

**CENTER ON JAPANESE ECONOMY AND BUSINESS**

---

日本経済経営研究所

Working Paper Series

June 2016, No. 349

---

# **Growth Convergence and the Middle Income Trap**

Takatoshi Ito

This paper is available online at [www.gsb.columbia.edu/cjeb/research](http://www.gsb.columbia.edu/cjeb/research)

---

C O L U M B I A   U N I V E R S I T Y   I N   T H E   C I T Y   O F   N E W   Y O R K

# Growth Convergence and the Middle Income Trap<sup>1</sup>

Takatoshi Ito<sup>2</sup>

Columbia University and NBER

March 25, 2016, Revised April 13, 2016

## Abstract:

Asian emerging market countries have followed growth convergence from a low-income, high-growth state to a middle-income, middle-growth state through industrialization. The economic development of Japan was first followed by the “four tigers” in the 1970s, by the ASEAN countries in the 1980s, and China in the 1990s to 2000s. Asian economies were severely affected by the Asian Currency Crisis of 1997-98, and again by the Global Financial Crisis of 2008-09, but much more so by the former.

The growth rates of Asian countries are slowing over time. The growth rate may fall to the advanced countries level, before the income level fully catches up to the advanced countries’ level, which is defined as the middle income trap in the paper.

This paper proposes a hypothesis that there exist three convergence paths in Asia: low-income, middle-income, and high-income. Countries need to shift from one convergence path to a higher one by implementing economic and political reforms that would generate innovations. Without reform, countries may fall into a low-income trap or a middle-income trap.

The findings in the paper have important implications for the literature about middle-income traps. Providing an interpretation of the middle-income trap in the growth convergence framework is novel. Empirical investigations using panel data are also new. Some Asian countries are successfully transforming to a high-income convergence path, but others have failed thus far to make that transition. However, these results are more in the form of suggestive evidence than a hypothesis testing due to the limited sample size.

**Keywords:** Growth Convergence, Middle-income Trap, Asian Currency Crisis, Global Financial Crisis

**JEL:** O11, O14, O33, O40

---

<sup>1</sup> This paper is based on a distinguished lecture at the Asian Development Bank in Manila, The Philippines, on January 7, 2016. Comments by Shang-Jin Wei, Giovanni Campanelli, Chalongsob Sussangkarn, and other participants in the January 7 lecture.

<sup>2</sup> Professor, School of International and Public Policy, Columbia University. Email: [ti2164@columbia.edu](mailto:ti2164@columbia.edu).

## 1. Introduction

It is well-known that in the past several decades, East Asian countries have achieved high economic growth compared to countries in other regions. One Asian country after another have followed similar growth paths, or growth convergences, from low-income, high-growth states to middle income, middle-growth states, through industrialization. Several of them, Japan and Singapore, have reached an advanced economy status. The economic development of Japan was first followed by the “four tigers” (South Korea, Singapore, Hong Kong and Taiwan) in the 1970s, and later by the ASEAN countries in the 1980s and China in the 1990s to 2000s.

The history of economic development in the Asian region has experienced several stages. In the 1950s, Japan was already experiencing high-speed growth of 10 percent annually. However, this growth was viewed as the case of a pre-war industrial powerhouse catching up to its previous level before the devastation from World War II, and an exception within Asia. The rest of Asia’s governments were still struggling to establish effective governments after independence from European colonial powers.<sup>3</sup> Most Asian countries were characterized by populous cities in poverty and stagnant agrarian rural areas. At the time, the most influential writing on the subject was Gunnar Myrdal’s *Asian Drama* (1968), which painted a rather pessimistic view of the prospects for economic development, arguing such development would be difficult considering their large populations, among other factors.

In the 1960s and 1970s, the four tigers—South Korea, Hong Kong, Singapore, and Taiwan—started to accelerated growth. Both South Korea and Singapore had strong governments that pursued industrial policy, employing government planning that encouraged particular industries with zoning, subsidies, and the allocation of credits. They increased production and exports in goods that Japan had yielded in order to move to higher value-added goods for exports. The success of the four tigers prompted policy changes in the Southeast economies. Growth rates in Thailand, Indonesia and Malaysia started to rise in the mid-1980s. As Asian growth spread to the ASEAN countries, the high growth in Asia as a region attracted attention. A World Bank study, *World Bank* (1993) painted a positive picture of East Asian experiences of industrialization, export-oriented policies and equitable growth. The study, “The East Asian Miracle,” replaced Myrdal’s “Asian Drama” as a representative view of Asia with an opposite conclusion.

The positive view of East Asia suffered a brief setback in the wake of the Asian Financial Crisis (AFC) of 1997-98. The currency crises in East Asia—in particular, Thailand, Indonesia, and Korea that required IMF assistance—were blamed on crony capitalism and too much risk taken by the banking sector, among other factors. The manufacturing success was replaced by

---

<sup>3</sup> Thailand was never colonized. The Philippines had been colonized by the United States since 1898. Other Asian states had been ruled by European countries.

finance failure. However, most Asian countries had a V-shaped recovery, and they learned lessons from the experience. The banking sector was reformed, and foreign reserves were accumulated as a buffer for volatile capital flows. During the Global Financial Crisis (GFC) in 2008-09, no Asian banks failed due to the problem of asset-backed securities and related financial products. The damage to East Asian growth during the GFC was much shallower than that of the AFC.

However, at present, growth rates in Asian countries are slowing down to advanced country levels. One fear is that these economies will never catch up with the advanced countries, but will rather be trapped in middle-income status. Several factors contribute to this pessimism. Japan has experienced two decades of stagnation. China has excelled on all industry fronts, leap-frogging forward and leaving some of the neighboring countries behind. Constraints in elements of growth, such as infrastructure and human capital development, have not been solved in some countries.

In order to explain the long-run growth experiences of the Asian countries in a more generalized framework, growth convergence regressions are applied. Growth theory predicts that a low-income state tends to record high growth, and that the growth rate gradually becomes lower as the income level becomes higher. The inverse relationship between the income level and the growth rate is often depicted as a downward-sloping convergence line. This relationship is basically derived from the diminishing returns to capital. The convergence path has been often observed in a time-series of one country, but it has been difficult to be found in cross-section data, or in panel data. Within a group of countries, such as OECD countries, a common convergence path can be found. However, an attempt to find a global cross-sectional or panel relationship of convergence often fails. This is understandable, since the globally unique convergence path assumes that countries' production functions, including the technological level and progress, are identical and the only difference is the initial level of capital (per capita). The unconditional convergence is refuted easily. The literature moves into the direction of conditional convergence that allows for differences in culture, geography, colonial heritage and other socio-economic terms as initial conditions. There can be different convergence lines for different groups of countries.

Within the failed attempt to find unconditional convergence, the East Asian countries always showed positive forecast errors, which means the high-growth rate of East Asia – relative to South Asian, African and Latin American countries – recorded higher growth rates, given the same income level. Hence, the levels of income among Asian developing countries moved toward advanced country levels much faster than countries in other regions. Although the Asian Miracle (World Bank, 1993) can be attributed to many factors, it remained untested whether experiences in East Asia are unique or applicable to other regions.

This paper focuses on growth convergence in East Asia. It looks at the panel data of major economies in the region. The first test is whether they share a common convergence path. A

common, unconditional convergence seems to be denied. Then the paper proceeds to find three distinct convergence paths in East Asia. Given the findings, I propose a hypothesis that three convergence paths exist in Asia: one converges to a low-income steady state; another to a middle-income steady state; and yet another to a high-income steady state. A country can shift from one convergence line to a higher one by implementing economic reforms, such as the Chinese reform and opening-up that started in 1978 and the Vietnamese Doi Moi which started in 1986. Without reforms, a country may end up in the poverty trap, the steady state of a low-income convergence path; or in the middle-income trap, the steady state of a middle-income convergence path. Data seem to suggest that China is moving from a middle-income convergence path to a high-income path, and the Philippines is moving from a low-income path to a middle-income path. Thailand seems to be heading toward a middle-income trap.

According to the hypothesis of three convergence lines, the current fear of being trapped in middle-income status can be understood as a policy failure that prevents a leap from one convergence line to a higher one. The leap requires economic reforms to stimulate innovation.

The rest of the paper is organized as follows. Section 2 reviews the growth performances of the Asian economies from 1985 to 2015. The Asian countries suffered more in the AFC of 1997-98 than in the GFC of 2008-09. Section 3 establishes a long-run slowdown of the growth rate in almost all countries in Asia. However, slowdowns may be perfectly natural if a growth convergence is taking place. Crucial questions are whether the convergence path is common for all the Asian countries, and if not, how many of them exist.

Section 4 establishes three convergence paths—low-income, middle-income and high-income—in Asia, which is a new finding. Countries can and do jump from one convergence path to another by taking up reforms and stimulating innovation. When a country fails to jump from a middle-income convergence path to a high-income convergence path, a country is said to be caught in a middle-income trap. The country closest to a middle-income trap is Thailand. China is making a jump from a middle-income path to a high-income path; and the Philippines is making a jump from a low-income path to a middle-income path.

## **2. Experiences of the crises' impacts**

The GFC of 2008-09 had significant impacts on many economies, most severely in the United States and Europe. Asian countries did suffer from the negative spillover from the western advanced countries, but the negative impact on growth was much less than other regions. This shows a resilience of Asian regions. For emerging and developing Asia, the dip in growth rates during the GFC was much shallower than that during the AFC. The severe impact on Asia in 1997-98 was due to the fact that some of the economies in the region were the origin (epicenter) of AFC. Figure 1 is the time series (1985-2015) of the (real GDP) growth rates of various regions, using the definition of the International Monetary Fund (IMF), showing that Asia consistently grew faster than other regions and its decline in growth was the most serious

during the 1997-98 AFC.

Figure 1 about here

Figure 2 shows the time series of the growth rates of Japan and the original Four Tigers—South Korea (Korea), Singapore, Hong Kong SAR (Hong Kong), and Taipei, China (Taiwan)<sup>4</sup>—to show growth trends and fluctuations in the last three decades. The figure shows that the Four Tigers had a larger dip during the AFC than the GFC, but Japan had the opposite pattern. The Figure also shows that the medium-term trend growth of the Four Tigers has been declining from 1985-1996 (pre-AFC) to 1999-2007 (inter-crises), to post-GFC.

