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# AN EMPIRICAL STUDY ON ECONOMIC GROWTH OF BRICS COUNTRIES — FROM THE PERSPECTIVE OF CONVERGENCE THEORY

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*Abstract:* The BRICS countries refer to Brazil, Russia, India, China and South Africa. In this paper, they are selected as the important representatives of developing countries. Based on convergence theory, this paper confirms the following by econometric method: During the 1980-2019 period, measured by the steady state of the per-capita output, the relative positions of Brazil, Russia and South Africa in a test sample were generally always slightly below the average level of all sample countries; the relative position of India had a relatively slow rise, but it was always far below the overall level of Brazil, Russia and South Africa; China's relative position was only slightly higher than India's in the 1980s, but it kept rising rapidly since then, and caught up with the overall level of Brazil, Russia and South Africa in the 2010s. Therefore, in the 1980-2019 period, measured by the steady state of the per-capita output, among the BRICS countries, only China had a remarkable and sustained relative rise in the test sample, and its upward trend shows no obvious signs of weakening. Such a change in China has positive practical significance for all developing countries because China seems to be able to become a developed country soon. Finally, the paper puts forward some suggestions on government policy for the future growth of the steady states of the per-capita output of the above countries.

*Keywords:* Important developing countries; steady state of per-capita output; β-convergence

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## 1. INTRODUCTION

The BRICS countries (Brazil, Russia, India, China and South Africa) are important developing countries and emerging markets in the world. They can gain a greater say on behalf of developing countries in the international political and economic fields, so they have attracted worldwide attention. In recent years, the BRICS countries have continuously strengthened their economic strength and strived to improve their position and influence in the world economy, which has aroused widespread concern from many economists. Some economists have put together their research work on the economic growth of the five countries and also made a comparison among them to achieve research results with important reference values. Examples are as follows, Mehmet and Ýsmet (2013), Mousumi and Sharad (2016), Natanya and Daniel (2017), Anju and Amandeep (2018), Bilal (2019), Saileja and Narayan (2019), Chandrashekar and Krishna (2020), Gulnawaz, Vaseem and Bushra (2021), Haroon, Shafat and Tarique (2021), Rohit and Shigufta (2021) and others have also published research results. These economists have studied the influence of trade, tourism, infrastructure, finance and other factors on the growth of the BRICS countries. If summarising the research results of these economists, one can draw the following conclusions: due to the limitations of system, policy and culture, Brazil, Russia, India and South Africa have not yet realised the correct transformation of their economic development strategies and methods, resulting in difficulties in upgrading their domestic industries and the insufficient endogenous motivation for economic growth, and it is expected that the above four countries will still have difficulty in making substantial leaps in their growths in the future; China is the only one among the BRICS countries with impressive growth, but it will face the pressure of slowing growth in the future.

The above conclusions which are drawn from these scholars' research are generally pertinent, but these scholars' research is not good enough. This is reflected in the fact that the explanation of the reasons behind the phenomenon is not convincing enough, and the more convincing quantitative analysis (especially the quantitative analysis of econometrics) is obviously less, which directly affects the academic value of their research results. Future research should try to make up for this deficiency.

Different from the previous scholars' research work, this paper will use the econometric method to investigate the changes in the steady states of the per-capita output of the BRICS countries. According to the theory of convergence, an economy's per-capita output always converges to its steady state of per-capita output for a given period. From the perspective of economic convergence, it can be considered that developed economies are obviously richer than developing economies, and the reason for that is they enjoy much higher steady states of per-capita output than developing economies. In other words, if developing countries want to become developed ones, they need to catch up with developed countries in a steady state of per-capita output. In addition, due to the existence of capital accumulation and technological innovation, the steady state of per-capita output is constantly improving over time for most countries, but the growth rate is not the same among countries, so it is necessary to investigate whether the steady state of the per-capita output of a country (especially for some important developing countries) has changed relatively among many countries.

To carry out such a study, this paper establishes an important concept: the relative steady state of the per-capita output, which is the ratio of the steady state of the per-capita output of a country to the average level of a set of countries. Based on this definition, to judge whether there is a relative change in the steady state of the per-capita output of a country in a set of countries, one just needs to investigate whether there is a change in the relative steady state of the per-capita output of the country.

This paper will use econometric methods to obtain the estimates of the relative steady states of the per-capita output of the BRICS countries and United States (as a representative of developed countries) in the 1980s, 1990s, 2000s and 2010s to show the relative changes in the steady states of the per-capita output of the above countries in a test sample of 112 countries during the 1980-2019 period, and will also make a corresponding description. Conclusions and suggestions will be made for the BRICS countries.

Seven sections are included in this paper. Section 1 is the introduction. A review of previous related research is given in Section 2. Section 3 will give explanations of some concerned concepts on convergence. The regression equation to test the hypothesis of β-convergence is shown in Section 4. Next, the data and the empirical method are introduced in Section 5, and the details of both results and analyses are also given. After Section 6 uses paths to show the relative changes in the steady states of the per-capita output of both BRICS countries and the United States, conclusions and suggestions are provided in Section 7.

## 2. A REVIEW OF PREVIOUS RELATED RESEARCH

Most economists make their studies on convergence stemming from Solow's Classical Growth Model. The Solow model presents β-convergence, which consists of absolute convergence and conditional convergence (the details for them are given in Section 3). Conditional convergence is more common in a set of economies, so the previous studies on β-convergence generally focuses on conditional convergence. β-convergence mentions the concept of the steady state of per-capita output.

In addition, Phillips & Sul (2007) established a new model presenting a new method to investigate convergence, which is regarded as an important contribution in the field of convergence and has been used frequently by some economists. Phillips & Sul (2009) also used their method to study the growths of various countries by displaying the relative variation parameters, which are computed for the per-capita income of the countries during a given period. It is necessary to stress that without involving the steady state mentioned in the Solow model, they can still show that the growths of developed and developing countries will converge to different levels, which means conditional convergence. Therefore, the previous studies using the method of Phillips & Sul did not show any information about the steady state mentioned in the Solow model.

Through testing the hypothesis of conditional convergence, this paper makes a study on convergence to obtain information about the steady state mentioned in the Solow model. It is well known, based on the steady-state mentioned in the Solow model, a lot of economists have shown the evidence of conditional convergence (e.g., Baumol (1986), Barro (1991), Mankiw, Romer, and Weil (1992), Caselli, Esquivel, and Lefort (1996), Lee, Pesaran, and Smith (1997), Panik and Rassekh (2002), Mathur (2005), Mcquinn and Whelan (2007), Karras (2008), Cavenaile and Dubois (2011), Bagci (2012), Rath (2016), Stengos, Yazgan, and Ozkan (2018), etc.), the main difference is their regression results show the speed of convergence is different. However, it is necessary to point out that their studies on convergence were made using only *one* period rather than *several successive* periods. The reason for that is these economists believe that convergence applies to a long period (such as several decades or even more than a hundred years), and they support two propositions: (1) No matter whether a country is developed or developing, its steady state of per-capita output can remain unchanged for decades or even more than a hundred years; (2) Many developing countries can enjoy similar steady state with developed countries, but the developed countries are near to their steady state while the developing countries are much away from their steady state. But their idea is probably wrong. Let's make a brief analysis in theory and list several reasons for questioning.

Firstly, the Solow model shows that an economy's steady state of per-capita output depends on both its economic parameters and the effectiveness of labour. In the real world, a country's economic parameters (such as saving rate, population growth rate, etc.) usually change at times, and so does its effectiveness of labour. Therefore, the idea that a country's steady state of per-capita output remains unchanged for decades or even more than a hundred years is possibly wrong, at least for most countries, this idea is not applicable.

Secondly, based on the Solow model, it can be judged that most developing countries, do not enjoy a similar steady state with developed countries, their steady states are usually obviously lower than those of developed countries. The reason for this is that even if there is no significant difference in economic parameters (saving rate, population growth rate, etc.) between developing and developed countries, developing countries are usually obviously lower than developed countries in labour efficiency, so developing countries are usually obviously lower than developed countries in the steady state of per-capita output.

Thirdly, the economic convergence theory derived from Solow's model does imply that an economy's steady state of per-capita output exists for a given period, but the length of the given period is not specified. Theoretically, an economy's steady state of per-capita output can exist in a relatively short period, such as 10 years.

All previously mentioned studies tested the hypothesis of conditional convergence during a long period, rather than across sub-periods, so they did not assess whether there happened, across sub-periods, a change in a country's relative steady state of per-capita output, whose definition is given in Section 1. If such a change happens for a country, it means, measured by the steady state of per-capita output, there is a change in its relative position in a set of sample countries, i.e., a relative change in its steady state of per-capita output. It is undoubtedly worth to make a study to investigate such a change, especially for some important developing countries.

Through testing the hypothesis of conditional convergence in a sample of 112 countries in the 1980s, 1990s, 2000s and 2010s, respectively, this paper will make such a study to show the paths of relative steady states of per-capita output of the BRICS countries and United States (as a representative of developed countries) by using the obtained estimates of the above countries in the above four successive sub-periods. A comparison of the paths will give some information of reference value on the growth of the above countries.

## 3. THE EXPLANATIONS OF SOME CONCERNED CONCEPTS ON CONVERGENCE

This paper makes a study on convergence based on the Solow model which is shown in Figure 1. Several concepts on convergence are involved: the steady state, social infrastructure, the speed of convergence $\beta$ and $\beta$-convergence.

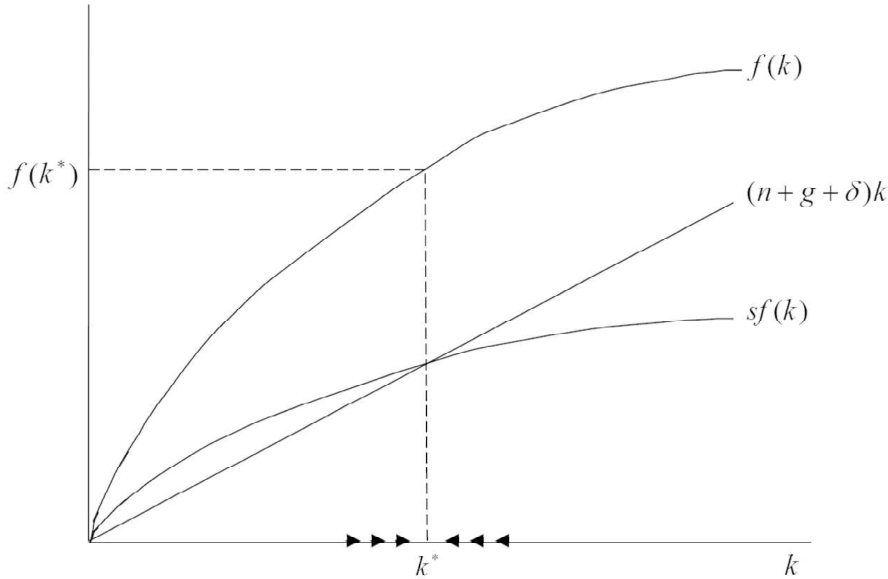


**Figure 1: An economy's steady state for a given period**

The steady state is shown in Figure 1. Figure 1 shows, for an economy for a given period, the capital per unit of effective labour $k$ converges to its steady state $k^*$, so the output per unit of effective labour $f(k)$ converges to its steady state $f(k^*)$. Further, the output per unit of labour (i.e., per-capita output) $Af(k)$ converges to its steady state $Af(k^*)$, where $A$ denotes the effectiveness of labour for the given period.

