the contribution of a variable to others, FROM is the contribution of a variable from others, and NET is the net connectedness (TO-FROM). AZ: Azerbaijan, CH: China, KA: Kazakhstan, KR: Kyrgyzstan, TU: Turkey, UZ: Uzbekistan.

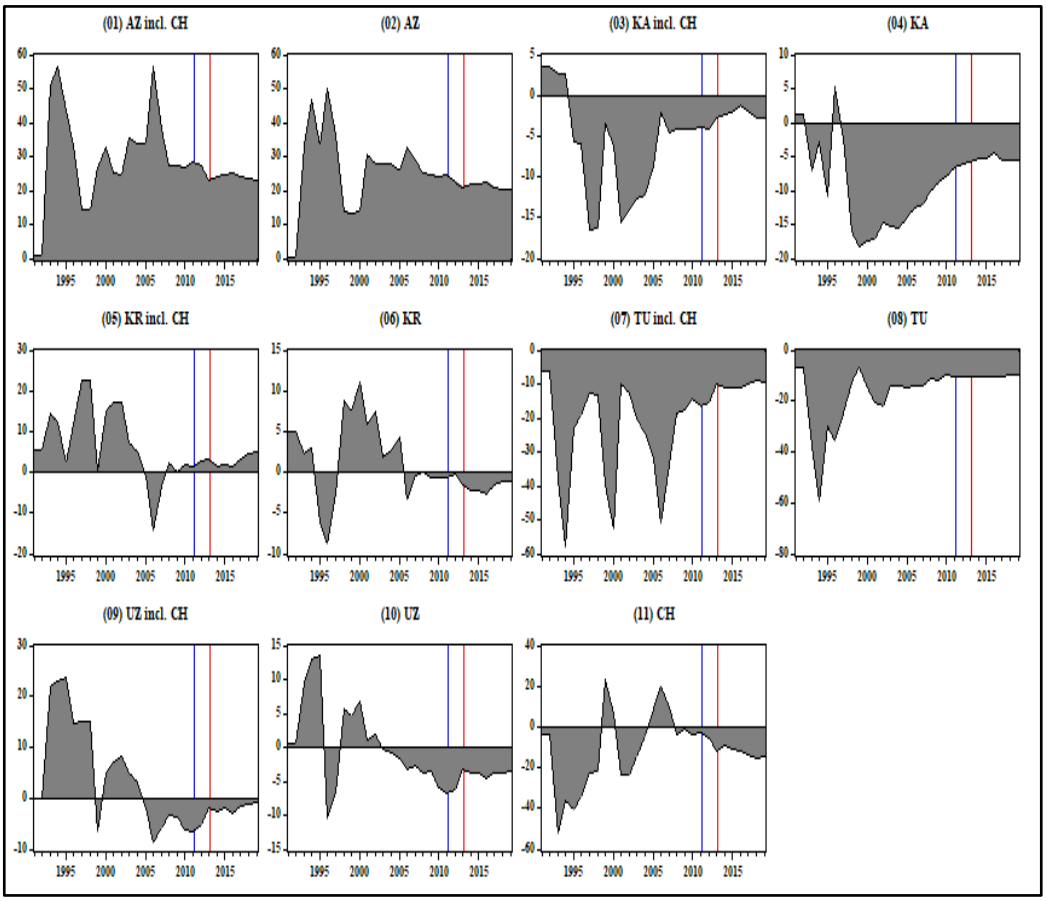
Similarly, the NET connectedness parameters by the inclusion of China in Table 4 indicate that GDPpc of AZ and KR are net transmitters with higher percentages of 28.43 and 5.83, respectively. Moreover, UZ is also found as a net transmitter with 2.79 percent, which was a receiver without China in the system. Furthermore, the GDPpc of TU and KA are net receivers with higher percentages of 20.99 and 5.11, respectively. Lastly, CH is also found as a net receiver with 10.96 percent. To continue with pairwise analysis, the highest is 28.70 percent from AZ to KA and the lowest is 0.57 percent from TU to AZ, in Table 4. The diagonal of TU (66.79 percent) is the second-highest after CH with a 72.67 percent level of pairwise connectedness. The row-column combination of TU and CH are representing the lowest parameters when compared to other countries' pairwise connectedness. When these are examined in detail, the relations of TU and CH with others are lower than their relationships with themselves. Column TU is higher with CH (6.54 percent) and column CH is higher with TU (11.49 percent). The inclusion of China, somehow or another, exerts a particular effect on the net and pairwise connectedness parameters.

Before starting to review the following graphs in more detail, there are a few important things to note for all graphs covered in Figures 1 to 7. Firstly, it should be noted that there are milestones indicated with different colored lines. The blue denotes the first summit meeting of the Organization of the Turkic States, which was held in Almaty in October 2011. This meeting turned out to be of great importance for the countries with the theme of "Economic and Commercial Cooperation". Moreover, the inference of the red line is twofold: first, the third meeting of the organization was held in August 2013 in the city of Gabala, Azerbaijan, with the theme of "Transport and Connectivity"; second, the official announcement of the BRI in September 2013. Within the scope of these issues, there may have been an impact on the organization in terms of transportation.

