THE RELATIONSHIP BETWEEN ECONOMIC COMPLEXITY INDEX AND EXPORT: THE CASE OF TURKEY AND CENTRAL ASIAN AND TURKIC REPUBLICS

The paper focuses on the mutual interaction between export from Turkey to Central Asian and Turkic Republics (the CATRs) and exported product range. For measuring the range of exported products, we use economic complexity index (ECI) that refers to the knowledge intensity accumulated in the country’s exported products. In addition, ECI provides information regarding the countries’ export structures and income levels. We explore how export levels of Turkey and the CATRs, which have common religion and ethnicity, and the countries’ ECI scores interact with each other. In this regard, we demonstrate how export affects the countries’ ECI for both the CATRs and Turkey. For this purpose, we study the possible relationship between mutual trade volume and the countries’ ECI scores by employing Westerlund’s cointegration analysis, Pooled Mean Group Estimator (PMGE) model and Dumitrescu-Hurlin’s panel causality method. We used the data on the researched countries for the period from 1996 to 2015 collected from official web sites. We have found that export from Turkey to the CATRs and Turkey’s ECI scores have a long-term relationship. Additionally, there is a unidirectional causality relationship from Turkey’s export to the CATRs to Turkey’s ECI score and from the CATRs’ ECI scores to the CATRs’ export to Turkey. To sum up, our findings support the hypothesis that higher trade volume between Turkey and the CATRs increases the export of complex products for both sides. Based on the results, stronger mutual trade relations increase the total gain not only for Turkey but for the CATRs, too. Lastly, in future studies, we plan to cover all Post-Soviet countries and reveal the relations between bilateral trade and the range of exported products.

Keywords: Economic Complexity Index (ECI), Export, Economic Cooperation, Developing Countries, Central Asian and Turkic Republics, Regional Economics, Post-Soviet Economics, Export Dependent Growth, Free Market, Panel Co-integration, Panel Causality

1. Introduction

Following the dissolution of Union of Soviet Socialist Republics (USSR) in 1991, eight states declared their independencies in Central Asia and Caucasus. Six out of eight countries (Azerbaijan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan) are Muslim. The collapse of the USSR accelerated the integration of Eastern Europe, Caucasus, and Central Asia into the global economic system. Moreover, Turkey had intensified economic cooperation with these countries thanks to religious and ethnic roots. Thus, the relations between Turkey and these regions were built on the Muslim-Turk background [1, p. 9–10]. Due of this aspect, Turkey extended both social and economic relationship with Central Asian and Turkic Republics (the CATRs) 2.

In the context of economics, in 2017 the total trade volume between Turkey and the CATRs was 8.3 billion USD, whereas in 1996 it was 1 billion USD. On the other hand, despite improved re-

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2 Although the official language of Tajikistan is close to Persian, majority of population are Sunni Muslim.
Table 1