Figure 2 about here

Since China seems to dominate in the economic statistics of the emerging and developing Asian countries, a careful decomposition within the region is important. Figure 3 shows the growth rate of the same time period for the original ASEAN Five<sup>5</sup>—Indonesia, Malaysia, the Philippines, Singapore, and Thailand—to show a group of emerging Asia. (Singapore appear both in Figure 1 and Figure 2.) A long-run growth slowdown from the 1980s to 2010s is evident here, particularly under-5% growth in the 2010s, which prompted concerns that Indonesia, Malaysia, and Thailand may fall into a middle-income trap. The Philippines used to be at the bottom of the growth ranking among the ASEAN Five. However, it is now the highest performing country among the ASEAN Five during the first half of the 2010s. Something must have clicked in the Philippines in the post-GFC period while other ASEAN countries, as well as advanced countries, experienced growth slowdowns. Furthermore, until very recently, the growth rate of Singapore, despite its high per-capita income, has been comparable to Indonesia, Thailand and Malaysia. That implies the income gap between Singapore and the other three countries in the region has not narrowed. It suggests that Singapore and the three countries are not on the same convergence path.

Figure 3 about here

Figure 4 shows the growth pattern of China and India in the same time period, and the growth scale as before. China introduced major reforms in 1978 that made the economy much more market-oriented and open to the rest of the world. Reformer Deng Xiaoping mapped out and implemented a strategy toward reforms that included the privatization of state-owned companies. The growth rate subsequently rose in the 1980s. Then Chinese economic growth had a big drop in 1989 and 1990. The drop coincided with a decline in foreign direct investment into China, most likely a backlash from the Tiananmen Square protests of 1989. A series of

---

<sup>4</sup> The economy of the Island of “Taiwan” is known as “Taiwan Province of China” in IMF, “Taipei, China” in ADB, and “Chinese Taipei” in the Asia-Pacific Economic Cooperation (APEC) and the Olympic games. In this paper, these names are used interchangeably without any connotation or implication.

<sup>5</sup> The Association of Southeast Asian Nations (ASEAN) was established in August 1967 by these five countries, and the five countries are often referred to the ASEAN Five, or the ASEAN original five.

reforms continued even after the Tiananmen Square incident and Deng's retirement in 1992. The Shanghai Stock Exchange was reopened in 1990 after a 41-year closure. The multiple foreign exchange rates were unified in 1994. For two decades from 1991 through 2011, China maintained a very high growth rate averaging above 10 percent. Only very recently has the Chinese growth rate seemed to slow down, which is typical of any country that has achieved over 10 percent growth for twenty years.<sup>6</sup>

Indian economic growth in the last thirty years has been consistently lower than that of China. The income gap between China and India has been widening. There seems to be no convergence, but rather divergence between the two countries. However, the growth rate in India since 1992 has been higher than before and seems to be accelerating over time. The balance-of-payment crisis of 1991 prompted widespread reforms, moving away from Socialism. Although these reforms started in 1991, implementation and reaping benefits took a long time. India may still be in the slow process of privatization, removing regulatory barriers.

### 3. Slowdown of growth

After the GFC, many advanced countries have struggled to stimulate growth even with super-relaxed monetary policies and fiscal stimulus. Some economists argued for the case of secular stagnation and/or slowed innovations. Others regarded the slowdown more normally, considering the GFC was a crisis that originated among advanced countries. It has been commonly observed that an economy where a crisis originates suffers from dysfunctional financial markets that bring down real activities. The post-financial crisis slowdown in growth is commonplace.

Emerging market economies also suffered a growth slowdown. The Chinese growth rate fell from 10% in 2010 to below 7% in 2015. This produced commodity price declines that affected resource-producing economies. Other Asian countries also experienced growth slowdowns.

Table 1 summarizes the average growth rates for the three periods: pre-AFC (1985-96); inter-crises (1999-2007); and post-GFC (2010-2015). It is evident that, in the Asian emerging market economies, the post-GFC growth is less than the period before the GFC. The average growth rates between the two crises – the inter-crises period – is even lower than the pre-AFC period. Typically the period-average growth rate,  $g(\text{period})$ , of Asian EM countries have experienced:

$$g(1985-1996) > g(1999-2007) > g(2010-2015)$$

Table 1 about here

---

<sup>6</sup> A typical such example is Japan that had 10 percent growth in the 1950s and 1960s, but the growth rate became much lower after 1974.

Two notable exceptions to this stylized fact are the Philippines and the Lao Republic. These countries experienced rising growth rates from pre-ACC to post-ACC and from pre-GFC to post-GFC. Improving macroeconomic policy management in the Philippines is finally bearing fruit. For Lao, increasing exports of water power electricity to Thailand is helping its economic growth.

Many policy makers and scholars view this stylized fact as post-crisis slowdown and stagnation among EM countries. After the AFC, we often heard frustration among policy makers from Bangkok to Jakarta to Kuala Lumpur, in that the growth rate did not recover to the pre-GFC level.

More recently, some policy makers in ASEAN-5 talk about “middle income traps.” Although incomes are still at the upper-middle level, potential growth rates seem to have declined significantly. The Chinese industrial potential is fast catching up to the ASEAN-5 levels, while innovation among ASEAN countries seems to have failed to catch up with that of Japan, Singapore, and Korea. They also blame lingering effects of the GFC and volatility in capital flows.

However, a middle income trap is too easy an answer. The growth slowdowns shown in Table 1 are consistent with at least three other hypotheses: Post-financial crisis slowdown, global secular stagnation, and growth convergence.

A post-financial crisis slowdown is not unique, as Reinhart and Rogoff (2009, 2014) argued. According to them, the median length to reach a pre-crisis level is about 6.5 years. In fact, “[F]ive to six years after the onset of crisis, only Germany and the United States (out of 12 systemic cases) have reached their 2007-2008 peaks in real income.” Reinhart and Rogoff (2014: p.50). This tendency can explain the Asian slowdown of growth from the pre-AFC to the inter-crisis period. However, it may not explain the slowdown from the inter-crisis period to the post-GFC period, since Asia did not suffer from a financial crisis during the GFC. The Asian slowdown during the GFC was due to a trade channel from the west to Asia.

Another possibility for the Asian growth slowdown is that it is a part of global secular stagnation. In addition to the growth rate, the inflation rate and the real interest rate have been declining since the early 1990s, as Bean, et al (2015) showed. The Asian region may be a part of global lack of aggregate demand and savings glut. Any explanations that are consistent with secular stagnation are most applicable to advanced countries. Emerging and developing Asian countries are unlikely in the state of secular stagnation, that is, the persistent aggregate demand being less than aggregate supply.

The last explanation for the growth slowdown in emerging and developing Asia is the theory of growth convergence. The stylized facts of slowing down growth rates can be viewed as the act of “convergence,” in addition to the lingering effect of a crisis.



#### 4. Growth Convergence

##### Concept of Growth Convergence

In the growth literature, a phenomenon called “convergence” is theoretically predicted and empirically observed. Given common technologies, the higher the income has become, the slower the growth rate will become. Put differently, a low-income country can grow faster than a high-income country, since marginal contribution to growth of capital accumulation is much higher among the low-income countries. As Appendix to this paper shows, the typical convergence equation can be written as follows:

$$g_j(t) = a + b\{\log(y_j(t)) - \log y_j^*(t)\}$$

where  $g_j$  denotes the per-capita income growth rate;  $a$  is a steady state growth rate;  $y_j(t)$  is the county  $j$ 's per capita income; and  $y_j^*(t)$  is the output at the steady state where the effective capital-labor ratio stays constant. The growth convergence implies  $b < 0$ . The growth rate can be decomposed into the steady-state growth rate,  $a$ , and the catch-up factor, the second term. The more the current per-capita income level is below the steady state level, the higher the growth rate becomes. Thus, country  $j$  converges to a steady state.

The steady-state income level is changing over time, since even at a steady state, the growth rate is positive. Once the per-capita income reaches a steady state,  $y^*$ , then the second term becomes zero and the per-capita income increases at the constant rate of  $a$ .

The steady state for country  $j$  may not be known in reality, unless the country reaches that stage of constant growth. However, among the advanced countries, it is expected that the steady state, or the goal of catch-up process, is the level of US income and growth rate. Advanced countries should converge to the US (or OECD) level of income. If this holds true, we can substitute the US income level at time  $t$ ,  $y_{US}(t)$ , for  $y_j^*(t)$ .

$$g_j(t) = a + b\{\log y_j(t) - \log y_{US}(t)\}$$

This is the basic regression equation of growth convergence. The growth convergence predicts  $b < 0$ . In empirical research, the convergence hypothesis can be shown as the negative correlation between the period-average per-capita GDP growth rate and the level of the per-capita GDP level at the beginning of the period. The lower-income countries can grow faster than the high-income countries. There may be several reasons for this. First, the high marginal productivity of capital in low-income countries imply the higher growth rate. This is possible even if the production function has the same specification. Second, it is more likely that the low-income country has a low technological level that depresses its income level. However, it is possible to achieve a higher growth rate because technological transfers and learning by doing are possible. For a low-income country, imitation, not innovation, may be

enough to increase its total factor productivity. Third, starting from a low level of infrastructure and human capital, public spending on these public goods and education can easily increase its productivity. In the conditional convergence literature, it is often assumed that conditions are fixed at the initial point (the year where the analysis starts), and growth is traced for the following decades.

Of course, not all low-income countries can achieve high growth. There are many countries that are stuck in the low-income, low-growth state. Many factors can explain the poverty trap. Much of the population may be in a minimum subsistent level so that they have to spend all of their time in farming, fishing or hunting, without increasing human capital (education) or improving productivity (machines). Hence, poverty reproduces poverty. Under this state, large populations were once considered to be a disadvantage, as was in Myrdal (1968). Having exportable resources help in theory, but often the corrupt governments skim off most of export revenues for personal benefit.

East Asian countries, typically without large resources, successfully took off from the poverty trap one after another. Scholars and policy makers in the East Asian countries tend to credit industrial policies for the take-off. The government directed resources and credit to industries that have the best chance to become competitive in the global markets. Private sector companies compete in productivity and those who succeed in exports were rewarded by the government by more resources and financial incentives. The typical East Asian government also spent a substantial amount in building their infrastructure (road, electricity, rail, ports) networks and nationwide education systems. A positive view of market-friendly interventions by benevolent governments was and still is prevalent in the East Asia. The Asian Miracle, portrayed by the World Bank (1993), is applicable at least for Japan, the Four Tigers, and the ASEAN-5, with some time-lag.

The typical growth convergence is depicted in Figure 5. Once a take-off from the poverty trap is made, often by a big push by the government or by a significant policy reform, the economy reaches the growth convergence line and the economy enjoys the virtuous circle of higher growth and more investment, through the income increases of the population.

