Asian Journal of Economics and Business
Volume 4; Number 2; 2023 : pp. 241-292
https://DOI:10.47509/AJEB.2023.v04i02.06

ARF INDIA
Academic Open Access Publishing
www.arfjournals.com

The Relative changes in the Steady States of Per-Capita Output of Some Typical "Middle Income Trap" Countries and China

Gang Liu

Associate Professor, Department of International Economy and Trade, School of International Business, Zhejiang International Studies University, No. 299, Liuhe Road, Xihu District, Hangzhou, Zhejiang, P. R. China. E-mail: lliugangg@hotmail.com

Article History
Received : 31 January 2023; Revised : 19 May 2023; Accepted : 28 August 2023; Published : 16 October 2023

Abstract: Based on a sample of 114 countries and regions, this paper uses the econometric method to show that, in terms of steady state of per-capita output, the relative positions of Brazil, Mexico, Malaysia, Turkey and South Africa in the sample generally remained slightly lower than the average level of the sample in the 1970-2019 period; China's relative position in the sample was extremely low in the 1970s, then continued to rise rapidly and caught up with the overall level of the above five countries in 2010s. Thus, even in terms of steady state of per-capita output, the above five countries were still typical "middle income trap" countries in the 1970-2019 period while China was not, but China started to face the "middle income trap" in 2010s. Next, combining the theory of convergence with the practical data of the above 5 countries and China, this paper analyses the reasons, respectively, for their different changes in the relative position in the sample. Finally, from the perspective of steady state of per-capita output, this paper gives some suggestions, respectively, for the above five countries and China to cross the "middle income trap" in the future.

Keywords: "middle income trap" country; China; steady state of per-capita output; conditional convergence; social infrastructure

1. INTRODUCTION

Many scholars have, from different perspectives, studied the reasons why some developing countries fell into and have been staying in the "middle income

To cite this paper:
Gang Liu (2023). The Relative changes in the Stready States of Per-Capita Output of Some Typical "Middle Income Trap" Countries and China. *Asian Journal of Economics and Business*. 4(2), 241-292. *https://DOI:10.47509/AJEB.2023.v04i02.06*

trap", and actually they have made many valuable research results. For example, Kam (2014) believed that the productivity growth in Malaysian manufacturing sector was low and the lack of innovative capabilities of the Malaysian manufacturers undermined the industrial upgrading prospects. Luiz (2016) argued that South Africa was unlikely to move beyond middle-income status unless there was a dramatic policy shift which could bring appropriate investments and better human capital plan in the country. Ada and Acaroðlu (2016) expressed that Turkey could overcome the "middle income trap" if it attached enough importance for public spending on education for a better human capital growth. Foxley and Stallings (2016) stressed that Latin America needed greater institutional capacity to promote innovation which in turn increased productivity. Dabús, Tohmé, and Caraballo (2016) pointed out that once the world's demand for primary commodities did not increase or even decrease, Latin American countries that rely heavily on international prices of these commodities would fall into the "middle income trap". Paus (2019) argued that the current globalisation process had shifted the goal posts for middle-income countries and increased the urgency for Latin American countries to develop domestic innovation capabilities to improve their poor productivity performance. Topal (2020) indicated that economic and institutional reform requirements maintained their priority in the political agenda in most middle-income countries, especially in Latin American countries.

Based on the above findings, one could draw the following conclusion: after reaching the middle-income level, the above developing countries failed to realise the transformation of their economic development strategies and modes, which resulted in difficulties in their industrial upgrading and the lack of endogenous driving force for their economic growth. As a result, they have long been among the "middle income trap" countries. The above conclusion is certainly pertinent, but the work of these scholars can still be improved. The reason for that is the more convincing quantitative analysis (such as quantitative analysis of Econometrics) was obviously less in their research work, which directly affected the academic value of their research results. So the future research works should try to make up for this shortcoming.

This paper uses the econometric method to make a study on the "middle income trap" countries from the perspective of steady state of per-capita output, which results from the Solow model. As the Solow model shows, for a given period, an economy's per-capita output always converges toward its steady state of per-capita output in that period. It can also be inferred that developed countries' steady states of per-capita output are usually much higher than developing countries'. In addition, due to existence of capital accumulation and technological innovation, most countries (including developing and developed ones) experience growth in their steady states of per-capita output over time. The explanations for the above two statements will be given in Section 2. To catch up with developed countries, developing countries need to achieve a relative growth in the steady state of per-capita output, so it is worthwhile to investigate the relative changes in the steady states of per-capita output of important developing countries in a broad set of countries. For doing that, this paper builds an important concept: *the relative steady state of per-capita output.* The detailed explanation for this concept will be given as well in Section 2.

Through testing the hypothesis of conditional convergence, this paper obtained the estimates of the relative steady states of per-capita output of five typical "middle income trap" countries (Brazil, Mexico, Malaysia, Turkey and South Africa), China (the mainland of China, the same below) and the United States (as a representative of developed countries). These estimates were used to show the relative changes in the steady state of per-capita output of each of the above country in a test sample. Then, combining the theory of convergence with the practical data of the above countries, this paper made an analysis of the reasons for the relative changes in their steady states of per-capita output. Conclusions were given after a comparison of the five typical "middle income trap" countries and China.

The paper consists of seven sections. Section 1 is introduction. Section 2 is a brief review of previous studies on convergence. In Section 3, the regression equation to test the hypothesis of conditional convergence is described. In Section 4, the data and the empirical methodology used are described, and the details of results and analyses are also given. After Section 5 showing the paths of the relative steady states of per-capita output of the concerned countries, Section 6 provides an analysis of reasons for the relative changes in their steady states of per-capita output. Conclusions are given in Section 7.

2. A BRIEF REVIEW OF PREVIOUS STUDIES ON β-CONVERGENCE

Most economists did their studies on convergence which stemmed from the Solow's classical growth model. The Solow model proposed the concept of steady state of per-capita output, and Figure 1 shows the details. In Figure 1, for an economy in a given period, the capital per unit of effective labour k converges toward its steady state k^*, so the output per unit of effective labour $f(k)$ converges toward its steady state $f(k^*)$. Further, the output per unit of labour (i.e., per-capita output) $Af(k)$ converges toward its steady state $Af(k^*)$, where A denotes the effectiveness of labour in the given period.

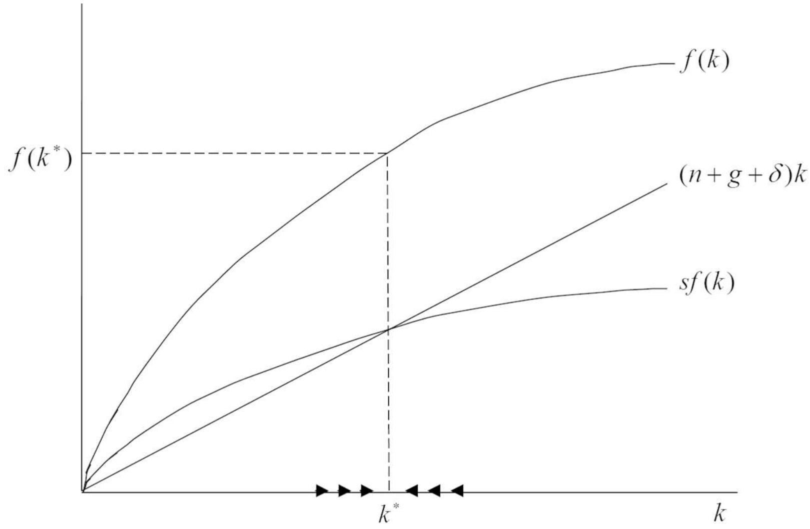

Figure 1: An economy's steady state in a given period

β-convergence exists for a set of economies. It is named after the speed of convergence β and consists of absolute convergence and conditional convergence. Absolute convergence means, the selected economies have similar steady state of per-capita output to converge. Conditional convergence means, the selected economies have different steady states of per-capita output to converge, respectively. Conditional convergence is obviously more common in a set of economies, so the previous studies on β-convergence generally focused on conditional convergence.

By the way, there are some other models which can be used for convergence study. For example, Phillips & Sul (2007) established a new model providing a new method to investigate convergence, which is regarded as an important contribution in the field of convergence and has actually been used frequently by many economists. Actually Phillips & Sul (2009) used their method to show that the growths of developed and developing countries would converge to different levels through displaying relevant transition parameters. But their method did not involve the steady state mentioned in the Solow model, so all previous studies using the method of Phillips & Sul did not give any information on the steady state mentioned in the Solow model.

This paper provides a study on convergence based on the steady state mentioned in the Solow model. It is well known, as for the steady state mentioned in Solow model, many economists have found 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), Rath (2016), Stengos, Yazgan, and Ozkan (2018), etc), the main difference among their regression results focused on the estimate of the speed of convergence. But it is necessary to point out that their studies on convergence were made by using only one period rather than *several successive* sub-periods. The reason for that is most economists believed that the concept of convergence only applied to a long period, which consists of several decades or even hundreds of years. When talking about developing countries, they even argued that the lack of development was due to the distance to steady state, not the level of different steady states among countries. Their idea is still commonly recognised today, but this paper tries to make it possible to challenge their idea.

Firstly, the Solow model focuses on discussing the effects of some economic parameters on the steady state of per-capita output $Af(k^*)$. This model implies that, if the economic parameters (s, n) change or the effectiveness of labour (A) changes between two different periods, a country may experience a change in its the steady state of per-capita output between the two periods. In reality, a country's the economic parameters and the effectiveness of labour will change at times, so the idea that a country's steady state remains unchanged during a long period is possibly wrong.

Furthermore, since the changes in steady state of per-capita output are usually different across countries, there will be a *relative change* in steady state of per-capita output of a country among a set of countries. Thus, one needs to find an indicator for such a relative change. Suppose there is a test sample which includes N countries, and let Y_i^* denote the steady state of per-capita output of country i for all i ($i = 1, 2, 3, \ldots, N$), so $Y_i^* = A_i f(k_i^*)$ holds for country i for all i. Let $\bar{Y}^*$ denote the average level of the N countries in the test sample, then $Y_i^* / \bar{Y}^*$ denotes *the relative steady state of per-capita output* of country i for all i, that is the ratio of the steady state of per-capita output of country i for all i to the average level of all countries in the test sample. If a change in this ratio is significant, it means there is a relative change in the steady state of per-capita output of country *i* for all *i* in the sample. In addition, the logarithmic version of this ratio, $\log(Y_i^* / \bar{Y}^*)$, can also be used to express the relative steady state of per-capita output of country *i* for all *i*, which is the operation of this paper.

Secondly, although the Solow model does not show whether a country is close to or obviously away from its steady state in a given period, it seems reasonable to believe a country is much possibly close to its steady state of per-capita output if the changes in its economic parameters (s, n) and effectiveness of labour (A) are not significant for several decades. In addition, according to the Solow model, even supposing there are no significant differences in economic parameters between developing and developed countries, one can believe that most developing countries are lower than developed countries in the steady state of per-capita output, for their effectiveness of labour are much lower than the level of developed countries.

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

No matter whether a country is developing or developed, and whether it is close to or obviously away from its steady state, the country will always converge toward its steady state which may change over time, so it is surely worthwhile to investigate the relative changes in the steady state of a country among a broad set of countries. But the previously mentioned studies did not test the hypothesis of conditional convergence across successive sub-periods, so they did not assess whether there happened, across sub-periods, a significant change in a country's relative steady state of per-capita output. Such a change means a relative change in a country's steady state of per-capita output among a broad set of countries.

This paper undertakes such a study by testing the hypothesis of conditional convergence in a test sample of 114 countries and regions in 1970s, 1980s, 1990s, 2000s and 2010s. This paper also shows the paths of the relative steady states of per-capita output of five typical "middle income trap" countries (Brazil, Mexico, Malaysia, Turkey and South Africa), China and United States by using their estimates obtained in the above five successive sub-periods. A comparison of the seven paths provides some valuable information on the growths of the above seven countries.

3. THE REGRESSION EQUATION TO TEST THE HYPOTHESIS OF β-CONVERGENCE

The following equation was actually provided by Barro and Sala-I-Martin (2004). The only difference is that the equation on the page 466 of *Economic Growth*

(2004, 2nd ed.) shows the time interval T of observations is between year 0 and year T.

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

where the subscript t denotes year t; the subscript i denotes economy i; T denotes the time interval of observations between year t-T and year t; $Y_{i,t}$ denotes per-capita output of economy i for all i in year t, i.e., $Y_i = A_i f(k_i)$ holds for economy i for all i; β 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 (i.e., $x_i = g_i$ holds for all i), the natural number $e \cong 2.718$, Y_i^* denotes the steady state of per-capita output of economy i for all i for a given period, so $Y_i^* = A_i f(k_i^*)$ holds for economy i for all i for the period. The equation (1) implies the average annual growth rate (from year t-T to year t) of per-capita output of economy i for all i depends positively on Y_i^* and negatively on $Y_{i,t-T}$.

In order to remove the time trend associated with the growth of technological progress (x_i), Coulombe (2004) defined $y_{i,t} = \log(Y_{i,t}/\bar{Y}_t)$, where $\bar{Y}_t$ is the cross section mean of $Y_{i,t}$ in year t for all t. With this definition, the equation (4) can be obtained by transforming the equation (1); the details are shown as follows.

Firstly, the equation (1) can be rewritten as

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

Then take the mean over the number of economies N of this equation and obtain

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

or $$(1/T)(\log \bar{Y}_t - \log \bar{Y}_{t-T}) = \bar{\alpha} - (1/T)(1-e^{-\beta T})\log \bar{Y}_{t-T} + \bar{u}_t, \tag{3}$$

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, the equation (4) is obtained through the equation (2) minus the equation (3).

$$(1/T)\Delta y_{i,t} = c_i - (1/T)\left(1 - e^{-\beta T}\right)y_{i,t-T} + \varepsilon_{i,t} \tag{4}$$

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 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 $\varepsilon_{i,t} = u_{i,t} - \bar{u}_t$.

In this paper, the equation (4) was used to test the hypothesis of β convergence. In the equation (4), c_i is the constant term of economy *i* for all *i*. In the case of conditional convergence, Y_i^* changes with *i*, then Y_i^* does not equal $\bar{Y}^*$ for most *i* or y_i^* does not equal zero for most *i*, thus c_i does not equal zero for most *i* or c_i is significant for most *i*. While in the case of absolute convergence, the reverse occurs c_i is not significant for most *i*.

4. DATA, THE EMPIRICAL METHODOLOGY, THE RESULTS AND THE ANALYSES

4.1. The data

World Bank provides data on GDP per-capita (constant 2010 US$) for countries and regions around the world. The downloaded data on GDP per-capita cover the years from 1970 to 2019 and includes 114 countries and regions[4] which are listed in *Appendix A* and whose data on GDP per-capita are available every year from 1970 to 2019.