The model can show the effects of some economic parameters on the steady state. For example, for an economy, if the saving rate $s$ rises or the population growth rate $n$ declines, $k^*$ and $f(k^*)$ will increase, resulting in an increase in the steady state of per-capita output $Af(k^*)$ with a given $A$. In addition, if the effectiveness of labour $A$ improves and $k^*$ is given, $Af(k^*)$ will also increase.

According to what Romer described, social infrastructure refers to the institutions, policies, traditions and cultures, which can influence economic growth. A country's social infrastructure can almost determine its steady state of per-capita output by influencing its economic parameters and the effectiveness of labour. Developed countries can enjoy high steady states of per-capita output mainly

because of their superior social infrastructures, so if a developing country wants to be a developed one, it should establish a superior social infrastructure in advance.

The speed of convergence β can be explained by the following equation.

$$k(t)-k^{*}=e^{-\beta t}\left(k(0)-k^{*}\right) \tag{1}$$

In equation (1), only a positive value of β let $k$ converge to $k^*$, and a larger value of β means a faster convergence. β in equation (1) is deemed as a small constant when $k$ is close to $k^*$ for an economy for a given period; otherwise, β is changeable.

β-convergence has two forms: absolute convergence and conditional convergence. Absolute convergence means all selected economies can enjoy a similar steady state of per-capita output to converge because they have similar social infrastructures, while conditional convergence means the situation is opposite because the selected economies might have different social infrastructures. Therefore, there will be either absolute convergence or conditional convergence in a set of economies. In addition, conditional convergence is more common in a broad set of economies.

## 4. THE REGRESSION EQUATION TO TEST THE HYPOTHESIS OF β-CONVERGENCE

The hypothesis of $\beta$-convergence is tested by the following equation.

$$(1/T)\log\left(Y_{i,t}/Y_{i,t-T}\right)=\alpha_i-(1/T)\left(1-e^{-\beta T}\right)\log Y_{i,t-T}+u_{i,t}, \tag{2}$$

where the subscript $t$ denotes year $t$; the subscript $i$ denotes economy $i$; $T$ denotes the length of the time interval of observations used; $Y_{i,t}$ denotes per-capita output of economy $i$ for all $i$ in year $t$, as shown in Section 3, $Y_i = A_i f(k_i)$ holds for economy $i$ for all $i$; $\beta$ denotes the average speed of convergence for all economies in a sample for a given period; $\alpha_i = x_i + (1/T)\left(1-e^{-\beta T}\right)\log Y_i^*$, $x_i$ denotes the technological progress rate of economy $i$ for all $i$ ($x_i = g_i$ holds for all i), $Y_i^*$ denotes the steady state of per-capita output of economy $i$ for all $i$ for a given period, and as shown in Section 3, $Y_i^* = A_i f(k_i^*)$ holds for economy $i$ for all $i$ for a given period. Equation (2) implies the average annual growth rate (between year $t$-$T$ and year $t$) of the per-capita output of economy $i$ for all $i$ depends positively on $Y_i^*$ and negatively on $Y_{i,t-T}$.

To remove the time trend associated with the growth of technological progress ($x_i$), Coulombe (2004) defines $y_{i,t} = \log(Y_{i,t}/\bar{Y}_t)$, where $\bar{Y}_t$ is the cross section mean of $Y_{i,t}$ in year *t* for all *t*. The equation (3) is gained by converting the equation (2), the details for that are given in *Appendix A*.

$$(1/T)\Delta y_{i,t} = c_i - (1/T)\left(1 - e^{-\beta T}\right) y_{i,t-T} + \varepsilon_{i,t}, \tag{3}$$

where $\Delta y_{i,t} = y_{i,t} - y_{i,t-T} = \log(Y_{i,t}/\bar{Y}_t) - \log(Y_{i,t-T}/\bar{Y}_{t-T})$;

$c_i = \alpha_i - \bar{\alpha} = (1/T)\left(1 - e^{-\beta T}\right) y_i^*$ almost holds because both $x_i$ and $\bar{x}$ are positive and little enough so that the gap $x_i - \bar{x}$ can be ignored, $y_i^* = \log(Y_i^*/\bar{Y}^*)$, which denotes the relatively steady state of the per-capita output (log version) of economy *i* for all *i*; and $\varepsilon_{i,t} = u_{i,t} - \bar{u}_t$.

Equation (3) can be used to test the hypothesis of β convergence. In equation (3), $c_i$ is the constant term (= the fixed effect) of economy *i* for all *i*. In the case of conditional convergence, $Y_i^*$ varies with *i*, then $Y_i^*$ does not equal $\bar{Y}^*$ for most *i* and $y_i^*$ does not equal zero for most *i*, thus $c_i$ does not equal zero for most *i*, i.e., $c_i$ is significant for most *i*. But for absolute convergence, the situation is just the opposite, $c_i$ is not significant for most *i*.

# 5. THE DATA, THE EMPIRICAL METHOD, THE RESULTS AND ANALYSES

## 5.1. The Data

Data on GDP per capita (constant 2015 US$) for countries can be found in the World Bank database. The downloaded data on GDP per capita covers the years from 1980 to 2019 and contains 112 countries. which are listed in *Appendix B* and whose data on GDP per-capita are available in each year from 1980 to 2019. The data are balanced panel data.

## 5.2. The empirical Method

Firstly, the above data is divided into four sub-samples: the 1980-1989 sub-sample, the 1990-1999 sub-sample, the 2000-2009 sub-sample and the 2010-2019 sub-sample. Because each above sub-sample contains both developed and developing countries, conditional convergence should exist in each sub-sample.

Secondly, the hypothesis test of conditional convergence should be completed in each above sub-sample to confirm whether conditional convergence exists in each one. Thirdly, after all hypothesis tests are completed, according to the regression results generated by the regression equation, the estimates of the relative steady states of per-capita output of the relevant countries in the 1980s, 1990s, 2000s and 2010s will be calculated, respectively, which can show the relative positions of the steady states of per-capita output of these countries among the sample countries in each sub-period.

In addition, $(1/T)(1-e^{-\beta T}) \cong \beta$ holds when $\beta$ is a very small positive number, so the constant term $c_i = \beta y_i^*$ holds for country *i* for all *i*. Now take one year as the time interval of observations, i.e., $T$ = 1 year, equation (3) is rewritten as

$$\Delta y_{i,t} = c_i - \beta y_{i,t-1} + \varepsilon_{i,t} \qquad (4)$$

Finally, it is equation (4) that is used to test the hypothesis of β convergence.

## 5.3. The results and analyses

According to the aforementioned related definition, if β in equation (4) is positive; $c_i$ in equation (4) is significant for most *i*, the hypothesis of conditional convergence cannot be rejected, respectively, the 1980-1989 sub-sample, the 1990-1999 sub-sample, the 2000-2009 sub-sample and the 2010-2019 sub-sample.

First, the data of the 1980-1989 sample is used to estimate equation (4). Now make two null hypotheses for the above sub-sample: $H_0$: $\beta = 0$, $H_0$: $c_i = 0$.

The regression results from estimating equation (4) by using data in the 1980-1989 sub-sample are shown in part 1 of *Appendix C*, but the results about Brazil, Russia, India, China, South Africa and the United States are chosen and given in Table 1.

Table 1: The selected regression results from using the 1980-1989 sub-sample

| *Variable* | *Coefficient* | *Estimates* | *Std. Error* | *t-statistic* | *p-value* |
|---|---|---|---|---|---|
| $y_{i,t-1}$ | -β | -0.126886 | 0.027891 | -4.549269 | 0.0000 |
| *c* (*BRA*) | *c* (*BRA*) | -0.051167 | 0.010644 | -4.807064 | 0.0000 |
| *c* (*RUS*) | *c* (*RUS*) | -0.023060 | 0.005485 | -4.204383 | 0.0000 |
| *c* (*IND*) | *c* (*IND*) | -0.377667 | 0.088520 | -4.266451 | 0.0000 |
| *c* (*CHN*) | *c* (*CHN*) | -0.327698 | 0.079509 | -4.121516 | 0.0000 |
| *c* (*ZFA*) | *c* (*ZFA*) | -0.086580 | 0.019095 | -4.534121 | 0.0000 |
| *c* (*USA*) | *c* (*USA*) | 0.146460 | 0.032453 | 4.513016 | 0.0000 |

R-squared: 0.330872

In Table 1, the p-value for the estimate of β shows $H_0: \beta = 0$ is rejected at the 1% significance level and the estimate of β shows β is positive. In part 1 of *Appendix C*, p values for most estimates of $c_i$ show $H_0: c_i = 0$ is rejected at the 1% significance level. Therefore, the regression results of β and $c_i$ show the hypothesis of conditional convergence is not rejected in the 1980-1989 sub-sample.

Then, the data of the 1990-1999 sub-sample, the 2000-2009 sub-sample and the 2010-2019 sub-sample are used to estimate equation (4), respectively. Now for each above sub-sample, we made two null hypotheses: $H_0: \beta = 0$, $H_0: c_i = 0$. Their regression results from equation (4) are shown, respectively, in parts 2, 3 and 4 of *Appendix C*, and the results about Brazil, Russia, India, China, South Africa and the United States are chosen and displayed accordingly in Tables 2, 3 and 4.

