

# An Empirical Study on the Steady States of Per-Capita Output of Ethiopia and South Africa

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**Abstract:** Ethiopia and South Africa are representative economies in Africa. But during the 2000-2024 period, the two countries were significantly different in economic performance because they chose different development models. Specifically, Ethiopia began to take the Chinese model to develop its economy in 2000, while South Africa has been using the Western model. Based on convergence theory, this paper reveals the followings by econometric method: during the 1960-2024 period, measured by the steady state of per-capita output, the relative position of South Africa in a test sample generally remained slightly lower than the average level of all sample countries and showed a slight downward trend; the relative position of Ethiopia was much lower than the average level of all sample countries and continuously declined from 1960s to 1990s, but began and kept rising significantly since 2000s. The paper gives explanations for the above empirical study results and also provides some suggestions for the future growth of the steady states of per-capita output of the above two countries.

**Keywords:** Ethiopia and South Africa; steady state of per-capita output;  $\beta$ -convergence

## 1. Introduction

In Africa, Ethiopia and South Africa are two representative countries in economic development. The reason is that the two countries chose different economic development models, which have brought about different effects in economic development. Specifically, Ethiopia chose the Chinese model to develop its economy since 2000, while South Africa has been using the Western model. In recent years, some economists have put their research work on the economic growth of Ethiopia and South Africa and the comparison between the two countries, and they have achieved many research results with important reference value. Examples are as follows: Seid Nuru (2019), Endaylalu Solomon (2019), Johanna A. Badenhorst-Weiss and Beverley J. Waugh (2019), Solomon Tilahun Mengistu (2022), Molobe Joyce Ramakgasha, Lungile Gidi and Tshephi Kingsley Thaba (2023), Girma Mulugeta Emeru (2023), Melkamu Wondimu (2023), Dikeledi Semenya and Kanayo Ogujiuba (2024), Addis Yimer and Alemayehu

Geda (2024), Gisele Mah (2025), Nomfundo Portia Vacu-Nggila (2025) and others have published the concerned research results. Specifically, the above economists have studied the influences of investment, exports, infrastructure, public expenditure, foreign and domestic debt, business environment and other factors on the growth of Ethiopia and South Africa.

These scholars' research work is generally valuable. However, there is a deficiency in their research work, which is reflected in the fact that these scholars are accustomed to using total output (i.e., GDP) or per-capita output (i.e., per-capita GDP) as a measure of economic growth, while ignoring investigation into the changes in the steady state of per-capita output of both Ethiopia and South Africa.

This paper uses the econometric method to investigate the changes in the steady states of per-capita output of Ethiopia and South Africa. 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; therefore, the steady state of per capita output can indicate the degree of affluence that an economy can achieve for the 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 that they enjoy much higher steady states of per-capita output than developing economies. This is to imply that if developing countries want to become developed ones, they need to catch up with developed countries in the steady state of per-capita output. In addition, developing countries are also different in the steady state of per-capita output. On the other hand, 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 usually different among countries. So it is necessary to investigate whether the steady state of per-capita output of a country (especially for those noticeable developing countries) shows a relative change in a test sample of many countries.

To carry out such a study, this paper establishes an important concept: ***the relative steady state of per-capita output***, which is the ratio of the steady state of 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 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 per-capita output of the country.

To show the relative changes in the steady states of per-capita output of Ethiopia and South Africa in a test sample of 110 countries during the 1960-2019 period, this paper uses econometric methods to obtain the estimates of the

relative steady states of per-capita output of the two countries in the 1960s, 1970s, 1980s, 1990s, 2000s and 2010s, and also makes a corresponding description. Conclusions and suggestions have been finally given for the two countries.

This paper consists of seven sections. Section 1 is the introduction. Section 2 gives the explanations of some of the concepts on convergence. Section 3 introduces the regression equation used in this paper. Next, the data, the empirical method and the details of both results and analyses are shown in Section 4. Section 5 uses paths to show the relative changes in the steady states of per-capita output of both Ethiopia and South Africa. Section 6 explains the research results. Finally, conclusions and suggestions are provided in Section 7.

## 2. The Explanations of Some Concerned Concepts on Convergence

This paper makes a study on convergence based on the Solow model<sup>1</sup> which is shown in Figure 1<sup>2</sup>. Several concepts on convergence are involved: the steady state, social infrastructure, and the speed of convergence,  $\beta$  and  $\beta$ -convergence.

The steady state is shown in Figure 1. It shows, for an economy for a given

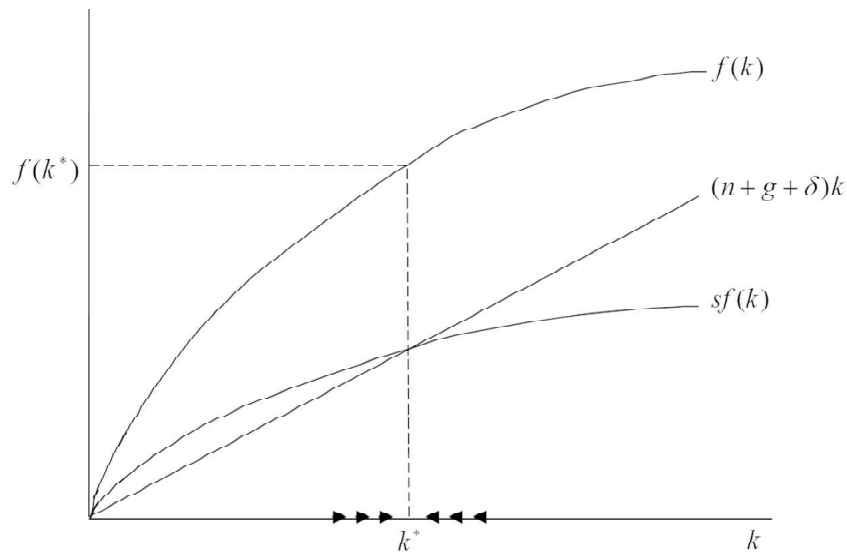


Figure 1: An economy's steady state for a given period

period, that 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<sup>3</sup> refers to the institutions, policies, traditions and cultures, which can influence economic growth. In fact, a country's social infrastructure can also influence its steady state of per-capita output. 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 improve its social infrastructure first.

The speed of convergence  $\beta$  can be explained by the following equation<sup>4</sup>.

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

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

$\beta$ -convergence consists of 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 enjoy similar social infrastructure, while conditional convergence means the situation is opposite because the selected economies might have different social infrastructures.

### 3. The Regression Equation to test the Hypothesis of $\beta$ -convergence

The hypothesis of  $\beta$ -convergence is tested by the following equation<sup>5</sup>.

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

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 the 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;  $\alpha_i = x_i + (1/T)(1 - e^{-\beta T}) \log Y_i^*$ ,  $x_i$  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 the 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 that the average annual growth rate (between year  $t-T$  and year  $t$ ) of 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-sectional mean of  $Y_{i,t}$  in year  $t$  for all  $t$ . Equation (3) is gained by converting the equation (2); the details for that are shown in *Appendix A*.

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

where  $\Delta y_{i,t} = y_{i,t} - y_{i,t-T} = \log(Y_{i,t} / \bar{Y}_t) - \log(Y_{i,t-T} / \bar{Y}_{t-T})$ ;  $c_i = \alpha_i - \bar{\alpha} = (1/T)(1 - e^{-\beta T})y_i^*$  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,  $y_i^* = \log(Y_i^* / Y^*)$ , which 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 (3) can be used to test the hypothesis of  $\beta$  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  $i$ .

## 4. The Data, the Empirical Method, the Results and Analyses

### 4.1. The Data

Data on GDP per-capita (constant 2015 US\$) for countries and regions can be found in the World Bank database. The downloaded data on GDP per-capita cover the years from 1960 to 2024 and contains 110 countries and regions<sup>6</sup>, which are listed in *Appendix B* and whose data on GDP per-capita are available in each year from 1960 to 2024.

#### 4.2. The Empirical Method

Firstly, the above data is divided into the six sub-samples: the 1960-1969 sub-sample, the 1970-1979 sub-sample, the 1980-1989 sub-sample, the 1990-1999 sub-sample, the 2000-2009 sub-sample, the 2010-2019 sub-sample and the 2020-2024 sub-sample. Each of the above sub-samples contains both developed and developing countries, thus conditional convergence should exist in each sub-sample. Secondly, the hypothesis test of conditional convergence was completed in each of the above sub-samples to confirm whether conditional convergence existed in each one. Thirdly, after all hypothesis tests were completed, according to the regression results obtained, the estimates of the relative steady states of per-capita output of Ethiopia and South Africa in the 1960s, 1970s, 1980s, 1990s, 2000s, 2010s and the 2020-2024 sub-period were calculated, respectively, showing the relative positions of the steady states of per-capita output of the two countries in the test sample in each sub-period.

In addition,  $(1/T)(1 - e^{-\beta T}) \cong \beta$  holds when  $\beta$  is a very small positive number<sup>7</sup>, so the constant term  $c_i = \beta y_i^*$  holds for country  $i$  for all  $i$ . Now, taking one year as the time interval of observations, i.e.,  $T = 1$  year, equation (3) is rewritten as

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

It is equation (4) that was used to test the hypothesis of conditional convergence.

#### 4.3. The Results and Analyses

According to the aforementioned related definition, if  $\beta$  in equation (4), is positive;  $c_i$  in equation (4) is significant for most  $i$ , the hypothesis of conditional convergence cannot be rejected for most  $i$ , respectively, in each of the above seven sub-samples.

First, the data of the 1960-1969 sub-sample was used to estimate equation (4). Then two null hypotheses were made 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 1960-1969 period sub-samples are shown in Part 1 of *Appendix C*, but the results for Ethiopia and South Africa are chosen and given in Table 1.

**Table 1: The Selected Regression Results from using the 1960-1969 sub-sample**

Variable	Coefficient	Estimates	Std. Error	t-statistic	p value
$y_{it-1}$	$-\beta$	-0.131739	0.026188	-5.030469	0.0000
$c$ (ETH)	$c$ (ETH)	-0.437378	0.080674	-5.421552	0.0000
$c$ (ZAF)	$c$ (ZAF)	-0.050454	0.007361	-6.854319	0.0000

In Table 1, the p-value for the estimate of  $\beta$  shows  $H_0: \beta = 0$  is rejected at the 1% significance level, and the estimate of  $\beta$  shows  $\beta$  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  $\beta$  and  $c_i$  show the hypothesis of conditional convergence is not rejected in the 1960-1969 sub-sample.

Then, the data of the other six sub-samples were used to estimate equation (4), respectively. Similarly, for each sub-sample, two null hypotheses were made:  $H_0: \beta = 0$ ,  $H_0: c_i = 0$ . Their regression results from equation (4) are shown, respectively, in parts 2, 3, 4, 5, 6 and 7 of Appendix C, and the results about Ethiopia and South Africa are chosen and displayed in the six following Tables, respectively.

