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An Empirical Study on the Steady States of Per-Capita Output of Five Latin American Countries and China

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***Abstract**:* This paper uses the econometric method to show, measured by steady state of per-capita output, the relative positions of five Latin American countries (Argentina, Brazil, Chile, Colombia and Mexico) remained slightly below the average level of a test sample of 112 countries during the 1970-2019 period, which means, even measured by steady state of per-capita output, the above five countries were still typical "middle income trap" countries during this period. This paper also verifies China's relative position was much lower than the overall level of the five Latin American countries in 1970s but kept rising rapidly since then, and almost caught up with theirs in 2010s, which means, measured by steady state of per-capita output, China was not a "middle income trap" country during the 1970-2019 period, but China started to face the problem in 2010s, and the future changes in China's steady state of per-capita output will determine whether China can cross the "middle income trap". Combining the convergence theory with the practical data of the above countries, this paper also makes explanations for the situations in their steady states of per-capita output. In addition, this paper's analysis includes USA as well, USA is chosen as a subject country only to reveal the typical gap between developed countries and "middle income trap" countries.

Keywords: Five Latin American countries; China; steady state of per-capita output; β-convergence; social infrastructure

1. INTRODUCTION

Many Latin American countries are well known for being "middle income trap" countries for long time. As for the reasons for this situation, many scholars have made studies from different perspectives, and have obtained many valuable research results. Examples are as follows, Caldentey (2012) indicated that in the late 1990s Chile's performance began to deteriorate due to the limited capability of the natural resources industry. To promote

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the extensive upgrading of other industries, the government formulated industrial policies to promote innovation, but this effort was limited by the low level of R & D expenses and the lack of creative culture in the private section. Paus (2014) argued that many Latin American countries have found that they have been unable to compete in labor-intensive, standardized goods, but their current production capacity has not been widely improved and they cannot compete in high value-added products. Foxley and Stallings (2016) emphasized that Latin America needs powerful institutions to promote innovation to increase their productivity. Lustig (2016) found that the effect of fiscal redistribution policy in Latin American countries was not always positive, even negative for some countries. For example, the fiscal redistribution policies in Brazil and Colombia have made poverty deep because of high consumption taxes on primary products. Dabús, Tohmé, and Caraballo (2016) found that when the world's demand for primary commodities became smaller, Latin American countries were easy to stay at the middle-income level due to their heavy dependence on international prices of these commodities. Argentina was a prominent example of this phenomenon. Albuquerque (2019) discussed Brazil's industrial policies that failed to reduce the distinction between Brazil and developed countries, as well as the historical origins of Brazil's long stay in the "middle-income trap" with special attention to the role of income inequality.

Based on the research works of above scholars , one can draw the following conclusions: after reaching the middle-income level, Latin American countries failed to make the correct adjustment of economic growth mode, leading to difficulties in industrial upgrading and insufficient endogenous power for their growth; furthermore, the unreasonable fiscal policies of government led to the aggravation of poverty and income inequality in some Latin American countries, which hindered the efforts to achieve equitable development. Therefore, these countries have been "middle income trap" countries for a long time.

The above conclusions are generally pertinent, but these scholars' research is not good enough. This is reflected in the fact that the explanation of the reasons behind the phenomenon is not convincing enough, and the more convincing econometric analysis is obviously less, which discounts the academic value of their research results. The future research work should try to make up for this deficiency.

This paper attempts to finish such a job based on convergence theory. According to convergence theory stemming from Solow model, for an economy, its per-capita output always converge to its steady state of per-capita output. On the other hand, because of existence of capital accumulation and technological innovation, the steady state of per-capita output also grows over time for most countries, but the growth rate is different across countries, i.e., the steady state of per-capita output can grow fast for some countries but slowly for some other countries. Obviously, it is an important work to investigate the relative change in the steady state of per-capita output of a country among a broad set of countries. To carry out such a study, this paper establishes an important concept: ***the relative steady state of per-capita output****,* which is the ratio of the steady state of per-capita output of a country to the average level of a broad set of countries. According to this definition, a change in the relative steady state of per-capita output of a country indicates there happens a relative change in the steady state of per-capita output of the country in a broad set of countries.

Although Latin America has the largest number of "middle income trap" countries in the world, this paper just chooses five Latin American countries with relatively large populations as representatives of "middle income trap" countries, they are Argentina, Brazil, Chile, Colombia and Mexico. This paper will use econometric methods to obtain the estimates of the relative steady states of per-capita output of the above five Latin American countries, China (i.e., the mainland of China, the same below) and United States (as a representative of developed countries) in the 1970s, 1980s, 1990s, 2000s and 2010s to show the relative changes in the steady states of per-capita output of these countries in a test sample during the 1970-2019 period. Based on convergence theory and the practical data of the above countries, this paper also makes explanations for the relative changes in the steady states of per-capita output of the above countries.

Nine sections are included in this paper. Section 1 is introduction. Section 2 gives the reason for choosing a study on β convergence. A review of previous empirical studies concerned is given in Section 3. Section 4 will give the explanations of several concepts involved in this paper. Section 5 will show the regression equation to test the hypothesis of convergence in this paper. Next, the data and the empirical method are introduced in Section 6, and the detailed results and analyses are also given. After Section 7 using paths to show the relative changes in steady states of per-capita output of the concerned countries, Section 8 makes explanations for the relative changes in steady states of per-capita output of the concerned countries. Conclusions and policy suggestions are provided in Section 9.

2. THE REASON FOR CHOOSING A STUDY ON β CONVERGENCE

Both β and α convergences are often involved in convergence study, but they are much different. since β denotes the speed of convergence, the larger the value of β is, the faster the variable converges to its steady state. For a group of economies, β convergence stresses each economy's per-capita output converges to its own steady state, and each economy can have its own different steady state among economies, so the study on β convergence may show the differences of steady state of per-capita output among economies; while σ convergence emphasizes whether the variance trend of per-capita outputs of a group of economies is zero, so the study of σ convergence cannot show the differences of steady state among economies. This is why this paper chooses to make a study on β rather than σ convergence.

3. A BRIEF REVIEW OF PREVIOUS EMPIRICAL STUDIES CONCERNED

β convergence stems from Solow's classical growth model and consists of absolute convergence and conditional convergence. Conditional convergence is more common for a given group of economies, so the previous empirical studies on β convergence generally focused on conditional convergence.

In fact, many economists have found the evidence of conditional convergence, which means, for a group of countries, each country can be different from others in the steady state of per-capita output. For example, Baumol (1986), Barro (1991), Mankiw, Romer, and Weil (1992), Panik and Rassekh (2002), Mathur (2005), Mcquinn and Whelan (2007), Karras (2008), Cavenaile and Dubois (2011), Bagci (2012), Rath (2016), Stengos, Yazgan, *and* Ozkan (2018), etc, all of above economists did empirical research and found the evidence of conditional convergence, i.e., after their testing the hypothesis of conditional convergence, they revealed the selected countries converged to different steady states of per-capita output, respectively.

But one needs to point out their studies on convergence were made using only *one* period rather than *several successive* periods. The reason for that is these economists believe that concept of convergence only applies to a long period which usually consists of several decades or even hundreds of years, and they also support two propositions: (1) No matter whether a country is developed or underdeveloped, its steady state of per capita output can remain unchanged for decades or even more than a hundred years; (2) Developing countries can enjoy similar steady state with developed ones, but the developed countries are close to their steady state while the developing ones are much away from their steady state. But their idea is probably wrong. Let's make a brief analysis in theory and list several reasons for questioning.

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

Secondly, based on the Solow model, it can be judged that for most developing countries, their steady states are usually obviously lower than those of developed countries. The reason for that is even if there is no significant difference in economic parameters between developing and developed countries, developing countries are usually obviously lower than developed countries in labor efficiency.

Thirdly, the Solow's model does imply that for an economy, it steady state of per-capita output should exist for a given period, but this model does not explicitly require the length of this period. Theoretically, the steady state of per-capita output of an economy can exist in a relatively short time, such as a short period of 10 years.

All previously mentioned studies tested the hypothesis of conditional convergence during a long period, rather than across sub-periods, so they did not assess whether there happened, across sub-periods, a change in a country's relative steady state of per-capita output, whose definition is given in Section 1. As stated earlier, such a change for a country implies a relative change in its steady state of per-capita output among countries, so it is undoubtedly worth to make a study to investigate such a change, especially for some important developing countries.

This paper will make such a study through testing the hypothesis of conditional convergence in a sample of 112 countries in 1970s, 1980s, 1990s, 2000s and 2010s, and will show the paths of relative steady states of per-capita output of the five Latin American countries, China and United States by using the obtained estimates of these countries in the above five successive sub-periods. The analyses and explanations of these paths under comparative conditions will give some useful information on the growth of the above countries.

4. THE EXPLANATIONS OF SEVERAL CONCEPTS INVOLVED

This paper makes a study on convergence which was stemmed from the Solow model[1]. Solow model is shown in Figure 1[2] and focuses on four variables: output (Y), capital (K), labor (L) and effectiveness of labor (A). The production function in the model takes the form $Y = F(K, AL)$. Several concepts on convergence are involved: the steady state, social infrastructure, the speed of convergence and β convergence.

Take the steady state first. Figure 1 shows that for an economy for a given period, the capital per unit of effective labor k (= K/AL) converges to

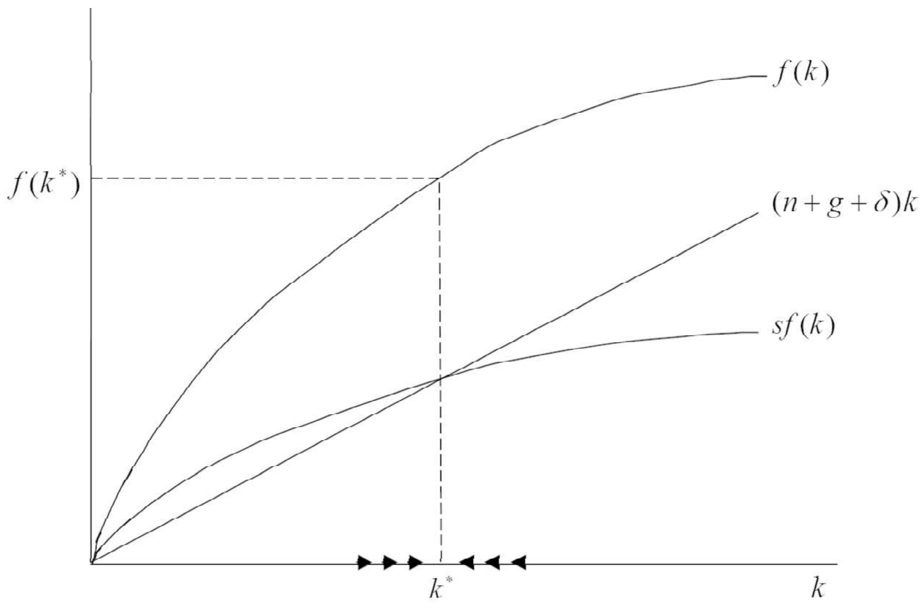

Figure 1: The steady state of an economy for a given period

its steady state k^*, so the output per unit of effective labor $f(k)$ converges to its steady state $f(k^*)$. Further, the output per unit of labor, i.e., per-capita output, $Af(k)$ converges to its steady state $Af(k^*)$, where A denotes the effectiveness of labor in the given period.

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

According to what Romer described (2001)[3], social infrastructure refers to those institutions, policies, traditions and cultures, which can influence economic growth. For an economy, its social infrastructure can almost determine its steady state of per-capita output through influencing its economic parameters and its effectiveness of labor. Developed countries can enjoy high level of steady state of per-capita output mainly because of their superior social infrastructures, so a developing country wants to be a developed one, it should establish a superior social infrastructure first.

β denotes the speed of convergence and is explained by the following equation[4].

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

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

β convergence is named using the speed of convergence β. It consists of absolute and conditional convergences. For a given group of economies, absolute convergence means the selected economies have the similar steady state of per-capita output to converge because they enjoy similar social infrastructure; conditional convergence means the selected economies have different steady states of per-capita output to converge, respectively, for they have different social infrastructures. For a group of economies, there must exist either absolute or conditional convergence.

5. THE REGRESSION EQUATION TO TEST THE HYPOTHESIS OF β CONVERGENCE

The hypothesis of β -convergence is tested by the following equation[5].

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

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

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

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

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

Equation (3) is the original equation to test the hypothesis of β convergence. In equation (3), c_i is the fixed effect of economy *i* for all *i*. For conditional convergence, Y_i^* changes with *i*, then Y_i^* is not equal to $\bar{Y}^*$ for most *i* and y_i^* is not equal to 0 for most *i*, thus c_i is not equal to 0 for most *i*, i.e., c_i is significant for most *i*. But for absolute convergence, c_i is not significant for most *i*.