Figure 5 about here

Although this view was strongly supported in time-series data of countries in East Asia, any casual test or a rigorous extension to other regions—South Asia, Latin America, and Africa—tends to fail. Cross-section or panel date analyses involving all countries (where data are available) in the world fail to produce the downward-sloping convergence line (see Barro (1991) for an early attempt). East Asia was treated as an exception (i.e., miracle) rather than as a standard role model.

A single convergence line in an attempt to explain many countries needs a strong assumption that the specification of the production function is identical across countries and the only difference is the degree of capital accumulations. In reality, the technological level,

whether it is embodied in labor or capital, may be vastly different. Technological progress, often measured in Total Factor Productivity, also differs. Capital and labor shares may be different too.

Many factors that are relevant to the production function also matter. The empirical literature has identified many factors that can explain the difference in growth. The list ranges from historical conditions, geographical conditions, institutions, and accumulated human capital. The historical conditions include human capital (Barro (1991) and Mankiw et al. (1992)) and “colonial origin” (Acemoglu, Johnson and Robinson (2001, 2002)). Demography also matters, as shown in Bloom, et al. (2000), since the age composition, given the size of population, is important for labor input. Thus, it becomes standard to consider the “conditional convergence,” where convergence speed differs among countries. In a sense, convergence paths may not be unique, but multiple paths exist. Theoretically, this reflects the difference in the level of technology and its growth contribution. See Han and Wei (2005) for an excellent overview.

Foreign direct investment (FDI) played an important role in East Asia, with the conspicuous exception of Japan and Korea. FDI brings in both physical capital and technology associated with the use of capital. Borensztein, et al. (1998) showed that FDI contributes more than domestic investment, presumably due to technological transfers, but that is the case only when the host country has a capacity to absorb with accumulated human capital. This should fit the story in East Asia since educational attainment in the region is relatively higher.

### Stylized Facts of Growth Convergence in Asia

In the rest of this section, I will search for and show the growth convergence pattern in East Asia. I will propose a framework that encompasses notions of the poverty trap, the middle-income trap, and convergence to a high-income group.<sup>7</sup> The three periods of pre-AFC (1985-96); inter-crises (1999-2007); and post-GFC (2010-2015) are used as in previous sections. The crisis years are omitted since that would make the average growth rate altered by the two unusual crises. In the following, we use the period average per-capita growth rates as the vertical axis and the log of per-capital income level (in US dollar converted at the market exchange rate) of the first year of each period as the horizontal axis. The sample countries are Japan, the Four Tigers, ASEAN-5, the four low-income ASEAN countries (CLMV), China, and India. The period-average growth rates are shown in Table 1.

Table 1 about here

For the growth convergence figures, the growth rate is taken as a vertical axis, and the income level is taken as a horizontal axis. The convergence hypothesis implies that plots of different periods of a particular country move along the line from the northwest to the

---

<sup>7</sup> The term middle income trap was first proposed by Gill and Kharas (2007).

southeast. If several countries can be plotted on the same line, then those countries are expected to converge in the same growth model (technology) toward a high-income, low-growth steady state (goal of development).

As a first attempt, Figure 6 shows plots of all the East Asian countries (and India) in one graph. The connected dots of each country is mostly downward sloping, suggesting that growth convergence is evident in the time-series of each country. Some low-income countries show an upward-sloping line. These upward movements – accelerations of growth as the income level rises – may still be part of a “take-off” from a poverty trap with the dysfunctional government via strong reforms.

Figure 6 about here

However, Figure 6 is not appropriate when the global leader, the United States, is also moving toward the right in the convergence graph. To be precise, growth convergence should be interpreted as a convergence to the US level of income level and the US steady state growth rate, say 2 percent. This will be explained in a rigorous manner in the following subsections.

In order to take this into account, the horizontal axis is modified to be the difference of the country’s per-capita income to the log of the difference of the country’s per-capita income from the US per-capita income. The zero in the horizontal axis implies reaching the US per-capita income level. Figure 7 shows the relative convergence to the US, using the log difference to the US for the horizontal axis. It shows the general tendency of growth convergence for each country, but as a panel data, no single convergence path can be drawn.

Figure 7 about here

### Multiple Convergence Paths

With careful observations of Figure 7, it seems that some countries can be grouped together to share a common convergence path. In fact, three groups can be found to experience similar growth patterns. Group 1 is the high-income group including Japan and the Four Tigers. Group 2 is the middle-income group including China, Thailand and Malaysia, and possibly Indonesia and the post-GFC Philippines. Group 3 is the low income group including CLMV, India and possibly the pre-AFC and inter-crises Philippines.

It is rather obvious that Japan and Four Tigers belongs to the same group, as dots of these countries line up on the straight convergence line with little deviation. China seems to be moving from the low-income group to the middle-income group, and now approaching the high-income group.

Both Indonesia and the Philippines are on the border area of Group 2 and Group 3 with atypical time-series behavior, namely they are not downward sloping. Indonesia in the inter-crises period has a lower growth rate AND lower per-capita income than the period before or after. This is because Indonesia suffered from long-lasting damage from AFC with large income decline and depreciation of the Rupiah. The inter-crises Indonesia is close to the low-

income group, while Indonesia in the pre-AFC and post-GFC periods may belong in the middle-income group.

The Philippine time-series shows an upward movement. Growth accelerated as the income level rose. This is opposite of what the growth convergence predicts. This unusual behavior may be due to continuous improvement in socio-economic and political conditions for the last thirty years. The improved investment climate is generally attributed to improved governance and especially greater political stability after the AFC and in particular after the GFC.

Hence, we will examine the following cases:

Case 1. Indonesia is in the middle-income group and the Philippines is in the low-income group;

Case 2. Both Indonesia and the Philippines are in the low-income group.

Case 3. Indonesia in the inter-crises period is in the low-income group but the other two periods in the middle-income group; and the Philippines in the pre-AFC and the inter-crises period is in the low-income group and during the post-AFC in the middle-income group.

For each case, the regression analysis is conducted to find the convergence line with the following specification which is consistent with theory:

$$g_j(t) = a + b\{\log y_j(t) - \log y_{US}(t)\}$$

where  $t = 1$  (pre-AFC),  $2$  (inter-crises),  $3$  (post-GFC);  $j$  denotes a country; and  $b < 0$  is expected. The cross-section, time-series pooled regression is conducted. Then the growth convergence line for each group of countries is found by estimates of  $a$  and  $b$ .

Table 2 shows the regression results for all three cases (regarding grouping of Indonesia and the Philippines). Using the estimated values of  $a$  and  $b$ , growth convergence lines can be superimposed on Figure 7.

Table 2 about here

Figure 8 shows the fitted lines of the regressions for case 1. The convergence line for Group 1 seems to have only small deviations (errors). However both Group 2 and Group 3 have wide variations around them.

Figure 8 about here

Similarly, Figures 9 and 10 show growth convergence lines of Case 2 and Case 3, respectively. Since we are agnostic as to whether Indonesia and the Philippines should be included in the middle-income group, these three cases are presented. They serve as a test of robustness regarding the grouping of countries.

Figures 9 and 10 about here

All three figures show downward sloping convergence lines. Convergence lines are almost parallel in Case 3. In all cases, the middle-income convergence hits the steady state growth rate,  $g$ , say 0.02 (2%), but it does not reach the level of the high-income steady state. Hence, it is not the matter of fast- or slow-convergence to the common high-income steady state, but the middle-income trap does exist. Countries on the middle-income convergence line have to make a jump to the high-income convergence line, sooner or later.

The three convergence lines suggest that if a country fails to jump from one convergence path to a higher one, the country will end up in the state where the gap to the US income level will not be narrowed.

### Conditional Convergence with Jumps

Figure 11 explains in a schematic way how jumps are required to avoid a trap: one from a low-income convergence path to a middle-income one, and another jump from a middle-income convergence path to a higher-income one.

Figure 11 about here

A group of countries belongs to the same convergence line. For example, Japan and the Four Tigers belong to one convergence line, while middle income ASEAN countries share one convergence path. The low-income ASEAN countries also have a common convergence path. This means that countries that belong to the same convergence path share similar technologies. The difference is the degree of capital accumulation.

China maintains a relatively high growth rate, although the per-capita income level is approaching the top of the middle-income range. Although the Chinese growth rate is declining slightly, it seems possible for them to avoid a middle-income trap.

### Middle-Income Trap in the context of Growth Convergence

With the framework proposed above, a middle-income trap is easily understood as a result of failing to make a jump from a middle-income convergence path to a high-income convergence path. Growth convergence comes at a steady state that is lower than the steady state of the advanced countries, say at the US level. When the country's growth rate becomes equal with the US long-run per-capita growth rate, the gap between the US and the country in per-capita income (position on the horizontal axis) stays constant. When a country follows the middle-income convergence path to a steady state, the income gap remains permanently. This country is said to be stuck in a middle income trap. In fact, it is not a trap, but a failure to adopt innovations in technological progress. In the examination above, Thailand is approaching close to 2% per-capita growth and it may fail to catch up to the US level of per-capita income, unless Thailand makes a regime shift toward innovation.

Aiyar, et al. (2013) had an investigation very similar to this study, comparing the time-series of Asian and Latin American emerging market economies. They define a middle income

trap as a sudden deceleration in growth. By probit regressions, they argue that “(i) middle-income countries are, in fact, disproportionately likely to experience growth slowdowns, and (ii) this result is robust to a wide range of income thresholds for defining ‘middle income.’” (Aiyar, 2013. P. 12) Then, they go on to examine factors that cause sudden growth slowdowns. The difference between our approach and the Aiyar, et al. approach is that it is assumed here that there exist multiple growth convergence lines, so that it could be a gradual slowdown that ends up in a middle-income steady state, in contrast to their idea that a middle income county can fall off from the growth convergence line. Felipe, et al. (2014) examined countries’ transitions across income groups, similar to this paper. They searched for evidence that supports the middle-income trap, i.e., a country is stuck in middle-income status. They refuted this proposition in favor of a hypothesis that there is a slow transition vs. a fast transition from middle to high income. Im and Rosenblatt (2013) examined transition phases in the cross-country distribution of income. Their transition matrix analysis provides little support for the idea of a middle-income trap. Han and Wei (2015) also examined a transition matrix analysis and rejected an unconditional middle-income trap. They argued that there are factors such as working age population, financial development, and macroeconomic stability that affect the choice between fast- and slow-growing countries.