**Table 2: The Selected Regression Results from using the 1970-1979 sub-sample**

Variable	Coefficient	Estimates	Std. Error	t-statistic	p value
$y_{it-1}$	$-\beta$	-0.193205	0.031945	-6.048017	0.0000
$c$ (ETH)	$c$ (ETH)	-0.677664	0.107481	-6.304994	0.0000
$c$ (ZAF)	$c$ (ZAF)	-0.119785	0.016216	-7.386909	0.0000

**Table 3: The Selected Regression Results from using the 1980-1989 sub-sample**

Variable	Coefficient	Estimates	Std. Error	t-statistic	p value
$y_{it-1}$	$-\beta$	-0.121608	0.032093	-3.789291	0.0002
$c$ (ETH)	$c$ (ETH)	-0.453641	0.113587	-3.993767	0.0001
$c$ (ZAF)	$c$ (ZAF)	-0.109629	0.027074	-4.049307	0.0001

**Table 4: The Selected Regression Results from using the 1990-1999 sub-sample**

Variable	Coefficient	Estimates	Std. Error	t-statistic	p value
$y_{it-1}$	$-\beta$	-0.240357	0.033010	-7.281326	0.0000
$c$ (ETH)	$c$ (ETH)	-0.964237	0.125359	-7.691800	0.0000
$c$ (ZAF)	$c$ (ZAF)	-0.259912	0.032345	-8.035681	0.0000

**Table 5: The Selected Regression Results from using the 2000-2009 sub-sample**

Variable	Coefficient	Estimates	Std. Error	t-statistic	p value
$y_{i,t-1}$	$-\beta$	-0.072642	0.036595	-1.985001	0.0475
$c$ (ETH)	$c$ (ETH)	-0.246978	0.154170	-1.601984	0.1095
$c$ (ZAF)	$c$ (ZAF)	-0.063451	0.038221	-1.660099	0.0973

**Table 6: The Selected Regression Results from using the 2010-2019 sub-sample**

Variable	Coefficient	Estimates	Std. Error	t-statistic	p value
$y_{i,t-1}$	$-\beta$	-0.218913	0.018160	-12.05489	0.0000
$c$ (ETH)	$c$ (ETH)	-0.683519	0.064939	-10.52549	0.0000
$c$ (ZAF)	$c$ (ZAF)	-0.226494	0.016783	-13.49508	0.0000

**Table 7: The Selected Regression Results from using the 2020-2024 sub-sample**

Variable	Coefficient	Estimates	Std. Error	t-statistic	p value
$y_{i,t-1}$	$-\beta$	-0.284792	0.048544	-5.866651	0.0000
$c$ (ETH)	$c$ (ETH)	-0.870240	0.153490	-5.669704	0.0000
$c$ (ZAF)	$c$ (ZAF)	-0.350425	0.054494	-6.430559	0.0000

Similarly, using the previous method, it can be known that for each sub-sample,  $\beta$  is positive and  $H_0: c_i = 0$  is rejected at the 5% or 10% significance level. According to the information about  $\beta$  and  $c_i$  the hypothesis of conditional convergence is not rejected, respectively, in each of the other five sub-samples.

In explaining equation (3) in Section 3, it is shown  $y_i^* = \log(Y_i^* / Y^*)$  denotes the relative steady state of per-capita output (log version) of country  $i$  for all  $i$ . Let  $y_{i,0}^*$  denote the relative steady state of per-capita output of country  $i$  for all  $i$  in the 1960s. In addition, as shown in Section 4.2,  $c_i = \beta y_i^*$  holds for country  $i$  for all  $i$ , so the estimates of  $y_i^*$  can be computed using the estimates of  $c_i$  and  $\beta$  in each sub-sample. Taking the estimates of  $c_i$  and  $\beta$  from Table 1, as an example, the estimates of  $y_i^*$  for the population of Ethiopia and South Africa in the 1960s are computed as follows:

$$\hat{y}_0^* (ETH) = \hat{c}_0 (ETH) / \beta_0 = -0.437378 / 0.131739 = -3.3200$$

$$\hat{y}_0^* (ZAF) = \hat{c}_0 (ZAF) / \beta_0 = -0.050454 / 0.131739 = -0.3830$$

Similarly, using the estimates in Tables 2, 3, 4, 5, 6 and 7, one can compute the estimates of  $y_i^*$  for the two countries, respectively, in the 1970s, 1980s, 1990s, 2000s, 2010s and the 2020-2024 sub-period by using the above method. All estimates are given in Table 8.

**Table 8: Estimates of Relative Steady States of Per-capita output of the Two Countries**

Names of countries	Estimates in 1960s	Estimates in 1970s	Estimates in 1980s	Estimates in 1990s	Estimates in 2000s	Estimates in 2010s	Estimates in the 2020-2024 period
Ethiopia	-3.3200	-3.5075	-3.7304	-4.0116	-3.3999	-3.1223	-3.0557
South Africa	-0.3830	-0.6200	-0.9015	-1.0813	-0.8735	-1.0346	-1.2305

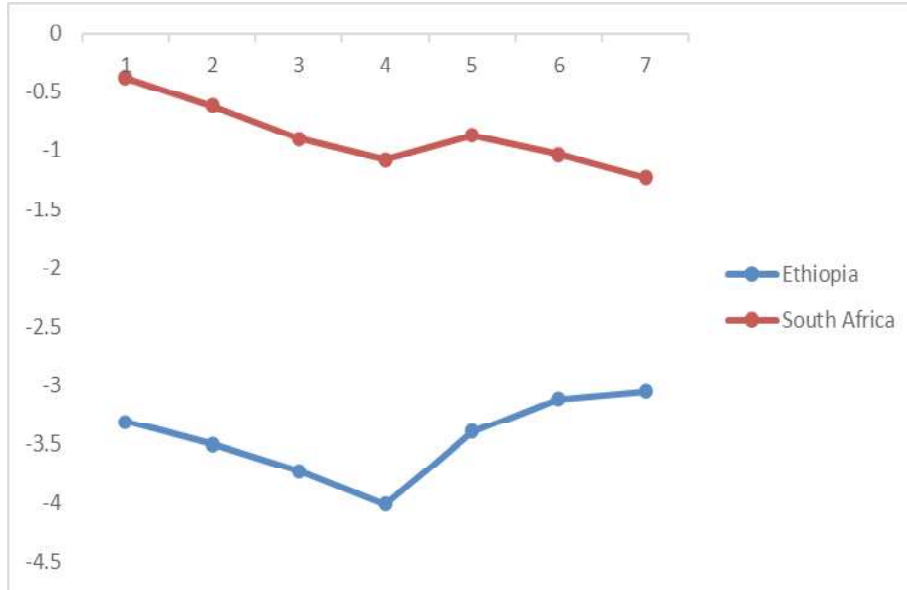
In Table 8, the estimates of Ethiopia and South Africa are all negative because both of them are developing countries. The estimates of all developing countries in the test sample should be significantly negative or near to zero. But for all developed countries in the test sample, their estimates will be positive.

### 5. The Paths of Relative Steady States of per-capita output of Ethiopia and South Africa

The path of a country’s relative steady state of per-capita output shows how its steady state of per-capita output changes relatively in a set of countries over time, i.e., measured by steady state of per-capita output, the path shows how a country’s relative position changes in a set of countries over time. The path can be drawn by using the estimates of a country’s relative steady state of per-capita output in the successive sub-periods. Thus, the paths of Ethiopia and South Africa are drawn by using their estimates in Table 8 and displayed in Figure 2.

As for the horizontal axis with a scale of 0 in Figure 2, as shown earlier,  $y_i^* = \log(Y_i^* / Y^*)$  signifies the relative steady state of per-capita output (log version) of country  $i$  for all  $i$ . So, the horizontal axis is for such a hypothetical country: its relative steady state of per-capita output equals 0 in each subperiod, i.e., its steady state of per-capita output equals the average of all sample countries in each subperiod.

South Africa’s path is slightly lower on the horizontal axis with a scale of 0, i.e., its relative position of the steady state of per-capita output generally remains slightly lower than the average of all sample countries, but the path shows an obvious downward trend, i.e., the growth of South Africa’s steady state of per-capita output is slower than most sample countries. South Africa has been using the Western model to develop its economy, but the results of the empirical study



**Figure 2: The Paths of Relative Steady States of per-capita output of Ethiopia and South Africa (1960-2024)**

*Note 1:* The numbers 1, 2, 3, 4, 5, 6 and 7 below the horizontal axis denote the 1960s, 1970s, 1980s, 1990s, 2000s, 2010s and the period of 2020-2024, respectively.

*Note 2:* The numbers arranged vertically denote the measures of the relative steady state of per-capita output.

of this paper show that, measured by the steady state of per-capita output, South Africa's performance was relatively poor among all sample countries during the 1960-2024 period, and may not be worth imitating.

Ethiopia's path is roughly much lower than the horizontal axis. What is striking is that the path continuously declined from the 1960s to the 1990s, but kept rising significantly since the 2000s, i.e., measured by the steady state of per-capita output, the relative position of Ethiopia in the sample countries continuously declined first, but began to rise significantly since the 2000s. This situation is consistent with the growth of per-capita output of Ethiopia in the period of 1960-2024, which is surely remarkable.

## **6. An explanation of the Above Empirical Research Results**

As shown earlier in Section 2, the social infrastructure mentioned in convergence theory refers to the system, policy, tradition and culture, which are related to economic growth. In fact, a country's social infrastructure can affect its steady state of per-capita output by affecting its economic parameters and labour

efficiency. For example, if a country's social infrastructure has been significantly improved, it will lead to favourable changes in both its saving rate (almost referred to as investment rate) and labour efficiency, which can cause a rapid and relative growth of its steady state of per-capita output. On the contrary, the situation is the opposite.

One explanation for the different growth performance of the steady state of per-capita output between Ethiopia and South Africa should be the difference in their development models. During the 1960-2024 period, South Africa had been following the Western development model. Even after Mandela became South Africa's President in 1994, only the personnel of South Africa's management had undergone major changes, but its development model continued to be the Western development model as a whole, i.e., South Africa's social infrastructure did not improve significantly during the 1960-2024 period.

Ethiopia also experienced a similar relative decline from the 1960s to 1990s, but at the end of the 1990s, it began to learn from China's model, focusing on imitating China's "state-led economic development" model. Meles Zenawi, the Prime Minister of Ethiopia, publicly stated in 2006 that Ethiopia should learn from the experience of the East, especially the development model of China, and pull the economy out of the quagmire with state-led forces. Mulatu Teshome, the next Prime Minister of Ethiopia, continued to carry out China's development model. Specifically, during the 2000-2019 period, Ethiopia mainly promoted its economic growth through infrastructure construction (such as roads and power stations, etc.) and industrialisation policies (especially the establishment of export-oriented enterprises). Regrettably, due to the intensification of ethnic conflicts, a military conflict broke out between the Ethiopian federal government and the Tigray State in November 2020. The civil war, combined with multiple factors such as the COVID-19 epidemic and drought, made the country's economic situation significantly worse, leading to a slowdown in economic growth, which was consistent with the last part of the Ethiopian path in Figure 2. Now that the COVID-19 epidemic has ended, people hope that the Ethiopian civil war will also end as soon as possible, so that its economy can resume its previous growth rate.