**Table 2: The selected regression results from using the 1990-1999 sub-sample**

| *Variable* | *Coefficient* | *Estimates* | *Std. Error* | *t-statistic* | *p-value* |
|---|---|---|---|---|---|
| $y_{i,t-1}$ | - | -0.227683 | 0.038320 | -5.941565 | 0.0000 |
| $c$ (*BRA*) | $c$ (*BRA*) | -0.104265 | 0.014347 | -7.267543 | 0.0000 |
| $c$ (*RUS*) | $c$ (*RUS*) | -0.210441 | 0.038497 | -5.466459 | 0.0000 |
| $c$ (*IND*) | $c$ (*IND*) | -0.654578 | 0.111910 | -5.849154 | 0.0000 |
| $c$ (*CHN*) | $c$ (*CHN*) | -0.484867 | 0.089456 | -5.420185 | 0.0000 |
| $c$ (*ZFA*) | $c$ (*ZFA*) | -0.201615 | 0.029644 | -6.801182 | 0.0000 |
| $c$ (*USA*) | $c$ (*USA*) | 0.255845 | 0.044518 | 5.747053 | 0.0000 |

R-squared: 0.333004

**Table 3: The selected regression results from using the 2000-2009 sub-sample**

| *Variable* | *Coefficient* | *Estimates* | *Std. Error* | *t-statistic* | *p-value* |
|---|---|---|---|---|---|
| $y_{i,t-1}$ | - | -0.067700 | 0.030345 | -2.230989 | 0.0259 |
| $c$ (*BRA*) | $c$ (*BRA*) | -0.025522 | 0.016573 | -1.540028 | 0.1239 |
| $c$ (*RUS*) | $c$ (*RUS*) | -0.003532 | 0.017017 | -0.207573 | 0.8356 |
| $c$ (*IND*) | $c$ (*IND*) | -0.151432 | 0.084077 | -1.801108 | 0.0720 |
| $c$ (*CHN*) | $c$ (*CHN*) | -0.040906 | 0.055575 | -0.736048 | 0.4619 |
| $c$ (*ZFA*) | $c$ (*ZFA*) | -0.048983 | 0.025844 | -1.895347 | 0.0584 |
| $c$ (*USA*) | $c$ (*USA*) | 0.069801 | 0.034826 | 2.004261 | 0.0453 |

R-squared: 0.372218

Table 4: The selected regression results from using the 2010-2019 sub-sample

| *Variable* | *Coefficient* | *Estimates* | *Std. Error* | *t-statistic* | *p-value* |
|---|---|---|---|---|---|
| $y_{i,t-1}$ | - | -0.149213 | 0.023765 | -6.278666 | 0.0000 |
| c (*BRA*) | c (*BRA*) | -0.079466 | 0.015650 | -5.077794 | 0.0000 |
| c (*RUS*) | c (*RUS*) | -0.065152 | 0.014238 | -4.575777 | 0.0000 |
| c (*IND*) | c (*IND*) | -0.313686 | 0.057054 | -5.498058 | 0.0000 |
| c (*CHN*) | c (*CHN*) | -0.106956 | 0.028205 | -3.792113 | 0.0002 |
| c (*ZFA*) | c (*ZFA*) | -0.140987 | 0.019478 | -7.238121 | 0.0000 |
| c (*USA*) | c (*USA*) | 0.161267 | 0.025084 | 6.428999 | 0.0000 |

R-squared: 0.334879

Similarly, using the previously used method, one can know that for each sub-sample, β is positive and $H_0: c_i = 0$ is rejected at the 1% or 5% significance level. According to the information about β and $c_i$, the hypothesis of conditional convergence is not rejected, respectively, in the 1990-1999 sub-sample, the 2000-2009 sub-sample and the 2010-2019 sub-sample.

In explaining equation (3) in Section 4, it is shown $y_i^* = \log(Y_i^* / \bar{Y}^*)$ Denotes the relatively steady state of the per-capita output (log version) of country *i* for all *i*. Let $y_{i,0}^*$, $y_{i,1}^*$, $y_{i,2}^*$ and $y_{i,3}^*$ denote the relatively steady state of the per-capita output of country *i* for all *i* in the 1980s, 1990s, 2000s and 2010s, respectively. In addition, as shown in Section 5.2, $c_i = \beta y_i^*$ holds for country *i* for all *i*, so the estimates of $y_i^*$ can be computed using the estimates of $c_i$ and β in each sub-sample. Take the estimates of $c_i$ and β in Table 1 as an example, the estimates of $y_i^*$ of the relevant countries in the 1980s are computed as follows.

$$\hat{y}_0^* (BRA) = \hat{c}_0 (BRA) / \beta_0 = \text{-}0.051167/0.126886 = \text{-}0.4033$$

$$\hat{y}_0^* (RUS) = \hat{c}_0 (RUS) / \beta_0 = \text{-}0.02306/0.126886 = \text{-}0.1817$$

$$\hat{y}_0^* (IND) = \hat{c}_0 (IND) / \beta_0 = \text{-}0.377667/0.126886 = \text{-}2.9764$$

$$\hat{y}_0^* (CHN) = \hat{c}_0 (CHN) / \beta_0 = -0.327698/0.126886 = -2.5826$$

$$\hat{y}_0^* (ZAF) = \hat{c}_0 (ZAF) / \beta_0 = -0.08658/0.126886 = -0.6823$$

$$\hat{y}_0^* (USA) = \hat{c}_0 (USA) / \beta_0 = 0.14646/0.126886 = 1.1543$$

Similarly, using the estimates in Tables 2, 3 and 4, one can compute the estimates of $y_i^*$ of the relevant countries, in the 1990s, 2000s and 2010s, respectively by using the above computing method. All estimates of the relevant countries are given in Table 5.

**Table 5: Estimates of relative steady states of the per-capita output of the six countries**

| *Names of countries* | *Estimates in 1980s* | *Estimates in 1990s* | *Estimates in 2000s* | *Estimates in 2010s* |
|---|---|---|---|---|
| Brazil | -0.4033 | -0.4932 | -0.3974 | -0.4946 |
| Russia | -0.1817 | -0.9526 | -0.0331 | -0.4231 |
| India | -2.9764 | -2.8615 | -2.3164 | -2.108 |
| China | -2.5826 | -2.1155 | -1.2498 | -0.7214 |
| South Africa | -0.6823 | -0.909 | -0.7508 | -0.9367 |
| United States | 1.1543 | 1.1291 | 1.0205 | 1.0662 |

In Table 5, the estimates of the United States are all positive. For a developed country like the United States, its steady state of per-capita output $Y^*(USA)$ is much higher than the average $\bar{Y}^*$ of all countries in each sub-sample, so its relative steady state of per-capita output $y^*(USA)$ is significantly positive, actually around 1. The estimates of the other five countries are significantly negative or near to zero as shown in Table 5 because they are all developing countries.

## 6. THE RELATIVE CHANGES IN THE STEADY STATES OF THE PER-CAPITA OUTPUT OF BOTH BRICS COUNTRIES AND THE UNITED STATES

The path of a country's relative steady state of per-capita output shows how the country's steady state of per-capita output changes relatively in a set of countries over time, i.e., measured by a steady state of the per-capita output, the path shows how a country's relative position changes in a set of countries over time. The path is gained by using the estimates of a country's relative steady state of per-capita output in the successive sub-periods. The paths of both BRICS countries and the United States are drawn by using their estimates in Table 5 and displayed in Figure 2.

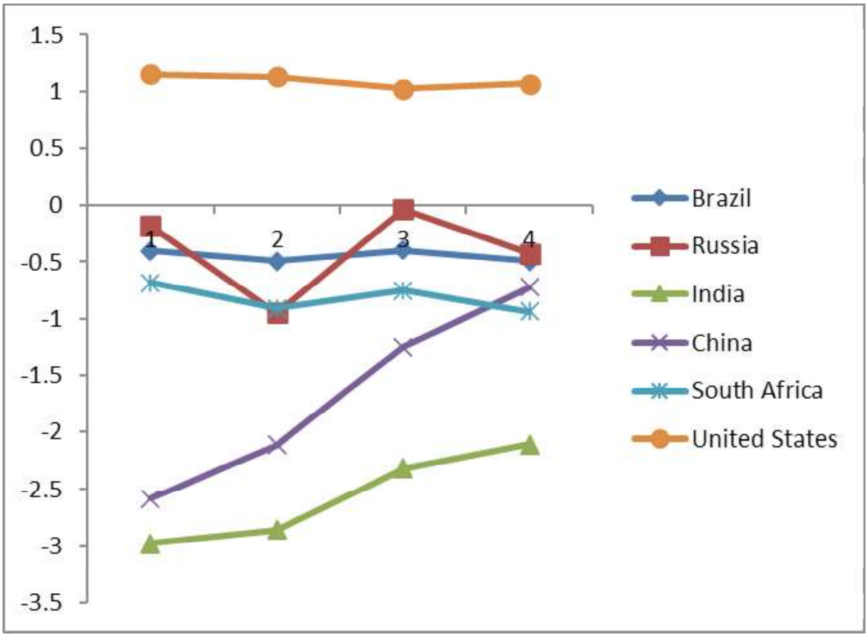


**Figure 2: The paths of relative steady states of the per-capita output of the BRICS countries and the United States (1980-2019)**

*Note 1:* The numbers 1, 2, 3 and 4 below the horizontal axis denote 1980s, 1990s, 2000s and 2010s, respectively.

*Note 2:* The numbers at the left side of the vertical axis denote the measures of relative steady state of per-capita output.

As shown earlier, $y_i^* = \log(Y_i^* / \bar{Y}^*)$ signifies the relatively steady state of the per-capita output (log version) of country *i* for all *i*. In Figure 2, the horizontal axis is for such a hypothetical country: its relative steady state of per-capita output always equals 0, i.e., its steady state of per-capita output always equals the average level of all countries in a test sample. The path of the US is obviously above the horizontal axis, so it is a typical path of a developed country. People have reason to believe the US's steady state of per-capita output kept growing from the 1980s to 2010s, but the path of the US shows US's relative steady state of per-capita output did not change significantly from the 1980s to 2010s, i.e., measured by the steady state of per-capita output, US's relative position did not change significantly in the test sample from 1980s to 2010s.

Brazil's path is very stable, indicating that the relative position of Brazil's steady state of per-capita output would not change significantly in the sample countries from the 1980s to the 2010s. Compared with Brazil, Russia's path fluctuates obviously, which means that the relative position of Russia's steady state of per-capita output has changed significantly and fluctuated in the sample countries. South Africa's path fluctuates slightly, but its path seems to have a slight downward trend. The paths of the above three countries are roughly between 0 and -1, or their relative positions of the steady states of per-capita output generally remain slightly lower than the average level of the sample countries (horizontal axis). In summary, during the 1980-2019 period, measured by the steady state of per-capita output, Brazil, Russia and South Africa were all developing countries, and they did not make relatively outstanding economic achievements, nor did they show signs of becoming developed countries soon.

The paths of China and India are much lower than the horizontal axis at first and then keep rising. Specifically, measured by the steady state of the per-capita output, the relative positions of China and India in the sample countries were far lower than the overall levels of Brazil, Russia and South Africa in the 1980s, but China was slightly higher than India at that time. After that, the relative position of China continued to rise rapidly, reaching the overall level of Brazil, Russia and South Africa in the 2010s, and its upward trend showed no signs of weakening. India's rising trend is relatively slow, resulting in its relative position still obviously lower than the overall level of Brazil, Russia and South Africa in the 2010s, and its rising trend shows signs of weakening. During the 1980-2019 period, China and India were both developing countries measured by the steady state of per-capita output. However, the relative position of China in the sample countries increased rapidly during this period, and its performance was not only relatively superior to India but also relatively superior to Brazil, Russia and South Africa. If China's steady state of per-capita output can maintain such a relative upward trend in the future, China will catch up with the overall level of the steady states of developed countries soon, which means that China will be able to become the first developed country among the BRICS countries.

## 7. CONCLUSIONS AND SUGGESTIONS

Regarding the concept of steady state mentioned in the Solow model, this paper puts forward two propositions: (1) Most countries' economic parameters and labour efficiency will change over time, so for most countries, the steady state of per-capita output will not remain unchanged for a long time. It is further inferred that the steady state of the per-capita output of a country can change relatively in a group of countries because of the difference in speed of change among countries. (2) The steady states of the per-capita output of developed countries are much higher than those of developing countries mainly because of the difference in labour efficiency. In view of this, it is inferred that if a developing country wants to become a developed one, its steady state of per-capita output must rise relatively until reaches the overall level of developed countries.

