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CONVERGENCE EXPERIENCES IN EMERGING MARKET ECONOMIES: (1950-2008)

GELİŞMEKTE OLAN PİYASA EKONOMİLERİNİN YAKINSAMA DENEYİMLERİ: (1950-2008)

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ABSTRACT

In this paper, we study the GDP per capita convergence in emerging market economies for the period of 1950-2008. As the convergence in emerging market economies hasn't been concerned as much as in the developed countries in the literature, hereby the situation of the convergence in emerging market economies is tried to be found out by the investigation. For this purpose, GDP per capita convergences in 25 developing countries were tested by ADF unit root test, Nahar and Inder (2002) Test and Kapetanios, Snell, and Shin (KSS) (2003) Test, which is based on the non-linear time series technique. While ADF unit root test allows to infer that there is convergence upon to the used series are stationary, the Nahar and Inder (2002) Test asserts that the existence of the convergence could also infer whether the used series are not stationary. On the other hand, the Kapetanios, Snell, and Shin (KSS) (2003) Test reveals that, if non-linear time series are stationary, the convergence could be inferred. In order to reach to the target aimed by the study, said tests were implemented. As per the results of Nahar and Inder (2002) Test, which emphasize that the existence of the convergence could be inferred whether the used series are not stationary? The findings show that there is

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polynomial type convergence toward the average of the sample in the 18 of those 25 market economies. Besides, findings also show that there aren't any non-linear effects in those sample countries and as per the Kapetanios, Snell, and Shin (KSS) (2003) Test results, it couldn't be inferred that there is any convergence over the sample.

Key words: *Convergence Hypothesis, Emerging Market Economies, ADF unit root test, Nahar and Inder (2002) Test, Kapetanios, Snell, and Shin (KSS) (2003) Test*

Jel Classification: *D31; E15*

ÖZET

Bu çalışmada 1950-2008 periyodundaki, gelişmekte olan piyasa ekonomilerindeki kişi başı gelir yakınsaması deneyimleri ele alınmaktadır. Gelişmekte olan piyasa ekonomilerindeki yakınsama literatürde gelişmiş ülkeler için olduğu kadar ilgi görmemiştir ve bundan dolayı bu çalışmayla gelişmekte olan piyasa ekonomilerindeki yakınsamanın durumu tespit edilmeye çalışılmaktadır. Bu amaçla gelişmekte olan 25 ülke ekonomisindeki kişi başı gelir yakınsaması standart ADF birim kök testi, Nahar ve Inder (2002) Testi ve doğrusal olmayan zaman serisi tekniğine dayanan KSS testi ile incelenmektedir. ADF birim kök testi incelenen serilerin durağan olması durumunda yakınsama çıkarımına izin verirken, Nahar ve Inder (2002) Testi ise incelenen serilerin durağan olmaması durumunda bile yakınsama çıkarımının yapılabileceğini ileri sürmektedir. Öte yandan KSS testi, doğrusal olmayan zaman serilerinde durağanlık bulgusunun yakınsama çıkarımı yaratacağını ortaya koymaktadır. Bu çalışmayla hedeflenen amaca ulaşabilmek için söz konusu testler uygulanmış olup ele alınan serilerin durağan olmaması durumunda bile yakınsama çıkarımının yapılabileceğini vurgulayan Nahar ve Inder (2002) Test sonuçlarına göre 25 piyasa ekonomisinden 18'inin örneklem ortalamasına doğru polynom–tipi yakınsama davranışı bulunmaktadır. Bununla birlikte, bulgular örneklem ülkelerinde herhangi bir doğrusal olmayan etki bulunmadığını ve Kapetanios, Snell, and Shin (KSS) (2003) Testi sonuçları ise örneklem ülkelerinde yakınsama bulgusu çıkarımı yapılamayacağını göstermektedir.

Anahtar kelimeler: Yakınsama hipotezi, Gelişmekte olan piyasa ekonomileri, ADF birim kök testi, Nahar ve Inder (2002) Testi, Kapetanios, Snell, ve Shin (KSS) (2003) Testi

Jel Sınıflaması: D31; E15

1. Introduction

The interests of the economists toward the growth literature have been highly increased along with the last 30 years. There are two main reasons for this. The collection of the macro economic variables for the long run by Madison (1982) is the first one. The second one is that the convergence hypothesis, which is the main inference of Solow model, and it could have been tested as the econometrical estimation models have been improved. The Neoclassical Growth Model suggests that there is an inverse relation between the latest per capita real income and the starting per capita real income under the closed economies. The diminishing revenue hypothesis (assumption) concerning the capital factor is the main reason of it. In this respect, the diminishing revenue of the capital in capital-poor countries decreases more slowly than the ones in the capital rich countries and, thereby, the capital-poor countries has higher growth rate (Baumol, 1986).