Eichengreen, et al. (2012, 2013) argue that there are certain income levels in which a sudden slowdown tends to occur. In their 2013 paper, they argued that the reflection levels are \$10,000-\$11,000 and \$15,000-\$16,000 (in 2005 purchasing power parity dollars). It is not clear whether they argue that a slowdown is a natural process of middle-income growth convergence, or falling off from the high-income growth convergence. However, their conclusion is that “slowdowns are less likely in countries where the population has a relatively high level of secondary and tertiary education and where high-technology products account for a relatively large share of exports.” This is a mirror to our argument that one needs innovation to jump from the middle-income convergence path to a high-income convergence path.

Bullman, et al. (2014) argue that determinants of growth at the low-income level are different from those at the high-income level. Their model implies that a transition from low- to high-income status can be smooth, if a country redirects its resources to factors that are important for high-income growth. The implication is that a middle income trap does not exist.

Robertson and Ye (2013), in contrast to the above papers, confirmed the existence of a middle-income trap. This is defined as when the per-capita income will not rise beyond the middle income range in the indefinite future. This can be investigated by the Augmented Dickey-Fuller (ADF) unit root test. The result is not immediately conclusive because ADF requires a large sample, while the sample size in growth convergence or middle-income trap is limited.

This paper defined the middle-income trap in the context of growth convergence. Providing

an interpretation of the middle-income trap in the growth convergence is novel. Empirical investigations using panel data are also new. Results are more in the form of suggestive evidence than a hypothesis testing due to the limited sample size.

## **5. Concluding Remarks**

This paper examined the growth experiences of Asian countries in the framework of conditional convergence. With a proper grouping of countries, three convergence paths are found. The estimations show that each of the Asian countries are following one of the three convergence paths. The middle-income trap can be viewed as a middle-income country that fails to make a jump and converge to a middle-income steady state.

It requires strong reforms or political regime shift to stimulate enough innovation (technological progress) to jump from a middle-income convergence path to a high-income convergence path. Finding three convergence paths is reasonable. To put the debate of middle-income trap in the framework of growth convergence is novel in this paper.

Admittedly, empirical results are subject to further examination. Extending the analysis to other regions is left for future study.



## References:

Acemoglu, Daron, 2009. *Introduction to Modern Economic Growth*. Princeton University Press.

Acemoglu, D., S. Johnson, and J. A. Robinson. 2001. "The Colonial Origins of Comparative Development: An Empirical Investigation." *American Economic Review* 91(5): 1369–1401.

Acemoglu, D., S. Johnson, and J. A. Robinson. 2002. "Reversal of Fortune: Geography and Development in the Making of the Modern World Income Distribution." *Quarterly Journal of Economics* 117(4): 1231–1294.

Aiyar, Shekhar; Romain Duval; Damien Puy; Yiqun Wu; and Longmei Zhang, 2013, "Growth Slowdowns and the Middle-Income Trap" IMF Working Paper, WP13/71, March 2013.  
<https://www.imf.org/external/pubs/ft/wp/2013/wp1371.pdf>

Asian Development Bank (2011). "Asia 2050: Realizing the Asian Century," Asian Development Bank (free online).  
<http://www.iopsweb.org/researchandworkingpapers/48263622.pdf>

Barro, Robert. 1991. Economic Growth in a Cross-Section of Countries. *Quarterly Journal of Economics* 106: 407–443.

Bean, Charles; Christian Broda; Takatoshi Ito and Randall Kroszner. 2015. *Low for Long? Causes and Consequences of Persistently Low Interest Rates*, Geneva Reports on the World Economy, volume 17, International Center for Monetary and Banking Studies, October 2015.

Bloom, David; David Canning and Pia M. Malaney, "2000. "Demographic Change and Economic Growth in Asia." *Population and Development Review* 26(Supplement): 257–290.

Borensztein, Eduardo, Jose De Gregorio, and Jong-Wha. Lee. 1998. "How does Foreign Investment Affect Growth?" *Journal of International Economics* 45(1): 115–172.

Bulman, David; Maya Eden, and Ha Nguyen. 2014. "Transitioning from Low-Income Growth to High-Income Growth: Is there a Middle Income Trap?" World Bank Policy Research Working Paper 7104.

Eichengreen, Barry, Donghyun Park and Kwanho Shin. 2012. "When Fast Growing Economies Slow Down: International Evidence and Implications for China," *Asian Economic Papers* 11, pp.42-87.

Eichengreen, Barry; Donghyun Park, and Kwanho Shin. 2013. "Growth Slowdowns Redux: New Evidence on the Middle-Income Trap," NBER Working Paper No. 18673  
January 2013.

Felipe, Jesus; Utsav Kumar, and Reynold Galope. 2014. "Middle-Income Transitions: Trap or Myth?" ADB Economics Working Paper No. 421. Asian Development Bank. Manila.

Gill, Indermit S., and Himi Kharas. 2007. *An East Asian Renaissance: Ideas for Economic Growth* (Washington D.C.: World Bank).

Han, Xuehui and Shang-Jin Wei, 2015, "Re-examining the Middle Income Trap Hypothesis: What to Reject and What to Revive?" copy, November 14, 2015

Mankiw, N. Gregory, David Romer, and David Weil. 1992. A Contribution to the Empirics of

Growth. *Quarterly Journal of Economics*, 107: 407-437.

Im, Fernando Gabriel and David Rosenblatt. 2013. "Middle-Income Traps: A Conceptual and Empirical Survey." Poly Research Working Paper No. 6594. The World Bank. Washington, DC.

Myrdal, Gunnar (1968) *Asian Drama: An Inquiry into the Poverty of Nations*, Allen Lane The Penguin Press.

Reinhart, Carmen M., and Kenneth S. Rogoff. 2009. *This Time is Different: Eight Centuries of Financial Folly*, Princeton University Press.

Reinhart, Carmen M., and Kenneth S. Rogoff. 2014. "Recovery from Financial Crises: Evidence from 100 Episodes." *American Economic Review*, 104(5): 50-55.

Robertson, Peter E. and Longfeng Ye. 2013. "On the Existence of a Middle Income Trap." Economics Discussion Paper No. 13.12. University of Western Australia. Perth.

World Bank (1993). *The East Asian Miracle: Economic Growth and Public Policy*, Oxford University Press.

### **Appendix:** Growth Convergence

The following derivation of the convergence regression is straight out of Acemoglu (2009: Chapters 2 and 3) with a few modification in notations and an additional complexity with heterogeneous countries.

Consider a labor-augmenting Solow-type growth model with a constant saving rate,  $s$ ; a constant depreciation rate  $z$ :

$$Y(t) = F(K(t), A(t)L(t)) \quad (1)$$

where  $Y$  is output;  $F$  is a production function of homogeneous of degree one;  $K$  is capital;  $A$  is the technological level; and  $L$  is labor. Define effective capital-worker ratio and effective output-labor ratio:

$$k(t) = \frac{K(t)}{A(t)L(t)}$$

With homogeneous of degree one, Equation (1) can be transformed as follows:

$$\begin{aligned} \frac{Y(t)}{A(t)L(t)} &= F\left(\frac{K(t)}{A(t)L(t)}, 1\right) \\ &= f(k(t)) \end{aligned} \quad (2)$$

Define per-capita income as

$$y(t) = \frac{Y(t)}{L(t)}$$

Then, using this definition of  $y(t)$  and (2) becomes

$$y(t) = A(t)f(k(t)) \quad (3)$$

A change in  $K(t)$ ,  $dK(t)$ , is a new accumulation of capital by investment, which is assumed to be equal to saving, minus depreciation.

$$dK(t) = sY(t) - zK(t)$$

where  $d$  is the notation of time derivative (assuming a continuous time model). The growth rate of  $k$  can be defined as

$$\frac{dk}{k} = \frac{dK}{K} - \frac{dA}{A} - \frac{dL}{L} \quad (4)$$

where time notation ( $t$ ) is omitted. Assume a constant rate of technological progress,  $a$ , and a constant rate of labor growth  $n$ ,

$$\frac{dk}{k} = \frac{dK}{K} - a - n \quad (5)$$

Combining (4) and (5),

$$\begin{aligned} \frac{dk}{k} &= \frac{sY(t) - zK(t)}{K(t)} - a - n \\ &= \frac{sY(t)}{K(t)} - (z + a + n) \end{aligned}$$

Substituting  $Y(t) = A(t)L(t)f(k(t))$ , which can be rearranged from (2)

$$\frac{dk(t)}{k(t)} = \frac{sf(k(t))}{k(t)} - (z + a + n) \quad (6)$$

Or equivalently,

$$dk(t) = sf(k(t)) - (z + a + n)k(t) \quad (7)$$

When the production function  $F$  satisfies certain conditions (Assumptions 1 and 2 Acemoglu (2009; p.29 and p.33, respectively)), there exists a unique, globally stable steady state  $k^* > 0$ , where

$$k^* \text{ is } k \text{ such that } sf(k^*) - (z + a + n)k^* = 0$$

The steady state per-capita income is denoted as  $y^*$  and  $y^*(t) = A(t)f(k^*)$ . At the steady state,  $Y/L$  and  $K/L$  increases at the rate of  $a$ , the technological progress. So, ultimately, the economy will converge to a state where the growth rate equals the technological progress rate. It is easy to show in comparative statics exercises that  $k^*$  is an increasing function of  $s$  and  $A(0)$ , i.e., the initial level of technology, and decreasing function of  $n$  and  $z$ . How to find  $k^*$  from (7) and

a set of parameters are depicted in Figure A-1.

Figure A-1 about here

Recall (3) and differentiate with respect to time, then the growth rate  $g$  of per-capita income can be shown as follows:

$$\begin{aligned}
 g &= \frac{dy(t)}{y(t)} \\
 &= \frac{dA(t)}{A(t)} + \frac{f'(k(t))dk(t)}{f(k(t))} \\
 &= a + \left( \frac{f'(k(t))k(t)}{f(k(t))} \right) \left( \frac{dk(t)}{k(t)} \right) \\
 &= a + \varepsilon(k) \frac{dk(t)}{k(t)}
 \end{aligned} \tag{8}$$

Where  $\varepsilon(k) \equiv f'(k(t))k(t)/f(k(t))$  is the elasticity of the production function. Note that  $0 < \varepsilon(k) < 1$ , and  $\{dk(t)/k(t)\}$  was shown in (6).