Using the econometric method, this paper makes a study on the steady states of the per-capita output of the BRICS countries and the United States (as a representative of developed countries). The paper illustrates the following: During the 1980-2019 period, even measured by the steady state of per-capita output, the United States was still a typical developed country while the BRICS countries were developing ones. Among the BRICS countries, both China and India achieved a relative increase in the steady state of per-capita output in this period, but the other three did not as a whole. In addition, China's increase rate is much faster than India's, and its upward trend shows no signs of weakening.

As shown earlier in Section 3, the social infrastructure in the theory of economic convergence refers to the system, policy, tradition and culture, which are related to economic growth. A country's social infrastructure can affect its steady state of per-capita output by affecting its economic parameters and labour efficiency. Specifically, if a country's social infrastructure has been significantly improved and relatively improved, it will lead to favourable changes in both its economic parameters (e.g., saving rate, population growth rate, etc.) and labour efficiency, which promote rapid growth and relative growth of its steady state of per-capita output; On the contrary, the situation is the opposite.

During the 1980-2019 period, the social infrastructures of Brazil, Russia and South Africa did not improve significantly, while the social infrastructure of India should have improved in the latter part of this period, which led to a relative increase in the steady state of the per-capita output of India accordingly. However, the degree of improvement in India was insufficient and there was still much room for improvement. This paper gives the following suggestions for the above four countries: on the premise of maintaining national sovereignty and independence, the above four countries should establish strong and stable governments and formulate practical and effective policies to improve their social infrastructures to increase their savings rate, further reduce their population growth rate (except Russia), and at the same time realise faster growth of their human capital and labour efficiency. Only in this way can the steady states of per-capita output of the above four countries rise rapidly and relatively in the future, and gradually approach the level of developed countries.

During the 1980-2019 period, owing to many beneficial policies formulated and implemented during China's reform and opening, China's social infrastructure continuously and significantly improved, and relatively improved in sample countries, which led to China's steady state of per-capita output and obtained a rapid and relative growth. The result was that China's steady state of per-capita output caught up with the overall level of Brazil, Russia and South Africa in the 2010s. However, it is necessary to point out that according to the data of the World Bank database, China's saving rate is already at a high level and is difficult to increase significantly further; China's population growth rate is already at a low level and there is little room for its decline. However, compared with developed countries, China still has much room for improvement in labour efficiency. Therefore, this paper puts forward the following suggestions for China: To let China's steady state of per-capita output maintain rapid and relative growth in the future and catch up with the overall level of developed countries as soon as possible, the Chinese government should pay more attention to promoting the improvement of labour efficiency in making policy, which will continue to accelerate the pace of domestic technological progress and innovation. In a word, the future growth of China's steady state of per-capita output depends on the future growth of its labour efficiency, which will also determine whether China can become a developed country soon.

## *Notes*

1. For details of Solow model, see Romer (2001, Chapter 1).
2. See Romer (2001, p. 21)
3. See Romer (2001, p.143)
4. See Romer (2001, p. 24)
5. Barro and Sala-I-Martin (2004. p.466), the equation on page 466 shows the time interval ($T$) of observations is from year 0 to year $T$.
6. World Bank provides data on GDP per-capita of countries, but data in both 1960s and 1970s are not available for a lot of countries, so this paper choose a data time span from 1980 to 2019 and only choose the 112 countries to form a test sample.
7. The natural number $e \approx 2.718$, the time interval $T$ e”1, and β is no more than 30% (= 0.3).

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## Appendix A The Transformation of Equation (2)

Firstly, equation (2) shown in the paper's Section 4 can be rewritten as

$$(1/T)(\log Y_{i,t} - \log Y_{i,t-T}) = \alpha_i - (1/T)(1-e^{-\beta T})\log Y_{i,t-T} + u_{i,t}, \qquad (2)^*$$

Then one takes the mean over the number of economies $N$ of this equation and obtains

$$(1/T)\left(\frac{1}{N}\sum_{i=1}^{N}\log Y_{i,t} - \frac{1}{N}\sum_{i=1}^{N}\log Y_{i,t-T}\right) = \frac{1}{N}\sum_{i=1}^{N}\alpha_i - (1/T)(1-e^{-\beta T})\frac{1}{N}\sum_{i=1}^{N}\log Y_{i,t-T} + \frac{1}{N}\sum_{i=1}^{N}u_{i,t}$$

or $$(1/T)(\log\bar{Y}_t - \log\bar{Y}_{t-T}) = \bar{\alpha} - (1/T)(1-e^{-\beta T})\log\bar{Y}_{t-T} + \bar{u}_t, \qquad (6)$$

where $\bar{Y}_t = \sqrt[N]{Y_{1,t}Y_{2,t}\cdots Y_{N,t}}$; $\bar{Y}_{t-T} = \sqrt[N]{Y_{1,t-T}Y_{2,t-T}\cdots Y_{N,t-T}}$; $\bar{\alpha} = \bar{x} + (1/T)(1-e^{-\beta T})\log\bar{Y}^*$, $\bar{x} = (1/N)\sum_{i=1}^{N}x_i$ and $\bar{Y}^* = \sqrt[N]{Y_1^*Y_2^*\cdots Y_N^*}$; and $\bar{u}_t = (1/N)\sum_{i=1}^{N}u_{i,t}$.

Finally, one can obtain the following equation through equation (2)* minus equation (6).

$$(1/T)\Delta y_{i,t} = c_i - (1/T)(1-e^{-\beta T})y_{i,t-T} + \varepsilon_{i,t} \qquad (7)$$

where $\Delta y_{i,t} = y_{i,t} - y_{i,t-T} = \log(Y_{i,t}/\bar{Y}_t) - \log(Y_{i,t-T}/\bar{Y}_{t-T})$; $c_i = \alpha_i - \bar{\alpha} = (1/T)(1-e^{-\beta T})y_i^*$ almost holds because both $x_i$ and $\bar{x}$ are positive and small enough so that the difference $x_i - \bar{x}$ can be neglected, $y_i^* = \log(Y_i^*/\bar{Y}^*)$, so $y_i^*$ denotes the relative steady state of per-capita output (log version) of economy *i* for all *i*; and $\varepsilon_{i,t} = u_{i,t} - \bar{u}_t$.

Equation (7) is the equation (3) shown in the paper's Section 4.

## Appendix B: The 112 Countries (with Their Codes) in the Test Sample

Andorra---AND, Argentina---ARG, Australia---AUS, Austria---AUT, Burundi---BDI, Belgium---BEL, Benin---BEN, Burkina Faso---BFA, Bangladesh---BGD, Bahamas---BHS, Belize---BLZ, Bolivia---BOL, Brazil---BRA, Botswana---BWA, Central African Republic---CAF, Canada---CAN, Switzerland---CHE-Chile---CHL, China---CHN, Cote d'Ivoire---CIV, Cameroon---CMR, Congo, Dem. Rep.--- COD, Congo, Republic of ---COG, Colombia---COL, Costa Rica---CRI, Cuba---CUB, Germany---DEU, Denmark---DNK, Dominican Republic---DOM, Algeria---DZA, Ecuador---ECU, Egypt---EGY, Spain---ESP, Finland---FIN, Fiji---FJI, France---FRA, Gabon---GAB, United Kingdom---GBR, Georgia---GEO, Ghana---GHA, Gambia---GMB, Guinea-Bissau---GNB, Greece---GRC, Greenland---GRL, Guatemala---GTM, Guyana---GUY, Honduras---HND, Haiti---HTI), Indonesia---IDN, India---IND, Ireland---IRL, Iran---IRN, Iraq---IRQ, Iceland---ISL, Israel---ISR, Italy---ITA, Jamaica---JAM, Japan---JPN, Kenya---KEN, Kiribati---KIR, Korea, Republic of--- KOR, Sri Lanka---LKA, Lesotho---LSO, Luxembourg---LUX, Morocco---MAR, Monaco---MCO, Madagascar---MDG, Mexico---MEX, Mali---MLI, Malta---MLT, Myanmar---MMR, Mauritania---MRT, Malawi---MWI, Malaysia---MYS, Niger---NER, Nigeria---NGA, Nicaragua---NIC, Netherlands---NLD, Norway---NOR, Nepal---NPL, New Zealand---NZL, Oman---OMN, Pakistan---PAK, Panama---PAN, Peru---PER, Philippines---PHL, Papua New Guinea---PNG, Puerto Rico---PRI, Portugal---PRT, Paraguay---PRY, Russian Federation---RUS, Rwanda---RWA, Saudi Arabia---SAU, Sudan---SDN, Senegal---SEN, Singapore---SGP, Sierra Leone---SLE, El Salvador---SLV, Suriname---SUR, Sweden---SWE, Swaziland---SWZ, Seychelles---SYC, Chad---TCD, Togo---TGO, Thailand---THA, Trinidad & Tobago---TTO, Tunisia---TUN, Turkey---TUR, Uruguay---URY, United States---USA,St. Vincent and the Grenadines---VCT, South Africa---ZAF, Zambia---ZMB, Zimbabwe---ZWE

# Appendix C: The Regression Results from the Equation (4) (Outputs of Eviews

## 1. The Regression Results by Using the 1980-1989 Sub-sample

Dependent Variable: D(Y?)
Method: Pooled EGLS (Cross-section weights)
Date: 10/06/23 Time: 13:27
Sample (adjusted): 1981 1989
Included observations: 9 after adjustments
Cross-sections included: 112
Total pool (balanced) observations: 1008
Linear estimation after one-step weighting matrix
White cross-section standard errors & covariance (d.f. corrected)

| *Variable* | *Coefficient* | *Std. Error* | *t-Statistic* | *Prob.* |
|---|---|---|---|---|
| Y?(-1) | -0.126886 | 0.027891 | -4.549269 | 0.0000 |
| AND--C | 0.127793 | 0.034649 | 3.688247 | 0.0002 |
| ARG--C | -0.083733 | 0.010907 | -7.677078 | 0.0000 |
| AUS--C | 0.141794 | 0.029895 | 4.743073 | 0.0000 |
| AUT--C | 0.132821 | 0.029691 | 4.473420 | 0.0000 |
| BDI--C | -0.448148 | 0.102659 | -4.365414 | 0.0000 |
| BEL--C | 0.127201 | 0.027360 | 4.649077 | 0.0000 |
| BEN--C | -0.338513 | 0.071962 | -4.704034 | 0.0000 |
| BFA--C | -0.424859 | 0.093738 | -4.532420 | 0.0000 |
| BGD--C | -0.424392 | 0.091893 | -4.618303 | 0.0000 |
| BHS--C | 0.119669 | 0.039142 | 3.057289 | 0.0023 |
| BLZ--C | -0.201082 | 0.054315 | -3.702139 | 0.0002 |
| BOL--C | -0.293861 | 0.060716 | -4.839929 | 0.0000 |
| BRA--C | -0.051167 | 0.010644 | -4.807064 | 0.0000 |
| BWA--C | -0.116202 | 0.043222 | -2.688514 | 0.0073 |
| CAF--C | -0.404908 | 0.083122 | -4.871257 | 0.0000 |
| CAN--C | 0.137931 | 0.032038 | 4.305229 | 0.0000 |
| CHE--C | 0.212991 | 0.046194 | 4.610830 | 0.0000 |
| CHL--C | -0.098341 | 0.035162 | -2.796837 | 0.0053 |
| CHN--C | -0.327698 | 0.079509 | -4.121516 | 0.0000 |
| CIV--C | -0.271726 | 0.053799 | -5.050786 | 0.0000 |
| CMR--C | -0.241432 | 0.051528 | -4.685439 | 0.0000 |
| COD--C | -0.347663 | 0.065722 | -5.289927 | 0.0000 |
| COG--C | -0.153330 | 0.048094 | -3.188118 | 0.0015 |
| COL--C | -0.126424 | 0.026208 | -4.823844 | 0.0000 |
| CRI--C | -0.125010 | 0.023290 | -5.367628 | 0.0000 |

