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***Research Article/Araştırma Makalesi***

# Financial Convergence Test with Fourier Panel KPSS Stationarity Test: Findings from Fragile Five Countries

## *Fourier Panel KPSS Durağanlık Testi ile Finansal Yakınsama Sınaması: Kırılgan Beşli Ülkelerden Bulgular*

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**Abstract**

Financial development is an important component of economic development. In particular, it is very important for developing countries to converge to developed countries in terms of financial development level. In this study, the convergence of the financial development indicators of the Fragile Five Countries to the average of the indicators of the four selected countries (USA, England, Australia and Japan) in the top ten in terms of financial development level for the period 1980-2020 is tested. In this respect, our study contributes to the literature by measuring the convergence of a developed country group, not a single country. The data used in the study were accessed from the World Bank official database. Stationarity test which is introduced to the literature by Nazlıoğlu and Karul (2017) based on the Fourier stationarity test developed first by Becker et al. (2006). This test gives results for both the individual and the panel as a whole. As a result of the tests, it is seen that the financial development indicators of the Fragile Five Countries do not converge to the selected country group and its average. Results showed that, the financial markets of the Fragile Five Countries are in a static structure. Their financial systems do not depth enough and so these systems are far from efficiency. Necessary precautions need to be taken in terms of inadequacy of financial indicators examined. Therefore, it can be inferred that there are weaknesses in financial systems in matters such as economic integration, liberalization, harmonization of regulations and globalization.

**Jel Codes:** *G10, G20, B23, C1*
**Keywords:** *Financial Development, Liquid Liabilities, Private Loan, Deposit Bank Assets, Fourier Panel Stationarity, Convergence.*

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**Öz**

Finansal gelişme, ekonomik gelişmenin önemli bir bileşenidir. Özellikle gelişmekte olan ülkelerin gelişmiş ülkelerle finansal gelişmişlik düzeyleri açısından yakınsaması oldukça önemlidir. Bu çalışmada 1980-2020 dönemi için Kırılgan Beşli Ülkelerin finansal gelişme göstergelerinin, finansal gelişmişlik düzeyi olarak ilk on içinde olan seçilmiş dört ülkenin (ABD, İngiltere, Avustralya ve Japonya) finansal gelişme göstergelerinin ortalamasına yakınsaması sınanmaktadır. Bu yönüyle çalışmamız tek bir ülkeye değil de gelişmiş bir ülke grubuna yakınsamayı ölçerek literatüre katkı sunmaktadır. Çalışmada kullanılan verilere Dünya Bankası resmi veri tabanından erişilmiştir. Durağanlık sınaması Becker vd. (2006)'nin geliştirdiği Fourier durağanlık testine dayanan Nazlıoğlu ve Karul (2017) tarafından literatüre kazandırılan test ile gerçekleştirilmiştir. Bu test hem bireysel hem de panelin geneli için sonuç vermektedir. Yapılan sınamalar neticesinde Kırılgan Beşli Ülkelerin finansal gelişme göstergelerinin seçilen ülke grubuna ve ortalamasına yakınsamadığı görülmektedir. Sonuçlar, Kırılgan Beşli Ülkelerin finansal piyasalarının statik bir yapıda olduğunu göstermiştir. Finansal sistemleri yeterince derin değildir ve bu sistemler verimlilikten uzaktır. İncelenen finansal göstergelerin yetersizliğini gidermek açısından gerekli önlemler alınmalıdır. Dolayısıyla ekonomik bütünleşme, serbestleşme, düzenlemelerin uyumlaştırılması ve küreselleşme gibi konularda finansal sistemlerde zafiyetlerin olduğu çıkarımı yapılabilir.

**Jel Codes:** *G10, G20, B23, C1*
**Keywords:** *Finansal Gelişme, Likit Yükümlülükler, Özel Kredi, Mevduat Bankası Varlıkları, Fourier Panel Durağanlık, Yakınsama.*

## 1. Introduction

Units that build up an economy (households, firms and the government) have to generate income and spend this income in line with their needs. In the economic structure, there may be savers with income above their expenditures, as well as those in need of funds with expenditures above their income. Here, the financial system brings together those who need funds and those who have surplus of funds (Hubard, 2002). The financial system has roles such as; providing risk transfer, providing liquidity, mediating different portfolio preferences, allocating funds to areas where they can be used effectively, ensuring that resources are allocated to investment projects, facilitating the exchange of goods and services, and ensuring economic growth by increasing savings (Schall & Haley, 1996: 15). In recent years, the existence of a well-functioning financial system has become very important for developing countries, especially due to financial liberalization and the increase in the diversity of financial instruments with technological development.

In the past decades, significant progress has been made in laying the foundations of modern economies and financial systems, especially in emerging market economies. It has been discussed whether these common developments converge between the financial systems of the countries and whether they have a common assumption (Antzoulatos et al., 2011: 2).

Fragile Five Economies (Brazil, India, Indonesia, South Africa and Turkey) first appeared in a report published by Morgan Stanley in August 2013. The sensitivity of its members to international financial movements, especially FED's policy changes, played an important role in the formation of this group of countries. The common feature of the Fragile Five countries is that they have major problems such as high inflation, an unstable growth rate, and current account deficit and capital insufficiency. (Kırca & Canbay, 2020: 132). Table 1 shows some selected macroeconomic indicators of the fragile five countries for the last two years (2019 and 2020). Through Table 1, the economic performance of the fragile five countries in recent years will be examined. Thus, it will be tried to reveal the extent of the macroeconomic indicators that constitute the common problems of the countries in question in recent years. Convergence to financially developed countries will also have a positive effect on macroeconomic indicators of these 5 countries.

