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THE RELATIONSHIP BETWEEN SAVINGS AND ECONOMIC GROWTH IN COUNTRIES WITH DIFFERENT LEVEL OF ECONOMIC DEVELOPMENT

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Abstract

The aim of this paper is to analyze the cause and effect relationship between economic growth and savings in advanced economies and in emerging and developing countries[2]*. In this work we used the method based on studies in macroeconomics and international finance as well as econometric methods (co-integration models and Granger's causality test). All statistical data used in this paper came from the International Monetary Fund database (World Economic Outlook database). The results confirmed the existence of one-way casual relationship between gross domestic savings and gross domestic product in the case of developed countries as well as in developing and transition countries. At the same time it was revealed the absence of causal relationship between gross domestic product and gross domestic savings both in developed economies and developing and transition countries.*

JEL classification: D91, E21
Key words: savings, economic growth, co-integration

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Introduction

A quick review of literature on the relationship between savings and economic growth indicates a positive relationship between domestic savings and economic growth. This positive relationship can be explained with several hypotheses. The first one assumes that increased savings may stimulate economic growth through increased investment (Bebczuk 2000). This approach is supported by Harrod (1939), Domar (1946) and Solow (1956) growth models. Also results of empirical research by Alguacil, Cuadros and Orts (2004) as well as by Singh (2009) provide support for the hypothesis that increased savings promote economic growth. The theories of economic growth stipulate that the dynamics of the country's

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[2] In World Bank and International Monetary Fund papers, the group of economically developed countries is called *advanced economies*. The group of developing countries, on the other hand, is known as *developing economies*, while since 2004 they have been defined as *emerging markets and developing countries*. The first group of countries includes 34 economies, while the second group includes 150 countries. Due to the limited availability of statistics on various countries, the study was based on available statistical data on average rates of saving and economic growth in developed countries, as well as in emerging and developing countries.

economic growth increases if the investment in human or material capital or in scientific research and development (R&D) grows. However, if the country has access to international financial markets, it may not necessarily develop faster due to domestic savings, as investment may be financed with foreign savings (Guterries, Solimano, 2007).

The second hypothesis, on the other hand, has it that economic growth stimulates increased savings. This approach is backed up by the Keynes model (1936). Moreover, the results of empirical research carried out by Sinh and Sinh (1998), Saltz (1999), Agrawal (2001), Anoruo and Ahmad (2001), Narayan and Narayan (2006) and Abu (2010) confirm this hypothesis.

Economic growth and domestic savings in view of the empirical analyses results

Economic literature usually analyzes the relationship between economic growth and savings using the correlation coefficient and dynamic econometric models. Bacha (1990), Otani and Villanueva (1990), DeGregorio (1992), Jappelli and Pagano (1994) in order to analyze the relationships between savings and economic growth used the ordinary least squares method (OLS). Their research proved that the higher the domestic savings rate (share of domestic savings in GDP), the higher the economic growth rate. Also research carried out by Krieckhaus (2002) in 32 countries indicates that higher level of domestic savings led to higher investment levels and thus contributed to higher rate of economic growth in analyzed countries.

Recently a lot of research on relationship between savings and economic growth has used the concept of the Granger causal relationship. Caroll and Weil (1994), basing on the data of five-year average rates of economic growth in OECD member states and using Granger causality test came to the conclusion that the rate of economic growth was the cause of savings in Granger sense. However, Attanasio, Picci and Scorcu (2000) questioned the reliability of the results obtained by Caroll and Weil (1994), implying that the use of annual data instead of average data from five years improves the precision and statistical importance of estimates and changes the structure of the causal relationship between variables.

Mohan (2006), using the Granger causality test, analyzed the relationship between economic growth and savings in four groups of countries with various levels of economic development in the 1960-2001 period. The results of this research turned out to be ambiguous and revealed that in 13 of the analyzed countries economic growth was the cause of increased savings in Granger sense. The opposite results, pointing at savings being the cause of economic growth, were obtained in two countries. Also in other two countries no causal relationship between savings and economic growth was observed. In five countries, however, the scientist confirmed the existence of a two-way relationship between economic growth and savings.