6. THE DATA, THE EMPIRICAL METHOD, THE RESULTS AND ANALYSES

6.1. The Data

World Bank can offer data on per-capita output, i.e., GDP per-capita (constant 2015 US$) for countries. The downloaded data on GDP per-capita cover years from 1970 to 2019 and contain 112 countries [6] which are listed in *Appendix B*, their data on GDP per-capita are available in each year from 1970 to 2019. The data are balanced panel data.

6.2. The empirical method

Firstly, the above data is considered as a collective sample (the 1970-2019 sample), which can be divided into the five subsamples: the 1970-1979 subsample, the 1980-1989 subsample, the 1990-1999 subsample, the 2000-2009 subsample and the 2010-2019 subsample. Since each subsample includes developed and developing countries, conditional convergence will be in each subsample.

Secondly, using the data in above five sub-samples, one can obtain the regression results which can 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 is tested in the five subsamples singly, the five estimates of each country will be got singly. According to the knowledge of econometrics, it is unsuitable to use two estimates to judge if the change in a variable or the gap between two variables is significant without doing a Wald test. To make Wald tests for assessments, the five estimates of all countries must be got simultaneously so that all estimates can be associated with each other in an econometric software. For this purpose, dummy variables should be added into the regression equation.

In equation (3), $(1/T)(1-e^{-\beta T}) \cong \beta$ exists if β is a very small positive value[7], so the constant term $c_i = \beta y_i^*$ holds for country *i* for all *i*. Let one year as the time interval of observations used, i.e., $T = 1$ year, equation (3) is rewritten as

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

Four dummy variables $D1$, $D2$, $D3$ and $D4$ are added into equation (4) to reveal, respectively, the changes in constant term c_i of country *i* for all *i* across subperiods. Another four dummy variables $DT1$, $DT2$, $DT3$ and $DT4$ are added into equation (4) to find, respectively, the changes in the average speed of convergence β of all sample countries across the subperiods. Such an addition of eight dummy variables creates equation (5).

$$\Delta y_{i,t} = c_{i,0} + \gamma_{i,1}D1 + \gamma_{i,2}D2 + \gamma_{i,3}D3 + \gamma_{i,4}D4$$
$$- \beta_0 y_{i,t-1} + \lambda_1 DT1 y_{i,t-1} + \lambda_2 DT2 y_{i,t-1} + \lambda_3 DT3 y_{i,t-1} + \lambda_4 DT4 y_{i,t-1} + \varepsilon_{i,t} \quad (5)$$

where $D1 = DT1 = 1$ when data in the 1980-1989 subsample, $D1 = DT1 = 0$ otherwise; $D2 = DT2 = 1$ when data in the 1990-1999 subsample, $D2 = DT2 = 0$ otherwise; $D3 = DT3 = 1$ when data in the 2000-2009 subsample, $D3 = DT3 = 0$ otherwise; $D4 = DT4 = 1$ when data in the 2010-2019 subsample, $D4 = DT4 = 0$ otherwise; $c_{i,0}$ denotes the fixed effect of country *i* for all *i* in 1970s; $\gamma_{i,1}$ denotes the distance between c_i in 1970s and 1980s for all *i*; $\gamma_{i,2}$ denotes that between c_i in 1970s and 1990s for all *i*; $\gamma_{i,3}$ denotes that between c_i in 1970s and 2000s for all *i*; $\gamma_{i,4}$ denotes that between c_i in 1970s and 2010s for all *i*; β_0 denotes the average speed of convergence of all sample countries in1970s; λ_1 denotes the distance between β in 1970s and 1980s; λ_2 denotes that between β in 1970s and 1990s; λ_3 denotes that between β in 1970s and 2000s; and λ_4 denotes that between β in 1970s and 2010s. Furthermore, $c_{i,0}$, $(c_{i,0}+\gamma_{i,1})=c_{i,1}$, $(c_{i,0}+\gamma_{i,2})=c_{i,2}$, $(c_{i,0}+\gamma_{i,3})=c_{i,3}$ and $(c_{i,0}+\gamma_{i,4})=c_{i,4}$ denote, respectively, the fixed effect of country *i* for all *i* in 1970s, 1980s, 1990s, 2000s, 2010s; 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 , respectively, the average speed of convergence of all sample countries in 1970s, 1980s, 1990s, 2000s and 2010s. After such an addition of eight dummy variables, data in the five subsamples can be used jointly to estimate equation (5) to acquire the estimates of all above mentioned coefficients simultaneously, further, to acquire simultaneously the five estimates of relative steady state of per-capita output of all sample countries in the above five successive subperiods.

6.3. The Results and Analyses

As for conditional convergence, if β_0 in equation (5) is positive, $c_{i,0}$ in equation (5) is significant for most *i*, the hypothesis of conditional convergence cannot be rejected in the 1970-1979 subsample. Similarly, if β_1, β_2, β_3 and β_4, which are implied in equation (5), are all positive, $c_{i,1}$, $c_{i,2}$, $c_{i,3}$ and $c_{i,4}$, which are implied in equation (5), are all significant for most *i*, the hypothesis of conditional convergence cannot be rejected, respectively, in the 1980-1989 subsample, the 1990-1999 subsample, the 2000-2009 subsample and the 2010-2019 subsample.

Now make the following ten null hypotheses for the above five subsamples:

$$H_0: \beta_0 = 0,\ H_0: c_{i,0} = 0;$$

$$H_0: \beta_1 = 0,\ H_0: c_{i,1} = 0;$$

$$H_0: \beta_2 = 0,\ H_0: c_{i,2} = 0;$$

$$H_0: \beta_3 = 0,\ H_0: c_{i,3} = 0;$$

$$H_0: \beta_4 = 0,\ H_0: c_{i,4} = 0.$$

The regression results from estimating equation (5) using data in the five subsamples jointly are shown in *Appendix C*, but the regression results about Argentina, Brazil, Chile, Colombia, Mexico, China and the United States are chosen and given in Table 1.

Table 1: The selected regression results from estimating equation (5)

Variable	*Coefficient*	*Estimates*	*Std. Error*	*t-statistic*	*p value*
$y_{i,t-1}$	$-\beta_0$	-0.199982	0.041515	-4.817125	0.0000
$DT1y_{i,t-1}$	λ_1	0.080308	0.051524	1.558653	0.1191
$DT2y_{i,t-1}$	λ_2	0.006861	0.059827	0.114683	0.9087
$DT3y_{i,t-1}$	λ_3	0.135475	0.048498	2.793392	0.0052
$DT4y_{i,t-1}$	λ_4	0.037872	0.049117	0.771069	0.4407
$c_0(ARG)$	$c_0\,(ARG)$	-0.052648	0.016556	-3.179949	0.0015
$D1\ (ARG)$	$\gamma_1\,(ARG)$	-0.026020	0.020796	-1.251209	0.2109
$D2\ (ARG)$	$\gamma_2\,(ARG)$	-0.040316	0.023413	-1.721966	0.0851
$D3\ (ARG)$	$\gamma_3\,(ARG)$	0.011227	0.026680	0.420782	0.6739
$D4\ (ARG)$	$\gamma_4\,(ARG)$	-0.039258	0.025821	-1.520381	0.1285
$c_0\ (BRA)$	$c_0\,(BRA)$	-0.041925	0.012210	-3.433626	0.0006
$D1\ (BRA)$	$\gamma_1\,(BRA)$	-0.001682	0.019927	-0.084426	0.9327
$D2(BRA)$	$\gamma_2\,(BRA)$	-0.054640	0.019175	-2.849570	0.0044
$D3(BRA)$	$\gamma_3\,(BRA)$	0.016393	0.019998	0.819743	0.4124
$D4(BRA)$	$\gamma_4\,(BRA)$	-0.037202	0.022065	-1.686025	0.0919
$c_0\ (CHL)$	$c_0\,(CHL)$	-0.162213	0.048846	-3.320936	0.0009
$D1\ (CHL)$	$\gamma_1\,(CHL)$	0.073379	0.062016	1.183234	0.2368
$D2(CHL)$	$\gamma_2\,(CHL)$	0.083731	0.051404	1.628893	0.1034
$D3(CHL$	$\gamma_3\,(CHL)$	0.153424	0.049847	3.077896	0.0021
$D4\ (CHL)$	$\gamma_4\,(CHL)$	0.135175	0.049588	2.725958	0.0064
$c_0(CHN)$	$c_0\,(CHN)$	-0.697024	0.149808	-4.652786	0.0000
$D1(CHN)$	$\gamma_1\,(CHN)$	0.384597	0.174260	2.207027	0.0274
$D2(CHN)$	$\gamma_2\,(CHN)$	0.280888	0.179918	1.561202	0.1185
$D3(CHN)$	$\gamma_3\,(CHN)$	0.615278	0.158224	4.141462	0.0000
$D4(CHN)$	$\gamma_4\,(CHN)$	0.569051	0.152974	3.719926	0.0002
$c_0(COL)$	$c_0\,(COL)$	-0.195279	0.042420	-4.603519	0.0000
$D1(COL)$	$\gamma_1\,(COL)$	0.075209	0.051715	1.454290	0.1459
$D2(COL)$	$\gamma_2\,(COL)$	-0.000552	0.056224	-0.009819	0.9922
$D3(COL)$	$\gamma_3\,(COL)$	0.135804	0.051305	2.647017	0.0081

contd. table 1

Variable	*Coefficient*	*Estimates*	*Std. Error*	*t-statistic*	*p value*
*D*4(*COL*)	γ_4 (*COL*)	0.059077	0.048139	1.227224	0.2198
c_0(*MEX*)	c_0 (*MEX*)	-0.066991	0.018095	-3.702220	0.0002
*D*1(*MEX*)	γ_1 (*MEX*)	0.015281	0.026732	0.571645	0.5676
*D*2(*MEX*)	γ_2 (*MEX*)	-0.019011	0.028938	-0.656946	0.5112
*D*3(*MEX*)	γ_3 (*MEX*)	0.019305	0.021720	0.888796	0.3742
*D*4(*MEX*)	γ_4 (*MEX*)	-0.025885	0.024297	-1.065379	0.2868
c_0(*USA*)	c_0 (*USA*)	0.205620	0.042799	4.804257	0.0000
*D*1(*USA*)	γ_1 (*USA*)	-0.072161	0.055917	-1.290510	0.1969
*D*2(*USA*)	γ_2 (*USA*)	0.008211	0.064678	0.126957	0.8990
*D*3(*USA*)	γ_3 (*USA*)	-0.139439	0.051264	-2.720042	0.0066
*D*4(*USA*)	γ_4 (*USA*)	-0.033115	0.050967	-0.649740	0.5159

R-squared: 0.343562

In Table 1, the p value for the estimate of β_0 shows H_0: $\beta_0 = 0$ is rejected totally, and the estimate of β_0 proves β_0 is positive. In *Appendix C*, p values for most estimates of $c_{i,0}$ reveal H_0: $c_{i,0} = 0$ is surely rejected. Therefore, the regression results of β_0 and $c_{i,0}$ express the 1970-1979 subsample does not reject the hypothesis of conditional convergence.

The information on β_1, β_2, β_3, β_4, $c_{i,1}$, $c_{i,2}$, $c_{i,3}$ and $c_{i,4}$ are not given directly by regression results from estimating equation (5), but one can make Wald tests to get the concerned information on them. The main results of all Wald tests of this paper are shown in Table 2, their original details are shown in *Appendix D*.

In Table 2, according to the results of the Wald test of H_0: $\beta_1 = 0$, the p value for the Chi-square is 0.0001, thus H_0: $\beta_1 = 0$ is rejected totally. The estimate of β_1 ($\hat{\beta}_1 = \hat{\beta}_0 - \hat{\lambda}_1 = 0.119674$) which is computed using the estimates in Table 1 proves β_1 is positive. Though the Wald test of H_0: $c_{i,1} =$ 0 can be made one country by one country, such a job is not done because there are too many sample countries involved in this paper. According to the p values shown in *Appendix C*, most estimates of $c_{i,0}$ are significant while most estimates of $\gamma_{i,1}$ are not significant, so one can judge that most estimates of $c_{i,1}(= c_{i,0} + \gamma_{i,1})$ are significant, i.e., if the Wald test of H_0: $c_{i,1} = 0$ is made, the results would support that H_0: $c_{i,1} = 0$ is surely rejected. Therefore, the information on β_1 and $c_{i,1}$ show that the 1980-1989 subsample does not reject the hypothesis of conditional convergence.

