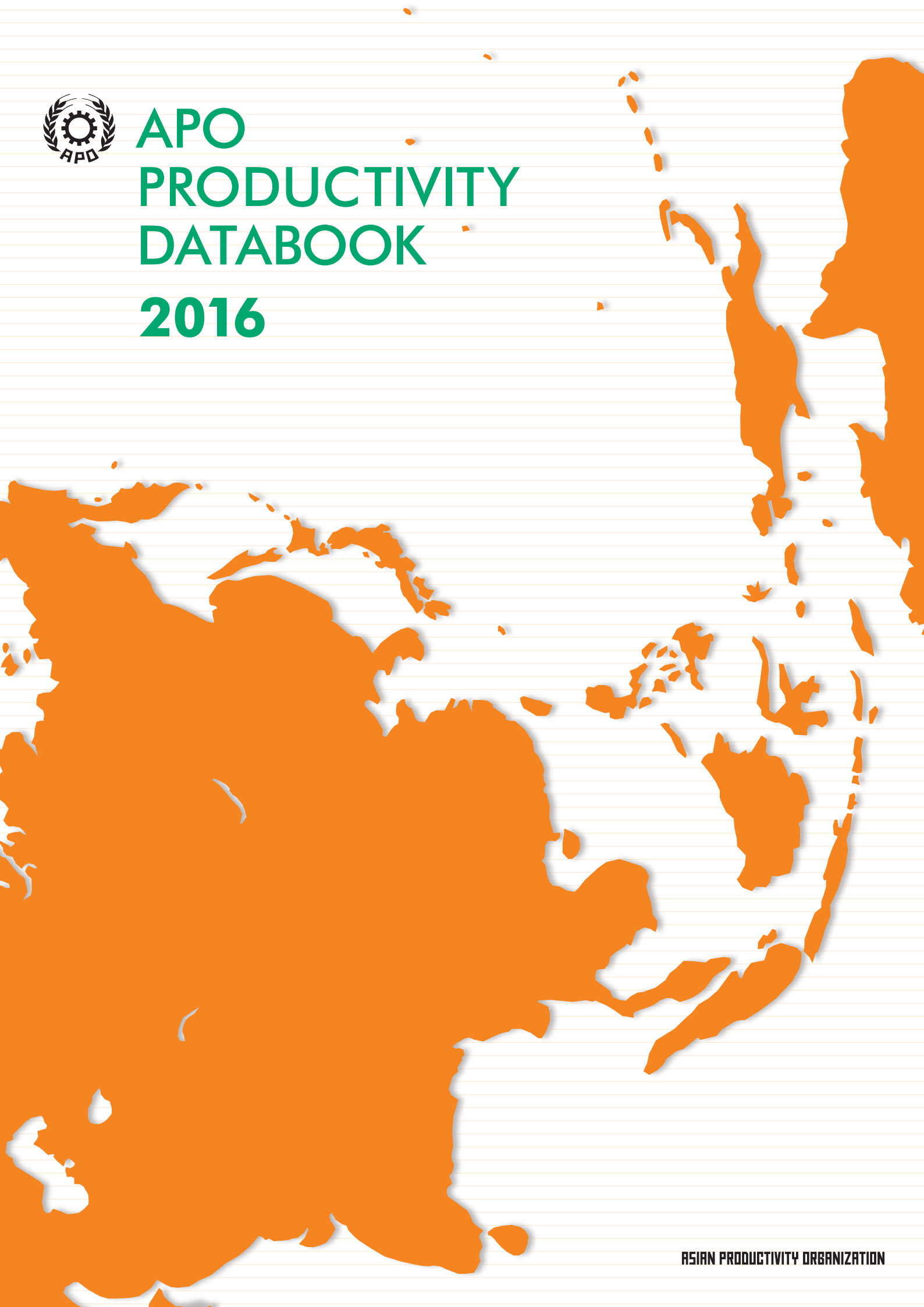
APO PRODUCTIVITY DATABOOK 2016



ASIAN PRODUCTIVITY ORGANIZATION

APO PRODUCTIVITY DATABOOK 2016

ASIAN PRODUCTIVITY ORGANIZATION

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Abbreviation

ADB	Asian Development Bank
AEC	ASEAN Economic Community
AIIB	Asian Infrastructure Investment Bank
APO	Asian Productivity Organization
APO20	20 member economies of the Asian Productivity Organization: Bangladesh, Cambodia, the Republic of China, Fiji, Hong Kong, India, Indonesia, Islamic Republic of Iran, Japan, the Republic of Korea, the Lao PDR, Malaysia, Mongolia, Nepal, Pakistan, the Philippines, Singapore, Sri Lanka, Thailand, and Vietnam
AEPM	Asian economy and productivity map (see Appendix 7)
ASEAN	Association of Southeast Asian Nations: Brunei, Cambodia, Indonesia, the Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam
ASEAN6	Brunei, Indonesia, Malaysia, the Philippines, Singapore, and Thailand
Asia24	APO20 plus the People's Republic of China, the Kingdom of Bhutan, Brunei, and Myanmar
Asia30	Asia24 plus GCC countries
CLMV	Cambodia, the Lao PDR, Myanmar, and Vietnam
CPI	consumer price index
EU	European Union
EU15	15 member economies of the European Union prior to enlargement: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and the United Kingdom
EU28	European Union: EU15 plus Bulgaria, Republic of Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovak Republic, and Slovenia
FDI	foreign direct investment
FISIM	financial intermediation services indirectly measured
GCC	Gulf Cooperation Council: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE
GDP	gross domestic product
GFCF	gross fixed capital formation
GNI	gross national income
ICP	International Comparisons Program
ILO	International Labour Organization
IMF	International Monetary Fund
ISIC	International Standard Industry Classification
IT	information technology
KEO	Keio Economic Observatory, Keio University
Lao PDR	Lao People's Democratic Republic
LDCs	less developed countries
NPISHs	non-profit institutions serving households
OECD	Organisation for Economic Co-operation and Development
PPP	purchasing power parity
QALI	quality adjusted labor inputs
QNA	quarterly national accounts
RCEP	Regional Comprehensive Economic Partnership
ROC	Republic of China
R&D	research and development
SNA	System of National Accounts
TFP	total factor productivity
TPP	Trans-Pacific Partnership
UAE	United Arab Emirates
UN	United Nations
UNSD	United Nations Statistics Division
US	United States

Foreword

One of the biggest challenges to sustaining growth in Asia is, and will continue to be, raising productivity. The Asian Productivity Organization (APO), as the sole organization devoted to productivity in Asia, has implemented a variety of projects since its establishment in 1961. Last year, we successfully trained some 5,000 participants through capacity building and knowledge sharing. We have encouraged businesses in emerging countries to grow efficiently through the development of process and product innovation. We have also cultivated new socioeconomic opportunities for productivity growth in the Asia-Pacific region, such as service- and public-sector productivity, demographic efficiency in labor participation, knowledge management, and agricultural innovation.

In recent years, in collaboration with multiple partners, the APO has assumed the role of policy advisory. The primary agenda of policy advice covers challenges in SME development, science and technology, innovation, and healthcare. These are ultimately key factors to improving national competitiveness. The APO has focused efforts on providing evidence-based policy guidance to its members through research on productivity measurement offering a wealth of data.

I am pleased to release this new edition of the *APO Productivity Databook* to readers. The databook presents an analytical report on recent and long-term productivity and economic performance of the region and reference economies. This publication is the result of concerted research efforts by the APO Productivity Databook Project of the Secretariat Research and Planning Department together with Keio Economic Observatory, Keio University, Tokyo. My gratitude goes to Professor Koji Nomura for his insightful leadership in project management. I also thank all of the contributors for developing the productivity database and this publication.

I hope that readers will enjoy this publication, while finding it a useful tool as a reference for their own work.

Mari Amano
Secretary-General
Asian Productivity Organization
Tokyo, September 2016

1 Introduction

1.1 Databook 2016

This is the ninth edition in the *APO Productivity Databook* series. The publication aims to provide a comprehensive cross-country comparison of economic growth, structural change, and productivity performance of Asian economies in relation to global and regional economies. Productivity gains, which enable an economy to produce more for the same amount of inputs, are the only route to sustainable economic growth in the long run. Therefore, it follows that monitoring and improving national productivity capability are important aspects of public policy, especially when many countries are facing aging population.

Baseline indicators on economic growth and productivity are calculated for 30 Asian economies, representing the 20 Asian Productivity Organization member economies (APO20) and the 10 non-member economies in Asia. The APO20 includes: Bangladesh, Cambodia, the Republic of China (ROC), Fiji, Hong Kong, India, Indonesia, the Islamic Republic of Iran (Iran), Japan, the Republic of Korea (Korea), the Lao People's Democratic Republic (Lao PDR), Malaysia, Mongolia, Nepal, Pakistan, the Philippines, Singapore, Sri Lanka, Thailand, and Vietnam. The 10 non-member economies in Asia are: the People's Republic of China (China), the Kingdom of Bhutan (Bhutan), Brunei, Myanmar, and the Gulf Cooperation Council (GCC) that consists of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates (UAE). In addition, Australia, the European Union (EU), Turkey, and the United States (US) are included as reference economies. This edition covers the period from 1970 to 2014.

Productivity can be defined simply as the ratio of an output volume measure to an input volume measure. Applying productivity is significantly more complex, especially when operationalizing this notion to suit different purposes in a world with data limitations, such as developing countries in Asia. The productivity measures in this report are based on the official data and our estimates collated for the APO Productivity Database project since September 2007. This is a joint research effort between the APO and the Keio Economic Observatory (KEO), at Keio University, Tokyo. Recent significant revisions based on the System of National Accounts in 2008 (2008 SNA) have resulted in updates for Brunei, Bangladesh, the ROC, Indonesia, Korea, Mongolia, and Singapore during 2014–2015 and in Sri Lanka as of March 2016. Additionally, Japan will publish the revised JSNA, also based on the 2008 SNA, as of the end of 2016. While there are movements toward upgrading the SNA, some countries, such as Cambodia, the Lao PDR, and Nepal, have yet to fully introduce the earlier version 1993 SNA. Because the varying SNA adaptions among the member economies can result in discrepancies between data definitions and coverage, data harmonization is necessary for comparative productivity analyses. The Databook attempts to reconcile these national accounts variations which are based on the different concepts and definitions. This is done by following the 2008 SNA and providing harmonized estimates for international comparison. The GDP harmonization process is provided in Appendix 1.

To analyze the overall productivity performance as well as productivity subsets (e.g., labor productivity, capital productivity, and energy productivity), this Databook project constructs estimates of capital services appropriate to the concept of capital input introduced in the 2008 SNA. The research and development (R&D) is treated as a factor of production. The energy productivity estimates are presented as a reflection of the impending need to improve energy productivity as a policy target for pursuing sustainable growth of the Asian countries. Based on the growth accounting framework, the sources of economic growth in each economy are further decomposed to factor inputs of labor and capital and total factor productivity (TFP) for 20 Asian economies – Bangladesh, Cambodia, the ROC, Fiji, Hong Kong, India, Indonesia, Iran, Japan, Korea, Malaysia, Mongolia, Nepal, Pakistan, the Philippines, Singapore, Sri Lanka, Thailand, Vietnam, and China – along with the US as a reference economy. It is a notable achievement that the TFP estimates for Nepal and the growth accounting for the Asian regions are newly developed in this edition. The estimates of labor input and its compensation in

some countries are revised in this edition, reflecting our work-in-progress estimates on number of workers, hours worked per worker, and hourly wages. This data is cross-classified by gender, education attainment, age, and employment status, which has been developed for the past few years in our project. In addition, this edition provides our preliminary estimates on the per-worker labor productivity for cities in Asia.

The structure of the Databook is as followed. The overview is presented in Chapter 2. In order to understand the dynamics of the long-term economic growth within Asia, Chapter 3 details countries' diverse development efforts and achievements, through cross-country level comparisons of GDP. In national accounts GDP is captured and measured by three approaches: production by industry, expenditure on final demand, and income to factor inputs. Decompositions of GDP are valuable in understanding the structure, and in turn the behavior, of an economy. Chapter 4 presents the composition of countries' expenditure (the demand side). The decomposition of output growth into factor inputs and TFP growths (the supply side) is analyzed in Chapter 5, while the industry structure of countries is presented in Chapter 6. Finally, Chapter 7 focuses real income to evaluate an improvement in the terms of trade.

The official national accounts and metadata information used for constructing the APO Productivity Database 2016 have been provided by national experts in APO member economies through questionnaires designed at KEO. The names of these experts are listed in Section 1.2. The submitted data was then examined and processed at KEO, where further information was collected on labor, production, prices, trades, and taxes as required. This edition effectively reflects the revisions to the official national accounts and other statistical data published as of May 2016. The project was managed by Koji Nomura (Keio University), under the consultancy of Professor Dale W. Jorgenson (Harvard University) and Professor W. Erwin Diewert (University of British Columbia), and with coordination by Yasuko Asano (APO). The text, tables, and figures of this edition were authored by Koji Nomura and Fukunari Kimura (Keio University), with support from the research assistants Shinyoung Oh, Hiroshi Shirane, Naoyuki Akashi, Shiori Nakayama, Misato Hori, and Rie Kinoshita, The Databook project appreciates Eunice Ya Ming Lau for her contribution to developing the foundation of Databook series and Trina Ott for her review of the draft.

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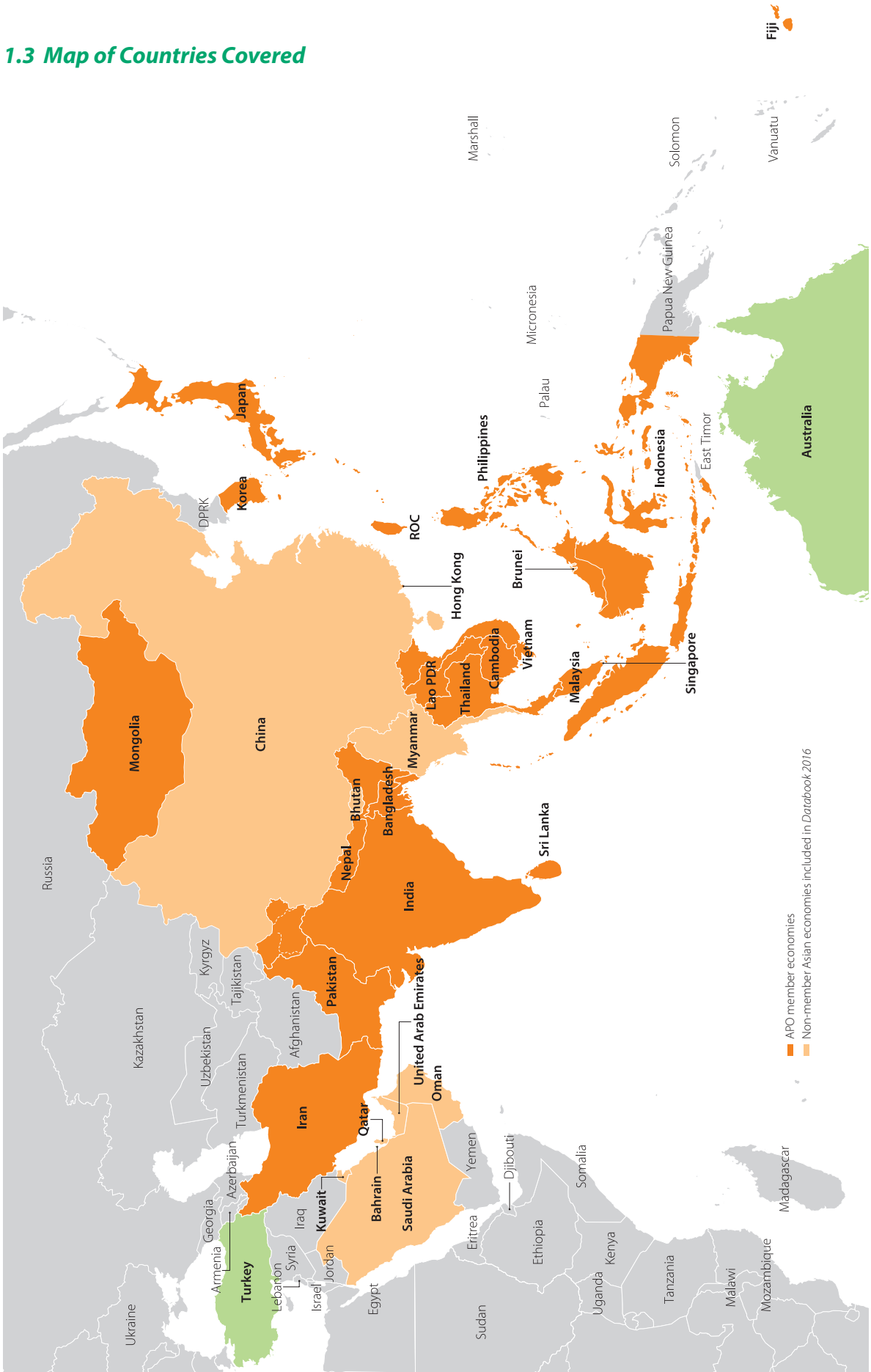
1.3 Map of Countries Covered



2 Overview

In 2015, most of the Asian developing economies successfully maintained steady economic growth. The average annual growth of GDP at constant market prices in 2010–2014 in the Asia30 and East Asia grew 5.4% and 5.7%, respectively. Despite the recent slowdown of the Chinese economy, the modest performance of the ASEAN and India's sustained rapid growth saved the downturn of the entire Asian economy. Low food and fuel prices helped most Asian economies keep inflation low and sustain the pace of economic growth.

Advanced economies continued to grow slowly. Among them, the US economy performed better than others. The average annual growth of GDP at constant market prices in 2010–2014 in the US was 1.9%. On the other hand, the European economy followed a low growth path in a slow recovery from the global financial crisis and the Euro Crisis. The average annual growth of GDP at constant market prices in 2010–2014 in the EU15 and the EU28 remained as low as 0.5% and 0.7%, respectively. The situation in some countries remains unstable, both economically and politically, being jeopardized by massive refugee inflows from the Middle East and "Brexit." The Japanese economy appeared to be going back to the pre-crisis normal performance but lost momentum for pulling up its potential growth rate. The average annual growth of GDP at constant market prices in 2010–2014 in Japan was 0.7%. The recent World Economic Outlook by the IMF (2016) presented a somewhat pessimistic view for continued slow growth of advanced economies.

While China's growth hit a serious slowdown, their economy had vigorous energy, achieving 7.8% in official statistics for the average annual growth of GDP at constant market prices in 2010–2014. However, the growth of trade and tradable sectors decelerated, particularly with excess capacity in basic metals and other material production, while services sector growth was steady. The Chinese government seemed to maintain control over short-term uncertainty in asset markets, but the adjustments in productive sectors took time. Negative impacts on the Korean and Japanese economies were obvious. To date, the impact on the ASEAN economies is limited.

Industrialization in developing East Asia has been characterized by the effective use of global value chains (GVCs). The Economic Research Institute for ASEAN and East Asia (ERIA, 2015) proposes the concept of the tier structure in terms of the sophistication of GVCs linkages. Tier 3 is a step to connect with slow GVCs such as that observed in traditional operations in food processing, garment industry, tourism, and others. Tier 2 is a stage where a country participates in fast and sophisticated international production networks (Ando and Kimura, 2005) or the second unbundling (Baldwin, 2011). Production networks in machinery industries are typical of this tier, though quick operations in other industries such as food processing with cold chains, cut flowers by air, call centers, and software outsourcing, are also categorized in this tier. In tier 1a, a country starts forming industrial agglomeration while maintaining strong channels of international production networks. The last tier, tier 1b, is a step to create an innovation hub in order to progress to a fully developed economy.

Latecomers in the ASEAN, Cambodia, the Lao PDR, and Myanmar, have rapidly grown in the past two decades, reaching $1,140, $1,780, and $1,310 in the per capita GDP using exchange rate in 2014, respectively. However, the easy catch-up period is almost gone. To achieve sustained economic growth, they have to engage in international production networks for tier 2. It is fortunate to see a sign of "Thai plus one" investment by machinery parts producers, setting up fragmented satellite factories off Thailand. Vietnam presented much deeper involvement in production networks after the global financial crisis, reaching $2,080 in the per capita GDP using exchange rate in 2014, facing a challenge for tier 1a. The Philippines and Indonesia are also struggling with the formation of efficient industrial agglomeration for tier 1a with $2,890 and $3,560 in the per capita GDP using exchange rate in 2014. Thailand, Malaysia, and Singapore have successfully completed the formation of efficient industrial

agglomerations with $6,100, $11,050, and $56,010 in the per capita GDP using exchange rate in 2014 and now face a challenge for tier 1b, the creation of innovation hubs.

On the other hand, the South Asian countries have not fully taken advantage of international production networks, although some of them have advocated "Look East" policies. Their engagement in GVCs is generally still in tier 3 rather than tier 2. The per capita GDP using exchange rate in 2014 in Nepal, Bangladesh, Pakistan, and India is $790, $1,110, $1,320, and $1,560, respectively. There is ample room for them to learn a novel development strategy with production networks from the ASEAN member states and China.

While overall economic growth in Asian economies seems fair, in the era of globalization, countries must always be prepared for possible turbulence in the asset and financial markets. Since the crisis, international capital flows have substantially slowed, but relatively good economic performance, as well as open capital markets in some of the Asian economies, attracts possible excessive footloose capital inflows. Although the current management of macroeconomic fundamentals is much better than that in the era of the Asian currency crisis, the financial world is also much more globalized now. A slight sign may trigger sudden massive outflows of capital, and a speculative attack may result. The financial authority must monitor asset and financial markets with heightened credibility.

There are numerous external events that could trigger turmoil in the region. A current prime risk is a possibly serious repercussion of the UK's exit from the EU, which may trigger a massive overturn of the current globalization trend not only in Europe but also in the rest of the world. In addition, there is a continuous concern of the impact of a tapering policy for monetary easing in the US, though such worry seems to have eased. The Asian economies should always be well-prepared for such possible negative shocks.

The year 2015 was a landmark year for economic integration in East Asia and the Asia-Pacific, marked by three major events. Three big events occurred. First, the ASEAN Economic Community (AEC) completed economic integration at the end of 2015, and the ASEAN came into a new era with the AEC2025 that furthers economic development. The AEC is the most successful economic integration concluded in the developing world. The AEC Blueprint in 2007 presented a detailed work program toward 2015, which consisted of four pillars: single market and production base; competitive economic region; equitable economic development; and integration into global economy. The first pillar corresponds to high-quality free trade agreements (FTAs) by which various international commercial policies are covered. The second and third pillars provide various programs for economic cooperation, which are not usually covered by FTAs. The fourth pillar sets the basis of economic diplomacy in order to integrate the ASEAN with external regions. The AEC Blueprint 2025 stands with five pillars. Retaining four pillars from the AEC2015, it adds another pillar by combining connectivity from the second pillar and integration priority sectors from the first pillar. Although the details will be documented in the coming year, the effort toward deepening the ASEAN Community will assuredly continue. As for economic integration, the link with utilizing global value chains will receive greater emphasis, rather than simply pursuing the textbook version of "single market." To enhance competitiveness, focus will be on productivity growth and innovation with good governance and responsive administrative practices a priority. For inclusiveness, the development of micro, small, and medium enterprises will continue.