4.2. The empirical methodology

Firstly, the above-mentioned data was regarded as a joint sample (the 1970-2019 sample), which consisted of the five sub-samples: the 1970-1979 sub-sample, the 1980-1989 sub-sample, the 1990-1999 sub-sample, the 2000-2009 sub-sample and the 2010-2019 sub-sample. There are both developed and less developed countries in each sub-sample, so conditional convergence should exist in each one.

Secondly, the regression results obtained by using the data in the five sub-samples could provide an estimate of relative steady state of per-capita output of each country in 1970s, 1980s, 1990s, 2000s and 2010s, respectively. If the hypothesis of conditional convergence was tested in the five sub-samples separately, the five estimates of each country would be obtained separately. According to econometrics, without making a Wald test, one cannot simply use two estimates to judge whether the change in a variable or the difference between two variables is significant. To make Wald tests for the assessments, the five estimates of all countries must be obtained simultaneously so that all estimates can be associated with each other in the econometric software. To solve this problem, dummy variables could be introduced into the regression equation.

In the equation (4), $(1/T)(1-e^{-\beta T}) \cong \beta$ holds when β is a very small positive number, so the constant term $c_i = \beta y_i^*$ holds for country *i* for all *i*. Take one year as the time interval of observations used, i.e., T = 1 year, the equation (4) is rewritten as

$$\Delta y_{i,t} = c_i - \beta y_{i,t-1} + \varepsilon_{i,t} \tag{5}$$

Four dummy variables $D1$, $D2$, $D3$ and $D4$ were introduced into the equation (5) to capture, respectively, the changes in constant term c_i of country *i* for all *i* across sub-periods. Another four dummy variables $DT1$, $DT2$, $DT3$ and $DT4$ were introduced to find, respectively, the changes in the average speed of convergence β for all countries in the sample across sub-periods. In this way, the following equation can be obtained.

$$\begin{aligned}\Delta y_{i,t} &= c_{i,0} + \gamma_{i,1}D1 + \gamma_{i,2}D2 + \gamma_{i,3}D3 + \gamma_{i,4}D4 \\ &\quad - \beta_0 y_{i,t-1} + \lambda_1 DT1 y_{i,t-1} + \lambda_2 DT2 y_{i,t-1} + \lambda_3 DT3 y_{i,t-1} + \lambda_4 DT4 y_{i,t-1} + \varepsilon_{i,t}\end{aligned} \tag{6}$$

where $D1 = DT1 = 1$ when data is in the 1980-1989 sub-sample, $D1 = DT1 = 0$ otherwise; $D2 = DT2 = 1$ when data is in the 1990-1999 sub-sample, $D2 = DT2 = 0$ otherwise; $D3 = DT3 = 1$ when data is in the 2000-2009 sub-sample, $D3 = DT3 = 0$ otherwise; $D4 = DT4 = 1$ when data is in the 2010-2018 sub-sample, $D4 = DT4 = 0$ otherwise; $c_{i,0}$ denotes the constant term (fixed effect) of country *i* for all *i* in 1970s; $\gamma_{i,1}$ denotes the gap between c_i in 1970s and 1980s for all *i*; $\gamma_{i,2}$ denotes the gap between c_i in 1970s and 1990s for all *i*; $\gamma_{i,3}$

denotes the gap between c_i in 1970s and 2000s for all *i*; $\gamma_{i,4}$ denotes the gap between c_i in 1970s and 2010s for all *i*; β_0 denotes the average speed of convergence for all countries in the sample in1970s; λ_1 denotes the gap between β in 1970s and 1980s; λ_2 denotes the gap between β in 1970s and 1990s; λ_3 denotes the gap between β in 1970s and 2000s; and λ_4 denotes the gap between β in 1970s and 2010s. Further, $c_{i,0}$, $(c_{i,0}+\gamma_{i,1})=c_{i,1}$, $(c_{i,0}+\gamma_{i,2})=c_{i,2}$, $(c_{i,0}+\gamma_{i,3})=c_{i,3}$ and $(c_{i,0}+\gamma_{i,4})=c_{i,4}$ denote the constant term of country *i* for all *i* in 1970s, 1980s, 1990s, 2000s, and 2010s, respectively; β_0, $(\beta_0-\lambda_1)=\beta_1$, $(\beta_0-\lambda_2)=\beta_2$, $(\beta_0-\lambda_3)=\beta_3$, $(\beta_0-\lambda_4)=\beta_4$ denote the average speed of convergence for all countries in the sample in 1970s, 1980s, 1990s, 2000s and 2010s, respectively. After such an introduction of eight dummy variables, data in the five sub-samples was used jointly to estimate the equation (6) to obtain simultaneously the estimates of all above coefficients, this means it is feasible to obtain simultaneously the five estimates of relative steady states of per-capita output of all countries in the sample in the above five successive sub-periods.

4.3. The results and the analyses

According to the definition of conditional convergence, if β_0 in the equation (6), β_1, β_2, β_3 and β_4, which are implied in the equation (6) , are all positive; $c_{i,0}$ in the equation (6), $c_{i,1}$, $c_{i,2}$, $c_{i,3}$ and $c_{i,4}$, which are implied in the equation (6), are all significant for most *i*, the hypothesis of conditional convergence cannot be rejected, respectively, in the 1970-1979 sub-sample, the 1980-1989 sub-sample, the 1990-1999 sub-sample, the 2000-2009 sub-sample and the 2010-2019 sub-sample.

Now make the following ten null hypotheses for the above five sub-samples: H_0: $\beta_0 = 0$, H_0: $c_{i,0} = 0$; H_0: $\beta_1 = 0$, H_0: $c_{i,1} = 0$; H_0: $\beta_2 = 0$, H_0: $c_{i,2} = 0$; H_0: $\beta_3 = 0$, H_0: $c_{i,3} = 0$; H_0: $\beta_4 = 0$, H_0: $c_{i,4} = 0$. The regression **results** obtained from estimating the equation (6) using data in the five sub-samples jointly are shown in *Appendix B*, and the regression results about Brazil, Mexico, Malaysia, Turkey and South Africa, China and United States are selected and shown in Table 1.

Table 1: The selected regression results obtained from estimating the equation (6)

Method: GLS (Cross Section Weights)					
Sample (adjusted): 1971 2019					
Included observations: 49 after adjustments					
Number of cross-sections included: 114					
Total pool (balanced) observations: 5586					
Variable	Coefficient	Estimates	Std. Error	t-statistic	p value
$y_{i,t-1}$	$-\beta_0$	-0.193381	0.041258	-4.687150	0.0000
$DT1y_{i,t-1}$	λ_1	0.072969	0.049827	1.464443	0.1431
$DT2y_{i,t-1}$	λ_2	0.000806	0.059595	0.013529	0.9892
$DT3y_{i,t-1}$	λ_3	0.125194	0.047810	2.618578	0.0089
$DT4y_{i,t-1}$	λ_4	0.044145	0.047281	0.933680	0.3505
$c_0(BRA)$	$c_0(BRA)$	-0.038935	0.012127	-3.210495	0.0013
$D1(BRA)$	$\gamma_1(BRA)$	-0.004447	0.019268	-0.230782	0.8175
$D2(BRA)$	$\gamma_2(BRA)$	-0.057058	0.019029	-2.998473	0.0027
$D3(BRA)$	$\gamma_3(BRA)$	0.010909	0.019224	0.567486	0.5704
$D4(BRA)$	$\gamma_4(BRA)$	-0.036503	0.021156	-1.725425	0.0845
$c_0(CHN)$	$c_0(CHN)$	-0.673089	0.149284	-4.508779	0.0000
$D1(CHN)$	$\gamma_1(CHN)$	0.358790	0.170019	2.110291	0.0349
$D2(CHN)$	$\gamma_2(CHN)$	0.258660	0.179484	1.441134	0.1496
$D3(CHN)$	$\gamma_3(CHN)$	0.587545	0.156993	3.973932	0.0001
$D4(CHN)$	$\gamma_4(CHN)$	0.562153	0.151754	3.704379	0.0002
$c_0(MEX)$	$c_0(MEX)$	-0.063913	0.018300	-3.492496	0.0005
$D1(MEX)$	$\gamma_1(MEX)$	0.012418	0.026273	0.472665	0.6365
$D2(MEX)$	$\gamma_2(MEX)$	-0.021504	0.028940	-0.743055	0.4575
$D3(MEX)$	$\gamma_3(MEX)$	0.013689	0.021505	0.636532	0.5245
$D4(MEX)$	$\gamma_4(MEX)$	-0.024957	0.022820	-1.093623	0.2742
$c_0(MYS)$	$c_0(MYS)$	-0.223053	0.056818	-3.925718	0.0001
$D1(MYS)$	$\gamma_1(MYS)$	0.109449	0.065681	1.666368	0.0957
$D2(MYS)$	$\gamma_2(MYS)$	0.092091	0.068271	1.348909	0.1774
$D3(MYS)$	$\gamma_3(MYS)$	0.185691	0.058642	3.166513	0.0016
$D4(MYS)$	$\gamma_4(MYS)$	0.165387	0.058394	2.832254	0.0046
$c_0(TUR)$	$c_0(TUR)$	-0.123010	0.018541	-6.634603	0.0000
$D1(TUR)$	$\gamma_1(TUR)$	0.048924	0.022437	2.180507	0.0293
$D2(TUR)$	$\gamma_2(TUR)$	0.020144	0.031600	0.637467	0.5238
$D3(TUR)$	$\gamma_3(TUR)$	0.094700	0.019641	4.821570	0.0000
$D4(TUR)$	$\gamma_4(TUR)$	0.100434	0.019974	5.028275	0.0000
$c_0(USA)$	$c_0(USA)$	0.199378	0.042692	4.670105	0.0000

$D1(USA)$	$\gamma_1(USA)$	-0.064690	0.054067	-1.196488	0.2316
$D2(USA)$	$\gamma_2(USA)$	0.014198	0.064549	0.219949	0.8259
$D3(USA)$	$\gamma_3(USA)$	-0.129767	0.050865	-2.551186	0.0108
$D4(USA)$	$\gamma_4(USA)$	-0.040304	0.048932	-0.823685	0.4102
$c_0(ZAF)$	$c_0(ZAF)$	-0.088085	0.013689	-6.434616	0.0000
$D1(ZAF)$	$\gamma_1(ZAF)$	0.009201	0.023762	0.387221	0.6986
$D2(ZAF)$	$\gamma_2(ZAF)$	-0.087301	0.036817	-2.371223	0.0178
$D3(ZAF)$	$\gamma_3(ZAF)$	0.035947	0.025307	1.420404	0.1556
$D4(ZAF)$	$\gamma_4(ZAF)$	-0.053242	0.024067	-2.212231	0.0270
R-squared: 0.342232					

In Table 1, the p value of the t-statistic for the estimate of β_0 shows H_0: $\beta_0 = 0$ is rejected at the 1% significance level, and the estimate of β_0 shows β_0 is positive. In *Appendix B*, p values of t-statistics for most estimates of $c_{i,0}$ show H_0: $c_{i,0} = 0$ is rejected at the 1% significance level. The regression results of β_0 and $c_{i,0}$ show the hypothesis of conditional convergence is not rejected in the 1970-1979 sub-sample.

The regression results obtained from estimating the equation (6) do not provide directly the information about β_1, $c_{i,1}$, β_2, $c_{i,2}$, β_3, $c_{i,3}$, β_4 and $c_{i,4}$, but Wald tests can be used to get the information about them. Table 2 contains the main results of all Wald tests made in this paper, and the original details are shown in *Appendix C.*

In Table 2, the results of the Wald test of H_0: $\beta_1 = 0$ show the p value for the Chi-square is 0.0001, thus H_0: $\beta_1 = 0$ is rejected at the 1% significance level, and the estimate of β_1 ($\hat{\beta}_1 = \hat{\beta}_0 - \hat{\lambda}_1 = 0.119674$) is calculated using the estimates of β_1 and λ_1 shown in Table 1, so β_1 is positive. The Wald test of H_0: $c_{i,1} = 0$ can be made on the country by country basis, but such a job is not done in this paper because of too many countries and districts in the sample. Since $c_{i,0}$ is significant for most *i* while $\gamma_{i,1}$ is not significant for most *i* according to p values of t-statistics for their estimates shown in *Appendix B*, one can infer $c_{i,1} (= c_{i,0} + \gamma_{i,1})$ is significant for most *i*, that is, if the Wald test of H_0: $c_{i,1} = 0$ is done, the results would show $H_0: c_{i,1} = 0$ is rejected at the 5% or 10% significance level. Thus the information obtained about β_1 and $c_{i,1}$ show that the hypothesis of conditional convergence is not rejected in the 1980-1989 sub-sample.

Table 2: The results of all Wald tests made in this paper

1. Null Hypothesis: $\beta_1 = 0$			
Chi-square	18.57513	p value	0.0000
2. Null Hypothesis: $\beta_2 = 0$			
Chi-square	20.05227	p value	0.0000
3. Null Hypothesis: $\beta_3 = 0$			
Chi-square	7.966911	p value	0.0048
4. Null Hypothesis: $\beta_4 = 0$			
Chi-square	41.76206	p value	0.0000
5. Null Hypothesis: $y_1^*(BRA) - y_0^*(BRA) = 0$			
Chi-square	2.168572	p value	0.1409
6. Null Hypothesis: $y_2^*(BRA) - y_1^*(BRA) = 0$			
Chi-square	1.367203	p value	0.2423
7. Null Hypothesis: $y_3^*(BRA) - y_2^*(BRA) = 0$			
Chi-square	0.569852	p value	0.4503
8. Null Hypothesis: $y_4^*(BRA) - y_3^*(BRA) = 0$			
Chi-square	0.587786	p value	0.4433
9. Null Hypothesis: $y_0^*(BRA) = 0$			
Chi-square	65.09192	p value	0.0000
10. Null Hypothesis: $y_1^*(BRA) = 0$			
Chi-square	11.77179	p value	0.0006
11. Null Hypothesis: $y_2^*(BRA) = 0$			
Chi-square	84.46333	p value	0.0000
12. Null Hypothesis: $y_3^*(BRA) = 0$			
Chi-square	16.11826	p value	0.0001
13. Null Hypothesis: $y_4^*(BRA) = 0$			
Chi-square	54.30023	p value	0.0000
14. Null Hypothesis: $y_0^*(CHN) - y_0^*(BRA) = 0$			
Chi-square	1357.977	p value	0.0000
15. Null Hypothesis: $y_1^*(CHN) - y_1^*(BRA) = 0$			
Chi-square	229.4352	p value	0.0000
16. Null Hypothesis: $y_2^*(CHN) - y_2^*(BRA) = 0$			
Chi-square	251.7001	p value	0.0000
17. Null Hypothesis: $y_3^*(CHN) - y_3^*(BRA) = 0$			
Chi-square	126.0329	p value	0.0000
18. Null Hypothesis: $y_4^*(CHN) - y_4^*(BRA) = 0$			
Chi-square	5.523785	p value	0.0188

Similarly, using the above method, one can know that β_2, β_3 and β_4 are all positive; $H_0: c_{i,2} = 0$, $H_0: c_{i,3} = 0$ and $H_0: c_{i,4} = 0$ are all rejected at the 5% or

10% significance level. So the information obtained about β_2, $c_{i,2}$, β_3, $c_{i,3}$, β_4 and $c_{i,4}$ suggest the hypothesis of conditional convergence is not rejected in the 1990-1999 sub-sample, the 2000-2009 sub-sample and the 2010-2019 sub-sample.