In view of the above-mentioned facts, many people who have been to Ethiopia call it "Little China" in Africa. In short, after the end of the 1990s, by learning from China's model, Ethiopia's social infrastructure was continuously and significantly improved and relatively improved in sample countries, which led to its steady state of per-capita output, and obtained a significant and relative growth.

## **7. Conclusions and Suggestions**

According to the theory of economic convergence, the steady state of per-capita output indicates the degree of wealth that a country can achieve. This paper puts forward three propositions: (1) For most countries, the steady state of per capita output cannot remain unchanged for a long time because their economic parameters and labour efficiency change over time. It is further inferred that the steady state of per-capita output of a country will change relatively in a group of countries because the involved countries will experience different speeds of change. (2) The steady-states of per-capita output of developed countries are much higher than those of developing countries, mainly due to the difference in social infrastructure. Therefore, if a developing country wants to become a developed one, it must improve its social infrastructure to let its steady state of per-capita output rise relatively close to the overall level of developed countries. (3) For some important developing countries, it is worth studying how their steady states of per-capita output changed relatively among many countries.

Using econometric methods, this paper makes a study of the steady states of per-capita output of Ethiopia and South Africa (as two representatives of African countries). The paper reveals the following: During the 1960-2019 period, measured by the steady state of per-capita output, in the early stage, both experienced a similar relative decline, but in the later stage, Ethiopia had a sustained and significant relative increase, while South Africa did not. Therefore, in the growth performance of the steady state of per-capita output, Ethiopia was better than South Africa.

As for South Africa, this paper gives the following suggestions: on the premise of maintaining national sovereignty and independence, South Africa should establish a strong and stable government to improve the execution of government policies. Then, a strong South African government should formulate practical and effective policies to improve its social infrastructures to attract more investments and, at the same time, realise faster growth of labour efficiency. Specifically, at present, South Africa's transportation network mainly serves mineral transportation and lacks comprehensive infrastructure (such as electricity and logistics), which restricts the development of other industrial fields and the labour efficiency of the whole economy. Only after South Africa eliminates the above shortcomings can the country obtain a rapid and relative rise in its steady state of per-capita output in the future.

As for Ethiopia, this paper makes the following suggestions: The Ethiopian government still needs to make better policies to improve the labour efficiency of the whole economy. Although Ethiopia began to learn from China's

development model systematically after the end of the 1990s, Ethiopia's economic level was far lower than that of South Africa's for a long time, and its economic foundation is still weak. Specifically, Ethiopia has attracted foreign investment to build some industrial parks, but most of them are full of labour-intensive enterprises such as textile and shoemaking, so the industrial base of the country is still weak, especially since the country lacks core technology and industry consolidation capacity. In addition, the product supply chain needs to be improved, and the logistics are still inefficient. If Ethiopia can eliminate these shortcomings, the country can catch up with or even exceed South Africa in the steady state of per-capita output in the future.

### Notes

1. For details of the 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 that the time interval ( $T$ ) of observations is from year 0 to year  $T$ .
6. The World Bank provides data on GDP per-capita, but data in both the 1960s and 1970s are not available for many countries and regions. This paper can only choose 110 countries and regions to form a test sample.
7. The natural number  $e \approx 2.718$ , the time interval  $T \geq 1$ , and  $\beta$  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

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

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

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

$$\text{or} \quad (1/T)(\log \bar{Y}_t - \log \bar{Y}_{t-T}) = \bar{\alpha} - (1/T)(1 - e^{-\beta T}) \log \bar{Y}_{t-T} + \bar{u}_t, \quad (5)$$

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 (5).

$$(1/T) \Delta y_{i,t} = c_i - (1/T)(1 - e^{-\beta T}) y_{i,t-T} + \varepsilon_{i,t} \quad (6)$$

where  $\Delta y_{i,t} = y_{i,t} - y_{i,t-T} = \log(Y_{i,t}/Y_t) - \log(Y_{i,t-T}/Y_{t-T})$ ;  $c_i = \alpha_i - \bar{\alpha} = (1/T)(1 - e^{-\beta T}) y_i^*$  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,  $y_i^* = \log(Y_i^*/Y^*)$ , 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 (6) is the equation (3) shown in the paper's Section 3.

**Appendix B The 110 Countries and Regions (with Codes) in the Test Sample**

Argentina—ARG, Australia—AUS, Austria—AUT, Burundi—BDI, Belgium—BEL, Benin—BEN, Burkina Faso—BFA, Bangladesh—BGD, Bahamas—BHS, Belize—BLZ, Bermuda—BMU, Bolivia—BOL, Brazil—BRA, Barbados—BRB, 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, Rep.—COG, Colombia—COL, Costa Rica—CRI, Germany—DEU, Denmark —DNK, Dominican Republic —DOM, Algeria—DZA, Ecuador—ECU, Egypt—EGY, Spain—ESP, Ethiopia—ETH, Finland—FIN, Fiji—FJI, France—FRA, Gabon—GAB, United Kingdom—GBR, Ghana—GHA, Greece—GRC, Guatemala—GTM, Guyana—GUY, Hong Kong—HKG, Honduras—HND, Haiti—HTI, Hungary—HUN, Indonesia—IDN, India—IND, Ireland—IRL, Iran—IRN, Iraq—IRQ, Iceland—ISL, Israel—ISR, Italy—ITA, Japan—JPN, Kenya—KEN, Korea, Rep.—KOR, Liberia—LBR, Libya—LBY, Sri Lanka—LKA, Lesotho—LSO, Luxembourg—LUX, Madagascar—MDG, Mexico—MEX, Myanmar—MMR, Mauritania—MRT, Mauritius—MUS, Malawi—MWI, Malaysia—MYS, Niger—NER, Nigeria—NGA, Nicaragua—NIC, Netherlands—NLD, Norway—NOR, Nepal—NPL, New Zealand—NZL, Pakistan—PAK, Panama—PAN, Peru—PER, Philippines—PHL, Papua New Guinea—PNG, Puerto Rico—PRI, Portugal—PRT, Paraguay—PRY, Rwanda—RWA, Saudi Arabia—SAU, Sudan—SDN, Senegal—SEN, Singapore—SGP, Sierra Leone—SLE, Somalia—SOM, Suriname—SUR, Sweden—SWE, Seychelles—SYC, Syrian Arab Republic—SYR, Chad—TCD, Togo—TGO, Thailand—THA, Trinidad and Tobago—TTO, Tunisia—TUN, Turkiye—TUR, Tanzania—TZA, Uruguay—URY, United States—USA, St. Vincent and the Grenadines—VCT, South Africa—ZAF, Zambia—ZMB, Zimbabwe—ZWE

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

#### I. The Regression Results by Using the 1960-1969 Sub-sample

Dependent Variable: D(Y?)

Method: Pooled EGLS (Cross-section weights)

Date: 07/18/25 Time: 22:08

Sample (adjusted): 1961 1969

Included observations: 9 after adjustments

Cross-sections included: 110

Total pool (balanced) observations: 990

Linear estimation after one-step weighting matrix

White cross-section standard errors & covariance (d.f. corrected)

<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
Y?(-1)	-0.131739	0.026188	-5.030469	0.0000
ARG—C	0.020733	0.014872	1.394083	0.1636
AUS—C	0.159734	0.036589	4.365692	0.0000
AUT—C	0.112635	0.021669	5.197920	0.0000
BDI—C	-0.439172	0.069963	-6.277172	0.0000
BEL—C	0.113023	0.020085	5.627322	0.0000
BEN—C	-0.310966	0.052917	-5.876437	0.0000
BFA—C	-0.433939	0.085703	-5.063303	0.0000
BGD—C	-0.365982	0.068954	-5.307651	0.0000
BHS—C	0.191002	0.036712	5.202741	0.0000
BLZ—C	-0.180853	0.033616	-5.379923	0.0000
BMU—C	0.266292	0.059063	4.508643	0.0000
BOL—C	-0.193607	0.035225	-5.496328	0.0000
BRA—C	-0.109539	0.027853	-3.932685	0.0001
BRB—C	0.054806	0.014660	3.738359	0.0002
BWA—C	-0.312730	0.071503	-4.373673	0.0000
CAF—C	-0.350662	0.067085	-5.227155	0.0000
CAN—C	0.141125	0.030445	4.635464	0.0000
CHE—C	0.256436	0.049880	5.141094	0.0000
CHL—C	-0.077257	0.015828	-4.881050	0.0000
CHN—C	-0.477093	0.072825	-6.551203	0.0000
CIV—C	-0.155826	0.033382	-4.667963	0.0000
CMR—C	-0.284278	0.052942	-5.369647	0.0000
COD—C	-0.238279	0.050869	-4.684183	0.0000
COG—C	-0.234914	0.050897	-4.615494	0.0000
COL—C	-0.156151	0.029231	-5.341972	0.0000
CRI—C	-0.073003	0.011004	-6.634506	0.0000
DEU—C	0.112107	0.021517	5.210121	0.0000
DNK—C	0.174206	0.031751	5.486576	0.0000
DOM—C	-0.212110	0.050216	-4.223908	0.0000
DZA—C	-0.159312	0.037863	-4.207532	0.0000
ECU—C	-0.145070	0.026746	-5.424005	0.0000
EGY—C	-0.269365	0.048627	-5.539450	0.0000
EMU—C	0.096805	0.016536	5.854124	0.0000

<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
ESP—C	0.070760	0.007010	10.09380	0.0000
<b>ETH—C</b>	<b>-0.437378</b>	<b>0.080674</b>	<b>-5.421552</b>	<b>0.0000</b>
FIN—C	0.104396	0.016305	6.402770	0.0000
FJI—C	-0.153714	0.030036	-5.117593	0.0000
FRA—C	0.114108	0.020955	5.445389	0.0000
GAB—C	-0.031907	0.017030	-1.873586	0.0613
GBR—C	0.121884	0.029684	4.106121	0.0000
GHA—C	-0.261274	0.050232	-5.201385	0.0000
GRC—C	0.054676	0.012245	4.465215	0.0000
GTM—C	-0.154173	0.026763	-5.760608	0.0000
GUY—C	-0.129465	0.031323	-4.133227	0.0000
HKG—C	-0.000615	0.014810	-0.041535	0.9669
HND—C	-0.220737	0.036196	-6.098393	0.0000
HTI—C	-0.218943	0.040422	-5.416386	0.0000
HUN—C	-0.044361	0.032304	-1.373247	0.1700
IDN—C	-0.334169	0.066751	-5.006177	0.0000
IND—C	-0.406483	0.078880	-5.153159	0.0000
IRL—C	0.064685	0.012255	5.278329	0.0000
IRN—C	-0.044764	0.022317	-2.005827	0.0452
IRQ—C	-0.228782	0.046872	-4.881011	0.0000
ISL—C	0.116905	0.036456	3.206701	0.0014
ISR—C	0.089830	0.016518	5.438327	0.0000
ITA—C	0.101045	0.015918	6.347822	0.0000
JPN—C	0.105364	0.013045	8.076756	0.0000
KEN—C	-0.289940	0.049171	-5.896545	0.0000
KOR—C	-0.179433	0.041582	-4.315199	0.0000
LBR—C	-0.128444	0.021832	-5.883311	0.0000
LBY—C	0.166239	0.035545	4.676824	0.0000
LKA—C	-0.303547	0.059133	-5.133309	0.0000
LSO—C	-0.409626	0.078387	-5.225677	0.0000
LUX—C	0.201143	0.039452	5.098478	0.0000
MDG—C	-0.302458	0.055254	-5.473969	0.0000
MEX—C	-0.032677	0.004603	-7.098350	0.0000
MMR—C	-0.533900	0.103023	-5.182320	0.0000
MRT—C	-0.194834	0.035060	-5.557093	0.0000
MUS—C	-0.194508	0.056193	-3.461402	0.0006
MWI—C	-0.411893	0.081351	-5.063163	0.0000
MYS—C	-0.184486	0.036000	-5.124532	0.0000
NER—C	-0.301765	0.054254	-5.562094	0.0000
NGA—C	-0.220987	0.056574	-3.906131	0.0001
NIC—C	-0.134747	0.027800	-4.847026	0.0000
NLD—C	0.134691	0.029814	4.517681	0.0000
NOR—C	0.171562	0.034578	4.961648	0.0000
NPL—C	-0.414007	0.075962	-5.450177	0.0000
NZL—C	0.138764	0.031667	4.382038	0.0000
PAK—C	-0.327246	0.062171	-5.263671	0.0000
PAN—C	-0.066204	0.018766	-3.527874	0.0004