Second, the negotiation of the Trans-Pacific Partnership (TPP) by 12 countries in the Asia-Pacific concluded in October 2015, and an agreement was signed in February 2016. There still exists uncertainty in TPP – the US and Japan must ratify the agreement in order to make the agreement effective. However, substantial repercussions have already been observed. We see strong domino effects where a number of non-negotiating countries reveal interest in participating in the TPP. When the presidents

of Indonesia and Korea visited the US in October 2015, they directly stated to President Obama their interest in entering into the TPP. In the ROC, pro-TPP government commenced in May 2016. The Philippines and Thailand also showed their interest. China, too, began studying the detailed contents of the TPP. The draft text of the TPP, consisting of 6,000-plus pages, was disclosed on the web in November 2015. Once the TPP goes into effect, it will set a new standard of deep liberalization for goods and services trade as well as investment. It will also move towards developing a new series of international rule including government procurement, intellectual property rights protection, competition policy – particularly with state-owned enterprises, and a dispute settlement mechanism including investor-state dispute settlements. Although a number of political concessions will certainly mitigate radical aspects of the agreement, the TPP will still be a landmark agreement, particularly for East Asia.

The negotiation over the Regional Comprehensive Economic Partnership (RCEP) by the ASEAN+6 countries now faces difficulties.[1] It is an important initiative for the ASEAN in order to keep their "ASEAN centrality" for East Asian economic integration. It would cover all of East Asia, including China and India, which is the extended area of international production networks, and thus should be important for Japan as well. However, India and China have continuously been reluctant in committing themselves to higher levels of trade liberalization, with the negotiation protocol set as low as only 80% tariff removals in August 2015. With this level of liberalization, RCEP would be futile and marginalized. Countries in the region should redefine the strategic significance of the ASEAN+6 economic integration and upgrade its quality.

Third, China's new approach toward development issues was launched in 2015. A new international financial institution called Asian Infrastructure Investment Bank (AIIB) was officially established in December 2015. Although China has already deeply committed to infrastructure development in the region in the form of bilateral aid or foreign direct investment as well as being an important member of Asian Development Bank (ADB) and the World Bank, the establishment of AIIB will upgrade China's commitment to Asia and other developing regions. China has also been active in extending its own initiative called "One Belt One Road" for infrastructure development and other economic cooperation with continental and maritime Asian countries.

Asia's economic vitality warrants considerable attention to the rapid and vigorous changes in its economic performance in the short run. To fully understand this economic dynamism, it is essential to grasp its growth performance, structural changes, and the advancement of its economic development within a context of its middle- and long-term performance. Asia, in particular, consists of a variety of countries at different development stages, with diversified resource endowments, and under various political regimes. The APO Productivity Databook provides concise information and useful insights into the basis of growth performance and economic structure of Asian countries by presenting such long-term data analysis.

International comparisons of economic performance are never a precise science; instead, they are fraught with measurement and data comparability issues. Despite best efforts in harmonizing data, some data uncertainty remains. Operating within a reality of data issues, some of the adjustments in the Databook are necessarily conjectural, while others are based on assumptions with scientific rigor. In addressing this shortcoming, findings drawn from the research are cross-referenced against other similar studies. Such magnitude of variations in the economic indicators is often subject to a certain degree of data uncertainty.

1: The ASEAN+6 are the ASEAN and its six major trading partners: China, India, Japan, Korea, Australia, and New Zealand.

Bearing in mind these caveats, the main findings from our analysis are as follows:

Recent economic growth of Asia

- In terms of exchange-rate-based GDP, China overtook Japan in 2010 as the largest economy in Asia and the second largest economy in the world, after the US. On this measure, the Asia30 was 43% and 53% larger than the US and the EU15 in 2014, respectively (Table 1).

- Based on GDP adjusted for purchasing power parity (PPP),[2] the weight of the world economy is even more tilted toward Asia, with the Asia30 1.69 times and 1.91 times larger than the US and the EU15 in 2014, respectively. China has overtaken Japan as the largest Asian economy since 1999; and its size was 106% relative to the US in 2014. India surpassed Japan, replacing it as the second largest economy in Asia in 2009. In 2014, the total GDP of the three largest Asian economies alone was 77% larger than the US economy (Table 2 and Figure 5).

- During the period 1990–2014, the Asia30 grew at 5.5% on average per annum, compared with 2.4% and 1.5% in the US and the EU15, respectively. Japan was the slowest growing economy among the Asia30 at 1.0%, compared with 25 of the 30 Asian economies with over 4.0% of annual economic growth (Table 3 and Figure 1).

- Since 2000, China and India have emerged as the driving force propelling Asia forward, accounting for 51% and 17% of regional growth, respectively (Figure 7).

- The global financial crisis slowed Asia30's growth significantly from a recent peak of 8.1% during 2006–2007, to 4.8% during 2007–2008 and further to 3.9% during 2008–2009, before rebounding strongly to 8.1% during 2009–2010. This is in comparison to the deep recession of –2.8% and –4.5% experienced by the US and the EU15, respectively, during 2008–2009 (Figure 1).

- The correlation coefficients between China and other Asian economies strengthened between the two decades. This suggests that China has become more integrated within the Asian economy. For most Asian countries, the correlation with the US and the EU15 has also grown stronger (Figures 8 and 9).

Catching up in per capita GDP

- Our results show the outcome of the dramatic development effort of the four Asian Tigers.[3] Singapore and Hong Kong have managed to close a per capita GDP gap with the US of around 60% in just under four decades. Singapore has even surpassed the US since 1993, and in 2014 its per capita GDP was 54% higher. In contrast, veteran Japan has fallen behind, widening its gap with the US to 29%. In 2014, the ROC's and Korea's per capita GDP was 85% and 65% of the US level, respectively (Table 6 and Figure 14).

- Despite their rapid growth, due to their population, per capita GDP of China and India was 25% and 10% of the US in 2014, respectively. However, this represents a tenfold increase in China's relative per capita GDP over the last four decades. The level achieved by the Asia30 was 21% of the US, indicating that there is ample room for catch-up (Table 6 and Figure 15).

2: This Databook based on the new PPP estimates of the 2011 International Comparisons Program (ICP) round published in April 2014. This has the significant effect of raising the relative sizes of Asian economies against the base economy, the US.
3: Refers to Hong Kong, Korea, Singapore, and the ROC.

- Asia's huge per capita GDP gap with the US is predominantly explained by its labor productivity gap. With the exception of the Asian Tigers, Japan, Iran, and Malaysia, all Asian countries have a labor productivity gap of 50% or higher (Figure 18).

- For most countries in Asia, the majority of per capita GDP growth can be explained by improvement in labor productivity. However, the employment rate contribution relative to labor productivity was also highly significant in Bhutan, Nepal, Singapore, and Pakistan in 2000–2014 (Figure 19).

- There is a significant variation in Asia's employment rate from 25% to over 60% at present. The employment rate has been rising in most Asian countries and is more than 10 percentage points above the US in Singapore, Myanmar, Cambodia, Thailand, and Vietnam (Figure 21).

Changes in demand composition

- With a few exceptions, household consumption is the biggest component of final demand. In recent years, Asia30's consumption ratio has dropped to 48.1% of GDP in 2014, largely reflecting the trend in China. This compares to 68.4% in the US, 56.9% in the EU15, and 56.9% in Australia (Table 8).

- The share of household consumption in GDP tends to be more volatile, dropping in countries that are undergoing rapid development. As countries get richer, the household consumption share tends to rise. At the other end of the spectrum, countries with low income and a high dependent population (under-15, over-65) sustain a high consumption ratio to GDP (Figures 24 and 25).

- Overall, Asia invests more than the US/EU15 as a share of its GDP. Lately this gap has been widening. Historically, Australia's investment share has been sandwiched between that of Asia and the US/EU15. In 2014, the Asia30 invested 36.0% of its GDP, compared with 19.9% for the US, 19.2% for the EU15, and 26.6% for Australia (Table 8 and Figure 30).

- China faces huge internal and external imbalances. The investment share of GDP (at 47.2%), as the biggest component in final demand and the household consumption share, plummeted to 36.7% in 2014. In contrast, the weight of net exports has been rising in the past decade, although it is declining in recent years due to weak foreign demand (Figure 22).

- GCC economies are unusually skewed toward net exports because of their oil. Net exports accounted for 19.7% of final demand in 2014, compared with Asia30's 2.3% and China's 2.7%. Only the US and South Asia run trade deficits of a more significant nature, which accounted for –3.1% and –3.9% of final demand, respectively, in 2014 (Table 8).

- Basic necessities account for a high proportion of household consumption in lower-income countries, according to the cross-country version of Engel's Law, which states that basic necessities will account for a high proportion of household consumption for a lower per capita income group and vice versa. They spend 30–50% of total consumption for food, which corresponds to Japan's experience in the 1950s and the 1960s (Figures 28 and 29).

- In the 2000s, investment recovered in the Asian economies and drove growth. For Singapore and the ROC, however, the strength of net exports was still the dominant force behind their economic growth. The growth slowed in the US and the EU15, and the contributions of government consumption to growth nearly tripled as contributions from investment took a plunge (Figures 35 and 39).

Labor productivity

- For most Asian countries, the per capita GDP gap with the US is largely explained by labor productivity shortfalls of 80% or more against the US level. Only Singapore and Hong Kong have effectively closed that gap. The relative labor productivity of the Asia24 was 20% of the US in 2014 (Table 9 and Figure 40).

- Growth of per-worker GDP in Asia has outstripped that in the US, allowing catch-up. In particular, the low-income countries appeared to experience a labor productivity growth spurt in the 2000s. China achieved the fastest labor productivity growth of 9.0% on average per year in 2005–2014, followed by Myanmar's 7.8% and Mongolia's 7.2%; this compares with the US's 1.0%. Japan's 0.5% growth over the same period was the weakest performance among the Asian Tigers and Japan (Table 10 and Figure 42).

- The productivity gap based on GDP per hour is generally wider between Asian countries and the US. While the adjustments are negligible for most Asian countries, the productivity gap significantly widened by 13–32 percentage points for the Asian Tigers, suggesting that people work much longer hours than in the US (Figure 43).

- Most Asian countries experience faster growth in GDP per hour than the US. Among them, China's performance is the most outstanding, with average annual productivity growth doubling from 4.5% to 8.4% between 1970–1990 and 1990–2014, compared to the US at 1.5% and 1.7% over the same periods (Figure 45).

- Mapped onto Japan's historical trajectory of GDP per hour, most Asian countries cluster around the level that Japan achieved in the 1950s and early 1970s, with the Asian Tigers being the clear frontrunners, sprinting away from the pack (Figure 47).

Total factor productivity

- Of the 20 Asian countries compared, 11 experienced faster TFP growth than the US over the period 1970–2014, with China in a league of its own. Its TFP growth was at 3.1% on average per year, compared with those of Thailand at 1.6% in second place and the US at 0.8%. With TFP growing at 0.6% on average per year, Singapore's productivity performance has been weak relative to its economic counterparts (Figure 49).

- Over the past four decades, economic growth in Asia has been predominantly explained by the contribution of capital input, but the role of TFP growth should not be underestimated. Its contribution accounted for over 25% of economic growth in eight of the 20 Asian countries compared, with it being most prominent in China (36%), India (35%), Sri Lanka (34%), and Pakistan (31%) (Figure 51).

- The composition of economic growth is shifting over time. In the past two decades, the contribution of capital input (especially of non-IT capital) has been getting progressively smaller in Asia, falling to a share of below 56% on average, while the contribution of TFP is getting progressively more significant, rising to a share of above 36% on average in 2000–2014 (Figures 53 and 59).

- The evident rise in the contribution of information technology (IT) capital is noteworthy. By the 2000s, it had risen to above 5% in most Asian countries compared, while accounting for around

one-third of economic growth in Japan and the US. The allocation shift towards IT capital started two decades earlier in the US than in any Asian country (Figures 53 and 57).

- Over the past decades, it has been observable that economic growth has decelerated in the early starters (Japan and the Asian Tigers). Their experience lends support to the likelihood of an eventual slowdown in China; the question is more likely "when," than "if." TFP growth slowed from its former peaks achieved in the late 1970s or late 1980s until recent years when countries experienced TFP resurgence (Figure 56).

Capital deepening and capital productivity

- Capital deepening appears to be an accompanying process of rapid economic development. The early starters (i.e., Japan and the Asian Tigers) underwent more rapid capital deepening in the initial period whereas the reverse is true for the currently emerging Asian economies. For example, the rise in capital–labor ratio decelerated from 10.2% on average per year to 7.0% in Korea between 1970–1990 and 1990–2014, whereas it doubled in China from 5.5% to 10.3% (Figure 60).

- Capital deepening tends to go hand in hand with deterioration in capital productivity. China's performance is particularly impressive as its acceleration in capital deepening over the past two decades did not compromise its capital productivity as much as the early starters in the early period (Figure 61).

- Over a long period – stretching four decades – a downward trend in labor productivity growth can be seen among the early starters, but there is a step-up in China and India. Singapore's productivity performance, albeit robust compared with other mature economies like the US, has been very modest against its Asian counterparts (Figure 68).

Industry structure

- Evidence supports the view that a country's industry structure transforms with its economic development. There is a broad negative correlation between the share of agriculture in total GDP and per capita GDP. Finance, real estate, and business activities increase in weight as countries move up income levels, whereas mining is the sector that defines the oil-exporting countries (Figure 72).

- Manufacturing is a significant sector, accounting for over 20% of total value added in most Asian economies. It is particularly prominent in Korea, China, the ROC, Thailand, Philippines, and Indonesia, in which higher TFP growths are measured in 2000–2014 (Figure 73). Asian manufacturing is dominated by machinery and equipment in the richer Asian economies while their poorer counterparts concentrate on light manufacturing such as textiles and the food industry (Figure 74).

- While Asian countries are diversifying away from agriculture, the sector still dominates employment, accounting for 35% of total employment in 2014 for the Asia30, down from 61% in 1980. Its share in total value added decreased more moderately, from 14% to 9% over the same period. Shifting out of agriculture into more efficient sectors will boost economy-wide productivity (Figures 75 and 78).

- Manufacturing is a main absorption sector for workers who have been displaced from the agriculture sector, especially in the initial stages of economic development. In Korea and the ROC, expansions to manufacturing output could account for the increase of employment in the 1970s and the

1980s. Since the 1990s, however, the manufacturing sector has no longer been an absorption sector of employment, regardless of the sound expansion of production in this sector. (Figure 80).

Industry origins of economic growth

- Our results support the observation that China and India have taken different development paths, with the former relying more on the traditional growth engine of manufacturing and the latter on services. In the past two and a half decades China has been undergoing a slight transition, with its growth shifting away from manufacturing-driven to more services-driven. In the period 2000–2014, the contributions to economic growth by manufacturing and services were 34% and 46%, respectively, compared with 42% and 35% in the 1990s (Figures 82 and 83).

- In contrast, growth in India has always been more driven by services, the contributions of which are 61% in the 1990s and 61% in 2000–2014, while manufacturing usually contributes one-fifth or less (Figures 82 and 83).

- A total of 28% of Asia30's regional growth originated from the expansion of manufacturing in 2000–2014, 61% of which was accounted for by China. In other words, China's manufacturing alone contributed 17% to regional growth (Figure 86).

- The importance of manufacturing as a contributor to overall labor productivity growth has never waned in Korea and the ROC. However, manufacturing has never been a major contributor in India in its recent development process or in Hong Kong and Sri Lanka in 2000–2014 (Table 18 and Figure 89).

Real income and terms of trade

- Real GDP could systematically underestimate (or overestimate) growth in real income if terms of trade improve (or deteriorate). It is generally observed that the trading gain effect is more significant in the short term than in the long term. Our findings confirm this observation, with the exceptions in some oil-exporting countries such as Kuwait and Brunei, where trading gain has always been positive and significant (Table 19 and Figure 97).

- Positive net primary income from abroad also bolsters a country's real income. In Japan and the Philippines, net primary income from abroad has been rising steadily, albeit at different magnitudes. In Japan, it rose from 0.6% of GDP in 1990 to 3.9% in 2014, compared with 1.5% in 1990 and 34.4% in 2014 in the Philippines. Singapore's historical margin fluctuates within a large range when compared with other rich economies – from +2.0% in 1997 to –7.0% in 2004, but on the whole, it has been more negative than positive (Figure 91).

- Our results show that for most countries studied, the difference between growth of real GDP and real income (reflecting the combined effect of trading gain and net primary income from abroad) was within the margin of ±20% over the long period from 1970–2014; Kuwait and Brunei appear to be the outliers (Figure 92).

- The five countries that have been enjoying a trading gain over 1% per annum in the past four decades are all oil-exporting countries. Among them, only Iran managed to achieve a positive growth in labor productivity. In contrast, export-oriented, high productivity Asian countries have been facing a deteriorating trading gain position as a price of their own success (Figure 98).

Asia is a diverse regional economy in which countries have embarked on their own journey of economic development at different times and different paces. As shown by our analysis, nearly all countries are making concerted efforts to move away from agriculture and accumulate capital in order to improve their growth potential and catch up with the West. Their efforts are yielding results beyond just impressive growth rates. The evidence gained from our research confirms that countries' capital accumulation is accompanied by strong productivity improvements. Through the statistics and data presented in this report, one manages to catch a glimpse of the current unparalleled economic dynamics inherent in the region.

3 Economic Growth

In the past quarter of a century, the story of the world economy belonged to Asia, featuring its steady rise in economic prowess. Before the mid-1980s, the fortune of Asia closely followed that of Japan but 1988 marked the start of their paths decoupling (Figure 1). Since the early 1990s, Asian growth consistently has been outperforming the West. With the exception of 1997–1999, when the economy was adversely affected by the Asian financial crisis (Figure 38 in Section 4.3, p. 56), the Asia30 has been growing faster than the US and the EU15 by 3 to 4 percentage points on average per year.[4]

In 2009 at the height of the global financial storm, the growth differentials were 6.7 and 8.4 percentage points with the US and the EU15, respectively. In 2010, simultaneous large-scale fiscal stimulus packages helped major economies rebound strongly, before growth slowed again in 2011. The Asian growth rate thereafter decreased to 5.3% on average per year during 2012–2014, from 7.1% before the global financial crisis (2002–2007). This is mainly due to the onset of deceleration in China's growth to 7.3% from 11.0% on average in the same periods.[5] Plagued by the euro crisis, the EU15 saw their economy shrink by 0.6% from 2011 to 2012 and their recovery to 1.2% in 2013–2014, whereas the US economy sustained a steady growth of 2.0% in the period 2012–2014. The difference in recent GDP growth is unchanged between Asia and the US (3.3 percentage points on average per year during 2012–2014), but expanded between Asia and the EU15 (5.1 percentage points).

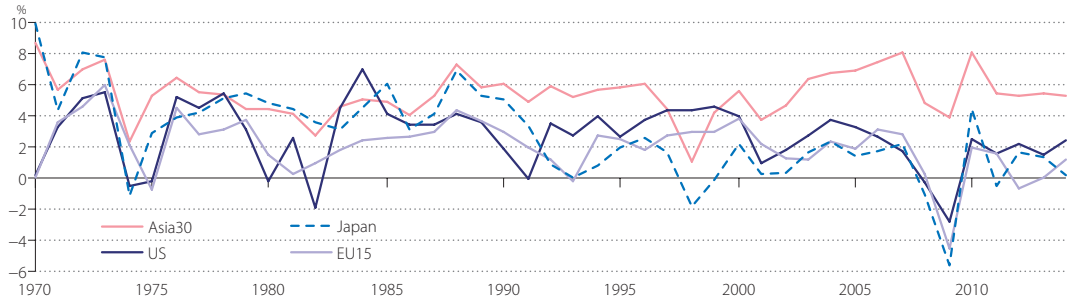


Figure 1 GDP Growth of Asia, the EU, Japan, and the US, 1970–2014
——Annual growth rate of GDP at constant market prices

Sources: Official national accounts in each country, including author adjustments.

It is therefore no surprise that the center of gravity in the global economy is gradually shifting towards Asia. In 2014, the Asian economy contributed 45% (42% for Asia30) of world output, compared with the US and the EU28, each accounting for 16% and 17%, respectively (Figure 2). The IMF (2016) projects the Asian share in world output will continue to rise, reaching 50% (47% for Asia30) by 2021. In contrast, the output shares of each of the US and the EU28 will shrink by a similar extent to 15%.

To better understand the dynamics of the long-term economic growth within the region, the remainder of this chapter details countries' diverse development efforts and achievements since 1970, through cross-country level comparisons of GDP and other related performance indicators. To facilitate international level comparisons, harmonized GDP for each of the individual countries is expressed

4: The data used in the Databook series includes author adjustments made to better harmonize GDP coverage across countries. See Appendix 1 for the GDP harmonization in this Databook.
5: According to the preliminary estimation by the National Bureau of Statistics of China, the growth rate of Chinese GDP is estimated as 6.9% in 2015 (reported on 19 January 2016), which is the weakest in a quarter century. The annualized growth for the 1st quarter of 2016 is 6.7% to the same quarter in 2015 (reported on 18 April 2016). OECD (2016b) forecasts the Chinese growth is set to edge down further, from 6.5% in 2016 to 6.2% by 2017.

in its equivalent in a common currency unit, customarily in the US dollar, using a set of conversion rates between the individual national currencies. The choices for conversion rates are exchange rate and PPP.

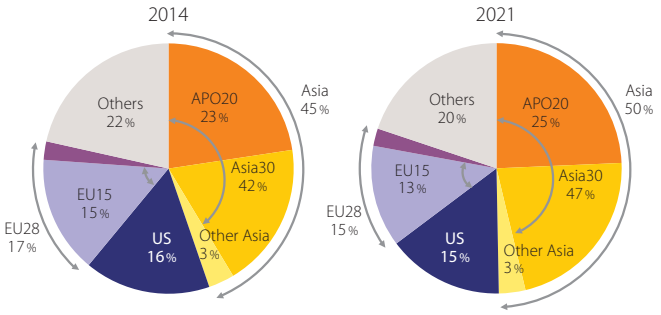


Figure 2 Share of Asia in World GDP in 2014 and Projection for 2021
——Share of GDP using constant PPP

Source: IMF, *World Economic Outlook Database*, April 2016.

3.1 Economic Scale and Growth

Table 1 provides snapshot-level comparisons of Asian countries, based on GDP at current market prices using exchange rates,[6] for the six separate years of 1970, 1980, 1990, 2000, 2010, and 2014. By this measure, Japan was the largest economy in Asia until 2010 when China finally overtook Japan's position to become the second-largest economy in the world next to the US. Japan clearly surged ahead between the 1970 and 1990 comparisons; dwarfing the relative size of all other Asian economies and reducing the US lead from five times to less than twice its economy. The turn of Japan's fortune came in 1990, when the country's excessive growth years of the late 1980s ended and its descent began. Thereafter, stagnation in Japan combined with vibrant growth in developing Asia has resulted in the rapid erosion of Japan's prominence in the regional economy. The leading position of the four largest Asian economies (China, Japan, India and Korea) has been consistent, with their positions rather secure in the past two decades. The ASEAN as a group has been demonstrating vigor in catching up since 2000. On this measure, the Asia30 was 43% and 53% larger than the US and the EU15 in 2014, respectively.