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

1. Null Hypothesis: $\beta_1 = 0$			
Chi-square	15.37879	p value	0.0001
2. Null Hypothesis: $\beta_2 = 0$			
Chi-square	20.09702	p value	0.0000
3. Null Hypothesis: $\beta_3 = 0$			
Chi-square	6.619603	p value	0.0101
4. Null Hypothesis: $\beta_4 = 0$			
Chi-square	38.14290	p value	0.0000
5. Null Hypothesis: $y_1^*(BRA) - y_0^*(BRA) = 0$			
Chi-square	2.100459	p value	0.1473
6. Null Hypothesis: $y_2^*(BRA) - y_1^*(BRA) = 0$			
Chi-square	1.329566	p value	0.2489
7. Null Hypothesis: $y_3^*(BRA) - y_2^*(BRA) = 0$			
Chi-square	0.653989	p value	0.4187
8. Null Hypothesis: $y_4^*(BRA) - y_3^*(BRA) = 0$			
Chi-square	0.454298	p value	0.5003
9. Null Hypothesis: $y_0^*(CHN) - y_0^*(BRA) = 0$			
Chi-square	1470.358	p value	0.0000
10. Null Hypothesis: $y_1^*(CHN) - y_1^*(BRA) = 0$			
Chi-square	229.5283	p value	0.0000
11. Null Hypothesis: $y_2^*(CHN) - y_2^*(BRA) = 0$			
Chi-square	257.7875	p value	0.0000
12. Null Hypothesis: $y_3^*(CHN) - y_3^*(BRA) = 0$			
Chi-square	126.0829	p value	0.0000
13. Null Hypothesis: $y_4^*(CHN) - y_4^*(BRA) = 0$			
Chi-square	8.147911	p value	0.0043

Similarly, using the above analyzing and inferring 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. Therefore, the information on β_2, β_3, β_4, $c_{i,2}$, $c_{i,3}$ and $c_{i,4}$ show the hypothesis of conditional convergence is not rejected by the 1990-1999 subsample, the 2000-2009 subsample and the 2010-2019 subsample, respectively.

As shown in Section 4, $y_i^* = \log(Y_i^* / \bar{Y}^*)$ represents the relative steady state of per-capita output (log version) of country *i* for all *i*. Accordingly, $y_{i,0}^*$, $y_{i,1}^*$, $y_{i,2}^*$, $y_{i,3}^*$ and $y_{i,4}^*$ represent, respectively, the relative steady state of per-capita output of country *i* for all *i* in 1970s, 1980s, 1990s, 2000s and 2010s. As shown in Section 5.2, $c_i = \beta y_i^*$ holds for country *i* for all *i*, the estimates of y_i^* can be computed using the estimates of c_i and β in each subperiod, e.g. $y^*(BRA)$ denotes Brazil's relative steady state of per-capita output, the details of the computation are shown as follows.

$$\hat{y}_0^*(BRA) = \hat{c}_0(BRA)/\hat{\beta}_0 = \text{-}0.041925/0.199982 = \text{-}0.2096$$

$$\hat{y}_1^*(BRA) = \hat{c}_1(BRA)/\hat{\beta}_1 = [\hat{c}_0(BRA) + \hat{\gamma}_1(BRA)]/(\hat{\beta}_0 - \hat{\lambda}_1)$$
$$= (\text{-}0.041925 \text{ -}0.001682)/(0.199982 \text{ -}0.080308) = \text{-}0.3645$$

$$\hat{y}_2^*(BRA) = \hat{c}_2(BRA)/\hat{\beta}_2 = [\hat{c}_0(BRA) + \hat{\gamma}_2(BRA)]/(\hat{\beta}_0 - \hat{\lambda}_2)$$
$$= (\text{-}0.041925 \text{ -}0.054640)/(0.199982 - 0.006861) = \text{-}0.4997$$

$$\hat{y}_3^*(BRA) = \hat{c}_3(BRA)/\hat{\beta}_3 = [\hat{c}_0(BRA) + \hat{\gamma}_3(BRA)]/(\hat{\beta}_0 - \hat{\lambda}_3)$$
$$=(\text{-}0.041925 + 0.016393)/(0.199982 \text{ -}0.135475)= \text{-}0.3953$$

$$\hat{y}_4^*(BRA) = \hat{c}_4(BRA)/\hat{\beta}_4 = [\hat{c}_0(BRA) + \hat{\gamma}_4(BRA)]/(\hat{\beta}_0 - \hat{\lambda}_4)$$
$$=(\text{-}0.041925 \text{ -}0.037202)/(0.199982 \text{ -}0.037872)= \text{-}0.4879$$

Let $y^*(ARG)$, $y^*(CHL)$, $y^*(COL)$, $y^*(MEX)$, $y^*(CHN)$ and $y^*(USA)$ denote, respectively, those of Argentina, Chile, Colombia, Mexico, China and United States, one can calculate their estimates of relative steady state of per-capita output by using the above method. All estimates of the seven countries are presented in Table 3.

Table 3: Estimates of relative steady states of per-capita output (log version) of the seven countries

Names of countries	*Estimates in 1970s*	*Estimates in 1980s*	*Estimates in 1990s*	*Estimates in 2000s*	*Estimates in 2010s*
Argentina	-0.2633	-0.6577	-0.4814	-0.6422	-0.5669
Brazil	-0.2096	-0.3645	-0.4997	-0.3953	-0.4879
Chile	-0.8111	-0.7425	-0.4064	-0.1364	-0.1668
Colombia	-0.9764	-1.0041	-1.0139	-0.9225	-0.8402
Mexico	-0.3350	-0.4323	-0.4454	-0.7395	-0.5729
China	-3.4851	-2.6120	-2.1548	-1.2666	-0.7896
United States	1.0282	1.1162	1.1072	1.0264	1.0642

The estimates of United States in Table 3 are all positive. For a developed country like United States, its steady state of per-capita output $Y^*(USA)$ is much higher than the average $\bar{Y}^*$ of all sample countries, so its relative steady state of per-capita output (log version) $y^*(USA)$ is significantly positive, actually around 1. The estimates of other countries in Table 3 are significantly negative or close to zero because they are all developing countries.

How to evaluate whether a country's relative steady state of per-capita output changes over time? Take $y^*(BRA)$ as example, one can 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: $y_4^*(BRA) - y_3^*(BRA) = 0$. As shown in Table 2, the results of the Wald test of H_0: $y_1^*(BRA) - y_0^*(BRA) = 0$ display the p value for the Chi-square is above 10%, this means H_0: $y_1^*(BRA) - y_0^*(BRA) = 0$ is not rejected, i.e., the difference between $y^*(BRA)$ in 1970s and 1980s is probably not significant. Therefore, Brazil's relative steady state of per-capita output in 1980s is probably not significantly different from its in 1970s.

Similarly, as shown in Table 2, 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: $y_4^*(BRA) - y_3^*(BRA) = 0$ show that each of the three null hypotheses is not rejected according to their p values for the Chi-square, i.e., as for Brazil, its relative steady state of per-capita output in 1990s is possibly not significantly different from its in 1980s, its in 2000s possibly does not differ significantly from its in 1990s, and its in 2010s is possibly not significantly different from its in 2000s.

How to evaluate if a country differs from another in the relative steady state of per-capita output for a subperiod? Take $y^*(CHN)$ and $y^*(BRA)$ as example, one can 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: $y_4^*(CHN) - y_4^*(BRA) = 0$. The results of Wald tests in Table 2 express all above null hypothesis are rejected totally because their p values for the Chi-square are all much lower than 1%. According to the estimates of $y^*(BRA)$ and $y^*(CHN)$ shown in Table 3, $y_0^*(CHN)$ lower than $y_0^*(BRA)$; $y_1^*(CHN)$ lower than $y_1^*(BRA)$; $y_2^*(CHN)$ lower than $y_2^*(BRA)$; $y_3^*(CHN)$ lower than $y_3^*(BRA)$; $y_4^*(CHN)$ lower than $y_4^*(BRA)$, i.e., China is lower than Brazil in the relative steady state of per-capita output in each subperiod.

7. THE PATHS OF RELATIVE STEADY STATES OF PER-CAPITA OUTPUT OF CONCERNED COUNTRIES

For a country, its path of relative steady state of per-capita output shows how its steady state of per-capita output changes relatively in a group of countries over time, i.e., measured by steady state of per-capita output, the path shows how this country's relative position changes in a group of countries over time. Thus, it is necessary to obtain the path. In fact, the path can be drawn by using the estimates of a country's relative steady state of per-capita output in the successive subperiods. In this paper, the paths of Argentina, Brazil, Chile, Colombia, Mexico, China and United States are drawn by using their estimates in Table 3. The seven paths are shown in Figure 2.

As shown earlier, $y_i^* = \log(Y_i^* / \bar{Y}^*)$ denotes 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 or its steady state of per-capita output always equals the average level of all sample countries. Figure 2 gives the following information.

The path of US is evidently higher than the horizontal axis, so it is a typical path of a developed country. It is justified to think US's steady state of per-capita output kept increasing from 1970s to 2010s, but the path of US

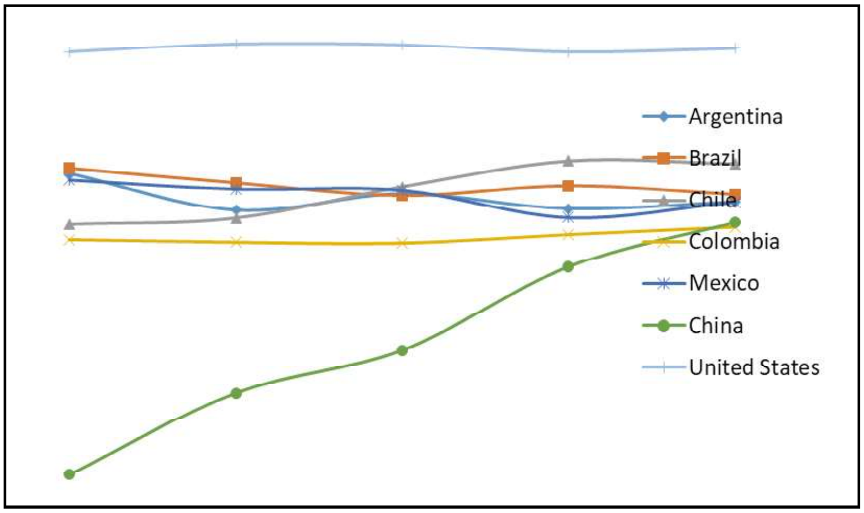

Figure 2: The paths of relative steady states of per-capita output (log version) of the five Latin American countries, China and United States (1970-2019)

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

reveals US's relative steady state of per-capita output did not change significantly from 1970s to 2010s, i.e., measured by steady state of per-capita output, US's relative position did not change significantly in the test sample from 1970s to 2010s.

The paths of the five Latin American countries are all below the horizontal axis, but not far away. The five paths show that the relative steady states of per-capita output of the five countries fluctuated slightly from 1970s to 2010s., i.e., measured by steady state of per-capita output, each country's relative position did not change obviously as a whole in a test sample from 1970s to 2010s. The above situations indicate that even measured by steady state of per-capita output, the above five countries were not only developing countries but also typical "middle income trap" countries during the 1970-2019 period.

The path of China is generally much below the horizontal axis. The path shows China's relative steady state of per-capita output was extremely low in 1970s, then kept improving dramatically, and almost caught up with the overall level of the five Latin American countries in 2010s, i.e., measured by steady state of per-capita output, China's relative position kept rising significantly in the test sample after 1970s, and almost reached the overall level of the five Latin American countries in 2010s. China's path shows, measured by steady state of per-capita output, China was a developing country but not a "middle income trap" country during the 1970-2019 period, or to be precise, China started to confront the "middle income trap" in 2010s.

8. THE EXPLANATIONS FOR THE RELATIVE CHANGES IN STEADY STATES OF PER-CAPITA OUTPUT OF THE CONCERNED COUNTRIES

Section 3 indicates social infrastructure determines the steady state of per-capita output through influencing the economic parameters and the effectiveness of labor. By looking up historical data of the five Latin American countries, this paper will show how their social infrastructures determined their steady states of per-capita output ($A\ f(k^*)$) through influencing their saving rates (s), population growth rates (n) and labor efficiencies (A) during the 1970-2019 period. In addition, in view of the need of this research work, the data of China and United States are also looked up.

First, look up the saving rate. The data on annual saving rate of the five Latin American countries, China and United States were downloaded from the World Bank database, and the average annual saving rate of each above country was computed, respectively, in the 1970s, 1980s, 1990s, 2000s and 2010s, and given in Table 4. The values in Table 4 provide the seven paths in Figure 3, which reflects in general the changes in the saving rates of the above seven countries during the 1970-2019 period.

Table 4: Estimates of the saving rates of the concerned countries (%)

Names of countries	*Estimates in 1970s*	*Estimates in 1980s*	*Estimates in 1990s*	*Estimates in 2000s*	*Estimates in 2010s*
Argentina	30.49	17.62	15.52	18.22	13.99
Brazil	19.61	19.86	15.87	16.94	16.17
Chile	11.41	12.27	22.53	22.67	19.40
Colombia	18.11	18.27	17.35	16.24	17.50
Mexico	21.82	24.61	20.93	21.69	22.58
China	—-	35.47	39.27	44.93	48.20
United States	22.32	20.84	19.17	17.86	18.54

Note: 1. The average annual saving rates are calculated based on data on annual saving rate in each sub-period.2. The World Bank database lacks data on China's annual saving rate in the 1970s, so China's average annual saving rate in the 1970s is blank in Table 4.