<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
PER—C	-0.098413	0.020794	-4.732843	0.0000
PHL—C	-0.225904	0.042434	-5.323708	0.0000
PNG—C	-0.175450	0.035592	-4.929465	0.0000
PRI—C	0.058956	0.008537	6.906227	0.0000
PRT—C	0.002291	0.006891	0.332533	0.7396
PRY—C	-0.181221	0.035498	-5.105162	0.0000
RWA—C	-0.434874	0.093360	-4.658040	0.0000
SAU—C	0.099442	0.018439	5.393142	0.0000
SDN—C	-0.315653	0.058494	-5.396357	0.0000
SEN—C	-0.272945	0.041235	-6.619285	0.0000
SGP—C	-0.020277	0.022514	-0.900647	0.3680
SLE—C	-0.338101	0.065636	-5.151127	0.0000
SOM—C	-0.413329	0.074676	-5.534963	0.0000
SUR—C	-0.029970	0.013579	-2.207047	0.0276
SWE—C	0.155681	0.030723	5.067303	0.0000
SYC—C	-0.095781	0.017043	-5.619887	0.0000
SYR—C	-0.310121	0.086323	-3.592584	0.0003
TCD—C	-0.365575	0.072804	-5.021384	0.0000
TGO—C	-0.283588	0.060180	-4.712363	0.0000
THA—C	-0.272877	0.053095	-5.139380	0.0000
TTO—C	-0.026832	0.013315	-2.015124	0.0442
TUN—C	-0.274135	0.048386	-5.665531	0.0000
TUR—C	-0.109651	0.016992	-6.452959	0.0000
TZA—C	-0.257666	0.045788	-5.627325	0.0000
URY—C	-0.022633	0.006904	-3.278190	0.0011
USA—C	0.164803	0.037017	4.452069	0.0000
VCT—C	-0.203218	0.041593	-4.885887	0.0000
<b>ZAF—C</b>	<b>-0.050454</b>	<b>0.007361</b>	<b>-6.854319</b>	<b>0.0000</b>
ZMB—C	-0.242897	0.037722	-6.439182	0.0000
ZWE—C	-0.239086	0.050742	-4.711852	0.0000

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Weighted Statistics

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R-squared	0.411059	Mean dependent var	-0.012160
Adjusted R-squared	0.337358	S.D. dependent var	0.056350
S.E. of regression	0.045870	Sum squared resid	1.849491
F-statistic	5.577364	Durbin-Watson stat	1.997058
Prob(F-statistic)	0.000000		

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Unweighted Statistics

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R-squared	0.331037	Mean dependent var	-0.009737
Sum squared resid	1.854837	Durbin-Watson stat	2.035115

**2. The Regression Results by Using the 1970-1979 Sub-sample**

Dependent Variable: D(Y?)

Method: Pooled EGLS (Cross-section weights)

Date: 07/18/25 Time: 22:28

Sample (adjusted): 1971 1979

Included observations: 9 after adjustments

Cross-sections included: 110

Total pool (balanced) observations: 990

Linear estimation after one-step weighting matrix

White cross-section standard errors & covariance (d.f. corrected)

<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
Y?(-1)	-0.193205	0.031945	-6.048017	0.0000
ARG—C	0.010234	0.013861	0.738335	0.4605
AUS—C	0.216963	0.039751	5.457983	0.0000
AUT—C	0.185548	0.029641	6.259899	0.0000
BDI—C	-0.636301	0.098691	-6.447383	0.0000
BEL—C	0.174049	0.029956	5.810124	0.0000
BEN—C	-0.506263	0.080142	-6.317104	0.0000
BFA—C	-0.664220	0.103846	-6.396226	0.0000
BGD—C	-0.623777	0.097363	-6.406732	0.0000
BHS—C	0.160555	0.024395	6.581402	0.0000
BLZ—C	-0.230763	0.041837	-5.515810	0.0000
BMU—C	0.403408	0.069322	5.819351	0.0000
BOL—C	-0.285245	0.040829	-6.986333	0.0000
BRA—C	-0.081249	0.015853	-5.125264	0.0000
BRB—C	0.055730	0.006873	8.108697	0.0000
BWA—C	-0.292544	0.066718	-4.384772	0.0000
CAF—C	-0.542732	0.080616	-6.732307	0.0000
CAN—C	0.200119	0.035531	5.632187	0.0000
CHE—C	0.344494	0.056892	6.055194	0.0000
CHL—C	-0.165345	0.043312	-3.817550	0.0001
CHN—C	-0.620553	0.109099	-5.687998	0.0000
CIV—C	-0.230873	0.038936	-5.929503	0.0000
CMR—C	-0.390526	0.074927	-5.212099	0.0000
COD—C	-0.424194	0.063180	-6.714096	0.0000
COG—C	-0.333535	0.057356	-5.815207	0.0000
COL—C	-0.211481	0.036649	-5.770465	0.0000
CRI—C	-0.082311	0.015153	-5.431964	0.0000
DEU—C	0.169124	0.027217	6.213894	0.0000
DNK—C	0.230355	0.038558	5.974310	0.0000
DOM—C	-0.241951	0.039346	-6.149245	0.0000
DZA—C	-0.186651	0.034284	-5.444238	0.0000
ECU—C	-0.170883	0.023679	-7.216554	0.0000
EGY—C	-0.390418	0.065133	-5.994153	0.0000
EMU—C	0.143911	0.023813	6.043347	0.0000
ESP—C	0.087349	0.020098	4.346153	0.0000
<b>ETH—C</b>	<b>-0.677664</b>	<b>0.107481</b>	<b>-6.304994</b>	<b>0.0000</b>

FIN—C	0.166493	0.027999	5.946309	0.0000
FJI—C	-0.182878	0.035216	-5.193083	0.0000
FRA—C	0.171589	0.027557	6.226660	0.0000
GAB—C	0.033537	0.059324	0.565316	0.5720
GBR—C	0.174344	0.027818	6.267191	0.0000
GHA—C	-0.454986	0.075395	-6.034678	0.0000
GRC—C	0.095207	0.018958	5.021935	0.0000
GTM—C	-0.210198	0.034357	-6.117992	0.0000
GUY—C	-0.210652	0.026475	-7.956674	0.0000
HKG—C	0.034128	0.013922	2.451414	0.0144
HND—C	-0.334342	0.055480	-6.026387	0.0000
HTI—C	-0.306977	0.053681	-5.718525	0.0000
HUN—C	-0.047062	0.011445	-4.112064	0.0000
IDN—C	-0.440843	0.074881	-5.887272	0.0000
IND—C	-0.630891	0.093846	-6.722649	0.0000
IRL—C	0.099360	0.019365	5.130831	0.0000
IRN—C	-0.081078	0.033331	-2.432506	0.0152
IRQ—C	-0.287571	0.062554	-4.597172	0.0000
ISL—C	0.215728	0.028007	7.702594	0.0000
ISR—C	0.134306	0.022385	5.999860	0.0000
ITA—C	0.147749	0.024859	5.943591	0.0000
JPN—C	0.128815	0.021300	6.047514	0.0000
KEN—C	-0.382315	0.076876	-4.973116	0.0000
KOR—C	-0.162229	0.037341	-4.344567	0.0000
LBR—C	-0.228971	0.037197	-6.155636	0.0000
LBY—C	0.159991	0.042988	3.721802	0.0002
LKA—C	-0.453371	0.072550	-6.249073	0.0000
LSO—C	-0.587064	0.110188	-5.327831	0.0000
LUX—C	0.287556	0.048156	5.971331	0.0000
MDG—C	-0.514351	0.083129	-6.187374	0.0000
MEX—C	-0.046825	0.012038	-3.889787	0.0001
MMR—C	-0.790999	0.130964	-6.039829	0.0000
MRT—C	-0.356675	0.054121	-6.590304	0.0000
MUS—C	-0.248791	0.041170	-6.042941	0.0000
MWI—C	-0.585859	0.102812	-5.698340	0.0000
MYS—C	-0.221703	0.042692	-5.193051	0.0000
NER—C	-0.541971	0.100759	-5.378875	0.0000
NGA—C	-0.276162	0.049403	-5.590022	0.0000
NIC—C	-0.292944	0.036466	-8.033309	0.0000
NLD—C	0.193951	0.034481	5.624903	0.0000
NOR—C	0.267551	0.043797	6.108829	0.0000
NPL—C	-0.648418	0.100008	-6.483641	0.0000
NZL—C	0.173249	0.033902	5.110236	0.0000
PAK—C	-0.513184	0.078983	-6.497382	0.0000