<table>
<thead>
<tr>
<th>Countries</th>
<th>GDP (Billion — USD)</th>
<th>Population (Million)</th>
<th>GDP Per Capita (USD)</th>
<th>Average Yearly Growth Rate (Last 5 Years), %</th>
<th>Total Export (Billion-USD)</th>
<th>Total Import (Billion-USD)</th>
<th>Trade Balance</th>
<th>Trade Openness Rate, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turkey</td>
<td>863.71</td>
<td>79.5</td>
<td>10.862</td>
<td>5.56</td>
<td>142.5</td>
<td>198.6</td>
<td>−56.1</td>
<td>39</td>
</tr>
<tr>
<td>Azerbaijan</td>
<td>37.85</td>
<td>9.76</td>
<td>3.876</td>
<td>1.6</td>
<td>9.1</td>
<td>8.5</td>
<td>0.6</td>
<td>46</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>137.28</td>
<td>17.8</td>
<td>7.713</td>
<td>3.46</td>
<td>36.7</td>
<td>25.1</td>
<td>11.6</td>
<td>45</td>
</tr>
<tr>
<td>Kyrgyzstan</td>
<td>6.55</td>
<td>6.08</td>
<td>1.077</td>
<td>4.5</td>
<td>1.4</td>
<td>3.8</td>
<td>−2.4</td>
<td>79</td>
</tr>
<tr>
<td>Tajikistan</td>
<td>6.9</td>
<td>8.7</td>
<td>799</td>
<td>6.9</td>
<td>0.9</td>
<td>3</td>
<td>−2.1</td>
<td>56</td>
</tr>
<tr>
<td>Turkmenistan</td>
<td>36.18</td>
<td>5.66</td>
<td>6.389</td>
<td>8.86</td>
<td>7.9</td>
<td>4.9</td>
<td>3.0</td>
<td>35</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>67.22</td>
<td>31.85</td>
<td>2.110</td>
<td>7.96</td>
<td>7.4</td>
<td>9.5</td>
<td>−2.1</td>
<td>25</td>
</tr>
</tbody>
</table>

Source: Authors calculations using World Bank and Trade Map data centre.

Table 2

<table>
<thead>
<tr>
<th>Countries</th>
<th>Export</th>
<th>Import</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turkey</td>
<td>87 (14 %)</td>
<td>84 (13.7 %)</td>
</tr>
<tr>
<td>Azerbaijan</td>
<td>27 (89 %)</td>
<td>84 (16.5 %)</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>71 (61 %)</td>
<td>84 (17.4 %)</td>
</tr>
<tr>
<td>Kyrgyzstan</td>
<td>71 (50 %)</td>
<td>27 (10.4 %)</td>
</tr>
<tr>
<td>Tajikistan</td>
<td>26 (26.5 %)</td>
<td>84 (10.2 %)</td>
</tr>
<tr>
<td>Turkmenistan</td>
<td>27 (15.7 %)</td>
<td>84 (10 %)</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>27 (84.8 %)</td>
<td>84 (12.9 %)</td>
</tr>
</tbody>
</table>

Source: Authors' calculation based on Trade Map data.
Note: Related HS2 codes are explained in Table 3.

lations, the share of the CATRs in the total trade volume of Turkey could not reach 5 %. Therefore, analysis of the product qualities contributes to reaching potential trade capacity of both sides. In the research framework, our main motivation is to discover whether the existence of the country trade affects the ECI score of other sides and analyse this impact's direction.

2. Theoretical Overview

2.1. Trade Performance of Countries

Following the end of 70 years of the communist regime, the transition from central state-planned economy to a free market economy was not a painless process. In fact, now there are still low-middle income countries (Kyrgyzstan, Tajikistan, and Uzbekistan) as well as high-middle income countries.¹


We present the current economic conditions of Turkey and the CATR countries for 2016 in Table 1. Turkey has an advantage in terms of population and economy in comparison with other countries. Nevertheless, for the last 5 years the average growth rates in Tajikistan, Turkmenistan, and Uzbekistan were higher than in Turkey. In this period (2012–2016) the average growth rate in the world was 2.6 %. All countries in Table 1 (except Azerbaijan) achieved a higher growth rate than the world's average. However, the total share of all aforementioned countries in world export and import is 1.3 % and 1.5 %, respectively. In addition, in terms of trade balance, Turkey, Kyrgyzstan, Tajikistan, and Uzbekistan have trade deficit contrary to Azerbaijan, Kazakhstan, and Turkmenistan. Kazakhstan's trade surplus equals approximately half of the total import value.

