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RESEARCH ARTICLE / ARAŞTIRMA MAKALESİ

Testing the middle income trap for upper middle income countries by fourier cointegration

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ABSTRACT

The middle income trap is defined as the inability to rise to a higher income group after the gross domestic product value reaches the middle income level and is stuck in a certain income range. Based on this point, the data used in the study covers the period 1960-2019. The middle income trap hypothesis was tested for upper middle income country groups in 2019 and has been included in the 22 countries included in the study. The per capita Gross Domestic Product data for the mentioned countries and the reference country were obtained from the World Bank database. In the study, in order to perform the Banerjee Arcabic Lee (2017) Fourier ADL cointegration test, the variables used in the analysis should be first-order I (1) stationary. For this reason, before the cointegration test, Ng-Perron Test (2001), Enders and Lee (2012) Fourier Function Stationarity Test, Christopoulos and Leon Ledesma (2010) Fourier CSR Stability tests were performed to determine the stationarity levels of variables. And then the Banerjee Arcabic Lee (2017) Fourier ADL cointegration test was applied to the above-mentioned 16 countries. According to the results of Fourier ADL Cointegration, the null hypothesis, which asserts that there is no cointegration for Botswana, Brazil, China, Colombia, Ecuador, Fiji, Gabon, Guatemala, Iran, Jamaica, Malaysia, Peru, South Africa, Suriname, Trinidad and Tobago, including Turkey cannot be rejected within 5% significance level. Therefore, empirical evidence has been obtained that these countries are in the middle income trap.

Keywords: Middle Income Trap, Fourier ADF Unit Root Test, Fourier ADL Cointegration Test

Jel codes: C19, C22, N17

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1. INTRODUCTION

While comparing the development levels of the countries' economies, their income levels provide important clues about the economic and social aspects of the relevant economies. Income is defined as the return earned by an economic unit over a period of time. According to Cai, the word trap refers to "super stable economic balance that cannot be changed by external forces in the short run under normal circumstances." (Cai, 2012: 50-51). Although there is no consensus on the definition of the middle income trap, it is generally defined as the stagnation of low-income countries at a certain income level after rapid growth and remaining at this income level for many years (Felipe - Kumar, 2012: 6; Jankowska, et al., 2012:1; Tho, 2013:3). The Middle Income Trap, in its simplest form, refers to the income threshold of countries that could not demonstrate structural transformation from physical factor accumulation to productivity-increasing costs-reducing labor and capital markets in order to finance their economic growth (Homi & Harinder, 2011: 281).

The concept of middle income trap is a concept that entered the economics literature as of 2007, and the concept was first mentioned in the World Bank's report titled "An East Asian Renaissance Ideas for Economic Growth". In this report, it is emphasized that middle-income countries have shown lower growth than high- or low-income countries and countries have to do something different in order to get out of this situation, where they cannot achieve economic convergence in the twentieth century. Middle-income countries are caught between the mature industries, where low wage policy is predominant, and innovative countries that are undergoing rapid technological changes (Gill-Kharas, 2007, 17). According to the World Bank's 2020 data, economies with an average annual income of $1.035 or less per capita are in the low-income class, those with a GDP per capita between $1,036 and $4,045 are in the low-middle-income economy class, those with a GDP per capita between $4,046 and $12,535 are classified in the upper middle-income economy class, while economies with a per capita GDP of $12,536 or more are considered in the high-income economy class. According to this classification made by the World Bank according to 2020 data, 29 of the countries are in the low income class, 50 of them are in the low middle income class, 56 are in the upper middle income class, and 83 are in the high income class (World Bank ,2020).

A few policy recommendations are not enough for countries caught in the middle-income trap to get out of this trap. Because it is very difficult to realize structural transformation reforms that will solve the problems that are quite complex and not independent from each other and to deteriorate the "unbalance in balance" situation in which the country has remained in a certain income band for many years. Middle-income countries must carry out the necessary structural transformations in order to escape from the income trap they are in. However, the realization of this transformation covers long years rather than short-term. In addition, countries that cannot achieve the necessary transformation can stay in the same income group for many years (Ünlü -Yıldız, 2018:5).

In this study, the validity of the middle income trap was tested in the period 1960-2019 with annual data in Turkey. In recent academic studies, nonlinear unit root tests that include trigonometric terms in the model have been widely used. For this reason, firstly linear Ng-Perron Test (2001) unit root test and then Christopoulos and Leon Ledesma (2010) FADF and FKSS unit root tests, which allow nonlinear smooth transitions, were used in the study. Since non-linear unit root tests give more reliable results than linear unit root tests, it was preferred to use both tests in this study. After the finding that both series were difference stationary, the Fourier delay distributed (FADL) cointegration test, which was introduced to the literature by Banerjee et al. (2017), was applied to the series. For the series determined to be cointegrated, in which the trigonometric terms were added as a deterministic component, long-term coefficient estimates were put forward.With this study, there are two ways to contribute to the existing literature, which includes studies carried out for Turkey. First, the validity of the middle-income trap was tested by comparing both linear and non-linear methodsIt is more significant to test with non-linear unit root tests, especially due to the asymmetries and unique factors. (Bolat and Koçbulut, 2019: 203). The second contribution is expected to contribute to the literature because of the method used and the period interval are different that previous studies. With this study, there are two ways to contribute to the existing literature, which includes studies carried out for Turkey. First, the validity of the middle-income trap was tested by comparing both linear and non-linear methods. It is more significant to test with non-linear unit root tests, especially due to the asymmetries and unique factors. (Bolat and Koçbulut, 2019: 203). The second contribution is expected to contribute to the literature because of the method used and the period interval are different that previous studies.