Table 4 and Figure 3 clearly show that during the period 1970-2019, the saving rates of the five Latin American countries did not change obviously on a whole (only Argentina's saving rate fell significantly in the 1980s and Chile's saving rate rose significantly in the 1990s). There are two main

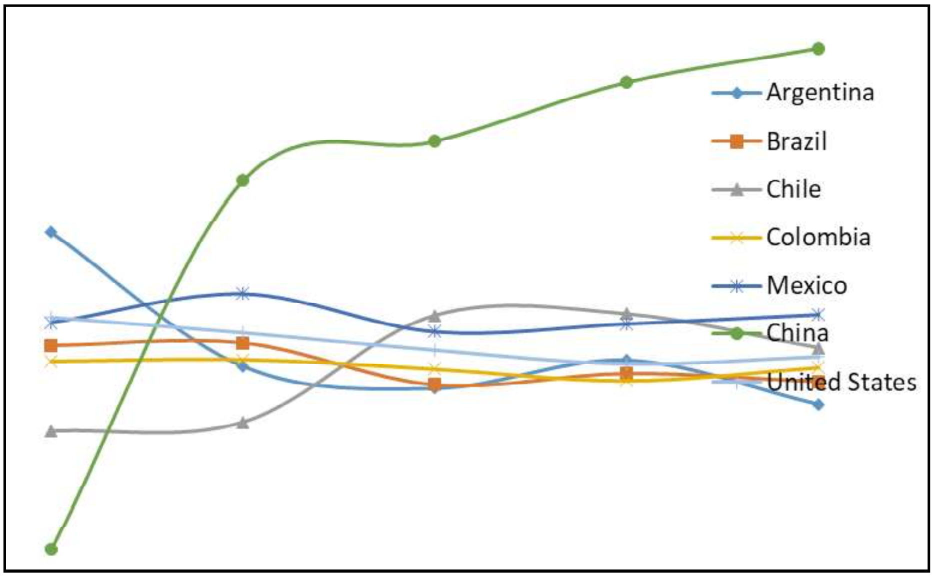

Figure 3: The paths of the saving rates of the concerned countries (1970-2019)

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

reasons for this situation: First, Latin American culture makes the local people get a habit of valuing consumption and neglecting saving; Second, the governments did not issue policies to encourage their nationals to increase saving. Both make contributions to their saving rates remaining at a relatively low level. The convergence theory shows, other factors remain unchanged, a higher saving rate generates a higher level of k^* and $f(k^*)$, and the converse is also true. From 1970s to 2010s, the saving rates of the five Latin American countries stayed at a relatively low level (around 20%), a little lower than the world average level (around 24%), this is an important reason why measured by the steady state of per-capita output, the relative positions of the five Latin American countries remained below but not far away the average level of the test sample.

Second, look at the population growth rate. The data of the above-mentioned countries are downloaded from the World Bank database, and their average annual population growth rates are computed, respectively, in the 1970s, 1980s, 1990s, 2000s and 2010s, and showed in Table 5. The values in Table 5 give the seven paths in Figure 4, which reflects in general the changes in the population growth rates of the concerned countries in the 1970-2019 period.

Table 5: Estimates of the population growth rates of the concerned countries (%)

Names of countries	*Estimates in 1970s*	*Estimates in 1980s*	*Estimates in 1990s*	*Estimates in 2000s*	*Estimates in 2010s*
Argentina	1.55	1.57	1.26	1.04	1.05
Brazil	2.40	2.16	1.63	1.18	0.86
Chile	1.56	1.49	1.48	1.08	1.15
Colombia	2.28	2.1	1.84	1.37	1.15
Mexico	2.81	2.19	1.68	1.43	1.3
China	1.97	1.43	1.13	0.61	0.50
United States	1.05	0.92	1.23	0.95	0.72

Note: The average annual population growth rates are calculated based on the data on annual population growth rates in each sub-period.

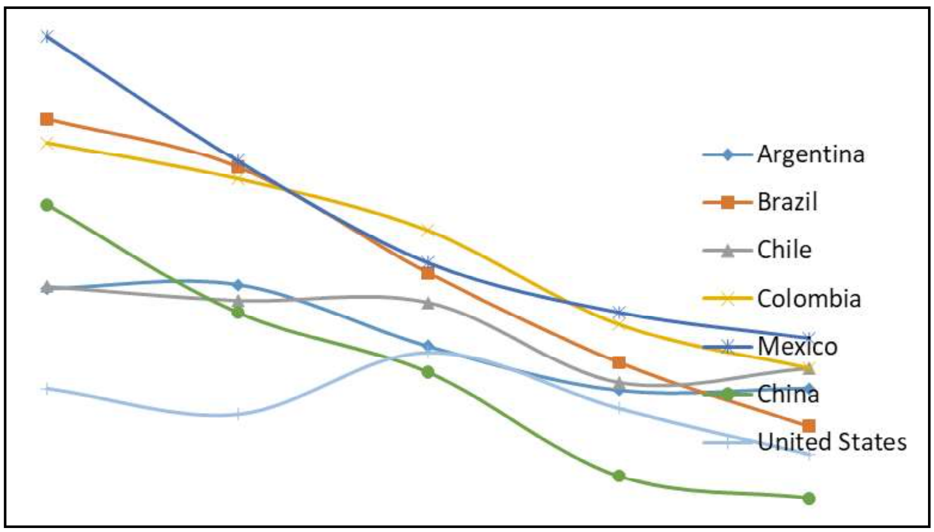

Figure 4: The paths of the population growth rates of the concerned countries (1970-2019)

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

Table 5 and Figure 4 clearly show that during the 1970-2019 period, like China's population growth rate, the population growth rates of the five Latin American countries maintained a marked downward trend on a whole, even the rate of the United States enjoyed a slightly declined trend. According to the convergence theory, when other factors remain unchanged, a lower population growth rate induces a higher level of k^* and $f(k^*)$, and the converse is also true. During the period 1970-2019, a marked downward trend in population growth rates of the five Latin American countries should be helpful to improve their $f(k^*)$. But perhaps most countries in the test sample experienced a similar downward trend in their population growth rates during the 1970-2019 period, so the population growth rates of the five Latin American countries might not decline relatively in the test sample, which made no significant effect on the relative improvement in their $f(k^*)$ in the test sample.

Finally, look at the labor efficiency, that is, the effectiveness of labor mentioned in Section 3. Undoubtedly, the steady state of per-capita output $Af(k^*)$ is heavily effected by labor efficiency (A). Since human capital is the source of technological progress and innovation, it can be used as the most important index to measure labor efficiency. Unfortunately, only in 2018 did the World Bank database begin to offer the data on the human capital index for countries in the world, so the tertiary school enrollment rate in the World Bank database is chosen to indicate the human capital level for each concerned country. After the data on annual tertiary school enrollment rates of the above mentioned seven countries are downloaded, the average annual tertiary school enrollment rate of each country is computed, respectively, in the 1970s, 1980s, 1990s, 2000s and 2010s, and showed in Table 6. The data in Table 6 are used to give the seven paths in Figure 5, which show approximately the changes in the tertiary school enrollment rates of the seven countries during the 1970-2019 period, also generally reflect the changes in the human capital and labor efficiency of the seven countries during this period.

Table 6: Estimates of the tertiary school enrollment rates of the concerned countries (%)

Names of countries	*Estimates in 1970s*	*Estimates in 1980s*	*Estimates in 1990s*	*Estimates in 2000s*	*Estimates in 2010s*
Argentina	20.81	29.39	42.27	63.94	81.19
Brazil	—-	—-	16.08	26.99	47.78
Chile	12.35	15.66	28.48	47.83	82.69
Colombia	6.50	11.13	17.44	29.24	50.91
Mexico	8.57	14.98	14.84	22.67	30.94
China	0.51	2.44	4.28	16.61	38.57
United States	50.87	59.32	75.90	79.52	90.37

Note: 1. The average annual tertiary school enrollment rates are calculated based on data on annual tertiary school enrollment rates in each sub-period. 2. The World Bank database lacks the data on Brazil in 1970s and 1980s, so there are two corresponding blanks for Brazil in Table 6.

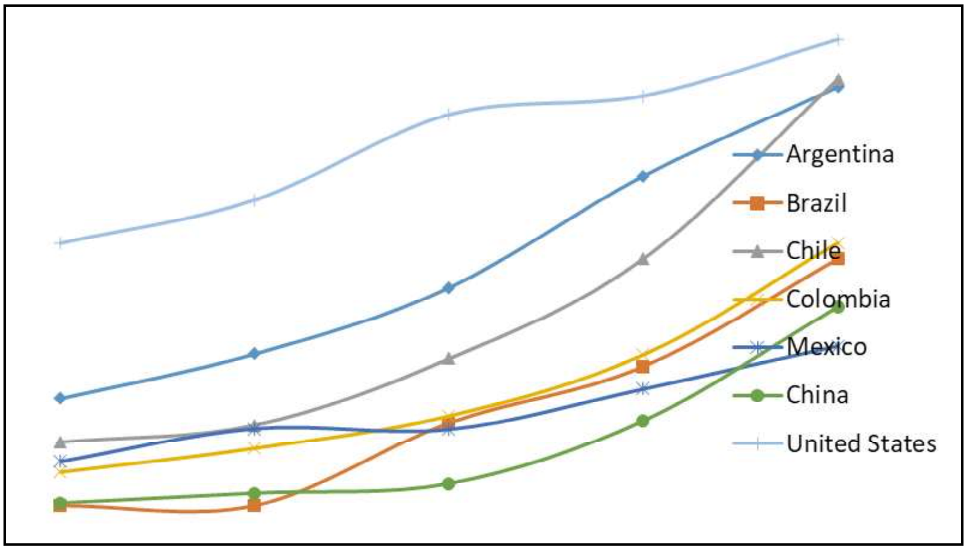

Figure 5: The paths of the tertiary school enrollment rates of the concerned countries (1970-2019)

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

Table 6 and Figure 5 show that during the 1970-2019 period, all the seven countries attached importance to the cultivation of human capital because all their tertiary school enrolment rates generally maintained a marked upward trend, but the growth rate was different across the seven countries. For example, China's tertiary school enrollment rate was extremely low (0.51%) in 1970s, but it grew much faster than others since 1980s; US's rate was the highest in each sub-period, but it grew relatively slow; the concerned Latin American countries' rates grew faster than US's except Mexico's. During the 1970-2019 period, the governments of the five countries advocated and encouraged higher education on their nationals through their human resources policies, which led to the continuous expansion in human capital of the five countries. Such a change in human capital should be helpful to improve labor efficiency (*A*) of the five countries. But probably the tertiary school enrollment rates of most countries in the test sample experienced a similar upward trend during this period, thus the human capital of the five Latin American countries might not grow relatively in the test sample, which played no significant role in the relative improvement in their labor efficiency (*A*) in the test sample, and then made no significant effect on the relative improvement in their steady states of per-capita output $A\,f(k^*)$ in the test sample.

As for the dramatically relative improvement in China's steady state of per-capita output in the test sample, the reasons are opposite. During 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 Latin American countries as shown in Table 4 and Figure 3, and should be also higher than the average level of all sample countries except in 1970s; China's population growth rate experienced a similar downward trend like the five Latin American countries', but was lower than the overall level of the five Latin American countries except in 1970s as shown in Table 5 and Figure 4, and should be also lower than the average level of all sample countries except in 1970s; China's tertiary school enrollment rate was obviously lower than the overall level of the five Latin American countries, but grew much faster than the five Latin American countries', even exceeded Mexico's in 2010s as shown in Table 6 and Figure 5, and undoubtedly also grew much faster than the most countries' in the test sample, i.e., so did China's human capital and labor efficiency. The above three reasons can explain why China's steady state of per-capita output kept rising rapidly and relatively in the test sample during the 1970-2019 period.

9. CONCLUSIONS AND POLICY SUGGESTIONS

From the perspective of economic convergence, this paper makes a study to explain why some Latin American countries fell into and stayed in the "middle-income trap" for long time. In this paper, the econometric method is used to reveal the followings: (1) Measured by steady state of per-capita output, the relative positions of Argentina, Brazil, Chile, Colombia and Mexico remained below but not far away the average level of all sample countries during the 1970-2019 period, i.e., measured by steady state of per-capita output, the above five countries were still typical "middle income trap" countries during this period. (2) China's relative position was far below the overall level of the five Latin American countries in 1970s, but kept rising rapidly later and almost reached the overall level of the five countries in 2010s, i.e., measured by steady state of per-capita output, China was not a "middle income trap" country during the 1970-2019 period, but China began to confront the "middle income trap" in 2010s. This paper provides following explanations for the above situations.

