

Growth Convergence and the Middle-Income Trap

TAKATOSHI ITO*

Emerging market economies in East Asia have followed a similar growth path (growth convergence) from a low-income, high-growth state to a middle-income, middle-growth state through industrialization. The economic development of Japan was followed by the “four tigers” (Hong Kong, China; the Republic of Korea; Singapore; and Taipei, China) in the 1970s; and subsequently by members of the Association of Southeast Asian Nations in the 1980s and the People’s Republic of China in the 1990s and 2000s.

The growth rates of Asian economies are slowing over time and may fall to advanced economy levels before incomes fully catch up with the advanced economies. This is defined as the middle-income trap in the paper.

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

Keywords: Asian financial crisis, global financial crisis, growth convergence, middle-income trap

JEL codes: O11, O14, O33, O40

I. Introduction

Over the past several decades, East Asian economies have achieved higher economic growth rates than economies in other regions. These Asian economies have all followed a similar growth path (growth convergence) from a low-income, high-growth state to a middle-income, middle-growth state through industrialization. Among them, Japan and Singapore have reached advanced economy status. The economic development of Japan was first followed by the “four tigers” (Hong Kong, China; the Republic of Korea; Singapore; and Taipei, China) in the 1970s; and subsequently by members of the Association of Southeast Asian Nations (ASEAN) in the 1980s and the People’s Republic of China (PRC) in the 1990s and 2000s.

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The history of economic development in Asia comprises several distinct stages. In the 1950s, Japan was already experiencing rapid growth of 10% annually. However, this was viewed as an isolated example of a prewar industrial powerhouse in Asia returning to the level of development it enjoyed before the devastation of the Second World War. Meanwhile, other Asian economies were still struggling to establish effective forms of government after gaining their independence from colonial powers.¹ Most Asian economies were characterized by populous urban areas with widespread poverty and stagnant agrarian sectors in rural areas. The most influential work at the time, Gunnar Myrdal's *Asian Drama*, offered a pessimistic view of the region's prospects for economic development. He argued that the burden of large populations, among other factors, was too great to overcome.

In the 1960s and 1970s, the "four tigers"—Hong Kong, China; the Republic of Korea; Singapore; and Taipei, China—experienced rapid and accelerating growth. Both the Republic of Korea and Singapore had strong governments that pursued industrial policy—government planning to encourage particular industries through zoning, subsidies, and the allocation of credit. These two economies increased their production and export of goods in sectors that Japanese industries had yielded in order to move to higher value-added goods. The success of the four tigers eventually prompted policy changes in Southeast Asian economies. Growth rates in Indonesia, Malaysia, and Thailand started to rise in the mid-1980s. As rapid growth spread to these ASEAN economies, Asia began attracting increased global attention. In 1993, the World Bank painted a very positive picture of East Asian industrialization, export-oriented policies, and equitable growth in *The East Asian Miracle*, which replaced *Asian Drama* as a representative view of the region.

The positive view of East Asia suffered a brief setback in the wake of the 1997/98 Asian financial crisis (AFC). The currency crises in East Asia—particularly in Indonesia, the Republic of Korea, and Thailand, all of which required International Monetary Fund assistance—were blamed on crony capitalism and excessive risk in the banking sector, among other factors. The image of manufacturing success was replaced by one of financial failure. However, most Asian economies experienced a V-shape recovery and learned valuable lessons from the experience. Banking sectors were reformed and foreign reserves were accumulated as a buffer against volatile capital flows. During the 2008–2009 global financial crisis (GFC), no Asian banks failed due to collapsing values for asset-backed securities and related financial products. The damage to East Asian growth during the GFC was much shallower than that endured during the AFC.

However, growth rates in Asian economies today are slowing down to those of advanced economy levels. A fear is that these economies will never catch up with the income levels of advanced economies and instead will be trapped in

¹Most Asian economies were colonized by a European power, except for Thailand, which was never colonized, and the Philippines, which was colonized first by Spain and then by the United States (US).

middle-income status. Several factors contribute to this pessimism. Japan has experienced 2 decades of stagnation. At the same time, the PRC has excelled on all fronts of industry, leaving behind some of its neighboring economies that have not been able to similarly overcome constraints to growth such as a lack of infrastructure and human capital development.

In order to explain the long-run growth experiences of Asian economies 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 income level and the growth rate is often depicted as a downward-sloping convergence line. This relationship is derived from diminishing returns to capital. The convergence path has often been evident in time series data for individual economies, but it has been difficult to find in cross-section or panel data. Within a group of economies such as the Organisation for Economic Co-operation and Development, 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 a global convergence path assumes that economies' production functions, including their technological level and productivity, are identical and the only difference is the initial level of capital (per capita). Therefore, an unconditional convergence is refuted easily. The literature instead favors conditional convergence that allows for differences in culture, geography, colonial heritage, and other socioeconomic variables as initial conditions. Hence, there can be different convergence lines for different groups of economies.

In the failed attempt to find unconditional convergence, East Asian economies show positive forecast errors, which means that East Asian economies recorded higher growth rates than South Asian, African, and Latin American economies at the same income levels. Hence, developing East Asian economies have moved toward advanced economy income levels much faster than economies in other regions. Although the "Asian Miracle" can be attributed to many factors, it remains untested whether East Asia as a region can be treated as one group and if the experiences across the region are common.

This paper focuses on growth convergence in East Asia. It looks at panel data for major economies in the region. The first test is whether they share a common, unconditional convergence path, which appears not to be the case. Instead, this paper finds three distinct convergence paths in East Asia: (i) one path that converges to a low-income steady state, (ii) another that converges to a middle-income steady state, and (iii) a third that converges to a high-income steady state. An economy can shift from one convergence line to a higher one by implementing economic reforms, such as the opening of the PRC's economy beginning in 1978 and Viet Nam's *doi moi* (reconstruction) policy launched in 1986. Without reform, an economy may end up in the poverty trap (steady state of the low-income convergence path) or the

middle-income trap (steady state of the middle-income convergence path). Data suggest that the PRC is moving from a middle-income convergence path to a high-income path and that the Philippines is moving from a low-income path to a middle-income path. Thailand seems to be headed for the middle-income trap.

According to the hypothesis of three distinct convergence paths, the fear of being trapped in middle-income status can be understood as the policy failure to make a leap from one convergence line to a higher one. This leap requires economic reforms to stimulate innovation.

The rest of the paper is organized as follows. Section II reviews the growth performances of East Asian economies from 1985 to 2015. These economies suffered more during the AFC than during the subsequent GFC. Section III establishes that there is a long-run slowdown in the growth rate in almost all economies in East Asia. However, the slowdown may be perfectly natural if growth convergence is taking place. A crucial question is whether there is a common convergence path for all Asian economies and, if not, how many such paths exist.