Figure 1 presents the comparison of NET income connectedness graphs for each country with and without China. Azerbaijan exhibits a net transmitter attitude constantly even though China is included in the system. Although there is a slight decrease after the first meeting (blue line), a

stable outlook was followed by Azerbaijan afterward. Kazakhstan played the role of a transmitter at the beginning of the period with the inclusion of China in Figure 1 (Panel 03), and it was observed as a net receiver after 1995. Moreover, the effect of blue and red points is neither slight nor tidy change is observed. Lastly, if we look at the periodic analysis of Turkey, besides saying that it is a net receiver, it is necessary to mention two important points. The first is the peak reverse point of the first half of the 1990s, possibly the 1994 economic crisis. This situation is seen as a triple deep reverse with the inclusion of China in the system in Figure 1 (Panel 07). These are again seen as the 1994 economic crisis, the 2001 economic crisis, and the last that coincides with 2006. When the blue and red occasions, some change is observed when only China is included in the system, and a stable process is observed apart from that.

Figure 1: **GDP Per Capita Net Connectedness Comparison**



The comparison of income pairwise connectedness graphs that are showing a bilateral connectedness between each country couple, which are listed alphabetically, is displayed in Figure 2. While reading pairwise connectedness graphs, it should be noted that if the shaded area is on the negative side, the leading country is dominant (transmitter and receiver), i.e., Azerbaijan and Kazakhstan, and if it is on the positive side, the second country is dominant (receiver and transmitter), i.e., Turkey and Uzbekistan. These situations can also be found mixed in the graphics, i.e., Kyrgyzstan and Uzbekistan. Graphical illustration and pairwise parameters in previous tables give a consistent connectedness within the organization.

Figure 2: **GDP Per Capita Pairwise Connectedness within the Turkic States**

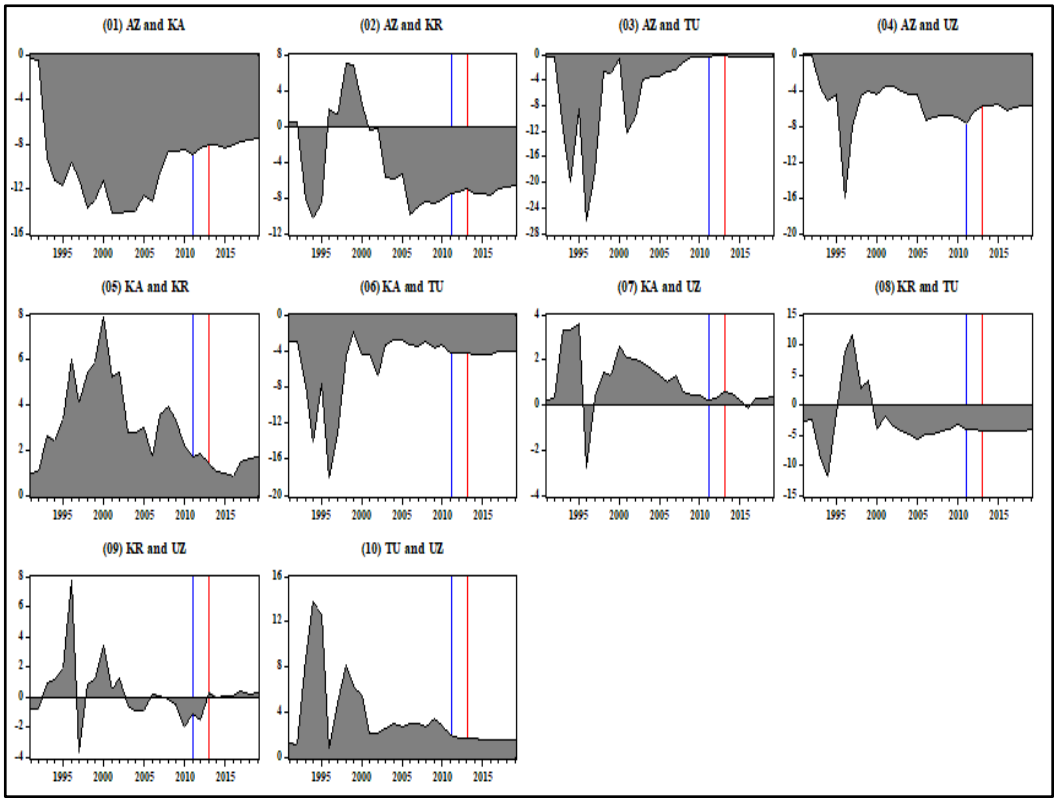


Figure 3: **GDP Per Capita Pairwise Connectedness within the Turkic States (incl. China)**