Comparisons based on exchange rates, however, appear arbitrary as movements in exchange rates can be volatile and subject to short-term or substantial fluctuations of speculative capital flows and government intervention. Furthermore, comparisons based on exchange rates typically underestimate the size of a developing economy and, in turn, the perceived welfare of its residents. The scale of economy rankings change dramatically when international price differences are properly taken into account.[7]

Figure 3 shows the extent to which the exchange rates have failed to reflect countries' price differentials properly, relative to the US, based on the PPP estimates of the 2011 International Comparisons Program (ICP) round, published in April 2014. With the exception of Japan and Australia, exchange rates systematically under-represent the relative purchasing power for all the countries covered in

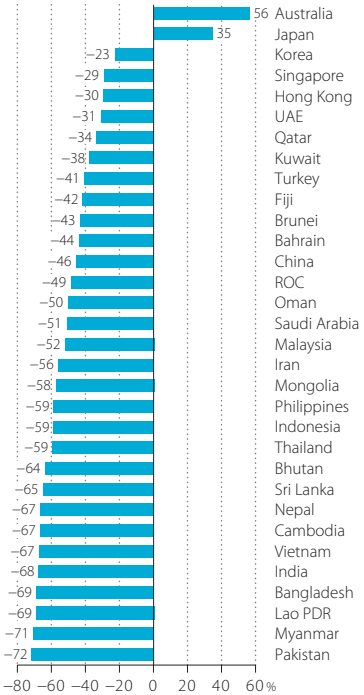


Figure 3 Price Level Indices of GDP, 2011
——Ratio of PPP to exchange rate (reference country=US)

Sources: Analysis of Main Aggregate rates by United Nations Statistics Division (UNSD) and PPP by World Bank (2014).

Table 1 GDP using Exchange Rate, 1970, 1980, 1990, 2000, 2010, and 2014

——GDP at current market prices, using annual average exchange rate

1970		(%)	1980		(%)	1990		(%)	2000		(%)	2010		(%)	2014		(%)
Japan	209	100.0	Japan	1,106	100.0	Japan	3,182	100.0	Japan	4,887	100.0	China	6,144	100.0	China	10,561	100.0
China	93	44.3	China	305	27.6	China	394	12.4	China	1,216	24.9	Japan	5,697	92.7	Japan	4,774	45.2
India	64	30.4	India	190	17.2	India	335	10.5	Korea	562	11.5	India	1,671	27.2	India	2,021	19.1
Iran	11	5.4	Saudi Arabia	165	14.9	Korea	279	8.8	India	482	9.9	Korea	1,094	17.8	Korea	1,411	13.4
Pakistan	10	4.8	Iran	97	8.8	ROC	167	5.2	ROC	331	6.8	Indonesia	756	12.3	Indonesia	891	8.4
Indonesia	10	4.7	Indonesia	80	7.2	Indonesia	127	4.0	Saudi Arabia	190	3.9	Saudi Arabia	532	8.7	Saudi Arabia	762	7.2
Bangladesh	10	4.7	Korea	65	5.9	Saudi Arabia	118	3.7	Hong Kong	172	3.5	Iran	477	7.8	ROC	530	5.0
Korea	9.0	4.3	UAE	44	4.0	Iran	95	3.0	Indonesia	168	3.4	ROC	446	7.3	Iran	457	4.3
Thailand	7.3	3.5	ROC	42	3.8	Thailand	89	2.8	Thailand	127	2.6	Thailand	342	5.6	UAE	412	3.9
Philippines	6.8	3.2	Thailand	33	3.0	Hong Kong	77	2.4	Iran	111	2.3	UAE	294	4.8	Thailand	408	3.9
ROC	5.8	2.8	Philippines	33	3.0	UAE	51	1.6	UAE	106	2.2	Malaysia	255	4.2	Malaysia	338	3.2
Saudi Arabia	5.4	2.6	Kuwait	30	2.7	Philippines	47	1.5	Singapore	96	2.0	Singapore	236	3.8	Singapore	306	2.9
Malaysia	3.9	1.9	Hong Kong	29	2.6	Malaysia	45	1.4	Malaysia	95	1.9	Hong Kong	229	3.7	Hong Kong	291	2.8
Hong Kong	3.8	1.8	Malaysia	25	2.2	Pakistan	44	1.4	Philippines	81	1.7	Philippines	200	3.2	Philippines	285	2.7
Kuwait	3.0	1.4	Pakistan	24	2.2	Singapore	39	1.2	Pakistan	72	1.5	Pakistan	175	2.9	Pakistan	249	2.4
Myanmar	2.7	1.3	Bangladesh	19	1.7	Bangladesh	31	1.0	Bangladesh	51	1.1	Qatar	128	2.1	Qatar	216	2.0
Sri Lanka	2.5	1.2	Singapore	12	1.1	Kuwait	19	0.6	Kuwait	38	0.8	Kuwait	118	1.9	Vietnam	188	1.8
Singapore	1.9	0.9	Qatar	7.9	0.7	Oman	12	0.4	Vietnam	33	0.7	Vietnam	117	1.9	Bangladesh	173	1.6
Vietnam	1.2	0.6	Oman	6.3	0.6	Sri Lanka	8.3	0.3	Oman	20	0.4	Bangladesh	115	1.9	Kuwait	167	1.6
Nepal	1.1	0.5	Myanmar	5.9	0.5	Qatar	7.5	0.2	Qatar	18	0.4	Oman	60	1.0	Oman	83	0.8
UAE	1.1	0.5	Brunei	5.0	0.5	Vietnam	6.5	0.2	Sri Lanka	17	0.3	Sri Lanka	50	0.8	Sri Lanka	76	0.7
Cambodia	0.8	0.4	Sri Lanka	4.3	0.4	Myanmar	5.2	0.2	Bahrain	8.4	0.2	Myanmar	42	0.7	Myanmar	67	0.6
Qatar	0.5	0.3	Bahrain	3.5	0.3	Bahrain	4.5	0.1	Myanmar	7.3	0.1	Bahrain	26	0.4	Bahrain	34	0.3
Bahrain	0.4	0.2	Nepal	2.6	0.2	Nepal	4.4	0.1	Nepal	6.3	0.1	Nepal	19	0.3	Nepal	22	0.2
Oman	0.3	0.1	Fiji	1.2	0.1	Brunei	3.4	0.1	Brunei	5.8	0.1	Brunei	14	0.2	Brunei	18	0.2
Fiji	0.2	0.1	Vietnam	1.0	0.1	Cambodia	1.8	0.1	Cambodia	3.7	0.1	Cambodia	11	0.2	Cambodia	17	0.2
Brunei	0.2	0.1	Cambodia	0.7	0.1	Mongolia	1.6	0.0	Fiji	1.7	0.0	Mongolia	7.2	0.1	Mongolia	12	0.1
Mongolia	0.1	0.1	Mongolia	0.5	0.0	Fiji	1.4	0.0	Lao PDR	1.7	0.0	Lao PDR	7.0	0.1	Lao PDR	12	0.1
Bhutan	0.1	0.0	Bhutan	0.1	0.0	Lao PDR	0.9	0.0	Mongolia	1.4	0.0	Fiji	3.2	0.1	Fiji	4.6	0.0
						Bhutan	0.3	0.0	Bhutan	0.4	0.0	Bhutan	1.6	0.0	Bhutan	2.0	0.0
(regrouped)			(regrouped)			(regrouped)			(regrouped)			(regrouped)			(regrouped)		
APO20	358	171.3	APO20	1,767	159.7	APO20	4,581	144.0	APO20	7,299	149.4	APO20	11,906	193.8	APO20	12,465	118.0
Asia24	454	217.0	Asia24	2,083	188.2	Asia24	4,985	156.7	Asia24	8,528	174.5	Asia24	18,107	294.7	Asia24	23,113	218.9
Asia30	464	222.0	Asia30	2,339	211.4	Asia30	5,196	163.3	Asia30	8,909	182.3	Asia30	19,264	313.5	Asia30	24,789	234.7
East Asia	320	153.2	East Asia	1,548	139.9	East Asia	4,100	128.9	East Asia	7,169	146.7	East Asia	13,617	221.6	East Asia	17,580	166.5
South Asia	87	41.7	South Asia	240	21.7	South Asia	424	13.3	South Asia	629	12.9	South Asia	2,031	33.1	South Asia	2,542	24.1
ASEAN	35	16.6	ASEAN	196	17.7	ASEAN	365	11.5	ASEAN	618	12.6	ASEAN	1,979	32.2	ASEAN	2,531	24.0
ASEAN6	30	14.3	ASEAN6	188	17.0	ASEAN6	350	11.0	ASEAN6	572	11.7	ASEAN6	1,802	29.3	ASEAN6	2,246	21.3
CLMV	4.7	2.2	CLMV	7.7	0.7	CLMV	14	0.5	CLMV	46	0.9	CLMV	177	2.9	CLMV	285	2.7
GCC	11	5.1	GCC	257	23.2	GCC	212	6.7	GCC	381	7.8	GCC	1,157	18.8	GCC	1,675	15.9
(reference)			(reference)			(reference)			(reference)			(reference)			(reference)		
US	1,076	514.5	US	2,863	258.7	US	5,980	187.9	US	10,285	210.5	US	14,964	243.6	US	17,348	164.3
EU15	1,247	596.5	EU15	3,321	300.2	EU15	6,387	200.8	EU15	9,899	202.6	EU15	14,592	237.5	EU15	16,180	153.2
									EU28	11,005	225.2	EU28	16,776	273.0	EU28	18,758	177.6
Australia	45	21.6	Australia	173	15.6	Australia	324	10.2	Australia	409	8.4	Australia	1,293	21.0	Australia	1,451	13.7
Turkey	24	11.4	Turkey	91	8.2	Turkey	200	6.3	Turkey	268	5.5	Turkey	740	12.0	Turkey	810	7.7

Unit: Billions of US dollars.
Sources: Official national accounts in each country, including author adjustments.
Note: See Appendix 1 for the adjustments made to harmonize GDP coverage across countries.

6: The exchange rates used in this Databook are the adjusted rates, which are called the Analysis of Main Aggregate (UNSD database) rates in the UN Statistics Division's National Accounts Main Aggregate Database. The AMA rates coincide with the IMF rates (which are mostly the annual average of market or official exchange rates) except for some periods in countries with official fixed exchange rates and high inflation, when there could be a serious disparity between real GDP growth and growth converted to US dollars based on IMF rates. In such cases, the AMA adjusts the IMF-based rates by multiplying the growth rate of the GDP deflator relative to the US.

7: This is because exchange rates embody the trade sector bias (i.e., is more influenced by the prices of traded than non-traded goods and services) and thus do not necessarily succeed in correcting the price differentials among countries. As developing economies tend to have relatively lower wages and, in turn, lower prices for non-traded goods and services, a unit of local currency has greater purchasing power in the local economy than reflected in its exchange rate.

Table 2 GDP using PPP, 1970, 1980, 1990, 2000, 2010, and 2014
——GDP at constant market prices, using the 2011 PPP, reference year 2014

1970		(%)	1980		(%)	1990		(%)	2000		(%)	2010		(%)	2014		(%)
Japan	1,586	100.0	Japan	2,499	100.0	Japan	3,970	100.0	China	4,956	100.0	China	13,504	100.0	China	18,428	100.0
India	718	45.3	India	965	38.6	China	1,834	46.2	Japan	4,453	89.9	India	5,773	42.7	India	7,256	39.4
China	413	26.0	Saudi Arabia	767	30.7	India	1,657	41.7	India	2,819	56.9	Japan	4,811	35.6	Japan	4,941	26.8
Saudi Arabia	290	18.3	China	755	30.2	Indonesia	814	20.5	Indonesia	1,236	24.9	Indonesia	2,153	15.9	Indonesia	2,687	14.6
Iran	289	18.2	Indonesia	440	17.6	Saudi Arabia	722	18.2	Korea	1,027	20.7	Korea	1,582	11.7	Korea	1,784	9.7
Indonesia	197	12.4	Iran	403	16.1	Korea	525	13.2	Saudi Arabia	945	19.1	Iran	1,394	10.3	Saudi Arabia	1,629	8.8
Kuwait	148	9.3	UAE	207	8.3	Iran	522	13.1	Iran	772	15.6	Saudi Arabia	1,318	9.8	Iran	1,400	7.6
Philippines	114	7.2	Korea	204	8.2	Thailand	392	9.9	ROC	638	12.9	ROC	960	7.1	ROC	1,080	5.9
Thailand	96	6.1	Philippines	203	8.1	ROC	334	8.4	Thailand	610	12.3	Thailand	956	7.1	Thailand	1,076	5.8
Pakistan	92	5.8	Thailand	184	7.4	Pakistan	297	7.5	Pakistan	478	9.6	Pakistan	772	5.7	Pakistan	891	4.8
Korea	85	5.3	ROC	152	6.1	Philippines	247	6.2	Malaysia	376	7.6	Malaysia	624	4.6	Malaysia	769	4.2
Bangladesh	84	5.3	Pakistan	148	5.9	UAE	211	5.3	UAE	347	7.0	Philippines	552	4.1	Philippines	693	3.8
ROC	56	3.5	Kuwait	119	4.8	Malaysia	185	4.7	Philippines	347	7.0	UAE	515	3.8	UAE	636	3.5
Malaysia	46	2.9	Malaysia	101	4.1	Hong Kong	162	4.1	Hong Kong	239	4.8	Vietnam	414	3.1	Vietnam	519	2.8
Vietnam	42	2.7	Bangladesh	92	3.7	Bangladesh	137	3.5	Bangladesh	227	4.6	Bangladesh	391	2.9	Bangladesh	499	2.7
Hong Kong	36	2.2	Hong Kong	84	3.4	Singapore	110	2.8	Singapore	219	4.4	Singapore	385	2.8	Singapore	458	2.5
Sri Lanka	26	1.6	Vietnam	55	2.2	Vietnam	94	2.4	Vietnam	203	4.1	Hong Kong	355	2.6	Hong Kong	401	2.2
Singapore	22	1.4	Singapore	52	2.1	Kuwait	91	2.3	Kuwait	160	3.2	Kuwait	242	1.8	Qatar	328	1.8
Myanmar	19	1.2	Sri Lanka	39	1.6	Oman	64	1.6	Oman	103	2.1	Qatar	242	1.8	Kuwait	282	1.5
Qatar	18	1.2	Qatar	32	1.3	Sri Lanka	60	1.5	Sri Lanka	100	2.0	Myanmar	198	1.5	Myanmar	266	1.4
Nepal	13	0.8	Brunei	29	1.2	Qatar	37	0.9	Qatar	71	1.4	Sri Lanka	166	1.2	Sri Lanka	219	1.2
Brunei	12	0.8	Oman	29	1.2	Myanmar	32	0.8	Myanmar	63	1.3	Oman	144	1.1	Oman	167	0.9
UAE	11	0.7	Myanmar	28	1.1	Nepal	27	0.7	Nepal	43	0.9	Nepal	63	0.5	Nepal	75	0.4
Oman	10	0.7	Nepal	17	0.7	Brunei	22	0.6	Bahrain	30	0.6	Bahrain	53	0.4	Bahrain	62	0.3
Bahrain	8	0.5	Bahrain	16	0.6	Bahrain	19	0.5	Brunei	28	0.6	Cambodia	38	0.3	Cambodia	51	0.3
Mongolia	4	0.2	Mongolia	7	0.3	Mongolia	12	0.3	Cambodia	18	0.4	Brunei	32	0.2	Lao PDR	35	0.2
Fiji	2	0.1	Fiji	4	0.1	Cambodia	9	0.2	Lao PDR	13	0.3	Lao PDR	26	0.2	Mongolia	35	0.2
Bhutan	0	0.0	Bhutan	1	0.0	Lao PDR	7	0.2	Mongolia	12	0.2	Mongolia	22	0.2	Brunei	32	0.2
						Fiji	5	0.1	Fiji	6	0.1	Fiji	7	0.0	Fiji	8	0.0
						Bhutan	1	0.0	Bhutan	2	0.0	Bhutan	5	0.0	Bhutan	6	0.0
(regrouped)			(regrouped)			(regrouped)			(regrouped)			(regrouped)			(regrouped)		
APO20	3,686	232.4	APO20	5,863	234.7	APO20	9,773	246.2	APO20	14,023	283.0	APO20	21,503	159.2	APO20	24,879	135.0
Asia24	4,234	266.9	Asia24	6,835	273.5	Asia24	11,902	299.8	Asia24	19,367	390.8	Asia24	35,380	262.0	Asia24	43,610	236.7
Asia30	4,738	298.7	Asia30	8,033	321.5	Asia30	13,071	329.3	Asia30	21,048	424.7	Asia30	37,908	280.7	Asia30	46,715	253.5
East Asia	2,346	147.9	East Asia	3,922	157.0	East Asia	7,111	179.1	East Asia	11,627	234.6	East Asia	21,369	158.2	East Asia	26,669	144.7
South Asia	1,001	63.1	South Asia	1,338	53.6	South Asia	2,276	57.3	South Asia	3,780	76.3	South Asia	7,215	53.4	South Asia	8,947	48.5
ASEAN	601	37.9	ASEAN	1,171	46.9	ASEAN	1,995	50.3	ASEAN	3,178	64.1	ASEAN	5,405	40.0	ASEAN	6,587	35.7
ASEAN6	530	33.4	ASEAN6	1,072	42.9	ASEAN6	1,845	46.5	ASEAN6	2,869	57.9	ASEAN6	4,724	35.0	ASEAN6	5,716	31.0
CLMV	75	4.7	CLMV	101	4.0	CLMV	152	3.8	CLMV	309	6.2	CLMV	681	5.0	CLMV	871	4.7
GCC	523	33.0	GCC	1,218	48.8	GCC	1,177	29.7	GCC	1,690	34.1	GCC	2,530	18.7	GCC	3,104	16.8
(reference)			(reference)			(reference)			(reference)			(reference)			(reference)		
US	5,132	323.5	US	7,011	280.6	US	9,733	245.2	US	13,651	275.4	US	16,068	119.0	US	17,348	94.1
EU15	6,339	399.6	EU15	8,666	346.8	EU15	11,076	279.0	EU15	13,864	279.8	EU15	15,697	116.2	EU15	16,043	87.1
									EU28	15,744	317.7	EU28	18,061	133.7	EU28	18,583	100.8
Australia	290	18.3	Australia	387	15.5	Australia	522	13.1	Australia	739	14.9	Australia	1,002	7.4	Australia	1,114	6.0
Turkey	244	15.4	Turkey	364	14.6	Turkey	607	15.3	Turkey	872	17.6	Turkey	1,281	9.5	Turkey	1,529	8.3

Unit: Billions of US dollars (as of 2014).
Sources: Official national accounts in each country, including author adjustments.
Note: See Appendix 1 for the adjustments made to harmonize GDP coverage across countries.

this report. The underestimation is substantial for some, ranging from 23% for Korea to 72% for Pakistan. Thus, the exchange-rate-based GDP considerably underestimates the economic scales in real terms for those countries. By taking into account the international price differentials, PPP rectifies the trade sector bias, and in turn the relative size of economies can be more adequately measured.[8]

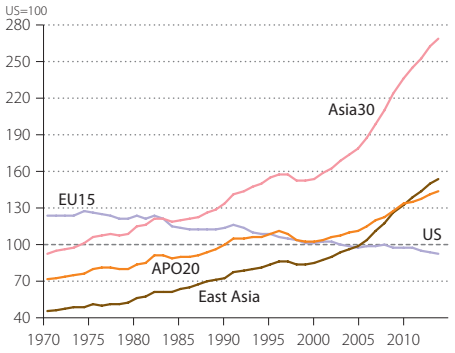


Figure 4 Regional GDP of Asia and the EU, Relative to the US, 1970–2014
——Indices of GDP at constant market prices, using 2011 PPP

Sources: Official national accounts in each country, including author adjustments.

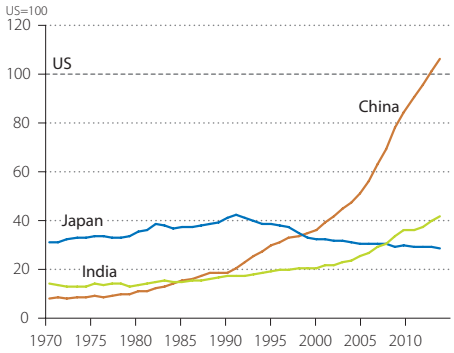


Figure 5 GDP of China, India, and Japan, Relative to the US, 1970–2014
——Indices of GDP at constant market prices, using 2011 PPP

Sources: Official national accounts in each country, including author adjustments.

Table 2 repeats the same snapshot level comparisons on real GDP for Asian countries in Table 1, using PPP as conversion rates. By correcting international price differentials, the Asia30 has been expanding rapidly. It was 159%, instead of 43%, larger than the US economy in 2014, having overtaken it in 1974 (Figure 4).[9] East Asia (China, the ROC, Hong Kong, Japan, Korea, and Mongolia) caught up with the US in 2006 from a low base of 46% in 1970. In contrast, the EU15 has been experiencing a gradual relative decline in economic size, from 124% of the US economy in 1970 to a low of 92% in 2014. Based on GDP using constant PPP, the weight of the world economy is even more tilted toward Asia than portrayed by GDP using exchange rates. This reflects the fact that nearly all Asian countries increase in relative size after international price differentials have been properly taken into account.

The relative size of China's economy in 2014 was 373% or about four times that of Japan, compared with 221% when exchange rates are used in Table 1. Considering that the Chinese economy was only 26% that of Japan and 58% that of India in 1970, represents remarkable growth. China overtook Japan after 1999 to become the leading economy in Asia as shown in Figure 5.[10] On this measure, Figure 5 also demonstrates that Chinese GDP overtook the US as the world's largest economy in 2013–2014, although it was only 8% that of the US in 1970. The level and the timing to overcome should not be taken as precise numbers,[11] but they may provide a good basis for assessing the relative production size of these two economies. For the first time in more than 140 years, China comes back as the largest producer in the world.

Given that PPP for India has been revised by –24% in the 2011 ICP round (see Box 1), the effects have been to raise the relative size of India. Compared to Japan, the Indian economy has been increasing from 45% in 1970 to 147% in 2014, surpassing Japan and replacing it as the second largest economy

8: It is therefore important to note that any international GDP comparisons are sensitive not only to revisions in national accounts but also to revisions in multilateral PPPs, which are currently benchmarked every six years. PPPs for most Asian countries have been revised downward, compared with what they would have been by extrapolating the 2005 benchmark PPP (see Box 1). This has the effect of raising the relative sizes of these economies against the base economy.
9: This compares with the findings in Databook 2013, which were based on the 2005 benchmark PPP, that the economic size of the Asia30 overtook the US in 1988.
10: The shift of the benchmark year PPP estimates from 2005 to 2011 has the effect of bringing forward the year when China overtook Japan in relative GDP to 1999, from 2002 in Databook 2013.
11: BBC News: Is China's economy really the largest in the world?, 16 December 2014.