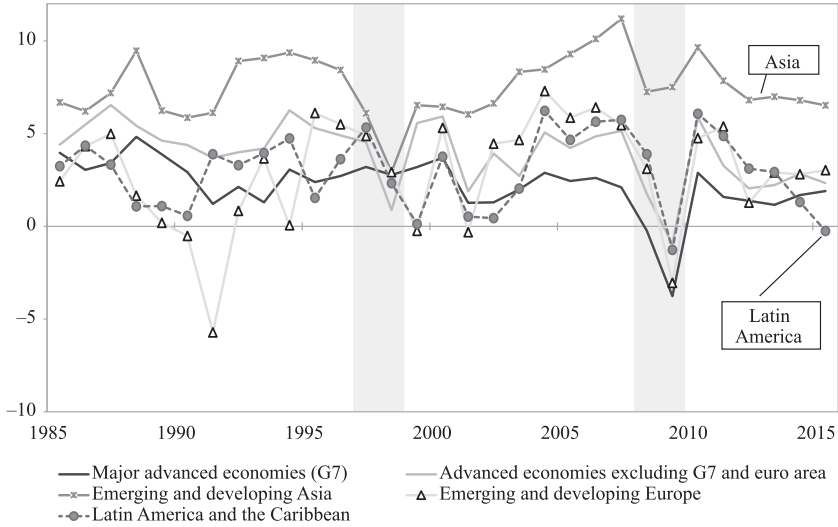
Section IV establishes that in Asia there are three convergence paths: low income, middle income, and high income. Economies can and do jump from one convergence path to another by pursuing reforms and stimulating innovation. When an economy fails to jump from a middle-income convergence path to a high-income convergence path, it is said to be caught in the middle-income trap.

II. Impacts of the 1997/98 Asian Financial Crisis and the 2008–2009 Global Financial Crisis

The GFC had significant impacts on many economies and affected most severely the United States (US) and Europe. Asian economies suffered from negative spillovers from the advanced economies, but the negative impact on growth was much less than in other regions. This showed the economic resilience of the Asian region. For emerging Asia, the dip in growth rates during the GFC was much shallower than during the AFC. The severe impacts in Asia in 1997/98 were due to the fact that the crisis originated in some of the region's economies. Figure 1 presents time series data (1985–2015) for real gross domestic product (GDP) growth rates of various regions as defined by the International Monetary Fund. Figure 1 shows that Asia has consistently grown faster than other regions except during crisis periods, the most serious of which was the AFC.

Figure 2 presents time series data (1985–2015) for the growth rates of Japan and the four tigers (Hong Kong, China; the Republic of Korea; Singapore; and Taipei, China). The figure shows that the four tigers experienced larger dips in growth during the AFC than the GFC, while Japan exhibits the opposite pattern. In addition, the medium-term growth trends of the four tigers declined from the pre-AFC period (1985–1996) to the intercrises period (1999–2007), and again in the post-GFC period (2010–2015).

Figure 1. **Growth Rates: Asia versus Other Regions**
GDP, constant prices (year-on-year, % change)

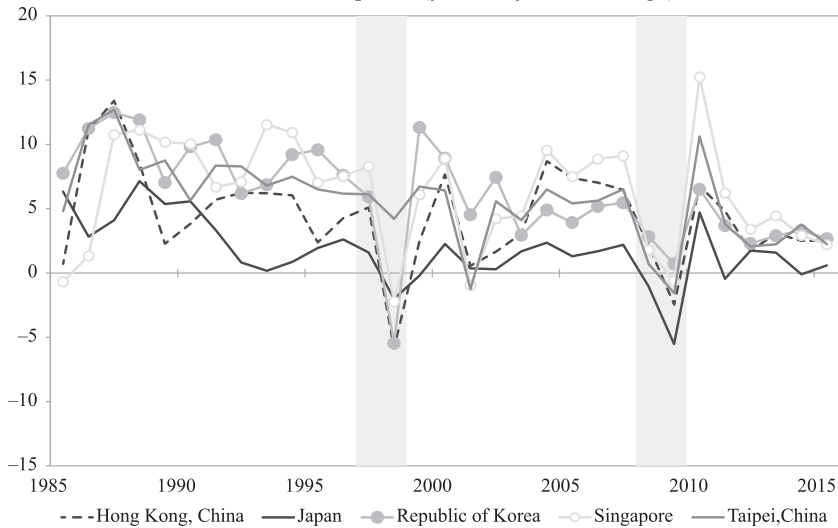


GDP = gross domestic product.

Source: International Monetary Fund. *World Economic Database, October 2015.*

<https://www.imf.org/external/pubs/ft/weo/2015/02/weodata/download.aspx>

Figure 2. **Growth Rates of Japan and the “Four Tigers”**
GDP, constant prices (year-on-year, % change)

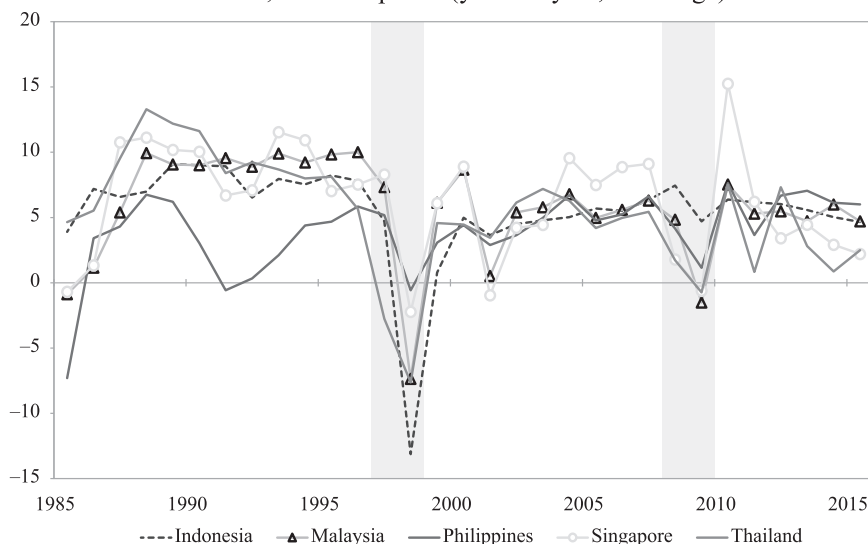


GDP = gross domestic product.

Source: International Monetary Fund. *World Economic Database, October 2015.*

<https://www.imf.org/external/pubs/ft/weo/2015/02/weodata/download.aspx>

Figure 3. **Growth Rates of Members of the Association of Southeast Asian Nations**
GDP, constant prices (year-on-year, % change)



GDP = gross domestic product.

Source: International Monetary Fund. *World Economic Database*, October 2015.