As shown in Section 3, $y_i^* = \log(Y_i^* / Y^*)$ denotes the relative steady state of per-capita output (log version) of country *i* for all *i*. Let $y_{i,0}^*$, $y_{i,1}^*$, $y_{i,2}^*$, $y_{i,3}^*$ and $y_{i,4}^*$ denote the relative steady state of per-capita output of country *i* for all *i* in 1970s, 1980s, 1990s, 2000s and 2010s, respectively. As shown in Section 4.2, $c_i = \beta y_i^*$ holds for country *i* for all *i*, so the estimate of y_i^* can be computed by using the estimates of c_i and β in each sub-period. Now take Brazil's relative steady state of per-capita output y^* (*BRA*) as an example. Using the concerned estimates provided in Table 1, the details of the computation are shown as follows.

$$\hat{y}_0^*(BRA) = \hat{c}_0(BRA)/\hat{\beta}_0 = -0.038935/0.193381 = -0.2013$$

$$\hat{y}_1^*(BRA) = \hat{c}_1(BRA)/\hat{\beta}_1 = [\hat{c}_0(BRA) + \hat{\gamma}_1(BRA)]/(\hat{\beta}_0 - \hat{\lambda}_1)$$
$$= (-0.038935 - 0.004447)/\ (0.193381 - 0.072969) = -0.3605$$

$$\hat{y}_2^*(BRA) = \hat{c}_2(BRA)/\hat{\beta}_2 = [\hat{c}_0(BRA) + \hat{\gamma}_2(BRA)]/(\hat{\beta}_0 - \hat{\lambda}_2)$$
$$= (-0.038935 - 0.057058)\ /\ (0.193381 - 0.000806) = -0.4984$$

$$\hat{y}_3^*(BRA) = \hat{c}_3(BRA)/\hat{\beta}_3 = [\hat{c}_0(BRA) + \hat{\gamma}_3(BRA)]/(\hat{\beta}_0 - \hat{\lambda}_3)$$
$$= (-0.038935 + 0.010909)\ /\ (0.193381 - 0.125194) = -0.4106$$

$$\hat{y}_4^*(BRA) = \hat{c}_4(BRA)/\hat{\beta}_4 = [\hat{c}_0(BRA) + \hat{\gamma}_4(BRA)]/(\hat{\beta}_0 - \hat{\lambda}_4)$$
$$=(-0.038935 - 0.036503)\ /\ (0.193381 - 0.044145) = -0.5054$$

Similarly, let y^* (*MEX*), y^* (*MYS*), y^* (*TUR)*, y^* (*ZAF*), y^* (*CHN*) and y^*(*USA*) denote, respectively, relative steady states of per-capita output of Mexico, Malaysia, Turkey, South Africa, China and United States, one can compute their estimates by using the above method. All estimates of the seven countries are shown in Table 3.

Table 3: The estimates of relative steady states of per-capita output of the five "middle-income trap" countries, China and United States

Names of countries	*Estimates in 1970s*	*Estimates in 1980s*	*Estimates in 1990s*	*Estimates in 2000s*	*Estimates in 2010s*
Brazil	-0.2013	-0.3605	-0.4984	-0.4106	-0.5054
Mexico	-0.3305	-0.4277	-0.4434	-0.7364	-0.5956
Malaysia	-1.1534	-0.9435	-0.6802	-0.5484	-0.3867
Turkey	-0.6361	-0.6153	-0.5343	-0.4150	-0.1515
South Africa	-0.4555	-0.6553	-0.9107	-0.7639	-0.9471
China	-3.4806	-2.6105	-2.1516	-1.2543	-0.7433
United States	1.0310	1.1188	1.1090	1.0205	1.0662

In Table 3, the estimates of United States are all positive. United States is a typical developed country; its steady state of per-capita output $Y^*(USA)$ is always higher than the average $\bar{Y}^*$ of all sample countries, so its relative steady state of per-capita output y^* (USA) is always significantly positive, actually around 1. The estimates of Brazil, Mexico, Malaysia, Turkey, South Africa and China are all significantly negative or near to zero as shown in Table 3 because they are all less developed countries.

How to assess whether a country's relative steady state of per-capita output y^* changes with time? Take $y^*(BRA)$ as an example and make the four null hypotheses: H_0: $y_1^*(BRA) - y_0^*(BRA) = 0$, H_0: $y_2^*(BRA) - y_1^*(BRA) = 0$, H_0: $y_3^*(BRA) - y_2^*(BRA) = 0$, H_0: $y_4^*(BRA) - y_3^*(BRA) = 0$. In Table 2, the results of the Wald test of H_0: $y_1^*(BRA) - y_0^*(BRA) = 0$ show that the p value for the Chi-square is above 10%, which means H_0: $y_1^*(BRA) - y_0^*(BRA) = 0$ is not rejected, i.e., the gap between y^* (BRA) in 1970s and 1980s is possibly not significant. Thus Brazil's relative steady state of per-capita output possibly did not change significantly from 1970s to 1980s.

Similarly, according to the results of the Wald tests of H_0: $y_2^*(BRA) - y_1^*(BRA) = 0$, H_0: $y_3^*(BRA) - y_2^*(BRA) = 0$ and H_0: $y_4^*(BRA) - y_3^*(BRA) = 0$, all of the three null hypotheses are not rejected because their p values for the Chi-square are all above 10% as shown in Table 2. So it is possible that Brazil's relative steady state of per-capita output did not change significantly from 1980s to 1990s, from 1990s to 2000s, and from 2000s to 2010s.

The formula $y_i^* = \log(Y_i^* / \bar{Y}^*)$ shows 0 is the average of relative steady states of per-capita output (log version) of all countries in the test sample. Now make five null hypotheses: $H_0: y_0^*(BRA) = 0$, $H_0: y_1^*(BRA) = 0$, $H_0: y_2^*(BRA) = 0$, $H_0: y_3^*(BRA) = 0$, $H_0: y_4^*(BRA) = 0$. In Table 2, the results of the Wald tests show all above five null hypotheses are rejected at the 1% significance level because their p values for the Chi-square are all below 1%. As shown in Table 3, the five estimates of $y^*(BRA)$ are all negative, so Brazil's relative steady state of per-capita output is significantly below the average of all countries in the test sample in each of the five sub-periods.

How to assess whether a country's relative steady state of per-capita output differs from another's in the same period? Take $y^*(CHN)$ and $y^*(BRA)$ as an example and make five null hypotheses: $H_0: y_0^*(CHN) - y_0^*(BRA) = 0$, $H_0: y_1^*(CHN) - y_1^*(BRA) = 0$, $H_0: y_2^*(CHN) - y_2^*(BRA) = 0$, $H_0: y_3^*(CHN) - y_3^*(BRA) = 0$ and $H_0: y_4^*(CHN) - y_4^*(BRA) = 0$. In Table 2, the results of Wald tests show all above null hypothesis are rejected at the 1% or 5% significance level according to their p values for the Chi-square. The estimates of $y^*(BRA)$ and $y^*(CHN)$ are shown in Table 3, so one can judge China's relative steady state of per-capita output is lower than Brazil's in each sub-period.

5. THE PATHS OF RELATIVE STEADY STATES OF PER-CAPITA OUTPUT OF THE SEVEN COUNTRIES

The path of relative steady state of per-capita output of a country shows how the steady state of per-capita output of the country changes relatively in a test sample, i.e., in terms of steady state of per-capita output, it shows how the relative position of a country changes in a test sample. The path is obtained by using the estimates of the relative steady state of per-capita output of a country in some successive sub-periods. In this paper, the paths of Brazil, Mexico, Malaysia, Turkey, South Africa, China and United States are drawn by using their estimates in Table 3 and shown in Figure 2.

As shown earlier, $y_i^* = \log(Y_i^* / Y^*)$ is the formula for the relative steady state of 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. A description of Figure 2 is shown as follows.

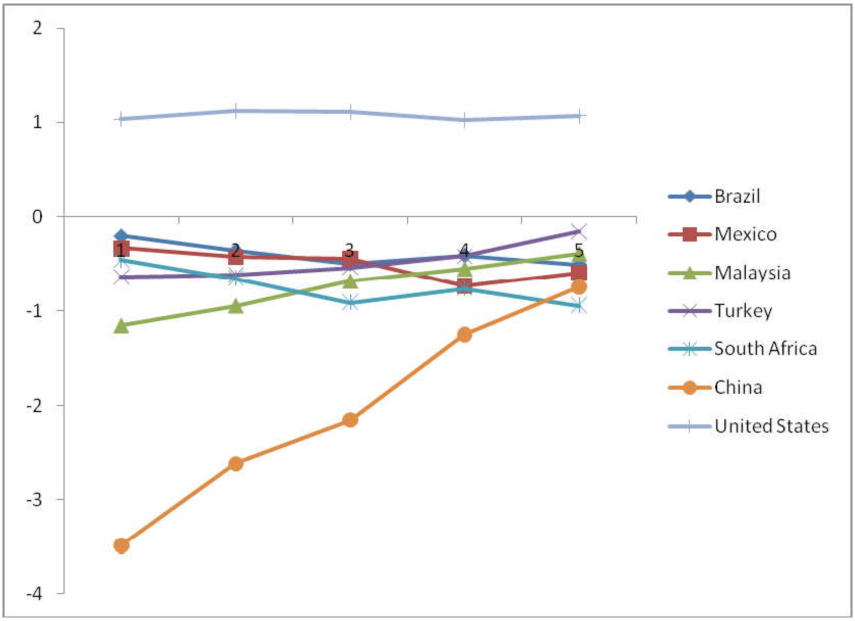

Figure 2: The paths of relative steady states of per-capita output of the five "middle-income trap" countries, China and United States (1970-2019)

Note: 1. The numbers 1, 2, 3, 4 and 5 below the horizontal axis denote 1970s, 1980s, 1990s, 2000s and 2010s, respectively. 2. The numbers at the left side of the vertical axis denote the measures of relative steady state of per-capita output.

In Figure 2, the path of the US is obviously above the horizontal axis, so it is a typical path of a developed country. Due to capital accumulation and technological progress, it is reasonable to believe the US's steady state of per-capita output kept growing from 1970s to 2010s, but the path of the US shows the US's relative steady state of per-capita output did not change significantly from 1970s to 2010s, i.e., in terms of steady state of per-capita output, the US's relative position in the test sample did not change significantly in the 1970-2019 period.

The paths of Brazil, Mexico, Malaysia, Turkey and South Africa are all below the horizontal axis, but generally not far apart. The five paths show that the relative steady states of per-capita output of the five countries generally fluctuated slightly from 1970s to 2010s, i.e., in terms of steady state of per-capita output, their relative positions in the test sample did not change greatly on the whole from 1970s to 2010s. The above situation shows that even in terms of steady state of per-capita output, the five countries were not only developing countries but also typical "middle income trap" countries in the 1970-2019 period.

The path of China is generally far below the horizontal axis. The path shows China's relative steady state of per-capita output was extremely low in 1970s, then it kept increasing dramatically, and almost caught up with the overall level of the above five countries in 2010s, i.e., in terms of steady state of per-capita output, China's relative position in the test sample kept rising significantly after 1970s, and almost reached the overall level of the above five countries in 2010s. The path of China suggests, in terms of steady state of per-capita output, China was a developing country but not a "middle income trap" country in the 1970-2019 period, or to be more exact, China started to face the "middle income trap" in 2010s.

6. AN ANALYSIS OF THE REASONS FOR THE RELATIVE CHANGES IN STEADY STATES OF PER-CAPITA OUTPUT OF THE SEVEN COUNTRIES

The Solow model shows that an economy's steady state of per-capita output depends on its economic parameters and effectiveness of labour. To be precise, it is an economy's social infrastructure that determines its steady state of per-capita output through influencing the economic parameters and the effectiveness of labour. As Romer described[5], the social infrastructure refers to those institutions, policies, traditions and cultures, which can influence economic growth. Next, by looking up historical data of the five typical "middle income trap" countries, this paper will reveal how their social infrastructures determined their steady states of per-capita output ($Af(k^*)$) through influencing the saving rate (s), the population growth rate (n) and the effectiveness of labour (A) in the 1970-2019 period. In addition, in view of the need of the research made in this paper, the data of China, the United States and the world are also looked up.

First, look at the saving rate. The data on annual saving rates of the concerned countries and the world were downloaded from the World Bank database, and their average annual saving rates in the 1970s, 1980s, 1990s, 2000s and 2010 were calculated, respectively, and shown in Table 4. The data in Table 4 provides the eight paths in Figure 3, which reflects roughly the changes in the saving rates of the seven countries and the world in the 1970-2019 period.

Table 4 and Figure 3 show that in the 1970-2019 period, the world's saving rate did not change significantly. Among the five typical "middle income trap" countries, only Malaysia's saving rate was higher than the world level in each sub-period while the saving rates of other four countries were lower than the world's at least in most sub-periods, thus, except Malaysia, the saving rates of the other four countries were generally lower than the world level, i.e., their saving rates might be lower than the average level of all sample countries. In addition, in the 1970-2019 period, Malaysia's saving situation was obviously better than that of other four countries, but Malaysia's saving rate was not high enough because the country did not keep its saving rate above 30% in this period. The convergence theory shows, other factors remain unchanged, a higher saving rate leads to a higher k^* and $f(k^*)$, and the converse is also true. The above situations show that the saving rates of the five countries were generally not high in the 1970-2019 period, this should be an important reason to explain why in this period, in terms of the steady state of per-capita output, the relative positions of the five countries in the test sample were always slightly lower than the average level of the test sample and also did not change greatly as a whole.

Table 4: The saving rates of the concerned countries and the world in the 1970-2019 period (%)

Names of countries	*Averages in 1970s*	*Averages in 1980s*	*Averages in 1990s*	*Averages in 2000s*	*Averages in 2010s*
Brazil	19.61	19.86	15.87	16.97	15.51
Mexico	21.82	24.61	20.93	21.7	22.68
Malaysia	26.75	27.81	34.73	35.72	29.29
Turkey	32.62	30.33	20.48	22.71	24.7
South Africa	27	23.32	15.78	16.59	16.07
China	—	35.43	39.21	44.66	46.74
United States	22.32	20.83	19.17	17.89	18.7
World	23.46	22.98	23.43	24.98	24.96

Note: The World Bank database lacks data on China's annual saving rate in 1970s, so China's average annual saving rate in 1970s is blank in Table 4.

Second, look at the population growth rate. The data on annual population growth rates of the concerned countries and the world are downloaded from the World Bank database, and their average annual population growth rates in the 1970s, 1980s, 1990s, 2000s and 2010 are calculated, respectively, and listed in Table 5. The data in Table 5 generate the eight paths in Figure 4, which reflects basically the changes in the population growth rates of the seven countries and the world in the 1970-2019 period.