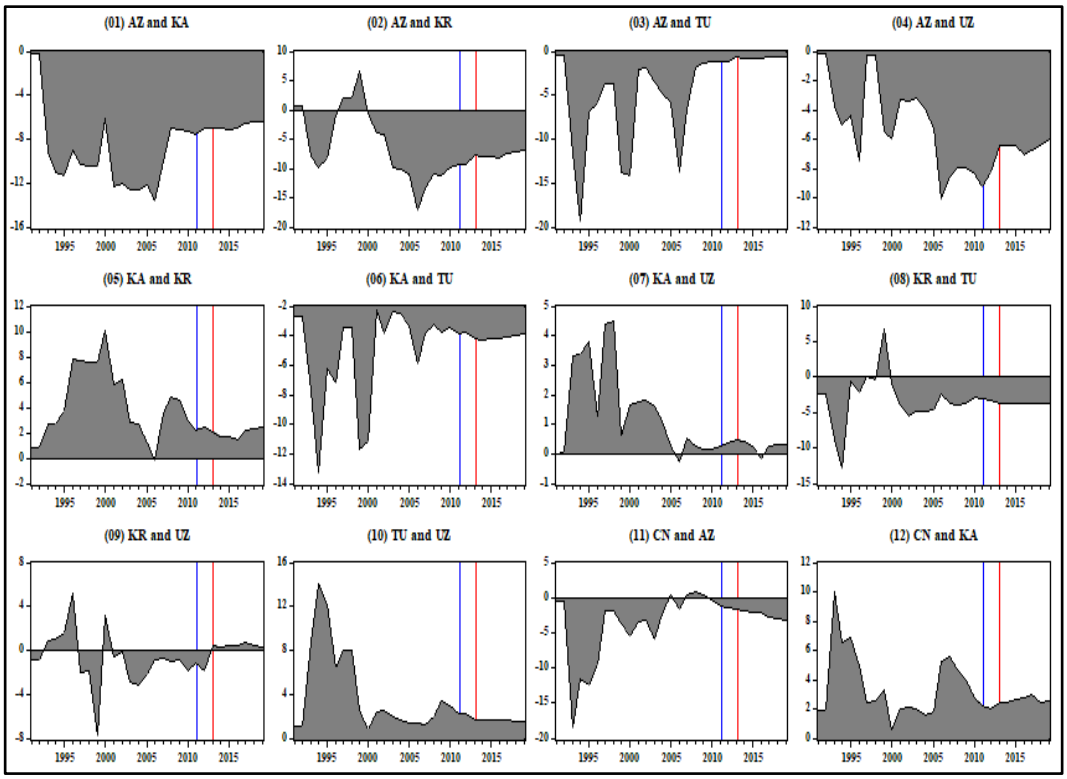


Figure 3(Continued): **GDP Per Capita Pairwise Connectedness within the Turkic States (incl. China)**

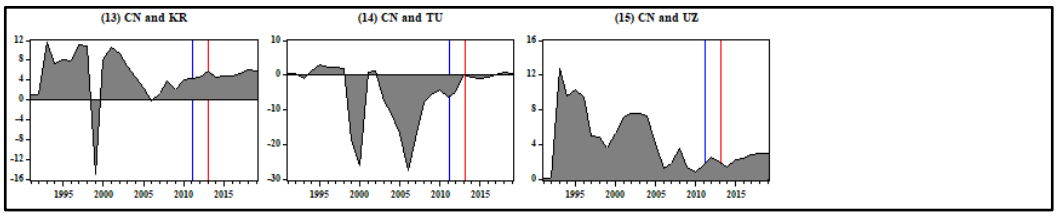


Figure 3 presents the comparison of income pairwise connectedness graphs that are showing a bilateral connectedness between each country couple including China. Information on how to read these graphs is explained in the paragraph above just after Figure 2. Along with the inclusion of China, although there are visible changes in peak and trough levels, both numerically and in number, there have been no dramatic changes in the roles of bilateral receiver and transmitter between countries.

4.3. Consumption Connectedness

This fragment reveals the consumption connectedness within the Turkic States merely and including China, through several parameters (Tables 5 and 6) and graphical analyses (Figures 4 to 6). The parameters in these tables and figures are calculated based on the equations (1) to (5) in the methodology subsection by using CONpc. Just to remind again that the graphical analyses also provide the opportunity to make a time-based analysis through the period 1990 to 2019.

The total connectedness index (TCI) is almost 50 percent within the Turkic States (in Table 5) but decreased to 48 percent with the inclusion of China (in Table 6). Graphical analyses and the comparison of the TCI parameters of income and consumption connectedness can also be seen in Figure 7 at the end of this subsection.

Table 5: **Consumption Per Capita Connectedness within the Turkic States**

	AZ	KA	KR	TU	UZ	FROM
AZ	37.22	26.08	24.23	3.53	8.94	62.78
KA	27.19	37.31	21.58	7.60	6.33	62.69
KR	26.92	23.17	35.72	6.72	7.47	64.28
TU	3.04	8.19	5.44	74.26	9.07	25.74
UZ	9.36	9.78	10.71	3.92	66.24	33.76
TO	66.50	67.22	61.96	21.77	31.80	**TCI**
NET	3.72	4.53	-2.32	-3.97	-1.96	49.85

Note: TCI is the Total Connectedness Index, TO is the contribution of a variable to others, FROM is the contribution of a variable from others, and NET is the net connectedness (TO-FROM). AZ: Azerbaijan, CH: China, KA: Kazakhstan, KR: Kyrgyzstan, TU: Turkey, UZ: Uzbekistan.

The NET connectedness parameters of consumption analysis displayed in Table 5 indicate that CONpc of KA and AZ are net transmitters with 4.53 and 3.72 percent, respectively. CONpc of TU, KR, and UZ are net receivers with 3.97, 2.32, and 1.96 percent, respectively. When compared with the income part, while AZ, TU, and UZ are in the same role, KA and KR have switched theirs. Afterward, pairwise connectedness parameters, which are read from column to row, i.e., the highest is 27.19 percent from AZ to KA and the lowest is 0.76 percent from AZ to TU, in Table 5. The highest is the same but the lowest is the reverse of the income part. The diagonal of TU (74.26

percent) is again the highest and followed by UZ which is also high with 66.24 percent. This time, however, TU is not alone, as UZ also contains low-level pairwise connectedness parameters. Of course, the most important indicator of this is undoubtedly the diagonal size of UZ. This situation briefly shows the internal state of the variable to a large extent. Pairwise connectedness parameters from TU (UZ) to others and from others to TU (UZ) correspond to the lowest levels between 3.53 (3.92) and 9.07 (10.71). When these and other pairwise parameters are examined in detail, the consumption pairwise connectedness is higher within the Turkic States except for Turkey and Uzbekistan.