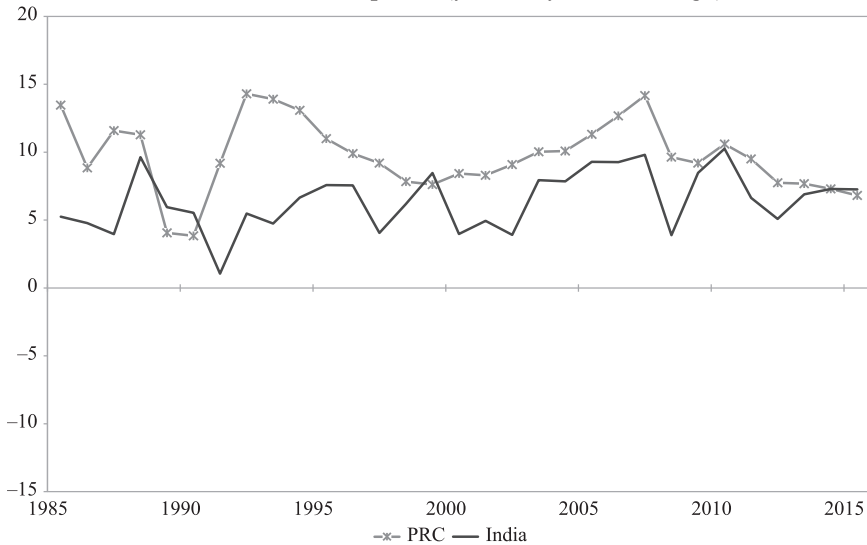
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Since the PRC seems to dominate the economic statistics of emerging Asia, a decomposition of the region is necessary. Figure 3 presents growth rates over the same time period for the five original members of ASEAN, which are collectively referred to as ASEAN-5, to show a representative group from emerging Asia.² (Singapore appears both in Figure 2 and Figure 3.) A long-run growth slowdown between the 1980s and 2010s is evident. Annual growth of less than 5% in the 2010s has prompted concerns that Indonesia, Malaysia, and Thailand could fall into the middle-income trap. While the Philippines used to be at the bottom of the ASEAN-5 growth rankings, it has been the highest-performing economy among the ASEAN-5 in the first half of the 2010s. The Philippines' growth rate accelerated in the post-GFC period when other ASEAN economies, as well as advanced economies, experienced growth slowdowns. Over the same period, the growth rate of Singapore, despite its high per capita income, has been comparable to those of Indonesia, Malaysia, and Thailand. This implies that the income gap between Singapore and these other three economies has not yet narrowed and that they may not be on the same convergence path.

Figure 4 shows the growth patterns of the PRC and India in the 1985–2015 period. Under Deng Xiaoping, the PRC introduced major market-oriented reforms

²ASEAN was established in August 1967 by Indonesia, Malaysia, the Philippines, Singapore, and Thailand.

Figure 4. **Growth Rates of the People's Republic of China and India**
GDP, constant prices (year-on-year, % change)



GDP = gross domestic product.

Source: International Monetary Fund. *World Economic Database, October 2015*.

<https://www.imf.org/external/pubs/ft/weo/2015/02/weodata/download.aspx>

in 1978, including the privatization of many state-owned enterprises, that gradually opened its economy to the rest of the world. As a result, its growth rate accelerated rapidly in the 1980s before experiencing a large dip in 1989/90, which coincided with a decline in foreign direct investment (FDI) following the 1989 Tiananmen Square protests. Reforms continued after Deng Xiaoping's retirement in 1992. The Shanghai Stock Exchange was reopened in 1990 after a 41-year closure and multiple foreign exchange rates were unified in 1994. From 1991 through 2001, the PRC maintained a very high annual average growth rate of more than 10%. Only recently has the PRC's growth rate slowed, which is typical for any economy that has achieved 10% annual growth for 20 years.³

India's economic growth over the last 30 years has been consistently lower than that of the PRC, leading to a widening of the income gap between them. Rather than a convergence, there appears to be a divergence between the two economies. However, India's growth rate has accelerated since a balance of payment crisis in 1991 prompted widespread reforms that moved the economy away from socialism. Today, India continues to pursue a gradual reform process of privatization and the removal of regulatory barriers.

³Japan also experienced an average annual growth rate that exceeded 10% during the 1950s and 1960s before slowing in the 1970s.

Table 1. **Period Average Growth Rates**
(%)

	Pre-AFC 1985–1996	Intercrisis 1999–2007	Post-GFC 2010–2015
Hong Kong, China	4.8	4.7	2.2
Japan	2.8	1.4	0.9
Republic of Korea	8.2	4.8	2.5
Singapore	5.7	4.4	2.1
Taipei, China	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 PDR	2.2	5.1	5.8
Myanmar	NA	12.1	6.8
Viet Nam	4.8	5.9	4.8
PRC	8.6	9.8	7.3
India	3.6	5.4	5.0

AFC = Asian financial crisis, GFC = global financial crisis,
Lao PDR = Lao People's Democratic Republic, PRC = People's
Republic of China.

Source: Author's compilation.

III. Slowdowns in Growth

Since the GFC, many advanced economies have struggled to stimulate growth even with highly accommodative monetary policies and fiscal stimulus. Some economists have argued that advanced economies have entered a new phase marked by secular stagnation and a slower pace of technological innovation. Others regard the slowdown as a more normal process, considering that the GFC originated in the advanced economies. It has been commonly observed that economies in which crises originate suffer from dysfunctional financial markets that drag down real economic activity. Hence, the post-GFC slowdown in growth is not surprising.

Emerging market economies have also suffered a growth slowdown since the GFC. The PRC's growth rate slowed from 10% in 2010 to less than 7% in 2015. This has led to declines in global commodity prices that have affected a number of resource-producing economies. Other Asian economies have experienced a similar growth slowdown in the aftermath of the GFC.

Table 1 summarizes the average growth rates for three periods: pre-AFC (1985–1996), intercrises (1999–2007), and post-GFC (2010–2015). For most emerging East Asian economies, the post-GFC period saw growth below that of the intercrises period preceding the GFC, which also saw slower growth than during the pre-AFC period. Typically, the period average growth rates, $g(\text{period})$, of emerging Asian economies is as follows:

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

Three notable exceptions to this stylized fact are India, the Lao People's Democratic Republic (Lao PDR), and the Philippines. These three economies experienced accelerating growth rates between the pre-AFC and intercrises periods, and again between the intercrisis and post-GFC periods. The reasons for these gains include improved macroeconomic policy management in the Philippines finally bearing fruit, while in the Lao PDR the increased exports of hydropower-generated electricity to Thailand is boosting economic growth.

Many policy makers and scholars view the postcrisis slowdown and stagnation among emerging economies as a stylized fact, while lamenting that growth rates have not yet recovered to their pre-GFC levels. More recently, policy makers in ASEAN-5 economies have expressed concern over the middle-income trap. Although their national income remains at upper-middle levels, their potential growth rates seem to have declined significantly since the GFC. Meanwhile, the PRC's industrial potential has caught up to ASEAN-5 levels, while innovation in ASEAN-5 economies seem to have failed in catching up with that of Japan, the Republic of Korea, and Singapore.

Yet, the middle-income trap is too easy an explanation for the slowdowns in growth observed in Table 1. The lingering effects of the GFC and the subsequent volatility in capital flows are also partially to blame, which is consistent with at least three other hypotheses for explaining declining growth rates in emerging East Asian economies: (i) postfinancial crisis slowdown, (ii) global secular stagnation, and (iii) growth convergence.