| | | | | |
|---|---|---|---|---|
| CUB--C | -0.095987 | 0.035458 | -2.707046 | 0.0069 |
| DEU--C | 0.126056 | 0.027656 | 4.558024 | 0.0000 |
| DNK--C | 0.175100 | 0.043698 | 4.007091 | 0.0001 |
| DOM--C | -0.177036 | 0.039732 | -4.455736 | 0.0000 |
| DZA--C | -0.146366 | 0.027959 | -5.235026 | 0.0000 |
| ECU--C | -0.149404 | 0.031913 | -4.681582 | 0.0000 |
| EGY--C | -0.245077 | 0.056682 | -4.323688 | 0.0000 |
| ESP--C | 0.078983 | 0.015723 | 5.023239 | 0.0000 |
| FIN--C | 0.138013 | 0.027095 | 5.093759 | 0.0000 |
| FJI--C | -0.192351 | 0.048268 | -3.985029 | 0.0001 |
| FRA--C | 0.128163 | 0.026539 | 4.829239 | 0.0000 |
| GAB--C | -0.015663 | 0.028428 | -0.550956 | 0.5818 |
| GBR--C | 0.118411 | 0.026083 | 4.539696 | 0.0000 |
| GEO--C | -0.117934 | 0.027055 | -4.359044 | 0.0000 |
| GHA--C | -0.356080 | 0.073761 | -4.827466 | 0.0000 |
| GMB--C | -0.337638 | 0.068584 | -4.922978 | 0.0000 |
| GNB--C | -0.361224 | 0.093099 | -3.879989 | 0.0001 |
| GRC--C | 0.059028 | 0.015501 | 3.808021 | 0.0001 |
| GRL--C | 0.116680 | 0.025801 | 4.522259 | 0.0000 |
| GTM--C | -0.228948 | 0.046019 | -4.975104 | 0.0000 |
| GUY--C | -0.275002 | 0.054080 | -5.085082 | 0.0000 |
| HND--C | -0.263733 | 0.049740 | -5.302222 | 0.0000 |
| HTI--C | -0.338169 | 0.059185 | -5.713796 | 0.0000 |
| IDN--C | -0.243630 | 0.059968 | -4.062692 | 0.0001 |
| IND--C | -0.377667 | 0.088520 | -4.266451 | 0.0000 |
| IRL--C | 0.085435 | 0.013097 | 6.523392 | 0.0000 |
| IRN--C | -0.149301 | 0.042442 | -3.517740 | 0.0005 |
| IRQ--C | -0.204876 | 0.040362 | -5.075980 | 0.0000 |
| ISL--C | 0.129560 | 0.032756 | 3.955288 | 0.0001 |
| ISR--C | 0.076554 | 0.020056 | 3.816949 | 0.0001 |
| ITA--C | 0.123662 | 0.025614 | 4.827811 | 0.0000 |
| JAM--C | -0.135953 | 0.036049 | -3.771286 | 0.0002 |
| JPN--C | 0.153545 | 0.027738 | 5.535549 | 0.0000 |
| KEN--C | -0.330042 | 0.071101 | -4.641876 | 0.0000 |
| KIR--C | -0.249580 | 0.047492 | -5.255224 | 0.0000 |
| KOR--C | -0.024925 | 0.019747 | -1.262175 | 0.2072 |
| LKA--C | -0.286286 | 0.062598 | -4.573429 | 0.0000 |
| LSO--C | -0.374763 | 0.082874 | -4.522083 | 0.0000 |
| LUX--C | 0.219861 | 0.042674 | 5.152118 | 0.0000 |
| MAR--C | -0.241891 | 0.053641 | -4.509464 | 0.0000 |
| MCO--C | 0.295160 | 0.063656 | 4.636837 | 0.0000 |

| | | | | |
|---|---|---|---|---|
| MDG--C | -0.407516 | 0.075729 | -5.381247 | 0.0000 |
| MEX--C | -0.059732 | 0.018457 | -3.236293 | 0.0013 |
| MLI--C | -0.404879 | 0.093140 | -4.347000 | 0.0000 |
| MLT--C | -0.003344 | 0.010290 | -0.325021 | 0.7452 |
| MMR--C | -0.515745 | 0.105750 | -4.877019 | 0.0000 |
| MRT--C | -0.258008 | 0.054156 | -4.764159 | 0.0000 |
| MWI--C | -0.464001 | 0.085247 | -5.443011 | 0.0000 |
| MYS--C | -0.120157 | 0.034735 | -3.459251 | 0.0006 |
| NER--C | -0.410928 | 0.090337 | -4.548820 | 0.0000 |
| NGA--C | -0.307691 | 0.056401 | -5.455449 | 0.0000 |
| NIC--C | -0.301149 | 0.053513 | -5.627596 | 0.0000 |
| NLD--C | 0.135720 | 0.031046 | 4.371587 | 0.0000 |
| NOR--C | 0.213424 | 0.051323 | 4.158461 | 0.0000 |
| NPL--C | -0.440168 | 0.102435 | -4.297061 | 0.0000 |
| NZL--C | 0.104353 | 0.026960 | 3.870587 | 0.0001 |
| OMN--C | 0.058015 | 0.019320 | 3.002800 | 0.0027 |
| PAK--C | -0.342841 | 0.078730 | -4.354620 | 0.0000 |
| PAN--C | -0.138266 | 0.032870 | -4.206490 | 0.0000 |
| PER--C | -0.184213 | 0.033804 | -5.449379 | 0.0000 |
| PHL--C | -0.265753 | 0.061840 | -4.297427 | 0.0000 |
| PNG--C | -0.269737 | 0.049421 | -5.457946 | 0.0000 |
| PRI--C | 0.052307 | 0.011478 | 4.557180 | 0.0000 |
| PRT--C | 0.039488 | 0.008457 | 4.669229 | 0.0000 |
| PRY--C | -0.156345 | 0.041922 | -3.729386 | 0.0002 |
| RUS--C | -0.023060 | 0.005485 | -4.204383 | 0.0000 |
| RWA--C | -0.435485 | 0.090235 | -4.826128 | 0.0000 |
| SAU--C | -0.015596 | 0.031885 | -0.489126 | 0.6249 |
| SDN--C | -0.342316 | 0.081371 | -4.206836 | 0.0000 |
| SEN--C | -0.300004 | 0.064925 | -4.620745 | 0.0000 |
| SGP--C | 0.089863 | 0.013832 | 6.496653 | 0.0000 |
| SLE--C | -0.430274 | 0.084780 | -5.075205 | 0.0000 |
| SLV--C | -0.241161 | 0.038558 | -6.254553 | 0.0000 |
| SUR--C | -0.079640 | 0.025510 | -3.121880 | 0.0019 |
| SWE--C | 0.152835 | 0.035053 | 4.360135 | 0.0000 |
| SWZ--C | -0.192038 | 0.058748 | -3.268818 | 0.0011 |
| SYC--C | -0.073704 | 0.024133 | -3.054035 | 0.0023 |
| TCD--C | -0.375121 | 0.088076 | -4.259076 | 0.0000 |
| TGO--C | -0.396520 | 0.081371 | -4.873001 | 0.0000 |
| THA--C | -0.197353 | 0.058766 | -3.358292 | 0.0008 |
| TTO--C | -0.103630 | 0.025726 | -4.028162 | 0.0001 |
| TUN--C | -0.216516 | 0.044284 | -4.889291 | 0.0000 |

| | | | | |
|---|---|---|---|---|
| TUR--C | -0.069800 | 0.013662 | -5.109061 | 0.0000 |
| URY--C | -0.083009 | 0.024690 | -3.362085 | 0.0008 |
| USA--C | 0.146460 | 0.032453 | 4.513016 | 0.0000 |
| VCT--C | -0.146219 | 0.040342 | -3.624452 | 0.0003 |
| ZAF--C | -0.086580 | 0.019095 | -4.534121 | 0.0000 |
| ZMB--C | -0.314013 | 0.065611 | -4.785957 | 0.0000 |
| ZWE--C | -0.275062 | 0.067825 | -4.055482 | 0.0001 |

Weighted Statistics

| | | | |
|---|---|---|---|
| R-squared | 0.470487 | Mean dependent var | -0.003878 |
| Adjusted R-squared | 0.404225 | S.D. dependent var | 0.056029 |
| S.E. of regression | 0.043247 | Sum squared resid | 1.703813 |
| F-statistic | 7.100414 | Durbin-Watson stat | 1.699892 |
| Prob(F-statistic) | 0.000000 | | |

Unweighted Statistics

| | | | |
|---|---|---|---|
| R-squared | 0.330872 | Mean dependent var | -0.007430 |
| Sum squared resid | 1.706822 | Durbin-Watson stat | 1.736547 |