As for the above five Latin American countries, their social infrastructures generally did not change significantly during the 1970-2019 period, which resulted in the followings: during this period, their saving rates should be no more than the average level of all sample countries; their population growth rates generally experienced a similar declined trend like the most countries' in the test sample, but not obtained a relative decline ; their human capital did not improved faster than the most countries' in the test sample, nor did their labor efficiency. The above three reasons can explain the situations in steady states of per-capita output of the five countries during the 1970-2019 period and why the five countries stayed in "middle income trap" during this period.

The policy suggestions for the five Latin American countries are as follows: their governments must formulate feasible and effective policies to improve their social infrastructures to significantly increase their saving rates, reduce further their population growth rates, and achieve a quicker growth of their human capital and labor efficiency, or they will continue to stay in the "middle-income trap".

The things for China are opposite. China's social infrastructure was improved significantly during the 1970-2019 period due to its many correct policies executed since 1979, which resulted in the followings: during this period, China's saving rate remained at a high level and kept rising except in 1970s, actually much higher than the average level of all sample countries except in 1970s; China's population growth rate declined fast and should be lower than the average level of all sample countries except in 1970s; China's tertiary school enrollment rate was extremely low in 1970s, but it grew much faster than most countries' in the test sample, so did China's human capital and labor efficiency. The above three reasons can explain why China's steady state of per-capita output kept rising quickly and relatively in the test sample during the 1970-2019 period.

However, it is necessary to point out, China's saving rate has been very high (48.2% in 2010s) and much difficult to increase further, its population growth rate has been very low (0.5% in 2010s) and leaves little room to decrease further, but China's tertiary school enrollment rate is relatively low (38.57% in 2010s) compared with others (especially with developed countries). Thus, the policy suggestion for China is as follows: to let the future growth of China's steady state of per-capita output quick enough, Chinese government must make some useful policies to let the future growth of China's human capital and labor efficiency still quick enough, this will decide whether China can cross the "middle income trap" successfully soon.

Notes

1. For the details of the Solow model, see Romer (2001, Chapter 1).
2. See Romer (2001, p.21)
3. See Romer (2001, p.143)

4. See Romer (2001, p.24)
5. Barro and Sala-I-Martin (2004. p.466), the equation on the page 466 shows the time interval (*T*) of observations is from year 0 to year *T*.
6. World Bank offers data on GDP per-capita for countries, but data in 1960s are not available for too many countries, so this paper chooses a data time span from 1970 to 2019 and can only chooses the 112 countries to form a test sample.
7. The natural number $e \approx 2.718$, the time interval $T \leq 1$, and β is less than 0.3.

References

Albuquerque, E. M. (2019), "Brazil and the Middle-Income Trap: Its Historical Roots." *Seoul Journal of Economics*, 32 (1): 23-62.

Bagci, K. (2012), "Explaining income disparity among the OIC countries." *Economic Cooperation and Development Review*, 5(1): 43-53.

Barro, R. J. (1991), "Economic Growth in a Cross Section of Countries." *Quarterly Journal of Economics*, 106 (2): 407-443.

Barro, R. J. and X. Sala- I- Martin (2004), *Economic Growth*. [M], 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.

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

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

Caldentey, E. P. (2012), "Income Convergence, Capability Divergence, and the Middle Income Trap: An Analysis of the Case of Chile." S*tudies in Comparative International Development*, 47 (2): 185-207.

Dabús, C., F. Tohmé, and M. A. Caraballo (2016), "A middle income trap in a small open economy: Modeling the Argentinean case" *Economic Modelling*, 53: 436-444.

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

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.

Lustig, N. (2016), "Inequality and Fiscal Redistribution in Middle Income Countries: Brazil, Chile, Colombia, Indonesia, Mexico, Peru and South Africa." *Journal of Globalization and Development*, 7 (1): 17-60.

Mankiw, N. G., D. Romer, and D. N. Weil (1992). "A Contribution to the Empirics of Economic Growth" *The Quarterly Journal of Economics*, 107 (2): 407-437.

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. and K. Whelan (2007), "Conditional Convergence and the Dynamics of the Capital-Output Ratio." *Journal of Economic Growth*, 12 (2): 159-184.

Panik, M. J. and F. Rassekh (2002), "A Model of Growth and Convergence in the Presence of Input-Enhancing Factors: An Empirical Study." *Economic Inquiry*, 40 (2): 158-165.

Paus, E. (2014), "Latin America and the Middle Income Trap." *ECLAC- Financing for Development Series No. 250*, United Nations publication, ISSN 1564-4197

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

Romer, D. 2001. *Advanced Macroeconomics*. [M], 2nd edition. New York: McGraw-Hill. Chapter 1

Stengos, T., M. E. Yazgan, and H. Ozkan (2018), "Persistence in Convergence and Club Formation." *Bulletin of Economic Research*, 70 (2): 119- 138.

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

APPENDIX A: THE TRANSFORMATION OF EQUATION (2)

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

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

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

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

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

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

where $\bar{Y}_t = \sqrt[N]{Y_{1,t}Y_{2,t}\cdots Y_{N,t}}$; $\bar{Y}_{t-T} = \sqrt[N]{Y_{1,t-T}Y_{2,t-T}\cdots Y_{N,t-T}}$;

$\bar{\alpha} = \bar{x} + (1/T)(1 - e^{-\beta T})\log \bar{Y}^*$, $\bar{x} = (1/N)\sum_{i=1}^{N}x_i$ and $\bar{Y}^* = \sqrt[N]{Y_1^* Y_2^* \cdots Y_N^*}$; and

$\bar{u}_t = (1/N)\sum_{i=1}^{N}u_{i,t}$.

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

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

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

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

APPENDIX B: THE 112 COUNTRIES (WITH THEIR CODES) IN THE TEST SAMPLE

1. The name list of **26** developed countries 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, Iceland—ISL, Israel —ISR, Italy—ITA, Japan—JPN, Luxembourg—LUX, Monaco—MCO, Netherlands—NLD, Norway—NOR, New Zealand—NZL, Singapore—SGP, Sweden—SWE, United States —USA
2. The name list of **86** 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, Georgi—GEO, Ghana—GHA, Gambia —GMB, Guinea-Bissau —GNB, Guatemala—GTM, Guyana—GUY, Honduras—HND, Haiti—HTI, Indonesia—IDN, India— IND, Ireland— IRL, 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, Portugal—PRT, Paraguay—PRY, Rwanda—RWA, Saudi Arabia—SAU, Sudan—SDN, Senegal—SEN, Sierra Leone—SLE, El Salvador—SLV, Suriname—SUR, Eswatini—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 C: THE REGRESSION RESULTS FROM THE EQUATION (5) (OUTPUTS OF EVIEWS)

Dependent Variable: D(Y?)
Method: Pooled EGLS (Cross-section weights)
Date: 07/18/23 Time: 22:45
Sample (adjusted): 1971 2019

Included observations: 49 after adjustments
Cross-sections included: 112
Total pool (balanced) observations: 5488
Linear estimation after one-step weighting matrix
White cross-section standard errors & covariance (d.f. corrected)

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
1 Y?(-1)	C(1)= -0.199982	0.041515	-4.817125	0.0000
DT1*Y?(-1)	C(2)= 0.080308	0.051524	1.558653	0.1191
DT2*Y?(-1)	C(3)= 0.006861	0.059827	0.114683	0.9087
DT3*Y?(-1)	C(4)= 0.135475	0.048498	2.793392	0.0052
5 DT4*Y?(-1)	C(5)= 0.037872	0.049117	0.771069	0.4407
AND—C	0.283117	0.070411	4.020892	0.0001
ARG—C	-0.052648	0.016556	-3.179949	0.0015
AUS—C	0.208516	0.048125	4.332800	0.0000
AUT—C	0.196158	0.038990	5.031007	0.0000
10 BDI—C	-0.723548	0.143479	-5.042879	0.0000
BEL—C	0.192295	0.040025	4.804401	0.0000
BEN—C	-0.581204	0.115964	-5.011953	0.0000
BFA—C	-0.699241	0.139770	-5.002816	0.0000
BGD—C	-0.687986	0.136118	-5.054355	0.0000
15 BHS—C	0.145796	0.020812	7.005411	0.0000
BLZ—C	-0.325155	0.071392	-4.554520	0.0000
BOL—C	-0.351198	0.064553	-5.440493	0.0000
BRA—C	C(18)= -0.041925	0.012210	-3.433626	0.0006
BWA—C	-0.310618	0.086170	-3.604725	0.0003
20 CAF—C	-0.563388	0.104405	-5.396198	0.0000
CAN—C	0.224632	0.048510	4.630607	0.0000
CHE—C	0.329048	0.069326	4.746405	0.0000
CHL—C	-0.162213	0.048846	-3.320936	0.0009
CHN—C	C(24)= -0.697024	0.149808	-4.652786	0.0000
25 CIV—C	-0.290325	0.058683	-4.947359	0.0000
CMR—C	-0.413368	0.093536	-4.419343	0.0000
COD—C	-0.485196	0.088837	-5.461667	0.0000
COG—C	-0.315261	0.065023	-4.848480	0.0000
COL—C	-0.195279	0.042420	-4.603519	0.0000
30 CRI—C	-0.137117	0.029963	-4.576283	0.0000
CUB—C	-0.232522	0.050083	-4.642739	0.0000
DEU—C	0.182197	0.036421	5.002471	0.0000
DNK—C	0.252654	0.052719	4.792459	0.0000
DOM—C	-0.271089	0.055736	-4.863785	0.0000
35 DZA—C	-0.210580	0.045946	-4.583208	0.0000
ECU—C	-0.200627	0.037228	-5.389096	0.0000

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
EGY—C	-0.469503	0.098665	-4.758538	0.0000
ESP—C	0.113038	0.028784	3.927161	0.0001
FIN—C	0.174997	0.036309	4.819621	0.0000
40 FJI—C	-0.242746	0.056457	-4.299644	0.0000
FRA—C	0.191899	0.038148	5.030371	0.0000
GAB—C	0.079207	0.064964	1.219244	0.2228
GBR—C	0.153666	0.030767	4.994446	0.0000
GEO—C	-0.207350	0.048070	-4.313472	0.0000
45 GHA—C	-0.487671	0.099556	-4.898457	0.0000
GMB—C	-0.602659	0.110327	-5.462456	0.0000
GNB—C	-0.582232	0.116459	-4.999479	0.0000
GRC—C	0.131267	0.028488	4.607861	0.0000
GRL—C	0.184432	0.030078	6.131821	0.0000
50 GTM—C	-0.284346	0.058870	-4.830047	0.0000
GUY—C	-0.323010	0.052621	-6.138466	0.0000
HND—C	-0.374761	0.078629	-4.766186	0.0000
HTI—C	-0.434181	0.093633	-4.637071	0.0000
IDN—C	-0.439521	0.094597	-4.646247	0.0000
55 IND—C	-0.646466	0.119863	-5.393355	0.0000
IRL—C	0.101218	0.023958	4.224744	0.0000
IRQ—C	-0.282913	0.077488	-3.651062	0.0003
ISL—C	0.192385	0.031635	6.081327	0.0000
ISR—C	0.120260	0.026255	4.580488	0.0000
60 ITA—C	0.164512	0.032439	5.071426	0.0000
JAM—C	-0.178720	0.035558	-5.026114	0.0000
JPN—C	0.180883	0.036042	5.018720	0.0000
KEN—C	-0.476167	0.109866	-4.334057	0.0000
KIR—C	-0.230044	0.055382	-4.153788	0.0000
65 KOR—C	-0.199360	0.055324	-3.603492	0.0003
LKA—C	-0.501197	0.101436	-4.940995	0.0000
LSO—C	-0.584401	0.140109	-4.171050	0.0000
LUX—C	0.286363	0.058877	4.863786	0.0000
MAR—C	-0.409015	0.081587	-5.013256	0.0000
70 MCO—C	0.472335	0.097720	4.833569	0.0000
MDG—C	-0.562063	0.110308	-5.095382	0.0000
MEX—C	-0.066991	0.018095	-3.702220	0.0002
MLI—C	-0.622631	0.128537	-4.843966	0.0000
MLT—C	-0.047293	0.033075	-1.429893	0.1528
75 MMR—C	-0.799950	0.164938	-4.850006	0.0000
MRT—C	-0.444670	0.085397	-5.207070	0.0000
MWI—C	-0.636443	0.136804	-4.652225	0.0000
MYS—C	-0.232298	0.057197	-4.061335	0.0000
NER—C	-0.610684	0.133291	-4.581602	0.0000