2. METHODOLOGY, DATA, LITERATUR REVİEW AND EMPIRICAL RESULTS

The data used in the study covers the period 1960-2019 and the middle income trap hypothesis was tested for upper middle income country groups. 22 upper middle-income countries of 2019, which are Belize, Botswana, Brazil, China, Colombia, Costa Rica, Dominican Republic, Ecuador, Fiji, Gabon, Guatemala, Guyana, Iran, Jamaica, Malaysia, Mexico, Peru, South Africa, Suriname, Thailand, Trinidad and Tobago, were included in the study. The GDP per capita variable for the specified countries was obtained from the World Bank database. The GDP per capita variable of the USA, which is considered as the reference country in the study, was also obtained from the same database. Econometric modeling is based on the following formula.

$$y_{i,t}=\beta y_{r,t} + u_t \quad (1)$$

While in the equation is the logarithmic form of the GDP per capita variable of the country (i) at time (t), $y_{r,t}$ represents the logarithmic form of the GDP per capita variable of the reference country. The absence of a cointegration relationship between the variables and indicates that country (i) is in the middle income trap (Hepsağ, 2019:247-248). In order to perform Banerjee Arcabic Lee (2017) Fourier ADL cointegration test in the study, the variables used in the analysis must be first order I (1) stationary. Therefore, before the cointegration test, Ng-Perron Test (2001), Enders and Lee (2012) Fourier Functional Stability Test, Christopoulos and Leon Ledesma (2010) Fourier CSR Stability tests were used to determine the stationary levels of the variables.

2.1. Ng-Perron Test (2001)

Ng-Perron (2001) developed a new unit root test on the GLS detrend procedure in their article. This test is a test that does not exhibit deviation when the PP test contains large negative MA and AR roots. In this test, there are four test statistics. The calculation of the three test statistics used is shown below. Test statistics are generated using GLS detrend data, .

$$MZ_a = (T^{-1}y_T^2 - s_{AR}^2)(2T^{-2}\sum_{t=1}^{T} y_{t-1}^2)^{-1} \quad (2)$$

$$MSB = (T^{-2}\sum_{t=1}^{T} y_{t-1}^2 / s_{AR}^2)^{1/2} \quad (3)$$

$$MZ_T = MZ_a * MSB \quad (4)$$

$$p = 0 \quad MP_T^{GLS} = [c^{-2}T^{-2}\sum_{t=1}^{T} y_{t-1}^{-2} - c\,T^{-1}\,y_T^{-2}] / s_{AR}^2$$

$$c^{-2}\int_0^1 J_c\,(r)^2 dr - cJ_c(1)^2,$$

$$p = 1 \quad MP_T^{GLS} = [c^{-2}T^{-2}\sum_{t=1}^{T} y_{t-1}^{-2} + (1-c)\,T^{-1}\,y_T^{-2}] / s_{AR}^2$$

$$c^{-2}\int_0^1 V_{c,c}\,(r)^2 dr + (1-c)V_{c,c}(1)^2. \quad (5)$$

In the series, if there is no trend effect, only constant ($p = 0$), $\bar{c}$= - 7.0; if there is both trend and accumulation ($p = 1$), $\bar{c}$=13,5 tables must be used. In the case of negative moving averages, the MZ test statistics obtained are more efficient and contain less deviations than the PP. In the decision phase of the test, it is treated like the ADF test (Ng and Perron, 2001:1521-1523).

2.2. Enders and Lee (2012) Stationary Test with Fourier Function

Enders and Lee (2012) proposed a new Dickey-Fuller (DF) type unit root test with Fourier function in deterministic terms. They stated that while the initial value was high, the DF type tests were more resistant than the DF-GLS (Rodrigues - Taylor, 2012) and LM (Enders- Lee, 2012a) types of tests that performed the de-trending operation. In addition, unlike Rodrigues and Taylor (2012), the F test is recommended as a pre-test that tests the nonlinearity. It has been stated that such a pre-test is important since the use of Fourier tests will reduce the power of the test in the case of linearity. They consider the DF test in the first equation, where the deterministic term is represented by a time-dependent function α(t):

$$Y_t = a(t) + pY_{t-1} + Y_t + \varepsilon_t \quad (6)$$

The ε_t's represent the stationary error term with constant variance (δ_u^2). Therefore, the Fourier regression to be estimated is defined as:

$$\Delta Y_t = \rho Y_{t-1} + c_1 + c_2 t + c_3(\sin 2\pi kt/T) + c_4(\cos 2\pi kt/T) + e_t. \quad (7)$$