The trade openness rates (ratio of total trade to gross domestic product (GDP)) are generally between 35–45 %. However, Uzbekistan's trade openness is lower than general, whereas...
Table 3

<table>
<thead>
<tr>
<th>HS2 Code</th>
<th>Products</th>
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<tbody>
<tr>
<td>07</td>
<td>Edible vegetables and certain roots and tubers</td>
</tr>
<tr>
<td>08</td>
<td>Edible fruit and nuts; peel of citrus fruit or melons</td>
</tr>
<tr>
<td>10</td>
<td>Cereals</td>
</tr>
<tr>
<td>26</td>
<td>Mineral fuels, mineral oils, and products of their distillation; bituminous substances; mineral waxes</td>
</tr>
<tr>
<td>27</td>
<td>Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioative elements or of isotopes</td>
</tr>
<tr>
<td>30</td>
<td>Pharmaceutical products</td>
</tr>
<tr>
<td>31</td>
<td>Fertilisers</td>
</tr>
<tr>
<td>39</td>
<td>Plastics and articles thereof</td>
</tr>
<tr>
<td>52</td>
<td>Cotton</td>
</tr>
<tr>
<td>55</td>
<td>Man-made staple fibres</td>
</tr>
<tr>
<td>61</td>
<td>Articles of apparel and clothing accessories, knitted or crocheted</td>
</tr>
<tr>
<td>64</td>
<td>Footwear, gaiters and the like; parts of such articles</td>
</tr>
<tr>
<td>71</td>
<td>Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal and articles thereof; imitation, jewellery; coin</td>
</tr>
<tr>
<td>72</td>
<td>Iron and steel</td>
</tr>
<tr>
<td>73</td>
<td>Articles of iron or steel</td>
</tr>
<tr>
<td>74</td>
<td>Copper and articles thereof</td>
</tr>
<tr>
<td>76</td>
<td>Aluminium and articles thereof</td>
</tr>
<tr>
<td>84</td>
<td>Nuclear reactors, boilers, machinery, and mechanical appliances; parts thereof</td>
</tr>
<tr>
<td>85</td>
<td>Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles</td>
</tr>
<tr>
<td>87</td>
<td>Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof</td>
</tr>
<tr>
<td>89</td>
<td>Ships, boats and floating structures</td>
</tr>
<tr>
<td>99</td>
<td>Commodities not elsewhere specified</td>
</tr>
</tbody>
</table>

Kyrgyzstan and Tajikistan have the higher rate (79 % and 56 %, respectively).

Competitiveness in international trade depends on the country’s comparative advantage. Therefore, product varieties and most traded products are crucial for detecting the country’s trade capacity.

Table 2 demonstrates exported and imported goods of Turkey and the CATR countries under HS2 (Harmonized Commodity Description and Coding System) subject.

The share of top 5 exported products of all countries (except Turkey) is between 68 % and 95 % in total export volume. This ratio is lower for Turkey (42 %). That means that the CATR countries are poorer in terms of product variety than Turkey. On the other hand, the share of top imported products in total import varies between 36 % and 60 %. That fact means that high variety of the imported goods of the CATR countries demonstrates low product variety in export.

For the majority of the CATRs (Azerbaijan, Kazakhstan, Tajikistan, Turkmenistan, and Uzbekistan) HS27 "Mineral Fuels, Mineral Oils, and Products of Their Distillation; Bituminous Substances; Mineral Waxes" is one of the most exported commodities. The top export product in Kyrgyzstan is HS71 "Natural, Cultured Pearls; Precious, Semi-Precious Stones; Precious Metals, Metals Clad with Precious Metal, and Articles Thereof; Imitation Jewellery; Coin"; in Tajikistan it is HS26 "Ores, Slag and Ash". It is easier to classify the countries’ import than export. HS84 "Nuclear Reactors, Boilers, Machinery, and Mechanical Appliances; Parts Thereof” commodities are either the first or second item for all studied countries.

The significant sectors of the export products depend on those countries’ natural resources. Knowledge and skill level necessary for producing natural resources products are lower than the ones needed for producing the goods from cosmetics or machine sectors.