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
80 NGA—C	-0.310653	0.067114	-4.628765	0.0000
NIC—C	-0.331233	0.041105	-8.058295	0.0000
NLD—C	0.217256	0.047485	4.575292	0.0000
NOR—C	0.302849	0.061954	4.888276	0.0000
NPL—C	-0.715716	0.140347	-5.099626	0.0000
85 NZL—C	0.159566	0.038553	4.138892	0.0000
OMN—C	-0.007557	0.038489	-0.196330	0.8444
PAK—C	-0.602201	0.118817	-5.068292	0.0000
PAN—C	-0.186168	0.041038	-4.536506	0.0000
PER—C	-0.203530	0.032635	-6.236475	0.0000
90 PHL—C	-0.366126	0.074496	-4.914735	0.0000
PNG—C	-0.357582	0.071857	-4.976315	0.0000
PRI—C	0.067745	0.007933	8.539616	0.0000
PRT—C	0.038266	0.009965	3.840147	0.0001
PRY—C	-0.262854	0.065077	-4.039094	0.0001
95 RWA—C	-0.669645	0.144849	-4.623051	0.0000
SAU—C	0.286562	0.057732	4.963651	0.0000
SDN—C	-0.498907	0.081217	-6.142856	0.0000
SEN—C	-0.434987	0.079272	-5.487247	0.0000
SGP—C	0.043610	0.005768	7.560147	0.0000
100 SLE—C	-0.615750	0.121177	-5.081422	0.0000
SLV—C	-0.244272	0.042274	-5.778239	0.0000
SUR—C	-0.069576	0.021579	-3.224323	0.0013
SWE—C	0.218754	0.051109	4.280114	0.0000
SWZ—C	-0.366306	0.069106	-5.300643	0.0000
105 SYC—C	-0.100505	0.049936	-2.012674	0.0442
TCD—C	-0.612667	0.091632	-6.686155	0.0000
TGO—C	-0.558255	0.105663	-5.283373	0.0000
THA—C	-0.410689	0.089186	-4.604834	0.0000
TTO—C	-0.067035	0.019844	-3.378127	0.0007
110 TUN—C	-0.325512	0.072227	-4.506771	0.0000
TUR—C	-0.127747	0.019038	-6.710191	0.0000
URY—C	-0.086953	0.019405	-4.480934	0.0000
USA—C	0.205620	0.042799	4.804257	0.0000
VCT—C	-0.307506	0.081322	-3.781317	0.0002
115 ZAF—C	-0.090953	0.013752	-6.613685	0.0000
ZMB—C	-0.404284	0.068006	-5.944868	0.0000
ZWE—C	-0.421892	0.079154	-5.330032	0.0000
AND—D1	-0.162299	0.080095	-2.026337	0.0428
ARG—D1	-0.026020	0.020796	-1.251209	0.2109
120 AUS—D1	-0.076199	0.058469	-1.303237	0.1926
AUT—D1	-0.072427	0.050826	-1.424987	0.1542
BDI—D1	0.296087	0.179995	1.644979	0.1000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BEL—D1	-0.069826	0.049618	-1.407269	0.1594
BEN—D1	0.225920	0.145303	1.554825	0.1201
BFA—D1	0.280196	0.173488	1.615078	0.1064
BGD—D1	0.283247	0.167848	1.687522	0.0916
BHS—D1	-0.031716	0.042637	-0.743872	0.4570
BLZ—D1	0.142386	0.094521	1.506391	0.1320
BOL—D1	0.072209	0.091040	0.793161	0.4277
BRA—D1	-0.001682	0.019927	-0.084426	0.9327
BWA—D1	0.200046	0.097222	2.057619	0.0397
CAF—D1	0.174525	0.136226	1.281138	0.2002
CAN—D1	-0.086870	0.060859	-1.427399	0.1535
CHE—D1	-0.127148	0.085127	-1.493639	0.1353
CHL—D1	0.073379	0.062016	1.183234	0.2368
CHN—D1	0.384597	0.174260	2.207027	0.0274
CIV—D1	0.021329	0.078177	0.272825	0.7850
CMR—D1	0.176687	0.105906	1.668344	0.0953
COD—D1	0.155951	0.115179	1.353988	0.1758
COG—D1	0.176815	0.080050	2.208805	0.0272
COL—D1	0.075209	0.051715	1.454290	0.1459
CRI—D1	0.017202	0.040466	0.425096	0.6708
CUB—D1	0.130344	0.058124	2.242524	0.0250
DEU—D1	-0.065640	0.047326	-1.386961	0.1655
DNK—D1	-0.091661	0.070876	-1.293257	0.1960
DOM—D1	0.106731	0.071210	1.498820	0.1340
DZA—D1	0.068590	0.053562	1.280568	0.2004
ECU—D1	0.059105	0.050158	1.178386	0.2387
EGY—D1	0.239482	0.116700	2.052126	0.0402
ESP—D1	-0.040759	0.033450	-1.218485	0.2231
FIN—D1	-0.043912	0.046559	-0.943143	0.3457
FJI—D1	0.057492	0.074840	0.768207	0.4424
FRA—D1	-0.072981	0.048685	-1.499036	0.1339
GAB—D1	-0.094452	0.069908	-1.351084	0.1767
GBR—D1	-0.048389	0.042846	-1.129355	0.2588
GEO—D1	0.090434	0.055555	1.627834	0.1036
GHA—D1	0.150555	0.129713	1.160679	0.2458
GMB—D1	0.223371	0.143322	1.558523	0.1192
GNB—D1	0.221052	0.146196	1.512022	0.1306
GRC—D1	-0.077171	0.033252	-2.320795	0.0203
GRL—D1	-0.069962	0.038596	-1.812673	0.0699
GTM—D1	0.067666	0.078790	0.858809	0.3905
GUY—D1	0.066299	0.080829	0.820237	0.4121
HND—D1	0.122130	0.096956	1.259637	0.2079
HTI—D1	0.124016	0.116721	1.062500	0.2881

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
IDN—D1	0.211790	0.115462	1.834293	0.0667
IND—D1	0.289714	0.153582	1.886375	0.0593
IRL—D1	-0.022901	0.028788	-0.795499	0.4264
IRQ—D1	0.107842	0.095449	1.129843	0.2586
ISL—D1	-0.066847	0.046185	-1.447370	0.1479
ISR—D1	-0.052340	0.034475	-1.518225	0.1290
ITA—D1	-0.048596	0.042428	-1.145381	0.2521
JAM—D1	0.041779	0.049351	0.846564	0.3973
JPN—D1	-0.039116	0.048194	-0.811640	0.4170
KEN—D1	0.164956	0.134875	1.223033	0.2214
KIR—D1	-0.022115	0.068823	-0.321333	0.7480
KOR—D1	0.163404	0.059189	2.760736	0.0058
LKA—D1	0.230641	0.122533	1.882275	0.0599
LSO—D1	0.222308	0.165154	1.346067	0.1783
LUX—D1	-0.083346	0.075184	-1.108560	0.2677
MAR—D1	0.178390	0.100402	1.776760	0.0757
MCO—D1	-0.196052	0.120669	-1.624719	0.1043
MDG—D1	0.161800	0.142667	1.134116	0.2568
MEX—D1	0.015281	0.026732	0.571645	0.5676
MLI—D1	0.233156	0.162525	1.434588	0.1515
MLT—D1	0.046003	0.034721	1.324915	0.1853
MMR—D1	0.316434	0.201890	1.567354	0.1171
MRT—D1	0.149070	0.111797	1.333403	0.1825
MWI—D1	0.197121	0.166364	1.184878	0.2361
MYS—D1	0.119041	0.067293	1.768991	0.0770
NER—D1	0.184937	0.168230	1.099311	0.2717
NGA—D1	0.025808	0.095256	0.270927	0.7865
NIC—D1	0.049752	0.071651	0.694371	0.4875
NLD—D1	-0.091218	0.058110	-1.569734	0.1165
NOR—D1	-0.101558	0.081791	-1.241672	0.2144
NPL—D1	0.292812	0.176577	1.658263	0.0973
NZL—D1	-0.063282	0.048467	-1.305663	0.1917
OMN—D1	0.058829	0.043820	1.342509	0.1795
PAK—D1	0.280967	0.146907	1.912549	0.0559
PAN—D1	0.063299	0.054979	1.151334	0.2497
PER—D1	0.032991	0.050463	0.653754	0.5133
PHL—D1	0.112985	0.099272	1.138139	0.2551
PNG—D1	0.098143	0.089496	1.096616	0.2729
PRI—D1	-0.018450	0.013030	-1.415972	0.1568
PRT—D1	-0.001240	0.012719	-0.097504	0.9223
PRY—D1	0.120602	0.080169	1.504362	0.1326
RWA—D1	0.255490	0.176765	1.445365	0.1484
SAU—D1	-0.292836	0.064057	-4.571495	0.0000

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
SDN—D1	0.175750	0.116292	1.511283	0.1308
SEN—D1	0.145059	0.103252	1.404900	0.1601
SGP—D1	0.042610	0.014835	2.872291	0.0041
SLE—D1	0.211864	0.153073	1.384069	0.1664
SLV—D1	0.005831	0.059112	0.098651	0.9214
SUR—D1	-0.014767	0.030777	-0.479816	0.6314
SWE—D1	-0.077328	0.063527	-1.217247	0.2236
SWZ—D1	0.187611	0.093919	1.997584	0.0458
SYC—D1	0.024630	0.055481	0.443937	0.6571
TCD—D1	0.246721	0.127891	1.929147	0.0538
TGO—D1	0.188939	0.144118	1.310999	0.1899
THA—D1	0.221410	0.108330	2.043841	0.0410
TTO—D1	-0.021442	0.034740	-0.617207	0.5371
TUN—D1	0.123219	0.087871	1.402272	0.1609
TUR—D1	0.053697	0.023379	2.296770	0.0217
URY—D1	0.013217	0.033973	0.389055	0.6973
USA—D1	-0.072161	0.055917	-1.290510	0.1969
VCT—D1	0.165717	0.091384	1.813418	0.0698
ZAF—D1	0.011996	0.024889	0.481961	0.6299
ZMB—D1	0.108215	0.097716	1.107446	0.2682
ZWE—D1	0.169192	0.108154	1.564352	0.1178
AND—D2	-0.092932	0.081571	-1.139271	0.2546
ARG—D2	-0.040316	0.023413	-1.721966	0.0851
AUS—D2	0.003780	0.067001	0.056410	0.9550
AUT—D2	0.009592	0.058992	0.162594	0.8708
BDI—D2	-0.057238	0.219693	-0.260537	0.7945
BEL—D2	0.003882	0.058426	0.066444	0.9470
BEN—D2	-0.001468	0.175788	-0.008350	0.9933
BFA—D2	0.021379	0.206652	0.103453	0.9176
BGD—D2	0.048304	0.197353	0.244759	0.8067
BHS—D2	-0.010364	0.038735	-0.267549	0.7891
BLZ—D2	0.075101	0.094343	0.796042	0.4260
BOL—D2	-0.065201	0.111271	-0.585964	0.5579
BRA—D2	-0.054640	0.019175	-2.849570	0.0044
BWA—D2	0.117463	0.099653	1.178725	0.2386
CAF—D2	-0.113084	0.178604	-0.633153	0.5267
CAN—D2	-0.020970	0.067937	-0.308662	0.7576
CHE—D2	-0.032252	0.097169	-0.331921	0.7400
CHL—D2	0.083731	0.051404	1.628893	0.1034
CHN—D2	0.280888	0.179918	1.561202	0.1185
CIV—D2	-0.160023	0.109652	-1.459366	0.1445
CMR—D2	-0.090784	0.139456	-0.650991	0.5151
COD—D2	-0.253301	0.169889	-1.490975	0.1360

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
COG—D2	-0.025111	0.092410	-0.271739	0.7858
COL—D2	-0.000552	0.056224	-0.009819	0.9922
CRI—D2	-0.024167	0.044583	-0.542067	0.5878
CUB—D2	-0.072720	0.085466	-0.850861	0.3949
DEU—D2	0.009606	0.055763	0.172272	0.8632
DNK—D2	0.006792	0.078703	0.086301	0.9312
DOM—D2	0.013769	0.076993	0.178832	0.8581
DZA—D2	-0.065959	0.073143	-0.901779	0.3672
ECU—D2	-0.047494	0.060421	-0.786053	0.4319
EGY—D2	0.079892	0.132553	0.602722	0.5467
ESP—D2	0.011476	0.038175	0.300610	0.7637
FIN—D2	0.004244	0.054088	0.078469	0.9375
FJI—D2	-0.031256	0.086076	-0.363124	0.7165
FRA—D2	-0.005144	0.056660	-0.090792	0.9277
GAB—D2	-0.120530	0.066786	-1.804731	0.0712
GBR—D2	0.014782	0.049313	0.299770	0.7644
GEO—D2	-0.305437	0.136141	-2.243538	0.0249
GHA—D2	-0.033600	0.151554	-0.221704	0.8246
GMB—D2	-0.048925	0.180138	-0.271596	0.7859
GNB—D2	-0.021673	0.182800	-0.118562	0.9056
GRC—D2	-0.045356	0.035293	-1.285145	0.1988
GRL—D2	-0.055655	0.051345	-1.083948	0.2784
GTM—D2	-0.046295	0.092383	-0.501121	0.6163
GUY—D2	-0.015979	0.092406	-0.172926	0.8627
HND—D2	-0.050366	0.116454	-0.432499	0.6654
HTI—D2	-0.130250	0.155856	-0.835712	0.4034
IDN—D2	0.090754	0.124715	0.727688	0.4668
IND—D2	0.089875	0.175715	0.511484	0.6090
IRL—D2	0.094746	0.040678	2.329156	0.0199
IRQ—D2	0.004975	0.162350	0.030642	0.9756
ISL—D2	-0.018185	0.050590	-0.359453	0.7193
ISR—D2	0.007339	0.039690	0.184912	0.8533
ITA—D2	0.012716	0.052234	0.243438	0.8077
JAM—D2	-0.020392	0.056138	-0.363246	0.7164
JPN—D2	0.034931	0.061211	0.570663	0.5683
KEN—D2	-0.067208	0.160122	-0.419731	0.6747
KIR—D2	-0.184475	0.099299	-1.857778	0.0633
KOR—D2	0.206826	0.057750	3.581389	0.0003
LKA—D2	0.097767	0.138502	0.705890	0.4803
LSO—D2	0.034516	0.185354	0.186218	0.8523
LUX—D2	0.066501	0.093890	0.708288	0.4788
MAR—D2	0.029826	0.117687	0.253439	0.7999
MCO—D2	-0.035590	0.138804	-0.256406	0.7976