PAN—C	-0.121879	0.025149	-4.846260	0.0000
PER—C	-0.182128	0.023924	-7.612755	0.0000
PHL—C	-0.324516	0.051696	-6.277448	0.0000
PNG—C	-0.283929	0.048472	-5.857630	0.0000
PRI—C	0.091728	0.009717	9.439472	0.0000
PRT—C	0.021870	0.010767	2.031264	0.0425
PRY—C	-0.218791	0.045430	-4.816006	0.0000
RWA—C	-0.633213	0.108452	-5.838640	0.0000
SAU—C	0.271186	0.048703	5.568119	0.0000
SDN—C	-0.481704	0.059626	-8.078775	0.0000
SEN—C	-0.439225	0.064515	-6.808094	0.0000
SGP—C	0.060236	0.004558	13.21417	0.0000
SLE—C	-0.530120	0.084041	-6.307838	0.0000
SOM—C	-0.636753	0.093795	-6.788741	0.0000
SUR—C	-0.056711	0.019642	-2.887252	0.0040
SWE—C	0.205754	0.039246	5.242632	0.0000
SYC—C	-0.062960	0.038200	-1.648170	0.0997
SYR—C	-0.415549	0.071951	-5.775413	0.0000
TCD—C	-0.622378	0.077025	-8.080256	0.0000
TGO—C	-0.481505	0.072716	-6.621721	0.0000
THA—C	-0.375029	0.064400	-5.823429	0.0000
TTO—C	-0.048915	0.014732	-3.320430	0.0009
TUN—C	-0.317669	0.057693	-5.506228	0.0000
TUR—C	-0.158921	0.019932	-7.973074	0.0000
TZA—C	-0.554469	0.083718	-6.623020	0.0000
URY—C	-0.040870	0.012454	-3.281579	0.0011
USA—C	0.225539	0.037646	5.991050	0.0000
VCT—C	-0.278362	0.066036	-4.215320	0.0000
<b>ZAF—C</b>	<b>-0.119785</b>	<b>0.016216</b>	<b>-7.386909</b>	<b>0.0000</b>
ZMB—C	-0.416758	0.056849	-7.331028	0.0000
ZWE—C	-0.358407	0.057838	-6.196794	0.0000

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Weighted Statistics

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R-squared	0.404075	Mean dependent var	-0.000476
Adjusted R-squared	0.329499	S.D. dependent var	0.063215
S.E. of regression	0.051763	Sum squared resid	2.355182
F-statistic	5.418335	Durbin-Watson stat	1.913778
Prob(F-statistic)	0.000000		

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Unweighted Statistics

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R-squared	0.267984	Mean dependent var	-0.003325
Sum squared resid	2.367822	Durbin-Watson stat	1.765631

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

Dependent Variable: D(Y?)

Method: Pooled EGLS (Cross-section weights)

Date: 07/18/25 Time: 22:39

Sample (adjusted): 1981 1989

Included observations: 9 after adjustments

Cross-sections included: 110

Total pool (balanced) observations: 990

Linear estimation after one-step weighting matrix

White cross-section standard errors & covariance (d.f. corrected)

<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
Y?(-1)	-0.121608	0.032093	-3.789291	0.0002
ARG—C	-0.043193	0.014928	-2.893320	0.0039
AUS—C	0.145333	0.036525	3.979046	0.0001
AUT—C	0.124101	0.033045	3.755502	0.0002
BDI—C	-0.389952	0.109180	-3.571658	0.0004
BEL—C	0.115514	0.029488	3.917317	0.0001
BEN—C	-0.328900	0.084741	-3.881247	0.0001
BFA—C	-0.419654	0.109549	-3.830750	0.0001
BGD—C	-0.379096	0.100637	-3.766945	0.0002
BHS—C	0.129742	0.046875	2.767831	0.0058
BLZ—C	-0.138408	0.047865	-2.891622	0.0039
BMU—C	0.245645	0.067080	3.661971	0.0003
BOL—C	-0.251011	0.061723	-4.066705	0.0001
BRA—C	-0.074177	0.014365	-5.163702	0.0000
BRB—C	0.036171	0.011976	3.020398	0.0026
BWA—C	-0.110905	0.048883	-2.268779	0.0235
CAF—C	-0.364769	0.089712	-4.065985	0.0001
CAN—C	0.130828	0.034372	3.806216	0.0002
CHE—C	0.220627	0.056786	3.885215	0.0001
CHL—C	-0.100195	0.040833	-2.453813	0.0143
CHN—C	-0.278980	0.084607	-3.297356	0.0010
CIV—C	-0.223550	0.052453	-4.261899	0.0000
CMR—C	-0.223956	0.058745	-3.812331	0.0001
COD—C	-0.311003	0.071323	-4.360506	0.0000
COG—C	-0.159822	0.056854	-2.811100	0.0050
COL—C	-0.138515	0.035246	-3.929950	0.0001
CRI—C	-0.090394	0.020457	-4.418627	0.0000
DEU—C	0.115571	0.029772	3.881918	0.0001
DNK—C	0.158904	0.046631	3.407712	0.0007
DOM—C	-0.158779	0.043777	-3.626965	0.0003
DZA—C	-0.135312	0.031289	-4.324622	0.0000
ECU—C	-0.131171	0.033487	-3.917068	0.0001
EGY—C	-0.196894	0.055871	-3.524093	0.0004
EMU—C	0.098776	0.024409	4.046746	0.0001
ESP—C	0.061400	0.013971	4.394875	0.0000
<b>ETH—C</b>	<b>-0.453641</b>	<b>0.113587</b>	<b>-3.993767</b>	<b>0.0001</b>

FIN—C	0.131200	0.030590	4.288989	0.0000
FJI—C	-0.161598	0.046229	-3.495571	0.0005
FRA—C	0.113465	0.028130	4.033622	0.0001
GAB—C	-0.045470	0.030627	-1.484622	0.1380
GBR—C	0.129146	0.032991	3.914559	0.0001
GHA—C	-0.330916	0.083450	-3.965433	0.0001
GRC—C	0.035212	0.012953	2.718477	0.0067
GTM—C	-0.188204	0.044893	-4.192291	0.0000
GUY—C	-0.203613	0.048300	-4.215605	0.0000
HKG—C	0.092438	0.018759	4.927579	0.0000
HND—C	-0.236541	0.055194	-4.285620	0.0000
HTI—C	-0.249158	0.050189	-4.964396	0.0000
HUN—C	-0.022398	0.009484	-2.361635	0.0184
IDN—C	-0.243813	0.072418	-3.366758	0.0008
IND—C	-0.365067	0.102761	-3.552596	0.0004
IRL—C	0.082231	0.014819	5.548910	0.0000
IRN—C	-0.163406	0.042355	-3.858037	0.0001
IRQ—C	-0.212970	0.049187	-4.329836	0.0000
ISL—C	0.144405	0.040132	3.598295	0.0003
ISR—C	0.083580	0.023501	3.556498	0.0004
ITA—C	0.110923	0.026776	4.142669	0.0000
JPN—C	0.118738	0.023877	4.972942	0.0000
KEN—C	-0.266355	0.069183	-3.850008	0.0001
KOR—C	-0.003012	0.018345	-0.164162	0.8696
LBR—C	-0.273926	0.043097	-6.355993	0.0000
LBY—C	-0.042240	0.035880	-1.177260	0.2394
LKA—C	-0.255292	0.068229	-3.741706	0.0002
LSO—C	-0.376015	0.099133	-3.793052	0.0002
LUX—C	0.218265	0.051114	4.270173	0.0000
MDG—C	-0.389468	0.086735	-4.490328	0.0000
MEX—C	-0.045388	0.019671	-2.307367	0.0213
MMR—C	-0.505059	0.126470	-3.993522	0.0001
MRT—C	-0.256295	0.064640	-3.964962	0.0001
MUS—C	-0.125118	0.043260	-2.892240	0.0039
MWI—C	-0.434979	0.096466	-4.509142	0.0000
MYS—C	-0.116875	0.039720	-2.942514	0.0033
NER—C	-0.402841	0.101998	-3.949494	0.0001
NGA—C	-0.284377	0.060705	-4.684550	0.0000
NIC—C	-0.272486	0.059243	-4.599451	0.0000
NLD—C	0.119445	0.032282	3.700028	0.0002
NOR—C	0.188216	0.052561	3.580875	0.0004
NPL—C	-0.394585	0.110795	-3.561403	0.0004
NZL—C	0.112189	0.032217	3.482337	0.0005
PAK—C	-0.291563	0.080059	-3.641855	0.0003
PAN—C	-0.097963	0.031020	-3.158039	0.0016

PER—C	-0.170134	0.038338	-4.437798	0.0000
PHL—C	-0.237175	0.065149	-3.640501	0.0003
PNG—C	-0.212567	0.047025	-4.520298	0.0000
PRI—C	0.065999	0.015461	4.268678	0.0000
PRT—C	0.028219	0.008996	3.136747	0.0018
PRY—C	-0.127631	0.042527	-3.001184	0.0028
RWA—C	-0.412569	0.103251	-3.995802	0.0001
SAU—C	-0.008897	0.032645	-0.272521	0.7853
SDN—C	-0.316974	0.093036	-3.406990	0.0007
SEN—C	-0.287483	0.075609	-3.802213	0.0002
SGP—C	0.097477	0.016104	6.053152	0.0000
SLE—C	-0.369907	0.088740	-4.168458	0.0000
SOM—C	-0.431155	0.126594	-3.405796	0.0007
SUR—C	-0.065062	0.025305	-2.571144	0.0103
SWE—C	0.142054	0.037948	3.743417	0.0002
SYC—C	-0.042016	0.019833	-2.118505	0.0344
SYR—C	-0.306176	0.079007	-3.875314	0.0001
TCD—C	-0.376218	0.106744	-3.524482	0.0004
TGO—C	-0.347856	0.084836	-4.100313	0.0000
THA—C	-0.176628	0.063361	-2.787648	0.0054
TTO—C	-0.090918	0.025638	-3.546185	0.0004
TUN—C	-0.208860	0.053961	-3.870553	0.0001
TUR—C	-0.089387	0.023587	-3.789664	0.0002
TZA—C	-0.384299	0.096627	-3.977150	0.0001
URY—C	-0.051046	0.021527	-2.371259	0.0179
USA—C	0.157085	0.039921	3.934890	0.0001
VCT—C	-0.124085	0.042137	-2.944800	0.0033
ZAF—C	-0.109629	0.027074	-4.049307	0.0001
ZMB—C	-0.314895	0.080189	-3.926905	0.0001
ZWE—C	-0.239620	0.068641	-3.490894	0.0005

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Weighted Statistics

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R-squared	0.467442	Mean dependent var	-0.002061
Adjusted R-squared	0.400797	S.D. dependent var	0.058520
S.E. of regression	0.045300	Sum squared resid	1.803750
F-statistic	7.013860	Durbin-Watson stat	1.760473
Prob(F-statistic)	0.000000		

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Unweighted Statistics

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R-squared	0.330987	Mean dependent var	-0.008081
Sum squared resid	1.803904	Durbin-Watson stat	1.784610

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**4. The Regression Results by Using the 1990-1999 Sub-sample**

Dependent Variable: D(Y?)