**Table 1: Selected Macroeconomic Indicators of Fragile Five Economies (2019, 2020)**

| | Brazil | | India | | Indonesia | | South Africa | | Turkey | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **2019** | **2020** | **2019** | **2020** | **2019** | **2020** | **2019** | **2020** | **2019** | **2020** |
| **GDP per capita growth (annual %)** | 0.7 | -4.7 | 3.0 | -8.2 | 3.9 | -3.1 | -1.2 | -7.6 | -0.4 | 0.7 |
| **Inflation, consumer prices (annual %)** | 3.7 | 3.2 | 3.7 | 6.6 | 3.0 | 1.9 | 4.1 | 3.2 | 15.2 | 12.3 |
| **Current account balance (% of GDP)** | -3.5 | -1.7 | -1.0 | 1.2 | -2.7 | -0.4 | -2.6 | 2.0 | 0.7 | -4.9 |
| **Unemployment rate (%)** | 11.9 | 13.7 | 5.3 | 8.0 | 3.6 | 4.3 | 28.5 | 29.2 | 13.7 | 13.1 |

**Resource:** World Bank, World Development Indicators

In the light of the indicators in Table 1, one can say that the Covid-19 Pandemic has had a significant impact, especially in terms of the GDP per capita growth indicator. Respectively India, South Africa and Brazil are the countries most affected by adverse conditions caused by Covid-19. In terms of inflation rate, Turkey is the country in the worst situation with rates above 10 percent, followed by India in the second place. When we analyze the table in terms of current account balance, we can say that the data show ups and downs in both five countries. In 2019 Brazil has the worst condition in terms of current account balance and especially Turkey in the following year. Finally, the country with the highest unemployment rate is South Africa with average rate of 29.0%, and the country with the lowest unemployment rate is Indonesia with an average of 4.0%.

As a requirement of development, highly developed countries need more sophisticated financial systems for their economic mechanisms to function better (Dekle & Pundit, 2016: 1106). However, there are significant differences between the financial systems of developed countries and those of developing countries. In this context, the convergence of the financial systems of developing countries to developed countries gains great importance. A significant number of studies examining the phenomenon of convergence are studies in which countries or regions are investigated in terms of GDP per capita. However, in the literature, especially in recent years, studies on financial convergence are frequently included. Therefore, in our study, it is investigated whether there is a convergence to the financial markets of developed countries for Fragile Five Economies. In this context, financial indicators of the four selected countries (USA, England, Australia and Japan) in the top ten in terms of financial development level. The first reason we choose these countries is the full and reliable access to financial indicators data used in our analysis period from 1980 to 2020. Secondly, we choose these countries for not only their financial performances. The fact that their economic performance is above Fragile Five Economies has also formed another criterion for these 4 countries to be chosen.

## 2. Literature Review

In this section studies examining whether financial indicators converge between countries or country groups will be examined. After giving an extensive information about related literature, a brief summary of studies on country groups will be shown in a table.

A pioneer study, Bianco et al. (1997) examined the nexus between financial development and economic growth for 6 developed economies (Italy, Germany, United States, France, United Kingdom and Japan) using the data from 1980 to 1994. Comparing the historical and recent development of the financial structures they found a limited convergence of the financial systems of the countries analyzed. Murinde et al. (2004) empirically investigated the financial convergence in seven European Union member countries using panel data method with data spanning from 1972 to 1996. Results revealed that EU member countries converge towards a banking oriented system. Fung (2009) analyzed the convergence in financial sectors of 57 countries at different levels of development examining data from 1967 to 2001. Results showed a strong conditional convergence especially in middle and high income countries. Results also confirmed the divergence between poor and rich countries. Gallizo et al. (2010)

investigated the financial convergence of ten new members of European Union (CEECs and Malta and Cyprus) during the period 1998-2004. They performed a dynamic factor analysis of financial ratios (returns, cost of debt, productivity, and indebtedness) of firms. Results revealed the convergence of returns and cost of debt ratios. On the other hand no convergence found for productivity and indebtedness ratios. Antzoulatos et al. (2011) analyzed the financial system convergence for a panel of industrialized and developing countries using data spanning from 1987 to 2005. They found no evidence of financial convergence for both whole system and main segments of it. Stolbov & Veysov (2011) investigated the financial convergence of 102 countries of 4 different income groups during the period 1980-2009. Countries analyzed exhibit convergence but the speed of convergence is not sufficient for developing countries. Bruno et al. (2012) examined the financial convergence for two panels of OECD countries. Results confirmed convergence in shares and insurance products. However, mixed results found for debt securities and deposits caused from differences between countries. Apergis et al. (2012) investigated the financial development convergence of 50 countries using data spanning from 1980 to 2003. According to results, they reject the hypothesis of all countries converge to an equilibrium level of financial development. Bahadir & Valev (2015) examined the convergence of countries which are further away from United States in terms of financial indicators. Results revealed that credit levels/GDP and other indicators of financial development converge across countries during the period examined. Dekle & Pundit (2016) investigated the financial convergence of Asian economies with weaker financial systems through benchmark economies (Singapore, Hong Kong, China, the Republic of Korea and Japan) examining the time period 2004-2011. They found that economies with weaker financial systems converging on the benchmark economies. Kılınç et al. (2017) investigated the convergence process in European Union countries during the transition of the monetary system. Their analyses cover two different periods of 1963-2012 and 1988-2012. Results revealed that financial measures tend to converge across the EU. Özek & Ergür (2020) examined the financial convergence of fragile five economies (Brazil, India, Indonesia, South Africa and Turkey) to US economy, during the period 1980-2017. They found that Turkey financially converges to US economy but found no evidence of convergence for Brazil, India, Indonesia and South Africa. Uğur & Bingöl (2021) investigated the financial convergence of Turkey to G7 economies using data spanning from 1980 to 2017. Their results confirmed that Turkey's financial system converge to five of the G7 economies except Great Britain and France.

In terms of contribution to the literature, especially compared with the recent study of Özek & Ergür (2020) on fragile five economies, our study differs in several aspects. Firstly, our study measures the convergence of fragile five economies to a developed country group, not to a single country (USA). Additionally, instead of using a single financial indicator, we used 3 different indicators representing financial development; the ratio of liquid liabilities to GDP, the ratio of private loans extended by deposit banks and other financial institutions to GDP, and the ratio of assets of deposit banks to GDP. In this respect, our study keeps the scope of financial development broader, and the indicators we use in this context increase the representation power of financial development. By using these indicators we aimed to reveal the financial system in all its aspects. Another contribution of our study differs from previous works in terms of the method used in the study. We used a Fourier-based panel stationarity

test recently developed by Nazlıoğlu & Karul (2017). This test is a highly powerful test that allows gradual structural changes and cross-sectional dependence and heterogeneity between sections. Furthermore, this test provides individual results for each unit of the panel and the entire panel. The aforementioned advantages of this test obtain more robust results.