The first critical study, which tests the Convergence Hypothesis, was done by Baumol (1986). Baumol (1986) examined the per capita real income level of 16 industrialized countries for the period of 1870-1979 and achieved a highly strength inference of income convergence related with the said period. His study took the attention of the economists, who are interested in the growth literature. DeLong (1988) criticizes the study of Baumol (1986) suggesting that it has sample problem although it is more interesting. In accordance with DeLong (1988)'s evaluation, Baumal's study includes the 16 richest countries of the year for 1979, but the countries taken into consideration are not the 16 richest countries of 1870, which is the beginning of the period. This means that the beginning year and the ending year countries are not the overlapping economies within the perspective of the study and such a test cannot meet the expectation. Thus, his study is criticized as it is based on an ex post analysis by DeLong (1988)[3]. Dowrick and Nguyen (1989), Barro (1991), Barro and Sala-i Martin (1990, 1992), Mankiw, Romer and Weil (1992) were inspired by DeLong (1988) and tested the convergence hypothesis for various samples composed by different countries. These researchers reached to an inference, which implies that there are highly strength income convergences between not only countries but also regions under some assumptions, i.e. Neoclassical Growth Model. In the mid 1980s, just after the studied out of New Growth Theory, convergence hypothesis were placed on to the focus of varied discussions. Within those discussions, Romer (1986), Lucas (1988), King and Rebelo (1989) suggested that the convergence hypothesis could not be valid under the assumptions of the New Growth Theory. Therefore, the opinion got the power on that the studies, which aspire to test the convergence hypothesis investigate the stress that exists between the New Growth Theory and the Neoclassical Growth Theory (Islam, 2003). The results in favour of the convergence are

[3] Detailed by DeLong (1998)

perceived as the evidence of validness of New Growth Theory and against them are perceived as the evidence of validness of the Neoclassical Growth Theory.

There are two basic descriptions concerning the Convergence Hypothesis in the literature (Barro and Sala-i Martin, 1992). One of them is called as "β - convergence" and the other is called as "σ - convergence". When β - convergence states that if the growth rate of the poor countries are higher than the rich ones, the poor countries incline in a convergence, the σ - convergence reveals that the convergence tendency comes up if there is any decrease in the dispersions (standard deviations) of the countries' per capita real GDP series.

For example, let suppose that there are per capita real GDP series of the economies in the chosen sample and the yearly growth rate of the "economy i" is $y_{i,t,t+T} \equiv \log(y_{i,t,t+T})/T$ in between the t & $t+T$ period and if at " t " the logarithm of per capita real GDP series of it is as $\log(y_{i,t})$ and through the below regression estimation,

$$y_{i,t,t+T} = \alpha - \beta \log(y_{i,t}) + \varepsilon_{i,t} \quad (1)$$

The result" $\beta > 0$ " is achieved, it can be stated that the data set shows β - convergence. For the σ - convergence, meeting the below stated condition is accepted as sufficient.

$$\sigma_{t+T} < \sigma_t \quad (2)$$

From this point of view, Cheshire and Carbonaro (1995, 1996) argue that β - convergence is not suitable for testing the Neoclassical Growth Model and it does not bring any healthy measure. Additionally, they put forth this thought both in practise and measurement terms. Furthermore, the similar of the Cheshire and Carbonaro (1995, 1996)'s inference has been brought out by Quah (1993, 1996a and 1996b) & Friedman (1992). The indication that most of the main studies, by which the convergence hypothesis is theoretically and empirically tested, are insufficient is the common point of Quah and Friedman because these studies does not reply the question of whether the rich countries converge the poor countries or not. The criticisms of Quah and Friedman are based on the problems caused by the horizontal cross section data set. Especially, when considering the situation dealing with the convergence analysis, horizontal cross section analysis has some problems as the horizontal cross section analysis analyzes the issue of whether the sample shows convergence behaviour as a whole or not. Therefore, it does not provide information about the internal mobility of the sample. As an example, there can be a group of countries contained by a horizontal cross section data set, which shows divergence behaviour and it is defined by the neoclassical growth model (Cheshire and Carbonaro, 1996). Besides, when we look at the hypothesis tests considered in