Table 6: **Consumption Per Capita Connectedness within the Turkic States (incl. China)**

	AZ	KA	KR	TU	UZ	CH	FROM
AZ	37.50	23.67	24.19	4.43	9.54	0.67	62.50
KA	28.10	37.02	21.27	6.02	5.94	1.67	62.98
KR	25.46	21.64	35.19	9.43	7.70	0.57	64.81
TU	3.51	7.47	4.94	69.02	8.66	6.40	30.98
UZ	10.78	8.87	11.75	3.71	64.27	0.62	35.73
CH	1.52	3.06	1.48	5.28	19.50	69.16	30.84
TO	69.36	64.71	63.63	28.86	51.34	9.92	**TCI**
NET	6.87	1.72	-1.17	-2.12	15.61	-20.92	47.97

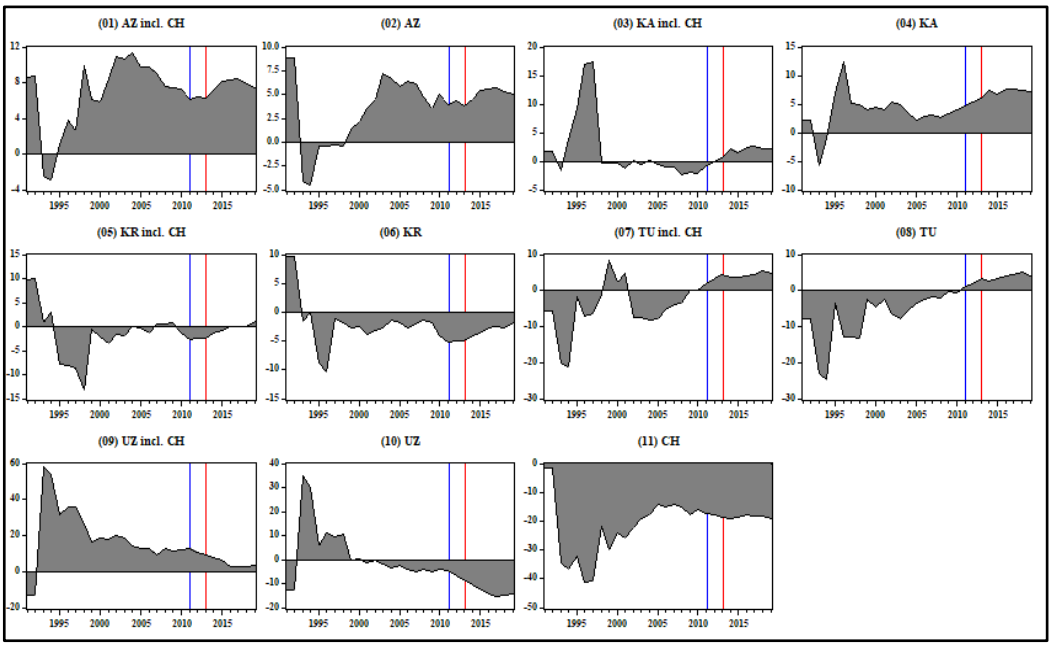
Note: TCI is the Total Connectedness Index, TO is the contribution of a variable to others, FROM is the contribution of a variable from others, and NET is the net connectedness (TO-FROM). AZ: Azerbaijan, CH: China, KA: Kazakhstan, KR: Kyrgyzstan, TU: Turkey, UZ: Uzbekistan.

Examining Table 6; the analysis continues with the NET connectedness parameters by the inclusion of China indicates that CONpc of UZ, AZ, and KA are net transmitters with 15.61, 6.87, and 1.72 percent, respectively. While UZ was a net receiver in the previous group, it now stands out as the highest-level net transmitter. Moreover, CONpc of TU and KR are net receivers with 2.12 and 1.17 percent levels. China, on the other hand, has been included in the system as the highest-level receiver with a 20.92 percent level. The highest among pairwise connectedness parameters again from AZ to KA with 28.10 percent and the lowest is 0.57 percent from CH to KR, in Table 6. China is the highest with 69.16 percent, followed by TU and UZ with 69.02 and 64.27 percent levels among diagonal connectedness parameters. Therefore, the row-column combination of CH, TU, and UZ are representing the lowest parameters when compared to other countries' pairwise connectedness. When these are examined in detail, the relations of these countries with others are lower than their relationships with themselves. Column TU is higher with KR (9.43 percent) and column CH is higher again with TU (6.40 percent). The inclusion of China, somehow or another, exerts a particular effect on the net and pairwise consumption connectedness parameters as well.