**Table 2: A Brief Summary of Empirical Studies Analyzing the Financial Convergence in Different Country Groups**

| Authors | Countries & Time Period | Methodology | Results |
|---|---|---|---|
| **Murinde et al. (2004)** | 7 EU Member Countries, 1972-1996 | Panel data, GMM estimation | Convergence towards banking sectors. |
| **Fung (2009)** | 57 different level developed countries, 1967-2001 | Panel Data Approach | Conditional convergence in middle and high income countries. Divergence between poor and rich countries. |
| **Gallizo et al. (2010)** | 10 new members of EU, 1998-2004 | Dynamic factor analysis | Convergence in returns and cost of debt ratios. |
| **Antzoulatos et al. (2011)** | 38 developed and developing countries, 1987-2005 | Panel Convergence Method | No financial convergence. |
| **Stolbov & Veysov (2011)** | 102 Countries, 1980-2009 | Panel Data Approach | Relatively faster convergence of middle income countries but insufficient to catch up developing world. |
| **Bruno et al. (2012)** | G7 Countries, 1980-2005 and 23 OECD Countries, 1960-2009 | Panel Data Approach | Convergence in shares and insurance products |
| **Apergis et al. (2012)** | 50 countries, 1980-2003 | Nonlinear time-varying factor model | No convergence of countries to a single equilibrium state in financial development. |
| **Bahadir & Valev (2015)** | A broad sample of countries, 1965-2009 | Panel data approach and cross-section database | Bank credit levels/GDP and other measures of financial development converge. |
| **Dekle & Pundit (2016)** | 23 Asian Economies, 2004-2011 | Panel data approach | Economies with weaker financial systems converge through benchmark economies |
| **Kılınç et al. (2017)** | 15 European Union Countries, 1963-2012 and 1988-2012 | Dynamic panel data analysis. | Stock market and banking measures converge across the EU |
| **Özek & Ergür (2020)** | Fragile Five Economies, 1980-2017 | Fourier unit root test. | Countries except Turkey diverge from US financial performance. |
| **Uğur & Bingöl (2021)** | Turkey and G7 Economies, 1980 to 2017 | Fractional FADF Unit Root Test | Convergence to G7 economies other than Great Britain and France. |

## 3. Dataset and Econometric Methodology

In this study, the existence of financial convergence in the Fragile Five Countries for the period 1980-2020 is investigated. For this purpose, the ratio of liquid liabilities to GDP (%), (M2Y), Private credit by deposit money banks and other financial institutions to GDP (%), (PCD) and Deposit money banks assets to GDP (%), (DMB) (Stolbov & Veysov, 2011; Sadorsky, 2011; Çoban & Topçu, 2013; Zeren & Koç, 2014; Dekle & Pundit , 2016; Bahadir & Valev, 2015 and Çağlar & Kubar, 2017) used as the financial development indicators for the Fragile Five countries.

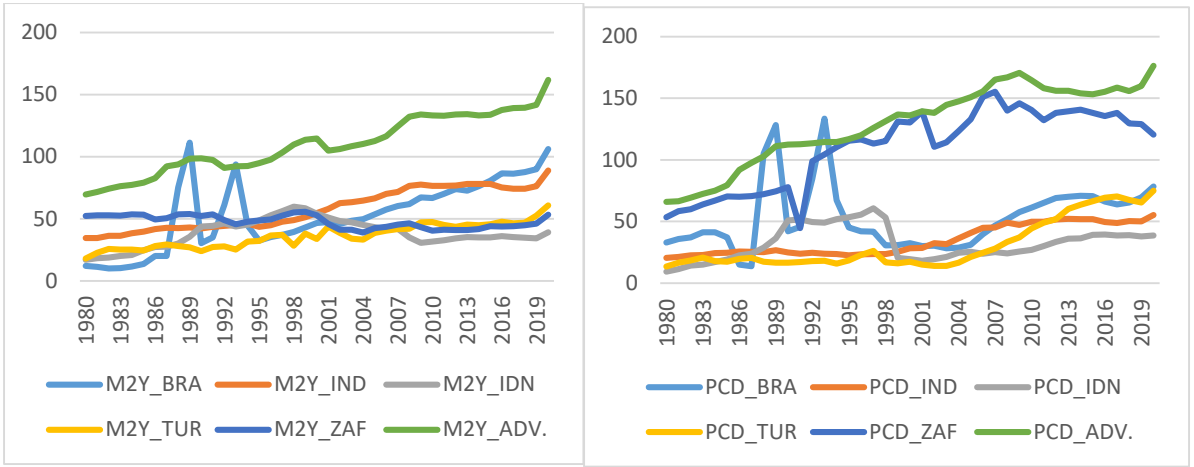
It is investigated whether the financial development indicators of the Fragile Five Countries converge to the average of the financial development indicators (ADV) of the four selected countries (USA, England, Australia and Japan) which are in the top ten in terms of financial development level. Also, stochastic convergence based on relative financial indicator figures is investigated.

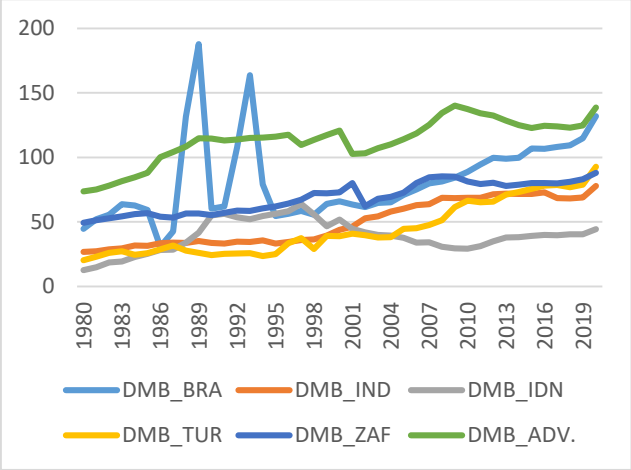
$$y_{it} = \ln\left(X_{it}/ADV_t\right), X = M2Y, PCD\ and\ DMB \quad (1)$$

$$z_{it} = \ln\left(X_{it}/X_t\right), X = M2Y, PCD\ and\ DMB \quad (2)$$

Here $t$, the time shows $X_{it}$the financial development indicators considered in the study in the Fragile Five Countries, the $ADV_t$financial development indicator average of the four selected countries in the top ten in terms of financial development, $X_t$ is the average of the financial development indicators of the Fragile Five Countries and $z_{it}$ is the relative financial development. To test convergence, the Fourier-based KPSS panel stationarity method proposed by Nazlıoğlu & Karul (2017) was used. The data used in the test were accessed from the World Bank official database. The graphs and descriptive statistics of the data are as follows.