the horizontal cross section, it is understood that the null hypothesis denotes the absence of the converging country and the alternative hypothesis asserts that all of the countries converge and the mid positions are excluded from the analysis. As of these inconveniences, Bernard and Durlauf (1995, 1996), Greasley and Oxley (1997), Evans and Karras (1996) suggested a new test technique based on time series. In addition to their suggestion, in order to eliminate the mentioned inconveniences, Islam (1995) has put forth another test based on panel data. By their analysis, Bernard and Durlauf (1995) included the per capita real GDP series of 15 OECD countries and rejected the convergence hypothesis depending on ADF unit root test. Nahar and Inder (2002) inspired by the study of Bernard and Durlauf (1995) and has reached to a strong convergence inference through a polynomial type convergence investigation, in which they included per capita real GDP series of 22 OECD countries although it is compatible with the new convergence description expressed by Bernard and Durlauf (1995). Even though the used series are not stationary, Nahar and Inder (2002) test is important as it shows that the convergence can be inferred.

In the 2000s, the interests of the economists slide toward the time series techniques, thereby Kapetanios, Snell, and Shin (2003) put forth a unit root test (KSS) based on STAR models (Smooth Transition Auto Regressive Models). KSS test based on the ESTAR (Exponential Smoothing Threshold Autoregressive) methodology and it is important as it provides to get the instant constructional refractions at the used series out. Because of this reason, for the convergence analysis, a rising interest in the nonlinear techniques came out.

The recent advancements in nonlinear time series analyses show that the more suitable methods are nonlinear time series techniques for modelling the macroeconomic time series. As asserted by the economic theory, if the market dynamics cause to shifts from the main equilibrium as of the nonlinear shocks, ESTAR (Exponential Smoothing Threshold Autoregressive), which is one of the STAR models (Smooth Transition Auto Regressive Models) that are theoretically founded by Terasvirta and Anderson (1992) and Terasvirta (1994) is a suitable macroeconomic modelling process.

Kapetanios et al (2003) have asserted a test procedure, which is more powerful than the conventional Dickey-Fuller test and let constructional refractions. This test is based on ESTAR modelling process. It is known as KSS (Kapetanios, Snell, and Shin) test as mentioned above. In order to find out whether the convergence is nonlinear or not, it is applied on to the differences between the sample average and each of the per capita real GDP series of 25 emerging market economies herein the study,

As per the literature, it is thought that the convergence brings out meaningful inferences for the samples related with the developed countries, generally for the period that follows the 2.nd World War. By the way, at this point, it might be stated that the convergence hypothesis has mostly

been tested for the country groups such as EU, OECD and G-7. There has not been much study for the emerging market economies. The definition of emerging market economies is used in order to express an upward trend of the social and economic activities during a country's growth and industrialization process.

Recently, there are 28 countries having emerging market economies. The trade between these countries has been increasing steadily. This advancement can cause to convergence. Thereby, through this study, it is aimed to find out whether those economies converge or not for the period of 1950-2008, for 60 years long. In the study, the differences between the sample average and each of the per capita real GDP series of 25 emerging market economies are used. For the convergence research, ADF unit root test that is based on the linear time series technique, KSS unit root test, which is based on nonlinear time series technique and Nahar & Inder test, which tests the polynomial type convergence are applied in this study. Because of the applied tests, the findings show that there are polynomial convergences in the emerging market economies.

2. DATA SET

In this study, the logarithmic values of the per capita real GDP series of 25 emerging market economies for the period of 1950-2008. The data set consists of the yearly observation values of the per capita GDP logarithm and the Data Set has been obtained from web site address,"www.ggdc.net". Argentina, Algeria, Brazil, Bulgaria, Ecuador, Peru, Chilli, Venezuela, Colombia, Romania, Turkey, Hungary, Poland, Tunisia, Egypt, Morocco, South Africa, Hong-Kong, South Korea, China, India, Indonesia, Malaysia, Philippines, and Mexico are the countries, of which emerging market economies are included in the sample. The per capita income real GDP series has been obtained from the Geary-Khamis data set which was calculated according to USD values of 1990. There are two main features of the study. The application of Nahar-Inder test, which provides investigations by polynomial type convergence, is one of them and the other is the application of KSS test, which provides the nonlinear convergence investigation. Besides, the de-meaned series were used in the study and through the Figure 1; the logarithms of per capita incomes of 25 emerging market economies are shown. It can be easily seen from the figure that per capita real incomes of those countries tend to increase steadily. Because of the series subtracted from the average are to be used in the study, the courses in time of those series were subtracted from the average, calculated for the emerging market economies are important. At the "Figure 2", the per capita real GDP series subtracted from the average of the 25 emerging market economies are shown.