2.2. Economic Complexity Index (ECI)

Massachusetts Institute of Technology (MIT) developed Economic Complexity Index (ECI) to measure the quality of the countries’ exported goods according to commodity groups.¹ All products that have the ECI score are classified under HS or Standard International Trade Classification (SITC) codes that takes into account the embedded useful knowledge embedded for calculating the ECI².

ECI also provides some information regarding the country’s income level and possible growth rate for next years [2]. Consumers purchase not only a product but whole knowledge about that product. Thanks to the division of labour, people specialise in the market and gain knowledge via goods [3].

To illustrate, for producing a smartphone it is expected to combine knowledge from different fields, such as electronics, informatics, design, etc.

¹ You can find details regarding ECI calculation: https://atlas.media.mit.edu/en/resources/methodology/. (Date of Access: 25.06.2019).
Knowledge capacity of the country has a linear relationship with product diversification. In addition, $ECI$ is also interested in the number of countries producing certain products. Table 4 gives information on some countries and relevant production sectors:

According to Table 4, the diversification score of Germany is 4. The ubiquity score of pharmaceutical sector is 2 (Germany and Sweden are the producers). For countries and products, average ubiquity and average diversity are required for calculation. For calculating the $ECI$ score, domestic produced and exported goods are taken into account, while domestic consumed products and services are excluded.

We present the highest and lowest $ECI$ scored products in Table 5.

Table 5 demonstrates product groups and the $ECI$ score for these products. Whereas the most complicated products belong to chemical and machine sectors, which require qualified labour, the lowest $ECI$ scored products are raw materials or basic agriculture products. For elevating the $ECI$ scores, it is necessary for countries to increase the complexity levels of exported products and competitiveness at the related sectors.

### 2.3. Literature Review on Trade Relations between Turkey and the CATRs

Turkey recognized the independence of the CATR countries right after the declaration of their independencies. The political, social, and economic relations between Turkey and the region have progressed significantly, especially economic relations based on international trade between the countries. In the literature, there are quite a lot of studies regarding trade relations between Turkey and the CATRs.

Dikkaya [4] studies trade relations in order to monitor the structure and interdependence of trade relations. The works analyse not only commodity trade but also the movements of the Turkey-based capital volumes. Solak [5] focuses on the foreign trade development between Turkey and the CATR countries. The study demonstrates which products are exported to and imported from the Commonwealth of Independent States (CIS) and Turkey. However, this paper can be accepted only as an analysis of the current situation.

Apart from Tajikistan, Alagoz et. al. [6] investigate the relations of Turkey with Asian Turkic Republics. The paper analyses goods and service trade as other studies in the field, and examines economic regulations between Turkey and the CATRs. These regulations include cooperation agreements, mutual promotion of investments, and documents precluding the double taxation. All aforementioned studies state that the countries trade could not react at a sufficient level. Ersungur et. al. [7] discuss trade relations of Turkey and the CATRs preparing distribution of the traded products. At the end of the study, they state that fi-
nancially strong Turkey could assist in raising the CATRs’ total trade capacity. Generally, the studies focus on the shares of product groups in the process of mutual international trade. Similarly, Bal et. al. [8] divide traded products into agricultural and industrial, and explain the trade relations by giving descriptive statistics.

The weakness of the Turkish economy in the 1990s could not hamper Russia’s economic influence on the region [9]. Nevertheless, Russia’s limited economic and military capacity in those years provided an opportunity for the CATRs to act independently [10].

The low trade volume between Turkey and the CATRs also demonstrates that the CATR countries could not adapt to the free market economy. The approach of Gürbüz and Karabulut [11] differs from previous studies. They analyse the degrees of the ex-Soviet countries’ similarity in terms of socio-economic conditions. According to the study’s results, Latvia and Lithuania are the most similar countries; the Central Asian Republics have some similarities, too. Moreover, these countries’ export structure based on natural resources and agricultural production (you can see it in Table 2) confirms the result of the paper.