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
MDG—D2	-0.119045	0.183529	-0.648646	0.5166
MEX—D2	-0.019011	0.028938	-0.656946	0.5112
MLI—D2	-0.001454	0.188738	-0.007702	0.9939
MLT—D2	0.087695	0.033511	2.616898	0.0089
MMR—D2	0.050969	0.238061	0.214101	0.8305
MRT—D2	-0.058355	0.137315	-0.424972	0.6709
MWI—D2	-0.051276	0.207869	-0.246673	0.8052
MYS—D2	0.100546	0.068601	1.465673	0.1428
NER—D2	-0.113860	0.202041	-0.563552	0.5731
NGA—D2	-0.131679	0.119339	-1.103402	0.2699
NIC—D2	-0.144829	0.113371	-1.277480	0.2015
NLD—D2	0.004392	0.066431	0.066112	0.9473
NOR—D2	0.033067	0.097463	0.339280	0.7344
NPL—D2	0.047982	0.204970	0.234092	0.8149
NZL—D2	-0.027128	0.050630	-0.535818	0.5921
OMN—D2	0.051044	0.042056	1.213712	0.2249
PAK—D2	0.058959	0.167094	0.352847	0.7242
PAN—D2	0.010448	0.058861	0.177501	0.8591
PER—D2	-0.086174	0.066525	-1.295366	0.1953
PHL—D2	-0.057608	0.118602	-0.485726	0.6272
PNG—D2	-0.028813	0.105805	-0.272324	0.7854
PRI—D2	0.024057	0.025414	0.946631	0.3439
PRT—D2	0.037707	0.017543	2.149479	0.0316
PRY—D2	0.015302	0.082125	0.186333	0.8522
RWA—D2	-0.064071	0.225202	-0.284505	0.7760
SAU—D2	-0.217850	0.062903	-3.463285	0.0005
SDN—D2	-0.020096	0.135819	-0.147962	0.8824
SEN—D2	-0.063758	0.133351	-0.478120	0.6326
SGP—D2	0.121876	0.034082	3.576006	0.0004
SLE—D2	-0.128201	0.202843	-0.632020	0.5274
SLV—D2	-0.072057	0.080906	-0.890628	0.3732
SUR—D2	-0.109766	0.037937	-2.893367	0.0038
SWE—D2	-0.012286	0.068981	-0.178106	0.8586
SWZ—D2	0.086864	0.099551	0.872558	0.3829
SYC—D2	0.031578	0.054354	0.580971	0.5613
TCD—D2	-0.039000	0.162359	-0.240209	0.8102
TGO—D2	-0.078025	0.177190	-0.440348	0.6597
THA—D2	0.156514	0.109360	1.431183	0.1524
TTO—D2	-0.025511	0.034073	-0.748721	0.4541
TUN—D2	0.020316	0.102555	0.198097	0.8430
TUR—D2	0.024233	0.032176	0.753134	0.4514
URY—D2	0.007820	0.024696	0.316635	0.7515
USA—D2	0.008211	0.064678	0.126957	0.8990

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
VCT—D2	0.096233	0.094584	1.017432	0.3090
ZAF—D2	-0.085204	0.036978	-2.304194	0.0213
ZMB—D2	-0.121655	0.132210	-0.920168	0.3575
ZWE—D2	-0.010079	0.127141	-0.079274	0.9368
AND—D3	-0.224384	0.077941	-2.878893	0.0040
ARG—D3	0.011227	0.026680	0.420782	0.6739
AUS—D3	-0.132755	0.054996	-2.413903	0.0158
AUT—D3	-0.130670	0.046478	-2.811406	0.0050
BDI—D3	0.434733	0.181835	2.390814	0.0168
BEL—D3	-0.130847	0.046661	-2.804220	0.0051
BEN—D3	0.381254	0.141707	2.690435	0.0072
BFA—D3	0.486485	0.165828	2.933667	0.0034
BGD—D3	0.501696	0.161368	3.109010	0.0019
BHS—D3	-0.122441	0.026641	-4.595881	0.0000
BLZ—D3	0.245402	0.079286	3.095142	0.0020
BOL—D3	0.211563	0.087875	2.407557	0.0161
BRA—D3	0.016393	0.019998	0.819743	0.4124
BWA—D3	0.245701	0.088736	2.768889	0.0056
CAF—D3	0.323816	0.146071	2.216839	0.0267
CAN—D3	-0.158767	0.055545	-2.858328	0.0043
CHE—D3	-0.235269	0.078022	-3.015400	0.0026
CHL—D3	0.153424	0.049847	3.077896	0.0021
CHN—D3	0.615278	0.158224	4.141462	0.0000
CIV—D3	0.098737	0.090698	1.088636	0.2764
CMR—D3	0.246417	0.114919	2.144263	0.0321
COD—D3	0.216817	0.132439	1.637108	0.1017
COG—D3	0.196233	0.084229	2.329761	0.0199
COL—D3	0.135804	0.051305	2.647017	0.0081
CRI—D3	0.095407	0.037306	2.557417	0.0106
CUB—D3	0.185475	0.061724	3.004926	0.0027
DEU—D3	-0.128512	0.042440	-3.028121	0.0025
DNK—D3	-0.176427	0.062292	-2.832267	0.0046
DOM—D3	0.203370	0.066348	3.065208	0.0022
DZA—D3	0.132159	0.057577	2.295345	0.0218
ECU—D3	0.120351	0.052236	2.303979	0.0213
EGY—D3	0.357117	0.113052	3.158867	0.0016
ESP—D3	-0.071020	0.032708	-2.171336	0.0300
FIN—D3	-0.106128	0.046195	-2.297415	0.0216
FJI—D3	0.138417	0.068650	2.016286	0.0438
FRA—D3	-0.138141	0.043854	-3.150016	0.0016
GAB—D3	-0.145273	0.067237	-2.160621	0.0308
GBR—D3	-0.098049	0.038581	-2.541399	0.0111
GEO—D3	0.128127	0.067363	1.902042	0.0572

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
GHA—D3	0.326139	0.122609	2.659993	0.0078
GMB—D3	0.371530	0.145371	2.555729	0.0106
GNB—D3	0.353662	0.147403	2.399290	0.0165
GRC—D3	-0.087438	0.032637	-2.679065	0.0074
GRL—D3	-0.108227	0.036804	-2.940665	0.0033
GTM—D3	0.166613	0.075094	2.218724	0.0266
GUY—D3	0.210412	0.074768	2.814202	0.0049
HND—D3	0.237823	0.095534	2.489408	0.0128
HTI—D3	0.213644	0.124506	1.715926	0.0862
IDN—D3	0.341408	0.107250	3.183291	0.0015
IND—D3	0.498032	0.140531	3.543940	0.0004
IRL—D3	-0.025487	0.039079	-0.652192	0.5143
IRQ—D3	0.182501	0.111654	1.634525	0.1022
ISL—D3	-0.122863	0.041315	-2.973817	0.0030
ISR—D3	-0.085864	0.029666	-2.894375	0.0038
ITA—D3	-0.121522	0.038562	-3.151376	0.0016
JAM—D3	0.092603	0.045547	2.033132	0.0421
JPN—D3	-0.124903	0.044679	-2.795564	0.0052
KEN—D3	0.281893	0.134091	2.102262	0.0356
KIR—D3	0.066460	0.079836	0.832451	0.4052
KOR—D3	0.232538	0.055520	4.188367	0.0000
LKA—D3	0.396791	0.113560	3.494121	0.0005
LSO—D3	0.423100	0.158977	2.661382	0.0078
LUX—D3	-0.165512	0.075661	-2.187561	0.0287
MAR—D3	0.305334	0.097705	3.125050	0.0018
MCO—D3	-0.331553	0.115036	-2.882161	0.0040
MDG—D3	0.314845	0.145341	2.166247	0.0303
MEX—D3	0.019305	0.021720	0.888796	0.3742
MLI—D3	0.421988	0.156327	2.699397	0.0070
MLT—D3	0.063634	0.033931	1.875388	0.0608
MMR—D3	0.672656	0.187275	3.591806	0.0003
MRT—D3	0.274483	0.107257	2.559120	0.0105
MWI—D3	0.399485	0.165984	2.406766	0.0161
MYS—D3	0.198190	0.059326	3.340690	0.0008
NER—D3	0.346598	0.166742	2.078643	0.0377
NGA—D3	0.201230	0.089047	2.259813	0.0239
NIC—D3	0.175022	0.074004	2.365030	0.0181
NLD—D3	-0.146518	0.054342	-2.696231	0.0070
NOR—D3	-0.196511	0.074433	-2.640116	0.0083
NPL—D3	0.504295	0.168552	2.991927	0.0028
NZL—D3	-0.111740	0.042169	-2.649814	0.0081
OMN—D3	0.012678	0.039510	0.320884	0.7483
PAK—D3	0.423586	0.139158	3.043916	0.0023

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
PAN—D3	0.146603	0.048794	3.004506	0.0027
PER—D3	0.135215	0.049617	2.725144	0.0065
PHL—D3	0.235504	0.093113	2.529218	0.0115
PNG—D3	0.203682	0.094880	2.146730	0.0319
PRI—D3	-0.036521	0.014914	-2.448666	0.0144
PRT—D3	-0.024384	0.011577	-2.106220	0.0352
PRY—D3	0.161308	0.075304	2.142095	0.0322
RWA—D3	0.473526	0.173555	2.728386	0.0064
SAU—D3	-0.283468	0.059555	-4.759749	0.0000
SDN—D3	0.358696	0.105443	3.401800	0.0007
SEN—D3	0.268519	0.103873	2.585075	0.0098
SGP—D3	0.027370	0.029963	0.913441	0.3611
SLE—D3	0.383279	0.150798	2.541675	0.0111
SLV—D3	0.128570	0.061426	2.093076	0.0364
SUR—D3	0.033300	0.032804	1.015111	0.3101
SWE—D3	-0.145121	0.059326	-2.446171	0.0145
SWZ—D3	0.282198	0.078907	3.576332	0.0004
SYC—D3	0.063550	0.053926	1.178467	0.2387
TCD—D3	0.444060	0.122283	3.631422	0.0003
TGO—D3	0.316820	0.138123	2.293760	0.0218
THA—D3	0.344448	0.094959	3.627320	0.0003
TTO—D3	0.096634	0.021383	4.519204	0.0000
TUN—D3	0.245733	0.083582	2.940022	0.0033
TUR—D3	0.102090	0.020741	4.921998	0.0000
URY—D3	0.056879	0.031180	1.824209	0.0682
USA—D3	-0.139439	0.051264	-2.720042	0.0066
VCT—D3	0.259998	0.084710	3.069268	0.0022
ZAF—D3	0.042654	0.026223	1.626601	0.1039
ZMB—D3	0.257239	0.099233	2.592259	0.0096
ZWE—D3	0.174856	0.120609	1.449778	0.1472
AND—D4	-0.153619	0.075535	-2.033744	0.0420
ARG—D4	-0.039258	0.025821	-1.520381	0.1285
AUS—D4	-0.029251	0.056864	-0.514404	0.6070
AUT—D4	-0.037657	0.045965	-0.819240	0.4127
BDI—D4	-0.000992	0.183730	-0.005402	0.9957
BEL—D4	-0.046352	0.046517	-0.996439	0.3191
BEN—D4	0.085241	0.141538	0.602250	0.5470
BFA—D4	0.170314	0.165497	1.029107	0.3035
BGD—D4	0.247681	0.157332	1.574260	0.1155
BHS—D4	-0.085986	0.025103	-3.425356	0.0006
BLZ—D4	0.084845	0.080562	1.053160	0.2923
BOL—D4	0.032578	0.083426	0.390503	0.6962
BRA—D4	-0.037202	0.022065	-1.686025	0.0919