When convergence hypothesis is tested, by σ-convergence, which is described by Sala-i Martin (1996), it is investigated that whether the whole of the sample is in a trend of convergence or not. As mentioned before, the σ- convergence reveals that the convergence tendency comes up if,

there is any decrease in the dispersions (standard deviations) of the countries' per capita real GDP series.

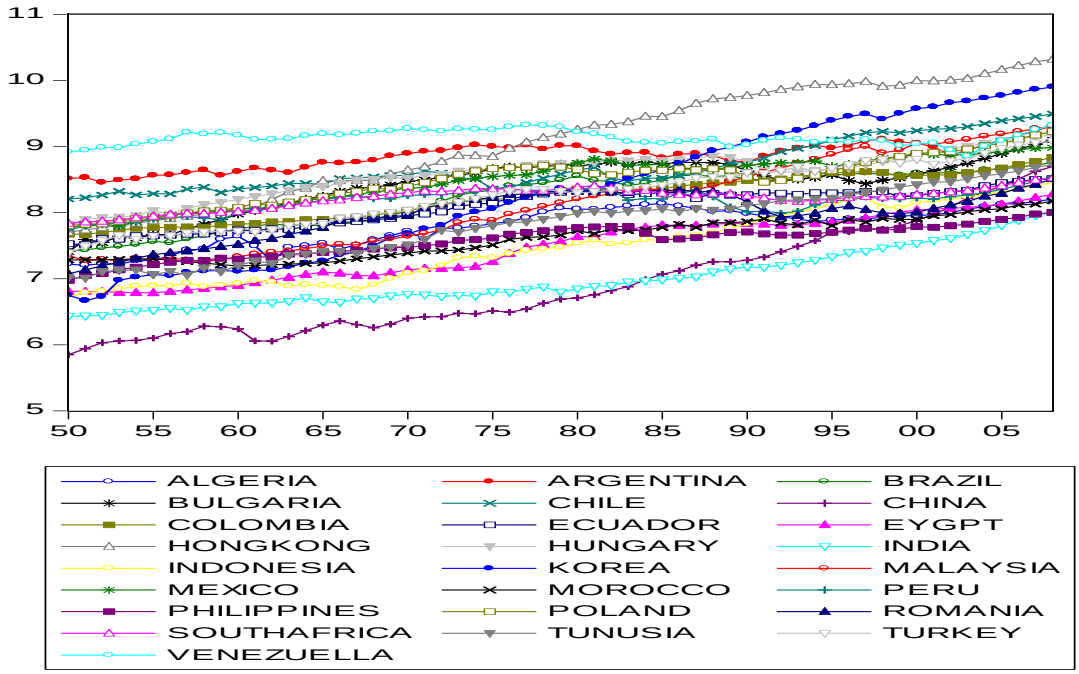

Figure 1: 25 Per capita Real GDP series of the 25 emerging market economies included in the study.