Box 1 PPP in the 2011 ICP Round

Purchasing power parities (PPPs) are indispensable inputs into economic research and policy analysis involving cross-country comparisons of macroeconomic aggregates. They affect a double conversion of macroeconomic measures, estimated in national currencies and price levels, into comparable cross-country volume measures. These are expressed in a common currency and at a uniform price level. PPPs are price relatives that show the ratio of the prices in national currencies of single or composite goods and services in different countries. They are compiled within the International Comparisons Program (ICP). Comparisons are made from the expenditure side of GDP. To this end, the ICP compiles PPPs by holding worldwide surveys at regular intervals (currently, every six years) to collect comparable price and expenditure data for the whole range of final goods and services that make up the final expenditures on GDP. In April 2014, the new benchmark PPP estimates were published by the ICP 2011 round. For a number of methodological improvements, see Eurostat-OECD (2012) and World Bank (2014).

Chapter 3 mainly provides the cross-country comparison of economic volumes. To obtain comparable volume measures, the Databook uses the constant PPP approach, which relies not on a time series of PPPs, but on one of the benchmark estimates. The Databook has used the new benchmark estimates by the ICP 2011 round since last year's publication. The use of this approach creates national series for volumes at the prices of a common reference year (i.e., 2014), and deflates these by the PPP for a fixed year (i.e., 2011).

It is inevitable that they will be compared with the results of the previous round in 2005, which has provided the benchmark estimate for the past Databook series in 2009–2013. Figure B1 shows the revisions of PPPs in Asian countries at the 2011 ICP round, in comparison with the 2005 ICP round. The 2011 benchmark PPP for most of the Asian countries is lower than suggested by their extrapolated equivalents from the 2005 benchmark, with a difference ranging from +3% for Korea to –47% for Myanmar. With the exception of Singapore, it is observed that revisions for the more mature economies are much smaller (ranging within ±4%) than those for the rapidly developing economies (with downward revisions greater than 10%). Therefore, the impact of the PPP revisions is to raise the relative size of Asian economies, moving them closer to the level of the more mature economies. More specifically, the PPP revisions for India and China are –24% and –16%, respectively. As a result, the relative positions of India and China have improved considerably in cross-country level comparisons after PPP revisions at the 2011 ICP round.

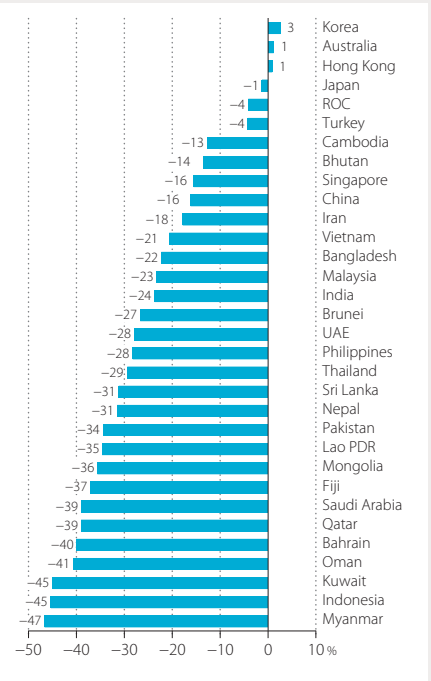


Figure B1 Revisions of PPP for GDP by the 2011 ICP Round

Ratio of the 2011 ICP PPP to the 2005 ICP PPP (extrapolated for 2011)

Source: World Bank, *World Development Indicators 2014.*

These revisions by the 2005 ICP round have a property to partly offset the past upward revisions by the 2005 ICP round for many Asian countries. The 2005 benchmark PPP for most of the Asian countries were upwardly revised compared to their extrapolated equivalents from the 1993 benchmark estimates that had been used in the Databook 2008. For example, the PPP estimates were upwardly revised by 55% and 65% (thus the internationally comparable measures of GDP in 2005 were reduced by 36% and 40%) for India and China, respectively.

Singapore is an exceptional country, in which the PPP has been downwardly revised (thus the relative size of the economy has been upwardly revised) by both of the revisions of the ICP 2005 and 2011 rounds. The PPP for Singaporean GDP was revised by –29% and by –16% in the ICP 2005 and 2011 rounds, respectively.

continued on next page >

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Based on the constant PPP approach, the revision by the ICP 2011 round advanced the years when the Singapore economy has surpassed Japan and the US to 1980 (from 1993) and 1992 (from 2004), respectively, as a measure of per capita GDP. It may require further examination if this revision provides an appropriate view. Generally speaking, the cross-country level comparison has to face a much larger opportunity to be revised, compared to the cross-country growth comparison. The readers should bear in mind these circumstances.

in Asia in 2009. In 2014, the total GDP of the three countries, which are counted as the largest economies in Asia, was larger than the US economy by 77%.

Figure 6 shows the rapid expansion of the relative size of the South Asian economy (consisting of Bangladesh, Bhutan, India, Nepal, Pakistan, and Sri Lanka), 81% of which was accounted for by India in 2014. The ASEAN also showed vigor in their catch-up effort. They were on par with the South Asian economy in 1996–1997 before the setback caused by the Asian financial crisis of 1997–1998 took hold, setting them on a lower growth path, once again opening up a divergence. In contrast, the progress of GCC[12] countries lagged for more than two decades. Only in the past decade has it picked up and brought the relative size of the country group back to its previous peak of the early 1980s.[13]

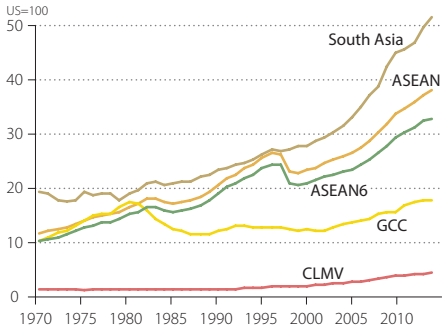

Figure 6 Regional GDP of South Asia, ASEAN, CLMV, and GCC, Relative to the US, 1970–2014
——Indices of GDP at constant market prices, using 2011 PPP

Sources: Official national accounts in each country, including author adjustments.

Performance of each country is also transformed when economic growth is used as a yardstick. Table 3 presents cross-country comparisons of real GDP growth in Asia since 1990. The ranking varies from period to period and the economic giants no longer take precedence in the ranking. In fact, small developing Asian countries, like Qatar, Myanmar, Cambodia, Vietnam, the Lao PDR, and Mongolia, are equally capable of exhibiting exuberant growth.[14] As labor costs are edging up in China (see Box 5, p. 67), the workshop of the world has started shifting its location to the neighboring countries such as Cambodia, the Lao PDR, Myanmar, and Vietnam, called CLMV. They are clearly the faster growing group among the ASEAN countries, at 7.6% on average per year compared with 4.9% managed by the ASEAN6 in the period 1990–2014.

At the other end of the table, Japan consistently has been struggling at the bottom over the past two decades (1990–2014), with an average growth of 0.9% per year, compared with Asia30's 5.5% and EU15's 1.5%. During this period, only three Asian countries – Brunei, Fiji, and Japan – grew slower than the US (2.4%). The divergence of growth performance between the Asian countries on the one hand

12: GCC consists of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE. These GCC countries display economic characteristics very different from those of other Asian economies due to their profound reliance on the oil and energy sector. In 2012, these countries account for about 34% of the world's proven crude oil reserves and possess at least 21% of the proven global natural gas reserves (GCC Secretariat General, 2014).

13: In interpreting the results in this report, one must bear in mind that conventional GDP tends to overstate the income of these oil-exporting countries since it does not account for the depletion of natural resource stock, and in turn a large part of their GDP may not be sustainable. Besides, GDP growth can underestimate the growth of real income available to the country brought about by a favorable change in terms of trade, and vice versa. For an oil-exporting country, the growth wedge of the two measures could be significant in the face of volatile oil prices. See Chapter 7.

14: See footnote 14 in Section 3.2 and footnote 25 in Section 3.3 for the reliability of the data in Myanmar.

Table 3 GDP Growth, 1990–1995, 1995–2000, 2000–2005, 2005–2010, and 2010–2014
——Average annual growth rate of GDP at constant market prices

1990–1995		1995–2000		2000–2005		2005–2010		2010–2014		1990–2014	
China	11.6	Qatar	10.6	Myanmar	12.1	Qatar	16.6	Mongolia	11.5	China	9.6
Malaysia	9.3	China	8.3	China	9.4	Myanmar	10.7	China	7.8	Qatar	9.1
Kuwait	9.2	Myanmar	8.0	Cambodia	9.0	China	10.7	Lao PDR	7.7	Myanmar	8.8
Singapore	8.3	Vietnam	7.3	Qatar	8.0	Bhutan	9.1	Qatar	7.6	Cambodia	7.2
Vietnam	8.1	Cambodia	7.0	Vietnam	8.0	Lao PDR	7.8	Myanmar	7.4	Vietnam	7.1
Thailand	8.1	UAE	6.3	Bhutan	7.6	India	7.8	Sri Lanka	7.0	Lao PDR	6.7
Korea	8.1	Lao PDR	6.0	Kuwait	7.2	Cambodia	6.5	Cambodia	7.0	Bhutan	6.2
Indonesia	7.6	ROC	5.8	Iran	6.9	Singapore	6.5	Bangladesh	6.1	India	6.2
ROC	7.2	Bhutan	5.7	India	6.5	Mongolia	6.4	India	5.7	Malaysia	5.9
Cambodia	6.6	India	5.7	Mongolia	6.3	Indonesia	6.2	Philippines	5.7	Singapore	5.9
Lao PDR	6.0	Singapore	5.5	Lao PDR	6.2	Sri Lanka	6.2	Vietnam	5.7	Sri Lanka	5.4
Oman	5.7	Korea	5.3	Bahrain	5.9	Vietnam	6.2	Indonesia	5.5	Bangladesh	5.4
Myanmar	5.7	Bangladesh	5.1	Pakistan	5.9	Bangladesh	5.9	Saudi Arabia	5.3	Korea	5.1
Pakistan	5.5	Malaysia	4.9	UAE	5.4	Oman	5.7	UAE	5.3	Bahrain	5.0
Bahrain	5.3	Sri Lanka	4.9	Thailand	5.3	Bahrain	5.4	Malaysia	5.2	Indonesia	5.0
Sri Lanka	5.3	Nepal	4.8	Malaysia	5.2	Malaysia	5.0	Bhutan	5.1	ROC	4.9
Hong Kong	5.2	Bahrain	4.2	Bangladesh	5.0	Iran	5.0	Singapore	4.4	Kuwait	4.7
Bangladesh	5.0	Iran	4.1	Indonesia	4.9	Philippines	4.8	Nepal	4.3	UAE	4.6
India	5.0	Pakistan	4.0	Singapore	4.8	Nepal	4.4	Bahrain	3.8	Pakistan	4.6
Nepal	4.9	Philippines	3.9	Korea	4.6	ROC	4.2	Kuwait	3.8	Mongolia	4.6
Iran	3.7	Oman	3.7	Philippines	4.5	Korea	4.0	Oman	3.7	Nepal	4.3
UAE	3.6	Mongolia	2.7	Hong Kong	4.1	Hong Kong	3.8	Pakistan	3.6	Philippines	4.3
Bhutan	3.4	Hong Kong	2.6	Saudi Arabia	4.0	Thailand	3.7	Fiji	3.5	Thailand	4.2
Brunei	3.1	Saudi Arabia	2.6	Sri Lanka	4.0	Pakistan	3.7	Hong Kong	3.0	Iran	4.1
Philippines	2.8	Kuwait	2.1	ROC	4.0	Saudi Arabia	2.7	Korea	3.0	Oman	4.0
Saudi Arabia	2.8	Fiji	2.0	Nepal	3.1	UAE	2.5	Thailand	3.0	Hong Kong	3.8
Fiji	2.7	Brunei	1.3	Brunei	2.1	Kuwait	1.2	ROC	3.0	Saudi Arabia	3.4
Qatar	2.4	Japan	0.9	Fiji	2.0	Fiji	0.7	Japan	0.7	Fiji	2.1
Japan	1.4	Indonesia	0.8	Japan	1.2	Brunei	0.7	Iran	0.1	Brunei	1.5
Mongolia	−2.8	Thailand	0.7	Oman	1.0	Japan	0.3	Brunei	0.0	Japan	0.9
(regrouped)		(regrouped)		(regrouped)		(regrouped)		(regrouped)		(regrouped)	
APO20	4.3	APO20	3.1	APO20	4.3	APO20	4.5	APO20	3.7	APO20	4.0
Asia24	5.7	Asia24	4.3	Asia24	5.8	Asia24	6.7	Asia24	5.4	Asia24	5.6
Asia30	5.5	Asia30	4.3	Asia30	5.7	Asia30	6.5	Asia30	5.4	Asia30	5.5
East Asia	5.5	East Asia	4.5	East Asia	5.7	East Asia	6.9	East Asia	5.7	East Asia	5.7
South Asia	5.1	South Asia	5.4	South Asia	6.3	South Asia	7.1	South Asia	5.5	South Asia	5.9
ASEAN	7.3	ASEAN	2.4	ASEAN	5.3	ASEAN	5.6	ASEAN	5.1	ASEAN	5.2
ASEAN6	7.3	ASEAN6	2.0	ASEAN6	4.9	ASEAN6	5.3	ASEAN6	4.9	ASEAN6	4.9
CLMV	7.4	CLMV	7.4	CLMV	9.0	CLMV	7.5	CLMV	6.3	CLMV	7.6
GCC	3.8	GCC	3.6	GCC	4.6	GCC	3.7	GCC	5.3	GCC	4.2
(reference)		(reference)		(reference)		(reference)		(reference)		(reference)	
US	2.6	US	4.2	US	2.5	US	0.8	US	1.9	US	2.4
EU15	1.6	EU15	2.9	EU15	1.8	EU15	0.7	EU15	0.5	EU15	1.5
		EU28	2.9	EU28	1.9	EU28	0.9	EU28	0.7	EU28	1.6
Australia	3.2	Australia	3.8	Australia	3.4	Australia	2.7	Australia	2.7	Australia	3.2
Turkey	3.2	Turkey	4.1	Turkey	4.5	Turkey	3.2	Turkey	4.4	Turkey	3.8

Unit: Percentage.
Sources: Official national accounts in each country, including author adjustments.
Note: See Appendix 1 for the adjustments made to harmonize GDP coverage across countries.

and the US and the EU15 on the other was even more pronounced if focusing on the most recent years, with the Asia30 growing at 5.4% on average per annum, compared with 1.9% in the US and 0.5% in the EU15 in the period 2010–2014.

The change of guards in Asia is clearly illustrated in Figure 7. While Japan was the standard-bearer in yesteryears in the left chart of Figure 7, China and India have emerged as the driving force propelling Asia forward since 1990. Their growth accounts for 39% and 14% of regional growth, respectively, in

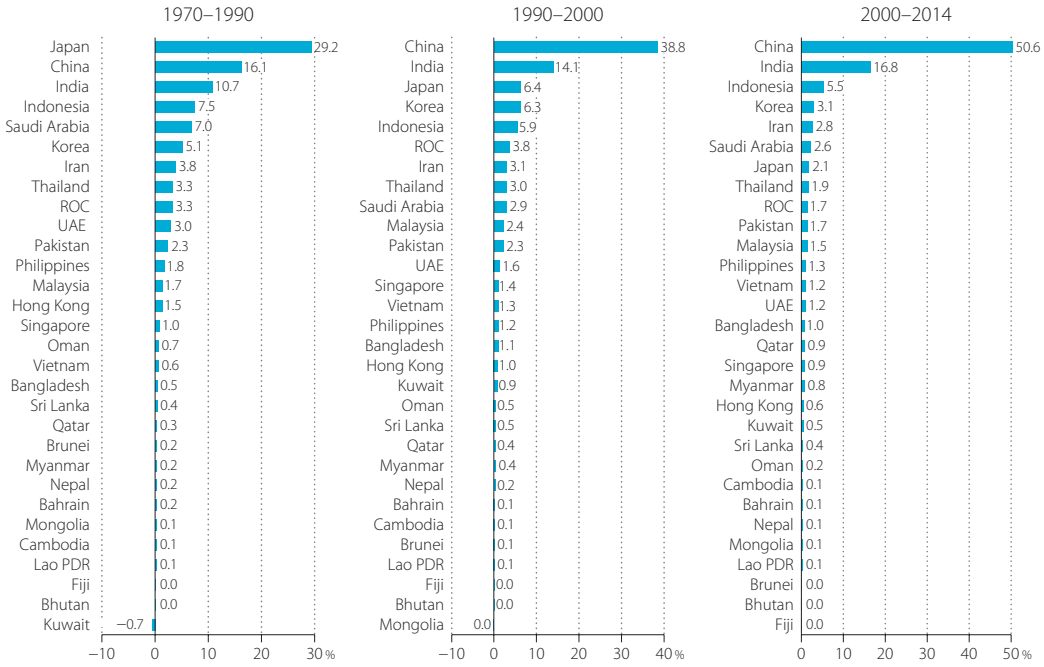

Figure 7 Country Contributions to Regional GDP Growth, 1970–1990, 1990–2000, and 2000–2014

——Contribution share to the growth of gross regional products (growth rate of Asia30=100)

Sources: Official national accounts in each country, including author adjustments.
Note: The starting periods for the Lao PDR and Cambodia are 1981 and 1987, respectively.

the 1990s. In the period 2000–2014, the growth in China and India accounts for more than two-thirds of regional growth (51% and 17%, respectively).[15] Indonesia became the third engine of Asian growth (5.5%), followed by Korea (3.1%).

It has been a subject of much debate whether the Asian economy has decoupled from the US and the EU15. If it has, the world economy will be substantially less volatile. Figures 8 and 9 compare the correlation coefficients of growth rates among countries in the 1990s and the period from 2000 to 2014, respectively. Countries are grouped by region. Overall, the fortunes of the reference countries have become increasingly tied to Asia in a pro-cyclical manner. It is interesting to note that China's correlation with the US and the EU15 has moved from negative to positive. Correlation among the East Asian countries (Group 1) has been strengthened over time and their correlation with the US, the EU15, and the South Asian countries (Group 2) has strengthened as well. Although the inter-regional correlation in the Southeast Asian countries (Group 3) is stable, their correlation with the US and the EU15 has grown much stronger. Therefore, comparisons of the correlation coefficients of growth between the two periods lend support to an increase, not a decrease, in business cycle synchronicity.

15: The growth in Chinese manufacturing sector explains about one-third of the China's contribution to regional growth (17 percentage points of 51%) in the period 2000–2014. See Figure 86 in Section 6.2 (p. 116) for the industry origins of regional growth.

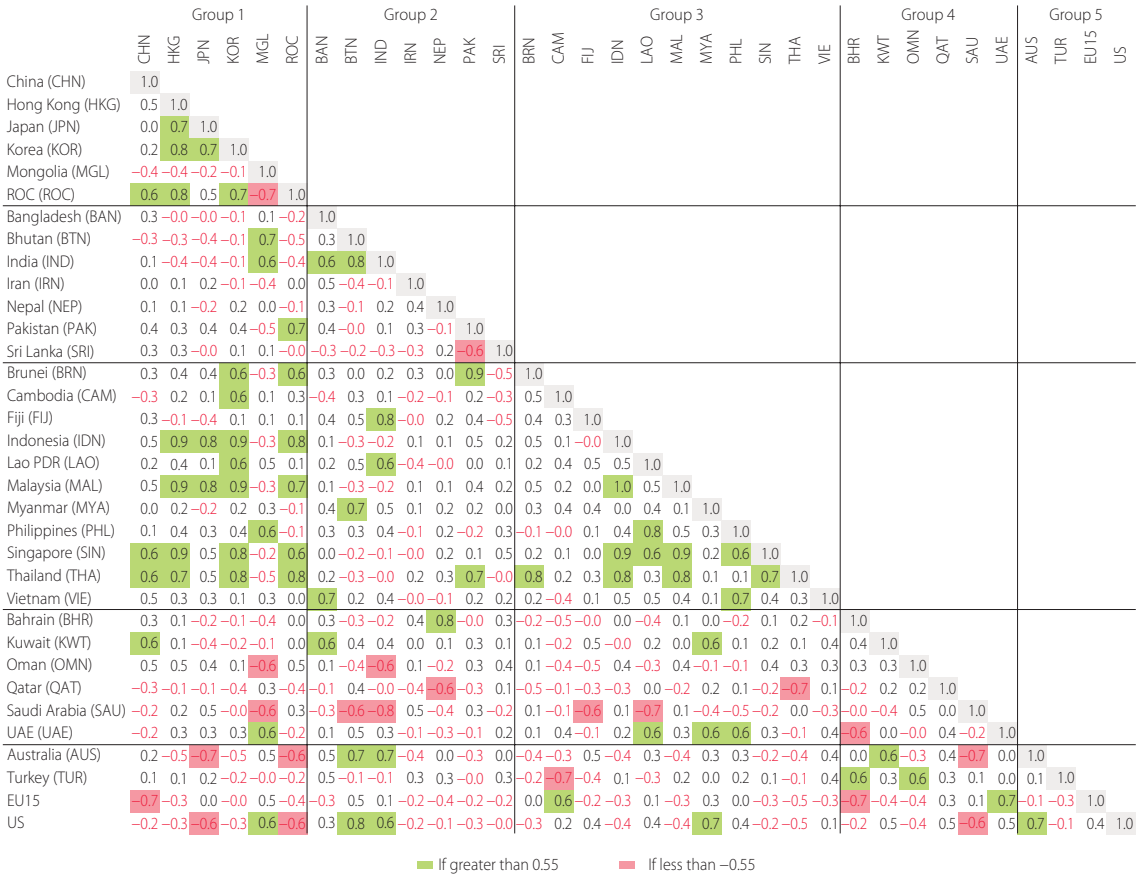

Figure 8 Correlation of GDP Growth, 1990–2000
——Correlation of GDP growth at constant market prices

Sources: Official national accounts in each country, including author adjustments.

3.2 Catching Up in Per Capita GDP

Performance comparisons based on the whole-economy GDP do not take into account the population and can in turn exaggerate the wellbeing of countries with large populations. Asia is the most populous region in the world. In 2014, the population of Asia accounted for 60% of the world's population (56% for Asia30), with China and India alone accounting for more than one-third (Figure 10). In addition, there is a significant difference in the population among Asian economies, as Table 4 shows. Six countries' populations were over 100 million in 2014 (in addition the Philippine population reached 100 million in 2015), but the populations are less than 20 million in 14 economies of the Asia30. Based on per capita GDP, which adjusts for the differences in population, China and India, two rising giants in the Asian economy, remain substantially less well-off in light of the US standard. Conversely, the Asian Tigers proliferate.