## 2. The Regression Results by Using the 1990-1999 Sub-sample

Dependent Variable: D(Y?)
Method: Pooled EGLS (Cross-section weights)
Date: 10/06/23 Time: 13:58
Sample (adjusted): 1991 1999
Included observations: 9 after adjustments
Cross-sections included: 112
Total pool (balanced) observations: 1008
Linear estimation after one-step weighting matrix
White cross-section standard errors & covariance (d.f. corrected)

| *Variable* | *Coefficient* | *Std. Error* | *t-Statistic* | *Prob.* |
|---|---|---|---|---|
| Y?(-1) | -0.227683 | 0.038320 | -5.941565 | 0.0000 |
| AND--C | 0.225096 | 0.035080 | 6.416572 | 0.0000 |
| ARG--C | -0.098882 | 0.019512 | -5.067804 | 0.0000 |
| AUS--C | 0.252615 | 0.043680 | 5.783260 | 0.0000 |
| AUT--C | 0.243964 | 0.039618 | 6.157923 | 0.0000 |
| BDI--C | -0.918126 | 0.150843 | -6.086618 | 0.0000 |
| BEL--C | 0.229814 | 0.037820 | 6.076544 | 0.0000 |

| | | | | |
|---|---|---|---|---|
| BEN--C | -0.616203 | 0.103230 | -5.969230 | 0.0000 |
| BFA--C | -0.764612 | 0.136715 | -5.592759 | 0.0000 |
| BGD--C | -0.751998 | 0.125755 | -5.979874 | 0.0000 |
| BHS--C | 0.165433 | 0.030237 | 5.471173 | 0.0000 |
| BLZ--C | -0.294820 | 0.054994 | -5.360917 | 0.0000 |
| BOL--C | -0.488014 | 0.080488 | -6.063172 | 0.0000 |
| BRA--C | -0.104265 | 0.014347 | -7.267543 | 0.0000 |
| BWA--C | -0.226029 | 0.045765 | -4.938929 | 0.0000 |
| CAF--C | -0.790341 | 0.130267 | -6.067062 | 0.0000 |
| CAN--C | 0.223928 | 0.041084 | 5.450517 | 0.0000 |
| CHE--C | 0.351242 | 0.062763 | 5.596303 | 0.0000 |
| CHL--C | -0.087067 | 0.015613 | -5.576582 | 0.0000 |
| CHN--C | -0.484867 | 0.089456 | -5.420185 | 0.0000 |
| CIV--C | -0.522962 | 0.083270 | -6.280318 | 0.0000 |
| CMR--C | -0.583520 | 0.094762 | -6.157734 | 0.0000 |
| COD--C | -0.861148 | 0.128509 | -6.701100 | 0.0000 |
| COG--C | -0.395345 | 0.059761 | -6.615380 | 0.0000 |
| COL--C | -0.227005 | 0.029582 | -7.673714 | 0.0000 |
| CRI--C | -0.185713 | 0.028231 | -6.578319 | 0.0000 |
| CUB--C | -0.356376 | 0.060747 | -5.866536 | 0.0000 |
| DEU--C | 0.226945 | 0.037507 | 6.050709 | 0.0000 |
| DNK--C | 0.309523 | 0.052531 | 5.892215 | 0.0000 |
| DOM--C | -0.291372 | 0.049885 | -5.840921 | 0.0000 |
| DZA--C | -0.321050 | 0.050467 | -6.361636 | 0.0000 |
| ECU--C | -0.288526 | 0.042105 | -6.852549 | 0.0000 |
| EGY--C | -0.457869 | 0.076713 | -5.968589 | 0.0000 |
| ESP--C | 0.148399 | 0.022216 | 6.679683 | 0.0000 |
| FIN--C | 0.213434 | 0.038707 | 5.514047 | 0.0000 |
| FJI--C | -0.323507 | 0.052550 | -6.156238 | 0.0000 |
| FRA--C | 0.222333 | 0.038020 | 5.847804 | 0.0000 |
| GAB--C | -0.045452 | 0.017143 | -2.651339 | 0.0082 |
| GBR--C | 0.203590 | 0.035744 | 5.695750 | 0.0000 |
| GEO--C | -0.587202 | 0.120599 | -4.869050 | 0.0000 |
| GHA--C | -0.609874 | 0.102305 | -5.961327 | 0.0000 |
| GMB--C | -0.645446 | 0.107154 | -6.023528 | 0.0000 |
| GNB--C | -0.709101 | 0.122298 | -5.798157 | 0.0000 |
| GRC--C | 0.106621 | 0.016274 | 6.551610 | 0.0000 |
| GRL--C | 0.167747 | 0.029763 | 5.636084 | 0.0000 |
| GTM--C | -0.384136 | 0.062638 | -6.132615 | 0.0000 |
| GUY--C | -0.390002 | 0.069499 | -5.611587 | 0.0000 |
| HND--C | -0.495096 | 0.071419 | -6.932267 | 0.0000 |

| | | | | |
|---|---|---|---|---|
| HTI--C | -0.667802 | 0.115415 | -5.786104 | 0.0000 |
| IDN--C | -0.408846 | 0.069278 | -5.901488 | 0.0000 |
| IND--C | -0.654578 | 0.111910 | -5.849154 | 0.0000 |
| IRL--C | 0.228290 | 0.032553 | 7.012947 | 0.0000 |
| IRN--C | -0.238625 | 0.044939 | -5.310010 | 0.0000 |
| IRQ--C | -0.375858 | 0.098551 | -3.813827 | 0.0001 |
| ISL--C | 0.207160 | 0.034689 | 5.971861 | 0.0000 |
| ISR--C | 0.153144 | 0.029135 | 5.256407 | 0.0000 |
| ITA--C | 0.212407 | 0.036864 | 5.761962 | 0.0000 |
| JAM--C | -0.231600 | 0.037446 | -6.184844 | 0.0000 |
| JPN--C | 0.255340 | 0.045522 | 5.609179 | 0.0000 |
| KEN--C | -0.637658 | 0.101952 | -6.254504 | 0.0000 |
| KIR--C | -0.481649 | 0.073593 | -6.544805 | 0.0000 |
| KOR--C | 0.011753 | 0.015525 | 0.757055 | 0.4492 |
| LKA--C | -0.474645 | 0.082753 | -5.735665 | 0.0000 |
| LSO--C | -0.643299 | 0.106805 | -6.023144 | 0.0000 |
| LUX--C | 0.417403 | 0.062446 | 6.684254 | 0.0000 |
| MAR--C | -0.443765 | 0.077456 | -5.729242 | 0.0000 |
| MCO--C | 0.517344 | 0.088404 | 5.852052 | 0.0000 |
| MDG--C | -0.770061 | 0.120076 | -6.413124 | 0.0000 |
| MEX--C | -0.099765 | 0.020965 | -4.758650 | 0.0000 |
| MLI--C | -0.726746 | 0.130609 | -5.564283 | 0.0000 |
| MLT--C | 0.048535 | 0.006112 | 7.941332 | 0.0000 |
| MMR--C | -0.879067 | 0.150491 | -5.841315 | 0.0000 |
| MRT--C | -0.489748 | 0.078143 | -6.267340 | 0.0000 |
| MWI--C | -0.807715 | 0.142681 | -5.661000 | 0.0000 |
| MYS--C | -0.153490 | 0.032345 | -4.745402 | 0.0000 |
| NER--C | -0.778898 | 0.121667 | -6.401864 | 0.0000 |
| NGA--C | -0.525799 | 0.082414 | -6.379998 | 0.0000 |
| NIC--C | -0.555620 | 0.094452 | -5.882533 | 0.0000 |
| NLD--C | 0.262662 | 0.041749 | 6.291465 | 0.0000 |
| NOR--C | 0.399891 | 0.067073 | 5.961986 | 0.0000 |
| NPL--C | -0.783879 | 0.132970 | -5.895144 | 0.0000 |
| NZL--C | 0.160845 | 0.033532 | 4.796775 | 0.0000 |
| OMN--C | 0.054045 | 0.011959 | 4.519351 | 0.0000 |
| PAK--C | -0.638035 | 0.104206 | -6.122828 | 0.0000 |
| PAN--C | -0.206601 | 0.038689 | -5.340029 | 0.0000 |
| PER--C | -0.329403 | 0.053096 | -6.203900 | 0.0000 |
| PHL--C | -0.487383 | 0.077916 | -6.255201 | 0.0000 |
| PNG--C | -0.442112 | 0.070908 | -6.235001 | 0.0000 |
| PRI--C | 0.116976 | 0.018632 | 6.278389 | 0.0000 |

| | | | | |
|---|---|---|---|---|
| PRT--C | 0.090199 | 0.011420 | 7.898042 | 0.0000 |
| PRY--C | -0.287855 | 0.042873 | -6.714097 | 0.0000 |
| RUS--C | -0.210441 | 0.038497 | -5.466459 | 0.0000 |
| RWA--C | -0.845502 | 0.165595 | -5.105829 | 0.0000 |
| SAU--C | 0.076828 | 0.023468 | 3.273683 | 0.0011 |
| SDN--C | -0.603970 | 0.104243 | -5.793868 | 0.0000 |
| SEN--C | -0.580672 | 0.097910 | -5.930687 | 0.0000 |
| SGP--C | 0.196374 | 0.033873 | 5.797421 | 0.0000 |
| SLE--C | -0.876217 | 0.144701 | -6.055368 | 0.0000 |
| SLV--C | -0.370594 | 0.058321 | -6.354348 | 0.0000 |
| SUR--C | -0.201323 | 0.032745 | -6.148294 | 0.0000 |
| SWE--C | 0.248077 | 0.041785 | 5.936977 | 0.0000 |
| SWZ--C | -0.340348 | 0.054177 | -6.282152 | 0.0000 |
| SYC--C | -0.082189 | 0.019495 | -4.215972 | 0.0000 |
| TCD--C | -0.756573 | 0.127884 | -5.916078 | 0.0000 |
| TGO--C | -0.732936 | 0.126224 | -5.806653 | 0.0000 |
| THA--C | -0.300737 | 0.052365 | -5.743070 | 0.0000 |
| TTO--C | -0.104803 | 0.027289 | -3.840514 | 0.0001 |
| TUN--C | -0.360072 | 0.063412 | -5.678256 | 0.0000 |
| TUR--C | -0.123528 | 0.020129 | -6.136929 | 0.0000 |
| URY--C | -0.086939 | 0.015219 | -5.712412 | 0.0000 |
| USA--C | 0.255845 | 0.044518 | 5.747053 | 0.0000 |
| VCT--C | -0.247206 | 0.041739 | -5.922622 | 0.0000 |
| ZAF--C | -0.201615 | 0.029644 | -6.801182 | 0.0000 |
| ZMB--C | -0.613608 | 0.101529 | -6.043677 | 0.0000 |
| ZWE--C | -0.509095 | 0.088140 | -5.775965 | 0.0000 |

Weighted Statistics

| | | | |
|---|---|---|---|
| R-squared | 0.426620 | Mean dependent var | -0.004148 |
| Adjusted R-squared | 0.354869 | S.D. dependent var | 0.067725 |
| S.E. of regression | 0.054397 | Sum squared resid | 2.695660 |
| F-statistic | 5.945833 | Durbin-Watson stat | 1.700769 |
| Prob(F-statistic) | 0.000000 | | |

Unweighted Statistics

| | | | |
|---|---|---|---|
| R-squared | 0.333004 | Mean dependent var | -0.005702 |
| Sum squared resid | 2.903170 | Durbin-Watson stat | 1.744366 |