Süm'er and Uner [12] assess psychological distance as a determinant for the trade relations between Turkey and the CATRs. Therefore, trade volume between two countries (Turkey and Azerbaijan), which have the lowest psychological distance, is expected to be high. However, psychological distance theory cannot explain the trade volume between Turkey and Tajikistan.

In addition to such studies, some papers examine competitiveness, technological specialization, and comparative advantage via trade relations [13; 14].

The dependence of the CATRs on natural resources and agricultural raw materials makes their economies vulnerable. The fall of prices of the internationally traded food in the second half of 2014 caused a revenue loss in the CATR countries [15, p. 316]. Additionally, when the CATRs start to ask “How?” instead of “What?” [16], these countries’ level of competitiveness in the international trade market can increase. Moreover, as compared with 1990s, the high stability of the Turkish economy positively affects the development of the mutual trade relations.

Contrary to the mentioned papers, we are going to use empirical tests to analyze trade relations between Turkey and the CATRs. Therefore, our study aims to contribute into the current literature by investigating the possible impact of trade on the countries’ ECI scores of countries.

3. Econometric Analysis

3.1. Research Model

The study’s main goal is to assess the status of trade in the context of ECI scores for Turkey and the CATRs. In this respect, we are going to establish how export of both Turkey and the CATRs affects the countries’ ECI. The study will focus on the results obtained from commercial cooperation between Turkey and the CATRs considering the countries’ trade potential and win-win strategy.

3.2. Research Methods and Data

The paper analyses the relationship between mutual export and ECI scores of Turkey and the CATRs using panel time-series model in the study’s context.

The study’s dependent variables are ECI scores of both Turkey (model 1) and the CATRs (model 2). The model’s independent variables are export of both Turkey (model 2) and the CATRs (model 1). We derived the data on countries’ economic complexity indices from the database of the Observatory of Economic Complexity in the Massachusetts Institute of Technology. We obtained the data on countries’ trade from the database of Turkey Statistical Institute. In the study, we used the following variables:

ECI_Tur: Economic Complexity Index Score of Turkey;
ECI_CATR: Economic Complexity Index Score of the CATRs;
\( \ln(\text{EXP}_{\text{Tur}}) \): Export from Turkey to the CATRs;
\( \ln(\text{EXP}_{\text{CATR}}) \): Export from the CATRs to Turkey.

Depending on this information, we have created the panel time-series model for Turkey and the CATRs to analyse the relationship between the ECI score and export;

\[
ECI_{\text{Tur}} = \beta_0 + \beta_1 \ln(\text{EXP}_{\text{Tur}}) + \epsilon_{\text{Tur}}, \quad (1)
\]

\[
ECI_{\text{CATR}} = \beta_0 + \beta_1 \ln(\text{EXP}_{\text{CATR}}) + \epsilon_{\text{CATR}}. \quad (2)
\]

The study’s hypothesis is that increase in the volume of mutual export between Turkey and the CATRs positively influences the economies and enhances the countries’ ECI scores. We examine the relationships between export and the ECI score for both Turkey and the CATRs using the panel and time series analyses. However, firstly, it is necessary to test the stationary variables of the panel time-series.

3.3. Unit Root and Cross-Sectional Dependence Tests

For analysing the co-integration relation between variables in panel time-series, the variables...
must be stationary. In this regard, stationary levels of variables should be determined.

Variables in the panel time-series models have been tested using first generation panel unit root tests developed by Harris-Tzavalis [17], Maddala and Wu [18], Choi [19], Levin, Lin and Chu [20], and Im, Pesaran and Shin [21].