A postfinancial crisis slowdown is not a unique occurrence. Reinhart and Rogoff (2009, 2014) have argued that the median length of time needed to return to precrisis growth levels is about 6.5 years. In fact, “[5 to 6] years after the onset of crisis, only Germany and the US (out of 12 systemic cases) have reached their 2007–2008 peaks in real income” (Reinhart and Rogoff 2014, 50). This tendency can help explain the slowdown of growth in East Asian economies between the pre-AFC period and the intercrises period. However, it may not explain the slowdown between the intercrises period and the post-GFC period since Asia did not suffer a financial crisis during the GFC. Rather, the slowdown experienced during the GFC was transmitted through trade channels from advanced economies to Asia.

Another possibility for the Asian growth slowdown is that it is in line with global secular stagnation. Not only growth rates, but also inflation and real interest rates have been declining since the early 1990s (Bean et al. 2015). Asia may be suffering from a global lack of aggregate demand and a savings glut. Any explanations that are consistent with secular stagnation are most applicable to advanced economies. Hence, emerging Asian economies are unlikely experiencing a state of secular stagnation; that is, one in which persistent aggregate demand is less than aggregate supply.

The last explanation for the growth slowdown in emerging Asia is the theory of growth convergence. The stylized fact of slowing growth rates can be

viewed as part of the process of convergence in addition to the lingering effects of a crisis.

IV. Growth Convergence

A. Concept of Growth Convergence

In the growth literature, the phenomenon known as convergence is theoretically predicted and empirically observed. Given common technology, the higher an economy's income level, the slower its growth rate will become. Put differently, a low-income economy can grow faster than a high-income economy since the marginal contribution to the growth of capital accumulation is much higher among low-income economies. As the Appendix details, the typical convergence equation can be written as

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

where g_j denotes the per capita income growth rate, a is the steady-state growth rate, $y_j(t)$ is the country 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, which is the second term. The more the current per capita income level is below the steady-state level, the higher the growth rate becomes. This is what allows economy j to converge to the steady state.

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

The steady state for economy j may not be known in reality, unless the economy reaches that stage of constant growth. However, among the advanced economies, it is expected that the steady state (or the goal of the catch-up process) is the income level and growth rate in the US. Advanced economies should converge to the US (or Organisation for Economic Co-operation and Development) 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 of the per capita GDP growth rate and per capita GDP at the beginning of the period. As stated

above, low-income economies can grow faster than high-income economies. There may be several reasons for this. First, the high marginal productivity of capital in low-income economies implies a higher growth rate. This is possible even if the production function has the same specification. Second, it is more likely that a low-income economy has a lower level of technology, which depresses the income level. However, it is possible to achieve a higher growth rate through technology transfers and learning-by-doing. For a low-income economy, imitation, not innovation, may be enough to increase total factor productivity. Third, starting from low levels of infrastructure and human capital, public spending on these public goods and education can easily increase productivity. In the conditional convergence literature, conditions are often fixed at the initial point (the year in which the analysis starts) so that growth can be tracked in subsequent decades.

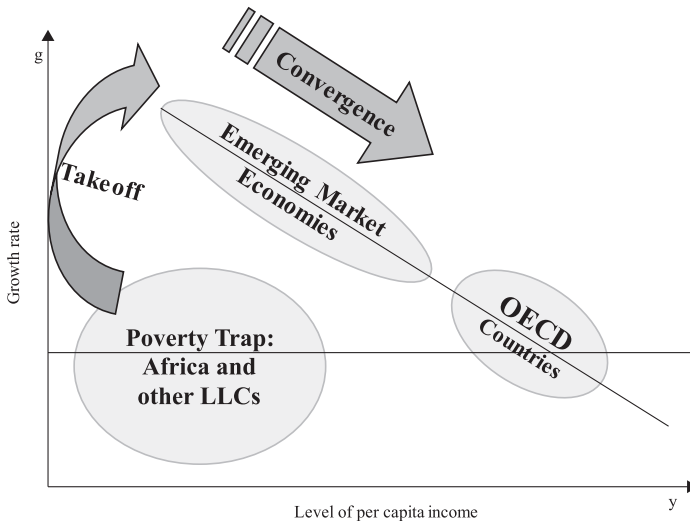
Of course, not all low-income economies can achieve high rates of growth. There are many economies that are stuck in a low-income, low-growth state. Many factors can explain the poverty trap. For example, much of the population may be living at a minimum subsistence level so that they have to spend all of their time farming, fishing, or hunting rather than increasing human capital (e.g., education) or improving productivity (e.g., machines). Hence, poverty begets poverty. Under these conditions, a large population was once considered to be a disadvantage (Myrdal 1968). Having exportable resources helps in theory, but often public sector corruption has led to the skimming of export revenues for personal benefits.

Many East Asian economies, which typically lack significant natural resources, have successfully escaped the poverty trap. Scholars and policy makers in East Asian economies tend to credit industrial policies for the takeoff. Under such policies, the government directs resources and credit to industries with the best chances to become competitive in global markets. Private sector companies compete in productivity and those who succeed in exports are rewarded by the government with more resources and financial incentives. The typical East Asian government has also spent substantial amounts on physical infrastructure networks (e.g., roads, electricity, rail, and ports) and the nationwide education system. The positive view of market-friendly interventions by benevolent governments is still prevalent in East Asia. The Asian Miracle, as portrayed by the World Bank (1993), is applicable to the experiences of Japan, the four tigers, and ASEAN-5.

The typical growth convergence pattern is depicted in Figure 5. Once a takeoff from the poverty trap has occurred, often resulting from a big push by the government or significant policy reforms, the economy reaches the growth convergence line and enjoys a virtuous circle of higher growth and more investment as the income level of the population increases.

Although this view is strongly supported by time series data for economies in East Asia, any casual test or rigorous extension to other regions—such as South Asia, Latin America, and Africa—tends to fail. Cross-section and panel data analyses involving all economies in the world for which data are available fail to produce

Figure 5. Growth Convergence



Source: Author's illustration.

a downward-sloping convergence line (see, for example, Barro 1991). Hence, East Asia is considered the exception rather than a standard role model.

A single convergence line used in an attempt to explain many economies needs a strong assumption that the specification of the production function is identical across economies and that the only difference is the degree of capital accumulation. In reality, the technological level, whether it is embodied in labor or capital, may be vastly different across economies. Technological progress, often measured through total factor productivity, also differs, as well as the respective shares of capital and labor.

Many factors that are relevant to the production function in each economy can explain differences in growth. The list ranges from historical and geographic conditions to institutions and accumulated human capital. Historical conditions can also include human capital (Barro 1991; Mankiw, Romer, and Weil 1992) and an economy's "colonial origin" (Acemoglu, Johnson, and Robinson 2001, 2002). Demography also matters since the population's age composition, in addition to its overall size, is important for labor inputs (Bloom, Canning, and Malaney 2000). Thus, it becomes standard to consider "conditional convergence," in which the rate of convergence differs among different economies. Hence, convergence paths may not be unique, but rather multiple paths might exist. Theoretically, this reflects differences in the level of technology and its growth contribution (see, for example, Han and Wei 2015).