## 3. The Regression Results by Using the 2000-2009 Sub-sample

Dependent Variable: D(Y?)
Method: Pooled EGLS (Cross-section weights)
Date: 10/06/23 Time: 14:26
Sample (adjusted): 2001 2009
Included observations: 9 after adjustments
Cross-sections included: 112
Total pool (balanced) observations: 1008
Linear estimation after one-step weighting matrix
White cross-section standard errors & covariance (d.f. corrected)

| *Variable* | *Coefficient* | *Std. Error* | *t-Statistic* | *Prob.* |
|---|---|---|---|---|
| Y?(-1) | -0.067700 | 0.030345 | -2.230989 | 0.0259 |
| AND--C | 0.062532 | 0.032038 | 1.951806 | 0.0513 |
| ARG--C | -0.038120 | 0.020787 | -1.833808 | 0.0670 |
| AUS--C | 0.080825 | 0.034261 | 2.359075 | 0.0185 |
| AUT--C | 0.069138 | 0.031301 | 2.208801 | 0.0274 |
| BDI--C | -0.298103 | 0.132677 | -2.246831 | 0.0249 |
| BEL--C | 0.064777 | 0.029613 | 2.187417 | 0.0290 |
| BEN--C | -0.187922 | 0.087262 | -2.153541 | 0.0315 |
| BFA--C | -0.212856 | 0.102714 | -2.072308 | 0.0385 |
| BGD--C | -0.193071 | 0.100816 | -1.915085 | 0.0558 |
| BHS--C | 0.023638 | 0.018905 | 1.250380 | 0.2115 |
| BLZ--C | -0.090572 | 0.040003 | -2.264156 | 0.0238 |
| BOL--C | -0.143169 | 0.068508 | -2.089797 | 0.0369 |
| BRA--C | -0.025522 | 0.016573 | -1.540028 | 0.1239 |
| BWA--C | -0.064086 | 0.026874 | -2.384681 | 0.0173 |
| CAF--C | -0.243414 | 0.118665 | -2.051278 | 0.0405 |
| CAN--C | 0.075644 | 0.033107 | 2.284866 | 0.0225 |
| CHE--C | 0.098381 | 0.044652 | 2.203306 | 0.0278 |
| CHL--C | -0.008169 | 0.010458 | -0.781127 | 0.4349 |
| CHN--C | -0.040906 | 0.055575 | -0.736048 | 0.4619 |
| CIV--C | -0.195159 | 0.080437 | -2.426231 | 0.0154 |
| CMR--C | -0.172425 | 0.079146 | -2.178578 | 0.0296 |
| COD--C | -0.268873 | 0.115447 | -2.328977 | 0.0201 |
| COG--C | -0.125980 | 0.060685 | -2.075952 | 0.0382 |
| COL--C | -0.059169 | 0.031882 | -1.855883 | 0.0638 |
| CRI--C | -0.040857 | 0.025096 | -1.628054 | 0.1039 |
| CUB--C | -0.047952 | 0.039650 | -1.209386 | 0.2268 |
| DEU--C | 0.055850 | 0.026383 | 2.116872 | 0.0345 |
| DNK--C | 0.079609 | 0.040121 | 1.984228 | 0.0475 |

| | | | | |
|---|---|---|---|---|
| DOM--C | -0.069573 | 0.040830 | -1.703983 | 0.0887 |
| DZA--C | -0.079981 | 0.040431 | -1.978198 | 0.0482 |
| ECU--C | -0.078914 | 0.041930 | -1.882022 | 0.0602 |
| EGY--C | -0.117487 | 0.062732 | -1.872838 | 0.0614 |
| ESP--C | 0.041571 | 0.018363 | 2.263811 | 0.0238 |
| FIN--C | 0.071424 | 0.032848 | 2.174380 | 0.0299 |
| FJI--C | -0.103820 | 0.046437 | -2.235717 | 0.0256 |
| FRA--C | 0.056329 | 0.026958 | 2.089556 | 0.0369 |
| GAB--C | -0.063993 | 0.020303 | -3.151870 | 0.0017 |
| GBR--C | 0.059519 | 0.027493 | 2.164844 | 0.0307 |
| GEO--C | -0.074990 | 0.055192 | -1.358710 | 0.1746 |
| GHA--C | -0.165900 | 0.082946 | -2.000093 | 0.0458 |
| GMB--C | -0.211141 | 0.096131 | -2.196390 | 0.0283 |
| GNB--C | -0.240795 | 0.106048 | -2.270617 | 0.0234 |
| GRC--C | 0.047331 | 0.018328 | 2.582435 | 0.0100 |
| GRL--C | 0.078542 | 0.029125 | 2.696714 | 0.0071 |
| GTM--C | -0.118887 | 0.054257 | -2.191167 | 0.0287 |
| GUY--C | -0.113139 | 0.060787 | -1.861250 | 0.0630 |
| HND--C | -0.143507 | 0.064534 | -2.223734 | 0.0264 |
| HTI--C | -0.230792 | 0.096964 | -2.380183 | 0.0175 |
| IDN--C | -0.100929 | 0.057395 | -1.758499 | 0.0790 |
| IND--C | -0.151432 | 0.084077 | -1.801108 | 0.0720 |
| IRL--C | 0.075900 | 0.035542 | 2.135472 | 0.0330 |
| IRN--C | -0.052178 | 0.028167 | -1.852474 | 0.0643 |
| IRQ--C | -0.101800 | 0.087819 | -1.159199 | 0.2467 |
| ISL--C | 0.073915 | 0.031449 | 2.350308 | 0.0190 |
| ISR--C | 0.034243 | 0.019357 | 1.768963 | 0.0772 |
| ITA--C | 0.044326 | 0.024266 | 1.826700 | 0.0681 |
| JAM--C | -0.087321 | 0.034891 | -2.502721 | 0.0125 |
| JPN--C | 0.059014 | 0.031832 | 1.853935 | 0.0641 |
| KEN--C | -0.198470 | 0.090691 | -2.188428 | 0.0289 |
| KIR--C | -0.174301 | 0.067933 | -2.565776 | 0.0105 |
| KOR--C | 0.037287 | 0.006652 | 5.605464 | 0.0000 |
| LKA--C | -0.109169 | 0.056901 | -1.918576 | 0.0554 |
| LSO--C | -0.166204 | 0.087214 | -1.905695 | 0.0570 |
| LUX--C | 0.123906 | 0.056670 | 2.186449 | 0.0290 |
| MAR--C | -0.103849 | 0.062077 | -1.672891 | 0.0947 |
| MCO--C | 0.148283 | 0.070421 | 2.105672 | 0.0355 |
| MDG--C | -0.249794 | 0.108869 | -2.294437 | 0.0220 |
| MEX--C | -0.051088 | 0.014202 | -3.597278 | 0.0003 |
| MLI--C | -0.202697 | 0.106995 | -1.894455 | 0.0585 |

| | | | | |
|---|---|---|---|---|
| MLT--C | 0.014956 | 0.009402 | 1.590644 | 0.1120 |
| MMR--C | -0.133709 | 0.101654 | -1.315328 | 0.1887 |
| MRT--C | -0.158220 | 0.065671 | -2.409287 | 0.0162 |
| MWI--C | -0.244191 | 0.107095 | -2.280138 | 0.0228 |
| MYS--C | -0.037480 | 0.017036 | -2.200073 | 0.0281 |
| NER--C | -0.246933 | 0.113639 | -2.172969 | 0.0300 |
| NGA--C | -0.110387 | 0.067336 | -1.639351 | 0.1015 |
| NIC--C | -0.162687 | 0.073752 | -2.205861 | 0.0276 |
| NLD--C | 0.074210 | 0.032852 | 2.258935 | 0.0241 |
| NOR--C | 0.112406 | 0.050727 | 2.215915 | 0.0269 |
| NPL--C | -0.221654 | 0.108736 | -2.038448 | 0.0418 |
| NZL--C | 0.051925 | 0.021121 | 2.458422 | 0.0141 |
| OMN--C | 0.001515 | 0.010915 | 0.138784 | 0.8897 |
| PAK--C | -0.183989 | 0.086042 | -2.138356 | 0.0328 |
| PAN--C | -0.036872 | 0.027213 | -1.354944 | 0.1758 |
| PER--C | -0.067141 | 0.041165 | -1.631033 | 0.1032 |
| PHL--C | -0.131047 | 0.064154 | -2.042680 | 0.0414 |
| PNG--C | -0.153516 | 0.069659 | -2.203826 | 0.0278 |
| PRI--C | 0.033517 | 0.015038 | 2.228837 | 0.0261 |
| PRT--C | 0.014461 | 0.008300 | 1.742230 | 0.0818 |
| PRY--C | -0.099045 | 0.042404 | -2.335761 | 0.0197 |
| RUS--C | -0.003532 | 0.017017 | -0.207573 | 0.8356 |
| RWA--C | -0.196967 | 0.110188 | -1.787562 | 0.0742 |
| SAU--C | 0.002862 | 0.017258 | 0.165827 | 0.8683 |
| SDN--C | -0.146219 | 0.079707 | -1.834460 | 0.0669 |
| SEN--C | -0.171677 | 0.079285 | -2.165323 | 0.0306 |
| SGP--C | 0.072305 | 0.036506 | 1.980642 | 0.0479 |
| SLE--C | -0.242806 | 0.105543 | -2.300542 | 0.0216 |
| SLV--C | -0.117946 | 0.052640 | -2.240605 | 0.0253 |
| SUR--C | -0.033439 | 0.026435 | -1.264974 | 0.2062 |
| SWE--C | 0.077993 | 0.035884 | 2.173475 | 0.0300 |
| SWZ--C | -0.083969 | 0.043484 | -1.931017 | 0.0538 |
| SYC--C | -0.036535 | 0.022011 | -1.659897 | 0.0973 |
| TCD--C | -0.164096 | 0.094933 | -1.728547 | 0.0842 |
| TGO--C | -0.248958 | 0.104819 | -2.375127 | 0.0177 |
| THA--C | -0.067171 | 0.038306 | -1.753527 | 0.0798 |
| TTO--C | 0.032332 | 0.009218 | 3.507656 | 0.0005 |
| TUN--C | -0.082126 | 0.047663 | -1.723059 | 0.0852 |
| TUR--C | -0.027430 | 0.006526 | -4.202940 | 0.0000 |
| URY--C | -0.025506 | 0.022979 | -1.109951 | 0.2673 |
| USA--C | 0.069801 | 0.034826 | 2.004261 | 0.0453 |

| | | | | |
|---|---|---|---|---|
| VCT--C | -0.045839 | 0.027653 | -1.657647 | 0.0977 |
| ZAF--C | -0.048983 | 0.025844 | -1.895347 | 0.0584 |
| ZMB--C | -0.149662 | 0.082447 | -1.815260 | 0.0698 |
| ZWE--C | -0.258923 | 0.105420 | -2.456116 | 0.0142 |

Weighted Statistics

| | | | |
|---|---|---|---|
| R-squared | 0.372218 | Mean dependent var | 0.008412 |
| Adjusted R-squared | 0.293659 | S.D. dependent var | 0.043582 |
| S.E. of regression | 0.036628 | Sum squared resid | 1.222197 |
| F-statistic | 4.738083 | Durbin-Watson stat | 1.558128 |
| Prob(F-statistic) | 0.000000 | | |

Unweighted Statistics

| | | | |
|---|---|---|---|
| R-squared | 0.293001 | Mean dependent var | 0.007137 |
| Sum squared resid | 1.254703 | Durbin-Watson stat | 2.005013 |

## 4. The Regression Results by Using the 2010-2019 Sub-sample

Dependent Variable: D(Y?)
Method: Pooled EGLS (Cross-section weights)
Date: 10/06/23 Time: 14:46
Sample (adjusted): 2011 2019
Included observations: 9 after adjustments
Cross-sections included: 112
Total pool (balanced) observations: 1008
Linear estimation after one-step weighting matrix
White cross-section standard errors & covariance (d.f. corrected)