Table 5 presents cross-country comparisons of per capita current-price GDP, using exchange rates as conversion rates.[16] However, given the volatile nature of exchange rates, snapshot comparisons as those presented in Table 5 can appear arbitrary. Rather, long-term trends of nominal per capita GDP provide a better guide of relative movements. Based on this measure, Japan closed in on the US level in the late 1980s and peaked in 1995, reflecting the strong yen (Figure 11). Figure 12 shows comparisons

	Group 1						Group 2							Group 3												Group 4						Group 5			
	CHN	HKG	JPN	KOR	MGL	ROC	BAN	BTN	IND	IRN	NEP	PAK	SRI	BRN	CAM	FJI	IDN	LAO	MAL	MYA	PHL	SIN	THA	VIE	BHR	KWT	OMN	QAT	SAU	UAE	AUS	TUR	EU15	US
China (CHN)	1.0																																	
Hong Kong (HKG)	0.6	1.0																																
Japan (JPN)	0.3	0.8	1.0																															
Korea (KOR)	0.4	0.5	0.6	1.0																														
Mongolia (MGL)	0.0	0.6	0.5	0.1	1.0																													
ROC (ROC)	0.6	0.8	0.8	0.7	0.3	1.0																												
Bangladesh (BAN)	0.4	0.4	0.2	–0.2	0.6	0.1	1.0																											
Bhutan (BTN)	0.7	0.2	0.2	0.6	–0.2	0.5	0.1	1.0																										
India (IND)	0.6	0.4	0.4	0.1	–0.2	0.4	0.3	0.2	1.0																									
Iran (IRN)	0.6	0.4	0.2	0.6	–0.3	0.5	–0.3	0.6	0.3	1.0																								
Nepal (NEP)	0.2	0.0	–0.1	–0.3	0.3	0.1	0.3	0.1	0.1	–0.2	1.0																							
Pakistan (PAK)	0.5	0.6	0.3	0.2	0.2	0.3	0.1	–0.1	0.4	0.4	–0.1	1.0																						
Sri Lanka (SRI)	0.4	0.6	0.4	0.0	0.7	0.6	0.5	0.0	0.3	–0.1	0.7	0.1	1.0																					
Brunei (BRN)	0.2	0.3	0.4	0.6	0.2	0.4	–0.2	0.4	–0.2	0.5	–0.4	0.2	–0.0	1.0																				
Cambodia (CAM)	0.5	0.8	0.7	0.4	0.5	0.5	0.4	0.1	0.3	0.3	–0.2	0.7	0.2	0.3	1.0																			
Fiji (FJI)	–0.4	0.3	0.4	0.4	0.5	0.3	–0.3	–0.3	–0.2	–0.1	–0.1	–0.0	0.1	0.2	0.1	1.0																		
Indonesia (IDN)	0.4	0.5	0.5	0.3	0.3	0.7	0.5	0.3	0.3	–0.1	0.3	–0.2	0.7	–0.0	0.1	0.0	1.0																	
Lao PDR (LAO)	0.3	0.3	0.1	–0.2	0.5	0.2	0.7	–0.1	0.3	–0.4	0.5	–0.2	0.7	–0.2	–0.1	–0.0	0.7	1.0																
Malaysia (MAL)	0.4	0.8	0.9	0.6	0.5	0.9	0.2	0.2	0.3	0.2	0.2	0.2	0.7	0.3	0.5	0.3	0.7	0.2	1.0															
Myanmar (MYA)	0.5	0.3	0.2	0.3	–0.4	0.3	–0.3	0.2	0.5	0.7	–0.3	0.7	–0.2	0.1	0.4	–0.2	–0.2	–0.4	0.1	1.0														
Philippines (PHL)	0.2	0.7	0.9	0.3	0.5	0.7	0.4	0.0	0.5	–0.1	0.2	0.2	0.6	–0.0	0.5	0.4	0.6	0.4	0.8	–0.0	1.0													
Singapore (SIN)	0.6	0.9	0.8	0.6	0.4	1.0	0.3	0.4	0.5	0.4	0.2	0.3	0.7	0.3	0.4	0.3	0.8	0.4	0.9	0.2	0.7	1.0												
Thailand (THA)	0.2	0.5	0.8	0.5	0.2	0.7	–0.1	0.3	0.3	0.2	–0.2	0.3	0.2	0.4	0.5	0.3	0.3	–0.2	0.7	0.3	0.7	0.6	1.0											
Vietnam (VIE)	0.4	0.5	0.4	0.4	–0.1	0.4	–0.1	0.2	0.3	0.7	–0.4	0.8	–0.1	0.3	0.7	–0.1	–0.2	–0.6	0.3	0.7	0.0	0.3	0.4	1.0										
Bahrain (BHR)	0.6	0.5	0.5	0.3	–0.0	0.4	0.2	0.2	0.5	0.4	0.1	0.6	0.1	–0.1	0.7	–0.2	0.0	–0.1	0.4	0.7	0.4	0.3	0.4	0.6	1.0									
Kuwait (KWT)	0.3	0.5	0.4	0.1	0.6	0.3	0.2	0.0	–0.0	0.2	0.1	0.6	0.3	0.4	0.7	0.0	–0.1	–0.2	0.5	0.2	0.3	0.2	0.4	0.5	0.5	1.0								
Oman (OMN)	–0.0	–0.2	–0.2	–0.3	–0.1	–0.3	0.5	–0.2	0.1	–0.6	–0.0	–0.4	–0.0	–0.5	–0.2	–0.3	0.3	0.6	–0.3	–0.3	0.0	–0.1	–0.3	–0.6	–0.2	–0.6	1.0							
Qatar (QAT)	0.7	0.5	0.1	0.3	0.3	0.4	0.4	0.2	0.3	0.3	0.1	0.2	0.5	0.1	0.1	0.1	0.5	0.7	0.2	0.2	0.2	0.5	–0.0	–0.1	0.2	–0.1	0.3	1.0						
Saudi Arabia (SAU)	0.1	0.5	0.4	–0.2	0.6	0.3	0.3	–0.2	–0.0	–0.1	0.2	0.2	0.6	0.1	0.4	0.2	0.3	0.2	0.5	–0.1	0.4	0.4	0.2	0.2	0.1	0.7	–0.3	0.1	1.0					
UAE (UAE)	0.2	0.7	0.6	0.2	0.7	0.4	0.3	–0.2	0.1	0.1	0.0	0.6	0.4	0.4	0.8	0.4	0.0	0.1	0.6	0.2	0.6	0.4	0.6	0.4	0.4	0.8	–0.3	0.2	0.7	1.0				
Australia (AUS)	0.4	0.3	0.3	0.4	0.2	0.2	–0.0	0.4	0.1	0.6	–0.2	0.4	–0.1	0.7	0.5	0.0	–0.3	–0.4	0.1	0.3	0.0	0.1	0.3	0.5	0.3	0.6	–0.6	–0.0	0.2	0.5	1.0			
Turkey (TUR)	0.4	0.8	0.7	0.5	0.6	0.9	0.2	0.2	0.2	0.3	0.3	0.5	0.8	0.4	0.5	0.4	0.5	0.2	0.9	0.1	0.6	0.8	0.5	0.4	0.3	0.6	–0.4	0.4	0.6	0.6	0.2	1.0		
EU15	0.5	0.8	0.8	0.8	0.4	0.6	0.2	0.4	0.1	0.5	–0.3	0.4	0.2	0.6	0.8	0.3	0.2	–0.1	0.6	0.3	0.5	0.6	0.5	0.6	0.5	0.5	–0.3	0.3	0.3	0.6	0.7	0.6	1.0	
US	0.3	0.8	0.9	0.6	0.6	0.7	0.2	0.1	0.3	0.3	–0.2	0.6	0.3	0.5	0.8	0.4	0.2	–0.1	0.8	0.3	0.7	0.7	0.8	0.6	0.5	0.7	–0.5	0.1	0.5	0.8	0.5	0.8	0.8	1.0

If greater than 0.55 If less than –0.55

Figure 9 Correlation of GDP Growth, 2000–2014
——Correlation of GDP growth at constant market prices

Sources: Official national accounts in each country, including author adjustments.

among the Asian Tigers. Singapore and Hong Kong have been moving closely with one another for three and a half decades until the mid-2000s, when Singapore overtook Hong Kong.[17] Hong Kong's per capita GDP peaked in 1997, the year when Hong Kong was returned to China, and subsequently plummeted until 2004. Singapore followed a similar path to that of Hong Kong – peaking in 1996, and falling to an all-time low in 2002 before the surge from the late 2000s. The ROC and Korea moved together but at a lower level than Singapore and Hong Kong. In Asia, Japan and Singapore are the two countries that have income levels almost equivalent to the US. However, this view

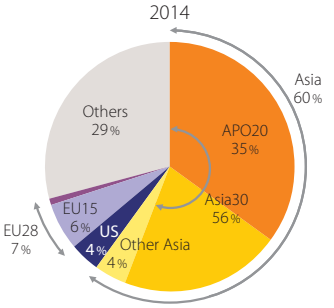

Figure 10 Share of Asian Population in the World, 2014

Source: IMF, *World Economic Outlook Database*, April 2016.

16: In Myanmar the first census in three decades was conducted between March 30, 2014 and April 10, 2014. This showed that the total population was 51 million, which was considerably below the official estimate of 61 million. Reflecting this revision, the per capita GDP is upwardly revised, compared to the results in the Databook 2014.

Table 4 Population, 1970, 1980, 1990, 2000, 2010, and 2014

	1970	(%)		1980	(%)		1990	(%)		2000	(%)		2010	(%)		2014	(%)
China	829.9	41.2	China	987.1	40.0	China	1143.3	38.4	China	1267.4	36.9	China	1340.9	34.8	China	1367.8	34.1
India	553.9	27.5	India	697.2	28.3	India	870.6	29.2	India	1053.5	30.7	India	1231.0	31.9	India	1295.3	32.3
Indonesia	116.1	5.8	Indonesia	147.5	6.0	Indonesia	179.4	6.0	Indonesia	206.3	6.0	Indonesia	237.6	6.2	Indonesia	250.3	6.2
Japan	104.7	5.2	Japan	117.1	4.7	Japan	123.6	4.1	Pakistan	137.9	4.0	Pakistan	173.5	4.5	Pakistan	188.7	4.7
Bangladesh	71.2	3.5	Bangladesh	85.4	3.5	Pakistan	112.1	3.8	Japan	126.9	3.7	Bangladesh	147.3	3.8	Bangladesh	155.9	3.9
Pakistan	60.6	3.0	Pakistan	82.6	3.3	Bangladesh	109.0	3.7	Bangladesh	124.1	3.6	Japan	128.1	3.3	Japan	127.1	3.2
Vietnam	42.7	2.1	Vietnam	53.7	2.2	Vietnam	66.0	2.2	Vietnam	77.6	2.3	Philippines	92.3	2.4	Philippines	98.4	2.5
Philippines	36.7	1.8	Philippines	48.1	1.9	Philippines	60.7	2.0	Philippines	76.5	2.2	Vietnam	86.9	2.3	Vietnam	90.7	2.3
Thailand	34.4	1.7	Thailand	44.8	1.8	Iran	55.1	1.8	Iran	64.2	1.9	Iran	74.3	1.9	Iran	78.1	1.9
Korea	32.2	1.6	Iran	38.8	1.6	Thailand	54.5	1.8	Thailand	60.6	1.8	Thailand	65.9	1.7	Thailand	66.9	1.7
Iran	28.4	1.4	Korea	38.1	1.5	Korea	42.9	1.4	Korea	47.0	1.4	Myanmar	49.7	1.3	Myanmar	51.4	1.3
Myanmar	27.3	1.4	Myanmar	31.8	1.3	Myanmar	40.2	1.3	Myanmar	45.6	1.3	Korea	49.4	1.3	Korea	50.6	1.3
ROC	14.8	0.7	ROC	17.9	0.7	ROC	20.4	0.7	Malaysia	23.5	0.7	Malaysia	28.6	0.7	Malaysia	30.6	0.8
Sri Lanka	12.5	0.6	Sri Lanka	14.7	0.6	Malaysia	18.1	0.6	Nepal	22.8	0.7	Nepal	26.4	0.7	Nepal	27.5	0.7
Nepal	11.3	0.6	Nepal	14.6	0.6	Nepal	18.1	0.6	ROC	22.3	0.6	ROC	23.2	0.6	ROC	23.4	0.6
Malaysia	10.9	0.5	Malaysia	13.9	0.6	Sri Lanka	17.0	0.6	Sri Lanka	19.1	0.6	Sri Lanka	20.7	0.5	Sri Lanka	20.8	0.5
Cambodia	6.77	0.3	Cambodia	6.59	0.3	Cambodia	8.84	0.3	Cambodia	11.9	0.3	Cambodia	14.0	0.4	Cambodia	14.9	0.4
Hong Kong	3.96	0.2	Hong Kong	5.06	0.2	Hong Kong	5.70	0.2	Hong Kong	6.67	0.2	Hong Kong	7.02	0.2	Hong Kong	7.24	0.2
Lao PDR	2.50	0.1	Lao PDR	3.20	0.1	Lao PDR	4.14	0.1	Lao PDR	5.22	0.2	Lao PDR	6.26	0.2	Lao PDR	6.73	0.2
Singapore	2.07	0.1	Singapore	2.41	0.1	Singapore	3.05	0.1	Singapore	4.03	0.1	Singapore	5.08	0.1	Singapore	5.47	0.1
Mongolia	1.25	0.1	Mongolia	1.66	0.1	Mongolia	2.07	0.1	Mongolia	2.39	0.1	Mongolia	2.76	0.1	Mongolia	2.96	0.1
Fiji	0.52	0.0	Fiji	0.63	0.0	Fiji	0.74	0.0	Fiji	0.80	0.0	Fiji	0.86	0.0	Fiji	0.89	0.0
Bhutan	0.29	0.0	Bhutan	0.41	0.0	Bhutan	0.54	0.0	Bhutan	0.60	0.0	Bhutan	0.70	0.0	Bhutan	0.75	0.0
Bahrain	0.21	0.0	Bahrain	0.34	0.0	Bahrain	0.49	0.0	Bahrain	0.64	0.0	Bahrain	1.23	0.0	Bahrain	1.31	0.0
Kuwait	0.74	0.0	Kuwait	1.36	0.1	Kuwait	2.10	0.1	Kuwait	1.86	0.1	Kuwait	2.91	0.1	Kuwait	3.41	0.1
Oman	0.68	0.0	Oman	1.09	0.0	Oman	1.63	0.1	Oman	2.40	0.1	Oman	2.77	0.1	Oman	4.18	0.1
Qatar	0.11	0.0	Qatar	0.22	0.0	Qatar	0.42	0.0	Qatar	0.61	0.0	Qatar	1.70	0.0	Qatar	2.09	0.1
Saudi Arabia	5.84	0.3	Saudi Arabia	9.91	0.4	Saudi Arabia	16.4	0.5	Saudi Arabia	21.4	0.6	Saudi Arabia	28.1	0.7	Saudi Arabia	30.9	0.8
UAE	0.25	0.0	UAE	1.04	0.0	UAE	1.77	0.1	UAE	3.00	0.1	UAE	8.26	0.2	UAE	9.01	0.2
Brunei	0.13	0.0	Brunei	0.19	0.0	Brunei	0.25	0.0	Brunei	0.32	0.0	Brunei	0.39	0.0	Brunei	0.41	0.0
(regrouped)			(regrouped)			(regrouped)			(regrouped)			(regrouped)			(regrouped)		
APO20	1147.5	57.0	APO20	1434.0	58.1	APO20	1772.0	59.5	APO20	2093.3	60.9	APO20	2421.2	62.8	APO20	2542.5	63.3
Asia24	2005.1	99.6	Asia24	2453.5	99.4	Asia24	2956.3	99.2	Asia24	3407.2	99.1	Asia24	3812.9	98.8	Asia24	3962.9	98.7
Asia30	2012.9	100.0	Asia30	2467.4	100.0	Asia30	2979.0	100.0	Asia30	3437.1	100.0	Asia30	3857.8	100.0	Asia30	4013.8	100.0
East Asia	986.8	49.0	East Asia	1166.8	47.3	East Asia	1338.0	44.9	East Asia	1472.7	42.8	East Asia	1551.3	40.2	East Asia	1579.1	39.3
South Asia	709.8	35.3	South Asia	895.0	36.3	South Asia	1127.3	37.8	South Asia	1357.9	39.5	South Asia	1599.5	41.5	South Asia	1688.8	42.1
ASEAN	279.5	13.9	ASEAN	352.2	14.3	ASEAN	435.2	14.6	ASEAN	511.6	14.9	ASEAN	586.8	15.2	ASEAN	615.9	15.3
ASEAN6	200.3	9.9	ASEAN6	256.9	10.4	ASEAN6	316.0	10.6	ASEAN6	371.2	10.8	ASEAN6	430.0	11.1	ASEAN6	452.1	11.3
CLVM	79.3	3.9	CLVM	95.3	3.9	CLVM	119.2	4.0	CLVM	140.3	4.1	CLVM	156.9	4.1	CLVM	163.8	4.1
GCC	7.82	0.4	GCC	14.0	0.6	GCC	22.8	0.8	GCC	29.9	0.9	GCC	45.0	1.2	GCC	50.9	1.3
(reference)			(reference)			(reference)			(reference)			(reference)			(reference)		
US	205.1	10.2	US	227.2	9.2	US	249.6	8.4	US	282.2	8.2	US	309.3	8.0	US	318.9	7.9
EU15	342.1	17.0	EU15	357.3	14.5	EU15	366.3	12.3	EU15	377.6	11.0	EU15	397.3	10.3	EU15	402.8	10.0
EU28	439.9	21.9	EU28	461.6	18.7	EU28	475.2	16.0	EU28	486.8	14.2	EU28	503.2	13.0	EU28	506.9	12.6
Australia	12.6	0.6	Australia	14.7	0.6	Australia	17.1	0.6	Australia	19.0	0.6	Australia	22.0	0.6	Australia	23.5	0.6
Turkey	35.6	1.8	Turkey	44.7	1.8	Turkey	56.5	1.9	Turkey	67.8	2.0	Turkey	73.7	1.9	Turkey	77.7	1.9

Unit: Millions of persons.
Sources: Population census and other official data in each country, including author interpolations.

is considerably revised if focusing on production or real income per capita, using PPP as the conversion rates, as shown in Table 6.

17: Singapore's population comprises not only Singaporean citizens but also non-citizens who have been granted permanent residence in Singapore as well as non-permanent residents such as employment pass holders, work permit holders, and student pass holders. It is known that many workers and students commute to Singapore from outside the country every day. According to the most recent census, the share of Singaporean citizens with respect to total population was 74% in 2000, the share of permanent residents who are not Singaporean citizens was 7%, and the share of non-permanent residents was 19%.

Table 5 Per Capita GDP using Exchange Rate, 1970, 1980, 1990, 2000, 2010, and 2014

——GDP at current market prices per person, using annual average exchange rate

1970		(%)	1980		(%)	1990		(%)	2000		(%)	2010		(%)	2014		(%)
Japan	2.00	100.0	Japan	9.45	100.0	Japan	25.74	100.0	Japan	38.50	100.0	Singapore	46.57	100.0	Singapore	56.01	100.0
Hong Kong	0.96	48.2	Hong Kong	5.70	60.3	Hong Kong	13.49	52.4	Hong Kong	25.76	66.9	Japan	44.48	95.5	Hong Kong	40.22	71.8
Singapore	0.93	46.3	Singapore	5.00	52.9	Singapore	12.77	49.6	Singapore	23.79	61.8	Hong Kong	32.55	69.9	Japan	37.56	67.1
Fiji	0.43	21.4	Iran	2.51	26.5	ROC	8.17	31.7	ROC	14.88	38.6	Korea	22.15	47.6	Korea	27.90	49.8
Iran	0.40	19.8	ROC	2.37	25.0	Korea	6.52	25.3	Korea	11.95	31.0	ROC	19.26	41.4	ROC	22.62	40.4
ROC	0.39	19.6	Fiji	1.92	20.3	Malaysia	2.50	9.7	Malaysia	4.04	10.5	Malaysia	8.92	19.2	Malaysia	11.05	19.7
Malaysia	0.36	17.8	Malaysia	1.78	18.8	Fiji	1.86	7.2	Fiji	2.11	5.5	Iran	6.42	13.8	China	7.72	13.8
Korea	0.28	14.0	Korea	1.70	18.0	Iran	1.72	6.7	Thailand	2.09	5.4	Thailand	5.18	11.1	Thailand	6.10	10.9
Bhutan	0.23	11.4	Thailand	0.74	7.9	Thailand	1.63	6.3	Iran	1.72	4.5	China	4.58	9.8	Iran	5.85	10.4
Thailand	0.21	10.6	Philippines	0.69	7.3	Philippines	0.77	3.0	Philippines	1.06	2.8	Fiji	3.68	7.9	Fiji	5.16	9.2
Sri Lanka	0.20	10.1	Indonesia	0.54	5.7	Mongolia	0.77	3.0	China	0.96	2.5	Indonesia	3.18	6.8	Mongolia	4.15	7.4
Philippines	0.18	9.3	Bhutan	0.34	3.6	Indonesia	0.71	2.8	Sri Lanka	0.89	2.3	Mongolia	2.61	5.6	Sri Lanka	3.64	6.5
Pakistan	0.17	8.4	China	0.31	3.3	Bhutan	0.58	2.2	Indonesia	0.82	2.1	Sri Lanka	2.41	5.2	Indonesia	3.56	6.4
Bangladesh	0.14	6.9	Sri Lanka	0.29	3.1	Sri Lanka	0.49	1.9	Bhutan	0.74	1.9	Bhutan	2.28	4.9	Philippines	2.89	5.2
Cambodia	0.12	5.9	Pakistan	0.29	3.1	Pakistan	0.39	1.5	Mongolia	0.60	1.6	Philippines	2.16	4.6	Bhutan	2.65	4.7
India	0.11	5.7	Mongolia	0.29	3.0	India	0.38	1.5	Pakistan	0.52	1.4	India	1.36	2.9	Vietnam	2.08	3.7
China	0.11	5.6	India	0.27	2.9	China	0.34	1.3	India	0.46	1.2	Vietnam	1.35	2.9	Lao PDR	1.78	3.2
Myanmar	0.10	4.9	Bangladesh	0.22	2.3	Bangladesh	0.29	1.1	Vietnam	0.42	1.1	Lao PDR	1.11	2.4	India	1.56	2.8
Nepal	0.10	4.9	Myanmar	0.19	2.0	Nepal	0.25	1.0	Bangladesh	0.42	1.1	Pakistan	1.01	2.2	Pakistan	1.32	2.4
Mongolia	0.09	4.7	Nepal	0.18	1.9	Lao PDR	0.21	0.8	Lao PDR	0.32	0.8	Myanmar	0.84	1.8	Myanmar	1.31	2.3
Indonesia	0.09	4.3	Cambodia	0.11	1.2	Cambodia	0.20	0.8	Cambodia	0.31	0.8	Cambodia	0.81	1.7	Cambodia	1.14	2.0
Vietnam	0.03	1.4	Vietnam	0.02	0.2	Myanmar	0.13	0.5	Nepal	0.28	0.7	Bangladesh	0.78	1.7	Bangladesh	1.11	2.0
						Vietnam	0.10	0.4	Myanmar	0.16	0.4	Nepal	0.72	1.5	Nepal	0.79	1.4
Bahrain	1.88	94.3	Bahrain	10.30	108.9	Bahrain	9.25	35.9	Bahrain	13.18	34.2	Bahrain	20.84	44.7	Bahrain	25.76	46.0
Kuwait	4.00	200.4	Kuwait	21.82	230.9	Kuwait	9.10	35.3	Kuwait	20.61	53.5	Kuwait	40.68	87.4	Kuwait	49.08	87.6
Oman	0.40	19.8	Oman	5.79	61.3	Oman	7.20	28.0	Oman	8.21	21.3	Oman	21.46	46.1	Oman	19.90	35.5
Qatar	4.97	248.6	Qatar	35.31	373.6	Qatar	17.71	68.8	Qatar	29.33	76.2	Qatar	75.14	161.3	Qatar	103.55	184.9
Saudi Arabia	0.92	46.2	Saudi Arabia	16.67	176.4	Saudi Arabia	7.19	27.9	Saudi Arabia	8.89	23.1	Saudi Arabia	18.92	40.6	Saudi Arabia	24.68	44.1
UAE	4.28	214.4	UAE	42.28	447.3	UAE	28.94	112.4	UAE	35.33	91.8	UAE	35.57	76.4	UAE	45.72	81.6
Brunei	1.43	71.5	Brunei	26.73	282.8	Brunei	13.43	52.2	Brunei	17.76	46.1	Brunei	35.45	76.1	Brunei	42.58	76.0
(regrouped)			(regrouped)			(regrouped)			(regrouped)			(regrouped)			(regrouped)		
APO20	0.31	15.6	APO20	1.23	13.0	APO20	2.59	10.0	APO20	3.49	9.1	APO20	4.92	10.6	APO20	4.90	8.8
Asia24	0.23	11.3	Asia24	0.85	9.0	Asia24	1.69	6.6	Asia24	2.50	6.5	Asia24	4.75	10.2	Asia24	5.83	10.4
Asia30	0.23	11.5	Asia30	0.95	10.0	Asia30	1.74	6.8	Asia30	2.59	6.7	Asia30	4.99	10.7	Asia30	6.18	11.0
East Asia	0.32	16.2	East Asia	1.33	14.0	East Asia	3.06	11.9	East Asia	4.87	12.6	East Asia	8.78	18.8	East Asia	11.13	19.9
South Asia	0.12	6.2	South Asia	0.27	2.8	South Asia	0.38	1.5	South Asia	0.46	1.2	South Asia	1.27	2.7	South Asia	1.51	2.7
ASEAN	0.12	6.2	ASEAN	0.56	5.9	ASEAN	0.84	3.3	ASEAN	1.21	3.1	ASEAN	3.37	7.2	ASEAN	4.11	7.3
ASEAN6	0.15	7.5	ASEAN6	0.73	7.7	ASEAN6	1.11	4.3	ASEAN6	1.54	4.0	ASEAN6	4.19	9.0	ASEAN6	4.97	8.9
CLVM	0.06	3.0	CLVM	0.08	0.9	CLVM	0.12	0.5	CLVM	0.32	0.8	CLVM	1.13	2.4	CLVM	1.74	3.1
GCC	1.36	67.9	GCC	18.38	194.4	GCC	9.30	36.1	GCC	12.73	33.1	GCC	25.72	55.2	GCC	32.91	58.8
(reference)			(reference)			(reference)			(reference)			(reference)			(reference)		
US	5.25	262.6	US	12.60	133.3	US	23.95	93.1	US	36.45	94.7	US	48.37	103.9	US	54.40	97.1
EU15	3.65	182.5	EU15	9.29	98.3	EU15	17.44	67.7	EU15	26.21	68.1	EU15	36.73	78.9	EU15	40.16	71.7
									EU28	22.61	58.7	EU28	33.34	71.6	EU28	37.00	66.1
Australia	3.57	178.8	Australia	11.78	124.6	Australia	18.97	73.7	Australia	21.49	55.8	Australia	58.70	126.0	Australia	61.84	110.4
Turkey	0.67	33.7	Turkey	2.03	21.5	Turkey	3.55	13.8	Turkey	3.96	10.3	Turkey	10.04	21.6	Turkey	10.42	18.6