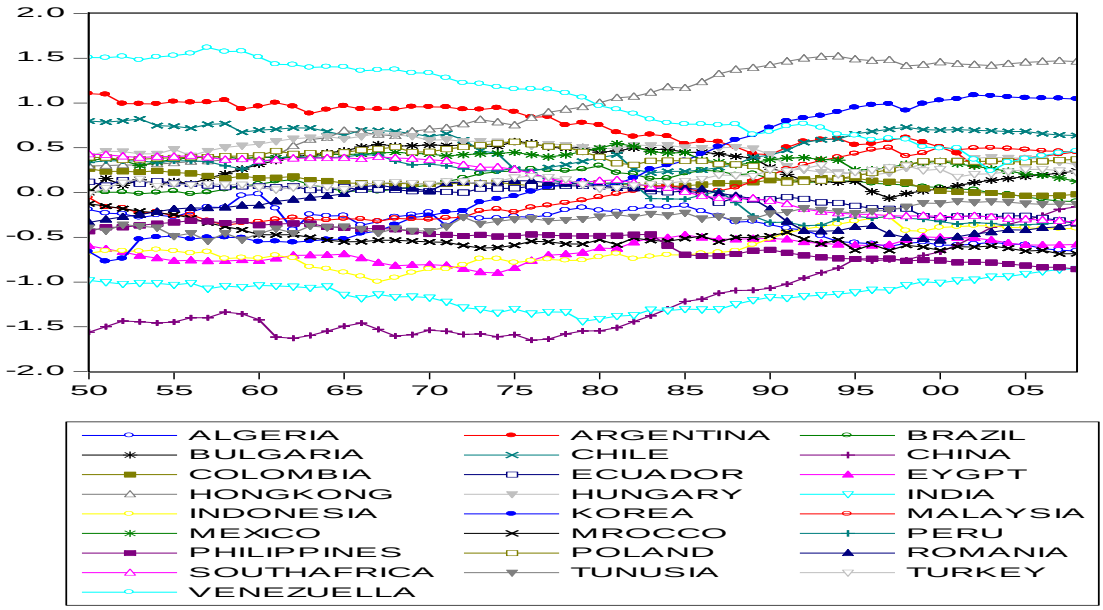

Figure 2: The per capita real GDP series subtracted from the average of the 25 emerging market economies.

The Figure 3 displays how the standard error of per capita real GDP differences of 25 emerging market economies for the period 1950-2008 alters. After the examination of the outputs of figure

3, it is seen that there are two important results. One of them is that the standard error does not display much decrease within the period of 1950-1970. Conversely, along with the posterior period of 1970, the display of the rapid fall of standard error is the second one. Thereupon, concerning whole of the sample, especially in the posterior period of 1970, it can be supposed that the convergence of the 25 emerging market economies is more rapid in the view of the standard error decrease criteria. σ-convergence, which is based on horizontal cross section analysis, does not provide information to illustrate internal mobility for the sample. It covers the sample in whole and does not provide any possibility to decompose the countries that show different behaviours within the sample. Thus, in order to expose the countries displaying different behaviours by means of convergence, Bernard and Durlauf (1996), Greasley and Oxley (1995, 1997), Nahar and Inder (2002) studied the description issue of convergence by time series.

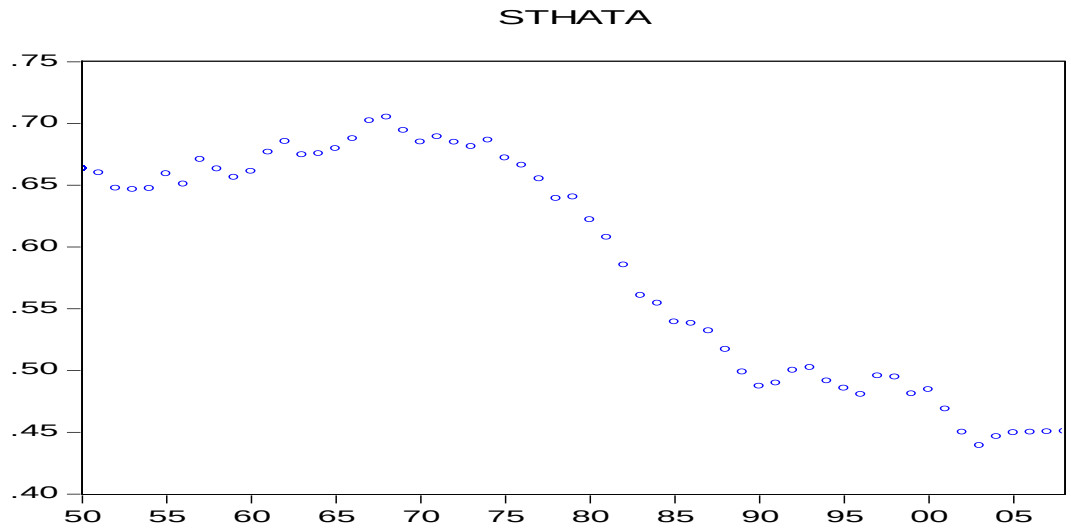

Figure 3: The standard deviation of the per capita real GDP values of 25 emerging market economies for the period "1950-2008"

3. ECONOMETRICAL METHOD

a) Nahar and Inder (2002) Test

Bernard and Durlauf (1996) proposed a new definition of convergence, which relies on the notions of unit roots and co integration in time series.

Countries i and j converge if the long-term forecasts of output for both countries are equal, that is:

$$\lim_{n\to\infty} E\left(y_{it+n} - y_{jt+n} \middle| I_t\right) = 0 \qquad (3)$$

Where I_t denotes all information available at time t.