The critical values of the null hypothesis that the series contains a unit root will depend only on the frequency number k and the number of observations T. The coefficient of Fourier or other deterministic terms will not be decisive in this sense. After k is estimated, Enders and Lee (2012b) list the stages of the fracture test as follows:

Stage 1: Model 2 is estimated for all values of k from 1 to 5, and k is determined, which gives the sum of least squares of residuals. Then, it is tested whether the residues contain autocorrelation.

Stage 2: Nonlinearity is investigated by pre-test. For this purpose, c (3) = c (4) = 0 null hypothesis F test is applied. Since the F statistic does not have a standard distribution, critical values are taken into account. If the F statistical value is less than the critical value, the existence of a linear trend cannot be denied. At this stage, standard unit root tests will be appropriate. In some cases, the deterministic trend in the model may not be needed. In case the model does not contain a trend, the prediction made by excluding the trend will be stronger, thus the power of the test increases. Therefore, it is necessary to make a preliminary test of whether the series contains a trend, and to exclude the trend in the non-trend series to increase the power of the test. In such a case, only fixed models will be estimated (Lee and Enders,2012:197-198).

2.3. Fourier ADF and KSS Unit Roots Tests

Christopoulos and Leon-Ledesma (2010) developed unit root tests that consider structural breaks and nonlinear structures together. For a stochastic variable yt, the following model can be considered:

$$y_t = \delta(t) + v_{t,} \quad (8)$$

Here, $v_t \sim N(0, \sigma)$ and δ(t) are time-varying deterministic components. Christopoulos and Leon-Ledesma (2010) used Fourier series for δ(t):

$$\delta(t) = \delta_0 + \sum_{k=1}^{G} \delta_1^k \sin\left(\frac{2\pi kt}{T}\right) + \sum_{k=1}^{G} \delta_2^k \cos\left(\frac{2\pi kt}{T}\right) \quad (9)$$

Here, k is the frequency of the Fourier function, t is the time term, and T is the sample size. If the basic hypothesis ($\delta k \neq 0$) is rejected for at least one frequency (k=*1, 2,…,G*), the nonlinear function can adequately explain the deterministic component of yt and there is at least one structural change in the data generation process. Otherwise, the linear model emerges as a special case without any structural change. Christopoulos and Leon-Ledesma (2010) followed Ludlow and Enders (2000), who stated that a single frequency was sufficient to determine the number of frequencies (G) to be included in the model. So the equation can be written as:

$$\delta(t) = \delta_0 + \delta_1 sin\frac{2\pi kt}{T} + \delta_2 cos\frac{2\pi kt}{T} \quad (10)$$

If the appropriate frequency number k is known, the presence of unknown structural breaks in Equation 1 could be tested. However, the true value of k is often unknown. In order to find the appropriate frequency number, Equation (2) is estimated for each integer value of k between 1 and 5. Then, the k value, which gives the least residual squares sum, is chosen as the appropriate frequency number.

The existence of unknown breaks in the data generation process of yt is investigated by testing the basic hypothesis ($H0$: $\delta 1 = \delta 2 = 0$) against the alternative hypothesis ($H1$: $\delta 1 = \delta 2 \neq 0$). The F statistic can be used to test this basic hypothesis. This test for constrained (temporary) structural breaks performs particularly well compared to other tests when the breaks are temporary and the breaks tend to be in opposite directions. Since the F-statistics have low power if the data are not stationary, this test can only be used if the basic hypothesis expressing the existence of a unit root is rejected. In this context, if the model given below is taken into account:

$$\delta(t) = \delta_0 + \delta_1 sin\frac{2\pi kt}{T} + \delta_2 cos\frac{2\pi kt}{T} \quad (11)$$

The main hypothesis can be expressed as follows:

$$H_0: v_t = \mu_t, \mu_{t-1} + h_t$$

Here is assumed to be a stationary process with a mean of zero. The test statistics proposed by Christopoulos and Leon-Ledesma (2010) are calculated by a three-step procedure. The procedure is implemented as follows.