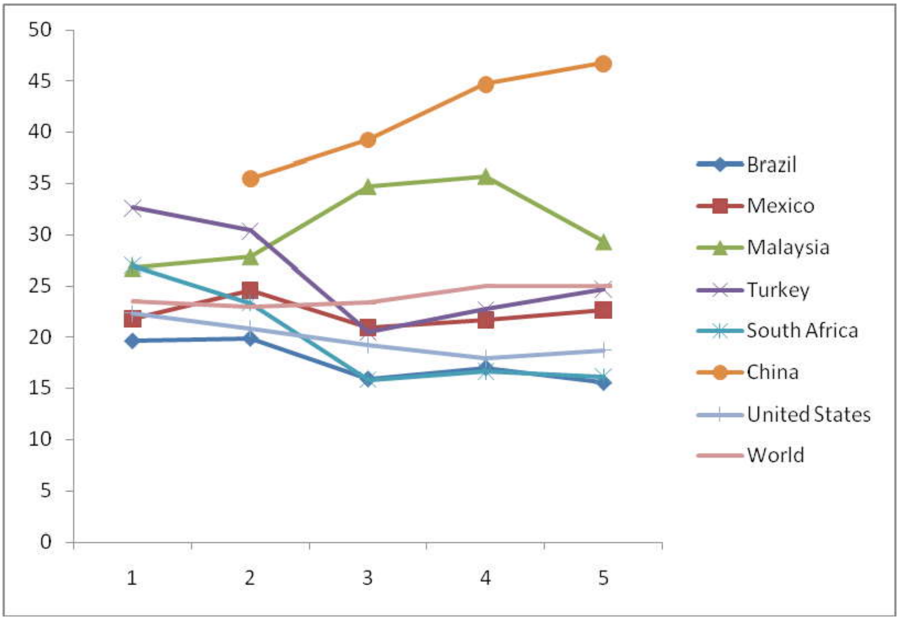

Figure 3: The paths of the saving rates of the concerned countries and the world (1970-2019)

Note: 1. The numbers 1, 2, 3, 4 and 5 below the horizontal axis denote 1970s, 1980s, 1990s, 2000s and 2010s, respectively. 2. The numbers at the left side of the vertical axis denote the measures (%) of saving rate. 3. The World Bank database lacks data on China's annual saving rate in 1970s, so there is one corresponding blank for China's path in Figure 3.

Table 5: The population growth rates of the concerned countries and the world in the 1970-2019 period (%)

Names of countries	*Averages in 1970s*	*Averages in 1980s*	*Averages in 1990s*	*Averages in 2000s*	*Averages in 2010s*
Brazil	2.4	2.16	1.63	1.18	0.85
Mexico	2.81	2.2	1.68	1.43	1.26
Malaysia	2.44	2.64	2.57	2.02	1.41
Turkey	2.33	2.09	1.62	1.35	1.57
South Africa	2.58	2.56	2.1	1.3	1.49
China	1.97	1.44	1.13	0.61	0.49
United States	1.05	0.92	1.23	0.95	0.68
World	1.91	1.76	1.52	1.26	1.16

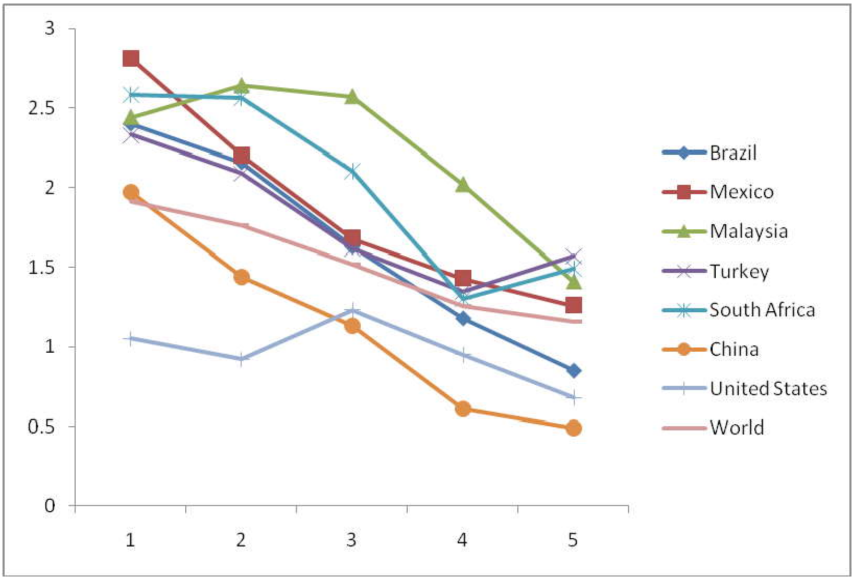

Figure 4: The paths of the population growth rates of the concerned countries and the world (1970-2019)

Note: 1. The numbers 1, 2, 3, 4 and 5 below the horizontal axis denote 1970s, 1980s, 1990s, 2000s and 2010s, respectively. 2. The numbers at the left side of the vertical axis denote the measures (%) of population growth rate.

Table 5 and Figure 4 show that in the 1970-2019 period, the world's population growth rate kept an obvious downward trend, and the population growth rates of the five typical "middle income trap" countries also showed a similar downward trend as a whole. According to the theory of convergence, other factors remain unchanged, a lower population growth rate leads to a higher level of k^* and $f(k^*)$, and the converse is also true. A downward trend in population growth rates of the five countries should be helpful to increase their $f(k^*)$. However, the world's population growth rate maintained a marked downward trend in the 1970-2019 period, it means most sample countries also experienced a similar downward trend in their population growth rates in this period, so logically the population growth rates of the five countries might not show a relative decline in the test sample. Thus, although the population growth rates of the five countries had a general downward trend, this might make no significant effect on improving the relative positions of the steady states of per-capita output of the five countries in the test sample. On the other hand, as shown in Table 5 and Figure 4, during the 1970-2019 period, the population growth rates of the five countries were actually higher than the world level (except Brazil in the 2000s and 2010s), it means that the population growth rates of the five countries might be higher than the average level of the test sample in this period. This situation is helpful to explain why in the 1970-2019 period, their relative positions of the steady states of per-capita output were always slightly lower than the average level of the test sample.

Finally, look at the labour efficiency (i.e., the effectiveness of labour mentioned in the Section 2). Labour efficiency (A) undoubtedly makes a huge effect on the steady state of per-capita output $Af(k^*)$. Human capital is the source of technological progress and innovation, so one can think of human capital as the most important indicator to measure labour efficiency. Unfortunately, since 2017 the World Bank's database has only begun to provide data on the human capital index of countries and regions around the world, thus this paper chose the tertiary school enrollment rate to roughly reflect the human capital level. The data on annual tertiary school enrollment rates of the concerned countries and the world were downloaded from the World Bank database, and their average annual tertiary school enrollment rate in 1970s, 1980s, 1990s, 2000s and 2010 were calculated, respectively, and listed in Table 6. The data in Table 6 give the eight paths in Figure 5, which shows the changes in the tertiary school enrollment rates of the seven countries and the world in the 1970-2019 period, and also roughly reflects the changes in the human capital and the labour efficiency of the seven countries and the world in this period.

Table 6: The tertiary school enrollment rates of the concerned countries and the world in the 1970-2019 period (%)

Names of countries	*Averages in 1970s*	*Averages in 1980s*	*Averages in 1990s*	*Averages in 2000s*	*Averages in 2010s*
Brazil	—-	—-	16.08	26.99	43.46
Mexico	8.78	15.13	16.26	23.75	33.2
Malaysia	3.82	5.69	12.32	29.4	41.36
Turkey	6.87	8.34	18.9	—-	—-
South Africa	4.33	12	13.82	—-	20.99
China	0.5	2.44	4.21	16.61	40.09
United States	50.9	59.45	75.9	79.52	90.14
World	10.95	13.1	15.39	23.82	35.22

Note: The World Bank database lacks the data on Brazil's annual tertiary school enrollment rate in 1970s and 1980s, the data on Turkey's in 2000s and 2010s, and the data on South Africa 's in 2000s, so there are some corresponding blanks for them in Table 6.

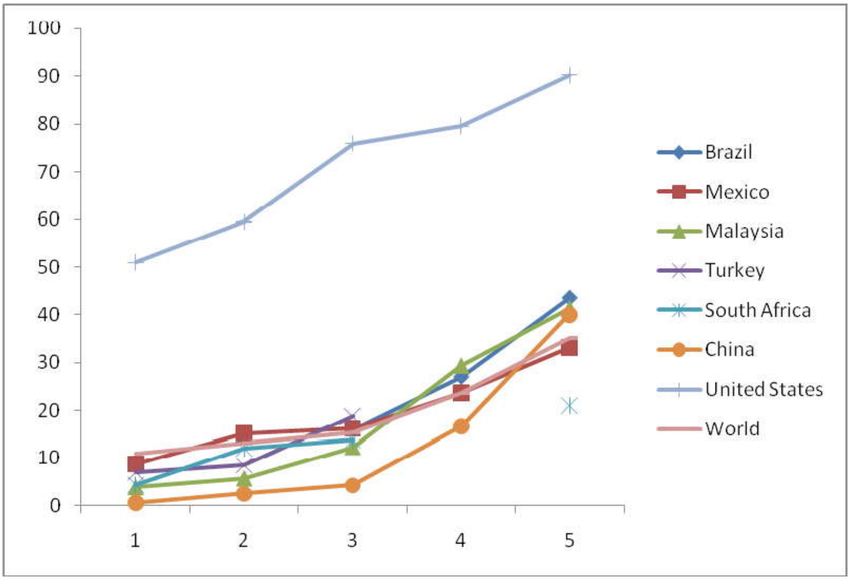

Figure 5: The paths of the tertiary school enrollment rates of the concerned countries and the world (1970-2019)

Note: 1. The numbers 1, 2, 3, 4 and 5 below the horizontal axis denote 1970s, 1980s, 1990s, 2000s and 2010s, respectively. 2. The numbers at the left side of the vertical axis denote the measures (%) of tertiary school enrollment rate. 3. The World Bank database lacks the data on Brazil in 1970s and 1980s, the data on Turkey's in 2000s and 2010s, and the data on South Africa 's in 2000s, so there are some corresponding blanks for them in Figure 5.

Table 6 and Figure 5 show that in the 1970-2019 period, the tertiary school enrolment rate of the world kept an obvious upward trend, so did the tertiary school enrolment rates of the five typical "middle income trap" countries, and both had a less difference as a whole. It can be inferred that in the 1970-2019 period, the human capital and labour efficiency of the five countries were constantly improving, which should be very helpful to increase the steady states of per-capita output of the five countries. However, the tertiary school enrolment rate of the world kept an obvious upward trend, it means that in this period, the tertiary school enrolment rates of most sample countries had a similar upward trend, accordingly, the human capital of most sample countries had a similar upward trend, so the human capital of the five countries might show no relative improvement in the test sample, and so did the labour efficiency of the five countries. Thus, the tertiary school enrolment rates of the five countries kept rising in the 1970-2019 period, but it might play no significant role in improving the relative positions of steady states of per-capita output of the five countries in the test sample.

China's steady state of per-capita output maintained a significant relative growth in the test sample because the changes in China's indicators were completely different in the 1970-2019 period. As shown in Table 4 and Figure 3, in the 1970-2019 period, except in 1970s (the data on China's saving rate in 1970s is not available), China's saving rate kept rising and was much higher than the overall level of the five countries and the world level, and should be also much higher than average level of all sample countries. Table 5 and Figure 4 show that, China's population growth rate experienced a downward trend like the five countries' and the world's in the 1970-2019 period, but was lower than the overall level of the five countries, also lower than the world level (except almost equal the world level in the 1970s), and should be also lower than the average level of all sample countries. Finally, there happened a dramatic growth in China's tertiary school enrollment rate in the 1970-2019 period. As shown in Table 6 and Figure 5, China's tertiary school enrollment rate was extremely low (0.5%) in 1970s, but by 2010s it was higher than the world level and even caught up with the high-end level of the five countries, so it grew much faster than the five countries' and the world's, undoubtedly also much faster than most sample countries', and so did China's human capital and labour efficiency in this period. The above changes in China's indicators can explain why China's steady state of per-capita output kept growing rapidly and relatively in the test sample in the 1970-2019 period.

Finally, a brief analysis of the reasons for the situation in the United States is given. As shown in Table 4 and Figure 3, in the 1970-2019 period, the US's saving rate showed a slight downward trend, and was always lower than the world level, and might be also lower than the average level of all sample countries, so this certainly made a negative effect on the relative position of the US's steady state of per-capita output in the test sample. However, Table 5 and Figure 4 show that during this period, the US's population growth rate also had a slight downward trend and was always lower than the world level, and might be also lower than the average level of all sample countries. In addition, as shown in Table 6 and Figure 5, during this period, the US's tertiary school enrollment rate kept an obvious upward trend like the world's, more importantly, it was much higher than the world level, and should be also much higher than the average level of all sample countries, and so was US's human capital and labour efficiency in this period. The above changes in the US's population growth rate and tertiary school enrollment rate (especially the latter) surely made a significantly greater positive effect on the relative position of the US's steady state of per-capita output in the test sample, and actually played a dominant role. Thus, the net result from the changes in the US's indicators is that during the 1970-2019 period, the relative position of the US's steady state of per-capita output in the test sample did not change significantly, and were always significantly higher than the average level of the test sample, and certainly also significantly higher than the relative positions of the five typical "middle income trap" countries and China.

7. CONCLUSIONS

Based on the theory of convergence, this paper used econometric method mainly revealing the followings: (1) In terms of steady state of per-capita output, the relative positions of Brazil, Mexico, Malaysia, Turkey and South Africa in the test sample generally remained slightly below the average level of the sample countries in the 1970-2019 period, i.e., in terms of steady state of per-capita output, the five countries were typical "middle income trap" countries in this period. (2) China's relative position in the test sample was far below the overall level of the five countries in 1970s, but kept rising rapidly since then, and almost reached the overall level of the five countries in 2010s, so in terms of steady state of per-capita output, China was not a "middle income trap" country in the 1970-2019 period, but started to face the "middle income trap" in 2010s.

This paper also provides an analysis of the reasons for the above situations. In general, the social infrastructures of the five typical "middle-income trap" countries did not change significantly in the 1970-2019 period, this resulted in the followings: in this period, their saving rates (except Malaysia's) should be lower than the average level of the sample countries; their population growth rates should be higher than the average level of the sample countries; their human capital did not significantly exceed the most sample countries', and nor did their labour efficiency. Therefore, if the five countries want to make their steady states of per-capita output increase relatively in the test sample in the future, their governments must formulate feasible and effective policies to improve their social infrastructures so as to significantly increase their saving rates, reduce further their population growth rates, and achieve a quicker growth of their human capital and labour efficiency, or the five countries will continue to stay in the "middle-income trap".