FDI has played an important role in East Asia's development, with the conspicuous exceptions of Japan and the Republic of Korea. FDI brings in both

physical capital and technology associated with the use of capital. Borensztein, De Gregorio, and Lee (1998) showed that FDI contributes more to growth than domestic investment, presumably due to technology transfers; but this only holds when the host economy has sufficient absorptive capacity through accumulated human capital. This appears to be the case in East Asia where educational attainment is relatively high.

B. Stylized Facts of Growth Convergence in Asia

In the rest of this section, I will present the growth convergence pattern in East Asia and propose a framework that encompasses notions of the poverty trap, the middle-income trap, and conditional convergence.⁴ Three periods—pre-AFC (1985–1996), intercrises (1999–2007), and post-GFC (2010–2015)—are used as in previous sections. The crisis years (1997–1998 and 2008–2009) are omitted to avoid having average growth rates altered by these two unusual crises. The following discussion uses the period average per capita growth rates as the vertical axis and the log of per capita income (US dollars converted at market exchange rates) of the first year of each period as the horizontal axis. The sample economies are Japan, the four tigers, the ASEAN-5, the four low-income members of ASEAN, the PRC, and India.⁵ Recall that the period average growth rates are shown in Table 1.

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 economy move along the line from the northwest to the southeast. If several economies can be plotted on the same line, then those economies are expected to converge in the same growth model (technology) toward a high-income, low-growth steady state, which is the goal of development.

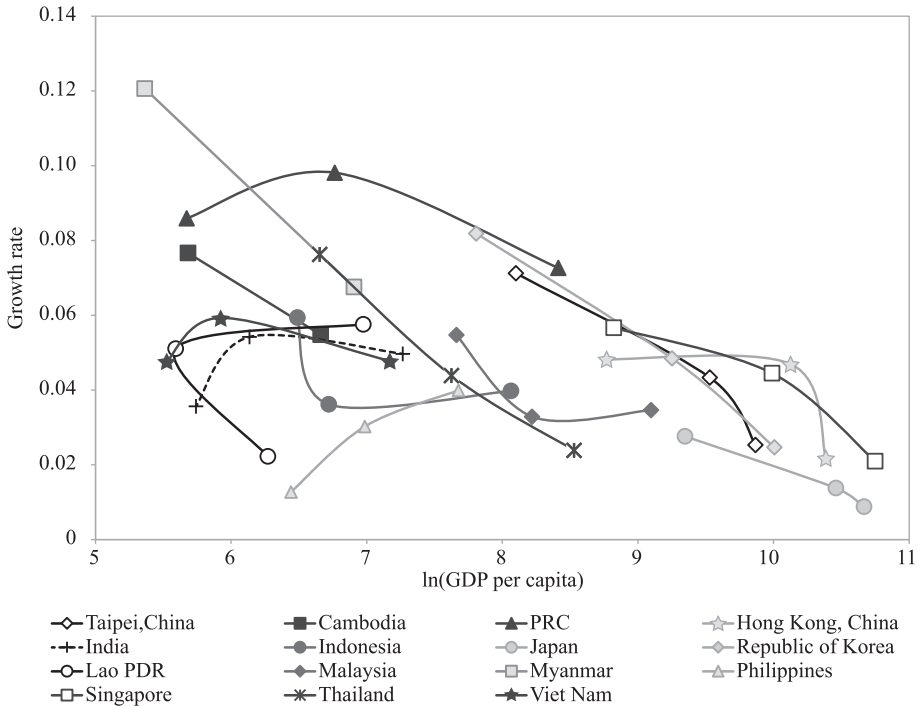
As a first attempt, Figure 6 includes all of the aforementioned East Asian economies and India in one graph. The connected dots for each economy are mostly downward sloping, suggesting that growth convergence is evident in the time series data of each economy. Some low-income economies show an upward-sloping line. These upward movements, which depict an acceleration of growth as the income level rises, may actually be part of the takeoff from a poverty trap that resulted from a previously dysfunctional government implementing major reforms.

However, Figure 6 is not appropriate when the global leader, the US, is also moving toward the right on the convergence graph. To be precise, growth convergence should be interpreted as a convergence to the US income level and its steady-state growth rate of about 2% per year.

⁴The term middle-income trap was first proposed by Gill and Kharas (2007).

⁵The four low-income ASEAN member economies are Cambodia, the Lao PDR, Myanmar, and Viet Nam.

Figure 6. Growth Convergence in East Asia
 $\ln(\text{GDP per capita, current prices } [\text{\$}])$



GDP = gross domestic product, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
 Source: Author's calculations.

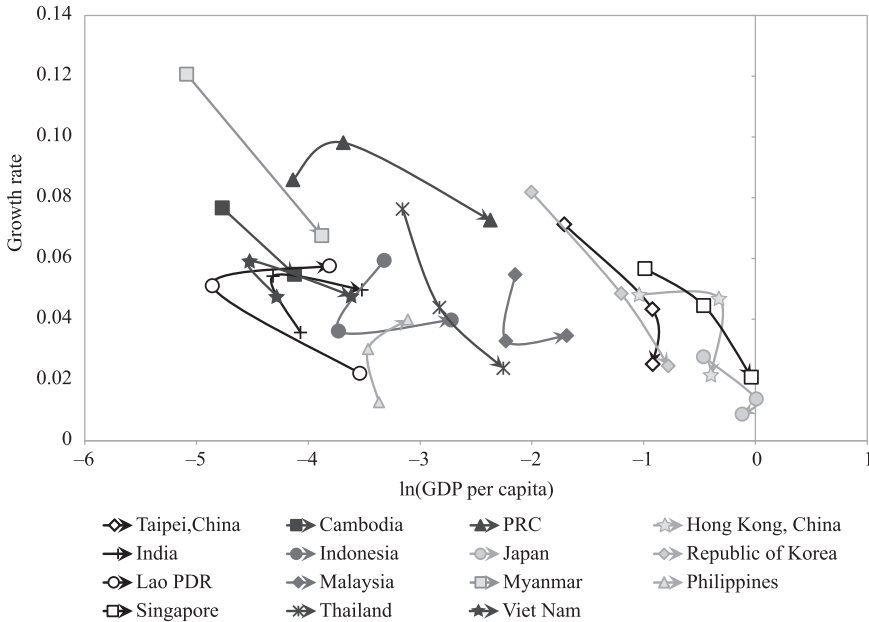
In order to take this into account, the horizontal axis of Figure 7 is modified to be the log difference of an economy's per capita income level to the log of the US per capita income level. The zero in the horizontal axis implies reaching the US per capita income level. Figure 7 shows relative convergence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

C. Multiple Convergence Paths

Figure 7 shows that three distinct groups of economies can be grouped together to share a common convergence path. Group 1 is the high-income group comprising Japan and the four tigers. Group 2 is the middle-income group comprising the PRC, Indonesia, Malaysia, Thailand, and the post-GFC Philippines. Group 3 is the low-income group comprising Cambodia, the Lao PDR, Myanmar, and Viet Nam, as well as India and the pre-AFC and intercrises Philippines.