Acemoglu (2009, pp. 80-81) describes the process of taking the first-order Taylor expansion of (6) with respect to  $\log k(t)$  and substituting it into (8). Then it would become the following convergence equation (Acemoglu (2009), equation (3.10), p.81).

$$\begin{aligned}
 g &= \frac{dy(t)}{y(t)} \approx a - \varepsilon(k^*)(1 - \varepsilon(k^*))(z + a + n)(\log k(t) - \log k^*) \\
 g &= \frac{dy(t)}{y(t)} \approx a - (1 - \varepsilon(k^*))(z + a + n)(\log k(t) - \log k^*)
 \end{aligned} \tag{9}$$

The first term is the steady state growth rate, which is the technological progress rate. The second term is the convergence term. If  $y < y^*$ , then  $g > a$ , and vice versa. This shows that the growth rate is a decreasing function of  $y$ , thus the downward sloping convergence line. This is depicted as the solid line in Figure A-2.

The following is an application of the above summary of theory of convergence a la Acemoglu (2009), which is needed to derive multiple convergence lines. Suppose that at some point of time  $t=t_0$ , there was jump in technology from  $A(t_0)$  to  $A^+(t_0)$ , other parameters being equal, where

$$A(t_0) < A^+(t_0)$$

Then,  $k^*$  and  $y^*$  will become larger and the convergence line shifts to right as depicted in the broken line in Figure A-2. As  $k(t)$  is defined as  $K(t)/A(t)L(t)$ , a sudden jump in the value of  $A$  will lower the  $k(t_0)$ . However,  $y(t_0) = A(t_0) f(k(t_0))$  will become higher. The economy will jump

from  $(y(t_0), g(t_0))$  to  $(y^+(t_0), g^+(t_0))$  to  $y^+(t_0)$ , and the growth rate will become higher due to the convergence term. These lines corresponds to multiple convergence lines in the text.