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| Y?(-1) | -0.149213 | 0.023765 | -6.278666 | 0.0000 |
| AND--C | 0.128715 | 0.020189 | 6.375526 | 0.0000 |
| ARG--C | -0.098282 | 0.015655 | -6.278201 | 0.0000 |
| AUS--C | 0.165312 | 0.028121 | 5.878619 | 0.0000 |
| AUT--C | 0.145365 | 0.022321 | 6.512442 | 0.0000 |
| BDI--C | -0.674227 | 0.102950 | -6.549047 | 0.0000 |
| BEL--C | 0.135412 | 0.022562 | 6.001689 | 0.0000 |
| BEN--C | -0.404156 | 0.068647 | -5.887424 | 0.0000 |
| BFA--C | -0.464232 | 0.077890 | -5.960091 | 0.0000 |
| BGD--C | -0.392146 | 0.073434 | -5.340134 | 0.0000 |

| | | | | |
|---|---|---|---|---|
| BHS--C | 0.050574 | 0.013318 | 3.797345 | 0.0002 |
| BLZ--C | -0.229090 | 0.031806 | -7.202724 | 0.0000 |
| BOL--C | -0.289322 | 0.047646 | -6.072331 | 0.0000 |
| BRA--C | -0.079466 | 0.015650 | -5.077794 | 0.0000 |
| BWA--C | -0.117190 | 0.023409 | -5.006097 | 0.0000 |
| CAF--C | -0.605359 | 0.104670 | -5.783508 | 0.0000 |
| CAN--C | 0.150533 | 0.024839 | 6.060327 | 0.0000 |
| CHE--C | 0.212153 | 0.034681 | 6.117320 | 0.0000 |
| CHL--C | -0.026651 | 0.007148 | -3.728717 | 0.0002 |
| CHN--C | -0.106956 | 0.028205 | -3.792113 | 0.0002 |
| CIV--C | -0.353886 | 0.057098 | -6.197897 | 0.0000 |
| CMR--C | -0.373233 | 0.059232 | -6.301166 | 0.0000 |
| COD--C | -0.558499 | 0.089812 | -6.218502 | 0.0000 |
| COG--C | -0.293298 | 0.039921 | -7.346966 | 0.0000 |
| COL--C | -0.122880 | 0.022076 | -5.566191 | 0.0000 |
| CRI--C | -0.089889 | 0.015167 | -5.926746 | 0.0000 |
| CUB--C | -0.149194 | 0.022276 | -6.697627 | 0.0000 |
| DEU--C | 0.141257 | 0.021173 | 6.671476 | 0.0000 |
| DNK--C | 0.182693 | 0.028215 | 6.474986 | 0.0000 |
| DOM--C | -0.124266 | 0.026802 | -4.636532 | 0.0000 |
| DZA--C | -0.205949 | 0.028455 | -7.237765 | 0.0000 |
| ECU--C | -0.186836 | 0.029443 | -6.345775 | 0.0000 |
| EGY--C | -0.278644 | 0.046971 | -5.932201 | 0.0000 |
| ESP--C | 0.078613 | 0.013404 | 5.864729 | 0.0000 |
| FIN--C | 0.138655 | 0.021214 | 6.536029 | 0.0000 |
| FJI--C | -0.198447 | 0.033789 | -5.873106 | 0.0000 |
| FRA--C | 0.125161 | 0.019196 | 6.519982 | 0.0000 |
| GAB--C | -0.106066 | 0.016007 | -6.626080 | 0.0000 |
| GBR--C | 0.125030 | 0.021057 | 5.937554 | 0.0000 |
| GEO--C | -0.186818 | 0.038718 | -4.825157 | 0.0000 |
| GHA--C | -0.331287 | 0.062530 | -5.298033 | 0.0000 |
| GMB--C | -0.486302 | 0.073361 | -6.628859 | 0.0000 |
| GNB--C | -0.508209 | 0.085998 | -5.909523 | 0.0000 |
| GRC--C | 0.016179 | 0.010504 | 1.540253 | 0.1238 |
| GRL--C | 0.139796 | 0.025797 | 5.419071 | 0.0000 |
| GTM--C | -0.253552 | 0.041871 | -6.055569 | 0.0000 |
| GUY--C | -0.218015 | 0.039816 | -5.475579 | 0.0000 |
| HND--C | -0.316769 | 0.050928 | -6.219882 | 0.0000 |
| HTI--C | -0.484031 | 0.074442 | -6.502144 | 0.0000 |
| IDN--C | -0.207895 | 0.038778 | -5.361105 | 0.0000 |
| IND--C | -0.313686 | 0.057054 | -5.498058 | 0.0000 |

| | | | | |
|---|---|---|---|---|
| IRL--C | 0.218414 | 0.037337 | 5.849766 | 0.0000 |
| IRN--C | -0.157783 | 0.031611 | -4.991418 | 0.0000 |
| IRQ--C | -0.171804 | 0.028471 | -6.034334 | 0.0000 |
| ISL--C | 0.151889 | 0.025813 | 5.884267 | 0.0000 |
| ISR--C | 0.094573 | 0.013624 | 6.941760 | 0.0000 |
| ITA--C | 0.087077 | 0.014740 | 5.907566 | 0.0000 |
| JAM--C | -0.205533 | 0.032073 | -6.408320 | 0.0000 |
| JPN--C | 0.142439 | 0.024469 | 5.821271 | 0.0000 |
| KEN--C | -0.403081 | 0.068487 | -5.885516 | 0.0000 |
| KIR--C | -0.349341 | 0.052505 | -6.653429 | 0.0000 |
| KOR--C | 0.065318 | 0.008458 | 7.722596 | 0.0000 |
| LKA--C | -0.217009 | 0.036954 | -5.872378 | 0.0000 |
| LSO--C | -0.379733 | 0.058291 | -6.514485 | 0.0000 |
| LUX--C | 0.261387 | 0.042672 | 6.125490 | 0.0000 |
| MAR--C | -0.252070 | 0.041749 | -6.037709 | 0.0000 |
| MCO--C | 0.356249 | 0.057344 | 6.212531 | 0.0000 |
| MDG--C | -0.546915 | 0.086779 | -6.302422 | 0.0000 |
| MEX--C | -0.088511 | 0.011618 | -7.618567 | 0.0000 |
| MLI--C | -0.477599 | 0.078154 | -6.110992 | 0.0000 |
| MLT--C | 0.069221 | 0.012320 | 5.618519 | 0.0000 |
| MMR--C | -0.354019 | 0.062256 | -5.686503 | 0.0000 |
| MRT--C | -0.354714 | 0.056354 | -6.294413 | 0.0000 |
| MWI--C | -0.535377 | 0.086362 | -6.199229 | 0.0000 |
| MYS--C | -0.055237 | 0.013308 | -4.150587 | 0.0000 |
| NER--C | -0.524267 | 0.082044 | -6.390052 | 0.0000 |
| NGA--C | -0.304557 | 0.046369 | -6.568127 | 0.0000 |
| NIC--C | -0.340689 | 0.046580 | -7.314066 | 0.0000 |
| NLD--C | 0.157937 | 0.024185 | 6.530498 | 0.0000 |
| NOR--C | 0.234910 | 0.039925 | 5.883854 | 0.0000 |
| NPL--C | -0.454613 | 0.079970 | -5.684820 | 0.0000 |
| NZL--C | 0.109622 | 0.017541 | 6.249550 | 0.0000 |
| OMN--C | -0.046255 | 0.008525 | -5.425576 | 0.0000 |
| PAK--C | -0.411664 | 0.065116 | -6.321983 | 0.0000 |
| PAN--C | -0.052671 | 0.012818 | -4.109237 | 0.0000 |
| PER--C | -0.149948 | 0.025042 | -5.987903 | 0.0000 |
| PHL--C | -0.252008 | 0.046401 | -5.431114 | 0.0000 |
| PNG--C | -0.296466 | 0.046845 | -6.328731 | 0.0000 |
| PRI--C | 0.056346 | 0.012074 | 4.666701 | 0.0000 |
| PRT--C | 0.031434 | 0.006329 | 4.966997 | 0.0000 |
| PRY--C | -0.184992 | 0.031533 | -5.866654 | 0.0000 |
| RUS--C | -0.065152 | 0.014238 | -4.575777 | 0.0000 |

| | | | | |
|---|---|---|---|---|
| RWA--C | -0.445880 | 0.078683 | -5.666811 | 0.0000 |
| SAU--C | 0.018185 | 0.010101 | 1.800312 | 0.0721 |
| SDN--C | -0.336107 | 0.050096 | -6.709269 | 0.0000 |
| SEN--C | -0.371381 | 0.060799 | -6.108344 | 0.0000 |
| SGP--C | 0.174803 | 0.026392 | 6.623234 | 0.0000 |
| SLE--C | -0.532720 | 0.096347 | -5.529169 | 0.0000 |
| SLV--C | -0.245467 | 0.040743 | -6.024703 | 0.0000 |
| SUR--C | -0.127545 | 0.023024 | -5.539692 | 0.0000 |
| SWE--C | 0.167119 | 0.027219 | 6.139866 | 0.0000 |
| SWZ--C | -0.200191 | 0.030773 | -6.505358 | 0.0000 |
| SYC--C | -0.025366 | 0.013871 | -1.828727 | 0.0678 |
| TCD--C | -0.469497 | 0.067867 | -6.917885 | 0.0000 |
| TGO--C | -0.486560 | 0.080109 | -6.073730 | 0.0000 |
| THA--C | -0.155904 | 0.026204 | -5.949582 | 0.0000 |
| TTO--C | -0.036659 | 0.010022 | -3.657752 | 0.0003 |
| TUN--C | -0.219122 | 0.031098 | -7.046064 | 0.0000 |
| TUR--C | -0.020210 | 0.009550 | -2.116118 | 0.0346 |
| URY--C | -0.030917 | 0.007412 | -4.171332 | 0.0000 |
| USA--C | 0.161267 | 0.025084 | 6.428999 | 0.0000 |
| VCT--C | -0.152384 | 0.022180 | -6.870399 | 0.0000 |
| ZAF--C | -0.140987 | 0.019478 | -7.238121 | 0.0000 |
| ZMB--C | -0.358606 | 0.054248 | -6.610536 | 0.0000 |
| ZWE--C | -0.391525 | 0.058038 | -6.746058 | 0.0000 |

Weighted Statistics

| | | | |
|---|---|---|---|
| R-squared | 0.518470 | Mean dependent var | 0.005866 |
| Adjusted R-squared | 0.458213 | S.D. dependent var | 0.039045 |
| S.E. of regression | 0.028740 | Sum squared resid | 0.752450 |
| F-statistic | 8.604278 | Durbin-Watson stat | 1.627457 |
| Prob(F-statistic) | 0.000000 | | |

Unweighted Statistics

| | | | |
|---|---|---|---|
| R-squared | 0.334879 | Mean dependent var | 0.003214 |
| Sum squared resid | 0.762036 | Durbin-Watson stat | 1.801732 |