Method: Pooled EGLS (Cross-section weights)

Date: 07/18/25 Time: 22:53

Sample (adjusted): 1991 1999

Included observations: 9 after adjustments

Cross-sections included: 110

Total pool (balanced) observations: 990

Linear estimation after one-step weighting matrix

White cross-section standard errors & covariance (d.f. corrected)

<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
Y?(-1)	-0.240357	0.033010	-7.281326	0.0000
ARG—C	-0.034273	0.013222	-2.592182	0.0097
AUS—C	0.282598	0.040105	7.046427	0.0000
AUT—C	0.246730	0.032454	7.602357	0.0000
BDI—C	-0.881397	0.118378	-7.445619	0.0000
BEL—C	0.225721	0.029989	7.526731	0.0000
BEN—C	-0.658090	0.090610	-7.262863	0.0000
BFA—C	-0.830376	0.122294	-6.790007	0.0000
BGD—C	-0.736390	0.100697	-7.312895	0.0000
BHS—C	0.191464	0.029062	6.588159	0.0000
BLZ—C	-0.212796	0.036363	-5.851973	0.0000
BMU—C	0.478263	0.068070	7.026033	0.0000
BOL—C	-0.452371	0.060887	-7.429654	0.0000
BRA—C	-0.165964	0.018696	-8.877131	0.0000
BRB—C	0.033203	0.009946	3.338308	0.0009
BWA—C	-0.244835	0.041557	-5.891560	0.0000
CAF—C	-0.810438	0.108018	-7.502811	0.0000
CAN—C	0.232794	0.034322	6.782589	0.0000
CHE—C	0.400018	0.058055	6.890293	0.0000
CHL—C	-0.108081	0.015794	-6.843045	0.0000
CHN—C	-0.455884	0.068737	-6.632287	0.0000
CIV—C	-0.479543	0.064215	-7.467732	0.0000
CMR—C	-0.608035	0.081899	-7.424178	0.0000
COD—C	-0.855242	0.105330	-8.119621	0.0000
COG—C	-0.446573	0.056956	-7.840669	0.0000
COL—C	-0.277581	0.029793	-9.317034	0.0000
CRI—C	-0.137545	0.016339	-8.418065	0.0000
DEU—C	0.225001	0.030225	7.444122	0.0000
DNK—C	0.304406	0.042184	7.216111	0.0000
DOM—C	-0.293725	0.041183	-7.132190	0.0000
DZA—C	-0.328700	0.042845	-7.671806	0.0000
ECU—C	-0.277203	0.033165	-8.358351	0.0000
EGY—C	-0.417261	0.056953	-7.326422	0.0000
EMU—C	0.189832	0.025363	7.484565	0.0000
ESP—C	0.123464	0.014195	8.697979	0.0000
<b>ETH—C</b>	<b>-0.964237</b>	<b>0.125359</b>	<b>-7.691800</b>	<b>0.0000</b>

FIN—C	0.218102	0.032452	6.720717	0.0000
FJI—C	-0.285530	0.037196	-7.676434	0.0000
FRA—C	0.211160	0.029659	7.119684	0.0000
GAB—C	-0.107718	0.018576	-5.798822	0.0000
GBR—C	0.241627	0.034490	7.005758	0.0000
GHA—C	-0.618769	0.084902	-7.288046	0.0000
GRC—C	0.067403	0.007515	8.969358	0.0000
GTM—C	-0.344783	0.045438	-7.587964	0.0000
GUY—C	-0.291825	0.042747	-6.826870	0.0000
HKG—C	0.169293	0.027942	6.058766	0.0000
HND—C	-0.491081	0.056588	-8.678266	0.0000
HTI—C	-0.557830	0.081730	-6.825274	0.0000
HUN—C	-0.124945	0.012369	-10.10149	0.0000
IDN—C	-0.459211	0.063744	-7.203953	0.0000
IND—C	-0.705381	0.098171	-7.185253	0.0000
IRL—C	0.234663	0.027830	8.431958	0.0000
IRN—C	-0.294999	0.045801	-6.440822	0.0000
IRQ—C	-0.430927	0.097708	-4.410335	0.0000
ISL—C	0.254949	0.034408	7.409627	0.0000
ISR—C	0.179318	0.027676	6.479272	0.0000
ITA—C	0.204686	0.029079	7.039006	0.0000
JPN—C	0.207845	0.031043	6.695367	0.0000
KEN—C	-0.574067	0.074489	-7.706723	0.0000
KOR—C	0.041792	0.012996	3.215806	0.0013
LBR—C	-0.865276	0.195513	-4.425672	0.0000
LBY—C	-0.031265	0.021475	-1.455868	0.1458
LKA—C	-0.470685	0.066698	-7.056952	0.0000
LSO—C	-0.699905	0.095971	-7.292901	0.0000
LUX—C	0.448448	0.054925	8.164679	0.0000
MDG—C	-0.811392	0.103117	-7.868696	0.0000
MEX—C	-0.087300	0.017340	-5.034738	0.0000
MMR—C	-0.956244	0.133271	-7.175175	0.0000
MRT—C	-0.545910	0.071556	-7.629171	0.0000
MUS—C	-0.222530	0.031184	-7.136113	0.0000
MWI—C	-0.832512	0.121241	-6.866581	0.0000
MYS—C	-0.174097	0.029923	-5.818116	0.0000
NER—C	-0.835878	0.106283	-7.864675	0.0000
NGA—C	-0.531573	0.068847	-7.721081	0.0000
NIC—C	-0.554907	0.077794	-7.133080	0.0000
NLD—C	0.251854	0.032163	7.830579	0.0000
NOR—C	0.384628	0.052534	7.321492	0.0000
NPL—C	-0.776458	0.107887	-7.196938	0.0000
NZL—C	0.190105	0.032633	5.825532	0.0000
PAK—C	-0.603740	0.079814	-7.564362	0.0000
PAN—C	-0.151913	0.024974	-6.082872	0.0000

PER—C	-0.337015	0.043721	-7.708332	0.0000
PHL—C	-0.482434	0.063070	-7.649156	0.0000
PNG—C	-0.406528	0.052473	-7.747346	0.0000
PRI—C	0.149570	0.019980	7.486004	0.0000
PRT—C	0.070656	0.006693	10.55607	0.0000
PRY—C	-0.264796	0.031377	-8.439295	0.0000
RWA—C	-0.919897	0.151488	-6.072404	0.0000
SAU—C	0.075692	0.023360	3.240252	0.0012
SDN—C	-0.597071	0.088997	-6.708873	0.0000
SEN—C	-0.613798	0.084886	-7.230853	0.0000
SGP—C	0.221619	0.032083	6.907715	0.0000
SLE—C	-0.847119	0.114673	-7.387227	0.0000
SOM—C	-0.908837	0.135595	-6.702582	0.0000
SUR—C	-0.181993	0.025894	-7.028373	0.0000
SWE—C	0.248826	0.034032	7.311550	0.0000
SYC—C	-0.039461	0.016418	-2.403579	0.0164
SYR—C	-0.546283	0.069851	-7.820700	0.0000
TCD—C	-0.837413	0.117347	-7.136191	0.0000
TGO—C	-0.711107	0.101937	-6.975932	0.0000
THA—C	-0.307157	0.043360	-7.083843	0.0000
TTO—C	-0.099977	0.023589	-4.238341	0.0000
TUN—C	-0.386612	0.056279	-6.869603	0.0000
TUR—C	-0.182110	0.024093	-7.558695	0.0000
TZA—C	-0.772246	0.106034	-7.282993	0.0000
URY—C	-0.036608	0.010148	-3.607583	0.0003
USA—C	0.298158	0.042214	7.062942	0.0000
VCT—C	-0.239668	0.033056	-7.250418	0.0000
ZAF—C	-0.259912	0.032345	-8.035681	0.0000
ZMB—C	-0.674842	0.092294	-7.311892	0.0000
ZWE—C	-0.490242	0.069660	-7.037585	0.0000

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Weighted Statistics

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R-squared	0.441263	Mean dependent var	-0.005120
Adjusted R-squared	0.371341	S.D. dependent var	0.074477
S.E. of regression	0.059051	Sum squared resid	3.065139
F-statistic	6.310825	Durbin-Watson stat	1.701596
Prob(F-statistic)	0.000000		

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Unweighted Statistics

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R-squared	0.284435	Mean dependent var	-0.005458
Sum squared resid	3.202617	Durbin-Watson stat	1.665214

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

Dependent Variable: D(Y?)

Method: Pooled EGLS (Cross-section weights)

Date: 07/18/25 Time: 23:05

Sample (adjusted): 2001 2009

Included observations: 9 after adjustments

Cross-sections included: 110

Total pool (balanced) observations: 990

Linear estimation after one-step weighting matrix

White cross-section standard errors & covariance (d.f. corrected)

<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
Y?(-1)	-0.072642	0.036595	-1.985001	0.0475
ARG—C	-0.019870	0.019565	-1.015552	0.3101
AUS—C	0.090623	0.042217	2.146617	0.0321
AUT—C	0.070939	0.036195	1.959917	0.0503
BDI—C	-0.300895	0.148201	-2.030320	0.0426
BEL—C	0.064407	0.032657	1.972207	0.0489
BEN—C	-0.204806	0.106540	-1.922339	0.0549
BFA—C	-0.238073	0.128366	-1.854634	0.0640
BGD—C	-0.190994	0.114881	-1.662541	0.0968
BHS—C	0.036078	0.026672	1.352617	0.1765
BLZ—C	-0.072067	0.033030	-2.181879	0.0294
BMU—C	0.146400	0.074021	1.977810	0.0483
BOL—C	-0.134408	0.074905	-1.794382	0.0731
BRA—C	-0.044575	0.029030	-1.535485	0.1250
BRB—C	0.004133	0.009968	0.414610	0.6785
BWA—C	-0.085244	0.029193	-2.919959	0.0036
CAF—C	-0.257575	0.141553	-1.819640	0.0692
CAN—C	0.065780	0.035742	1.840430	0.0660
CHE—C	0.114109	0.057613	1.980600	0.0479
CHL—C	-0.013226	0.015200	-0.870092	0.3845
CHN—C	-0.031903	0.060992	-0.523069	0.6011
CIV—C	-0.191755	0.089655	-2.138811	0.0327
CMR—C	-0.181975	0.094373	-1.928257	0.0541
COD—C	-0.274362	0.135715	-2.021598	0.0435
COG—C	-0.147575	0.082334	-1.792388	0.0734
COL—C	-0.076394	0.046016	-1.660181	0.0972
CRI—C	-0.026826	0.021736	-1.234207	0.2175
DEU—C	0.055800	0.030603	1.823326	0.0686
DNK—C	0.079266	0.045278	1.750654	0.0804
DOM—C	-0.071157	0.047639	-1.493668	0.1356
DZA—C	-0.085686	0.048524	-1.765844	0.0778
ECU—C	-0.077111	0.047677	-1.617361	0.1062
EGY—C	-0.109911	0.067734	-1.622688	0.1050
EMU—C	0.049180	0.026755	1.838140	0.0664