We can also observe the growing importance of the research on the relationship between savings and economic growth using the co-integration techniques. Katircioglu and Naraliyeva (2006) analyzed the relationships between domestic savings, direct foreign investment and economic growth in Kazakhstan in the 1993-2002 period using the Granger causality test and co-integration methods. The results of their research pointed at the existence of one-way, positive relation between domestic savings and economic growth in Kazakhstan in a long period of time.

Saltz (1999) using the model of vector error correction (VEC) and the model of vector auto regression (VAR) analyzed the relation between savings and economic growth in seventeen countries from all over the world. The results of the analysis indicated that in nine of the analyzed countries economic growth was the cause of increased domestic savings. In two countries the opposite relation was noticed, while in three other countries no causal relation between economic growth and domestic savings was identified. Finally, in two countries, the existence of a two-way causal relation between analyzed variables was confirmed. Also Baharumshah, Thanoon and Rashid (2003) examined the relation between economic growth and savings in five Asian countries (Singapore, South Korea, Malaysia, Thailand and Philippines). On the basis of statistical data from the 1960-1997 period and using the VECM model, the authors reached the conclusion that the growth rate of savings was not the economic cause of economic growth in Granger sense in all analyzed countries with the exception of Singapore.

Economic growth and savings in advanced economies and in developing and emerging countries

To analyze the cause and effect relation between the size of savings and the speed of economic growth, we used co-integration methods and Granger causality test, which are the most frequently used methods of analyzing relations between savings and economic growth in economics. The econometric model used in this paper is based on the Keynes model (1936) and the Solow hypothesis (1956). According to the Keynes model, savings (S) are the function of economic growth (Y), which can be presented by the formula below:

$$S = \alpha_0 + \alpha_1 Y + U_1 \qquad (1)$$

where:

S = savings,
Y = economic growth,
α_0 = free term in the equation
α_1 = savings to economic growth sensitivity coefficient,
U_1 = random component.

On the other hand, according to the Solow hypothesis, savings are a determinant of economic growth. In this way, economic growth is the function of savings, which can be presented by the formula below:

$$Y = \beta_0 + \beta_1 S + U_2 \qquad (2)$$

where:

S = savings,
Y = economic growth,
β_0 = free term in the equation,
β_1 = economic growth to savings sensitivity coefficient,
U_2 = random component.

To assess the relation between economic growth and savings in advanced economies and in developing and emerging countries, two econometric models contoured on the basis of models (1) and (2) were used:

$$GDS_t = \sum_{i=1}^{n} \alpha_1 GDS_{t-i} + \sum_{i=1}^{n} \alpha_2 GDP_{t-i} + U_{1,t} \quad (3)$$

$$GDP_t = \sum_{i=1}^{n} \beta_1 GDP_{t-i} + \sum_{i=1}^{n} \beta_2 GDS_{t-i} + U_{2,t} \quad (4)$$

where:

GDS = (*Gross National Savings*) gross domestic savings in relation to GDP (as percentage),
GDP = (*Gross Domestic Product*) gross domestic product (percentage changes in fixed prices),
α, β = sensitivity coefficient,
U = residual component,
t = period of analysis,
i = number of variable delays.

All the above mentioned time series had annual frequency and covered the 1980 to 2009 period, together with the economic growth and savings forecasts until 2010. In the analysis we assumed one period of lag between independent variables and dependent variable (one year). The choice of lag range was made in accordance with the results of information criteria of Akaike model, Schwartz-Bayesian and Hannan-Quinn. According to those criteria, the biggest information capacity is characteristic of a single lag model.
Finally, the changes of the indicators used in the model were as on the figures below [Figure 1 and 2].