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Figure 7. **Growth Convergence in East Asia: Relative to the US**
 $\ln(\text{GDP per capita, current prices} / \text{US GDP per capita, current prices})$



GDP = gross domestic product, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China, US = United States.

Source: Author's calculations.

Japan and the four tigers clearly belong to the same group as the plots for each of these economies line up on a straight convergence line with little deviation. The PRC seems to have moved from the low-income group to the middle-income group and is approaching the high-income group.

Both Indonesia and the Philippines are on the border area between Groups 2 and 3, while exhibiting atypical time series behavior in that they are not downward sloping. Indonesia has a lower growth rate and per capita income level during the intercrises period than in either the pre-AFC or post-GFC periods, reflecting lasting damage from the AFC that included a significant income decline and the depreciation of the rupiah. Intercrisis Indonesia is close to being in the low-income group, while during the pre-AFC and post-GFC periods, it is closer to being in the middle-income group.

The Philippines' time series data show upward movement; its growth accelerated as the income level rose, which is the opposite of what growth convergence predicts. This unusual behavior may be due to long-term improvements in socioeconomic and political conditions over a 30-year period. Political stability and better governance after the AFC and, in particular, after the GFC are often credited with improving the investment climate in the Philippines.

I will now 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 intercrises period is in the low-income group and in the other two periods is in the middle-income group. The Philippines in the pre-AFC and the intercrises periods is in the low-income group and in the post-AFC period is in the middle-income group.

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

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

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

Table 2 shows the regression results for all three Indonesia–Philippines cases mentioned above. Using the estimated values of a and b , growth convergence lines can be superimposed on Figure 7.

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 Groups 2 and 3 have wide variations around them.

Similarly, Figures 9 and 10 show the growth convergence lines for Cases 2 and 3, respectively, since it is an open question as to whether or not Indonesia and the Philippines should be included in the middle-income group. With all three cases presented, it serves as a robustness test regarding the grouping of economies.

All three figures show downward-sloping convergence lines. Convergence lines are almost parallel in Case 3. In all cases, the middle-income convergence reaches the steady-state growth rate, g , of 2%, but does not reach the level of the high-income steady state. Hence, it is not a matter of fast or slow convergence with the high-income steady state, but the middle-income trap does exist. To avoid it, economies on the middle-income convergence line have to eventually make the jump to the high-income convergence line.

The three convergence lines suggest that if an economy fails to jump from one convergence path to a higher one, then the economy will end up in a state in which the gap with the US income level cannot be narrowed.

D. Conditional Convergence with Jumps

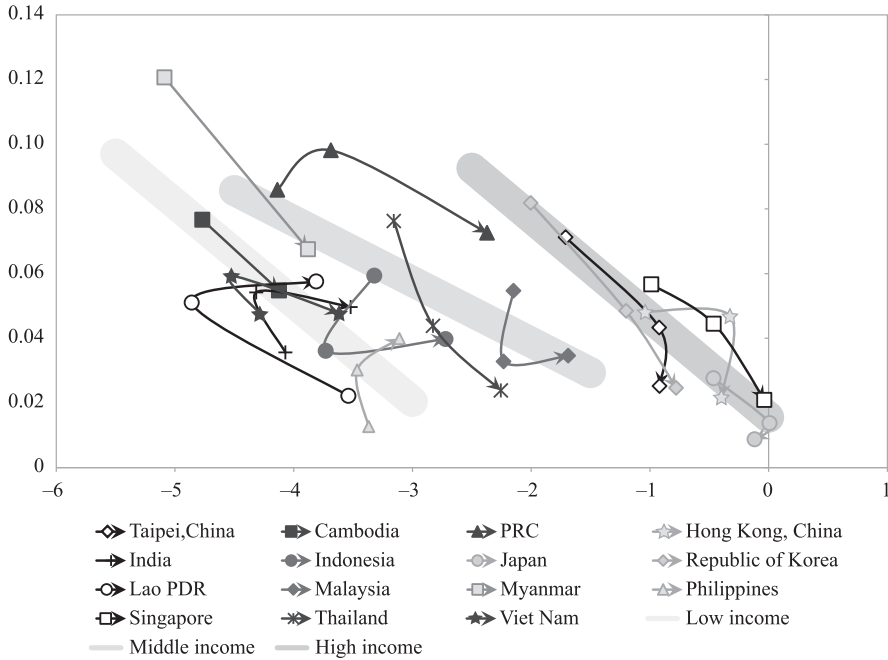
Figure 11 explains in a schematic way how jumps are required to avoid a trap: one type of jump is from a low-income convergence path to a middle-income one,

Table 2. Conditional Convergence

	Case 1			Case 2			Case 3		
	α	β	# obs	α	β	# obs	α	β	# obs
Group 1									
Coefficient	0.016	-0.031	Coefficient	0.016	-0.031	Coefficient	0.016	-0.031	Case 1: Hong Kong, China; Japan; Republic of Korea; Singapore; and Taipei,China
STD Er	0.005	0.005	STD Er	0.005	0.005	STD Er	0.005	0.005	
t-stat	3.298	-6.172	t-stat	3.298	-6.172	t-stat	3.298	-6.172	Case 2: Hong Kong, China; Japan; Republic of Korea; Singapore; and Taipei,China
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		Case 3: Hong Kong, China; Japan; Republic of Korea; Singapore; and Taipei,China
# obs	15		# obs	15		# obs	15		
Group 2									
Coefficient	0.001	-0.019	Coefficient	-0.013	-0.026	Coefficient	-0.011	-0.024	Case 1: PRC, Indonesia, Malaysia, and Thailand
STD Er	0.023	0.008	STD Er	0.021	0.007	STD Er	0.021	0.007	Case 2: PRC, Indonesia, Malaysia, and Thailand
t-stat	0.050	-2.359	t-stat	-0.629	-3.517	t-stat	-0.518	-3.212	Case 3: PRC; Malaysia; and Thailand; Indonesia (t = 1, 3); Philippines (t = 3)
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									
Coefficient	-0.071	-0.031	Coefficient	-0.042	-0.024	Coefficient	-0.089	-0.035	Case 1: Cambodia, India, Lao PDR, Myanmar, Philippines, Viet Nam
STD Er	0.031	0.008	STD Er	0.027	0.007	STD Er	0.033	0.008	
t-stat	-2.282	-3.973	t-stat	-1.584	-3.537	t-stat	-2.711	-4.309	Case 2: Cambodia, India, Indonesia, Lao PDR, Myanmar, Philippines, Viet Nam
p stat	0.039	0.001	p stat	0.132	0.003	p stat	0.017	0.001	Case 3: Cambodia; India; Indonesia (t = 2); Lao PDR; Myanmar; Philippines (t = 1, 2); Viet Nam
R-bar sq	0.496		R-bar sq	0.39		R-bar sq	0.539		
# obs	16		# obs	19		# obs	16		

Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
Source: Author's calculations.