China's social infrastructure was improved significantly in the 1970-2019 period due to its many correct policies executed since the late 1970s, this resulted in the followings: in this period, China's saving rate maintained at a high level and kept rising except in 1970s, actually much higher than the average level of the sample countries except in 1970s; China's population growth rate kept declining, actually lower than the average level of the sample countries; China's tertiary school enrollment rate was extremely low in 1970s, but it grew much faster than most sample countries', and so did China's human capital and labour efficiency. But it is necessary to point out, China's saving rate was already very high (46.74% in 2010s) and much difficult to increase further significantly, its population growth rate was already very low (0.49% in 2010s) and leaves little room to decrease further, but China's tertiary school enrollment rate was not high (40.09% in 2010s) in comparison with developed countries (e.g. the United States). So the Chinese government should pay more attention to promoting the growth of China's human capital and labour efficiency in the future. The future growth of China's human capital and labour efficiency will, to large extent, determine the future growth of China's steady state of per-capita output, which will decide whether China can smoothly cross the "middle income trap" after 2010s.

Notes

1. The typical "middle income trap" countries selected in this paper refer to those that were always "middle income trap" countries in the 1970-2019 period. After meeting this requirement and considering the geographical distribution of the selected countries, Brazil and Mexico were selected as representative countries in the America; Malaysia and Turkey were selected as representative countries in Asia; South Africa was chosen as the representative country in Africa. Since the World Bank database had not provided the per-capita GDP data of Eastern European countries in 1970s and 1980s, in order to ensure the rigour of the regression results, the test sample used in this paper does not include the "middle income trap" countries in Europe (such as Bulgaria and Romania, etc.).
2. For more details of the Solow model, see Romer (2001, Chapter 1).
3. Romer, D. 2001. *Advanced Macroeconomics*. 2nd edition. New York: McGraw-Hill. P.21
4. World Bank provides data on GDP per-capita of countries and regions in the world from 1960 to 2019, but data in 1960s are not available for most countries, even data in 1970s are not available for some countries, so this paper has to choose the 114 countries and regions and a data time span from 1970 to 2019 to form a test sample.
5. See Romer (2001, p.143)

References

Ada, A. A., & Acaroðlu, H. (2016). An empirical remark about the middle income trap problem for Turkey. *Research Journal of Politics, Economics & Management, 4*(3), 81-95.

Barro, R. J. (1991). Economic growth in a cross-section of countries. *Quarterly Journal of Economics, 106*(2), 407-443.

Barro, R. J., & Sala-I-Martin, X. (2004). *Economic Growth* (2nd edition). New York: McGraw-Hill.

Baumol, W. J. (1986). Productivity growth, convergence, and welfare: What the long-run data show. *The American Economic Review, 76*(5), 1072-1085.

Caselli, F., Esquivel, G., & Lefort, F. (1996). Reopening the convergence debate: A new look at cross-country growth empirics. *Journal of Economic Growth, 1*(3), 363-389. DOI: 10.1007/BF00141044

Cavenaile, L., & Dubois, D. (2011). An empirical analysis of income convergence in the European Union. *Applied Economics Letters, 18*(17), 1705–1708. DOI: 10.1080/13504851.2011.560104

Coulombe, S. (2004). *Macroeconomics lecture*. University of Ottawa, Canada.

Dabús, C., Tohmé, F., & Caraballo, M.A. (2016). A middle-income trap in a small open economy: Modeling the Argentinean case. *Economic Modelling, 53*, 436-444. DOI: 10.1016/j.econmod.2015.10.042

Foxley, A., & Stallings, B. (2016). *Innovation and Inclusion in Latin America: Strategies to Avoid the Middle Income Trap*. London: Palgrave MacMillan.

Kam, A. J. Y. (2014). Revisiting the productivity growth and spillovers debate: the case of Malaysian manufacturing sector. *Journal of the Asia Pacific Economy, 19*(4), 656-681.

Karras, G. (2008). Growth and convergence, 1950-2003. What Can We Learn from the Solow Model? *Applied Econometrics and International Development, 8*(1), 5-18.

Lee, K., Pesaran, M. H., & Smith, R. (1997). Growth and convergence in a multi-country empirical stochastic Solow model. *Journal of Applied Econometrics, 12*(4), 357-392.

Luiz, J. M. (2016). The political economy of middle-income traps: Is South Africa in a long-run growth trap? *South African Journal of Economics, 84*(1), 3-19.

Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A Contribution to the empirics of economic growth. *The Quarterly Journal of Economics, 107*(2), 407-437. DOI: 10.2307/2118477

Mathur, S. K. (2005). Economic growth and conditional convergence: its speed for selected regions for 1961-2001. *Indian Economic Review, 40*(2), 185-208.

Mcquinn, K., & Whelan, K. (2007). Conditional convergence and the dynamics of the capital-output ratio. *Journal of Economic Growth, 12*(2), 159-184. DOI: 10.1007/s10887-007-9013-3

Panik, M. J., & Rassekh, F. (2002). A model of growth and convergence in the presence of input-enhancing factors: An empirical study. *Economic Inquiry, 40*(2), 158-165. DOI: 10.1093/ei/40.2.158

Paus, E. (2019). Innovation strategies matter: Latin America's middle-income trap meets China and globalization. *Journal of Development Studies, 56*(4), 657-679. DOI: 10.1080/00220388.2019.1595600

Phillips, P. C. B., & Sul, D. (2007). Transition modeling and econometric convergence tests. *Econometrica, 75*(6), 1771-1855. DOI: 10.1111/j.1468-0262.2007.00811.x

Phillips, P. C. B., & Sul, D. (2009). Economic transition and growth. *Journal of Applied Econometrics, 24*(7), 1153-1185. DOI: 10.1002/jae.1080

Rath, B. N. (2016). Does the digital divide across countries lead to convergence? New international evidence. *Economic Modelling, 58*, 75-82. DOI: 10.1016/j.econmod.2016.05.020

Romer, D. (2001). *Advanced Macroeconomics* (2nd edition). New York: McGraw-Hill.

Stengos, T., Yazgan, M. E., & Ozkan, H. (2018). Persistence in convergence and club formation. *Bulletin of Economic Research, 70*(2), 119-138. DOI: 10.1111/boer.12130

Topal, M. H. (2020). The Middle Income Trap: Theory and Empirical Evidence. *Bogazici Journal, Review of Social, Economic and Administrative Studies*, Bogazici University, Department of Economics, *34*(1), 51-75.

World Bank database. Retrieved from https://data.worldbank.org.cn/

Appendix A

The 114 Countries and Regions with Their Codes in the Sample

1. The name list of **29** developed countries and regions

Andorra—AND, Australia—AUS, Austria—AUT, Belgium—BEL, Canada—CAN, Switzerland—CHE, Germany—DEU, Denmark—DNK, Spain—ESP, Finland—FIN, France —FRA, United Kingdom—GBR, Greece—GRC, Greenland—GRL, Hong Kong—-HKG, Ireland—-IRL, Iceland—ISL, Israel —ISR, Italy—ITA, Japan—JPN, Luxembourg—LUX, Monaco—MCO, Netherlands—NLD, Norway—NOR, New Zealand—NZL, Portugal—-PRT, Singapore—SGP, Sweden—SWE, United States—USA

2. The name list of **85** developing countries

Argentina—ARG, Burundi—-BDI, Benin—BEN, Burkina Faso—-BFA, Bangladesh—-BGD, Bahamas—BHS, Belize—BLZ, Bolivia—BOL, Brazil—BRA, Botswana—-BWA, Central African Republic—-CAF, 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, Dominican Republic—-DOM, Algeria—-DZA, Ecuador—-ECU, Egypt—-EGY, Fiji—-FJI, Gabon—-GAB, Georgia—-GEO, Ghana —-GHA, Gambia—-GMB, Guinea-Bissau —GNB, Guatemala—-GTM, Guyana—-GUY, Honduras—-HND, Haiti—HTI, Indonesia—-IDN, India—-IND, Iran—-IRN, Iraq—-IRQ, Jamaica—-JAM, Kenya—-KEN, Kiribati —KIR, Korea, Republic of—-KOR, Sri Lanka—-LKA, Lesotho—-LSO, Morocco—-MAR, Madagascar—-MDG, Mexico—-MEX, Mali—-MLI, Malta—-MLT, Myanmar—-MMR, Mauritania—-MRT, Malawi—-MWI, Malaysia—-MYS, Niger—-NER, Nigeria—-NGA, Nicaragua—-NIC, Nepal—-NPL, Oman—-OMN, Pakistan—-PAK, Panama—-PAN, Peru—-PER, Philippines—-PHL, Papua New Guinea—-PNG, Puerto Rico—-PRI, Paraguay—-PRY, Rwanda—-RWA, Saudi Arabia—-SAU, Sudan—-SDN, Senegal—-SEN, Sierra Leone—-SLE, El Salvador—-SLV, Suriname—SUR, Swaziland—-SWZ, Seychelles—-SYC, Chad—-TCD, Togo—-TGO, Thailand—-THA, Trinidad & Tobago—-TTO, Tunisia—-TUN, Turkey—-TUR, Uruguay—-URY, St. Vincent and the Grenadines—-VCT, South Africa—-ZAF, Zambia—-ZMB, Zimbabwe—-ZWE

Appendix B

The Regression Results from Estimating the Equation (6) (Outputs of Eviews)

Dependent Variable: D(Y?)

Method: Pooled EGLS (Cross-section weights)

Date: 08/01/21 Time: 23:20

Sample (adjusted): 1971 2019

Included observations: 49 after adjustments

Cross-sections included: 114

Total pool (balanced) observations: 5586

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)	C(1)= -0.193381	0.041258	-4.687150	0.0000
DT1*Y?(-1)	C(2)= 0.072969	0.049827	1.464443	0.1431
DT2*Y?(-1)	C(3)= 0.000806	0.059595	0.013529	0.9892
DT3*Y?(-1)	C(4)= 0.125194	0.047810	2.618578	0.0089
DT4*Y?(-1)	C(5)= 0.044145	0.047281	0.933680	0.3505
AND—C	0.271399	0.069710	3.893285	0.0001
ARG—C	-0.050771	0.016708	-3.038728	0.0024
AUS—C	0.201802	0.047824	4.219635	0.0000
AUT—C	0.190616	0.038714	4.923712	0.0000
BDI—C	-0.699684	0.142295	-4.917156	0.0000
BEL—C	0.184124	0.039325	4.682124	0.0000
BEN—C	-0.501747	0.102466	-4.896714	0.0000
BFA—C	-0.653104	0.134012	-4.873475	0.0000
BGD—C	-0.665966	0.135407	-4.918261	0.0000
BHS—C	0.140782	0.020893	6.738232	0.0000
BLZ—C	-0.311833	0.071099	-4.385875	0.0000
BOL—C	-0.339140	0.063980	-5.300713	0.0000
BRA—C	C(18)= -0.038935	0.012127	-3.210495	0.0013
BWA—C	-0.297091	0.085622	-3.469783	0.0005
CAF—C	-0.544847	0.103422	-5.268208	0.0000
CAN—C	0.201966	0.044869	4.501262	0.0000
CHE—C	0.318145	0.068980	4.612162	0.0000
CHL—C	-0.156884	0.048447	-3.238220	0.0012
CHN—C	C(24)= -0.673089	0.149284	-4.508779	0.0000
CIV—C	-0.280008	0.057898	-4.836193	0.0000
CMR—C	-0.398326	0.093412	-4.264170	0.0000
COD—C	-0.470284	0.088137	-5.335855	0.0000
COG—C	-0.304220	0.064920	-4.686077	0.0000
COL—C	-0.187820	0.042145	-4.456568	0.0000
CRI—C	-0.131716	0.029746	-4.428057	0.0000
CUB—C	-0.223799	0.049619	-4.510358	0.0000
DEU—C	0.177455	0.036377	4.878222	0.0000
DNK—C	0.244714	0.052524	4.659069	0.0000
DOM—C	-0.261452	0.055407	-4.718707	0.0000
DZA—C	-0.202663	0.046211	-4.385593	0.0000
ECU—C	-0.192870	0.037151	-5.191515	0.0000
EGY—C	-0.453020	0.097865	-4.629028	0.0000
ESP—C	0.110332	0.028792	3.832081	0.0001

FIN—C	0.168876	0.035662	4.735498	0.0000
40 FJI—C	-0.233823	0.056344	-4.149930	0.0000
FRA—C	0.186346	0.037971	4.907618	0.0000
GAB—C	0.078445	0.064909	1.208535	0.2269
GBR—C	0.150140	0.030877	4.862539	0.0000
GEO—C	-0.189259	0.046061	-4.108848	0.0000
45 GHA—C	-0.472373	0.098635	-4.789097	0.0000
GMB—C	-0.482186	0.088236	-5.464720	0.0000
GNB—C	-0.562635	0.115898	-4.854572	0.0000
GRC—C	0.127991	0.028601	4.474998	0.0000
GRL—C	0.179885	0.030051	5.986066	0.0000
50 GTM—C	-0.262862	0.056500	-4.652457	0.0000
GUY—C	-0.312539	0.052282	-5.977967	0.0000
HKG—C	-0.006477	0.018846	-0.343699	0.7311
HND—C	-0.360510	0.077647	-4.642942	0.0000
HTI—C	-0.423921	0.094045	-4.507648	0.0000
55 IDN—C	-0.423826	0.094092	-4.504394	0.0000
IND—C	-0.625306	0.118810	-5.263059	0.0000
IRL—C	0.099270	0.023988	4.138409	0.0000
IRN—C	-0.034777	0.036355	-0.956588	0.3388
IRQ—C	-0.271517	0.077482	-3.504237	0.0005
60 ISL—C	0.183444	0.030789	5.958185	0.0000
ISR—C	0.117838	0.026272	4.485221	0.0000
ITA—C	0.160096	0.032233	4.966903	0.0000
JAM—C	-0.173314	0.035177	-4.926955	0.0000
JPN—C	0.175763	0.035879	4.898706	0.0000
65 KEN—C	-0.459318	0.109019	-4.213192	0.0000
KIR—C	-0.222343	0.056360	-3.945033	0.0001
KOR—C	-0.191524	0.055517	-3.449855	0.0006
LKA—C	-0.484168	0.101000	-4.793754	0.0000
LSO—C	-0.561408	0.138618	-4.050025	0.0001
70 LUX—C	0.277305	0.058583	4.733566	0.0000
MAR—C	-0.394786	0.080972	-4.875576	0.0000
MCO—C	0.457498	0.097240	4.704822	0.0000
MDG—C	-0.518442	0.104345	-4.968532	0.0000
MEX—C	C(74)= -0.063913	0.018300	-3.492496	0.0005
75 MLI—C	-0.601184	0.127735	-4.706498	0.0000
MLT—C	-0.042741	0.032967	-1.296480	0.1949
MMR—C	-0.773176	0.163889	-4.717689	0.0000