As mentioned before, the blue and red lines in Figures 4 to 7 denote the first summit meeting of the organization in October 2011 and the official announcement of the BRI in September 2013, respectively. Figure 4 introduces the comparison of NET consumption connectedness graphs for each country with and without China. When these graphs are examined carefully, it is seen that no country except China has exhibited a net receiver or transmitter in the analysis process in Figure 4 (Panel 11). China is a net receiver, and it has been observed that China followed a process that increased to a 40 percent trough, from there decreased to 30, and in the remainder of the period, she followed a variable process at the levels of 20 to 25 percent and reached the end at these levels. When the periodic analysis of Turkey is examined in Figure 4 (Panel 08), it is seen that it follows the role of the NET receiver until it comes to the blue area, and then it is a NET transmitter.

As can be seen here, the blue area indicates a significant breakout, while the red area shows a slight decrease and then an increase.

Figure 4: **Consumption Per Capita Net Connectedness Comparison**



Continuing the evaluation for Figure 4, in the part (Panel 07) where China is included in the system, Turkey's role as a NET transmitter between 1998 and 2002 draws attention. Apart from that, no significant change was observed, including the trough points like 1994 and 2003-04. When other periodic analyses are investigated, relations between China and other countries, a significant effect is seen except Azerbaijan.

The comparison of consumption pairwise connectedness graphs that are showing a bilateral connectedness between each country couple, which are listed alphabetically, is displayed in Figure 5. It is necessary to inform that while reading pairwise connectedness graphs, if the shaded area is on the negative side, the leading country is dominant (transmitter and receiver), i.e., Azerbaijan and Kyrgyzstan in Panel (02), and if it is on the positive side, the second country is dominant (receiver and transmitter), i.e., Turkey and Uzbekistan in Panel (10). These situations can also be found as mixed, i.e., Azerbaijan and Turkey in Panel (03). Graphical illustration from Figure 5 and pairwise parameters in Tables 5 and 6 give a consistent connectedness within the organization.

Figure 5: **Consumption Per Capita Pairwise Connectedness within the Turkic States**

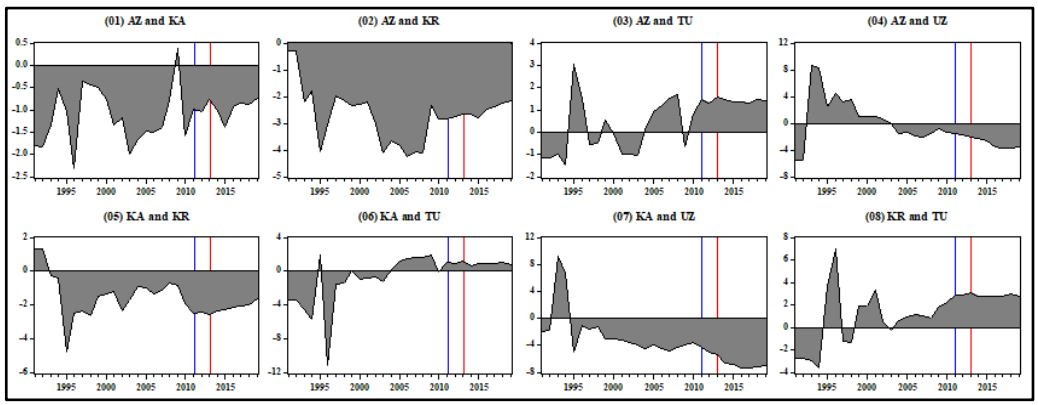


Figure 5(Continued): **Consumption Per Capita Pairwise Connectedness within the Turkic States**

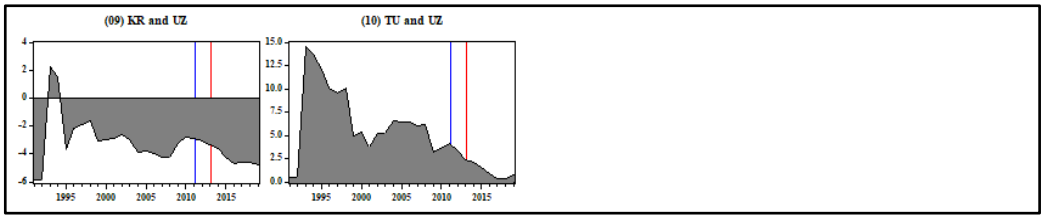
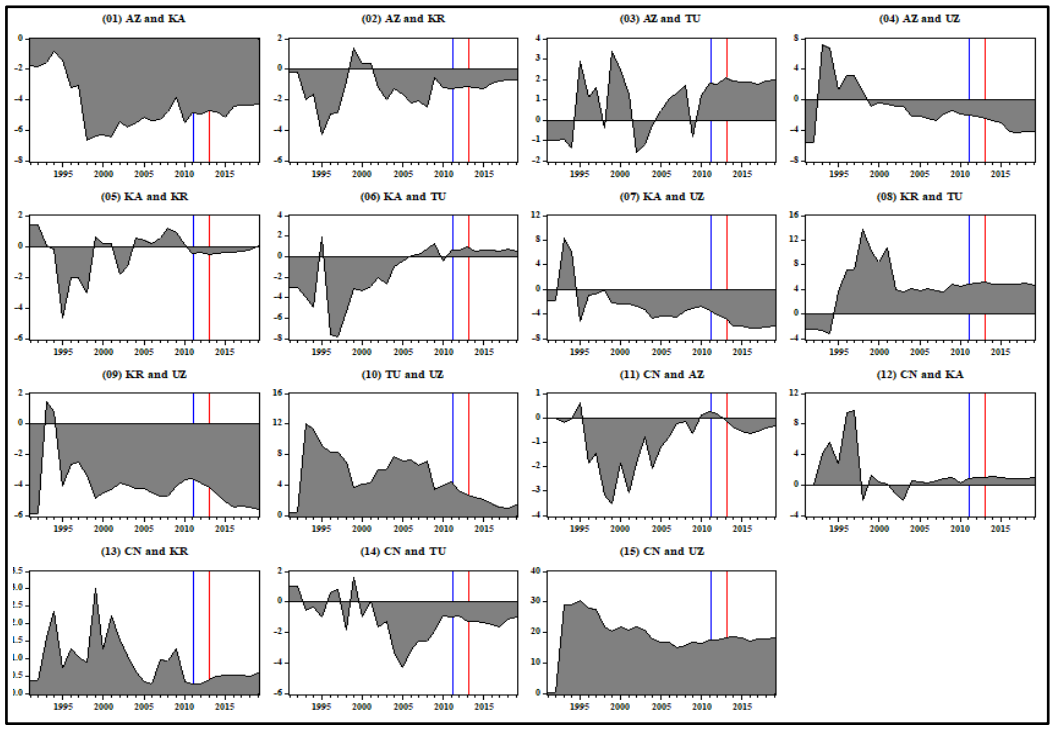