As can be seen in Table 6, all of the variables I(0) “In level” contain unit root, while the variables I(1) “In first difference” are stationary. According to the results obtained by the first generation unit root tests, at their first difference levels I(1) variables are stationary. Therefore, it is necessary to test variables by means of the cross-sectional dependence tests. The panel unit root and co-integration tests do not account for the cross-sectional dependence of the contemporaneous error terms. It has been seen in the literature that not considering cross-sectional dependence may cause sizable distortions in panel unit root tests. An analysis that takes into account cross-sectional dependence demonstrates more accurate results. Accordingly, we applied Breusch-Pagan [22] LM test and Pesaran CD-LM [23] tests to panel time-series analysis to test for cross-sectional dependence.

According to the results in Table 7, the null hypothesis, which refers to cross-sectional independence, is rejected for variables ECI_{catr}, ECI_{catc}, lnEXP_{catr}, and lnEXP_{catc}. Hereunder, both for Equation 1 and 2 cross-sectional dependence in all panel time series are valid. Since the asymptotic properties of the first generation unit root tests affect the cross-sectional section dependence, it is required to test the variables with second generation unit root tests that take into account the correlation of the panel data series. The results of second-generation unit root test are given in Table 8.

The results of the second-generation panel unit root test (PESCADF) in Table 8 demonstrate that variables have unit root [24]. This situation shows that relationship between Turkey and the CATRs as actors in the market are mutually affected. [25, p. 551].
3.4. Panel Cointegration Analysis

Westerlund’s [26] co-integration analysis determines whether there is a long-term relationship between variables. This co-integration analysis provides four panel co-integration tests based on the error correction model for testing the co-integration relationship between panel data. The existence of the co-integration relationship is tested by examining whether each unit has its own error correction [27, p. 239]. Results of Westerlund’s panel co-integration analysis of the equations 1 and equations 2 are presented in Table 9.

According to Akaike information criteria, both constant and constant-trend models have a lag length of 0.67 and a lead length of 1 in equation 1. In the case of equation 2, both constant model and constant-trend model have a lag length of 1 and a lead length of 0.5. According to results of Westerlund’s panel co-integration analysis, H0 hypothesis has been rejected at 1 % and 5 % significance level in constant and constant-trend models; co-integration relation is determined between panel series in equation 1. In other words, the long-term relationship of the panel series is confirmed. H0 hypothesis has been rejected only at 5 % level for $P_\tau$ statistic in the constant model in equation 2. According to the $G_\tau$, $G_\alpha$ and $P_\tau$ statistics, the H0 hypothesis has not been rejected, thus, there is no co-integration relation among panel series in equation 2. Therefore, variables in equation 2 do not have the long-term relationship.

We assessed the results of the panel co-integration analysis are assessed. We determined that whereas there is a long-term relationship between Turkey’s export to CATRs and Turkey’s ECI score, there is no long-term relationship between the CATRs’ export to Turkey and the CATRs’ ECI score.

3.5. Analysis of Long-Term and Short-Term Relationship

The existence of a cointegration relationship between panel data variables in Equation 1 allows analysing the long- and short-term relationships between these variables. At first, we tested the long-term homogeneity using the Hausman statistic to determine the most appropriate method of analysis; the results of the test are given in Table 10.

According to the results in Table 10, the long-term parameters are homogeneous. In other words, the long-term parameters do not change from unit to unit. Therefore, the H0 hypothesis cannot be rejected, meaning that we accept the Pooled Mean Group Estimator (PMGE), which is more effective under the H0 hypothesis, as valid. PMGE analysis method developed by Pesaran, Shin and Smith [28] is based on Mean Group Estimator (MGE), which allows changing both constant and slope parameters in accordance with the units and fixed effect estimator (that permits alternating the constant parameter). In this regard, whereas PMGE keeps the long-term parameters constant, it allows specifying the short-term parameters and error variances in accordance with the units. Table 11 shows the PMGE results for Equation 1.
According to the results presented in Table 11, the error correction term (ECT) is rejected at 1% significance level; here the ECT has a negative value (−0.509). Thus, it is proved that there is a long-term relationship between the variables. The ECT demonstrates the existence of deviations in the short-term and the speed of reaching equilibrium in the next period. In this respect, approximately 51% of the imbalances in any period will be balanced in the next period getting closer to the long-term steady state condition. In addition, the long-term coefficient of Turkey’s export to the CATRs (lnEXP_{tur}) is positive (0.081) and significant at 1% level. However, it was concluded that the short-term parameter (ΔlnEXP_{tur}) in the model is statistically insignificant. Hence, 1% increase of export from Turkey to the CATRs provides to ECU 0.081% increase of Turkey’s ECI score in the long-term. Results reveal that export from Turkey to the CATRs has a positive relationship with the product diversification of Turkey. Moreover, a possible commercial partnership with the CATRs contributes to the diversity of Turkey’s export products.