MRT—C	-0.346585	0.067239	-5.154557	0.0000
MWI—C	-0.614457	0.135777	-4.525493	0.0000
80 MYS—C	C(80)= -0.223053	0.056818	-3.925718	0.0001
NER—C	-0.534001	0.120557	-4.429467	0.0000
NGA—C	-0.300006	0.066508	-4.510849	0.0000
NIC—C	-0.321612	0.039191	-8.206229	0.0000
NLD—C	0.210572	0.047298	4.452011	0.0000
85 NOR—C	0.293799	0.061562	4.772422	0.0000
NPL—C	-0.692232	0.139466	-4.963453	0.0000
NZL—C	0.153572	0.038108	4.029935	0.0001
OMN—C	-0.012654	0.037946	-0.333471	0.7388
PAK—C	-0.583550	0.118343	-4.931001	0.0000
90 PAN—C	-0.179718	0.040711	-4.414481	0.0000
PER—C	-0.196846	0.032592	-6.039677	0.0000
PHL—C	-0.346043	0.072419	-4.778335	0.0000
PNG—C	-0.345865	0.071360	-4.846790	0.0000
PRI—C	0.066429	0.007922	8.385786	0.0000
95 PRT—C	0.037652	0.009959	3.780528	0.0002
PRY—C	-0.252540	0.064933	-3.889237	0.0001
RWA—C	-0.635407	0.141297	-4.496966	0.0000
SAU—C	0.278707	0.057613	4.837575	0.0000
SDN—C	-0.487128	0.081195	-5.999491	0.0000
100 SEN—C	-0.420861	0.078811	-5.340101	0.0000
SGP—C	0.044131	0.005716	7.721103	0.0000
SLE—C	-0.595720	0.120473	-4.944850	0.0000
SLV—C	-0.235943	0.041661	-5.663361	0.0000
SUR—C	-0.066407	0.021288	-3.119462	0.0018
105 SWE—C	0.212940	0.050946	4.179702	0.0000
SWZ—C	-0.353707	0.068763	-5.143854	0.0000
SYC—C	-0.095222	0.049677	-1.916831	0.0553
TCD—C	-0.593813	0.089860	-6.608216	0.0000
TGO—C	-0.529967	0.102767	-5.156974	0.0000
110 THA—C	-0.395992	0.088591	-4.469899	0.0000
TTO—C	-0.064014	0.019766	-3.238636	0.0012
TUN—C	-0.313436	0.071780	-4.366632	0.0000
TUR—C	C(113)= -0.123010	0.018541	-6.634603	0.0000
URY—C	-0.083577	0.019583	-4.267810	0.0000
115 USA—C	C(115)= 0.199378	0.042692	4.670105	0.0000
VCT—C	-0.296802	0.080495	-3.687212	0.0002

	ZAF—C	-0.088085	0.013689	-6.434616	0.0000
	ZMB—C	-0.391928	0.067164	-5.835347	0.0000
	ZWE—C	-0.408702	0.078503	-5.206173	0.0000
120	AND—D1	-0.150468	0.077860	-1.932541	0.0533
	ARG—D1	-0.027725	0.020727	-1.337639	0.1811
	AUS—D1	-0.068247	0.056716	-1.203308	0.2289
	AUT—D1	-0.065700	0.048976	-1.341480	0.1798
	BDI—D1	0.270036	0.173786	1.553846	0.1203
125	BEL—D1	-0.062075	0.047411	-1.309302	0.1905
	BEN—D1	0.182536	0.124766	1.463024	0.1435
	BFA—D1	0.246131	0.161827	1.520952	0.1283
	BGD—D1	0.259215	0.162390	1.596249	0.1105
	BHS—D1	-0.025573	0.041160	-0.621314	0.5344
130	BLZ—D1	0.129148	0.091558	1.410567	0.1584
	BOL—D1	0.059123	0.087103	0.678771	0.4973
	BRA—D1	C(132)= -0.004447	0.019268	-0.230782	0.8175
	BWA—D1	0.185933	0.095463	1.947697	0.0515
	CAF—D1	0.154345	0.130510	1.182631	0.2370
135	CAN—D1	-0.072806	0.054879	-1.326651	0.1847
	CHE—D1	-0.114570	0.082543	-1.388003	0.1652
	CHL—D1	0.067926	0.060518	1.122402	0.2617
	CHN—D1	C(138)= 0.358790	0.170019	2.110291	0.0349
	CIV—D1	0.010277	0.074906	0.137196	0.8909
140	CMR—D1	0.160804	0.103428	1.554743	0.1201
	COD—D1	0.139599	0.110356	1.264985	0.2059
	COG—D1	0.165365	0.078109	2.117110	0.0343
	COL—D1	0.067595	0.050064	1.350182	0.1770
	CRI—D1	0.011633	0.038932	0.298804	0.7651
145	CUB—D1	0.121336	0.056940	2.130959	0.0331
	DEU—D1	-0.059420	0.045822	-1.296742	0.1948
	DNK—D1	-0.082304	0.068600	-1.199772	0.2303
	DOM—D1	0.096246	0.068894	1.397026	0.1625
	DZA—D1	0.060387	0.052339	1.153778	0.2486
150	ECU—D1	0.051007	0.048279	1.056506	0.2908
	EGY—D1	0.221880	0.113058	1.962529	0.0498
	ESP—D1	-0.036955	0.032684	-1.130700	0.2582
	FIN—D1	-0.037151	0.044433	-0.836121	0.4031
	FJI—D1	0.048018	0.072487	0.662438	0.5077
155	FRA—D1	-0.066267	0.046946	-1.411570	0.1581

	GAB—D1	-0.093060	0.069893	-1.331474	0.1831
	GBR—D1	-0.043260	0.041364	-1.045832	0.2957
	GEO—D1	0.078207	0.052330	1.494495	0.1351
	GHA—D1	0.133860	0.124724	1.073247	0.2832
160	GMB—D1	0.163593	0.112073	1.459704	0.1444
	GNB—D1	0.199735	0.142005	1.406535	0.1596
	GRC—D1	-0.073037	0.032711	-2.232766	0.0256
	GRL—D1	-0.064291	0.037281	-1.724502	0.0847
	GTM—D1	0.048273	0.073442	0.657288	0.5110
165	GUY—D1	0.054938	0.076969	0.713767	0.4754
	HKG—D1	0.071228	0.022838	3.118758	0.0018
	HND—D1	0.107720	0.093119	1.156791	0.2474
	HTI—D1	0.109538	0.113733	0.963117	0.3355
	IDN—D1	0.195014	0.112014	1.740975	0.0817
170	IND—D1	0.266688	0.147950	1.802558	0.0715
	IRL—D1	-0.019751	0.027972	-0.706090	0.4802
	IRN—D1	-0.137593	0.052357	-2.627955	0.0086
	IRQ—D1	0.095926	0.093365	1.027431	0.3043
	ISL—D1	-0.059218	0.043569	-1.359154	0.1742
175	ISR—D1	-0.048499	0.033540	-1.446035	0.1482
	ITA—D1	-0.042954	0.040820	-1.052299	0.2927
	JAM—D1	0.036232	0.047775	0.758395	0.4483
	JPN—D1	-0.032809	0.046208	-0.710016	0.4777
	KEN—D1	0.146700	0.130533	1.123850	0.2611
180	KIR—D1	-0.030573	0.067945	-0.449969	0.6528
	KOR—D1	0.156079	0.059309	2.631625	0.0085
	LKA—D1	0.212319	0.118740	1.788097	0.0738
	LSO—D1	0.198896	0.160009	1.243033	0.2139
	LUX—D1	-0.072746	0.072470	-1.003800	0.3155
185	MAR—D1	0.163127	0.097125	1.679568	0.0931
	MCO—D1	-0.178938	0.116757	-1.532576	0.1254
	MDG—D1	0.132547	0.130797	1.013377	0.3109
	MEX—D1	C(188)= 0.012418	0.026273	0.472665	0.6365
	MLI—D1	0.209894	0.157226	1.334985	0.1819
190	MLT—D1	0.041920	0.034528	1.214089	0.2248
	MMR—D1	0.287226	0.194705	1.475183	0.1402
	MRT—D1	0.102148	0.086308	1.183520	0.2367
	MWI—D1	0.173107	0.160478	1.078695	0.2808
	MYS—D1	C(194)= 0.109449	0.065681	1.666368	0.0957

195	NER—D1	0.141961	0.148678	0.954822	0.3397
	NGA—D1	0.014175	0.091281	0.155291	0.8766
	NIC—D1	0.039145	0.065891	0.594089	0.5525
	NLD—D1	-0.083304	0.056429	-1.476250	0.1399
	NOR—D1	-0.090963	0.079098	-1.150005	0.2502
200	NPL—D1	0.267154	0.170641	1.565594	0.1175
	NZL—D1	-0.056273	0.046973	-1.197991	0.2310
	OMN—D1	0.061183	0.043088	1.419963	0.1557
	PAK—D1	0.259839	0.142426	1.824388	0.0682
	PAN—D1	0.056655	0.052949	1.069999	0.2847
205	PER—D1	0.025931	0.048371	0.536087	0.5919
	PHL—D1	0.096451	0.094087	1.025127	0.3054
	PNG—D1	0.085444	0.086278	0.990335	0.3221
	PRI—D1	-0.016419	0.012352	-1.329226	0.1838
	PRT—D1	-0.000182	0.012372	-0.014713	0.9883
210	PRY—D1	0.109832	0.078196	1.404572	0.1602
	RWA—D1	0.226638	0.167982	1.349185	0.1773
	SAU—D1	-0.283980	0.064026	-4.435352	0.0000
	SDN—D1	0.159652	0.112483	1.419343	0.1559
	SEN—D1	0.129840	0.099346	1.306954	0.1913
215	SGP—D1	0.042824	0.013783	3.107003	0.0019
	SLE—D1	0.189970	0.147402	1.288789	0.1975
	SLV—D1	-0.003212	0.056274	-0.057074	0.9545
	SUR—D1	-0.017829	0.030109	-0.592172	0.5538
	SWE—D1	-0.069524	0.061795	-1.125074	0.2606
220	SWZ—D1	0.174157	0.090756	1.918943	0.0550
	SYC—D1	0.019358	0.054815	0.353157	0.7240
	TCD—D1	0.226127	0.121777	1.856895	0.0634
	TGO—D1	0.165135	0.135637	1.217479	0.2235
	THA—D1	0.205764	0.105518	1.950042	0.0512
225	TTO—D1	-0.024297	0.033923	-0.716224	0.4739
	TUN—D1	0.110380	0.085021	1.298265	0.1943
	TUR—D1	C(227)= 0.048924	0.022437	2.180507	0.0293
	URY—D1	0.009931	0.033152	0.299568	0.7645
	USA—D1	C(229)= -0.064690	0.054067	-1.196488	0.2316
230	VCT—D1	0.154434	0.089315	1.729105	0.0839
	ZAF—D1	C(231)= 0.009201	0.023762	0.387221	0.6986
	ZMB—D1	0.094684	0.093194	1.015985	0.3097
	ZWE—D1	0.154888	0.103903	1.490698	0.1361

	AND—D2	-0.083429	0.080807	-1.032448	0.3019
235	ARG—D2	-0.041565	0.023335	-1.781212	0.0749
	AUS—D2	0.010245	0.066759	0.153464	0.8780
	AUT—D2	0.014908	0.058819	0.253465	0.7999
	BDI—D2	-0.078691	0.218492	-0.360155	0.7187
	BEL—D2	0.008960	0.057502	0.155815	0.8762
240	BEN—D2	-0.018589	0.156489	-0.118789	0.9054
	BFA—D2	0.000204	0.198690	0.001027	0.9992
	BGD—D2	0.028456	0.196651	0.144702	0.8850
	BHS—D2	-0.005438	0.038771	-0.140268	0.8885
	BLZ—D2	0.064187	0.093828	0.684093	0.4939
245	BOL—D2	-0.075736	0.110656	-0.684424	0.4937
	BRA—D2	C(246)= -0.057058	0.019029	-2.998473	0.0027
	BWA—D2	0.104852	0.099104	1.057999	0.2901
	CAF—D2	-0.129269	0.177673	-0.727565	0.4669
	CAN—D2	-0.016750	0.063051	-0.265654	0.7905
250	CHE—D2	-0.021882	0.096912	-0.225789	0.8214
	CHL—D2	0.079042	0.050979	1.550476	0.1211
	CHN—D2	C(252)= 0.258660	0.179484	1.441134	0.1496
	CIV—D2	-0.168611	0.108915	-1.548098	0.1217
	CMR—D2	-0.103992	0.139146	-0.747359	0.4549
255	COD—D2	-0.266082	0.169081	-1.573694	0.1156
	COG—D2	-0.034766	0.092005	-0.377866	0.7055
	COL—D2	-0.006936	0.055844	-0.124194	0.9012
	CRI—D2	-0.028754	0.044407	-0.647516	0.5173
	CUB—D2	-0.080367	0.085059	-0.944833	0.3448
260	DEU—D2	0.014048	0.055838	0.251582	0.8014
	DNK—D2	0.014351	0.078508	0.182800	0.8550
	DOM—D2	0.004801	0.076836	0.062478	0.9502
	DZA—D2	-0.072752	0.073153	-0.994529	0.3200
	ECU—D2	-0.054254	0.060089	-0.902881	0.3666
265	EGY—D2	0.064870	0.131843	0.492025	0.6227
	ESP—D2	0.014698	0.038300	0.383752	0.7012
	FIN—D2	0.009753	0.053618	0.181898	0.8557
	FJI—D2	-0.039054	0.086064	-0.453779	0.6500
	FRA—D2	0.000219	0.056531	0.003873	0.9969
270	GAB—D2	-0.119177	0.066680	-1.787303	0.0739
	GBR—D2	0.019032	0.049491	0.384565	0.7006
	GEO—D2	-0.312313	0.132808	-2.351606	0.0187