ESP—C	0.034758	0.018293	1.900085	0.0577
<b>ETH—C</b>	<b>-0.246978</b>	<b>0.154170</b>	<b>-1.601984</b>	<b>0.1095</b>
FIN—C	0.074238	0.040246	1.844587	0.0654
FJI—C	-0.100116	0.049502	-2.022454	0.0434
FRA—C	0.053736	0.028978	1.854350	0.0640
GAB—C	-0.087661	0.032448	-2.701598	0.0070
GBR—C	0.069701	0.038101	1.829372	0.0677
GHA—C	-0.173854	0.098692	-1.761585	0.0785
GRC—C	0.036209	0.015841	2.285777	0.0225
GTM—C	-0.109436	0.057081	-1.917200	0.0555
GUY—C	-0.085489	0.056434	-1.514837	0.1302
HKG—C	0.071702	0.029991	2.390747	0.0170
HND—C	-0.145540	0.073702	-1.974701	0.0486
HTI—C	-0.183694	0.094457	-1.944749	0.0521
HUN—C	-0.013528	0.012100	-1.118010	0.2639
IDN—C	-0.118389	0.075394	-1.570277	0.1167
IND—C	-0.169669	0.106515	-1.592918	0.1115
IRL—C	0.080253	0.043434	1.847699	0.0650
IRN—C	-0.068660	0.041960	-1.636344	0.1021
IRQ—C	-0.130895	0.103961	-1.259079	0.2083
ISL—C	0.088385	0.044712	1.976779	0.0484
ISR—C	0.046068	0.024774	1.859564	0.0633
ITA—C	0.042515	0.027624	1.539050	0.1242
JPN—C	0.044316	0.029261	1.514488	0.1303
KEN—C	-0.186876	0.096003	-1.946568	0.0519
KOR—C	0.047511	0.010259	4.631312	0.0000
LBR—C	-0.269118	0.145908	-1.844437	0.0655
LBY—C	-0.015970	0.010863	-1.470118	0.1419
LKA—C	-0.112184	0.068123	-1.646789	0.1000
LSO—C	-0.195063	0.107394	-1.816329	0.0697
LUX—C	0.139404	0.070139	1.987538	0.0472
MDG—C	-0.266786	0.129096	-2.066563	0.0391
MEX—C	-0.051129	0.014372	-3.557581	0.0004
MMR—C	-0.158507	0.129888	-1.220342	0.2227
MRT—C	-0.171796	0.083841	-2.049068	0.0408
MUS—C	-0.040785	0.035496	-1.148987	0.2509
MWI—C	-0.255552	0.131576	-1.942233	0.0524
MYS—C	-0.048726	0.024772	-1.966968	0.0495
NER—C	-0.266721	0.138424	-1.926843	0.0543
NGA—C	-0.116406	0.080490	-1.446213	0.1485
NIC—C	-0.164055	0.083569	-1.963104	0.0499
NLD—C	0.072121	0.036235	1.990370	0.0469
NOR—C	0.109549	0.055671	1.967790	0.0494
NPL—C	-0.220464	0.124682	-1.768209	0.0774
NZL—C	0.061546	0.028040	2.194928	0.0284
PAK—C	-0.175637	0.095099	-1.846873	0.0651

PAN—C	-0.021911	0.025640	-0.854578	0.3930
PER—C	-0.071230	0.050697	-1.405025	0.1604
PHL—C	-0.133240	0.074184	-1.796061	0.0728
PNG—C	-0.161310	0.080475	-2.004457	0.0453
PRI—C	0.044129	0.020275	2.176533	0.0298
PRT—C	0.008716	0.006381	1.365921	0.1723
PRY—C	-0.088831	0.046508	-1.910015	0.0565
RWA—C	-0.215314	0.137042	-1.571160	0.1165
SAU—C	-0.001442	0.017436	-0.082687	0.9341
SDN—C	-0.172958	0.088584	-1.952482	0.0512
SEN—C	-0.193434	0.098878	-1.956291	0.0507
SGP—C	0.081434	0.043362	1.878018	0.0607
SLE—C	-0.239408	0.119161	-2.009116	0.0448
SOM—C	-0.249405	0.141209	-1.766208	0.0777
SUR—C	-0.033301	0.030231	-1.101565	0.2710
SWE—C	0.079499	0.041515	1.914940	0.0558
SYC—C	-0.027655	0.018994	-1.455953	0.1458
SYR—C	-0.169433	0.090108	-1.880321	0.0604
TCD—C	-0.192414	0.121628	-1.581991	0.1140
TGO—C	-0.248140	0.118724	-2.090058	0.0369
THA—C	-0.071972	0.045487	-1.582264	0.1139
TTO—C	0.033594	0.008278	4.058276	0.0001
TUN—C	-0.092693	0.060165	-1.540656	0.1238
TUR—C	-0.044467	0.017154	-2.592176	0.0097
TZA—C	-0.204744	0.118250	-1.731452	0.0837
URY—C	-0.012381	0.022980	-0.538763	0.5902
USA—C	0.083736	0.045455	1.842166	0.0658
VCT—C	-0.042878	0.031463	-1.362776	0.1733
ZAF—C	-0.063451	0.038221	-1.660099	0.0973
ZMB—C	-0.179800	0.107280	-1.675992	0.0941
ZWE—C	-0.261915	0.119774	-2.186745	0.0290

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*Weighted Statistics*

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R-squared	0.357238	Mean dependent var	0.007357
Adjusted R-squared	0.276801	S.D. dependent var	0.045212
S.E. of regression	0.038449	Sum squared resid	1.299416
F-statistic	4.441234	Durbin-Watson stat	1.496846
Prob(F-statistic)	0.000000		

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*Unweighted Statistics*

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R-squared	0.273552	Mean dependent var	0.006104
Sum squared resid	1.361555	Durbin-Watson stat	2.068220

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**6. The Regression Results by Using the 2010-2019 Sub-sample**

Dependent Variable: D(Y?)

Method: Pooled EGLS (Cross-section weights)

Date: 07/18/25 Time: 23:19

Sample (adjusted): 2011 2019

Included observations: 9 after adjustments

Cross-sections included: 110

Total pool (balanced) observations: 990

Linear estimation after one-step weighting matrix

White cross-section standard errors & covariance (d.f. corrected)

<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
Y?(-1)	-0.218913	0.018160	-12.05489	0.0000
ARG—C	-0.063188	0.011143	-5.670442	0.0000
AUS—C	0.263777	0.023240	11.35035	0.0000
AUT—C	0.210543	0.017154	12.27337	0.0000
BDI—C	-0.908587	0.071794	-12.65550	0.0000
BEL—C	0.191632	0.015715	12.19412	0.0000
BEN—C	-0.602879	0.054422	-11.07784	0.0000
BFA—C	-0.704523	0.061960	-11.37057	0.0000
BGD—C	-0.539128	0.053751	-10.03013	0.0000
BHS—C	0.113224	0.014221	7.961974	0.0000
BLZ—C	-0.241937	0.018578	-13.02298	0.0000
BMU—C	0.384450	0.033130	11.60414	0.0000
BOL—C	-0.369554	0.031869	-11.59608	0.0000
BRA—C	-0.153641	0.016053	-9.570595	0.0000
BRB—C	-0.006356	0.003970	-1.601189	0.1097
BWA—C	-0.217973	0.026655	-8.177674	0.0000
CAF—C	-0.857747	0.082494	-10.39773	0.0000
CAN—C	0.205498	0.017329	11.85892	0.0000
CHE—C	0.347433	0.029151	11.91822	0.0000
CHL—C	-0.047284	0.006089	-7.765108	0.0000
CHN—C	-0.123346	0.019896	-6.199649	0.0000
CIV—C	-0.460583	0.042166	-10.92299	0.0000
CMR—C	-0.546850	0.044257	-12.35633	0.0000
COD—C	-0.778425	0.065422	-11.89853	0.0000
COG—C	-0.471180	0.034190	-13.78121	0.0000
COL—C	-0.216003	0.018787	-11.49761	0.0000
CRI—C	-0.073487	0.006996	-10.50462	0.0000
DEU—C	0.198142	0.015905	12.45789	0.0000
DNK—C	0.253435	0.020489	12.36942	0.0000
DOM—C	-0.176767	0.022576	-7.829976	0.0000
DZA—C	-0.285587	0.020877	-13.67933	0.0000
ECU—C	-0.226031	0.019243	-11.74601	0.0000
EGY—C	-0.347574	0.032109	-10.82495	0.0000

EMU—C	0.155172	0.011512	13.47934	0.0000
ESP—C	0.092406	0.008011	11.53553	0.0000
<b>ETH—C</b>	<b>-0.683519</b>	<b>0.064939</b>	<b>-10.52549</b>	<b>0.0000</b>
FIN—C	0.205374	0.016333	12.57408	0.0000
FJI—C	-0.250303	0.023961	-10.44626	0.0000
FRA—C	0.169373	0.013277	12.75650	0.0000
GAB—C	-0.200353	0.015950	-12.56102	0.0000
GBR—C	0.213284	0.018069	11.80397	0.0000
GHA—C	-0.475324	0.046084	-10.31437	0.0000
GRC—C	-0.002372	0.007550	-0.314209	0.7534
GTM—C	-0.312982	0.027655	-11.31738	0.0000
GUY—C	-0.222753	0.021362	-10.42760	0.0000
HKG—C	0.204278	0.018332	11.14298	0.0000
HND—C	-0.435136	0.036363	-11.96655	0.0000
HTI—C	-0.550835	0.043818	-12.57102	0.0000
HUN—C	-0.045458	0.012901	-3.523700	0.0004
IDN—C	-0.333875	0.032769	-10.18863	0.0000
IND—C	-0.488314	0.046740	-10.44745	0.0000
IRL—C	0.302035	0.029569	10.21446	0.0000
IRN—C	-0.273923	0.022847	-11.98963	0.0000
IRQ—C	-0.278447	0.023408	-11.89542	0.0000
ISL—C	0.256876	0.022264	11.53749	0.0000
ISR—C	0.174992	0.012006	14.57530	0.0000
ITA—C	0.123494	0.009709	12.72005	0.0000
JPN—C	0.156158	0.015361	10.16588	0.0000
KEN—C	-0.522535	0.046424	-11.25570	0.0000
KOR—C	0.125670	0.008379	14.99738	0.0000
LBR—C	-0.710270	0.053160	-13.36102	0.0000
LBY—C	-0.166440	0.103660	-1.605635	0.1087
LKA—C	-0.294124	0.024690	-11.91276	0.0000
LSO—C	-0.607781	0.042272	-14.37781	0.0000
LUX—C	0.393096	0.035242	11.15430	0.0000
MDG—C	-0.794591	0.065329	-12.16295	0.0000
MEX—C	-0.117198	0.007678	-15.26333	0.0000
MMR—C	-0.554782	0.054108	-10.25322	0.0000
MRT—C	-0.522686	0.043481	-12.02108	0.0000
MUS—C	-0.107880	0.013341	-8.086349	0.0000
MWI—C	-0.752907	0.065338	-11.52321	0.0000
MYS—C	-0.104463	0.012958	-8.061898	0.0000
NER—C	-0.774055	0.063812	-12.13020	0.0000
NGA—C	-0.419576	0.033412	-12.55761	0.0000
NIC—C	-0.466616	0.030963	-15.07026	0.0000
NLD—C	0.215840	0.016555	13.03755	0.0000
NOR—C	0.320316	0.028786	11.12734	0.0000
NPL—C	-0.623878	0.060478	-10.31580	0.0000