Figure 1: Average households' savings rate and average GDP dynamics in advanced economies in the 1980-2010 period

Source: World Economic Outlook, (2010)

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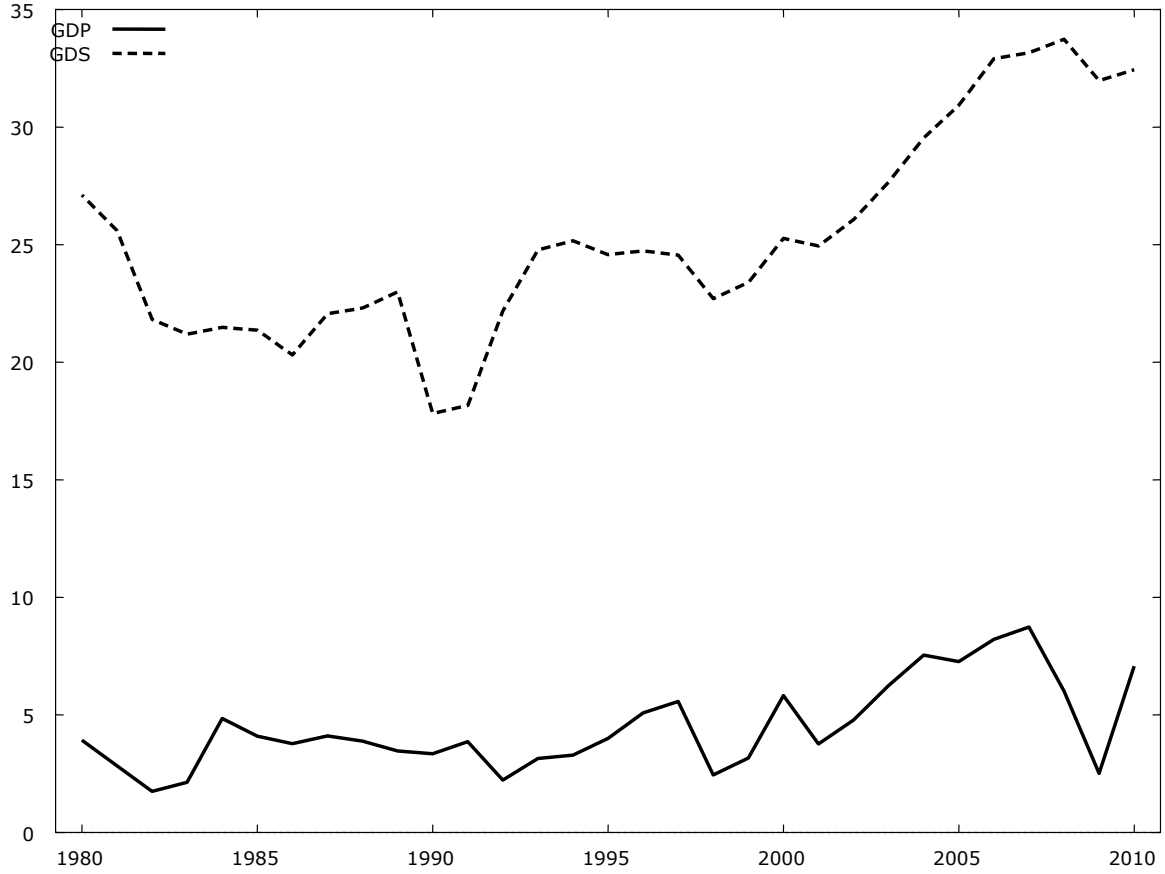
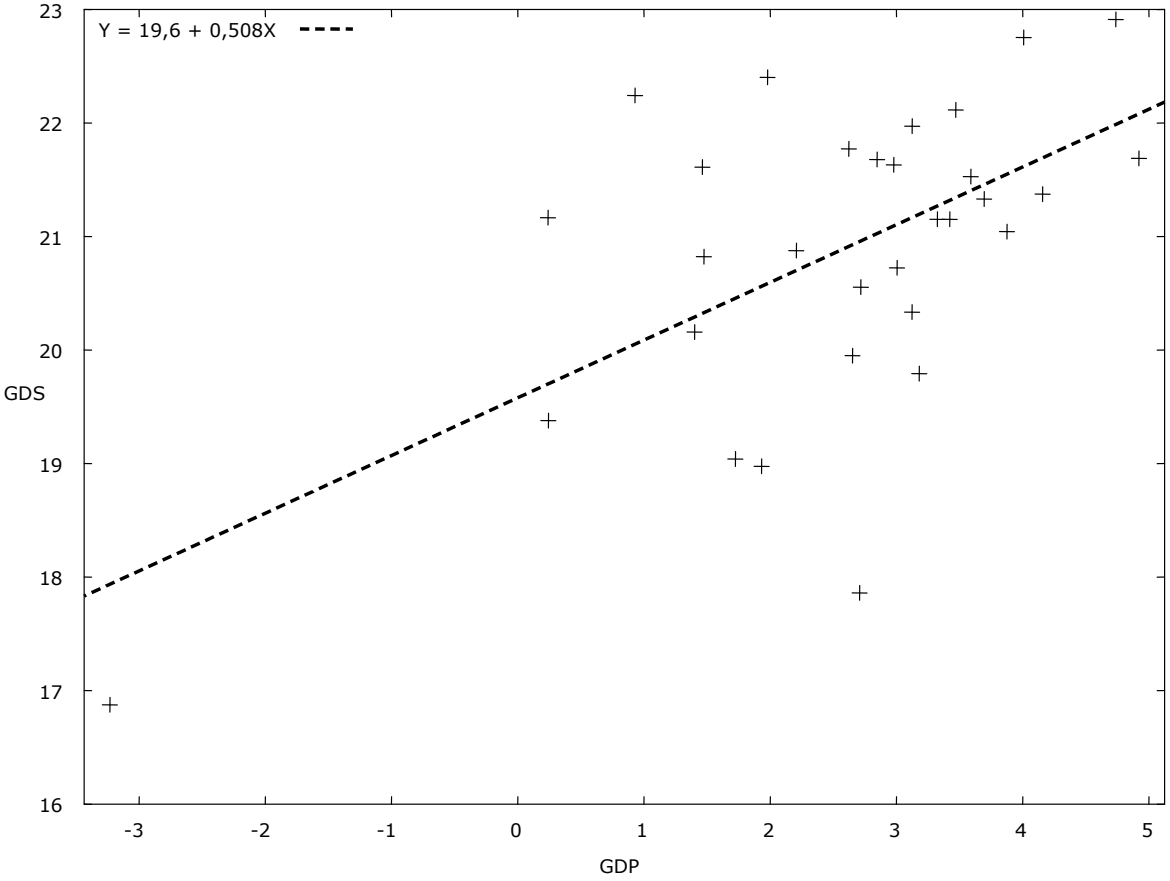
Figure 2: Average households' savings rate and average GDP dynamics in emerging and developing economies in the 1980-2010