Figure A-2 about here

Figure 1: Growth rates: Asia vs. other regions

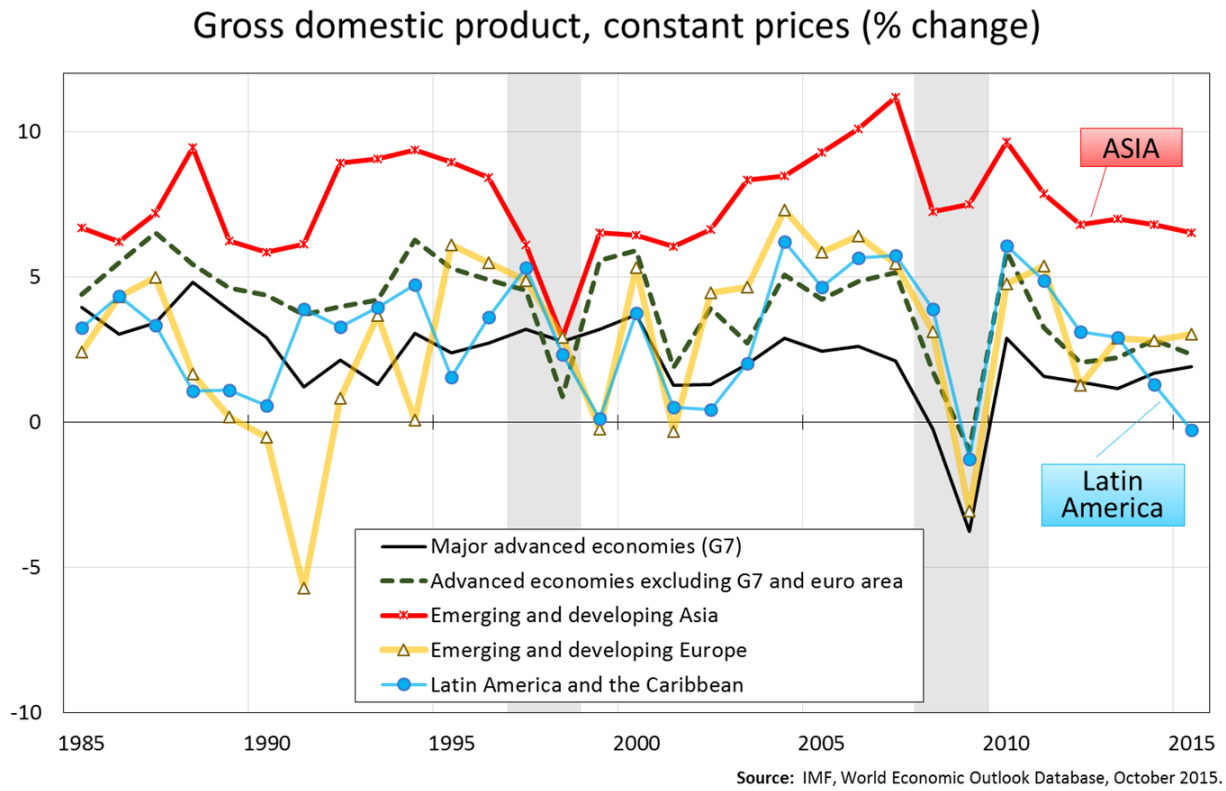


Figure 2: Growth Rates: Japan and the Four Tigers

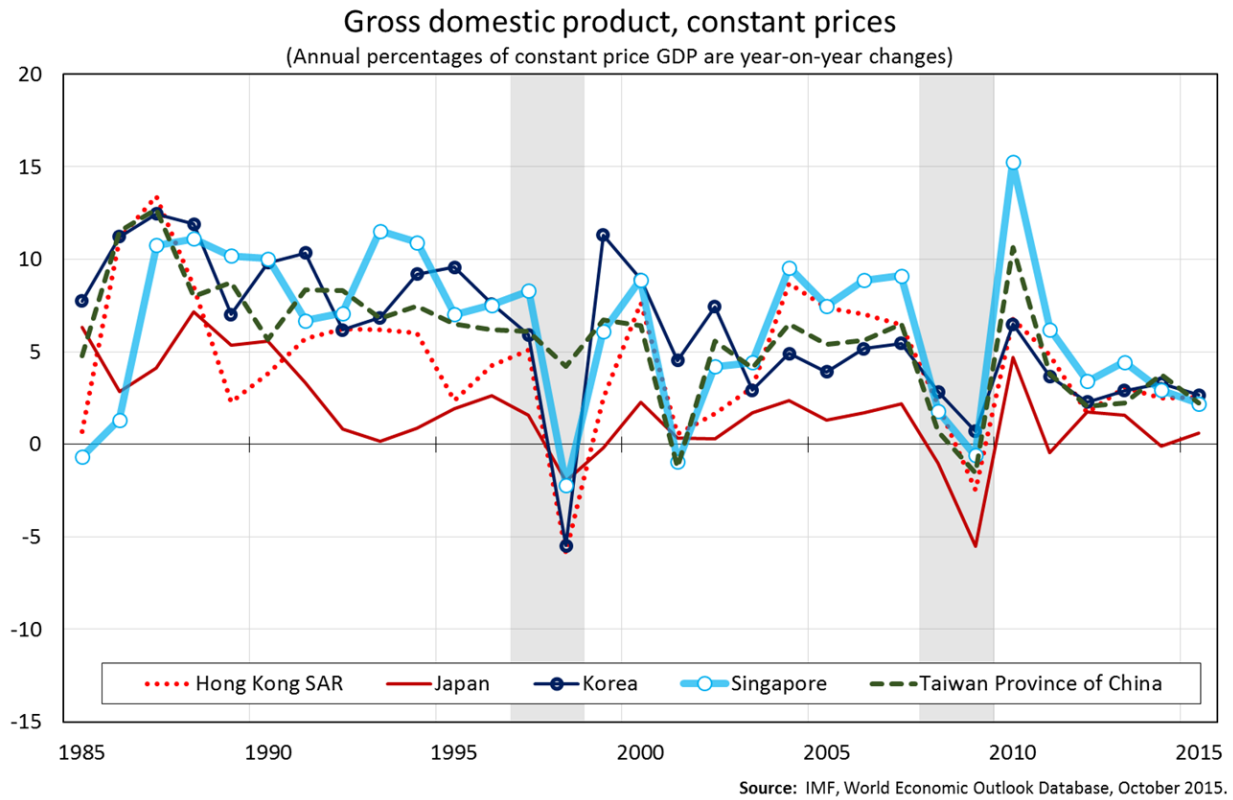


Figure 3: Growth Rates: ASEAN 5

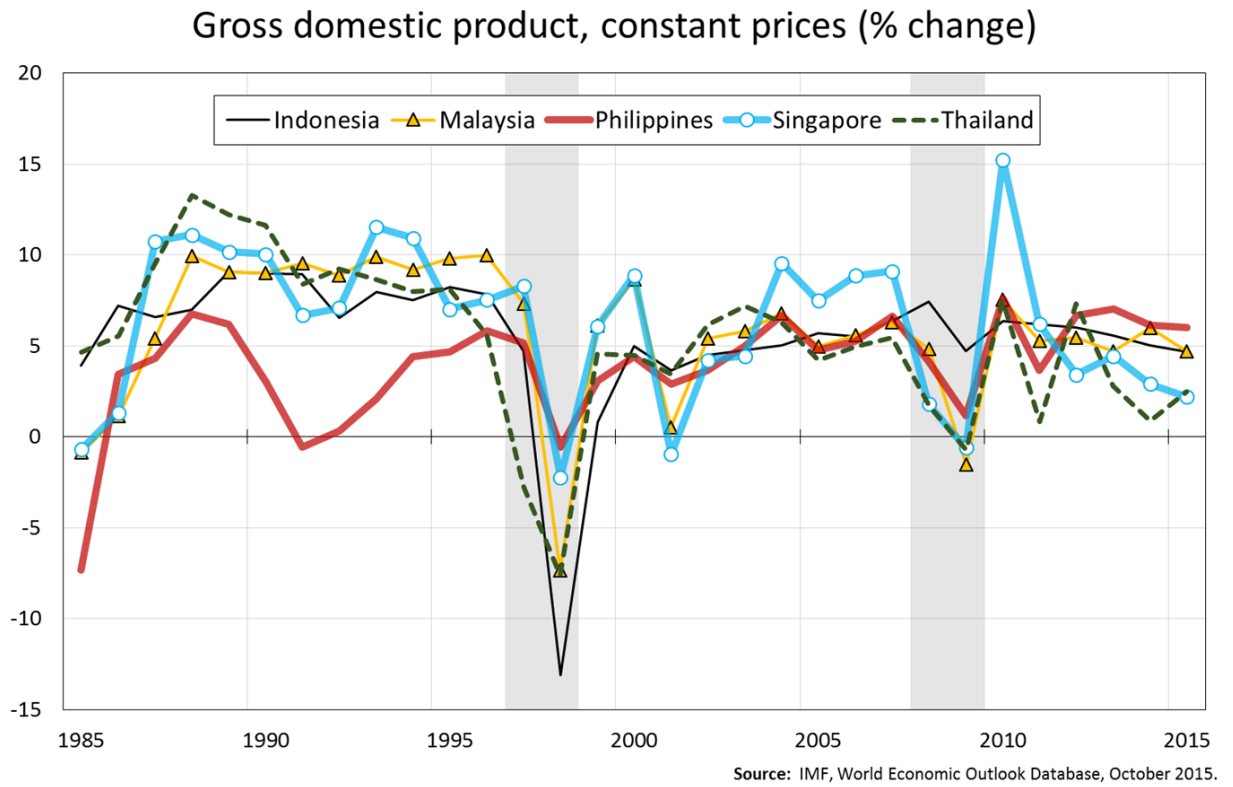
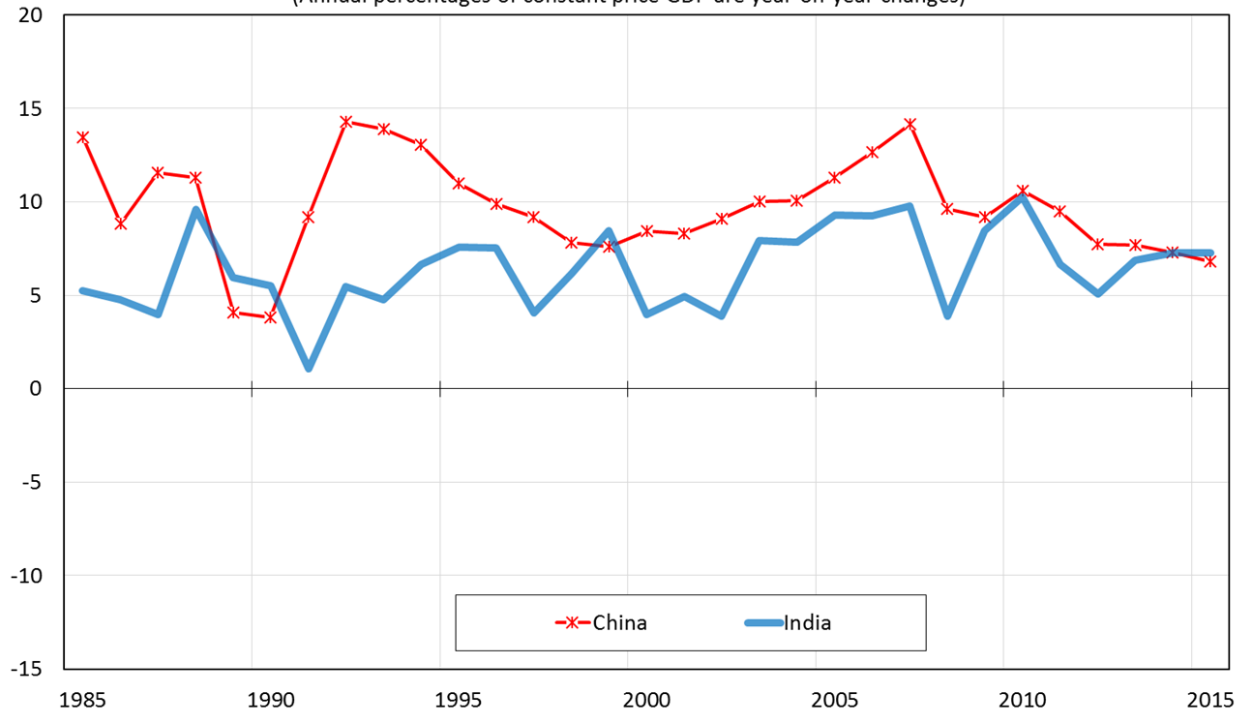


Figure 4: Growth Rates: China and India

### Gross domestic product, constant prices

(Annual percentages of constant price GDP are year-on-year changes)



Source: IMF, World Economic Outlook Database, October 2015.

Figure 5: Growth Convergence

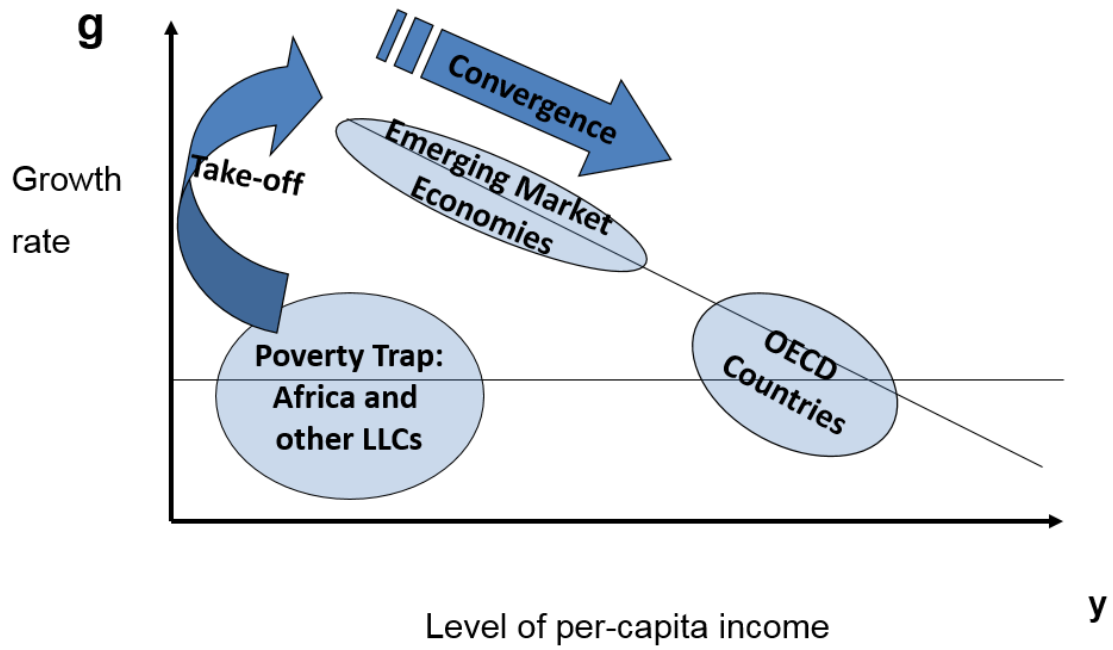




Table 1: Period-Average Growth Rates

<b>Table 1</b>			
	Pre-AFC	Inter crises	Post-GFC
	1985-96	1999-2007	2010-2015
Hong Kong	4.8%	4.7%	2.2%
Japan	2.8%	1.4%	0.9%
Korea	8.2%	4.8%	2.5%
Singapore	5.7%	4.4%	2.1%
Taiwan	7.1%	4.3%	2.5%
Malaysia	5.5%	3.3%	3.5%
Indonesia	5.9%	3.6%	4.0%
Thailand	7.6%	4.4%	2.4%
Philippines	1.3%	3.0%	4.0%
Cambodia	NA	7.7%	5.5%
Lao P.D.R.	2.2%	5.1%	5.8%
Myanmar	NA	12.1%	6.8%
Vietnam	4.8%	5.9%	4.8%
China	8.6%	9.8%	7.3%
India	3.6%	5.4%	5.0%