**Figure 1: Financial Progress Indicators by Years (1980-2020)**






As can be seen in Figure 1, the financial indicators of Fragile Five Countries are below the average of the four selected countries. Average of advanced economies is generally higher for the years analyzed except for certain years (almost for Brazil).

**Table 3: Descriptive Statistics of Variables**

| Variables | | Brazil | India | Indonesia | Turkey | South Africa |
|---|---|---|---|---|---|---|
| M2Y | $Mean$ | 53.135 | 57.593 | 37.983 | 36.037 | 47.611 |
| | $Median$ | 49.594 | 54.644 | 35.317 | 36.589 | 47.612 |
| | $Maximum$ | 111.325 | 88.876 | 59.860 | 60.904 | 55.734 |
| | $Minimum$ | 10.082 | 34.456 | 17.101 | 18.033 | 39.003 |
| | $Std.Dev.$ | 27.851 | 16.505 | 11.147 | 9.768 | 5.054 |
| | $Skewness$ | 0.110 | 0.1479 | -0.032 | 0.264 | -0.058 |
| | $Kurtosis$ | 2.155 | 1.479 | 2.365 | 2.334 | 1.560 |
| | $Jarque-Bera$ | 1.300 (0.521) | 4.096 (0.128) | 0.694 (0.706) | 1.232 (0.539) | 3.564 (0.168) |
| PCD | $Mean$ | 53.146 | 34.726 | 32.101 | 30.966 | 109.993 |
| | $Median$ | 45.200 | 28.340 | 28.686 | 19.654 | 116.395 |
| | $Maximum$ | 133.606 | 55.251 | 60.816 | 75.059 | 155.339 |
| | $Minimum$ | 13.961 | 20.543 | 9.528 | 13.588 | 44.809 |
| | $Std.Dev.$ | 26.516 | 12.270 | 13.726 | 20.235 | 31.894 |
| | $Skewness$ | 1.252 | 0.402 | 0.380 | 1.063 | -0.575 |
| | $Kurtosis$ | 4.670 | 1.386 | 2.061 | 2.484 | 1.931 |
| | $Jarque-Bera$ | 15.483 (0.000) | 5.556 (0.062) | 2.495 (0.287) | 8.172(0.016) | 4.216 (0.121) |
| DMB | $Mean$ | 82.043 | 49.316 | 38.929 | 44.315 | 68.765 |
| | $Median$ | 70.837 | 43.919 | 39.501 | 38.101 | 69.533 |
| | $Maximum$ | 188.037 | 78.040 | 63.986 | 92.914 | 88.083 |
| | $Minimum$ | 30.705 | 26.834 | 12.580 | 20.387 | 49.361 |
| | $Std.Dev.$ | 32.601 | 17.367 | 12.501 | 20.886 | 11.962 |
| | $Skewness$ | 1.225 | 0.215 | -0.084 | 0.729 | -0.042 |
| | $Kurtosis$ | 4.603 | 1.335 | 2.453 | 2.144 | 1.488 |
| | $Jarque-Bera$ | 14.646 (0.000) | 5.051(0.080) | 0.560 (0.755) | 4.884 (0.086) | 3.917 (0.141) |

**Note:** Values in parentheses indicate probability values.

Before performing the stationarity test, the cross-sectional dependency test of the considered series was examined and it was found that there was a cross- sectional dependence between the series. Therefore, using tests that take into account the cross-section dependency will make the results more reliable. Apart from this, it is a difficult possibility that all units included in the panel have both the same number of breaks and sudden breaks (Sigeze et al., 2019: 18). For this reason, catching non-sudden breaks by using soft-transition tests will also help increase the validity and reliability of the results obtained.

### 3.1. Gradual Structural Shifts Fourier Panel KPSS Stationarity Test (Nazlıoğlu & Karul, 2017)

Nazlıoğlu & Karul (2017) introduced a simple panel stationarity test to the literature, which takes into account structural shifts and cross-section dependence. This test is the panel adapted version of the Fourier KPSS test performed by Becker et al. (2006) and the structural shifts are modeled as a gradual/soft process with the Fourier approach. Contrary to traditional tests, the importance of structural breaks in the behavior of the series is taken into account, instead of sudden structural shifts. In this test, in which the test procedure is proposed with the Fourier approach, it is not necessary to know the break dates, numbers or break forms, since structural breaks are captured using frequency components (Enders & Lee, 2012b: 196, Nazlıoğlu & Karul, 2017: 181). Besides allowing heterogeneity among the cross- sections in the test panel, it proposes a simple panel stationarity test with gradual structural changes and cross-section dependence. The test procedure is based on the time series stationarity test developed by Becker (2006), in which structural shifts are modeled with a Fourier approach and the panel stationarity test with cross-section dependence, proposed by Hadri & Kurozumi (2011) and Hadri & Kurozumi (2012), which is explained with a common factor structure. The distribution of the individual statistic depends only on the Fourier frequency, and the panel statistic has a standard normal distribution. The small sample properties of the panel stationarity test, Monte Carlo simulations for different data generation processes have been tested and it appears to have appropriate size and power properties. The data generation process is as follows:

$$y_{it} = \alpha_i(t) + r_{it} + \lambda_i F_t + \varepsilon_{it} \quad (3)$$

$$r_{it} = r_{it-1} + u_{it} \quad (4)$$

where $i = 1, \dots, N$ is the cross-section dimension represents the $t = 1, \dots, T$ is time dimension and $r_{it}$ represents the random walk process with the initial value $r_{i0} = 0$ for all $i$ . $F_t$ is stationary and shows the unobservable common factor and is not serially correlated with $E(F_t) = 0$ and $E(F_t^2) = \sigma_F^2 > 0$. $\lambda_i$ expresses the factor load and it is distributed with $F_t$ and $\varepsilon_{it}$ independently (Nazlıoğlu and Karul, 2017: 182). Equation (3) is defined as a time dependent function represented by its deterministic component $\alpha_i(t)$. In Fourier form $\alpha_i(t)$ is as follow:

$$\alpha_i(t) = \alpha_i + \gamma_{1i} \sin\left(\frac{2\pi kt}{T}\right) + \gamma_{2i} \cos\left(\frac{2\pi kt}{T}\right) \quad (5)$$