	GHA—D2	-0.046954	0.150703	-0.311565	0.7554
	GMB—D2	-0.067330	0.148767	-0.452589	0.6509
275	GNB—D2	-0.039309	0.182283	-0.215648	0.8293
	GRC—D2	-0.041990	0.035431	-1.185122	0.2360
	GRL—D2	-0.051187	0.051369	-0.996453	0.3191
	GTM—D2	-0.065584	0.090212	-0.726996	0.4673
	GUY—D2	-0.025070	0.092181	-0.271959	0.7857
280	HKG—D2	0.103076	0.031192	3.304609	0.0010
	HND—D2	-0.061787	0.115402	-0.535410	0.5924
	HTI—D2	-0.143453	0.156450	-0.916928	0.3592
	IDN—D2	0.076408	0.124263	0.614890	0.5387
	IND—D2	0.070686	0.174900	0.404154	0.6861
285	IRL—D2	0.096763	0.040768	2.373517	0.0177
	IRN—D2	-0.163333	0.061730	-2.645915	0.0082
	IRQ—D2	-0.005200	0.162795	-0.031939	0.9745
	ISL—D2	-0.010530	0.049487	-0.212783	0.8315
	ISR—D2	0.010569	0.039864	0.265131	0.7909
290	ITA—D2	0.017420	0.052145	0.334067	0.7383
	JAM—D2	-0.024596	0.055705	-0.441539	0.6588
	JPN—D2	0.039769	0.061141	0.650439	0.5154
	KEN—D2	-0.082251	0.159293	-0.516350	0.6056
	KIR—D2	-0.190724	0.099599	-1.914922	0.0556
295	KOR—D2	0.202775	0.057820	3.507022	0.0005
	LKA—D2	0.082293	0.138037	0.596167	0.5511
	LSO—D2	0.015549	0.183730	0.084632	0.9326
	LUX—D2	0.074947	0.093690	0.799944	0.4238
	MAR—D2	0.017005	0.117055	0.145272	0.8845
300	MCO—D2	-0.021487	0.138426	-0.155222	0.8767
	MDG—D2	-0.134654	0.175142	-0.768823	0.4420
	MEX—D2	C(302)= -0.021504	0.028940	-0.743055	0.4575
	MLI—D2	-0.020670	0.187801	-0.110066	0.9124
	MLT—D2	0.083618	0.033426	2.501597	0.0124
305	MMR—D2	0.026738	0.237291	0.112681	0.9103
	MRT—D2	-0.074729	0.109494	-0.682496	0.4950
	MWI—D2	-0.070966	0.206632	-0.343441	0.7313
	MYS—D2	C(308)= 0.092091	0.068271	1.348909	0.1774
	NER—D2	-0.131076	0.181438	-0.722429	0.4701
310	NGA—D2	-0.140789	0.118697	-1.186119	0.2356
	NIC—D2	-0.152782	0.112509	-1.357949	0.1745

	NLD—D2	0.010817	0.066299	0.163161	0.8704
	NOR—D2	0.041413	0.097136	0.426342	0.6699
	NPL—D2	0.026745	0.204150	0.131008	0.8958
315	NZL—D2	-0.021313	0.050164	-0.424855	0.6710
	OMN—D2	0.051046	0.041124	1.241265	0.2146
	PAK—D2	0.040851	0.166809	0.244898	0.8065
	PAN—D2	0.004888	0.058465	0.083610	0.9334
	PER—D2	-0.091712	0.066455	-1.380048	0.1676
320	PHL—D2	-0.068956	0.115879	-0.595068	0.5518
	PNG—D2	-0.039093	0.105500	-0.370554	0.7110
	PRI—D2	0.025483	0.025382	1.003978	0.3154
	PRT—D2	0.038263	0.017621	2.171452	0.0299
	PRY—D2	0.006001	0.081862	0.073302	0.9416
325	RWA—D2	-0.084146	0.220187	-0.382156	0.7024
	SAU—D2	-0.209871	0.062853	-3.339075	0.0008
	SDN—D2	-0.034637	0.136347	-0.254037	0.7995
	SEN—D2	-0.075993	0.132813	-0.572180	0.5672
	SGP—D2	0.121293	0.033879	3.580221	0.0003
330	SLE—D2	-0.145929	0.201829	-0.723032	0.4697
	SLV—D2	-0.079125	0.080503	-0.982883	0.3257
	SUR—D2	-0.112173	0.037571	-2.985647	0.0028
	SWE—D2	-0.005879	0.069054	-0.085143	0.9322
	SWZ—D2	0.075419	0.099125	0.760850	0.4468
335	SYC—D2	0.026874	0.054018	0.497502	0.6189
	TCD—D2	-0.055569	0.161049	-0.345046	0.7301
	TGO—D2	-0.094360	0.173483	-0.543916	0.5865
	THA—D2	0.142940	0.108880	1.312814	0.1893
	TTO—D2	-0.027846	0.034067	-0.817387	0.4137
340	TUN—D2	0.009487	0.102131	0.092890	0.9260
	TUR—D2	C(341)= 0.020144	0.031600	0.637467	0.5238
	URY—D2	0.005043	0.024769	0.203596	0.8387
	USA—D2	C(343)= 0.014198	0.064549	0.219949	0.8259
	VCT—D2	0.086512	0.093802	0.922284	0.3564
345	ZAF—D2	C(345)= -0.087301	0.036817	-2.371223	0.0178
	ZMB—D2	-0.132269	0.131414	-1.006509	0.3142
	ZWE—D2	-0.021719	0.126388	-0.171845	0.8636
	AND—D3	-0.210017	0.074895	-2.804144	0.0051
	ARG—D3	0.006453	0.026224	0.246083	0.8056
350	AUS—D3	-0.122572	0.054539	-2.247417	0.0247

	AUT—D3	-0.121918	0.045804	-2.661698	0.0078
	BDI—D3	0.394702	0.178163	2.215396	0.0268
	BEL—D3	-0.119476	0.045564	-2.622171	0.0088
	BEN—D3	0.311241	0.124548	2.498962	0.0125
355	BFA—D3	0.431952	0.157490	2.742728	0.0061
	BGD—D3	0.467028	0.158783	2.941303	0.0033
	BHS—D3	-0.115470	0.026404	-4.373148	0.0000
	BLZ—D3	0.224827	0.078220	2.874309	0.0041
	BOL—D3	0.190689	0.085514	2.229916	0.0258
360	BRA—D3	C(360)= 0.010909	0.019224	0.567486	0.5704
	BWA—D3	0.227827	0.088169	2.583991	0.0098
	CAF—D3	0.291505	0.142444	2.046447	0.0408
	CAN—D3	-0.127135	0.051898	-2.449691	0.0143
	CHE—D3	-0.219456	0.077236	-2.841362	0.0045
365	CHL—D3	0.146060	0.049319	2.961537	0.0031
	CHN—D3	C(366)= 0.587545	0.156993	3.973932	0.0001
	CIV—D3	0.078627	0.087776	0.895765	0.3704
	CMR—D3	0.221430	0.113258	1.955089	0.0506
	COD—D3	0.186728	0.128791	1.449855	0.1472
370	COG—D3	0.177897	0.082165	2.165118	0.0304
	COL—D3	0.123732	0.050217	2.463962	0.0138
	CRI—D3	0.086333	0.036673	2.354116	0.0186
	CUB—D3	0.171236	0.060248	2.842204	0.0045
	DEU—D3	-0.121802	0.041903	-2.906779	0.0037
375	DNK—D3	-0.164285	0.061620	-2.666096	0.0077
	DOM—D3	0.188311	0.065224	2.887132	0.0039
	DZA—D3	0.118609	0.056741	2.090348	0.0366
	ECU—D3	0.107011	0.050889	2.102838	0.0355
	EGY—D3	0.332689	0.111121	2.993942	0.0028
380	ESP—D3	-0.067797	0.032447	-2.089472	0.0367
	FIN—D3	-0.096217	0.044743	-2.150454	0.0316
	FJI—D3	0.123431	0.067590	1.826160	0.0679
	FRA—D3	-0.129773	0.043423	-2.988619	0.0028
	GAB—D3	-0.146796	0.067109	-2.187447	0.0288
385	GBR—D3	-0.091325	0.038172	-2.392490	0.0168
	GEO—D3	0.105432	0.064331	1.638905	0.1013
	GHA—D3	0.300313	0.119899	2.504712	0.0123
	GMB—D3	0.269352	0.118615	2.270816	0.0232
	GNB—D3	0.321053	0.144526	2.221420	0.0264

390 GRC—D3	-0.082832	0.032415	-2.555396	0.0106
GRL—D3	-0.101271	0.037024	-2.735290	0.0063
GTM—D3	0.140218	0.071890	1.950452	0.0512
GUY—D3	0.192648	0.073219	2.631141	0.0085
HKG—D3	0.061659	0.024679	2.498446	0.0125
395 HND—D3	0.215299	0.093338	2.306667	0.0211
HTI—D3	0.189798	0.122924	1.544030	0.1226
IDN—D3	0.318226	0.105666	3.011635	0.0026
IND—D3	0.466032	0.137864	3.380383	0.0007
IRL—D3	-0.019808	0.038315	-0.516968	0.6052
400 IRN—D3	-0.020130	0.043362	-0.464225	0.6425
IRQ—D3	0.165432	0.109843	1.506082	0.1321
ISL—D3	-0.110947	0.039910	-2.779933	0.0055
ISR—D3	-0.082211	0.029823	-2.756677	0.0059
ITA—D3	-0.114244	0.037851	-3.018255	0.0026
405 JAM—D3	0.082406	0.044627	1.846572	0.0649
JPN—D3	-0.116628	0.044075	-2.646105	0.0082
KEN—D3	0.253720	0.131662	1.927051	0.0540
KIR—D3	0.049922	0.078568	0.635399	0.5252
KOR—D3	0.228768	0.055749	4.103526	0.0000
410 LKA—D3	0.371652	0.111856	3.322595	0.0009
LSO—D3	0.389750	0.156061	2.497426	0.0125
LUX—D3	-0.150247	0.074134	-2.026701	0.0427
MAR—D3	0.283408	0.096003	2.952067	0.0032
MCO—D3	-0.309067	0.112807	-2.739787	0.0062
415 MDG—D3	0.266059	0.136459	1.949734	0.0513
MEX—D3	C(416)= 0.013689	0.021505	0.636532	0.5245
MLI—D3	0.388327	0.154156	2.519057	0.0118
MLT—D3	0.059287	0.033865	1.750706	0.0801
MMR—D3	0.632622	0.184431	3.430127	0.0006
420 MRT—D3	0.177290	0.085665	2.069577	0.0385
MWI—D3	0.363313	0.162467	2.236222	0.0254
MYS—D3	C(422)= 0.185691	0.058642	3.166513	0.0016
NER—D3	0.277726	0.151222	1.836544	0.0663
NGA—D3	0.181795	0.086790	2.094657	0.0363
425 NIC—D3	0.155846	0.070975	2.195782	0.0282
NLD—D3	-0.136292	0.053738	-2.536207	0.0112
NOR—D3	-0.181870	0.073424	-2.476984	0.0133
NPL—D3	0.467433	0.165540	2.823689	0.0048

	NZL—D3	-0.103698	0.041599	-2.492770	0.0127
430	OMN—D3	0.015879	0.039162	0.405482	0.6851
	PAK—D3	0.394437	0.137393	2.870861	0.0041
	PAN—D3	0.136059	0.047834	2.844412	0.0045
	PER—D3	0.122595	0.048204	2.543276	0.0110
	PHL—D3	0.210326	0.089503	2.349920	0.0188
435	PNG—D3	0.183287	0.092265	1.986528	0.0470
	PRI—D3	-0.033915	0.014962	-2.266731	0.0234
	PRT—D3	-0.023073	0.011636	-1.982942	0.0474
	PRY—D3	0.145025	0.074300	1.951885	0.0510
	RWA—D3	0.429392	0.167543	2.562872	0.0104
440	SAU—D3	-0.275597	0.059478	-4.633626	0.0000
	SDN—D3	0.335161	0.104255	3.214830	0.0013
	SEN—D3	0.244358	0.101687	2.403037	0.0163
	SGP—D3	0.029459	0.029684	0.992422	0.3210
	SLE—D3	0.348502	0.147604	2.361068	0.0183
445	SLV—D3	0.113740	0.059638	1.907180	0.0566
	SUR—D3	0.026326	0.031632	0.832263	0.4053
	SWE—D3	-0.134449	0.058527	-2.297215	0.0216
	SWZ—D3	0.263466	0.077681	3.391626	0.0007
	SYC—D3	0.055916	0.053481	1.045530	0.2958
450	TCD—D3	0.412879	0.118398	3.487199	0.0005
	TGO—D3	0.274618	0.133373	2.059027	0.0395
	THA—D3	0.324162	0.093926	3.451232	0.0006
	TTO—D3	0.092230	0.021408	4.308275	0.0000
	TUN—D3	0.227384	0.082235	2.765037	0.0057
455	TUR—D3	C(455)= 0.094700	0.019641	4.821570	0.0000
	URY—D3	0.050878	0.030237	1.682650	0.0925
	USA—D3	C(457)= -0.129767	0.050865	-2.551186	0.0108
	VCT—D3	0.244883	0.083653	2.927362	0.0034
	ZAF—D3	C(459)= 0.035947	0.025307	1.420404	0.1556
460	ZMB—D3	0.234432	0.096229	2.436200	0.0149
	ZWE—D3	0.151329	0.117630	1.286486	0.1983
	AND—D4	-0.147310	0.072895	-2.020852	0.0433
	ARG—D4	-0.040656	0.024639	-1.650042	0.0990
	AUS—D4	-0.039063	0.054694	-0.714197	0.4751
465	AUT—D4	-0.046465	0.044217	-1.050838	0.2934
	BDI—D4	0.027158	0.175400	0.154836	0.8770
	BEL—D4	-0.049542	0.044638	-1.109869	0.2671

	BEN—D4	0.092423	0.121641	0.759804	0.4474
	BFA—D4	0.187626	0.154476	1.214598	0.2246
470	BGD—D4	0.267492	0.152436	1.754782	0.0794
	BHS—D4	-0.090739	0.023403	-3.877184	0.0001
	BLZ—D4	0.082265	0.078139	1.052808	0.2925
	BOL—D4	0.045303	0.078713	0.575550	0.5649
	BRA—D4	C(474)= -0.036503	0.021156	-1.725425	0.0845
475	BWA—D4	0.179471	0.088764	2.021888	0.0432
	CAF—D4	-0.053309	0.151853	-0.351056	0.7256
	CAN—D4	-0.052678	0.050808	-1.036805	0.2999
	CHE—D4	-0.106648	0.076302	-1.397716	0.1623
	CHL—D4	0.129442	0.049067	2.638047	0.0084
480	CHN—D4	C(480)= 0.562153	0.151754	3.704379	0.0002
	CIV—D4	-0.081399	0.081317	-1.001010	0.3169
	CMR—D4	0.021195	0.109536	0.193501	0.8466
	COD—D4	-0.091254	0.124095	-0.735356	0.4622
	COG—D4	0.014735	0.077938	0.189056	0.8501
485	COL—D4	0.062156	0.046966	1.323425	0.1858
	CRI—D4	0.039695	0.033724	1.177058	0.2392
	CUB—D4	0.072118	0.054318	1.327691	0.1843
	DEU—D4	-0.036534	0.041687	-0.876380	0.3809
	DNK—D4	-0.063914	0.059195	-1.079736	0.2803
490	DOM—D4	0.135496	0.061554	2.201257	0.0278
	DZA—D4	-0.004317	0.054681	-0.078951	0.9371
	ECU—D4	0.003716	0.046699	0.079574	0.9366
	EGY—D4	0.173843	0.108373	1.604118	0.1088
	ESP—D4	-0.034271	0.031850	-1.076025	0.2820
495	FIN—D4	-0.029957	0.040975	-0.731099	0.4648
	FJI—D4	0.030932	0.064619	0.478682	0.6322
	FRA—D4	-0.062629	0.042323	-1.479814	0.1390
	GAB—D4	-0.183949	0.066919	-2.748847	0.0060
	GBR—D4	-0.027236	0.036921	-0.737693	0.4607
500	GEO—D4	-0.001072	0.059480	-0.018023	0.9856
	GHA—D4	0.136971	0.114981	1.191253	0.2336
	GMB—D4	-0.000908	0.116872	-0.007769	0.9938
	GNB—D4	0.052652	0.141142	0.373043	0.7091
	GRC—D4	-0.114642	0.030334	-3.779343	0.0002
505	GRL—D4	-0.042445	0.037134	-1.143019	0.2531
	GTM—D4	0.005903	0.069150	0.085368	0.9320