Source: World Economic Outlook, (2010)

From a theoretical point of view it should exist a positive relationship between domestic savings and economic growth because, on the one hand, the increase in savings could stimulate economic growth, but on the other hand, the economic growth could stimulate the growth of domestic savings. In accordance with the theoretical approach, the relationship between savings and economic growth was positive in the analyzed groups of countries, as shown it the following picture [Figure3 and 4].

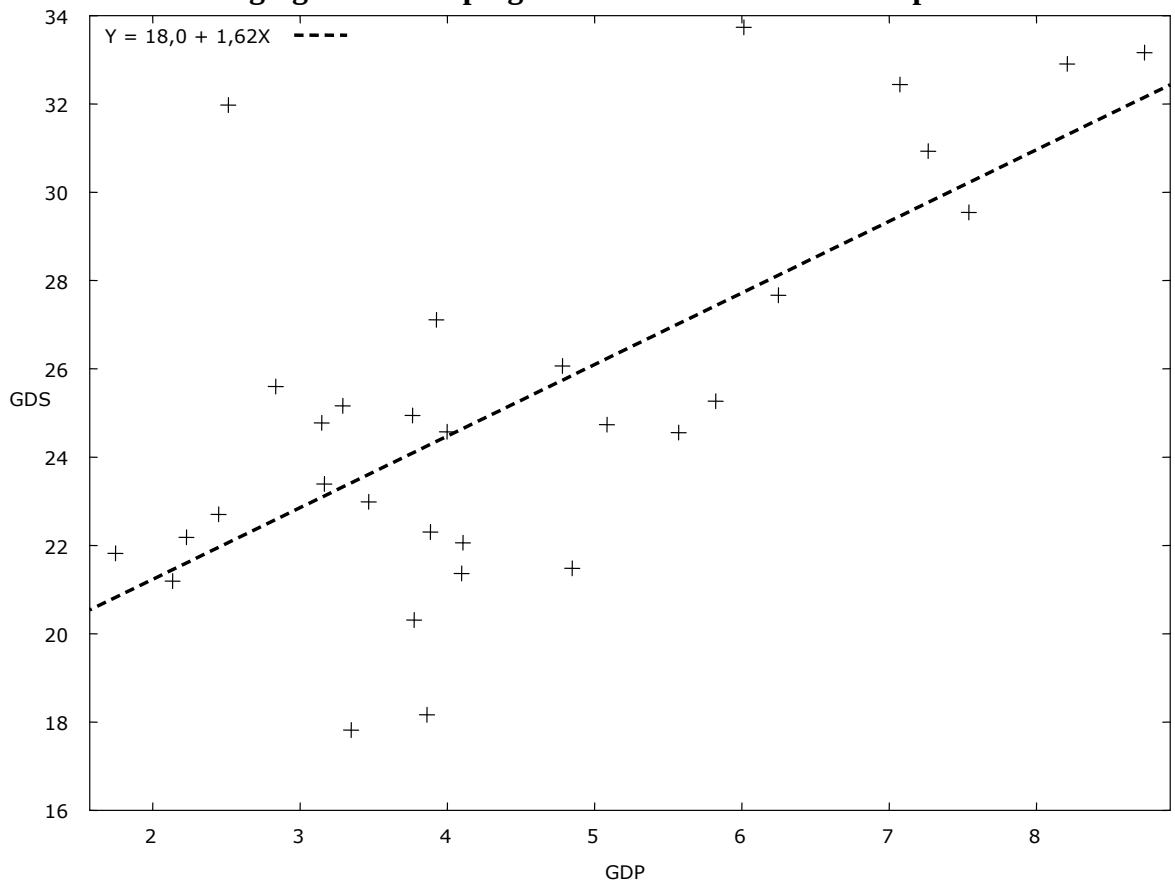
Figure 3: Relationship between households' savings rate and GDP dynamics in advanced economies in the 1980-2010 period



Source: World Economic Outlook, (2010)

The correlation coefficient between the GDP dynamics and savings rate in advanced economies calculated on the basis of the above data was 0,55 in the 1980-2010 period, which proves the existence of essential and positive linear relation between these variables.
On the other hand, the correlation coefficient between the GDP dynamics and savings rate in developing countries and emerging markets in the 1980-2010 period was 0.68, which points at the existence of quite high positive linear relation between domestic savings and economic growth.

Figure 4: Relationship between households' savings rate and GDP dynamics in emerging and developing economies in the 1980-2010 period



Source: World Economic Outlook, (2010)

Before estimating the model, it was essential to determine the stationariness of the analyzed time series. To do so, we used the ADF test (Augmented Dickey-Filler). The results of the augmented test showed lack of stationariness of analyzed variables (GDP and GDS). However, if we replaced the levels of analyzed variables with their first differences, such modification would result in stationariness of both time series. This situation was similar both in advanced economies and in emerging and developing economies [table 1].

Table 1: ADF test results

H_0: there is a single unit root H_1: there is no single unit root		
Advanced economies		
Variable	ADF	Significance
GDP	-1,192	
d_GDP	-5,247	***
GDS	-0,9596	
d_GDS	-4,292	***
Emerging and developing economies		

Variable	ADF	Significance
GDP	-0,3286	
d_GDP	-6,570	***
GDS	0,4389	
d_GDS	-4,434	***

Source: Own calculations

Due to the existence of a single unit root I(1), in case of all analyzed variables we carried out the Engle-Granger co-integration test, which confirmed the existence of correlation relationship between these variables (see appendix 1 and 2). Thus, according to the Granger Representation Theorem, if variables *y* and *x*, are of a single unit I(1) and are co-integrated, the relation between them may be presented as the error correction model (Maddala, 2008). Therefore in order to analyze the correlations between economic growth and savings in advanced economies and in emerging and developing economies in the 1980-2010 period, we used the correlation methods which indicated long-term cause and effect relationships between the analyzed variables.