PMGE also allows analysing the long- and short-term relationships for each unit. In this context, the results of PMGE for each unit are shown in Table 12.

Table 12 shows that the error correction parameter, short-term parameter, and constant parameters are assessed separately for each unit while assessing a single long-term parameter. In this context, we see that error correction parameters of Azerbaijan, Kazakhstan, Kyrgyzstan, Turkmenistan, and Uzbekistan are statistically significant and negative values. Thus, the long-term relationship between Turkey’s export to the CATRs and Turkey’s ECI score are verified. Moreover, the high ECT parameters of Azerbaijan, Kazakhstan, Kyrgyzstan, Turkmenistan, and Uzbekistan show that short-term deviations in these countries will be quickly balanced in the long-term. On the other hand, although the ECT parameter of Tajikistan is a negative value, it is statistically insignificant. Therefore, there is no long-term relationship between Turkey’s export to Tajikistan and Turkey’s ECI score.

### 3.6. Generalized Moments Method and Panel VAR Analysis

The panel VAR model has a dynamic model structure that is used for determining the mutual dynamic relations among the variables. The Generalized Moments Method (GMM) used within the scope of dynamic macro data can yield successful results in the absence of the assumption of externality and in the presence of heteroscedasticity [27, p. 261]. In Table 13, we present the results of panel VAR analysis using GMM.

As seen in Table 13, one lag length of both Turkey’s ECI score and Turkey’s export to the CATRs is positive and statistically significant. One lag length of both Turkey’s ECI score and Turkey’s export to the CATRs have a positive impact (nearly 0.38% and 0.05%, respectively) on Turkey’s ECI score. These results go hand in hand with economic prospects.

### 3.7. Panel Causality Analysis

Panel causality test developed by Dumitrescu and Hurlin [29] is used to analyse whether there is a causal relationship between the variables. Dumitrescu-Hurlin’s panel causality tests hypothesis that does not deny the existence of causality in at least one cross-section against the absence of the homogeneity of Granger causality relationship. In this respect, in the panel causal-
In this paper, we have analysed the influence of international trade of Turkey and the CATRs (that have the common religion or ethnicity) on the countries’ ECI scores. The paper also investigates the countries’ export performance in terms of "neo-factor endowment theory" that provides theoretical framework for technology-based comparative advantage theory. Countries usually implement new technologies or develop new products to enter the foreign markets by specialising their factor endowment basis including knowledge, labour and human capital [32]. Therefore, the study contributes to theoretical literature on international economic relations because the countries’ ECI score contains the countries’ used knowledge and technology endowment for export.

In the study, short-term and long-term relations between exports and ECI scores of Turkey and the CATRs are examined by PMGE methods. PMGE methods allow assessing both total and individual exports and the ECI scores of the countries. In addition, using GMM methods, we analysed dynamic relationship between variables. Furthermore, we analysed causality relationships among variables with panel causality test. These methodological approaches demonstrate new perspectives for analysing relationships between exports and the ECI scores.