Figure 8. **Three Groupings of Economies—Case 1**
 $\ln(\text{GDP per capita, current prices} / \text{US GDP per capita, current prices})$



GDP = gross domestic product, Lao PDR = Lao People’s Democratic Republic, PRC = People’s Republic of China, US = United States.

Source: Author’s calculations.

and the other jump is from a middle-income convergence path to a higher-income one.

A group of economies belongs to the same convergence line. For example, Japan and the four tigers belong to one convergence line, while middle-income ASEAN economies share another line. The low-income ASEAN economies also have a common convergence path. This means that economies that belong to the same convergence path have a similar level of technology. The difference among them is the degree of capital accumulation.

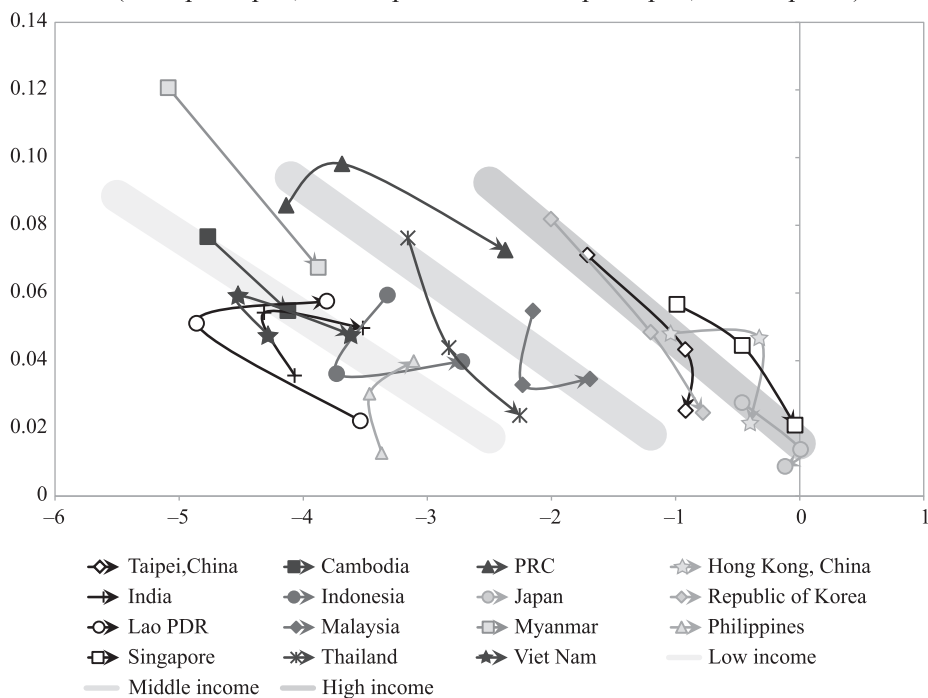
The PRC maintains a relatively high growth rate although its per capita income level is approaching the top of the middle-income range. Although the PRC’s growth rate is declining slightly, it still seems possible for it to avoid the middle-income trap.

E. Middle-Income Trap in the Context of Growth Convergence

Within the framework proposed above, the middle-income trap is understood as a result of failing to make the jump from the middle-income convergence path to

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Figure 9. **Three Groupings of Economies—Case 2**
 $\ln(\text{GDP per capita, current prices} / \text{US GDP per capita, current prices})$



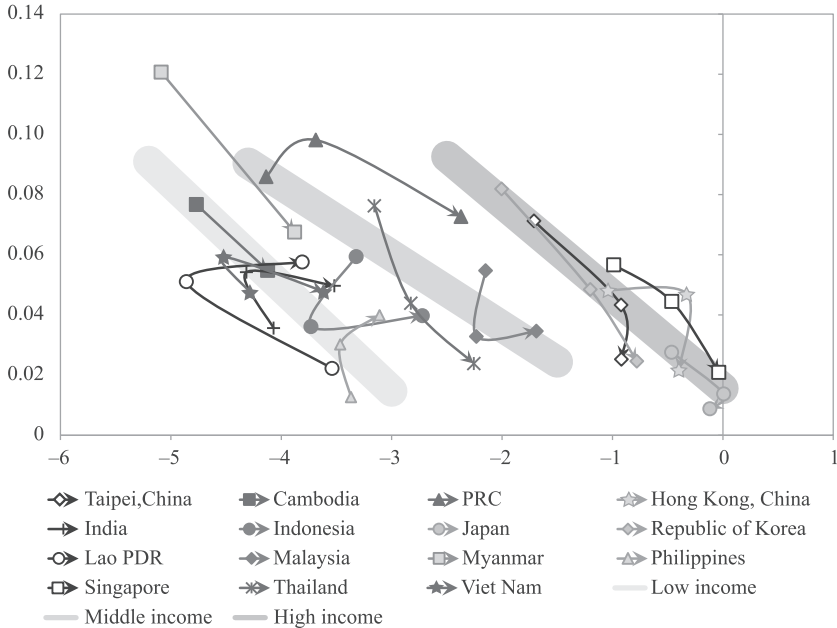
GDP = gross domestic product, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China, US = United States.

Source: Author's calculations.

the high-income convergence path. Hence, growth convergence results in a steady state that is lower than the steady state of the advanced economies (or the US). When an economy's growth rate is equal to the long-run per capita growth rate of the US, the gap with the US in terms of per capita income (position on the horizontal axis) stays constant. When an economy follows the middle-income convergence path to the steady state, the income gap remains permanently and the economy is said to be stuck in the middle-income trap. In fact, it is not a trap, but rather a failure to adopt innovation and progress in the use of technology. For example, while Thailand is approaching an average per capita growth rate of 2%, it may fail to catch up to the per capita income level of the US unless it makes a shift toward innovation.

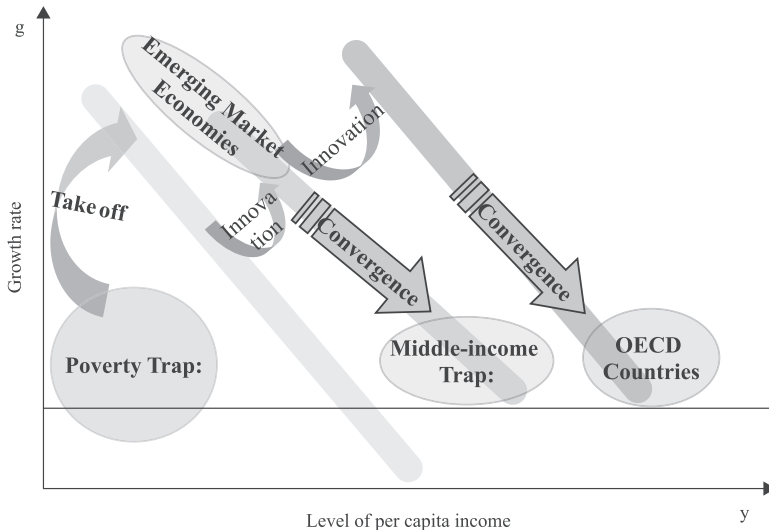
Aiyar et al. (2013) conducted an investigation very similar to this study in which they compared time series data for Asian and Latin American emerging market economies and defined the middle-income trap as a sudden deceleration in growth. By using probit regressions, they argue that "(i) middle-income economies are, in fact, disproportionately likely to experience growth slowdowns, and (ii) this

Figure 10. **Three Groupings of Economies—Case 3**
 $\ln(\text{GDP per capita, current prices} / \text{US GDP per capita, current prices})$



GDP = gross domestic product, Lao PDR = Lao People’s Democratic Republic, PRC = People’s Republic of China, US = United States.
 Source: Author’s calculations.