Figure 6: Growth Convergence in East Asia: per-capital GDP

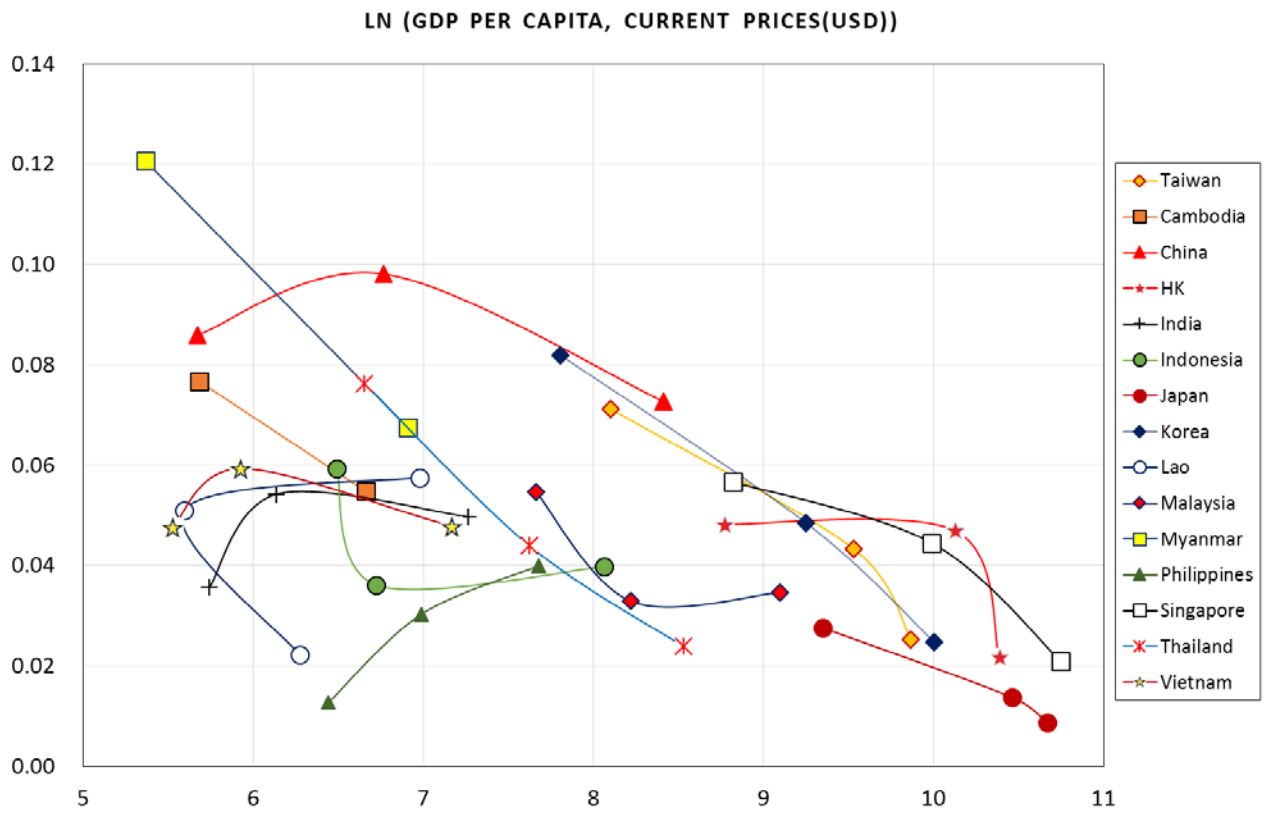


Figure 7: Growth Convergence in East Asia: Relative to the US

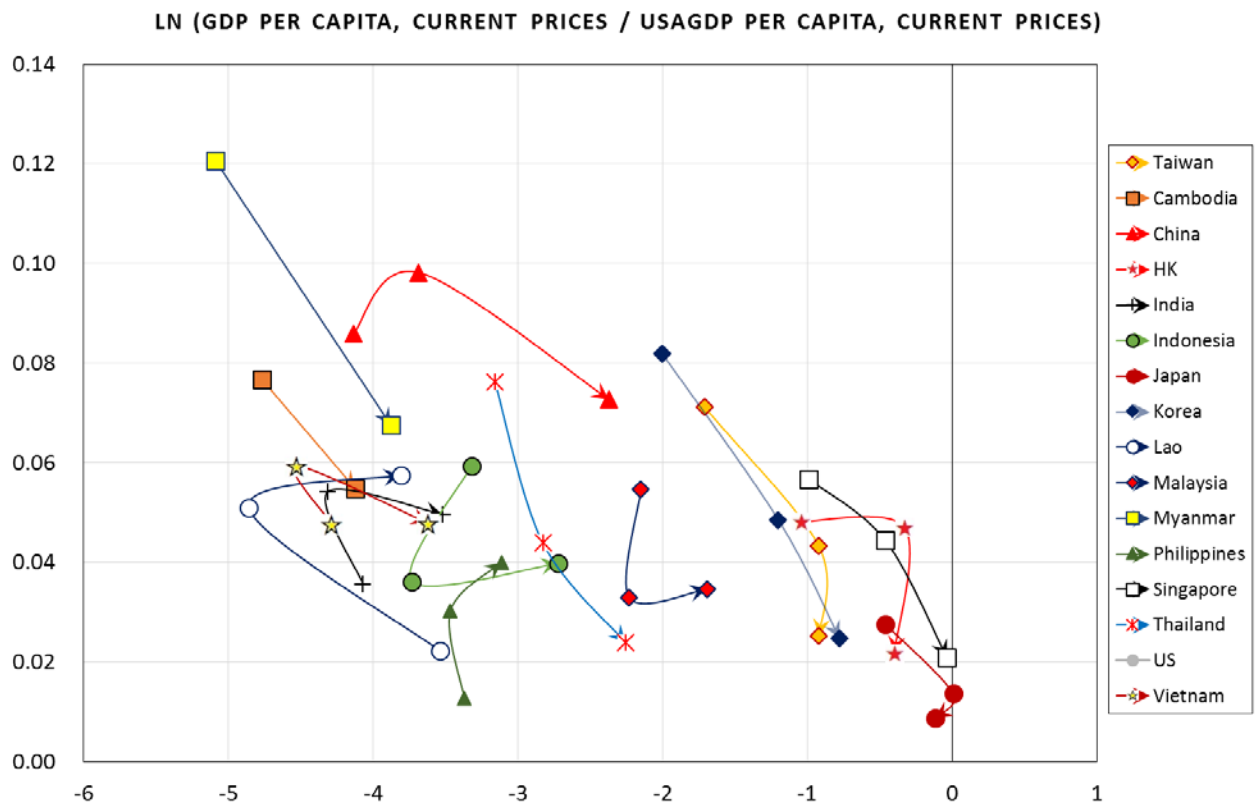


Table 2: Conditional convergence

	Case 1			Case 2			Case 3			
		$\alpha$	$\beta$		$\alpha$	$\beta$		$\alpha$	$\beta$	
Group 1	Coefficient	0.016	-0.031	Coefficient	0.016	-0.031	Coefficient	0.016	-0.031	<b>Case1:</b> Hong Kong, Japan, Korea, Singapore and Taiwan
	STD Er	0.005	0.005	STD Er	0.005	0.005	STD Er	0.005	0.005	<b>Case2:</b> Hong Kong, Japan, Korea, Singapore and Taiwan
	t-stat	3.298	-6.172	t-stat	3.298	-6.172	t-stat	3.298	-6.172	<b>Case3:</b> Hong Kong, Japan, Korea, Singapore and Taiwan
	p-stat	0.006	0.000	p-stat	0.006	0.000	p-stat	0.006	0.000	
	R-bar sq	0.726		R-bar sq	0.726		R-bar sq	0.726		
	# obs	15		# obs	15		# obs	15		
Group 2		$\alpha$	$\beta$		$\alpha$	$\beta$		$\alpha$	$\beta$	<b>Case1:</b> China, Indonesia, Malaysia and Thailand
	Coefficient	0.001	-0.019	Coefficient	-0.013	-0.026	Coefficient	-0.011	-0.024	<b>Case2:</b> China, Malaysia and Thailand
	STD Er	0.023	0.008	STD Er	0.021	0.007	STD Er	0.021	0.007	<b>Case3:</b> China, Malaysia and Thailand, Indonesia (t=1,3), Philippines (t=3)
	t-stat	0.050	-2.359	t-stat	-0.629	-3.517	t-stat	-0.518	-3.212	
	p-stat	0.961	0.040	p-stat	0.549	0.010	p-stat	0.616	0.009	
	R-bar sq	0.293		R-bar sq	0.587		R-bar sq	0.459		
	# obs	12		# obs	9		# obs	12		
Group 3		$\alpha$	$\beta$		$\alpha$	$\beta$		$\alpha$	$\beta$	<b>Case1:</b> Cambodia, India, Lao Republic, Myanmar, Philippines, Vietnam
	Coefficient	-0.071	-0.031	Coefficient	-0.042	-0.024	Coefficient	-0.089	-0.035	<b>Case2:</b> Cambodia, India, <b>Indonesia</b> , Lao Republic, Myanmar, Philippines, Vietnam
	STD Er	0.031	0.008	STD Er	0.027	0.007	STD Er	0.033	0.008	<b>Case3:</b> Cambodia, India, <b>Indonesia (t=2)</b> , Lao Republic, Myanmar, Philippines (t=1,2), Vietnam
	t-stat	-2.282	-3.973	t-stat	-1.584	-3.537	t-stat	-2.711	-4.309	
	p-stat	0.039	0.001	p-stat	0.132	0.003	p-stat	0.017	0.001	
	R-bar sq	0.496		R-bar sq	0.39		R-bar sq	0.539		
	# obs	16		# obs	19		# obs	16		