Unit: Thousands of US dollars.
Sources: Official national accounts in each country, including author adjustments.
Note: See Appendix 1 for the adjustments made to harmonize GDP coverage across countries.

In terms of per capita GDP at constant prices using PPP in Table 6, Japan was the first country in Asia to start catching up with the US. By 1970, its per capita GDP was 61% of the US, quite a distance ahead of other Asian countries. Japan had been closing the gap with the US steadily until 1991 (86%), but the gap widened again when the impact of the long recession of the 1990s started to manifest itself.[18] In recent years, Japan's level has stabilized to around 70–73% of the US (Figure 13).

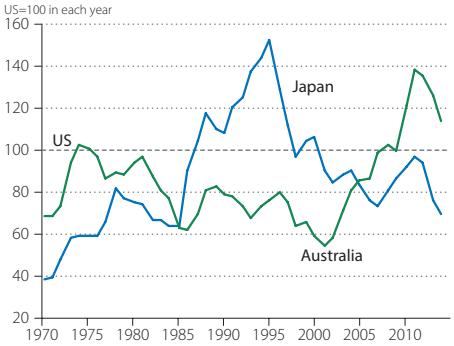

Figure 11 Per Capita GDP using Exchange Rate of Japan and Australia, Relative to the US, 1970–2014

——GDP at current market prices per person, using annual average exchange rate, relative to the US

Sources: Official national accounts in each country, including author adjustments.

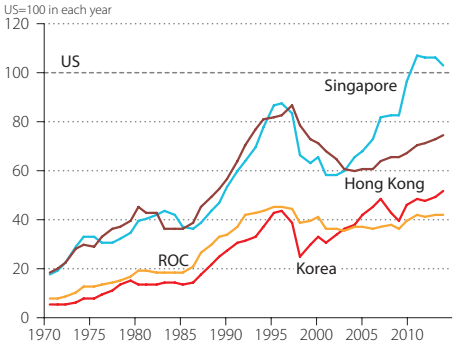

Figure 12 Per Capita GDP using Exchange Rate of the Asian Tigers, Relative to the US, 1970–2014

——GDP at current market prices per person, using annual average exchange rate, relative to the US

Sources: Official national accounts in each country, including author adjustments.

Japan's per capita GDP was the highest among Asian countries until it was overtaken by Singapore in 1980.[19] The result highlights the outcome of the dramatic development effort made by the Asian Tigers, as shown in Figure 14. Not only were they inching to the top, they were constantly closing the gap with the US. Starting from a level of 42% the US in 1970, Singapore surpassed the US in 1993.[20] In 2014, Singapore had a per capita GDP which was 54% above the US. It became the richest economy in Asia, representing a remarkable achievement. Hong Kong holds the second place, with a per capita GDP similar to the US. Japan's per capita GDP, at 71% of the US, or around 46% of the group leader (Singapore), is similar to that of the EU15. The ROC and Korea trail behind the other two Asian Tigers at 85% and 65% of the US, respectively.

The relative performance of China and India, the two most populous countries in the world, is diminished in this measure due to their population. Their per capita GDP is 24.8% and 10.3% of the US in 2014, respectively (Figure 15). However, this should not taint the remarkable progress made over the past decades, especially by China where the per capita GDP was less than 2.0% of the US in 1970. China's relative per capita GDP has increased more than tenfold in these four decades. The income gap between the US and the majority of Asian countries is still sizable,[21] indicating significant opportunity for catch-up.

18: Jorgenson, Nomura, and Samuels (2016) indicated that the manufacturing sector was the main contributor to the catching-up process of the Japanese economy in the 1960s, and that, by 1980, the US–Japan TFP gap for the manufacturing sector had almost disappeared. Japanese manufacturing productivity relative to the U.S. peaked at 103.8 in 1991 and deteriorated afterward, leaving a current gap that is almost negligible.

19: Among the mature economies in Asia, Singapore is a unique country, in which the PPP was downwardly revised from the 2005 ICP to the 2011 ICP (see Box 1). This shift has the significant effect of bringing forward the year when Singapore overtook Japan (or US) in relative per capita GDP to 1980 (1993 for the US), from 1993 (2004 for the US) as estimated in the Databook 2013, based on the 2005 ICP. Although this edition follows the 2011 ICP results, it may require a further examination if this time-series level comparison, based on the constant PPP approach, can provide an appropriate picture, especially for Singapore.

20: Generally, Singapore's GNI is lower than its GDP, and over the past four decades, the divergence was the largest in 2004 with GNI equivalent to 92.6% of GDP (see Figure 91 in Section 7.1, p. 129). On the other hand, the US GNI never goes outside +1.6% of GDP. However, Singapore's lead of 54% over the US in 2014 was large enough that their relative positions would be independent of whether GNI or GDP was used.

Table 6 Per Capita GDP, 1970, 1980, 1990, 2000, 2010, and 2014

——GDP at constant market prices per person, using 2011 PPP, reference year 2014

1970		(%)	1980		(%)	1990		(%)	2000		(%)	2010		(%)	2014		(%)
Japan	15.2	100.0	Singapore	21.7	100.0	Singapore	36.1	100.0	Singapore	54.3	100.0	Singapore	75.8	100.0	Singapore	83.7	100.0
Singapore	10.6	69.8	Japan	21.3	98.6	Japan	32.1	89.0	Hong Kong	35.8	65.9	Hong Kong	50.6	66.8	Hong Kong	55.4	66.2
Iran	10.2	67.1	Hong Kong	16.7	77.0	Hong Kong	28.4	78.6	Japan	35.1	64.6	ROC	41.4	54.7	ROC	46.1	55.1
Hong Kong	9.0	59.5	Iran	10.4	47.9	ROC	16.4	45.3	ROC	28.7	52.8	Japan	37.6	49.6	Japan	38.9	46.5
Fiji	4.5	29.4	ROC	8.5	39.2	Korea	12.2	33.9	Korea	21.8	40.2	Korea	32.0	42.3	Korea	35.3	42.2
Malaysia	4.2	27.7	Malaysia	7.3	33.7	Malaysia	10.2	28.3	Malaysia	16.0	29.4	Malaysia	21.8	28.8	Malaysia	25.1	30.0
ROC	3.8	25.1	Fiji	5.8	26.9	Iran	9.5	26.3	Iran	12.0	22.1	Iran	18.7	24.7	Iran	17.9	21.4
Philippines	3.1	20.5	Korea	5.3	24.7	Thailand	7.2	19.9	Thailand	10.1	18.5	Thailand	14.5	19.1	Thailand	16.1	19.2
Mongolia	3.1	20.3	Philippines	4.2	19.5	Fiji	6.3	17.4	Fiji	7.3	13.4	China	10.1	13.3	China	13.5	16.1
Thailand	2.8	18.5	Mongolia	4.2	19.4	Mongolia	5.7	15.7	Indonesia	6.0	11.0	Indonesia	9.1	12.0	Mongolia	11.8	14.1
Korea	2.6	17.3	Thailand	4.1	19.0	Indonesia	4.5	12.6	Sri Lanka	5.2	9.6	Sri Lanka	8.0	10.6	Indonesia	10.7	12.8
Sri Lanka	2.1	13.7	Indonesia	3.0	13.8	Philippines	4.1	11.3	Mongolia	4.9	9.0	Mongolia	8.0	10.6	Sri Lanka	10.6	12.6
Indonesia	1.7	11.2	Sri Lanka	2.7	12.3	Sri Lanka	3.5	9.7	Philippines	4.5	8.3	Fiji	7.8	10.3	Fiji	8.7	10.4
Pakistan	1.5	10.1	Pakistan	1.8	8.3	Pakistan	2.7	7.4	China	3.9	7.2	Bhutan	7.1	9.3	Bhutan	8.1	9.7
India	1.3	8.6	India	1.4	6.4	Bhutan	2.5	7.0	Bhutan	3.6	6.6	Philippines	6.0	7.9	Philippines	7.0	8.4
Bhutan	1.2	8.0	Bhutan	1.3	5.9	India	1.9	5.3	Pakistan	3.5	6.4	Vietnam	4.8	6.3	Vietnam	5.7	6.8
Bangladesh	1.2	7.8	Nepal	1.2	5.4	Lao PDR	1.7	4.7	India	2.7	4.9	India	4.7	6.2	India	5.6	6.7
Nepal	1.1	7.4	Bangladesh	1.1	5.0	China	1.6	4.4	Vietnam	2.6	4.8	Pakistan	4.4	5.9	Lao PDR	5.2	6.3
Vietnam	1.0	6.5	Vietnam	1.0	4.7	Nepal	1.5	4.1	Lao PDR	2.5	4.5	Lao PDR	4.2	5.5	Myanmar	5.2	6.2
Myanmar	0.7	4.5	Myanmar	0.9	4.1	Vietnam	1.4	3.9	Nepal	1.9	3.5	Myanmar	4.0	5.3	Pakistan	4.7	5.6
China	0.5	3.3	China	0.8	3.5	Bangladesh	1.3	3.5	Bangladesh	1.8	3.4	Cambodia	2.8	3.6	Cambodia	3.4	4.1
						Cambodia	1.0	2.8	Cambodia	1.5	2.7	Bangladesh	2.7	3.5	Bangladesh	3.2	3.8
						Myanmar	0.8	2.2	Myanmar	1.4	2.6	Nepal	2.4	3.2	Nepal	2.7	3.3
Bahrain	37.6	248.1	Bahrain	47.8	220.7	Bahrain	38.2	105.8	Bahrain	47.5	87.4	Bahrain	43.3	57.1	Bahrain	47.3	56.6
Kuwait	199.9	1318.9	Kuwait	87.9	405.9	Kuwait	43.4	120.2	Kuwait	85.8	158.0	Kuwait	83.4	110.1	Kuwait	82.7	98.8
Oman	15.1	100.0	Oman	26.5	122.6	Oman	39.6	109.7	Oman	42.9	79.1	Oman	52.0	68.6	Oman	40.0	47.8
Qatar	168.2	1109.7	Qatar	142.5	658.0	Qatar	87.7	242.9	Qatar	114.8	211.4	Qatar	142.3	187.8	Qatar	157.0	187.6
Saudi Arabia	49.7	327.9	Saudi Arabia	77.4	357.2	Saudi Arabia	44.1	122.2	Saudi Arabia	44.2	81.3	Saudi Arabia	46.9	61.9	Saudi Arabia	52.7	63.0
UAE	43.3	285.6	UAE	198.3	916.0	UAE	119.3	330.5	UAE	115.9	213.3	UAE	62.3	82.3	UAE	70.5	84.3
Brunei	93.7	618.0	Brunei	157.0	725.3	Brunei	88.5	245.2	Brunei	85.9	158.1	Brunei	82.6	109.1	Brunei	77.6	92.8
(regrouped)			(regrouped)			(regrouped)			(regrouped)			(regrouped)			(regrouped)		
APO20	3.2	21.2	APO20	4.1	18.9	APO20	5.5	15.3	APO20	6.7	12.3	APO20	8.9	11.7	APO20	9.8	11.7
Asia24	2.1	13.9	Asia24	2.8	12.9	Asia24	4.0	11.2	Asia24	5.7	10.5	Asia24	9.3	12.2	Asia24	11.0	13.1
Asia30	2.4	15.5	Asia30	3.3	15.0	Asia30	4.4	12.2	Asia30	6.1	11.3	Asia30	9.8	13.0	Asia30	11.6	13.9
East Asia	2.4	15.7	East Asia	3.4	15.5	East Asia	5.3	14.7	East Asia	7.9	14.5	East Asia	13.8	18.2	East Asia	16.9	20.2
South Asia	1.4	9.3	South Asia	1.5	6.9	South Asia	2.0	5.6	South Asia	2.8	5.1	South Asia	4.5	6.0	South Asia	5.3	6.3
ASEAN	2.1	14.2	ASEAN	3.3	15.4	ASEAN	4.6	12.7	ASEAN	6.2	11.4	ASEAN	9.2	12.2	ASEAN	10.7	12.8
ASEAN6	2.6	17.5	ASEAN6	4.2	19.3	ASEAN6	5.8	16.2	ASEAN6	7.7	14.2	ASEAN6	11.0	14.5	ASEAN6	12.6	15.1
CLVM	0.9	6.2	CLVM	1.1	4.9	CLVM	1.3	3.5	CLVM	2.2	4.1	CLVM	4.3	5.7	CLVM	5.3	6.4
GCC	66.9	441.3	GCC	87.2	402.9	GCC	51.7	143.3	GCC	56.5	104.0	GCC	56.3	74.3	GCC	61.0	72.9
(reference)			(reference)			(reference)			(reference)			(reference)			(reference)		
US	25.0	165.1	US	30.9	142.5	US	39.0	108.1	US	48.4	89.1	US	51.9	68.6	US	54.4	65.0
EU15	18.5	122.3	EU15	24.3	112.0	EU15	30.2	83.8	EU15	36.7	67.6	EU15	39.5	52.1	EU15	39.8	47.6
									EU28	32.3	59.5	EU28	35.9	47.4	EU28	36.7	43.8
Australia	22.9	151.4	Australia	26.4	121.8	Australia	30.6	84.7	Australia	38.8	71.5	Australia	45.5	60.0	Australia	47.5	56.8
Turkey	6.9	45.3	Turkey	8.1	37.6	Turkey	10.8	29.8	Turkey	12.9	23.7	Turkey	17.4	22.9	Turkey	19.7	23.5

Unit: Thousands of US dollars (as of 2014)
Sources: Official national accounts in each country, including author adjustments.
Note: See Appendix 1 for the adjustments made to harmonize GDP coverage across countries.

Table 6 presents individual figures for seven oil-rich economies (Brunei and the six GCC countries). At first glance, figures in 1970, and those to a lesser extent in 1990, suggest these economies had

21: Per capita GDP may have underestimated the welfare of people in some countries. In the ROC, Hong Kong, and Japan, for example, GNI is consistently higher than GDP although the fluctuations are within +6%. The Philippines is the exception where the divergence between GNI and GDP has been increasing and has become significant for the past two decades, and GNI was more than 30% higher than GDP in the 2010s (See Figure 91 in Section 7.1, p. 129).

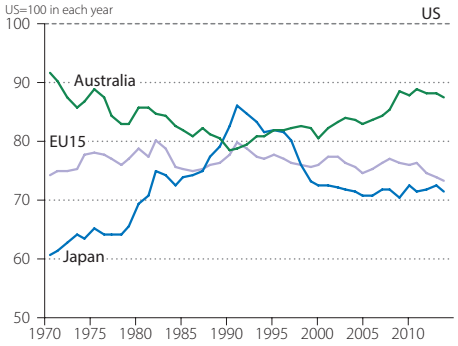

Figure 13 Per Capita GDP of Japan, the EU, and Australia, Relative to the US, 1970–2014
——GDP at current market prices per person, using 2011 PPP, relative to the US

Sources: Official national accounts in each country, including author adjustments.

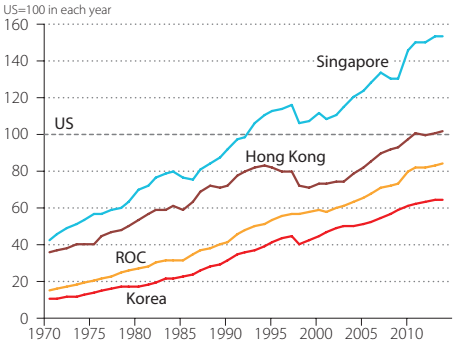

Figure 14 Per Capita GDP of the Asian Tigers, Relative to the US, 1970–2014
——Ratio of per capita GDP at constant market prices, using 2011 PPP, relative to the US

Sources: Official national accounts in each country, including author adjustments.

remarkably higher per capita GDP than those of Japan and the US. For example, in 1970, Kuwait, Qatar, and Brunei had a per capita GDP 13.2 times, 11.1 times, and 6.2 times that of Japan, respectively. However, the measurement of GDP as an indicator of production is misleading for these countries, as it erroneously includes proceeds from the liquidation of a natural resource stock as part of the income flow. In other words, GDP overestimates income from the oil-exporting economies because it does not account for depletion of their natural resource assets. To give a rough indication of the extent of distortion, Figure 16 provides comparisons of per capita GDP excluding production of the mining sector (e.g., crude oil and natural gas). The non-mining GDP per person in GCC economies, such as the UAE, Bahrain, and Kuwait, is almost similar to Japan's level, although total GDP per capita is much larger.

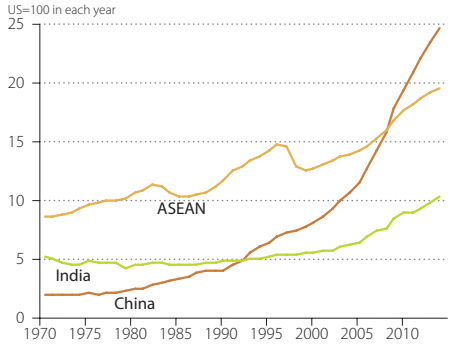

Figure 15 Per Capita GDP of China, India, and ASEAN, Relative to the US, 1970–2014
——Ratio of per capita GDP at constant market prices, using 2011 PPP, relative to the US

Sources: Official national accounts in each country, including author adjustments.

Catching up with the per capita GDP level of advanced economies is a long-term process that could take several decades to accomplish. Empirical evidence suggests there may be a negative correlation between per capita GDP level and the speed of catching up, with some exceptions. With the possibility of adopting successful practices and technologies from the more advanced economies, less advanced economies are poised to experience faster growth in per capita GDP, enabling themselves to catch up to average income level. However, as their income levels approach those of the more advanced countries, their economic growth rates are expected to gradually decline over time.[22]

22: The OECD (2016b) observes that GDP per capita has broadly converged in the OECD countries since the 1970s. However, more advanced economies that started with high income levels in the 1970s have had lower rates of catch-up, stagnated or recently diverged vis-à-vis the US.

Figure 17 plots countries' initial per capita GDP levels against their respective average growth rates per year between 1970 (or the initial year data first became available for the country in question) and 2014. If the two variables have a correlation coefficient of –0.5 (i.e., a negative relationship of medium strength), the higher the initial income level becomes, the more slowly the average growth rate per year is expected to move. However, this is not always true. Low-income countries like Bangladesh, Nepal, the Philippines, and Fiji have failed to catch up, while Thailand and Malaysia could be expected to have grown even faster, given their initial income levels. The Asian Tigers have enjoyed robust growth in the past four decades, but Korea and the ROC, with their lower initial per capita GDP, have sustained higher growth rates than Singapore and Hong Kong. Relative to the Asian Tigers, China appears to be at the start of the catch-up process. Mature economies like the US, the EU15, and Japan shared similar growth experiences (around 2% on average per year, in the past four decades).