NZL—C	0.182103	0.015509	11.74187	0.0000
PAK—C	-0.528123	0.046634	-11.32483	0.0000
PAN—C	-0.025772	0.004198	-6.139405	0.0000
PER—C	-0.211259	0.017151	-12.31791	0.0000
PHL—C	-0.355191	0.035212	-10.08711	0.0000
PNG—C	-0.421192	0.035501	-11.86431	0.0000
PRI—C	0.117540	0.012310	9.548574	0.0000
PRT—C	0.031900	0.004611	6.917644	0.0000
PRY—C	-0.226716	0.021492	-10.54897	0.0000
RWA—C	-0.664232	0.061959	-10.72055	0.0000
SAU—C	0.037997	0.010110	3.758473	0.0002
SDN—C	-0.578140	0.044826	-12.89743	0.0000
SEN—C	-0.562568	0.049225	-11.42851	0.0000
SGP—C	0.272282	0.020780	13.10329	0.0000
SLE—C	-0.714924	0.070899	-10.08374	0.0000
SOM—C	-0.760696	0.061840	-12.30106	0.0000
SUR—C	-0.149134	0.018354	-8.125379	0.0000
SWE—C	0.241012	0.019924	12.09634	0.0000
SYC—C	0.017387	0.013287	1.308589	0.1910
SYR—C	-0.705289	0.069978	-10.07866	0.0000
TCD—C	-0.712659	0.053536	-13.31185	0.0000
TGO—C	-0.668773	0.056838	-11.76633	0.0000
THA—C	-0.224217	0.019604	-11.43710	0.0000
TTO—C	-0.013430	0.018178	-0.738792	0.4602
TUN—C	-0.323113	0.025071	-12.88809	0.0000
TUR—C	-0.075615	0.009742	-7.762007	0.0000
TZA—C	-0.621468	0.055154	-11.26783	0.0000
URY—C	0.004852	0.005118	0.948063	0.3434
USA—C	0.269005	0.021328	12.61283	0.0000
VCT—C	-0.171904	0.015863	-10.83654	0.0000
<b>ZAF—C</b>	<b>-0.226494</b>	<b>0.016783</b>	<b>-13.49508</b>	<b>0.0000</b>
ZMB—C	-0.563839	0.043308	-13.01933	0.0000
ZWE—C	-0.539256	0.039125	-13.78279	0.0000

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*Weighted Statistics*

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R-squared	0.622540	Mean dependent var	0.015035
Adjusted R-squared	0.575304	S.D. dependent var	0.065164
S.E. of regression	0.042467	Sum squared resid	1.585208
F-statistic	13.17933	Durbin-Watson stat	1.466764
Prob(F-statistic)	0.000000		

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*Unweighted Statistics*

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R-squared	0.308769	Mean dependent var	0.004161
Sum squared resid	1.677889	Durbin-Watson stat	2.248145

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### 7. The Regression Results by Using the 2020-2024 Sub-sample

Dependent Variable: D(Y?)

Method: Pooled EGLS (Cross-section weights)

Date: 08/06/25 Time: 22:57

Sample (adjusted): 2021 2024

Included observations: 4 after adjustments

Cross-sections included: 110

Total pool (balanced) observations: 440

Linear estimation after one-step weighting matrix

White cross-section standard errors & covariance (d.f. corrected)

<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
Y?(-1)	-0.284792	0.048544	-5.866651	0.0000
ARG—C	-0.107258	0.019119	-5.609912	0.0000
AUS—C	0.325929	0.063429	5.138468	0.0000
AUT—C	0.246666	0.050035	4.929866	0.0000
BDI—C	-1.242135	0.208535	-5.956470	0.0000
BEL—C	0.243786	0.044227	5.512204	0.0000
BEN—C	-0.761671	0.136352	-5.586046	0.0000
BFA—C	-0.923459	0.161054	-5.733847	0.0000
BGD—C	-0.646640	0.111870	-5.780303	0.0000
BHS—C	0.190514	0.026026	7.320186	0.0000
BLZ—C	-0.282049	0.068138	-4.139360	0.0000
BMU—C	0.519797	0.091744	5.665739	0.0000
BOL—C	-0.507432	0.082137	-6.177872	0.0000
BRA—C	-0.199511	0.037077	-5.381059	0.0000
BRB—C	0.023913	0.036581	0.653678	0.5138
BWA—C	-0.277659	0.035780	-7.760108	0.0000
CAF—C	-1.121014	0.179846	-6.233178	0.0000
CAN—C	0.239156	0.047143	5.073003	0.0000
CHE—C	0.438413	0.078752	5.567013	0.0000
CHL—C	-0.070416	0.020201	-3.485750	0.0006
CHN—C	-0.101723	0.028304	-3.593937	0.0004
CIV—C	-0.592781	0.103878	-5.706511	0.0000
CMR—C	-0.738936	0.122566	-6.028877	0.0000
COD—C	-1.009191	0.172450	-5.852078	0.0000
COG—C	-0.709001	0.115123	-6.158645	0.0000
COL—C	-0.281511	0.049044	-5.739980	0.0000
CRI—C	-0.066858	0.018547	-3.604788	0.0004
DEU—C	0.232289	0.042638	5.447925	0.0000
DNK—C	0.340317	0.053350	6.378990	0.0000
DOM—C	-0.196802	0.044460	-4.426505	0.0000
DZA—C	-0.403223	0.067580	-5.966601	0.0000
ECU—C	-0.321310	0.045309	-7.091592	0.0000
EGY—C	-0.439620	0.069984	-6.281689	0.0000

<b>EMU—C</b>	<b>0.198048</b>	<b>0.034924</b>	<b>5.670767</b>	<b>0.0000</b>
ESP—C	0.124621	0.020100	6.199885	0.0000
ETH—C	-0.870240	0.153490	-5.669704	0.0000
FIN—C	0.234967	0.046557	5.046889	0.0000
FJI—C	-0.335028	0.066719	-5.021507	0.0000
FRA—C	0.207177	0.036094	5.739955	0.0000
GAB—C	-0.315768	0.050846	-6.210262	0.0000
GBR—C	0.262959	0.046453	5.660782	0.0000
GHA—C	-0.625901	0.111283	-5.624406	0.0000
GRC—C	0.047331	0.005176	9.144583	0.0000
GTM—C	-0.406390	0.070995	-5.724181	0.0000
GUY—C	0.223202	0.104452	2.136892	0.0333
HKG—C	0.238448	0.037243	6.402411	0.0000
HND—C	-0.562994	0.099934	-5.633647	0.0000
HTI—C	-0.819521	0.120312	-6.811610	0.0000
HUN—C	-0.036708	0.008352	-4.395035	0.0000
IDN—C	-0.423029	0.076431	-5.534785	0.0000
IND—C	-0.580909	0.107069	-5.425569	0.0000
IRL—C	0.461830	0.078128	5.911172	0.0000
IRN—C	-0.343247	0.057961	-5.922050	0.0000
IRQ—C	-0.440514	0.060002	-7.341604	0.0000
ISL—C	0.317336	0.067414	4.707288	0.0000
ISR—C	0.227612	0.041921	5.429609	0.0000
ITA—C	0.176157	0.030202	5.832548	0.0000
JPN—C	0.184114	0.036134	5.095247	0.0000
KEN—C	-0.664162	0.114533	-5.798846	0.0000
KOR—C	0.162596	0.033397	4.868625	0.0000
LBR—C	-0.959336	0.164043	-5.848084	0.0000
LBY—C	-0.243333	0.070860	-3.434018	0.0007
LKA—C	-0.450574	0.091555	-4.921355	0.0000
LSO—C	-0.852736	0.143704	-5.933996	0.0000
LUX—C	0.474629	0.083600	5.677405	0.0000
MDG—C	-1.072871	0.181321	-5.916963	0.0000
MEX—C	-0.175330	0.026939	-6.508484	0.0000
MMR—C	-0.831012	0.125416	-6.626042	0.0000
MRT—C	-0.707002	0.117350	-6.024723	0.0000
MUS—C	-0.138810	0.033058	-4.199059	0.0000
MWI—C	-1.020357	0.168093	-6.070182	0.0000
MYS—C	-0.137285	0.030115	-4.558679	0.0000
NER—C	-1.002668	0.176861	-5.669253	0.0000
NGA—C	-0.594367	0.099137	-5.995424	0.0000
NIC—C	-0.598613	0.105282	-5.685781	0.0000
NLD—C	0.283150	0.050336	5.625212	0.0000
NOR—C	0.401423	0.069238	5.797737	0.0000
NPL—C	-0.796069	0.139421	-5.709807	0.0000

NZL—C	0.218548	0.045928	4.758448	0.0000
PAK—C	-0.701540	0.121180	-5.789234	0.0000
PAN—C	-0.007465	0.003526	-2.117369	0.0350
PER—C	-0.289418	0.058484	-4.948666	0.0000
PHL—C	-0.448134	0.082478	-5.433383	0.0000
PNG—C	-0.584512	0.097353	-6.004031	0.0000
PRI—C	0.129752	0.024367	5.324967	0.0000
PRT—C	0.048733	0.013148	3.706449	0.0002
PRY—C	-0.309622	0.056065	-5.522582	0.0000
RWA—C	-0.813100	0.150042	-5.419165	0.0000
SAU—C	0.085445	0.028578	2.989874	0.0030
SDN—C	-1.027309	0.169856	-6.048118	0.0000
SEN—C	-0.725666	0.130385	-5.565552	0.0000
SGP—C	0.370458	0.055834	6.635039	0.0000
SLE—C	-0.807169	0.136006	-5.934791	0.0000
SOM—C	-1.070331	0.176991	-6.047365	0.0000
SUR—C	-0.289946	0.047922	-6.050331	0.0000
SWE—C	0.297489	0.051573	5.768306	0.0000
SYC—C	-0.060868	0.022686	-2.683088	0.0077
SYR—C	-0.979416	0.159703	-6.132734	0.0000
TCD—C	-0.873535	0.137302	-6.362127	0.0000
TGO—C	-0.865588	0.148617	-5.824278	0.0000
THA—C	-0.311553	0.053881	-5.782235	0.0000
TTO—C	-0.060697	0.013665	-4.441907	0.0000
TUN—C	-0.450183	0.075125	-5.992478	0.0000
TUR—C	-0.055803	0.015215	-3.667717	0.0003
TZA—C	-0.816735	0.139356	-5.860778	0.0000
URY—C	-0.000624	0.006052	-0.103120	0.9179
USA—C	0.355549	0.060219	5.904239	0.0000
VCT—C	-0.202997	0.042325	-4.796170	0.0000
ZAF—C	-0.350425	0.054494	-6.430559	0.0000
ZMB—C	-0.759516	0.126677	-5.995701	0.0000
ZWE—C	-0.735704	0.120973	-6.081578	0.0000

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*Weighted Statistics*

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R-squared	0.798049	Mean dependent var	-0.010838
Adjusted R-squared	0.730527	S.D. dependent var	0.069366
S.E. of regression	0.036008	Sum squared resid	0.426583
F-statistic	11.81916	Durbin-Watson stat	2.000625
Prob(F-statistic)	0.000000		

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*Unweighted Statistics*

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R-squared	0.594920	Mean dependent var	-0.000472
Sum squared resid	0.465537	Durbin-Watson stat	2.066796

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