Countries $m = 1,2,\ldots,N$ converge if the long-term forecasts of output for all countries are equal, that is:

$$\lim_{n \to n} E\left(y_{1t+n} - y_{mt+n} \middle| I_t\right) = 0 \quad \forall m \neq 1 \tag{4}$$

The definition of convergence asks whether the long-run forecasts of output differences tend to equal zero as the forecasting horizon approaches infinity. Bernard and Durlauf (1996) state that the above definition of convergence will be satisfied if $y_{1t} - y_{mt}$ is a mean zero stationary process.

Consequently, Nahar and Inder (2002) proposed a new procedure to test convergence hypothesis. Nahar and Inder (2002) test allows non-stationary processes to converge. When testing for convergence with respect to average throughout the period, the income differential between country i and the average is considered and the procedure starts by equation (5).

$$w_{i,t} = \log Y_{i,t} - Average_t \tag{5}$$

When convergence takes place $w_{i,t}$ gets closer to zero. For the empirical application, $w_{i,t}$ is defined as a function of time:

$$w_{i,t} = \Theta_0 + \Theta_1 t + \Theta_2 t^2 + \ldots + \Theta_{k-1} t^{k-1} + \Theta_k t^k + \varepsilon_{i,t}. \tag{6}$$

From equation (6), one can easily find the slope function:

$$\frac{\partial}{\partial t} w_{i,t} = f'(t) \tag{7}$$

One can use estimates of this slope function to check the convergence of an economy. In reality, the $w_{i,t}$ series may not have a tendency to decrease uniformly with time. However, if the economy tends to converge, then $w_{i,t}$ should be generally decreasing. One considers whether the average of these slopes is negative. It is believed that for convergence to hold, the average slope function of $w_{i,t}$ will be negative. That is:

$$\frac{1}{T} \sum_{t=1}^{T} \frac{\partial}{\partial t} w_{i,t} < 0 \tag{8}$$

This can be obtained from equation (7) as follows:

$$\frac{1}{T}\sum_{t=1}^{T}\frac{\partial}{\partial t}w_{i,t} = \Theta_1 + \Theta_2 r_2 + \ldots + \Theta_{k-1} r_{k-1} + \Theta_k r_k = r'\Theta$$

Where

$$r_2 = \frac{2}{T}\sum_{T=1}^{T} t, \ldots, r_{k-1} = \frac{(k-1)}{T}\sum_{t=1}^{T} t^{k-2},$$

$$r_k = \frac{k}{T}\sum_{t=1}^{T} t^{k-1}$$

$r = [0\ 1\ r_1 \ldots r_{k-1}\ \ r_k]$, and $\Theta = [\Theta_0\ \Theta_1 \ldots \Theta_{k-1}\ \Theta_k]$.

To test convergence hypothesis, one can define the following null hypothesis $H_0 : r'\Theta \geq 0$, against the alternative hypothesis $H_1 : r'\Theta < 0$. Thus, the null hypothesis was set as no convergence. In order to test this, equation (6) was estimated by ordinary least squares (OLS), and then it performs a t-test of this restriction on the Θ vector.

b) Kapetanios, Snell, and Shin (KSS) (2003) Test

The KSS test is based on non-linear unit root framework. We first check the linearity of the de-meaned series by the linearity test of Luukkonen *et al.* (1998). The following model is estimated:

$$z_t = \theta_0 + \left[\sum_{k=1}^{p}\left(\theta_{1k} z_{t-k} + \theta_{2k} z_{t-k} z_{t-d} + \theta_{3k} z_{t-k} z_{t-d}^2\right)\right] + \theta_4 z_{t-d}^3 + \varepsilon_t \qquad (9)$$

The main hypothesis of linearity ($\theta_{2k} = \theta_{3k} = \theta_{4k} = 0$ for all k) is tested against the alternative hypothesis of linearity using the $F-$type test statistic. The optimal autoregressive lag length (k) and optimal delay lag length (d), which are determined empirically based on sample data, are chosen from $k \in \{1,\ldots,4\}$ and $d \in \{1,\ldots,4\}$ such that the $F-$test statistic is optimized. If the series are non-linear then we can use the KSS test.