First Step: The first step involves obtaining the appropriate frequency value ($k*$). For k values between 1 and 5, the nonlinear deterministic component is estimated in Model (4) by using the EKK method and the k value that minimizes the residual sum of squares is selected. Then the EKK residuals of the model are calculated.

$$\hat{v_t} = y_t - [\hat{\delta}_0 + \hat{\delta}_1 \sin(\frac{2\pi k*t}{T}) + \hat{\delta}_2 \cos(\frac{2\pi k*t}{T})]. \quad (12)$$

Second Step: In the second step, unit root test is applied to the obtained EKK residues. Linear and nonlinear three different models have been proposed for the unit root test.

$$\Delta v_t = a_1 v_{t-1} + \sum_{j=1}^{p} \beta_j \Delta v_{t-j} + u_t, \quad (13)$$

$$\Delta v_t = p\, v_{t-1}(1 - \exp(-\theta \Delta v_{t-i}^2)) + \sum_{j=1}^{p} a_j \Delta v_{t-j} + u_t, \; i=1,2,\dots L, \quad (14)$$

$$\Delta v_t = \lambda_1 v_{t-1}^3 + \sum_{j=1}^{p} B_j \Delta v_{t-j} + u_t, \quad (15)$$

Here $\theta > 0$ and u_t is the white noise error term. Third Step: If the basic hypothesis expressing the existence of a unit root is rejected in the second step, the F test is used for Model (7) in the third step. At this stage, the basic hypothesis H_0: $\delta_1 = \delta_2 = 0$ is tested against the alternative hypothesis H_1: $\delta_1 = \delta_2 \neq 0$. If the basic hypothesis is rejected, it can be concluded that the variable is stationary around a deterministic function with a break.

The regression standard is an ADF called Fourier-ADF (FADF) by Christopoulos and Leon-Ledesma (2010). Model (7) and Model (8) assume that the adjustment speed is non-linear and follows the ESTAR process. Model (7) is a unit root test developed by Kilic and de Jong (2006).

Model (8) was named Fourier-CSS (FKSS) by Christopoulos and Leon-Ledesma (2010) and it is a unit test developed by Kapetanios et al. (2003). All models allow to test the existence of unit root in the original series after removing the breaks in the deterministic component. For the FADF model, the $H0$: $\alpha 1 = 0$ basic hypothesis, which expresses the existence of a unit root, is tested against the $H1$: $\alpha 1 \neq 0$ alternative hypothesis. Models (7) and Models (8) allow testing the existence of a unit root against the nonlinearity alternative hypothesis, in addition to temporary breaks (Christopoulos and Ledesma,2010:1079-1081).

2.4. Banerjee Arcabic Lee (2017) Fourier ADL Cointegration Test

The following model is considered in the FADL cointegration test (Banerjee et al., 2017: 116):

$$\Delta y_{1t} = d(t) + \delta_1 y_{1,t-1} + \gamma' y_{2,t-1} + \alpha y_{2t} + e_t \quad (16)$$

$d(t)$ is defined as the deterministic term and is expressed using the Fourier approximation as seen in equation (17):

$$d\,(t) = \beta_0 + \emptyset_1 \sin(\frac{2\pi kt}{T}) + \emptyset_1 \cos(\frac{2\pi kt}{T}) \quad (17)$$

Here, δ, γ, are explanatory variables and n x 1 represents parameter vectors. The dependent variable y_{1t} represents the error term ε_t. The Akaike Information Criteria is taken into account in determining the appropriate number of delays. The basic and alternative hypotheses of the FADL cointegration test are seen in equations (18) and (19) (Banerjee et al., 2017: 117):

$$H_0: \delta_1 = 0 \quad (18)$$

$$H_1: \delta_1 < 0 \quad (19)$$

The basic hypothesis shows that there is no long-term relationship between the variables, while the alternative hypothesis shows that there is a long-term relationship between the variables. The test statistic is obtained with the help of equation (20):

$$t_{ADL} = \frac{\hat{\delta}_1}{se(\hat{\delta}_1)} \delta_1 \quad (20)$$

For absolute values, if the calculated value is higher than the critical value, the basic hypothesis is rejected. In the opposite case, the main hypothesis is not rejected and it is accepted that there is no long-term relationship between the variables.

2.5. Literature Review

The aim of Balıkçıoğlu, İyidoğan, Dalgıç (2014) studies is to analyze the effect of middle income countries on the probability of realizing a growth performance at a higher level than the average growth rate in per capita income, in other words, transitioning to a higher income group in line with different technological data and macro-economic variables. Their analysis covers the years 1990-2013 for 56 middle-income countries, including Turkey. According to the results obtained from the analysis, it reveals the importance of improvement in human capital and technology, increase in institutional quality and healthy macro indicators for exiting the middle income trap.

Bozkurt, Bedir, Özdemir, and Çakmak (2014) conducted convergence and ARDL analysis using annual data for Turkey's 1971-2012 period in their study. The findings show that Turkey converges to high-income countries and higher education enrollment and domestic savings rates have positive and significant effects on per capita income. In order for Turkey to get rid of the middle-income trap phenomenon, Turkey must eliminate the risk of deindustrialization and at the same time be innovative and technology-centered towards the education system.

Yıldız (2015) investigated how developing countries caught in the middle income trap could increase their income levels to the income levels of developed countries. According to the results obtained from this research, in order for these countries to get out of the middle income trap, countries should increase the national savings rate, increase their research and development (R&D) investments and innovation capacities, increase the amount of public resources they allocate to human capital investments for qualified workforce, protect intellectual property and patent rights, reform the labor market and increase total factor productivity.