Figure 11. **Punctuated Conditional**



OECD = Organisation for Economic Co-operation and Development.
 Source: Author’s illustration.

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result is robust to a wide range of income thresholds for defining ‘middle income’” (Aiyar et al. 2013, 12). Then, they go on to examine factors that cause sudden growth slowdowns. The difference between my approach and that of Aiyar et al. (2013) is the assumption here that multiple growth convergence lines exist so that the middle-income steady state can be arrived at through a gradual slowdown, which is in contrast to the idea that a middle-income economy can fall off from the growth convergence line.

Felipe, Kumar, and Galope (2014) also examined economies’ transitions across income groups. They searched for evidence that supports the existence of the middle-income trap; that is, an economy that is stuck in middle-income status. They refuted this proposition in favor of a hypothesis that there can be a slow, rather than a fast, transition from middle- to high-income status. Im and Rosenblatt (2013) examined transition phases in the cross-economy distribution of income. Their transition matrix analysis provides little support for the idea of a middle-income trap. Han and Wei (2015) also conducted transition matrix analysis and rejected the existence of an unconditional middle-income trap. They argued that there are factors—such as working-age population, financial development, and macroeconomic stability—that differentiate fast- and slow-growing economies.

Eichengreen, Park, and Shin (2012, 2013) argued that there are certain income levels at which a sudden slowdown tends to occur: \$10,000–\$11,000 and \$15,000–\$16,000 (in 2005 dollars and in purchasing power parity terms). It is not clear whether they argue that this slowdown is a natural process of middle-income growth convergence or the result of falling off from the high-income growth convergence path. 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” (Eichengreen, Park, and Shin 2013; i). Meanwhile, this paper’s finding is that an economy needs innovation to jump from the middle-income convergence path to a high-income convergence path.

Bulman, Eden, and Nguyen (2014) argue that the determinants of growth at low-income levels are different from those at high-income levels. Their model implies that the transition from low- to high-income status can be smooth if an economy 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, which is the state in which an economy’s per capita income will not rise beyond the middle-income range over an infinite period of time into the future. They tested their hypothesis with the Augmented Dickey–Fuller unit root test, which was not immediately conclusive because this test requires a large sample and the sample size for growth convergence and the middle-income trap is limited.

V. Concluding Remarks

This paper has taken a novel approach by defining the middle-income trap in the context of growth convergence. An empirical investigation using panel data was also an innovation. However, the results are more in the form of suggestive evidence rather than hypothesis testing due to the limited sample size.

With the proper grouping of economies, the estimations in this paper show that each of the selected Asian economies is following one of the three convergence paths. The findings suggest that the middle-income trap can be viewed as a middle-income economy that fails to make a jump and converge toward a high-income steady state. Furthermore, making this jump requires significant reforms and/or a policy shift to stimulate enough innovation needed for technological progress.

Admittedly, the empirical results are subject to further examination. In addition, extending the analysis to other regions is left for future research.

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Appendix. Growth Convergence

The following derivation of the convergence regression is taken from chapters 2 and 3 of Acemoglu (2009) with a few modifications and an additional complexity with heterogeneous economies.

Consider a labor-augmenting, slow-growth model with a constant savings rate, s , and 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 technology level, and L is labor. The effective capital–worker ratio and effective output–labor ratio are defined as

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

With homogeneous of degree one, equation (1) can be transformed as

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

Per capita income is defined 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 savings 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. Assuming a constant rate of technological progress, a , and a constant rate of labor growth, n , results in

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

Combining (4) and (5) results in

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

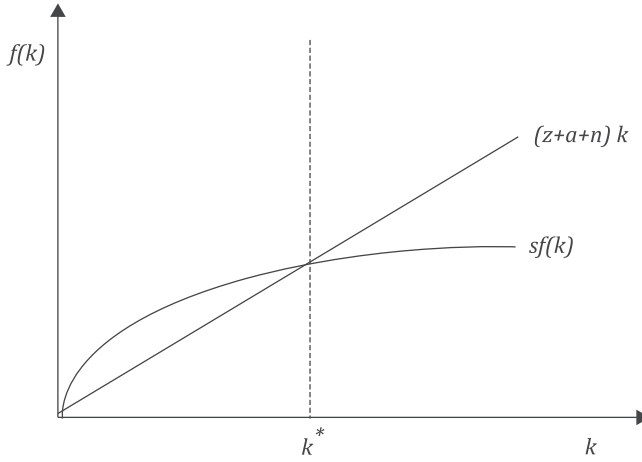
Substituting $Y(t) = A(t)L(t)f(k(t))$, which can be rearranged from (2), results in

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

or equivalently,

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

Figure A.1. Definition of the Steady State



Source: Author's illustration.

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

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

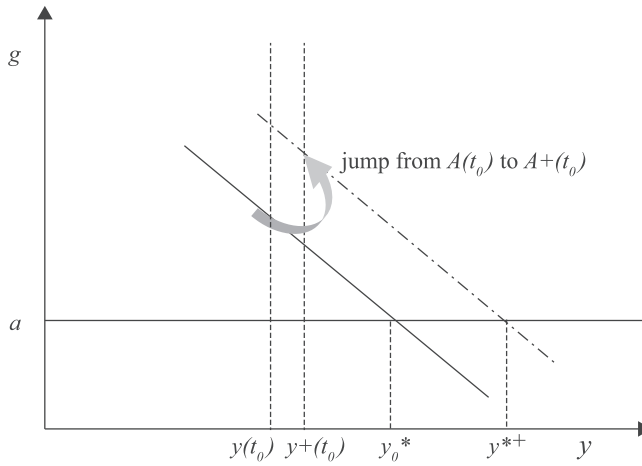
The steady-state per capita income is denoted as y^* and $y^*(t) = A(t)f(k^*)$.

At the steady state, Y/L and K/L increases at the rate of a , which is the rate of technological progress. Ultimately, the economy will converge to a state where the growth rate equals the technological progress rate. It is easy to show in comparative static exercises that k^* is an increasing function of s and $A(0)$; that is, the initial level of technology and decreasing function of n and z . Figure A.1 depicts how to find k^* from equation (7) and a given set of parameters.

Recalling equation (3) and differentiating with respect to time, the growth rate, g , of per capita income can be shown as

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

Figure A.2. Shift in the Convergence Path



Source: Authors' illustration.

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 equation (6).

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

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

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

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 the theory of convergence of 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 the 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 $k(t_0)$. 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 correspond to the multiple convergence lines in the text.