Firstly, co-integration analysis is performed in order to demonstrate the long-term relations between Turkey and the CATRs. According to the results of the analysis, there is a long-term relationship between the export of Turkey to the CATRs and Turkey’s ECI score. The results have demonstrated that 1% increase in Turkey’s export to the CATRs lead to raising 0.08 % of Turkey’s ECI score. Contrary to such relation, we have not found a long-term relationship between the CATRs’ export to Turkey and the CATRs’ ECI score. Therefore, the export volume of Turkey to the CATRs affects the diversification of Turkey’s export products. Thus, we have concluded that intensification of the commercial cooperation between Turkey and the CATRs will positively affect the diversification of Turkey’s export products. Accordingly, these results support the hypothesis that increasing Turkey’s exports to the CATRs enhances Turkey’s ECI scores.

As a result of analysing the long-term relationship, we have identified that there is a long-term relationship between the export of Turkey to the CATRs and Turkey’s ECI score. On the one hand, the high ECT parameters of Azerbaijan, Kazakhstan, Kyrgyzstan, Turkmenistan, and Uzbekistan have shown that the short-term deviations in these countries are quickly reaching the long-term balanced level. On the other hand, there is no long-term trade relationship between Tajikistan and Turkey. This situation is acceptable due to the low trade volume between the countries and different ethnic origin compared to other CATRs.

Table 13

<table>
<thead>
<tr>
<th>Generalized Moments Method Results</th>
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<tbody>
<tr>
<td>Variables</td>
</tr>
<tr>
<td>ECI_{ct} (1)</td>
</tr>
<tr>
<td>InEXP_{ct} (1)</td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>Wald Chi2(2) = 198.84</td>
</tr>
<tr>
<td>Prob &gt; Chi2 = 0.000</td>
</tr>
</tbody>
</table>

Note: “( )” term represents lag length.

Table 14

<table>
<thead>
<tr>
<th>Dumitrescu-Hurlin’s (2012) Panel Causality Tests Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Causality Relationship</td>
</tr>
<tr>
<td>lnEXP_{ct} \rightarrow ECI_{ct}</td>
</tr>
<tr>
<td>ECI_{ct} \rightarrow lnEXP_{ct}</td>
</tr>
<tr>
<td>lnEXP_{ct} \rightarrow ECI_{ct}</td>
</tr>
<tr>
<td>ECI_{ct} \rightarrow lnEXP_{ct}</td>
</tr>
</tbody>
</table>

Note: One lag lengths are chosen. ***, **, and * indicate significance at 1 %, 5 % and 10 % respectively.
Dynamic relation analysis between Turkey and the CATRs demonstrates that a lag of Turkey's ECI score and one lag of Turkey's export to the CATRs are effective for Turkey's ECI score. A lag of Turkey's ECI score contributes approximately 0.38% to Turkey's ECI score. Besides, one lag of Turkey's export to the CATRs contributes nearly 0.05% on Turkey's ECI score. These results are important evidence proving the hypothesis that exports from Turkey to the CATRs enhance Turkey's ECI score.

According to the results of causality analysis, there is unidirectional causality relationship from the export from Turkey to the CATRs to diversity in Turkey's export products. In this regard, increase in the economic cooperation or intensification of the trade relations between Turkey and the CATRs will positively affect the range of Turkey's exported products. Additionally, the diversification of the CATRs' exported products will also increase export of the CATRs to Turkey. As a result of the analysis performed in accordance with the research hypothesis, when diversification of the CATRs' exported products increases, the export from the CATRs to Turkey also follows an increasing trend. Obviously, the activities increasing the CATRs range of exported products range (R&D etc.) ensure a possibility of expanding the Turkey's market for those countries. According to the findings within the study's scope, mutually support for the increase in the volume of foreign trade suggests that "win-win" strategy will work for Turkey and the CATRs. In addition, while increase in Turkey's exports to the CATRs enhances Turkey's ECI scores, the difference between our conclusion and the expectations is that increment of the CATRs' exported products raises the exports from the CATRs to Turkey.

References


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