In their study, Bozkurt, Sevinç, Çakmak (2016) aimed to reveal the possibility of middle income trap for the period of 1982-2012 and the social and economic signs that can be effective in getting rid of this phenomenon with convergence and panel data analysis, based on a selected group of upper middle-income countries. Unconditional convergence analyzes found that the initial per capita income levels of the relevant country group increased throughout the process. The individual performances of countries were investigated by convergence analyzes based on unit root analysis, and it was found that 15 of them converged to high-income countries, while the remaining 13 countries diverged. The panel data results, on the other hand, revealed that the probability of being caught in the middle income trap is high when not only divergent countries but also convergent countries, including Turkey, cannot keep up with the structural transformation process.

In their study, Sarıbaş and Ursavaş (2017) analyzed the income level that middle income trap emerges and whether Turkey was in the trap, using GDP per capita data between 1957 and 2007, in line with the studies of Eichengreen et al. (2011). According to the results obtained from the analysis, the middle income trap emerges at the level of 7,200 dollars. According to this result, Turkey seems to have overcome the middle income trap.

Ünlü and Yıldız (2018) conducted a study to determine which middle-income countries are in the trap and which are not. In order to carry out this study, following the approach of Robertson and Ye (2013), the ADF unit root test and two structural break unit root tests, which developed by Narayan and Popp (2010), were conducted. The results of the analysis showed that while 35 of the 71 middle-income countries using per capita income data for the 1950-2014 period were in the middle-income trap, 36 countries were not. Turkey is included in the class of countries that are not in the middle-income trap.

In Kasa (2019) study, the effects of R&D expenditures, domestic savings rates and high technology product exports on economic growth of selected OECD countries were investigated. These variables were analyzed using the dynamic CCEGM model. According to the results of the panel data analysis based on the 1995-2015 data of 20 OECD countries, positive results between variables were obtained in accordance with the expectations. In addition, it has been concluded that variable R&D expenditures have a high impact on the growth performances of the 20 countries in question. In Turkey, it has been determined that the variable with the highest effect is domestic savings.

In Hepsağ (2019) study, high-middle-income countries such as Belize, Botswana, Brazil, Algeria, China, Dominican Republic, Ecuador, Fiji, Gabon, Guatemala, Guyana, South Africa, Jamaica, Colombia, Costa Rica, Cuba, Malaysia, Mexico, Paraguay, Peru, St. Vincent and the Grenadines, Suriname, Jordan, Thailand, Turkey and Venezuela were investigated whether the middle-income trap phenomenon is valid. This research is carried out with the asymmetric nonlinear cointegration test developed by Hepsağ (2019). According to the findings obtained from the study, Brazil, Algeria, China, Ecuador, Fiji, Gabon, Guyana, South Africa, Jamaica, Colombia, Cuba, Malaysia, Mexico, Paraguay, Peru, Suriname, Jordan, Thailand, Turkey and Venezuela are in the middle income trap.

In line with the study carried out by Öztürk (2019), no direct causality relationship was established between foreign direct investments and the middle income trap. However, the middle income trap determinants were separated and the interactions between these determinants and foreign direct investments were examined one by one. In this study, Turkey's middle income trap position was analyzed econometrically with the Robertson-Ye (2013) approach and it was concluded that Turkey is not in the middle income trap. However, regarding the determination of the middle income trap, it has been determined that Turkey's GDP per capita is very close to 20 percent of the US GDP in 2009 and after, and when compared with the world average income level, it has recently revealed similar characteristics.The year 2005 and after, when Turkey moved to the upper-middle income group, was determined as the period when it hosted the highest amount of foreign direct investment.

İlhan and Akdeniz (2020) examined the existence of the middle income trap for Turkey in general and sub-regions of the level. In the study, a number of methods for statistical classification were used, primarily CUI, in order to determine the middle income trap risk for low-level regions in Turkey. The existence of per capita GDP data for sub-regions/provinces in Turkey for a limited period has led to the use of statistical classification methods instead of econometric methods in the analysis of middle income trap risk. CUI values were calculated by dividing the GDP per capita series of the level subregions/provinces with the GDP per capita series of the USA. The data used in the analyzes are annual and cover the years 2004-2017. The GDP per capita data used for the level sub-regions were obtained from the database of the Turkish Statistical Institute (TUIK), while the per capita GDP data used for the USA were obtained from the World Bank database. In determining the middle income trap for Turkey in general, traditional and structural break unit root tests were used based on the approach of Robertson and Ye (2013). The data used in econometric analysis are annual and cover the years 1960-2018. The GDP per capita data used for Turkey and the USA in the analysis were taken from the World Bank database. According to the results of the econometric analysis in which the years 1960-2018 are discussed, there is no middle income trap in the Turkish economy. However, the CUI values for the period of 2004-2017 reveal that most of the sub-regions are classified as low-income, and some regions that have risen to the middle-income level have lost their status in recent periods.