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
BWA—D4	0.184176	0.089953	2.047467	0.0407
CAF—D4	-0.081551	0.164991	-0.494278	0.6211
CAN—D4	-0.060218	0.055649	-1.082118	0.2793
CHE—D4	-0.097498	0.078631	-1.239942	0.2151
CHL—D4	0.135175	0.049588	2.725958	0.0064
CHN—D4	0.569051	0.152974	3.719926	0.0002
CIV—D4	-0.104287	0.087688	-1.189294	0.2344
CMR—D4	0.004027	0.113771	0.035397	0.9718
COD—D4	-0.124074	0.132965	-0.933135	0.3508
COG—D4	0.006201	0.081018	0.076543	0.9390
COL—D4	0.059077	0.048139	1.227224	0.2198
CRI—D4	0.037257	0.035181	1.059012	0.2896
CUB—D4	0.070368	0.056372	1.248270	0.2120
DEU—D4	-0.026987	0.043037	-0.627076	0.5306
DNK—D4	-0.058018	0.061647	-0.941135	0.3467
DOM—D4	0.131820	0.063638	2.071385	0.0384
DZA—D4	-0.008750	0.057133	-0.153144	0.8783
ECU—D4	0.000231	0.048846	0.004721	0.9962
EGY—D4	0.164708	0.111596	1.475940	0.1400
ESP—D4	-0.029173	0.032234	-0.905047	0.3655
FIN—D4	-0.023551	0.042449	-0.554809	0.5791
FJI—D4	0.024602	0.068317	0.360114	0.7188
FRA—D4	-0.056575	0.043790	-1.291954	0.1964
GAB—D4	-0.190807	0.067139	-2.841961	0.0045
GBR—D4	-0.019867	0.038422	-0.517087	0.6051
GEO—D4	-0.013591	0.064569	-0.210489	0.8333
GHA—D4	0.120170	0.119472	1.005842	0.3145
GMB—D4	0.015317	0.145616	0.105190	0.9162
GNB—D4	0.028281	0.148288	0.190717	0.8488
GRC—D4	-0.115866	0.030410	-3.810175	0.0001
GRL—D4	-0.032300	0.039218	-0.823592	0.4102
GTM—D4	-0.004443	0.074444	-0.059688	0.9524
GUY—D4	0.078287	0.067380	1.161873	0.2453
HND—D4	0.027455	0.097285	0.282207	0.7778
HTI—D4	-0.096431	0.122637	-0.786310	0.4317
IDN—D4	0.206569	0.103652	1.992913	0.0463
IND—D4	0.298240	0.136256	2.188827	0.0287
IRL—D4	0.129542	0.048531	2.669252	0.0076
IRQ—D4	0.094810	0.084267	1.125115	0.2606
ISL—D4	-0.031827	0.043330	-0.734531	0.4627
ISR—D4	-0.017287	0.030346	-0.569650	0.5689
ITA—D4	-0.067070	0.035945	-1.865894	0.0621
JAM—D4	-0.046140	0.049491	-0.932288	0.3512

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
JPN—D4	-0.023687	0.043990	-0.538464	0.5903
KEN—D4	0.035161	0.133685	0.263014	0.7926
KIR—D4	-0.156631	0.079181	-1.978135	0.0480
KOR—D4	0.261992	0.055716	4.702294	0.0000
LKA—D4	0.262071	0.110317	2.375622	0.0176
LSO—D4	0.175495	0.155780	1.126553	0.2600
LUX—D4	-0.004187	0.074954	-0.055855	0.9555
MAR—D4	0.133281	0.093074	1.431992	0.1522
MCO—D4	-0.091814	0.117539	-0.781133	0.4348
MDG—D4	-0.056868	0.148049	-0.384115	0.7009
MEX—D4	-0.025885	0.024297	-1.065379	0.2868
MLI—D4	0.102518	0.154785	0.662325	0.5078
MLT—D4	0.115661	0.035234	3.282645	0.0010
MMR—D4	0.409347	0.179704	2.277893	0.0228
MRT—D4	0.021043	0.108904	0.193229	0.8468
MWI—D4	0.056529	0.166437	0.339639	0.7341
MYS—D4	0.167485	0.059219	2.828232	0.0047
NER—D4	-0.009401	0.167372	-0.056171	0.9552
NGA—D4	-0.014425	0.084556	-0.170591	0.8646
NIC—D4	-0.033641	0.068335	-0.492303	0.6225
NLD—D4	-0.046588	0.054538	-0.854241	0.3930
NOR—D4	-0.048170	0.075782	-0.635644	0.5250
NPL—D4	0.211956	0.164628	1.287485	0.1980
NZL—D4	-0.045081	0.043519	-1.035885	0.3003
OMN—D4	-0.029843	0.039906	-0.747851	0.4546
PAK—D4	0.152158	0.139791	1.088463	0.2764
PAN—D4	0.122181	0.043258	2.824458	0.0048
PER—D4	0.041977	0.044396	0.945499	0.3445
PHL—D4	0.075175	0.091489	0.821689	0.4113
PNG—D4	0.032787	0.089465	0.366484	0.7140
PRI—D4	-0.006986	0.016061	-0.434994	0.6636
PRT—D4	-0.006811	0.011621	-0.586082	0.5578
PRY—D4	0.068355	0.075381	0.906792	0.3646
RWA—D4	0.169765	0.168845	1.005447	0.3147
SAU—D4	-0.263854	0.058514	-4.509232	0.0000
SDN—D4	0.135973	0.097351	1.396726	0.1626
SEN—D4	0.025822	0.104946	0.246051	0.8057
SGP—D4	0.151496	0.024949	6.072155	0.0000
SLE—D4	0.033481	0.159851	0.209452	0.8341
SLV—D4	-0.025166	0.061503	-0.409178	0.6824
SUR—D4	-0.061703	0.033151	-1.861250	0.0628
SWE—D4	-0.035571	0.058350	-0.609611	0.5421
SWZ—D4	0.151534	0.076894	1.970690	0.0488

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
SYC—D4	0.064876	0.051332	1.263862	0.2063
TCD—D4	0.115672	0.121885	0.949031	0.3427
TGO—D4	0.023665	0.137539	0.172064	0.8634
THA—D4	0.240528	0.095195	2.526698	0.0115
TTO—D4	0.035388	0.022666	1.561260	0.1185
TUN—D4	0.089796	0.081501	1.101776	0.2706
TUR—D4	0.104654	0.021015	4.979952	0.0000
URY—D4	0.056657	0.021788	2.600442	0.0093
USA—D4	-0.033115	0.050967	-0.649740	0.5159
VCT—D4	0.138696	0.084976	1.632176	0.1027
ZAF—D4	-0.057807	0.026025	-2.221219	0.0264
ZMB—D4	0.020705	0.094007	0.220254	0.8257
ZWE—D4	0.018332	0.112673	0.162697	0.8708
		Weighted Statistics		
R-squared	0.343562	Mean dependent var		-0.000239
Adjusted R-squared	0.266607	S.D. dependent var		0.053105
S.E. of regression	0.045479	Sum squared resid		9.950565
F-statistic	4.464445	Durbin-Watson stat		1.706497
Prob(F-statistic)	0.000000			
		Unweighted Statistics		
R-squared	0.293418	Mean dependent var		-0.001059
Sum squared resid	10.06332	Durbin-Watson stat		1.925066

Appendix D 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	15.37879	(1, 4811)	0.0001
Chi-square	15.37879	1	0.0001

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-C(1) - C(2)	0.119674	0.030517

Restrictions are linear in coefficients.

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

2. The Result of the Wald Test for H_0: $\beta_2 = 0$

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	20.09702	(1, 4811)	0.0000
Chi-square	20.09702	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-C(1) - C(3)	0.193121	0.043079

Restrictions are linear in coefficients.

Note: -C(1) = $\hat{\beta}_0$; C(3) = $\hat{\lambda}_2$

3. The Result of the Wald Test for H_0: $\beta_3 = 0$

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	6.619603	(1, 4811)	0.0101
Chi-square	6.619603	1	0.0101

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-C(1) - C(4)	0.064507	0.025072

Restrictions are linear in coefficients.

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

4. The Result of the Wald Test for H_0: $\beta_4 = 0$

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	38.14290	(1, 4811)	0.0000
Chi-square	38.14290	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-C(1) - C(5)	0.162110	0.026248

Restrictions are linear in coefficients.

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

5. The Result of the Wald Test for H_0: $y_1^*(BRA) - y_0^*(BRA) = 0$

Wald Test:

Test Statistic	*Value*	*df*	*Probability*
F-statistic	2.100459	(1, 4811)	0.1473
Chi-square	2.100459	1	0.1473

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
C(18)/C(1) + (C(18) + C(130))/(-C(1) - C(2))	-0.154741	0.106770

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(130))/(-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	1.329566	(1, 4811)	0.2489
Chi-square	1.329566	1	0.2489

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-(C(18) + C(130))/(-C(1) - C(2)) + (C(18) + C(242))/(-C(1) - C(3))	-0.135640	0.117634

Delta method computed using analytic derivatives.

Note: (C(18) + C(130))/(-C(1) - C(2)) = $\hat{c}_1(BRA)/\hat{\beta}_1$;

(C(18) + C(242))/(-C(1) - C(3)) = $\hat{c}_2(BRA)/\hat{\beta}_2$

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	0.653989	(1, 4811)	0.4187
Chi-square	0.653989	1	0.4187

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-(C(18) + C(242))/(-C(1) - C(3)) + (C(18) + C(354))/(-C(1) - C(4))	0.104223	0.128878

Delta method computed using analytic derivatives.

Note: (C(18) + C(242))/(-C(1) - C(3)) = $\hat{c}_2(BRA)/\hat{\beta}_2$;

(C(18) + C(354))/(-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	0.454298	(1, 4811)	0.5003
Chi-square	0.454298	1	0.5003

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-(C(18) + C(354))/(-C(1) - C(4)) + (C(18) + C(466))/(-C(1) - C(5))	-0.092306	0.136949

Delta method computed using analytic derivatives.

Note: (C(18) + C(354))/(-C(1) - C(4)) = $\hat{c}_3(BRA))/\hat{\beta}_3$;

(C(18) + C(466))/(-C(1) - C(5)) = $\hat{c}_4(BRA))/\hat{\beta}_4$

9. 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	1470.358	(1, 4811)	0.0000
Chi-square	1470.358	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
C(18)/C(1) - C(24)/C(1)	-3.275792	0.085429

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)) = -$\hat{c}_0(BRA)/\hat{\beta}_0$

10. 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	229.5283	(1, 4811)	0.0000
Chi-square	229.5283	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-(C(18) + C(130))/(-C(1) - C(2)) + (C(24) + C(136))/(-C(1) - C(2))	-2.246276	0.148267

Delta method computed using analytic derivatives.

Note: (C(24) + C(136))/(-C(1) - C(2)) = $\hat{c}_1(CHN)/\hat{\beta}_1$; (C(18) + C(130))/(-C(1) - C(2)) = $\hat{c}_1(BRA)/\hat{\beta}_1$

11. 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	257.7875	(1, 4811)	0.0000
Chi-square	257.7875	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-(C(18) + C(242))/(-C(1) - C(3)) + (C(24) + C(248))/(-C(1) - C(3))	-1.654773	0.103064

Delta method computed using analytic derivatives.

Note: (C(24) + C(248))/(-C(1) - C(3)) = $\hat{c}_2(CHN)/\hat{\beta}_2$;

(C(18) + C(242))/(-C(1) - C(3)) = $\hat{c}_2(BRA)/\hat{\beta}_2$

12. 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	126.0829	(1, 4811)	0.0000
Chi-square	126.0829	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-(C(18) + C(354))/(-C(1) - C(4)) + (C(24) + C(360))/(-C(1) - C(4))	-0.251352	0.462084

Delta method computed using analytic derivatives.

Note: (C(24) + C(360))/(-C(1) - C(4)) = $\hat{c}_3(CHN)/\hat{\beta}_3$;

(C(18) + C(354))/(-C(1) - C(4)) = $\hat{c}_3(BRA)/\hat{\beta}_3$

13. 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	8.147911	(1, 4811)	0.0043
Chi-square	8.147911	1	0.0043

Null Hypothesis Summary:

Normalized Restriction (= 0)	*Value*	*Std. Err.*
-(C(18) + C(466))/(-C(1) - C(5)) + (C(24) + C(472))/(-C(1) - C(5))	-0.301314	0.105559

Delta method computed using analytic derivatives.

Note: (C(24) + C(472))/(-C(1) - C(5)) = $\hat{c}_4(CHN)/\hat{\beta}_4$;

(C(18) + C(466))/(-C(1) - C(5)) = $\hat{c}_4(BRA)/\hat{\beta}_4$