In order to determine the direction of the cause and effect relationship between the analyzed variables in advanced economies and in emerging and developing economies we used the Granger causality statistics. According to this approach, variable *x* is a cause in Granger sense ($x \rightarrow y$), if the current values *y* may be predicted with more precision using past values *x* than without them, with the rest of the information unchanged. The results of this test were presented in the table below [table 2].

Table 2: Granger causality test results

Hypothesis	F Statistics	Probability
Advanced economies		
GDP is the cause of GDS in Granger sense	0,1206	0,7310
GDS is the cause of GDP in Granger sense	10,1960	0,0035
Emerging and developing economies		
GDP is the cause of GDS in Granger sense	0,9240	0,3446
GDS is the cause of GDP in Granger sense	9,0351	0,0055

Source: Own calculations

In accordance with the results of the already mentioned test the changes of Gross Domestic Product were not the cause of the Gross Domestic Savings in Granger sense but at the same time the Gross Domestic Savings were the cause of changes in Gross Domestic product in Granger sense in advanced economies. Similarly, in the case of emerging and developing countries changes in Gross Domestic Product were not a cause of Gross Domestic Savings in Granger sense, while Gross Domestic Savings were the cause of changes in Gross Domestic Product in the Granger sense. Thus, unidirectional, long-term casual relationships between

the analyzed variables occurred both in the case of developed countries, as well as in the case of emerging and developing economies. Therefore, while the results of the research coincide to a large extent with the results of the research carried out by Alguacil,Cuadros and Orts (2004) and by Singh (2009), the relationship between savings and economic growth is still ambiguous in spite of obvious theoretical relationships between these variables.

Conclusions

The results of the research concerning the correlation between savings and economic growth in advanced economies and in emerging and developing economies are generally consistent with economic growth theories. From the point of view of a standard theory of economic growth, positive cause and effect relation between domestic savings and economic growth may appear in advanced economies, in which quite high domestic savings may constitute an essential source of financing domestic investment and an economic growth factor, without the necessity of using foreign investment. For the same reason, in the poorest countries there should not be any relation between domestic savings and economic growth, as these countries, in order to finance their investment, use mostly foreign savings as their domestic savings are quite scarce.

The research results also confirmed the existence of positive, unidirectional causual relationship between economic growth and savings. Namely, the growth of Gross Domestic Savings was the cause of the growth of Gross Domestic Product in advanced economies, as well as in emerging and developing economies. On the other hand, growth of Gross Domestic Product was not the reason for the growth of Gross Domestic Savings in developed, emerging and developing countries. Thus, obtained results are consistent with the Solow hypothesis. This situation can be explained by growing at a relatively faster rate the marginal propensity to save in comparison to the marginal propensity to consume as the country's economic development.

The main conclusion drawn from this analysis indicates that the occurrence of causal links between savings and economic growth is not determined significantly by the level of economic development. Moreover, if domestic savings are invested efficiently and are therefore an important factor of economic growth, the main objective of national economic policy should be to encourage the people to save. In addition, national economic authorities should create appropriate conditions for the reallocation of national resources from traditional (non-growth) sectors to the so-called modern (growth-led) sectors of the economy, stimulating economic growth (Patrick, 1966).