Figure 8: Three grouping of countries, Case 1

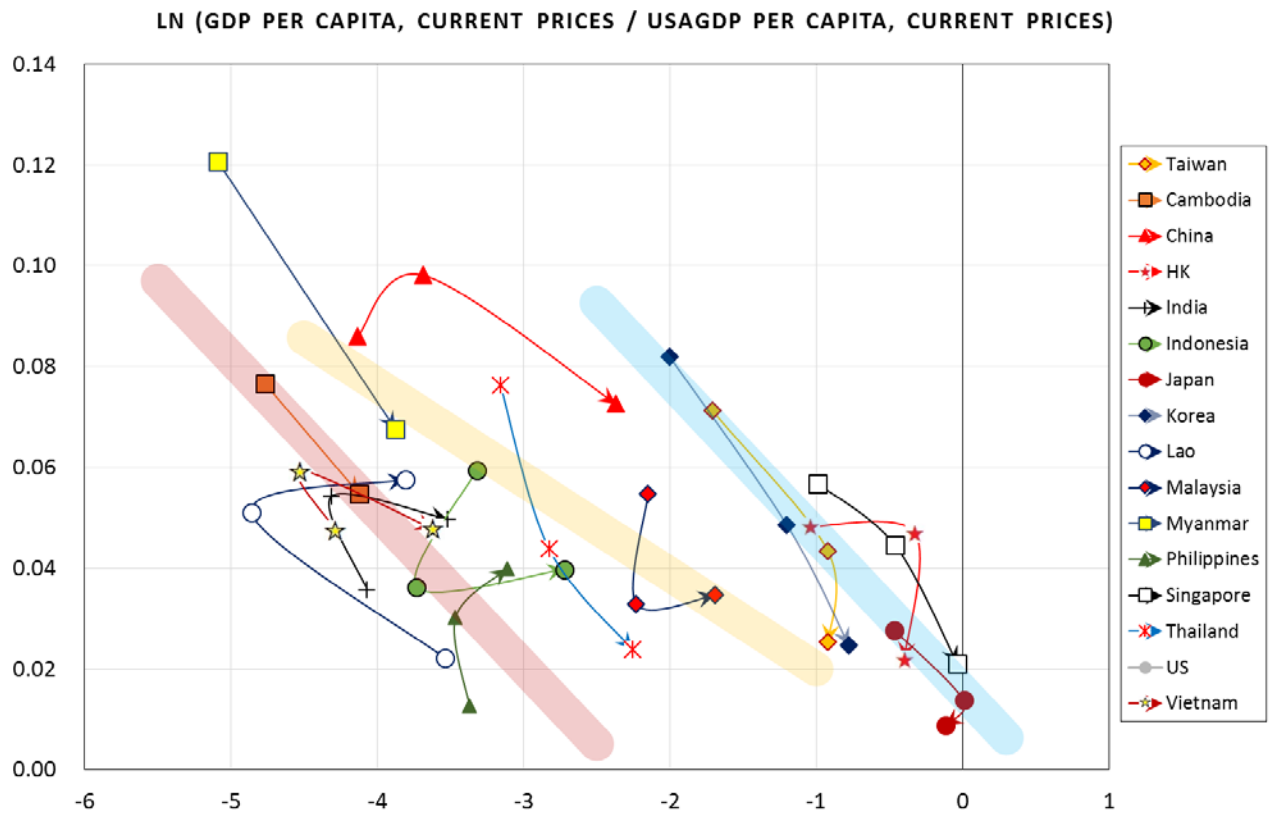


Figure 9: Three grouping of countries, Case 2

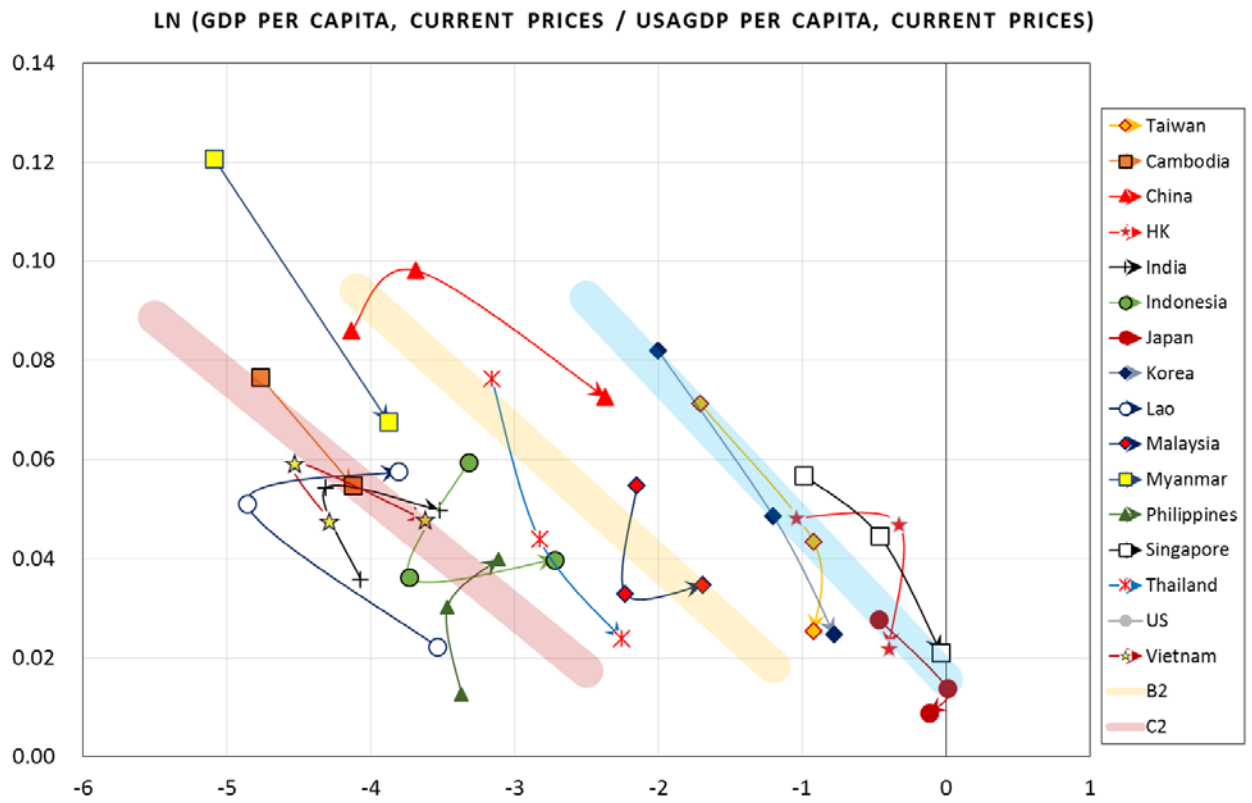


Figure 10: Three grouping of countries, Case 3

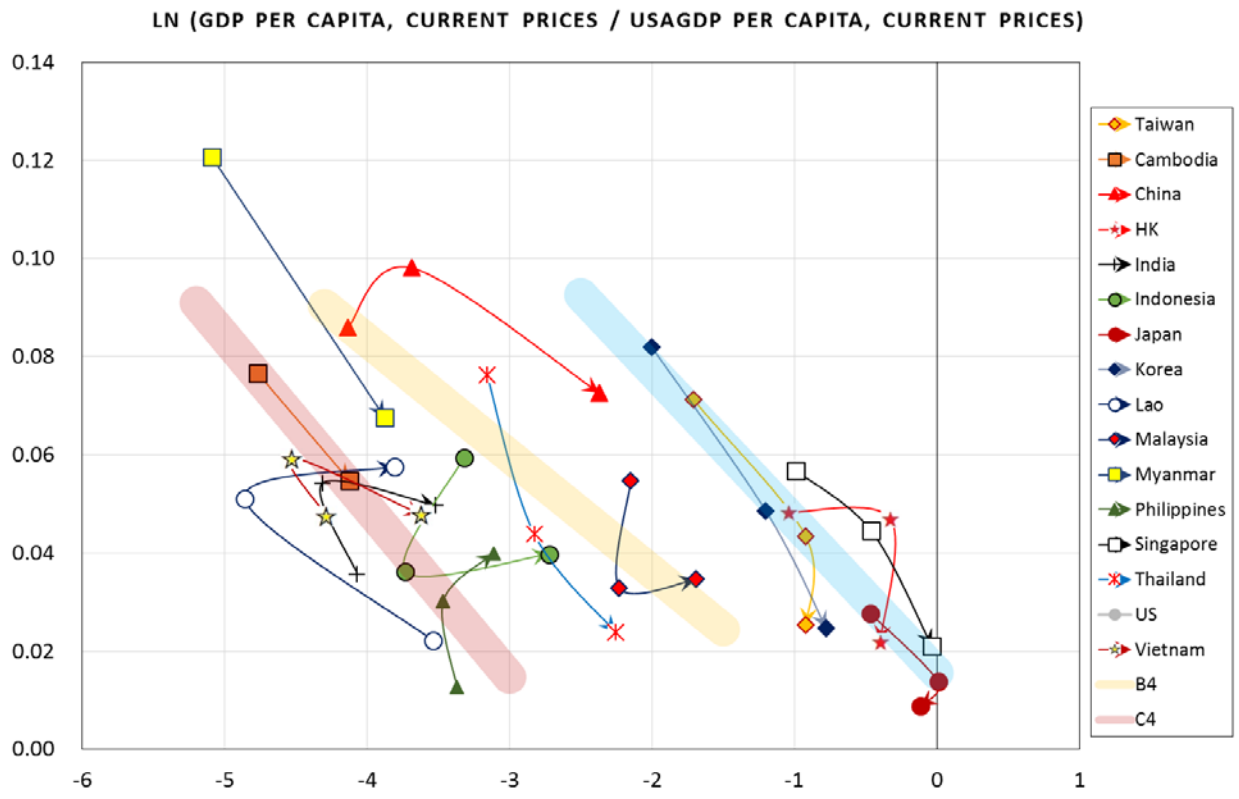


Figure 11: Punctuated Conditional

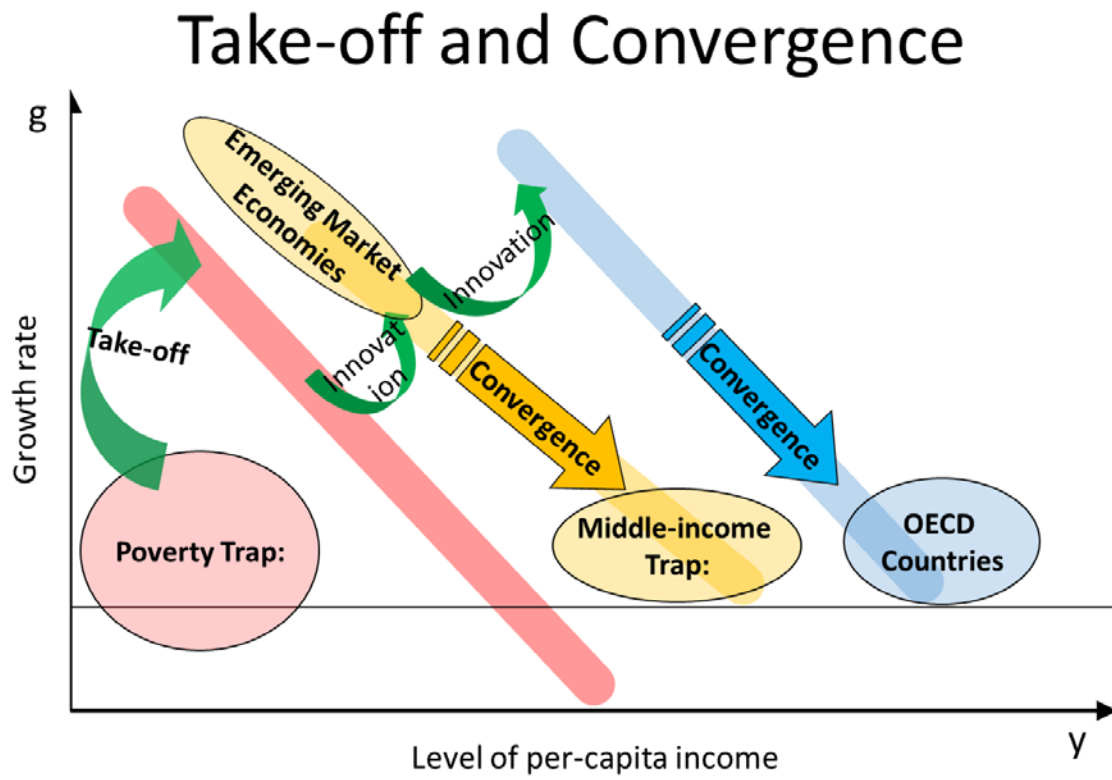




Figure A-1

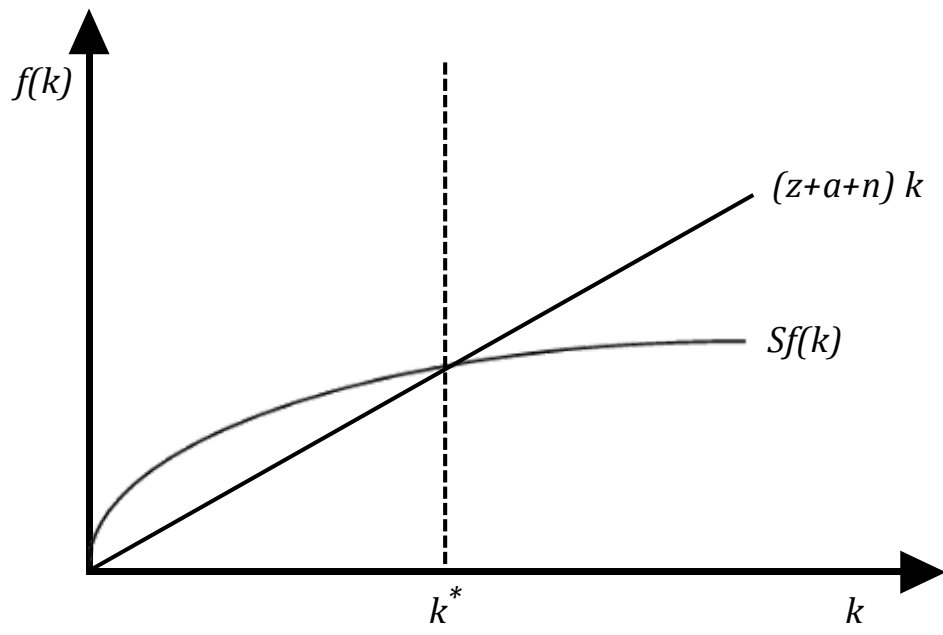


Figure A-2