Equation (5) allows obtaining the term time-varying constant to capture soft changes with non-zero values of $\gamma_{1i}$ and $\gamma_{2i}$.

$$\alpha_i(t) = a_i + b_i t + \gamma_{1i} \sin\left(\frac{2\pi kt}{T}\right) + \gamma_{2i} \cos\left(\frac{2\pi kt}{T}\right) \quad (6)$$

In equation (6), it is aimed to capture both the slope of the deterministic trend and any change in the constant term with non-zero values of, which shows the $\gamma_{1i}$ $and$ $\gamma_{2i}$ soft shift in the trend function. The basic hypothesis here is that there is stationarity for all $i$'s. The alternative unit root hypothesis allows $\sigma_{ui}^2$ for to differ between cross sections and also for some cross-sections to be stationary. The individual statistics based on the KPSS test, which allows the Fourier frequency, developed by Becker et al. (2006), are defined as follows:

$$\eta_i(k) = \frac{1}{T^2}\frac{\sum_{t=1}^{T}\tilde{S}_{it}(k)^2}{\tilde{\sigma}_{\varepsilon i}^2} \quad (7)$$

where $\tilde{S}_{it}(k)^2 = \sum_{j=1}^{t}\tilde{\varepsilon}_{ij}$ and $\tilde{\sigma}_{\varepsilon i}^2$ is the estimation of the long-run variance of the error term. Nazlıoğlu and Karul (2017) developed the panel statistics with the average of the individual statistics. Fourier expressed the panel statistics $FP(k)$) as follows:

$$FP(k) = \frac{1}{N}\sum_{i=1}^{N}\eta_i(k) \quad (8)$$

In this test asymptotic distribution of $\eta_i(k)$ for $T \to \infty$ depends on only $k$ and do not change with respect to other parameters in the data generation process. The only difference of this test model from Becker et al. (2006) model is the common factor (Nazlıoğlu & Karul, 2017: 183). As Hadri & Kurozumi (2011, 2012) have shown, the common factor will not accumulate permanently in $y_{it}$, if it is assumed to be stationary under the null hypothesis. The asymptotic distribution of the panel statistics can be obtained as the mean of the limiting distributions of the individual statistics when the common factor does not affect the individual limiting distribution. Under the stationary null hypothesis for $T \to \infty$ and $N \to \infty$ , $FP(k)$ converges to the standard normal distribution and is shown as follows:

$$FZ(k) = \frac{\sqrt{N}(FP(k)-\xi(k))}{\zeta(\mathrm{k})} \sim N(0,1) \quad (9)$$

Here $\xi(k)$and $\zeta^2(\mathrm{k})$denote mean and variance, respectively. Nazlıoğlu & Karul (2017) stated that any structural break or nonlinearity in the determinant term is aimed to be captured with a Fourier approach that imitates various shifts regardless of date, number and break form. They stated that there is a significant increase in power characteristic, regardless of size, close to 5% nominal size and also when $T$ or $N$ or both increase.

## 4. Results

In this study, in which financial convergence is investigated, the results of the cross-section dependency and Fourier panel KPSS stationarity test for Fragile Five Countries are presented in the tables below.

**Table 4: Cross-Section Dependency Test Results**

| | Test | Statistics Value | Probability Value |
|---|---|---|---|
| $y_1$ | Breusch-Pagan (1980) | 39.029 | 0.000*** |
| | Pesaran (2004) CD LM | 6.491 | 0.000*** |
| | Pesaran (2004) CD | -2.677 | 0.004*** |
| | Bias-Corrected Pesaran (2008) CD LM | 6.351 | 0.000*** |
| $y_2$ | Breusch-Pagan (1980) | 31.613 | 0.000*** |
| | Pesaran (2004) CD LM | 4.833 | 0.000*** |
| | Pesaran (2004) CD | -2.999 | 0.001*** |
| | Bias-Corrected Pesaran (2008) CD LM | 7.305 | 0.000*** |
| $y_3$ | Breusch-Pagan (1980) | 65.232 | 0.000*** |
| | Pesaran (2004) CD LM | 12.350 | 0.000*** |
| | Pesaran (2004) CD | -2.532 | 0.006*** |
| | Bias-Corrected Pesaran (2008) CD LM | 11.337 | 0.000*** |
| $z_1$ | Breusch-Pagan (1980) | 91.178 | 0.000*** |
| | Pesaran (2004) CD LM | 18.152 | 0.000*** |
| | Pesaran (2004) CD | -2.389 | 0.008*** |
| | Bias-Corrected Pesaran (2008) CD LM | 12.698 | 0.000*** |
| $z_2$ | Breusch-Pagan (1980) | 84.929 | 0.000*** |
| | Pesaran (2004) CD LM | 16.755 | 0.000*** |
| | Pesaran (2004) CD | -2.305 | 0.011** |
| | Bias-Corrected Pesaran (2008) CD LM | 7.699 | 0.000*** |
| $z_3$ | Breusch-Pagan (1980) | 33.951 | 0.000*** |
| | Pesaran (2004) CD LM | 5.356 | 0.000*** |
| | Pesaran (2004) CD | -3.889 | 0.000*** |
| | Bias-Corrected Pesaran (2008) CD LM | 12.204 | 0.000*** |

**Note:** ** and *** denotes significance at the 5% and 1% level, respectively. $i = 1,2,3$ The variables for $y_i$and $z_i$represent the financial development indicators of M2Y, PCD and DMB in equations (1) and (2), respectively.