GUY—D4	0.090652	0.064930	1.396149	0.1627
HKG—D4	0.115658	0.024916	4.641941	0.0000
HND—D4	0.040926	0.092269	0.443555	0.6574
510 HTI—D4	-0.067303	0.117201	-0.574253	0.5658
IDN—D4	0.212224	0.101316	2.094682	0.0362
IND—D4	0.307837	0.131189	2.346516	0.0190
IRL—D4	0.110926	0.045535	2.436081	0.0149
IRN—D4	-0.120718	0.047688	-2.531399	0.0114
515 IRQ—D4	0.097424	0.083332	1.169114	0.2424
ISL—D4	-0.038892	0.041294	-0.941837	0.3463
ISR—D4	-0.023983	0.029259	-0.819682	0.4124
ITA—D4	-0.072506	0.035119	-2.064592	0.0390
JAM—D4	-0.035739	0.046348	-0.771106	0.4407
520 JPN—D4	-0.032880	0.042233	-0.778540	0.4363
KEN—D4	0.054845	0.128016	0.428420	0.6684
KIR—D4	-0.133806	0.075006	-1.783938	0.0745
KOR—D4	0.256889	0.055965	4.590157	0.0000
LKA—D4	0.264714	0.107917	2.452949	0.0142
525 LSO—D4	0.176526	0.149849	1.178029	0.2388
LUX—D4	-0.015538	0.071388	-0.217654	0.8277
MAR—D4	0.140099	0.090081	1.555260	0.1199
MCO—D4	-0.106593	0.112712	-0.945704	0.3443
MDG—D4	-0.032366	0.133977	-0.241576	0.8091
530 MEX—D4	C(530)= -0.024957	0.022820	-1.093623	0.2742
MLI—D4	0.122437	0.148316	0.825514	0.4091
MLT—D4	0.107646	0.035030	3.072975	0.0021
MMR—D4	0.415968	0.175133	2.375158	0.0176
MRT—D4	-0.011334	0.085867	-0.131995	0.8950
535 MWI—D4	0.079309	0.159692	0.496640	0.6195
MYS—D4	C(536)= 0.165387	0.058394	2.832254	0.0046
NER—D4	0.009084	0.146893	0.061838	0.9507
NGA—D4	-0.002931	0.081156	-0.036111	0.9712
NIC—D4	-0.021905	0.060486	-0.362156	0.7173
540 NLD—D4	-0.054501	0.052982	-1.028667	0.3037
NOR—D4	-0.061501	0.072520	-0.848056	0.3964
NPL—D4	0.233339	0.159262	1.465124	0.1429
NZL—D4	-0.047491	0.041742	-1.137740	0.2553
OMN—D4	-0.031444	0.039054	-0.805142	0.4208
545 PAK—D4	0.166839	0.134176	1.243430	0.2138
PAN—D4	0.121357	0.042383	2.863338	0.0042
PER—D4	0.046795	0.041968	1.115032	0.2649

PHL—D4	0.090230	0.085608	1.053992	0.2919
PNG—D4	0.049766	0.085765	0.580263	0.5618
550 PRI—D4	-0.012215	0.013937	-0.876472	0.3808
PRT—D4	-0.006921	0.011675	-0.592785	0.5534
PRY—D4	0.070363	0.072466	0.970973	0.3316
RWA—D4	0.185095	0.160626	1.152335	0.2492
SAU—D4	-0.261954	0.058306	-4.492744	0.0000
555 SDN—D4	0.141678	0.093303	1.518478	0.1290
SEN—D4	0.045443	0.098935	0.459322	0.6460
SGP—D4	0.135323	0.023284	5.811984	0.0000
SLE—D4	0.059652	0.153779	0.387905	0.6981
SLV—D4	-0.012744	0.057274	-0.222514	0.8239
560 SUR—D4	-0.059037	0.031508	-1.873688	0.0610
SWE—D4	-0.044557	0.057087	-0.780511	0.4351
SWZ—D4	0.151934	0.075574	2.010394	0.0444
SYC—D4	0.064994	0.050926	1.276244	0.2019
TCD—D4	0.132028	0.116045	1.137723	0.2553
565 TGO—D4	0.039921	0.128942	0.309606	0.7569
THA—D4	0.240192	0.093272	2.575177	0.0100
TTO—D4	0.029883	0.022267	1.342027	0.1796
TUN—D4	0.094006	0.079184	1.187185	0.2352
TUR—D4	C(569)= 0.100434	0.019974	5.028275	0.0000
570 URY—D4	0.053515	0.021526	2.486007	0.0130
USA—D4	C(571)= -0.040304	0.048932	-0.823685	0.4102
VCT—D4	0.138755	0.083205	1.667634	0.0955
ZAF—D4	C(573)= -0.053242	0.024067	-2.212231	0.0270
ZMB—D4	0.035484	0.088075	0.402878	0.6871
575 ZWE—D4	0.024157	0.103241	0.233989	0.8150

Weighted Statistics

R-squared	0.342232	Mean dependent var	-0.000358
Adjusted R-squared	0.266886	S.D. dependent var	0.053221
S.E. of regression	0.045569	Sum squared resid	10.40535
F-statistic	4.542147	Durbin-Watson stat	1.706694
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.290712	Mean dependent var	-0.001243
Sum squared resid	10.52293	Durbin-Watson stat	1.899193

Appendix C

The Results of Wald Tests (Outputs of Eviews)

1. The Result of the Wald Test for $H_0: \beta_1 = 0$

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	18.57513	(1, 5011)	0.0000
Chi-square	18.57513	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-C(1) - C(2)	0.120412	0.027938

Restrictions are linear in coefficients.

Note: -C(1) = $\hat{\beta}_0$; C(2) = $\hat{\lambda}_1$

2. The Result of the Wald Test for := 0

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	20.05227	(1, 5011)	0.0000
Chi-square	20.05227	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-C(1) - C(3)	0.192575	0.043005

Restrictions are linear in coefficients.

Note: -C(1) = $\hat{\beta}_0$; C(3) = $\hat{\lambda}_1$

3. The Result of the Wald Test for : = 0

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	7.966911	(1, 5011)	0.0048
Chi-square	7.966911	1	0.0048

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-C(1) - C(4)	0.068187	0.024158

Restrictions are linear in coefficients.

Note: -C(1) = $\hat{\beta}_0$; C(4) = $\hat{\lambda}_3$

4. The Result of the Wald Test for : = 0

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	41.76206	(1, 5011)	0.0000
Chi-square	41.76206	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-C(1) - C(5)	0.149236	0.023093

Restrictions are linear in coefficients.

Note: -C(1)= $\hat{\beta}_0$; C(5)= $\hat{\lambda}_4$

5. The Result of the Wald Test for : y_1^* (*BRA*) -y_0^*(*BRA*) = 0

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	2.168572	(1, 5011)	0.1409
Chi-square	2.168572	1	0.1409

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(18)/C(1) + (C(18) + C(132))/(-C(1) - C(2))	-0.158940	0.107931

Delta method computed using analytic derivatives.

Note: C(18)/C(1) = -C(18)/(-C(1)) = -$\hat{c}_0$ (*BRA*)/ $\hat{\beta}_0$;

(C(18) + C(132))/(-C(1) - C(2)) = $\hat{c}_1$ (*BRA*)/ $\hat{\beta}_1$

6. The Result of the Wald Test for $H_0 : y_2^*(BRA) - y_1^*(BRA) = 0$

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	1.367203	(1, 5011)	0.2423
Chi-square	1.367203	1	0.2423

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-(C(18) + C(132))/(-C(1) - C(2)) + (C(18) + C(246))/(-C(1) - C(3))	-0.138193	0.118187

Delta method computed using analytic derivatives.

Note: (C(18) + C(132))/(-C(1) - C(2)) = $\hat{c}_1$ $(BRA)/$ $\hat{\beta}_1$;

(C(18) + C(246))/(-C(1) - C(3)) = $(BRA)/$

7. The Result of the Wald Test for $H_0 : y_3^* (BRA) - y_2^*(BRA) = 0$

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	0.569852	(1, 5011)	0.4504
Chi-square	0.569852	1	0.4503

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-(C(18) + C(246))/(-C(1) - C(3)) + (C(18) + C(360))/(-C(1) - C(4))	0.087458	0.115855

Delta method computed using analytic derivatives.

Note: (C(18) + C(246))/(-C(1) - C(3)) = $\hat{c}_2 (BRA)/$ $\hat{\beta}_2$;

(C(18) + C(360))/(-C(1) - C(4)) = $\hat{c}_3 (BRA)/$ $\hat{\beta}_3$

8. The Result of the Wald Test for $H_0: y_4^*(BRA)) - y_3^*(BRA) = 0$

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	0.587786	(1, 5011)	0.4433
Chi-square	0.587786	1	0.4433

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-(C(18) + C(360))/(-C(1) - C(4)) + (C(18) + C(474))/(-C(1) - C(5))	-0.094479	0.123233

Delta method computed using analytic derivatives.

Note: $(C(18) + C(360))/(-C(1) - C(4)) = \hat{c}_3(BRA))/\hat{\beta}_3$;

$(C(18) + C(474))/(-C(1) - C(5)) = \hat{c}_4(BRA))/\hat{\beta}_4$

9. The Result of the Wald Test for $H_0: y_0^*(BRA) = 0$

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	65.09192	(1, 5011)	0.0000
Chi-square	65.09192	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-C(18) / C(1)	-0.201337	0.024955

Delta method computed using analytic derivatives.

Note: $-C(18)/C(1) = C(18)/(-C(1)) = \hat{c}_0(BRA)/\hat{\beta}_0$

10. The Result of the Wald Test for $H_0: y_1^*(BRA) = 0$

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	11.77179	(1, 5011)	0.0006
Chi-square	11.77179	1	0.0006

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
(C(18) + C(132)) / (-C(1) - C(2))	-0.360277	0.105006

Delta method computed using analytic derivatives.

Note: (C(18) + C(132))/(-C(1) - C(2)) = $\hat{c}_1 (BRA) / \hat{\beta}_1$

11. The Result of the Wald Test for $H_0 : y_2^* (BRA) = 0$

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	84.46333	(1, 5011)	0.0000
Chi-square	84.46333	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
(C(18) + C(246)) / (-C(1) - C(3))	-0.498469	0.054238

Delta method computed using analytic derivatives.

Note: (C(18) + C(246))/(-C(1) - C(3)) = $\hat{c}_2 (BRA) / \hat{\beta}_2$

12. The Result of the Wald Test for $H_0 : y_3^* (BRA) = 0$

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	16.11826	(1, 5011)	0.0001
Chi-square	16.11826	1	0.0001

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
(C(18) + C(360)) / (-C(1) - C(4))	-0.411012	0.102375

Delta method computed using analytic derivatives.

Note: (C(18) + C(360))/(-C(1) - C(4)) = $\hat{c}_3$ (*BRA*)/ $\hat{\beta}_3$

13. The Result of the Wald Test for $H_0: y_4^*$ (*BRA*) = 0

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	54.30023	(1, 5011)	0.0000
Chi-square	54.30023	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
(C(18) + C(474)) / (-C(1) - C(5))	-0.505491	0.068598

Delta method computed using analytic derivatives.

Note: (C(18) + C(474)) / (-C(1) - C(5)) = $\hat{c}_4$ (*BRA*)/ $\hat{\beta}_4$

14. The Result of the Wald Test for $H_0: y_0^*$ (*CHN*) - y_0^* (*BRA*) = 0

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	1357.977	(1, 5011)	0.0000
Chi-square	1357.977	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
C(18)/C(1) - C(24)/C(1)	-3.279301	0.088989

Delta method computed using analytic derivatives.

Note: -C(24)/C(1) = C(24)/(-C(1)) = $\hat{c}_0$ (*CHN*)/ $\hat{\beta}_0$;

C(18)/C(1) = -C(18)/(-C(1)) = - $\hat{c}_0$ (*BRA*)/ $\hat{\beta}_0$

15. The Result of the Wald Test for $H_0: y_1^* (CHN) - y_1^* (BRA) = 0$

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	229.4352	(1, 5011)	0.0000
Chi-square	229.4352	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-(C(18) + C(132))/(-C(1) - C(2)) + (C(24) + C(138))/(-C(1) - C(2))	-2.249928	0.148538

Delta method computed using analytic derivatives.

Note: (C(24) + C(138))/(-C(1) - C(2)) = $\hat{c}_1 (CHN)/ \hat{\beta}_1$;

(C(18) + C(132))/(-C(1) - C(2)) = $\hat{c}_1 (BRA)/ \hat{\beta}_1$

16. The Result of the Wald Test for $H_0: y_2^* (CHN) - y_2^* (BRA) = 0$

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	251.7001	(1, 5011)	0.0000
Chi-square	251.7001	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-(C(18) + C(246))/(-C(1) - C(3)) + (C(24) + C(252))/(-C(1) - C(3))	-1.653575	0.104227

Delta method computed using analytic derivatives.

Note: (C(24) + C(252))/(-C(1) - C(3)) = $\hat{c}_2 (CHN)/ \hat{\beta}_2$;

(C(18) + C(246))/(-C(1) - C(3)) = $\hat{c}_2 (BRA)/ \hat{\beta}_2$

17. The Result of the Wald Test for $H_0: y_3^*(CHN) - y_3^*(BRA) = 0$

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	126.0329	(1, 5011)	0.0000
Chi-square	126.0329	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-(C(18) + C(360))/(-C(1) - C(4)) + (C(24) + C(366))/(-C(1) - C(4))	-0.843747	0.121137

Delta method computed using analytic derivatives.

Note: (C(24) + C(366))/(-C(1) - C(4)) = $\hat{c}_3(CHN)/\hat{\beta}_3$;

(C(18) + C(360))/(-C(1) - C(4)) = $\hat{c}_3(BRA)/\hat{\beta}_3$

18. The Result of the Wald Test for $H_0: y_4^*(CHN) - y_4^*(BRA) = 0$

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	5.523785	(1, 5011)	0.0188
Chi-square	5.523785	1	0.0188

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-(C(18) + C(474))/(-C(1) - C(5)) + (C(24) + C(480))/(-C(1) - C(5))	-0.237871	0.101210

Delta method computed using analytic derivatives.

Note: (C(24) + C(480))/(-C(1) - C(5)) = $\hat{c}_4(CHN)/\hat{\beta}_4$;

(C(18) + C(474))/(-C(1) - C(5)) = $\hat{c}_4(BRA)/\hat{\beta}_4$