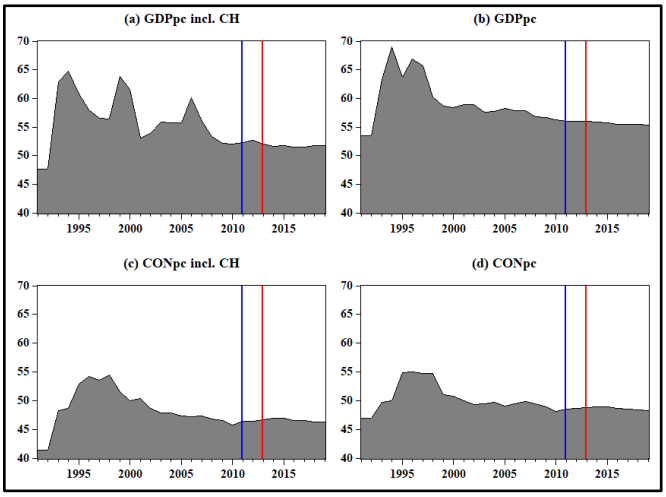
Figure 6 presents the comparison of consumption pairwise connectedness graphs that are showing a bilateral connectedness between each country couple including China. Information on how to read these graphs is explained in the paragraph above just before Figure 5. Along with the inclusion of China, although there are visible changes in peak and trough levels, both numerically and in number, there have been no dramatic changes in the roles of bilateral receiver and transmitter between countries.

Figure 6: **Consumption Per Capita Pairwise Connectednes within Turkic States (incl. China)**



When Figure 7, which includes TCI graphs of GDPpc and CONpc for the period 1990-2019 with and without China, is examined, the inclusion of China in the system causes a decrease in parameters, although it does not make a significant difference. In panel (a), GDPpc, including China, started at 47 percent level and remained stable from 2010 to 2019 above 50 percent after hovering between 53 and 65 percent in the period until 2009. In panel (b), GDPpc, without China, started at 53 percent and changed between 58 and 69 percent in the period until 2000 and followed a very smooth decreasing trend from 2001 to 2019 reaching 55 percent level. There appears a similar process for the consumption side, in panel (c), CONpc, including China, started at 41 percent, and changed between 47 and 55 percent in the period until 2003 and followed a very smooth decreasing trend with small changes from 2004 to 2019 reaching to 46 percent level. In panel (d), CONpc, without China, started at 46 percent and changed between 49 and 55 percent in the period until 2002 and followed a very smooth decreasing trend with small changes from 2003 to 2019 reaching 47 percent level.

Figure 7: **Total Connectedness Index Comparison**



5. Conclusion

In 2013, President Xi officially announced China's ambitious intention of building the world's largest mega infrastructure network project, the Belt and Road Initiative. According to Vision and Actions on jointly building Belt and Road (2017), the initiative aims to link regions from Asia to Europe and Africa via trade corridors. In March 2022, the number of countries that have participated in the Belt and Road Initiative by signing a Memorandum of Understanding (MoU) with China has reached 146 (Nedopil, 2022), and half of them are low- and lower-middle-income countries. The BRI's main concern is to foster economic prosperity through building infrastructure networks among participating countries. Çelebi (2019) states that especially low- and lower-middle-income countries can gain the highest advantages from their logistics performance with the increase in exports. In this respect, the BRI offers considerable funding and financing opportunities to these countries for improvements and developments of their transportation infrastructure.

The primary goal of this study is to contribute to the understanding of the BRI framework. In particular, the study aims to estimate the BRI's role in the connectedness of income and consumption among the Turkic States and China. In order to document the existence of connectedness, we exploit a time-varying vector autoregressive (TVP-VAR) dynamic connectedness approach over the period between 1990 and 2019. The details of our findings are as follows. First, given the connectedness of income per capita within the Turkic States, it is observed that Azerbaijan and Kyrgyzstan are net transmitters, while Turkey, Kazakhstan, and Uzbekistan are net receivers. Further, the income connectedness is higher within the Turkic States except in Turkey from the perspective of pairwise connectedness. Second, Uzbekistan moves from net receiver to net transmitter when we include China in the regression. Third, the relations of Turkey and China with others are lower than their relationships with themselves. Fourth, the inclusion of China has a particular effect on the net and pairwise income connectedness parameters.