According to the cross-sectional dependency test results, it is seen that there is a cross-sectional dependence between the series. For this, the FPKPSS test, which was brought to the literature by Nazlioglu & Karul (2017), which is one of the panel unit root tests that takes into account the cross-sectional dependence, was carried out. This test also has the advantage of capturing smooth transition breaks, as it is Fourier-based.

**Table 5: Fourier Panel KPSS Stationarity Test Results**

| | | Constant Model | | | Constant and Trend Model | | |
|---|---|---|---|---|---|---|---|
| | **Countries** | $k=1$ | $k=2$ | $k=3$ | $k=1$ | $k=2$ | $k=3$ |
| $y_1$ | Brazil | 0.122* | 0.526 | 0.467 | 0.057 | 0.156 | 0.088* |
| | India | 0.104* | 0.478 | 0.422* | 0.079 | 0.103* | 0.098* |
| | Indonesia | 0.086* | 0.412* | 0.368* | 0.064 | 0.224 | 0.169 |
| | Turkey | 0.053* | 0.618 | 0.649 | 0.042* | 0.034* | 0.056* |
| | South Africa | 0.349 | 0.556 | 0.571 | 0.065 | 0.137 | 0.096* |
| | FZ(k) Test Stat. | 3.205 (0.001) | 6.356 (0.000) | 5.358 (0.000) | 5.513 (0.000) | 4.537 (0.000) | 2.235 (0.013) |
| $y_2$ | Brazil | 0.137* | 0.396* | 0.560 | 0.040* | 0.070* | 0.099* |
| | India | 0.171* | 0.382* | 0.174* | 0.057 | 0.137 | 0.121* |
| | Indonesia | 0.234 | 0.374* | 0.218* | 0.048* | 0.105* | 0.120* |
| | Turkey | 0.223 | 0.422 | 0.395* | 0.043* | 0.149 | 0.159 |
| | South Africa | 0.114* | 0.166* | 0.302* | 0.053* | 0.107* | 0.074* |
| | FZ(k) Test Stat. | 4.563 (0.000) | 3.486 (0.000) | 2.751 (0.003) | 3.201 (0.001) | 3.555 (0.000) | 2.962 (0.002) |
| $y_3$ | Brazil | 0.106* | 0.494 | 0.378* | 0.055 | 0.055* | 0.068* |
| | India | 0.058* | 0.342* | 0.171* | 0.057 | 0.125* | 0.098* |
| | Indonesia | 0.197 | 0.149* | 0.123* | 0.053* | 0.147 | 0.123* |
| | Turkey | 0.118* | 0.244* | 0.277* | 0.050* | 0.141 | 0.146 |
| | South Africa | 0.120* | 0.113* | 0.085* | 0.060 | 0.099* | 0.082* |
| | FZ(k) Test Stat. | 2.238 (0.013) | 2.149 (0.016) | 0.814 (0.208)* | 4.366 (0.000) | 3.539 (0.000) | 2.355 (0.009) |
| $z_1$ | Brazil | 0.230 | 0.556 | 0.486 | 0.058 | 0.083 | 0.088* |
| | India | 0.215 | 0.362* | 0.299* | 0.044* | 0.101* | 0.094* |
| | Indonesia | 0.098* | 0.481 | 0.445* | 0.059 | 0.104* | 0.085* |
| | Turkey | 0.110* | 0.320* | 0.351* | 0.050* | 0.089* | 0.116* |
| | South Africa | 0.307 | 0.541 | 0.537 | 0.064 | 0.128* | 0.113* |
| | FZ(k) Test Stat. | 5.236 (0.000) | 5.239 (0.000) | 4.225 (0.000) | 4.400 (0.000) | 2.817 (0.002) | 2.238 (0.016) |
| $z_2$ | Brazil | 0.055* | 0.446 | 0.343* | 0.051* | 0.111* | 0.083* |
| | India | 0.136* | 0.413* | 0.120* | 0.052* | 0.092* | 0.088* |
| | Indonesia | 0.155* | 0.341* | 0.206* | 0.038* | 0.128* | 0.117* |
| | Turkey | 0.112* | 0.455 | 0.399* | 0.046* | 0.094* | 0.122* |
| | South Africa | 0.108* | 0.415* | 0.335* | 0.056 | 0.097* | 0.096* |
| | FZ(k) Test Stat. | 2.138 (0.025) | 4.602 (0.000) | 1.975 (0.024) | 3.269 (0.001) | 3.004 (0.001) | 2.240 (0.013) |
| $z_3$ | Brazil | 0.257 | 0.456 | 0.496 | 0.031* | 0.109* | 0.116* |
| | India | 0.152* | 0.364* | 0.209* | 0.058 | 0.135 | 0.099* |
| | Indonesia | 0.198 | 0.296* | 0.239* | 0.058 | 0.145 | 0.130* |
| | Turkey | 0.190 | 0.338 | 0.365* | 0.038* | 0.150 | 0.157 |
| | South Africa | 0.303 | 0.485 | 0.457 | 0.044* | 0.078* | 0.108* |
| | FZ(k) Test Stat. | 6.404 (0.000) | 4.161 (0.000) | 3.121 (0.001) | 2.822 (0.002) | 4.102 (0.000) | 3.378 (0.000) |

**Note:** The variables $i = 1,2,3$ for $y_i$ and $z_i$ represent the financial development indicators of M2Y, PCD and DMB in equations (1) and (2), respectively. * indicates that the null hypothesis, which is the stationarity assumption, cannot be rejected. The critical values for the constant model at the 5% significance level are as follows (see Becker et al. (2006)): k=1→ 0.1720, k=2 → 0.4152, k=3 → 0.4480. The critical values for the constant and trend model at the 5% significance level are as follows (see Becker et al. (2006)): k=1→ 0.0546, k=2 → 0.1321, k=3 → 0.1423.

According to the results obtained from Table 3, according to the FZ (k) test statistic, which is the result indicator for the overall panel, it is concluded that the null hypothesis is rejected. That is, the series has a unit root for the overall panel. Therefore, it is concluded that the Fragile Five Countries do not converge both to the country group with the selected financial indicator in the top ten and to the average of the Fragile Five Countries. The considered stationarity test FPKPSS provides results for the panel as a whole, as well as individually. Individual test results are summarized in the tables below.