2.6. Empirical Results

First, Ng Perron unit root test applied to the level values of GDP per capita variables of upper middle-income countries and the reference country USA, and the results are given in Table 1. According to the results in Table 1, Belize, Botswana, Brazil, China, Colombia, Costa Rica, Dominican Republic, Ecuador, Fiji, Gabon, Guatemala, Guyana, Iran, Jamaica, Malaysia, Peru, South Africa, Suriname, Trinidad and Tobago and Turkey, the existence of a unit root with a null hypothesis at the 95% significance level for the GDP per capita variables cannot be rejected, but for the per capita GDP variables of Mexico and Thailand, the existence of a unit root with a null hypothesis at the 5% significance level is rejected. In other words, it is concluded that while the GDP per capita variable for Mexico and Thailand is stationary at the level, the GDP per capita variable for the remaining 20 countries has a unit root.

Ng Perron unit root test results applied to the first difference of GDP per capita variables for 20 countries, including the reference country other than the countries that are stationary in level, are given in Table 2. According to the results of the Ng-Perron unit root test applied to the first differences of the GDP per capita variables of the countries, in Table 2, the null hypothesis expressing the existence of a unit root in 20 countries, including the reference country at the 5% significance level, is rejected. In other words, it was concluded that the GDP per capita variables for 20 countries, including the reference country, are stationary at the first difference.

The Fourier ADF Unit Root Test Results in Table 3 are compared with the critical values in the table in Enders and Lee (2012: 197). If the calculated test statistic is greater than the critical values in the table, the null hypothesis ($H0$) is rejected and it is decided that the series is stationary. The results of the Fourier ADF unit root test in Table 3 show that the series are not stationary at the

Table 1. Ng-Perron Unit Root Test Results for GDP Per Capita Variables at Level

		MZ_α	MZ_t	MSB	MST
ABD		-5,98081	-1,72294	0,28808	15,2291
Belize		-12,2331	-2,42063	0,19788	7,73508
Botswana		-10,3842	-2,27704	0,21928	8,78292
Brazil		-13,6477	-2,57230	0,18848	6,90696
China		-2,65340	-1,00300	0,37801	29,4870
Colombia		-10,3842	-2,27704	0,21928	8,78292
Costa Rica		-5,30606	-1,56664	0,29514	16,9482
Dominican Republic		-9,12855	-2,10946	0,23108	10,0895
Ecuador		-9,73643	-2,18363	0,22427	9,45972
Fiji		-9,99047	-2,22140	0,22235	9,18349
Gabon		-7,72352	-1,92630	0,24941	11,8945
Guatemala		-5,41513	-1,54634	0,28556	16,5271
Guyana		-1,60375	-0,73667	0,45934	43,0608
Iran		-6,04893	-1,73339	0,28656	15,0593
Jamaica		-7,29894	-1,89620	0,25979	12,5108
Malaysia		-18,1245	-3,00751	0,16594	5,04517
Mexico		-29,5397***	-3,80879***	0,12894***	3,28368***
Peru		-3,71500	-1,29872	0,34959	23,5840
South Africa		-21,3441	-3,25637	0,15257	4,33303
Suriname		-7,28493	-1,90735	0,26182	12,5109
Thailand		-23,6634**	-3,43118***	0,14500***	3,90247***
Trinidad and Tobago		-3,88382	-1,39308	0,35869	23,4568
Turkey		-7,82324	-1,95247	0,24957	11,7143
Asymptotic Critical Values	%1	-23,8000	-3,42000	0,14300	4,03000
	%5	-17,3000	-2,91000	0,16800	5,48000
	%10	-14,2000	-2,62000	0,18500	6,67000

***,**,* indicate that they are significant at 1%, 5% and 10% confidence intervals, respectively.

Table 2. Ng-Perron Unit Root Test Results Applied to First Differences of Variables