Similarly, given the connectedness of consumption per capita within the Turkic states, it is observed that Azerbaijan and Kazakhstan are net transmitters, while Turkey, Kyrgyzstan, and Uzbekistan are net receivers. Differently from the results of the connectedness of income per capita, Kazakhstan and Kyrgyzstan have switched their places as net transmitters and net receivers. Moreover, the consumption pairwise connectedness is higher within the Turkic States except for Turkey and Uzbekistan. On the other hand, China has been included in the system as the highest-level receiver. With the inclusion of China, Uzbekistan stands out as the highest-level net

transmitter while it was a net receiver in the previous group. Further, the net and pairwise consumption connectedness parameters are significantly affected by the inclusion of China.

This study contributes to the related literature two-fold. First, this is the first study that examines the contribution of the BRI framework in terms of Turkic States. Apart from other international organizations, the organization of Turkic States is an organization that was established mainly with ethnicity, common history, and common language concerns. In addition, each of the participant countries of the organization is a vital partner for China's BRI attempt especially in terms of geopolitical position. Therefore, investigating the connectedness of the Turkic States and China is a subject worth studying. Second, the study employs a unique empirical approach, a time-varying vector autoregressive (TVP-VAR) dynamic connectedness, when examining the connectedness of income per capita and consumption per capita within the Turkic States merely and including China. Moreover, in the period covering 1990-2019, the study provides the opportunity for comparison between years by reporting graphical analysis.

The policy implications in the light of connectedness parameters are significant because the organization of Turkic States and BRI add value to member economies. These edges also shed light on the extent to which the positive gains from income and consumption spillover condense via improved cooperation. Our findings are that there might be more advantages in terms of improved membership performance by encouraging as many sectors as possible. This versatile interaction might evolve income and consumption connectedness within the member countries. Another important result is that with the inclusion of China in the system, member countries do not turn into the losers-club. In conclusion, it should be noted that the effects of Turkey and China on the relations between other countries and their connectedness are limited. They might follow a more intensive process covering the sub aspects of national accounts in order to develop relations with other countries.

Although the study is limited to income and consumption variables, it constitutes a guide for future research. In particular, the study can be expanded by investigating the connectedness of variables such as trade volumes and foreign direct investments within the Turkic States merely and including China.

References

Aarhaug, J. & Gundersen, F. (2017). Infrastructure Investments to Promote Sustainable Regions. Transportation Research Procedia, 26, 187-195.

Antonakakis, N., Chatziantoniou, I. & Gabauer, D. (2020). Refined Measures of Dynamic Connectedness Based on Time-Varying Parameter Vector Autoregressions. Journal of Risk and Financial Management, 13(4), 84.

Arbués, P., Baños, J. F. & Mayor, M. (2015). The Spatial Productivity of Transportation Infrastructure. Transportation Research Part A, 75, 166-177.

Aschauer, D. A. (1989). Is Public Expenditure Productive. Journal of Monetary Economics, 23, 177-200.

Belt and Road Portal, (2021). https://eng.yidaiyilu.gov.cn/zchj/qwfb/86739.htm, (accessed: 21 December 2021).

Beyzatlar, M. A. (2020) Türkiye'de Ulaşım ve Ekonomik Göstergeler Arasındaki Yayılma Etkileri. Akıllı Ulaşım Sistemleri ve Uygulamaları Dergisi, 3(1), 1-23.

Beyzatlar, M. A., Karacal, M. & Yetkiner, H. (2014). Granger-Causality between Transportation and GDP: A Panel Data Approach. Transportation Research Part A, 63, 43-55.

Bottasso, A., Conti, M., Ferrari, C. & Tei, A. (2014). Ports and Regional Development: A Spatial Analysis on A Panel of European Regions. Transportation Research Part A, 65, 44-55.

Çelebi, D. (2019). The Role of Logistics Performance in Promoting Trade. Maritime Economics & Logistics, 21(3), 307-323

Del Bo, C. F. & Florio, M. (2012). Infrastructure and Growth in a Spatial Framework: Evidence from the EU Regions. European Planning Studies, 20(8), 1393-1414.

Diebold, F. X. & Yilmaz, K. (2012). Better to Give than to Receive: Predictive Directional Measurement of Volatility Spillovers. International Journal of Forecasting, 28(1), 57-66.

Diebold, F. X. & Yılmaz, K. (2014). On The Network Topology of Variance Decompositions: Measuring the Connectedness of Financial Firms. Journal of econometrics, 182(1), 119-134.

Fedderke, J. W., Perkins, P. & Luiz, J. M. (2006). Infrastructural Investment in Long-Run Economic Growth: South Africa 1875–2001. World development, 34(6), 1037-1059.

Forkenbrock, D. J. & Foster, N. S. (1990). Economic Benefits of a Corridor Highway Investment. Transportation Research Part A: General, 24(4), 303-312.

Hong, Z. (2016). China's One Belt One Road: An Overview of The Debate. ISEAS Publishing, 7-33.

Huang, Y. (2016). Understanding China's Belt & Road Initiative: Motivation, Framework and Assessment. China Economic Review, 40, 314-321.