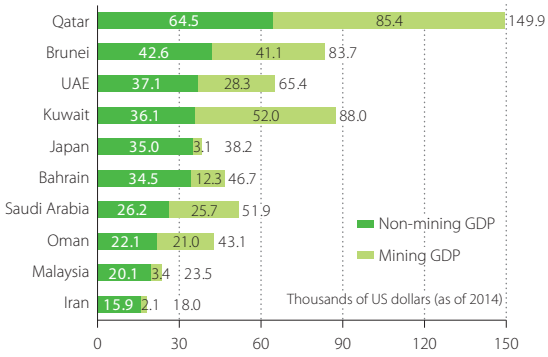

Figure 16 Per Capita Non-Mining GDP in Oil-Rich Countries and Japan, 2014
——GDP at constant market prices per person, using 2011 PPP, reference year 2014

Sources: Official national accounts in each country, including author adjustments.

Table 7 summarizes Figure 17 by country groups. Four levels of per-capita income groups are defined: Group-L1, with per capita GDP at or above 60% of the US; Group-L2, from 20% to under 60%; Group-L3, from 8% to under 20%; and Group-L4, below 8%. Likewise, countries are also grouped according to the speed of their catch-up with the US: Group-C1, at 3% per annum or above; Group-C2, from 1% to

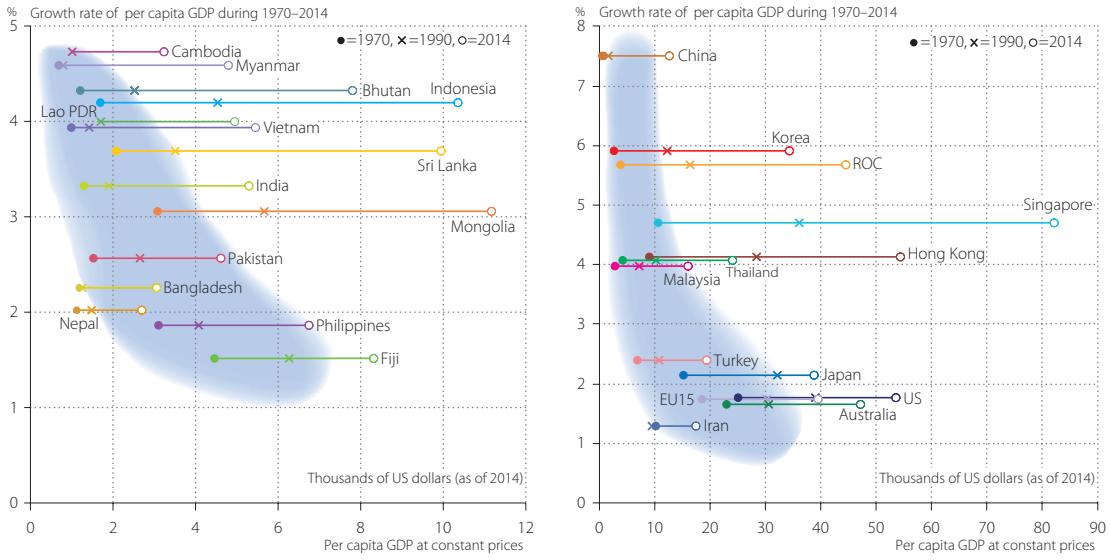

Figure 17 Initial Level and Growth of Per Capita GDP, 1970–2014
——Level and average annual growth rate of GDP at constant market prices, using 2011 PPP, reference year 2014

Sources: Official national accounts in each country, including author adjustments.
Note: The starting periods for the Lao PDR and Cambodia are 1981 and 1987, respectively.

under 3%; Group-C3, from 0% to under 1%; and Group-C4, under 0%. The speed of catch-up with the US is defined as the difference in the average annual growth rate of per capita real GDP between each country and the US. Table 7 shows that many Asian countries (not belonging to Group-C4) have managed to close the gap in per capita real GDP with the US over the last four decades, although some are more successful than others.

Table 7 Country Groups Based on the Initial Economic Level and the Pace of Catching Up

——Level and average annual growth rate of per capita GDP at constant market prices, using 2011 PPP

Initial GDP level to the US	Annual rate of catch-up to the US			
	(C1) > 3%	(C2) 1% <–< 3%	(C3) 0% <–< 1%	(C4) < 0%
(L1) 60% <			Japan, Oman	Australia, Bahrain, Brunei, EU15, Kuwait, Qatar, Saudi Arabia, UAE
(L2) 20% <–< 60%		Hong Kong, Singapore	Turkey	Iran
(L3) 8% <–< 20%	ROC, Korea	Malaysia, Mongolia, Sri Lanka, Thailand	Philippines	Fiji
(L4) < 8%	Cambodia, China	Bhutan, India, Indonesia, Lao PDR, Myanmar, Vietnam	Bangladesh, Nepal, Pakistan	

Sources: Official national accounts in each country, including author adjustments.
Note: The annual catch-up rates are based on the difference in the growths of per capita GDP at constant prices between each country and the US during 1970–2014. The starting years for some countries are different due to data availability: Cambodia (1987), the Lao PDR (1981).

From Table 7 one can see the initial economic level does not fully explain the catch-up process. If it did, the table would have been populated diagonally from the bottom left corner to top right corner. Of the Asia30 countries, five achieved a very fast catch-up (over 3% per year on average) between the respective starting years of their data series and 2014. Their initial per capita GDP level classifies them into the three groups: Singapore from Group-L2, the ROC and Korea from Group-L3, and Cambodia and China from Group-L4. Eleven countries in Group-C4 experienced deterioration in their relative income level against the US with low-income countries like Fiji failing to take off.[23] The seven high-income Asian countries in Group-C4 are all oil exporting countries, which had an exceptionally high GDP (a distortion, as aforementioned) at the beginning of the period. Japan was the only Asian non-oil-exporting country with a high-income level in 1970. But, like the EU15, it has since failed to achieve further parity with the US.

3.3 Sources of Per Capita GDP Gap

To further understand the diverse performance in the Asian group, per capita GDP can be simply broken into two components: labor productivity (defined as real GDP per worker in this section) and the employment rate.[24] Figure 18 shows the percentage point differences in per capita GDP decomposed into the contributions by the labor productivity gap and the employment rate gap, relative to the US in 1990 and 2014.[25]

23: Philippines shifted from Group-C4 to Group-C3 in this edition of the Databook, with a positive catch-up rate of 0.1% on average.

24: Employment rate is measured as the number of workers relative to the population, to ensure consistency with the definition of labor productivity (i.e., GDP per worker) that is measured in all APO member economies. In Section 5.2, labor productivity measures are provided based on hours worked for some selected countries. Also, in the computation of TFP in Section 5.3, hours worked data are used.

25: The gap of country x's per capita GDP relative to the US is decomposed into the sum of the gap of labor productivity and employment rate with respect to the US, as in:

$$\underbrace{\ln\left(GDP_x^t / POP_x^t\right) - \ln\left(GDP_{US}^t / POP_{US}^t\right)}_{\text{Gap of per capita GDP}} = \underbrace{\ln\left(GDP_x^t / EMP_x^t\right) - \ln\left(GDP_{US}^t / EMP_{US}^t\right)}_{\text{Gap of labor productivity}} + \underbrace{\ln\left(EMP_x^t / POP_x^t\right) - \ln\left(EMP_{US}^t / POP_{US}^t\right)}_{\text{Gap of employment rate}}$$

where POP_x^t is population of country x in period t and EMP_x^t is the number of employment of country x in period t.

Most of the Asian countries display a huge per capita GDP gap with the US. This is predominantly explained by their relative labor productivity performance. With the exception of the Asian Tigers, Japan, Iran, and Malaysia, all the other Asian countries had labor productivity gaps of more than 50% against the US in 2014. At the top end of performance, estimates show Singapore was 20% above while Hong Kong was 5% below the US labor productivity level. In Singapore, its employment rate was 34 percentage points higher, giving an overall per capita GDP which was 54% higher than the US in 2014. The labor productivity gaps of the other two Asian Tigers are still sizable against the US, at 16% and 41% for the ROC and Korea, respectively. In most countries, the effect of the employment rate was to widen the per capita GDP gap in 1990. However, in recent years more Asian countries have employment rates higher than the US, with the effect of narrowing the gap.

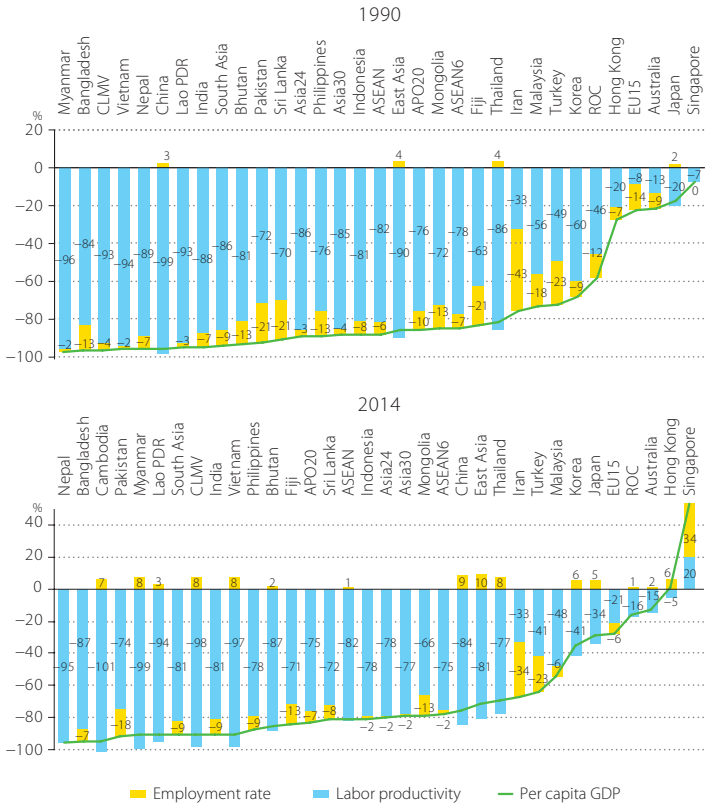

Figure 18 Labor Productivity and Employment Rate Gap Relative to the US, 1990 and 2014

——Decomposition of per capita GDP gap at constant market prices, using 2011 PPP

Sources: Official national accounts in each country, including author adjustments.

Figure 19 focuses on explaining a country's per capita GDP growth by its components: namely labor productivity growth and the change in the employment rate for the periods 1990–2000 and 2000–2014, respectively.[26] For most countries, labor productivity explains a larger share of per capita GDP growth than employment. However, this should not lead us to underestimate the role of changes in the employment rate. The employment rate contribution, relative to labor productivity, was also highly significant in countries such as, Bhutan (39%), Nepal (40%), Singapore (44%), and Pakistan (33%).

China's improvement was the most impressive, achieving per capita GDP growth of 8.9% and 8.8% per year on average in the two periods, respectively. Improvement in labor productivity explains almost all of that growth. According to official statistics,[27] Myanmar achieved a similar performance to China in growth terms, with per capita GDP growth of 5.6% and 9.4% per year on average in the two periods.

26: Country x's per capita GDP is decomposed into the product of its labor productivity and employment rate, as in:
$\underbrace{\ln\left(GDP_x^t / POP_x^t\right)}_{\text{Per capita GDP}} = \underbrace{\ln\left(GDP_x^t / EMP_x^t\right)}_{\text{Labor productivity}} + \underbrace{\ln\left(EMP_x^t / POP_x^t\right)}_{\text{Employment rate}}$ where POP_x^t is population of country x in period t and EMP_x^t is the number of employment of country x in period t.

However, this growth was from a very low base – even in 2014, Myanmar's per capita GDP was only 38% of China's (see Table 6). Like China, Myanmar's per capita GDP growth has been predominantly explained by labor productivity. In both periods Japan had a waning employment rate. With an aging population (see Box 2), this pattern may well continue. The US also experienced a declining employment rate in the recent period, which was a drag on per capita GDP growth. In contrast, falling labor productivity was the drag in GCC countries.

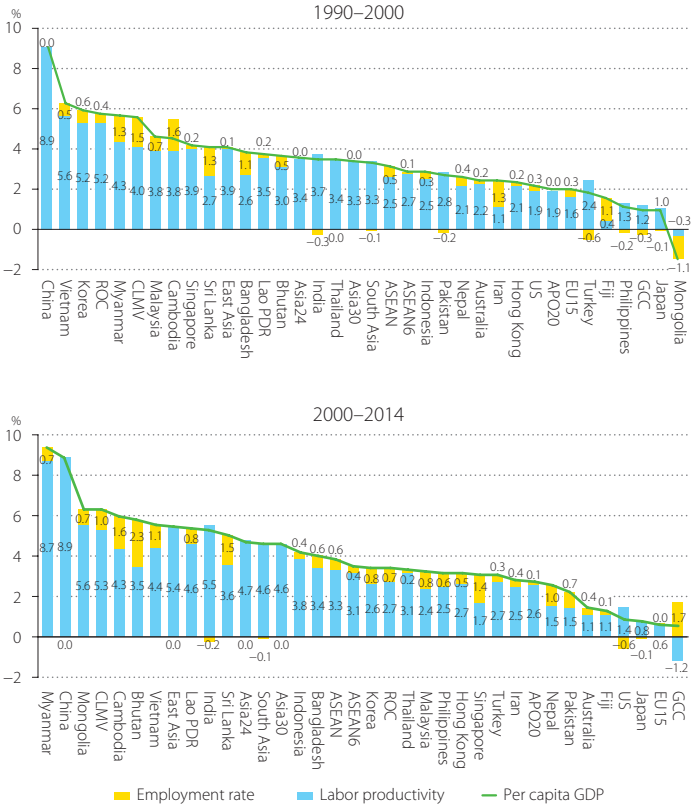

Figure 19 Sources of Per Capita GDP Growth, 1990–2000 and 2000–2014

——Decomposition of average annual growth rate of per capita GDP at constant market prices, using 2011 PPP

Sources: Official national accounts in each country, including author adjustments.
Note: The starting period for Cambodia are 1993.

In the Muslim countries like Iran, Turkey, and Pakistan, the employment rate is significantly less than the US, further reinforcing the poor productivity performances of these countries (Figure 18). It is no coincidence they are among the countries with the lowest shares of female workers in employment, at 15%, 30% and 23%, respectively, as shown in Figure 20. In contrast, a handful of countries such as Cambodia, the Lao PDR, Vietnam, and Mongolia, had higher employment rates than the US, counteracting the negative impact of their productivity performances.

All other things being equal, increasing employment and improving labor productivity could present a policy trade-off in the short term, as they cannot be achieved simultaneously. If the policy target is to increase employment, productivity may suffer in the short term as marginal and less-productive workers are recruited, bringing down the average productivity performance. The huge labor

27: The author would caution readers as to the reliability and quality of Myanmar's official statistics, which have been questioned (especially the estimate in a decade from 1999, based on our observations). Researchers have suggested that this is not consistent with other variables closely correlated with GDP, such as energy use. Non-official estimates put GDP growth at less than half of the official estimates (see The Economist Intelligence Unit, 2010). However, the recent growth with an expansion of mining production (in particular, natural gas and jade) may not necessarily require an increase in energy consumption. In the current edition of the Databook, the numbers reported in official statistics are presented. In order to improve the international comparability, however, we started a project to examine the national accounts in Myanmar as of March 2016 at APO. The past numbers are expected to be revised in the next edition of the Databook.

28: Japan is the exception where the employment rate in 2014 was lower than that in 1970. This reflects, among other things, its aging population. US employment rates also indicate weakening in the recent period, with levels in 2014 lower than that in 1990 (i.e., 48% compared with 51%).

productivity gap between Asia and the US – discussed in Chapter 5 – should be considered in the context of the generally high employment rate in Asia.

Figure 21 shows cross-country comparisons of employment rates in 2014, based on the labor statistics of each country. Employment consists of employees, own-account workers, and contributing family workers. Singapore and Myanmar lead the Asian group with employment rates of over 60%, around 15 and 18 percentage points higher than the US and the EU15, respectively, in 2014. It is clear that employment rates have been rising in most Asian countries.[28] The fastest catch-up countries (i.e., those in Group C1 in Table 7) are also countries with the largest surge in employment rates over the past four decades: China, Korea, Cambodia and the ROC. However, China seems to have exhausted its capacity for further improvement as its employment rate changed little between 1990 and 2014 at 56%. Some of the countries in Group C2 also experienced significant improvements in employment rates (for example, Indonesia and Vietnam). While there are exceptions, generally countries that have failed to catch up also tend to make less vigorous improvements over the period, and in turn continue to have lower employment rates.

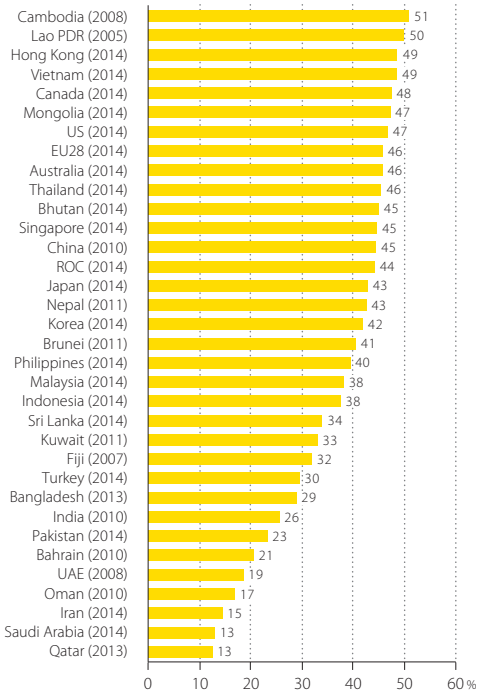

Figure 20 Share of Female Employment
——Ratio of female to total employment

Sources: Population census or labor survey in each country.

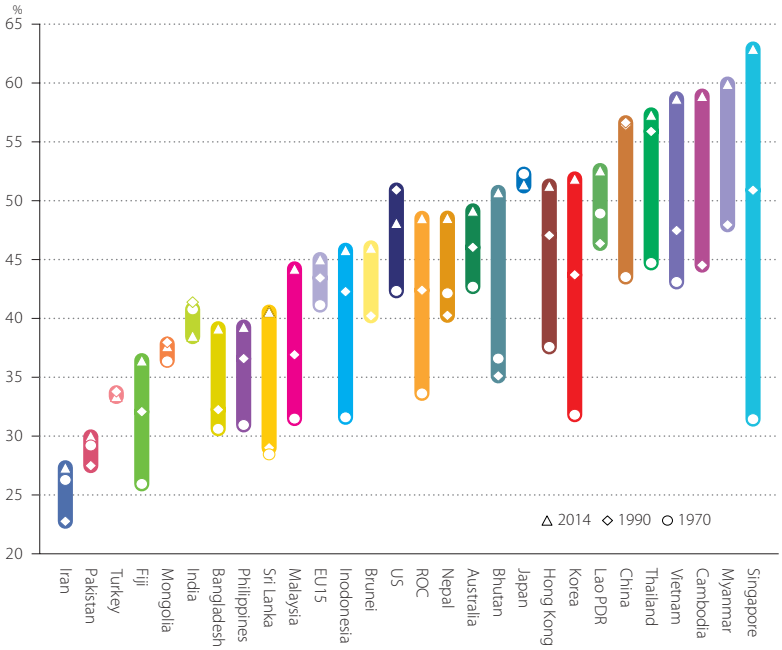

Figure 21 Employment Rates, 1970, 1990, and 2014
——Ratio of employment to total population

Sources: Employment and population data by national statistical offices in each country, including author adjustments.
Note: The starting period for Cambodia is 1993.

Box 2 Population and Demographic Dividend

According to the United Nations (UN) (2015), the world's population is estimated to reach 7.3 billion in 2014, of which Asian countries account for 60.0%. The region is by far the most populous in the world. China and India account for 18.8% and 17.8% of the world's population, respectively. It has been observed that falling fertility rates and rising living standards go hand in hand, although the direction of causality is less certain. The evolution of the demographic structure implies dynamics in a society that are not captured by the overall population size or growth. As people's economic behavior, aspirations, and needs vary at different stages of life, changes in a country's age structure can have a significant impact on its economic growth via supply-side and demand-side impacts.

The world's fertility rate is converging to the replacement level (the level at which a country's population stabilizes). According to the UN, the number of children a woman is expected to have in her reproductive years has dropped by more than half, from about 5.0 to 2.5 in the last 60 years, compared to the replacement level of 2.2 children, one of them a girl. There is regional divergence in this trend. In the last 60 years, the total fertility rate dropped from about 6.8 children to 2.4 in Central America, and from about 5.6 children to 1.6 (below the replacement level), in East Asia. In comparison, some parts of Africa have seen only a modest drop in total fertility, which today remains at more than five children per woman. What is even more staggering is the pace of change. For example, it took Britain over 130 years (1800–1930) to halve its fertility rate, while it took Korea only 20 years to achieve it. This is echoed around the world. This widespread social revolution has been heralded by a complex mix of economic and social development. Economic growth, greater access for women to education, income-earning opportunities, and sexual and reproductive health services, all have been contributing factors to this trend. Coupled with changes in the mortality rate, such a trend can dramatically alter the age profile of a country's population, bringing with it economic implications.

The growth rate of the world's population has slowed from its peak of around 2.0% in the 1970s to today's 1.2% per year. With falling fertility rates, the UN projects the world's population growth rate will decelerate to 0.54% per year by 2050 and further to 0.11% by 2100. Even so, the world population will still increase by one-third from today's 7.3 billion to 9.7 billion in 2050 and a further 12% to 11.2 billion by 2100. These estimates are based on the medium-fertility variant, but with only a small variation in fertility, particularly in the more populous countries, the total could be higher (10.8 billion by 2050 and 16.6 billion in 2100) or lower (8.7 billion in 2050 and 7.3 billion in 2100). Figure B2.1 depicts this shift in the distribution of the world population with the share from the more developed regions gradually declining from 17.2% in 2014 to 13.2% in 2050 and 11.4% in 2100, compared with 32.2% in 1950. Conversely, the share of the least developed countries is depicted as rising from today's 12.8% to a projected 19.5% in 2050 and 28.2% in 2100, up from 7.8% in 1950.

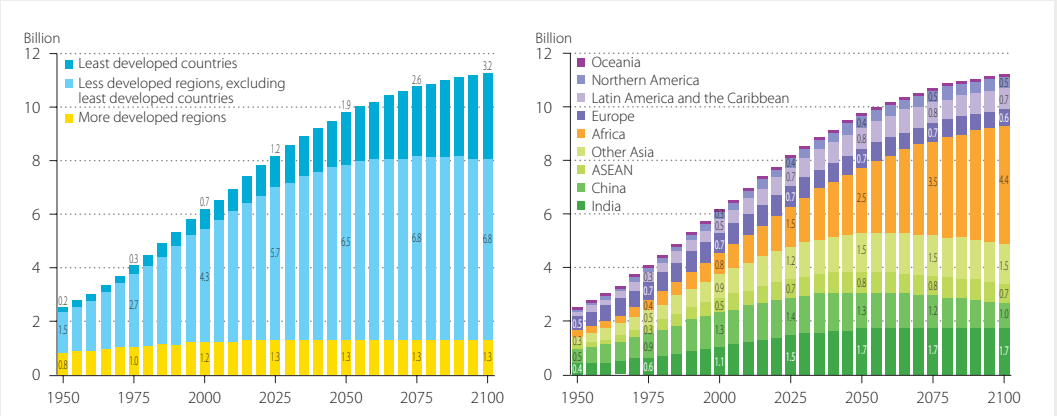

Figure B2.1 Distribution of the World's Population in Different Regions, 1950–2100

Source: UN (Department of Economic and Social Affairs), *World Population Prospects: The 2015 Revision*.