		MZ_α	MZ_t	MSB	MST
ABD		-60,8816	-5,50897	0,09049	1,53532
Belize		-28,4307***	-3,76135***	0,13230***	3,25766***
Botswana		-25,6072***	-3,55832***	0,13896***	3,67709***
Brazil		-26,7533***	-3,65715***	0,13670***	3,40765***
China		-25,9738***	-3,54795***	0,13660***	3,83831***
Colombia		-25,6072***	-3,55832***	0,13896***	3,67709***
Costa Rica		-28,0152***	-3,73102***	0,13318***	3,32108***
Dominican Republic		-28,2946***	-3,76129**	0,13293**	3,22058**
Ecuador		-22,4185***	-3,32964***	0,14852**	4,17626***
Fiji		-26,5906***	-3,63361***	0,13665***	3,50199***
Gabon		-26,6119***	-3,64729***	0,13705***	3,42687***
Guatemala		-26,7523***	-3,65510***	0,13663***	3,41952***
Guyana		-28,4608***	-3,77183***	0,13253***	3,20466***
Iran		-26,4249***	-3,63427***	0,13753***	3,45213***
Jamaica		-28,2136****	-3,75590***	0,13312***	3,22985***
Malaysia		-27,2327***	-3,68299***	0,13524***	3,38776***
Peru		-28,1836***	-3,75185***	0,13312***	3,45530***
South Africa		-53,3524***	-5,15771***	0,09667	1,74291
Suriname		-26,7757***	-3,65855***	0,13664***	3,40560***
Trinidad and Tobago		-27,1768***	-3,65519***	0,13560***	3,35929***
Turkey		-28,4874***	-3,76944***	0,13232***	3,22595***
Asymptotic Critical Values	%1	-23,800	-3,42000	0,14300	4,03000
	%5	-17,300	-2,91000	0,16800	5,48000
	%10	-14,200	-2,62000	0,18500	6,67000

***,**,* indicate that they are significant at 1%, 5% and 10% confidence intervals, respectively.

GDP per capita level of 21 countries, including the reference country, but become stationary at the first difference.

Fourier KSS unit root test results are given in Table 4. For the GDP per capita variables of Belize, Costa Rica, Dominican Republic and Guyana, the existence of a unit root with a null hypothesis at the 5% significance level is rejected. In other words, the existence of a unit root with a null hypothesis at the 5% significance level for GDP per capita variables is rejected. In another saying, it is concluded that while the GDP per capita variable for Belize, Costa Rica, Dominican Republic and Guyana is stationary at the level, the GDP per capita variable for the remaining 16 countries has a unit root. Since the F test, which is used to test the significance of trigonometric terms, is used only when the basic hypothesis is not rejected, the F test is applied for the series whose difference is taken. Since the F test, which is used to test the significance of trigonometric terms, is used only when the basic hypothesis is not rejected, the F test is applied for the series whose difference is taken. Since the trigonometric terms were not significant for both difference series, the KPSS test was applied to the difference series at the same time, and after this test, the difference of both series was found to be stationary. Therefore, it is stated that 16 countries are I (1) in both series.

Table 3. Fourier ADF Unit Root Test Results

Countries	Kmin	Tau_df	Results	Countries	Kmin	Tau_df	Results
Belize	4	-3.29386**	Ho cannot be denied	Iran	2	-3.35633**	Ho cannot be denied
Botswana	4	-2.53257**	Ho cannot be denied	Jamaica	2	-2.38293**	Ho cannot be denied
Brazil	4	-2.26025**	Ho cannot be denied	Malaysia	4	-2.67445**	Ho cannot be denied
China	1	-2.89108**	Ho cannot be denied	Peru	1	-2.50094**	Ho cannot be denied
Colombia	4	-2.53257**	Ho cannot be denied	South Africa	4	-2.47432**	Ho cannot be denied
Costa Rica	3	-2.05856**	Ho cannot be denied	Suriname	2	-1.77338**	Ho cannot be denied
DomRepublic	4	-2.22400**	Ho cannot be denied	TrinidadTobago	2	-2.69019**	Ho cannot be denied
Ecuador	4	-1.26426**	Ho cannot be denied	Turkey	4	-2.14916**	Ho cannot be denied
Fiji	3	-1.82595**	Ho cannot be denied	ABD	1	-3.01159**	Ho cannot be denied
Gabon	2	-2.36259**	Ho cannot be denied	Guatemala	4	-0.70687**	Ho cannot be denied
Guyana	1	-2.73225**	Ho cannot be denied				

Notes: ** indicates p <0.05 level. k=number of frequencies. The critical values for FADF values are (-4.95, and -4.35) for k=1, (-4.69 and -4.05) for k=2, (-4.45, and -3.78) for k=3), for k=4 (-4.29 and -3.65), for k=5 (-4.20 and -3.56), 1% and 5% are given in parentheses. F-test critical values are 10.35 (1%), 7.58 (5%) and 6.35 (10%). (Enders and Lee, 2012b: 1997 Table 1a)

Table 4. Fourier KSS Unit Root Test Results

	Freq.(k)	**F KSS**	**F test**	**Conclusion**
Belize	4	-4.61291***	17.16124***	**Ho: Denied**
Botswana	1	-1.84996		Ho cannot be denied
Brazil	3	-1.95587		Ho cannot be denied
China	1	-0.87044		Ho cannot be denied
Colombia	1	-1.84996		Ho cannot be denied
Costa Rica	1	-4.77367***	20.6713***	**Ho: Denied**
Dominican Republic	1	-4.78977***	11.61738***	**Ho: Denied**
Ecuador	1	-2.18334		Ho cannot be denied
Fiji	1	-1.85062		Ho cannot be denied
Gabon	2	-2.06608		Ho cannot be denied
Guatemala	1	-2.09587		Ho cannot be denied
Guyana	1	-4.54051***	128.25734***	**Ho: Denied**
Iran	2	-2.17059		Ho cannot be denied
Jamaica	1	-2.22838		Ho cannot be denied
Malaysia	2	-2.60115		Ho cannot be denied
Peru	1	-3.56633		Ho cannot be denied
South Africa	1	-3.1456		Ho cannot be denied
Suriname	1	-2.00481		Ho cannot be denied
Trinidad and Tobago	2	-1.88082		Ho cannot be denied
Turkey	1	-2.77779		Ho cannot be denied