Huseynov, R. (2017). Azerbaijan - Kazakhstan Relations: Current Situation and Prospects. Przeglad Politologiczny, (3), 139-160.

Kadılar, R. & Ergüney, E. (2017). One Belt One Road Initiative: Perks and Chalenges for Turkey. Turkish Policy Quarterly, 16(2), 87.

Kassenova, N. (2017). China's Silk Road and Kazakhstan's Bright Path: Linking Dreams of Prosperity. Asia Policy, 24(1), 110-116.

Kembayev, Z. (2020). Development of China-Kazakhstan Cooperation. Problems of Post-Communism, 67(3), 204-216.

Kulaksız, S. (2019). Financial Integration via Belt and Road Initiative: China–Turkey Cooperation. Global Journal of Emerging Market Economies, 11(1-2), 48-64.

Kuzu, S. & Önder, E. (2014). Research into the Long-Run Relationship between Logistics Development and Economic Growth in Turkey. Journal of Logistics Management, 3(1), 11-16.

Lam, J. S. L., Cullinane, K. P. B. & Lee, P. T.W. (2018). The 21st-Century Maritime Silk Road: Challenges and Opportunities for Transport Management and Practice. Transport Reviews, 38(4), 413-415.

Li, K. X., Jin, M., Qi, G., Shi, W. & Ng, A. K. (2017). Logistics as a Driving Force for Development under the Belt and Road Initiative–the Chinese Model for Developing Countries. Transport Reviews, 38(4), 457-478.

Li, K. X., Lin, K. C., Jin, M., Yuen, K. F., Yang, Z. & Xiao, Y. (2020). Impact of the Belt and Road Initiative on Commercial Maritime Power. Transportation Research Part A: Policy and Practice, 135, 160-167.

Lianlei, B. (2016). Azerbaijan in the Silk Road Economic Belt: A Chinese Perspective. Caucasus International, 6(1), 27-39.

Liu, X., Chen, Y. & Wang, X. (2019). Research on China-Kazakhstan Trade under "The Belt and Road Initiative" based on the Perspective of Factor Endowment Theory. International Conference on Management Science and Industrial Economy (MSIE 2019), 270-274.

Nedopil, C. (2022). "Countries of the Belt and Road Initiative"; Shanghai, Green Finance & Development Center, FISF Fudan University, www.greenfdc.org

Niebuhr, A. (2006). Market Access and Regional Disparities: New Economic Geography in Europe. Ann. Regional Sci., 40, 313-334

Perkins, P., Fedderke, J., & Luiz, J. (2005). An Analysis of Economic Infrastructure Investment in South Africa. South African Journal of Economics, 73(2), 211-228.

Tong, T., Yu, T. H. E., Cho, S. H., Jensen, K. & Ugarte, D. D. L. T. (2013). Evaluating the Spatial Spillover Effects of Transportation Infrastructure on Agricultural Output Across the United States. Journal of Transport Geography, 30, 47-55.

Vision and Actions on Jointly Building Belt and Road, (2017). http://2017.beltandroadforum.org/english/n100/2017/0410/c22-45-3.html (accessed: 15 May 2022)

Vogelsang, T. J. (1993). Essays on Testing for Nonstationarities and Structural Change in Time Series Models. Princeton University.

Wang, C., Lim, M. K., Zhang, X., Zhao, L. & Lee, P. T. W. (2020a). Railway and Road Infrastructure in the Belt and Road Initiative Countries: Estimating the Impact of Transport Infrastructure on Economic Growth. Transportation Research Part A: Policy and Practice, 134, 288-307.

Wang, X., Wong, Y. D., Yuen, K. F. & Li, K. X. (2020b). Environmental Governance of Transportation Infrastructure under Belt and Road Initiative: A Unified Framework. Transportation Research Part A: Policy and Practice, 139, 189-199.

Wang, C., Kim, Y. S. & Kim, C. Y. (2021). Causality between Logistics Infrastructure and Economic Development in China. Transport Policy, 100, 49-58.

Xu, X. & Wang, Y. (2017). Study on Spatial Spillover Effects of Logistics Industry Development for Economic Growth in the Yangtze River Delta City Cluster based on Spatial Durbin Model. International Journal of Environmental Research and Public Health, 14(12), 1508.

Yang, D., Jiang, L. & Ng, A. K. (2018). One Belt One Road, but Several Routes: A Case Study of New Emerging Trade Corridors Connecting the Far East to Europe. Transportation Research Part A: Policy and Practice, 117, 190-204.

Yu, N., De Jong, M., Storm, S. & Mi, J. (2013). Spatial Spillover Effects of Transport Infrastructure: Evidence from Chinese Regions. Journal of Transport Geography, 28, 56-66.

Zhang, X. (2008). Transport Infrastructure, Spatial Spillover and Economic Growth: Evidence from China. Frontiers of Economics in China, 3(4), 585-597.

Zhang, X., Zhang, W. & Lee, P. T. W. (2020). Importance Rankings of Nodes in the China Railway Express Network under the Belt and Road Initiative. Transportation Research Part A: Policy and Practice, 139, 134-147.

Zhao, J., Yu, Y., Wang, X. & Kan, X. (2017). Economic Impacts of Accessibility Gains: Case Study of the Yangtze River Delta. Habitat international, 66, 65-75.