**Table 6: Individual Convergence Results for the Selected Four Country Groups in the Top Ten Financial Indicators of Fragile Five Countries**

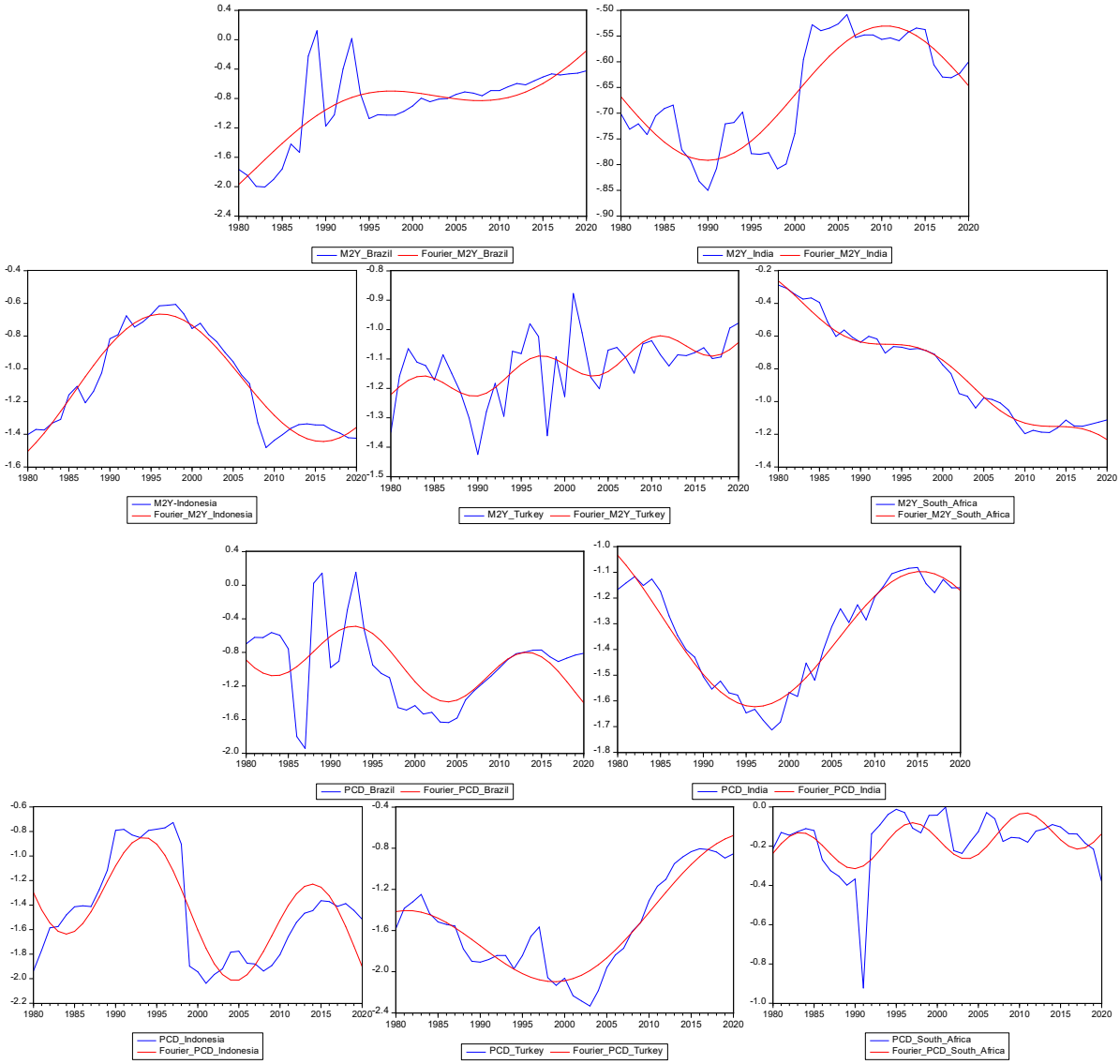
| | | M2Y | | | PCD | | | DMB | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | $k=1$ | $k=2$ | $k=3$ | $k=1$ | $k=2$ | $k=3$ | $k=1$ | $k=2$ | $k=3$ |
| **Constant Model** | Brazil | Stationary | Not | Not | Stationary | Stationary | | Stationary | Not | Stationary |
| | India | Stationary | Not | Stationary | Stationary | Stationary | Stationary | Stationary | Stationary | Stationary |
| | Indonesia | Stationary | Stationary | Stationary | Not | Stationary | Stationary | Not | Stationary | Stationary |
| | Turkey | Stationary | Not | Not | Not | Not | Stationary | Stationary | Stationary | Stationary |
| | South Africa | Not | Not | Not | Stationary | Stationary | Stationary | Stationary | Stationary | Stationary |
| **Constant and Trend Model** | Brazil | Not | Not | Stationary | Stationary | Stationary | Stationary | Not | Stationary | Stationary |
| | India | Not | Stationary | Stationary | Not | Not | Stationary | Not | Stationary | Stationary |
| | Indonesia | Not | Not | Not | Stationary | Stationary | Stationary | Stationary | Not | Stationary |
| | Turkey | Stationary | Stationary | Stationary | Stationary | Not | Not | Stationary | Not | Not |
| | South Africa | Not | Not | Stationary | Stationary | Stationary | Stationary | Not | Stationary | Stationary |