KSS propose a testing procedure to detect the presence of non-stationarity against non-linear but globally stationary exponential smooth transition autoregressive (ESTAR) process:

$$\Delta y_t = \gamma y_{t-1}\left[1-\exp\left(-\theta y_{t-1}^2\right)\right]+\varepsilon_t \quad (10)$$

Where y_t is the de-meaned series of interest and ε_t is an i.i.d. error with zero mean and constant variance. Meanwhile, $\theta \geq 0$ is known as the transition parameter of the ESTAR model that governs the speed of transition. The null hypothesis of this test procedure is $H_0 : \theta = 0$ against the alternative $H_1 : \theta > 0$. However, testing this null hypothesis directly is not feasible, since γ is not identified under the null. Thus, based on Taylor series approximation, KSS reparameterizes the equation (10) to obtain equation (11).

$$\Delta y_t = \delta y_{t-1}^3 + \sum_{j=1}^{p} \beta_j \Delta y_{t-j} + \varepsilon_t \quad (11)$$

In order to correct for plausible serially correlated errors. The null hypothesis to be tested is $H_0 : \delta = 0$ against the alternative $H_1 : \delta < 0$. Following Bernard and Durlauf (1996), we can say that if the non-linear unit root is not contain considered time series, then these series are stationary and convergence hold.

VI. APPLICATION AND RESULTS

First, we explore convergence for de-meaned series with using ADF- test. Second, we explore convergence for de-meaned series with using Nahar and Inder test. Third, if de-meaned series has non-linear effect, we can use KSS test. Table 1 shows ADF test results for the 25 emerging markets.

Table1: ADF test results for the 25 emerging markets (gap from average).

	Squared Demeaned Output		Demeaned Output	
Country	**Lag length**	**Test Statistic**	**Lag length**	**Test statistic**
Argentina	2	-0.7706	2	-0.6591
Brazil	0	-1.6810	2	-1.4110
Bulgaria	3	-1.6648	1	-1.0354
China	1	-0.0388	1	-1.2875
Chile	1	-1.5738	1	-1.5755
Colombia	4	-4.3019*	1	-1.0741
Ecuador	0	-2.1260	0	0.4473
Algeria	1	0.3775	0	-0.9536
Eygpt	1	-1.8667	1	-1.7088
Hongkong	3	-1.0119	3	-1.4493
Hungary	1	-0.8643	1	-1.0214
Indonesia	1	-0.9094	1	-0.7403
India	8	-2.7555	8	-2.5229
Korea	5	-1.3478	1	-0.9249
Morocco	1	-1.7413	1	-3.2828*
Mexico	1	-1.3965	1	-0.5437
Malaysia	3	-1.1816	1	0.0552

Peru	1	-2.3028	2	-0.4261
Philippines	4	1.1282	2	0.1100
Poland	1	-1.6182	1	-1.8304
Romania	5	-2.1919	1	-1.3129
Tunisia	7	-1.4686	6	-0.1381
Turkey	4	-0.8690	0	-2.3102
Venezuela	4	-0.8729	0	-0.2560
South Africa	1	-1.5788	1	0.1778

P.S: * at the %5 meaningful level, it shows that there is a convergence.

As per Table 1 and in accordance with the ADF test results, serious convergence tendency could not be reached to. However, a few convergence behaviours are seen in the table. For the squared de-meaned output series, only Colombia and for the de-meaned output series, only Morocco shows convergence behaviours. Thereupon, for the squared de-meaned output series equation, 6 were estimated and its results are shown in Table 2.

Table 2: Results of Nahar and Inder Test

Squared demeaned output

Country	Polynomial order	Average slope	t-ratio
Argentina	7	-0.09646	-2.2275*
Brazil	6	-0.00097	-8.8026*
Bulgaria	6	0.00104	0.5853
China	5	-0.0421	-5.4907*
Chile	8	-0.0892	-6.7039*
Colombia	3	-0.0013	-6.0704*
Ecuador	8	-0.0465	-5.8428*
Algeria	7	-0.0357	-5.6324*
Eygpt	7	-0.0657	-6.1855*
Hongkong	6	-0.0073	-0.7285
Hungary	7	-0.0953	-5.3987*
Indonesia	5	-0.0046	-1.8413*
India	6	-0.0139	-2.0974*
Korea	5	0.0062	1.0962
Morocco	5	0.0066	5.2105
Mexico	4	-0.0014	-2.6435*
Malaysia	5	-0.0373	-12.1045*
Peru	6	-0.0105	-6.7178*
Philippines	4	0.0015	1.4573
Poland	7	0.0019	1.5117
Romania	8	-0.0053	-1.9978*
Tunisia	6	-0.0020	-2.4953*
Turkey	5	0.0005	1.8759
Venezuela	4	-0.0348	-9.4382*
South Africa	8	-0.0916	-5.2999*

P.S: * at the %5 meaningful level, it shows that there is a convergence.