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Appendix 1: Engle-Granger co-integration test. Advanced economies

Step 1: testing for a unit root in GDP

Augmented Dickey-Fuller test for GDP
including one lag of (1-L)GDP
sample size 29
unit-root null hypothesis: a = 1

test without constant
model: (1-L)y = (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: -0.056
estimated value of (a - 1): -0.131309
test statistic: tau_nc(1) = -1.19225
asymptotic p-value 0.2139

Step 2: testing for a unit root in GDS

Augmented Dickey-Fuller test for GDS
including one lag of (1-L)GDS
sample size 29
unit-root null hypothesis: a = 1

test without constant
model: (1-L)y = (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: 0.032
estimated value of (a - 1): -0.00754851
test statistic: tau_nc(1) = -0.959585
asymptotic p-value 0.3016

Step 3: cointegrating regression

Cointegrating regression -
OLS, using observations 1980-2010 (T = 31)
Dependent variable: GDP

	coefficient	std. error	t-ratio	p-value
GDS	0.123701	0.0127837	9.676	9.79e-011 ***

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Mean dependent var   2.533065   S.D. dependent var   1.580547
Sum squared resid    66.45113   S.E. of regression   1.488300
R-squared            0.757347   Adjusted R-squared   0.757347
Log-likelihood      -55.80553   Akaike criterion     113.6111
Schwarz criterion    115.0450   Hannan-Quinn         114.0785
rho                  0.120978   Durbin-Watson        1.306727

Step 4: testing for a unit root in uhat

Augmented Dickey-Fuller test for uhat
including one lag of (1-L)uhat
sample size 29
unit-root null hypothesis: a = 1

  model: (1-L)y = (a-1)*y(-1) + ... + e
  1st-order autocorrelation coeff. for e: -0.026
  estimated value of (a - 1): -0.830555
  test statistic: tau_nc(2) = -3.41375
  asymptotic p-value 0.008078

There is evidence for a cointegrating relationship if:
(a) The unit-root hypothesis is not rejected for the individual variables.
(b) The unit-root hypothesis is rejected for the residuals (uhat) from the cointegrating regression.
```

Source: Own calculations.

Appendix 2: Engle-Granger co-integration test. Developing and emerging economies

```
Step 1: testing for a unit root in GDP

Augmented Dickey-Fuller test for GDP
including one lag of (1-L)GDP
sample size 29
unit-root null hypothesis: a = 1

  test without constant
  model: (1-L)y = (a-1)*y(-1) + ... + e
  1st-order autocorrelation coeff. for e: -0.124
  estimated value of (a - 1): -0.0221679
  test statistic: tau_nc(1) = -0.328561
  asymptotic p-value 0.5673

Step 2: testing for a unit root in GDS

Augmented Dickey-Fuller test for GDS
including one lag of (1-L)GDS
sample size 29
unit-root null hypothesis: a = 1
```

```
  test without constant
  model: (1-L)y = (a-1)*y(-1) + ... + e
  1st-order autocorrelation coeff. for e: -0.018
  estimated value of (a - 1): 0.00588913
  test statistic: tau_nc(1) = 0.438919
  asymptotic p-value 0.8087

Step 3: cointegrating regression

Cointegrating regression -
OLS, using observations 1980-2010 (T = 31)
Dependent variable: GDP

          coefficient   std. error   t-ratio    p-value
 ---------------------------------------------------------
 GDS        0.180602     0.0100821     17.91    1.44e-017 ***

Mean dependent var   4.481419   S.D. dependent var   1.857051
Sum squared resid    62.07589   S.E. of regression   1.438470
R-squared            0.914500   Adjusted R-squared   0.914500
Log-likelihood      -54.74984   Akaike criterion     111.4997
Schwarz criterion    112.9337   Hannan-Quinn         111.9671
rho                  0.167212   Durbin-Watson        1.244111

Step 4: testing for a unit root in uhat

Augmented Dickey-Fuller test for uhat
including one lag of (1-L)uhat
sample size 29
unit-root null hypothesis: a = 1

  model: (1-L)y = (a-1)*y(-1) + ... + e
  1st-order autocorrelation coeff. for e: -0.002
  estimated value of (a - 1): -0.771941
  test statistic: tau_nc(2) = -3.61991
  asymptotic p-value 0.004128

There is evidence for a cointegrating relationship if:
(a) The unit-root hypothesis is not rejected for the individual variables.
(b) The unit-root hypothesis is rejected for the residuals (uhat) from the cointegrating regression.
```

Source: Own calculations