Notes: *** and ** indicate p<0.01 and p<0.05, respectively. k=number of frequencies, Min SSR=minimum sum of squared residuals. C. of MIT=candidate of middle income trap. The critical values for the FKSS test are k=1 (-4.43, and -3.85); k=2 (-3.95, and -3.28); k=3 (-3.70, and -3,06) k=4 (-3,60 and -2,93); k=5 (-3,55 and -2,90) for different frequency values and the statistical significance levels f 1% and 5%, respectively (Christopoulos and Leon-Ledesma, 2010, p. 1084, Table 3). The critical values for the F-test are 10,35 (1%) and 7,41(5%) in FADF test, respectively. The critical values for the F-test are 6.87 (1%), and 4.97 (5%) for the FKSS test, respectively.

Based on the results obtained, it is seen that the GDP per capita variables of Mexico, Thailand, Belize, Costa Rica, Dominican Republic and Guyana are stationary at the level of I(0), and the rest GDP per capita variables of Botswana, Brazil, China, Colombia, Ecuador, Fiji, Gabon, Guatemala, Iran, Jamaica, Malaysia, Peru, South Africa, Suriname, Trinidad and Tobago, Turkey are stationary at the order of I(1).

In this context, Banerjee Arcabic Lee (2017) Fourier ADL cointegration test was applied to the 16 countries mentioned above and the results are given in Table 5. As seen in Table 5, it was determined the null hypothesis, stating that there was no cointegration for the Fourier ADL Cointegration test results at 5% significance level for Botswana, Brazil, China, Colombia, Ecuador, Fiji, Gabon, Guatemala, Iran, Jamaica, Malaysia, Peru, South Africa, Suriname, Trinidad and Tobago, Turkey, could not be rejected. Therefore, empirical evidence has been obtained that these countries are in the middle-income trap.

3. CONCLUSION

Sustainable growth and sustainable development policies take the first place among the primary goals of all economies. In order to survive in today's international arena, it is of great importance for economies to increase their technology and innovation-oriented competitiveness. Countries that ignore the innovations brought by the century we live in, cannot realize innovation and innovation management, cannot increase the production capacity as well as adapting technology to production, cannot increase the number of workforce that can use brain power instead of physical power, and fall below the expected targets in structural reforms, even though they rise to the middle income group they cannot rise to the upper income group and fix their place in the upper middle income group for a long time. In this context, it is necessary to deal with the middle income trap issue and to take into account the experiences of the countries that have experienced this trap, and at the same time, each country should produce its own policies to get rid of the trap. It was concluded that 16 of the 22 countries in the upper middle income group included in the study are in the middle income trap. In this regard, it is of great importance that economies focus on sustainable growth-oriented new economy investments, increase the share of R&D expenditures in GDP, increase the share of high technology-oriented exports, ensure the correct management of the obligations brought by Industry 4.0, evaluate the possible effects on the sectors and ensure rapid adaptation to the process.

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Table 5. Banerjee Arcabic Lee (2017) Fourier ADL Cointegration Test Results

	k min	tau df	5%	1%	Results
Belize	4	-1.35646	-6.59	-5.91	Ho cannot be denied
Botswana	4	-1.61706	-6.59	-5.91	Ho cannot be denied
Brazil	1	-0.00982	-4.73	-3.76	Ho cannot be denied
China	4	-1.35646	-6.59	-5.91	Ho cannot be denied
Colombia	4	-1.49102	-6.59	-5.91	Ho cannot be denied
Costa Rica	3	-1.75632	-6.04	-5.37	Ho cannot be denied
Dominican Republic	4	-1.31512	-6.59	-5.91	Ho cannot be denied
Ecuador	3	-1.29519	-6.04	-5.37	Ho cannot be denied
Fiji	2	-3.76823	-5.40	-4.76	Ho cannot be denied
Gabon	1	-3.14211	-4.73	-3.76	Ho cannot be denied
Guatemala	4	-0.71906	-6.59	-5.91	Ho cannot be denied
Guyana	1	-2.29381	-4.73	-3.76	Ho cannot be denied
Iran	4	-2.79808	-6.59	-5.91	Ho cannot be denied
Jamaica	2	-1.54701	-5.40	-4.76	Ho cannot be denied
Malaysia	2	-2.10727	-5.40	-4.76	Ho cannot be denied
Peru	4	-2.30229	-6.59	-5.91	Ho cannot be denied

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