In accordance with this table, 18 emerging market economies of those 25 show convergence behaviour toward the average. They are, respectively, Argentina, Brazil, China, Chile, Colombia, Ecuador, Algeria, Egypt, Hungary, Indonesia, India, Mexico, Malaysia, Peru, Romania, Tunisia, Venezuela, and South Africa. The others, which do not show any convergence behaviour, are Bulgaria, Hong-Kong, Korea, Morocco, Philippines, Poland, and Turkey. On the other hand, this table also exposes that a lot of them show linear convergence behaviour toward the average.

With the thought of that the used series could be non-linear, in order to apply the KSS test, the linearity test proposed by Luukkonen *et al.* (1998) was applied as well. Thereby, the equation 9 was estimated for each of the de-meaned series and their results are shown in Table 3.

Table 3: Linearity Tests for Emerging Markets

Country	**Lag Length (k)**	**Delay Parameter (d)**	**F-Test**
Argentina	2	1	2.9130**
Brazil	2	1	2.0244*
Bulgaria	3	1	3.1555**
Chile	4	1	2.0815**
China	2	1	2.3306**
Colombia	2	1	1.1195
Ecuador	1	1	0.8985
Egypt	2	1	3.0567**
Hungary	3	1	5.1924***
Hong-Kong	2	1	2.5826**
India	2	1	2.5052**
Indonesia	1	1	1.0340
Korea	2	1	4.4132***
Morocco	1	1	1.9456
Mexico	1	1	1.4380
Malaysia	2	1	4.2354***
Peru	2	1	2.6588**
Philippines	2	1	1.9151
Poland	2	1	0.7374
Romania	2	1	2.6429**
Tunisia	1	1	3.1511**
Turkey	1	1	6.1876***
Venezuela	1	1	3.3541**
Algeria	2	1	6.9024***
South Africa	1	1	5.2936***

Note: *; **, and *** shows that respectively significance level %10, %5, and %1.

As per this table, being non-linear, Poland, Philippines, Mexico, Morocco, Indonesia, Ecuador, and Colombia have to be taken out of the sample when applying the KSS test. Meanwhile, this result indicates that the KSS test can be applied for de-meaned per capita real GDPs that belong to the countries, in which the linearity hypothesis are rejected. The series that belong to the countries, for which the KSS tests conclude stationarity, show convergence behaviour toward the average. Table 4 was constituted in order to show the concerning results of the analysis. Table 4, indicates that KSS test does not bring us meaningful results related with the emerging markets. Thus, it is impossible to state that there is any non-linear convergence between the countries. The convergence for the emerging markets substantially comes out through the Nahar and Inder (2002) test as linear. The

KSS test gives stationary results for only Malaysia under %5 meaningful level. There upon, Malaysia is the only one, which shows convergence behaviour toward the average.

Table 4: KSS Test Results for 18 Emerging Markets

Country	Lag Length	tNL-statistic
Argentina	0	-2.1229
Brazil	2	-2.0149
Bulgaria	4	-1.0155
Chile	3	-1.4720
China	3	-1.1384
Egypt	5	-1.0310
Hungary	1	-1.0112
Hong-Kong	7	-0.5382
India	3	-0.5940
Korea	6	-1.0609
Malaysia	12	-3.1221**
Peru	1	-0.8447
Romania	1	-0.9856
Tunisia	0	-1.5547
Turkey	1	-2.0180
Venezuela	0	-2.0188
Algeria	3	1.1744
South Africa	1	-0.4217

V. CONCLUDING REMARKS

The most important finding of Solow Model is that the convergence hypothesis has produced successful results related with the developed countries' samples mostly within the posterior period of the World War II. However, reversely, there has not been any important study executed for the emerging markets. The lack of the study about the said markets has led us to investigate the matter and we tested the convergence hypothesis related with the emerging markets. For such a study, we applied both Nahar and Inder (2002) test, which is based on linear time series test technique together with the KSS (2003) test, which is based on non-linear time series test technique. In the study, 25 emerging markets were taken into consideration. In accordance with the Nahar and Inder (2002) test results, while 18 of those countries show linear convergence behaviour toward the average, there is not any convergence behaviour related with 7 of them. As per the KSS test, there is a convergence toward the average only for Malaysia. Thereby, through these findings, it possible to reach a result that there is not any non-linear effect. This study has put forward two important conclusions. The first one is that the sample consists of emerging market economies and the study is the first one, which covers such a wide range of countries' group. The second one is of the kinds of used test techniques. In other words, in this study, both of the analysis techniques that study the

linear and non-linear convergences out are used. Finally, the findings clearly state that the emerging markets show linear convergence behaviour toward the average.

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