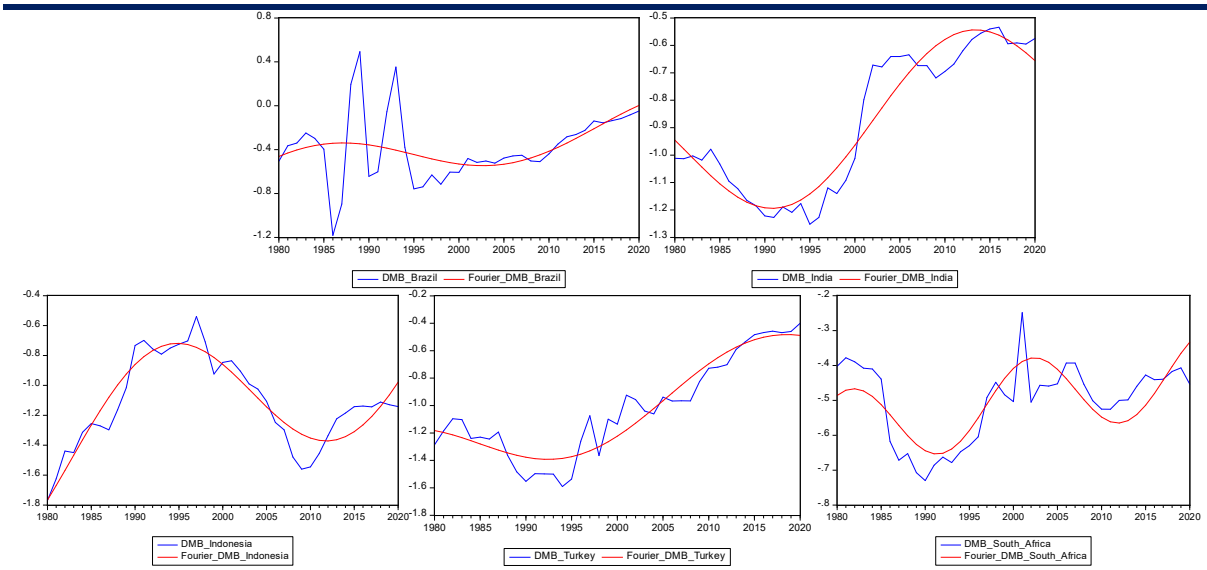
**Table 7: Individual Convergence Results by Mean for Fragile Five Countries**

| | | M2Y | | | PCD | | | DMB | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | $k=1$ | $k=2$ | $k=3$ | $k=1$ | $k=2$ | $k=3$ | $k=1$ | $k=2$ | $k=3$ |
| **Constant Model** | Brazil | Not | Not | Not | Stationary | Not | Stationary | Not | Not | Not |
| | India | Not | Stationary | Stationary | Stationary | Stationary | Stationary | Stationary | Stationary | Stationary |
| | Indonesia | Stationary | Not | Stationary | Stationary | Stationary | Stationary | Not | Stationary | Stationary |
| | Turkey | Stationary | Stationary | Stationary | Stationary | Not | Stationary | Not | Not | Stationary |
| | South Africa | Not | Not | Not | Stationary | Stationary | Stationary | Not | Not | Not |
| **Constant and Trend Model** | Brazil | Not | Not | Stationary | Stationary | Stationary | Stationary | Stationary | Stationary | Stationary |
| | India | Stationary | Stationary | Stationary | Stationary | Stationary | Stationary | Not | Not | Stationary |
| | Indonesia | Not | Stationary | Stationary | Stationary | Stationary | Stationary | Not | Not | Stationary |
| | Turkey | Stationary | Stationary | Stationary | Stationary | Stationary | Stationary | Stationary | Not | Not |
| | South Africa | Not | Stationary | Stationary | Not | Stationary | Stationary | Stationary | Stationary | Stationary |

In addition to the analysis results, the time path graphs of the financial indicator variables included in the analysis of the Fragile Five Countries are presented in Figure 2.

**Figure 2: Estimated Time Path of Fourier Functions of Variables**






It can be seen in Figure 2 that the estimated curves can capture the actual time path and reflect it well. Therefore, it is seen that allowing structural changes in order to catch soft transitions is necessary for the stagnation test.

## 5. Conclusion and Policy Implications

In this study, it is investigated whether the Fragile Five Economies convergence a similar level of financial development in the light globalization, advancing technology and deepening. For this purpose, M2Y (the ratio of liquid assets to GDP (%)), PCD (Private credit by deposit money banks and other financial institutions to GDP (%)), and DMB (Deposit money banks assets to GDP (%)) were chosen to represent the financial development. The convergence of the financial development indicators of the Fragile Five Economies to the average of advanced economies is tested for the period 1980-2020. The data used in the study were accessed from the World Bank official database. In order to carry out this study, the Fourier panel KPSS stationarity test, which was introduced to the literature by Nazlıoğlu & Karul (2017), was used. As a result of the tests, it is seen that the financial development indicators of the Fragile Five Countries do not converge to the selected country group and its average. Therefore , it is concluded that the Fragile Five Countries do not converge both to the country group with the selected financial indicator in the top ten and to the average of the Fragile Five Countries. In the light of these results, it can be stated that the financial markets for the selected country group are in a static structure. What is meant by static markets is that there is limited change in the structure and functioning of financial markets. In a static market, the prices and volumes of financial instruments do not change significantly over time, and the behavior of market players remains similarly stable. Naturally, such a market is generally predictable and low risk/low return and therefore investors attract low attention. Low demand also delays the need for changes in the market structure. This situation feeds itself in the form of a vicious cycle.

In addition, there may be many reasons why the financial depth of developing countries is lower than that of developed countries. It is seen that many factors expressing this situation

are mentioned in the economic theory and empirical literature in general. Firstly, the economic growth of developing countries is generally lower and this can also negatively affect the development of financial markets. Then, in developing countries, the structure of the public and private sectors is generally less developed and this may also have a negative impact on the development of financial markets. In addition, developing countries generally have less economic stability, which may negatively affect the development of financial markets. Last but not least, the development of financial markets may also be low, as the investment climate is generally less attractive in developing countries.

Some policies may need to be implemented to prevent this situation. For example, factors such as economic growth and stability, political risks, monetary policy can cause markets to change. Improvements in these indicators may increase the depth in financial markets. Firstly, it is necessary to improve the debt structures of these countries. In the debt structure, short-term debts should be reduced and long-term debts should be weighted. Also private loans should be restructured, both in terms of quantity and quality. In particular, the purpose of use of loans should be shaped in such a way that financial and real markets can function effectively. In this context, necessary regulations and guidance should be made in the banking sectors. Therefore, it can be inferred that there are weaknesses in financial systems in matters such as economic integration, liberalization, harmonization of regulations and globalization. For this, policy makers need to take new measures and increase existing ones.

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