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According to the projection, Asia's share will decline from its 59.9% today to 54.2% in 2050 and 43.6% in 2100, while Africa's share will rise from today's 15.9% to 25.5% and 39.1%, respectively. Figure B2.2 shows the current population size of individual Asian countries compared with the 1970 level and its 2050 projection. As can be seen from the chart, China's population is expected to more or less stabilize around the current level. China has socially engineered the change with its one-child policy, which has made its current population 300–400 million lower than it would have been otherwise. In less than two decades, India is projected to overtake China as the most populous country in the world.

Figure B2.3 shows the demographic make-up of countries in 2014 (the population proportions of the under-15 and over-65 age groups, which together make up the dependent population). Ranking the countries by the share of old-age population filters the rich economies to the top end. These economies also have a relatively low share of the young-age group compared to less developed countries. This suggests that demographic transition tends to run parallel with economic progress, although the direction of causation is not certain. As countries move from high to low mortality and fertility rates, the demographic transition produces a "boom" generation that is larger than those immediately before and after it. As this boom generation gradually works through a nation's age structure, it produces a demographic dividend of economic growth as people reach their prime.

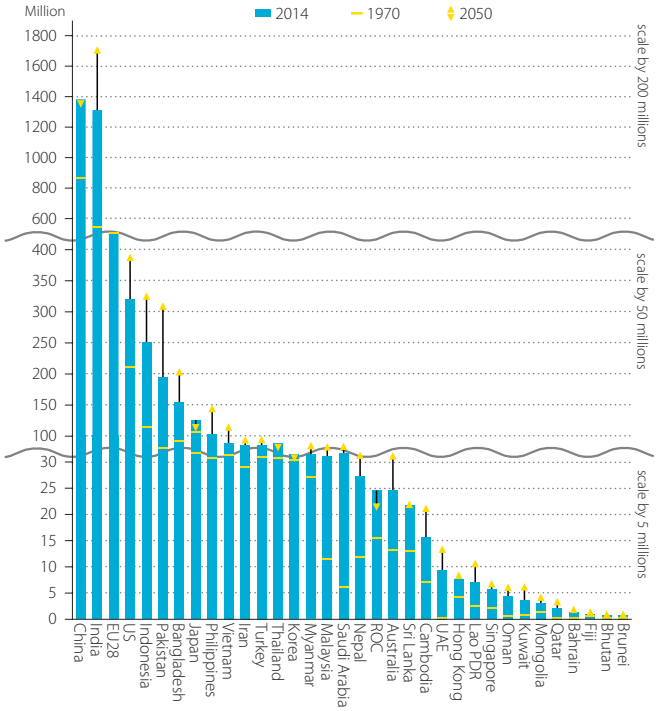

Figure B2.2 Asian Countries' Population Size and Projection, 1970, 2014, and 2050

Source: World Bank, *World Development Indicators 2015*.

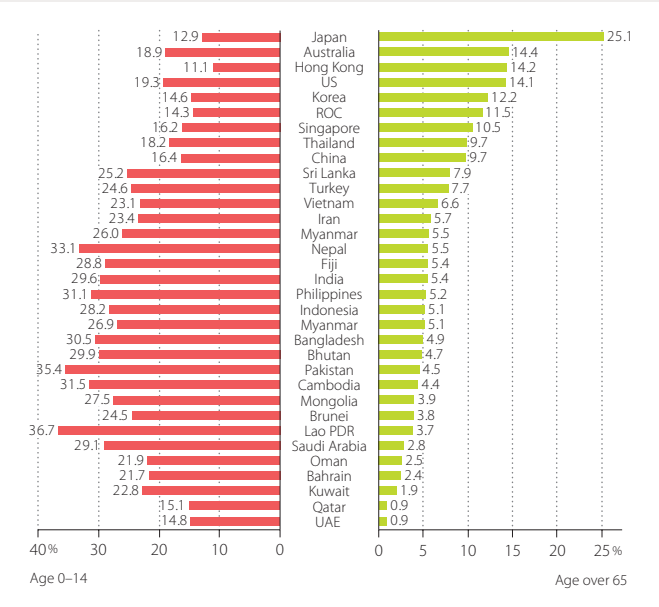

Figure B2.3 Proportion of the Dependent Population, 2014

Sources: Population census and official national accounts in each country.

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Using demographic data since 1950 and UN projections up to 2100, Figures B2.4 and B2.5 track changes in the ratio of the working population (aged 15-64) to dependent population (aged under 14 and over 65) by country and by country group, respectively. The higher the ratio, the more favorable its demography for economic growth. Japan could have capitalized on the demographic dividend in the 1960s, when its GDP growth was over 10% on average per year for ten years. Similarly, China, Hong Kong, Korea, Singapore, and Thailand are poised for the prospect of such demographic dividend in the 2000s and 2010s, whereas, based on projections, some ASEAN counties as Myanmar and Indonesia will have to wait for such opportunity until the 2020s and 2030s, and South Asian countries (except Sri Lanka) until the late 2030s and 2040s.

The reaping of this dividend, however, is far from automatic. A favorable demography can work wonders to produce a virtuous cycle of wealth creation only if it is combined with appropriate health, labor, financial, human capital, and growth-enhancing economic policies. The presence of these complementary factors cannot be taken for granted, but needs to be cultivated in order to earn the demographic dividend. As the analysis of the Databook shows, the contribution of labor to economic growth has been smaller than those of capital and TFP for most countries (Figure 53 in Section 5.3, p. 78). This means that countries should not be afraid of aging too much as long as fairly high growth rates of capital and TFP are maintained. Nevertheless, understanding the demographic shift and its implications is highly relevant for economic projections, providing valuable foresight for economic policy making.

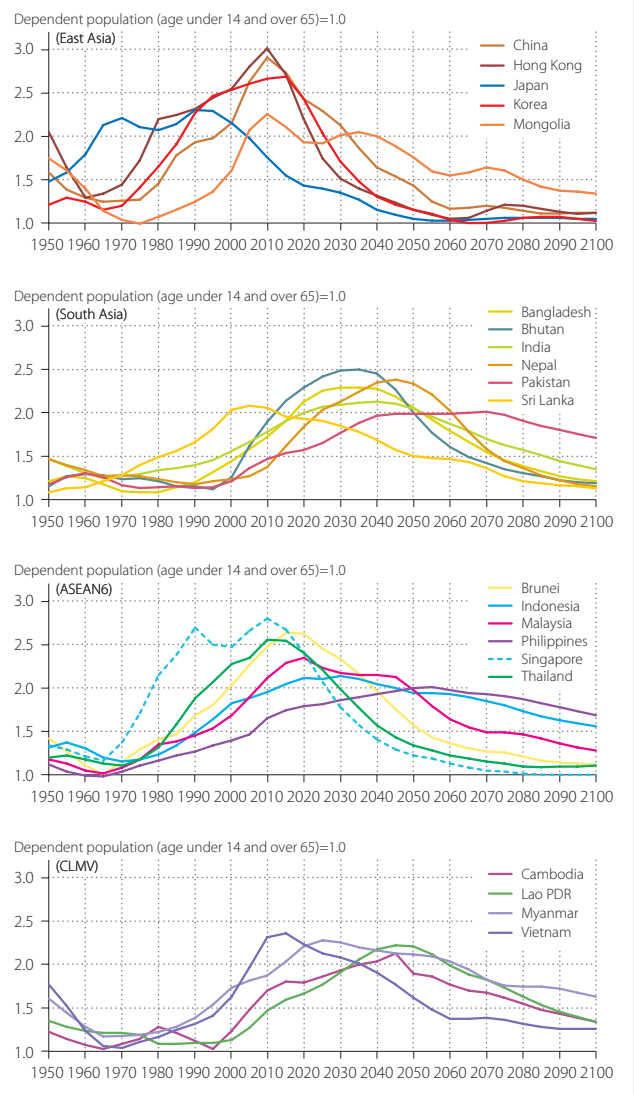

Figure B2.4 Demographic Dividend by Country, 1950–2100

Source: UN (Department of Economic and Social Affairs), *World Population Prospects: The 2015 Revision*.

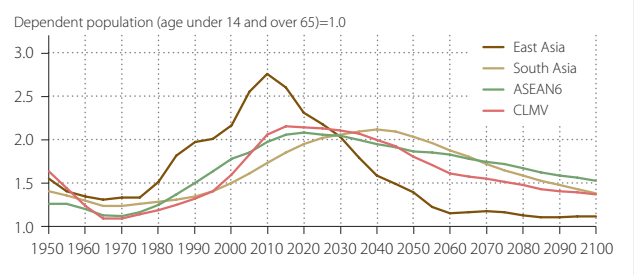

Figure B2.5 Demographic Dividend by Country Group, 1950–2100

Source: UN (Department of Economic and Social Affairs), *World Population Prospects: The 2015 Revision*.

4 Expenditure

GDP is measured by three approaches in national accounts: production by industry; expenditure on final demand; and income to factor inputs. In this chapter, the economic insights are drawn from analyzing the expenditure side of GDP. Sections 4.1 and 4.2 present the composition of countries' expenditure and the long-term trends in Asian countries, respectively. The expenditure-side decomposition of GDP growth is provided in Section 4.3.

4.1 Final Demand Compositions

Table 8 presents comparisons of final demand shares of nominal GDP, covering (1) household consumption, including consumption of non-profit institutions serving households (NPISHs), (2) government consumption, (3) investment or, in national accounts terminology, gross fixed capital formation (GFCF) plus changes in inventories, and (4) net exports (exports minus imports). One can see that country groups display distinctive features in their final demand composition, reflecting their development stage and economic makeup. With the differences in emphasis and vulnerabilities, their behavior and reaction to economic shocks are obviously quite diverse.

For most countries, household consumption is by far the biggest component of GDP.[29] Over the past four decades, the share of household consumption for mature economies has tended to be stable, trending upward in recent years. It is more volatile and largely trends downward in economies undergoing rapid transformation, such as the Asian Tigers in the 1970s and 1980s, and India and China in

Table 8 Final Demand Shares in GDP, 1970, 1990, 2000, 2010, and 2014
——Share of final demands with respect to GDP at current market prices

	Household consumption					Government consumption					Investment					Net exports				
	1970	1990	2000	2010	2014	1970	1990	2000	2010	2014	1970	1990	2000	2010	2014	1970	1990	2000	2010	2014
APO20	59.8	56.9	58.7	57.0	58.2	11.1	11.9	12.9	13.2	13.0	29.6	31.9	25.8	29.0	28.7	−0.5	−0.6	2.7	0.8	0.0
Asia24	59.5	55.6	55.4	48.8	49.1	11.1	12.2	13.9	13.0	13.2	29.9	32.2	28.0	36.2	36.6	−0.5	0.0	2.6	1.9	1.1
Asia30	56.8	55.0	54.3	48.0	48.1	11.5	13.4	14.4	13.2	13.6	28.7	30.7	27.2	35.7	36.0	3.0	0.8	4.0	3.1	2.3
East Asia	50.9	50.9	51.1	42.9	42.8	10.8	13.1	15.8	14.4	14.7	37.7	34.4	31.1	39.5	40.5	0.6	1.6	2.0	3.2	2.1
South Asia	75.6	65.7	66.7	61.1	62.0	8.8	11.6	11.8	11.2	10.8	16.0	25.2	23.1	32.6	31.2	−0.4	−2.5	−1.5	−4.9	−3.9
ASEAN	68.9	60.6	58.0	55.4	56.1	12.5	9.6	9.4	10.7	11.1	23.4	30.7	23.7	28.9	29.2	−4.8	−0.9	8.9	5.0	3.7
ASEAN6	68.5	59.1	57.1	54.3	55.3	10.5	9.7	9.6	11.1	11.6	23.5	31.6	23.4	28.2	29.3	−2.5	−0.3	9.9	6.3	3.8
CLMV	76.7	83.3	70.8	66.5	60.9	27.3	9.0	8.4	6.3	9.7	19.3	14.2	24.3	31.4	30.0	−23.3	−6.6	−3.5	−4.1	−0.7
GCC	34.8	49.4	41.3	36.3	33.5	14.9	25.7	20.9	16.5	19.9	19.2	15.8	18.2	28.5	26.9	31.2	9.2	19.6	18.8	19.7
China	55.8	49.0	46.4	35.7	36.7	11.1	13.7	16.6	12.8	13.3	33.0	34.6	34.6	47.9	47.2	0.1	2.7	2.4	3.6	2.7
India	74.0	62.4	64.1	57.5	58.7	9.4	11.9	12.8	11.7	11.1	16.7	27.1	23.9	35.3	33.3	−0.1	−1.4	−0.9	−4.5	−3.0
Japan	47.8	51.5	54.7	57.2	58.4	10.7	13.0	16.4	19.0	19.9	40.3	34.6	27.5	22.6	24.7	1.2	0.9	1.4	1.2	−3.0
Australia	54.3	57.9	58.7	54.0	56.9	13.8	18.1	17.6	17.8	18.0	32.2	24.3	23.5	27.1	26.6	−0.3	−0.2	0.2	1.0	−1.4
US	60.2	64.0	66.0	68.2	68.4	18.1	15.9	14.0	16.9	14.7	21.4	21.5	23.6	18.4	19.9	0.4	−1.3	−3.7	−3.4	−3.1
EU15	56.8	57.1	57.7	57.3	56.9	15.9	19.3	19.1	21.6	21.0	27.8	24.2	22.8	20.3	19.2	−0.5	−0.7	0.4	0.8	2.8

Unit: Percentage.
Sources: Official national accounts in each country, including author adjustments.
Note: Final demand shares in country groups are computed by using the PPPs for GDP. Household consumption includes consumption of NPISHs. Investment includes GFCF plus changes in inventories.

29: In theory, three approaches to measure GDP are accounting identities and should yield the same result, but in practice, they differ by statistical discrepancies. Based on our Metadata Survey 2016 on national accounts for APO member economies, Japan is an exceptional country that estimates GDP from its expenditure side. In other countries, GDP is estimated from the production side (value added in industries). And some countries record statistical discrepancy as the difference in the estimates between production-based GDP and the sum of final expenditures. In this Databook, statistical discrepancy is mainly attributed to household consumption when data is recorded. Readers should keep in mind that it can have some impact on the share of final demand: e.g., it accounts for 2.5% of GDP in 1990 in the Thailand SNA published in February 2016.

the present day, as the investment share increases for their development effort.

China's household consumption has been trending downward as a share of GDP. It fell from 55.8% in 1970 to 46.4% in 2000. This compares with the early communist era when household consumption was more volatile and at a higher level of over 60% of GDP (Figure 22). China was less well-off then. Figure 22 shows how household consumption share and investment share mirror each other.[30] As the decline in household consumption share accelerated in the 2000s, plummeting to 36.7% in 2014, the investment share rose rapidly to 47.2% of GDP from 34.6% in 2000. Investment has overtaken household consumption as the largest component in GDP expenditure since 2004, and the divide shows no sign of narrowing. The falling share of household consumption may partially reflect the falling labor income share of GDP and/or an uneven distribution of economic gain between the rich and the poor in these countries. There also is a notably rapid rise in exports as a share of GDP since the 1980s when China began to open its economy, from around 5.0% or below in the 1950s and 1960s to its peak of 36.3% in 2006 before softening to 21.2% in 2014.

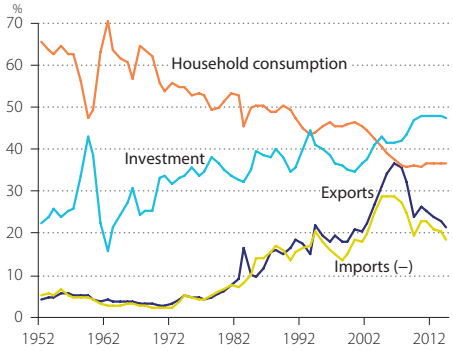

Figure 22 Final Demand Shares in GDP of China, 1952–2014
——Share of final demands with respect to GDP at current market prices

Sources: National accounts by National Bureau Statistics of China, including author interpolation.

With a low consumption ratio, coupled with an unsustainable rise in investment and an overdependence on exports, China faces huge internal and external imbalances. If not addressed, this could jeopardize its medium-term growth prospects. A low consumption share of GDP is not merely a reflection of consumer behavior or preference, but a manifestation of an array of underlying distortions in the economy. An undervalued currency, which favors the production of tradables over non-tradables, may result in an unusually low consumption ratio and a heavy reliance on exports. Lax corporate governance of state-owned enterprises is not conducive to distribution of dividends and therefore, in effect, may act to subsidize investment. Additionally, in the absence of a social safety net, well-developed domestic financial markets may provide a strong incentive for precautionary saving on the part of households (Eichengreen, Park, and Shin, 2012). All of these factors suggest that there are policy levers available to the government to impede or rebalance the economy.

In recent years, even labor-abundant China faced a tightened supply of surplus labor at its coasts, putting an upward pressure on wages (see Box 5, p. 67). This could be a good news for the world, as a higher labor share of GDP will bring about higher household consumption, helping the domestic market fulfill its potential. This will make China less dependent on foreign demand; at the same time, China will generate demand for foreign products. Early signs that the Chinese economy may have started moving in the right direction were evident when the decline in the consumption ratio halted (even turning up slightly since its recent trough in 2009) and external imbalances narrowed to 2.6% in

30: The Chinese official statistics on household consumption could be misleading. Zhang and Tian (2013), for example, point out three potential sources of a significant downward bias in Chinese consumption data. Firstly, the method used to impute rents for owner-occupiers does not take into account land costs, and in turn greatly underestimates the market values of housing. Secondly, private consumption on company accounts is misclassified as business costs (i.e., intermediate consumption), or investment expenditure. Thirdly, sample selection bias (under-representation of high income households) and reporting errors also contribute to the underestimation of household consumption. The authors suggest that taking into account these factors could add 10–15 percentage points to China's consumption, which would bring it to a level more comparable with other East Asian countries.

2014. Since the peak of 8.6% in 2007, net exports have been shrinking.

In contrast to China, the share of household consumption was relatively stable in the US at around 60–64% for the 1970s and 1980s before edging up to 68.4% of GDP in 2014. From a historical perspective as shown in Figure 23, the current level is below the share of household consumption that the US experienced during the Great Depression, when it was over 75%, even as high as 82% in 1932. The share of household consumption in the EU15, which is at around 57%, has remained fairly stable over the past four decades. The Asian average, meanwhile, has hovered around the 50% range until recently when the gap with the EU15 widened,

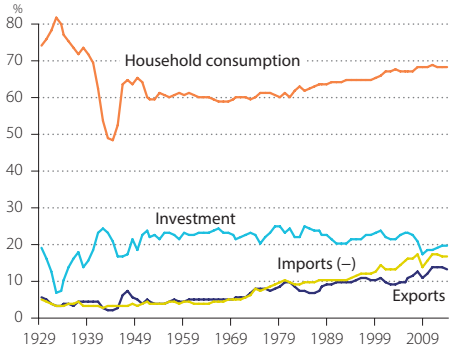

Figure 23 Final Demand Shares in GDP of the US, 1929–2014
——Share of final demands with respect to GDP at current market prices

Sources: National accounts by Bureau of Economic Analysis, US.

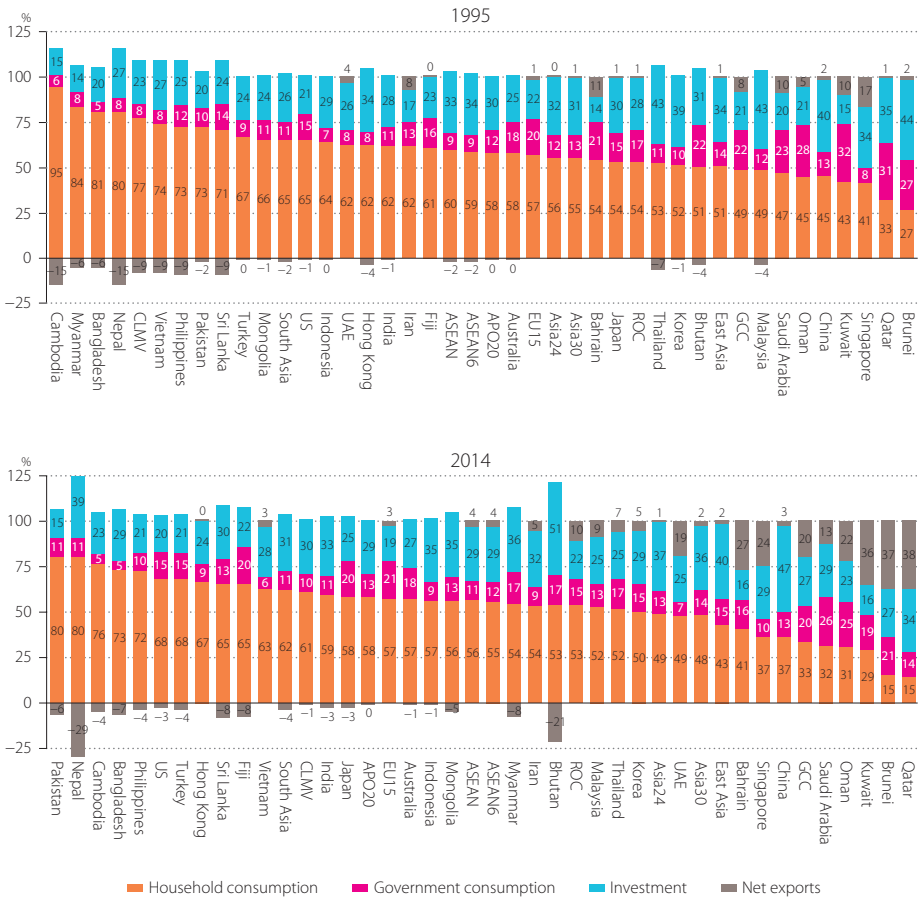

Figure 24 Final Demand Shares in GDP, 1995 and 2014
——Share of final demands with respect to GDP at current market prices

Sources: Official national accounts in each country, including author adjustments.
Note: Household consumption includes consumption of NPISHs. Investment includes GFCF plus changes in inventories.

largely reflecting the trend in China (Table 8). Within Asia, all regions display a decline in household consumption ratios. South Asia maintains the highest share, despite its fall from 75.6% in 1970 down to 62.0% in 2014.

Overall, Asian countries invest significantly more than the US and the EU15 as a share of GDP. Historically, the gap in the investment share between the Asia30 and the EU15 never exceeded 10 percentage points. However, since the beginning of the 1990s, it has started to widen (except for the period of the Asian financial crisis). In 2014 the difference was over 16 percentage points. In the 1970s the EU15 was investing on average 3% more of their GDP than the US. Thereafter, the EU15 investment share converged to the US level. They were out of synch with each other temporarily in the late 1980s and early 1990s. For the past five years, a divergence has opened up with the US investment share of GDP declining faster than that of the EU15 (Figure 30.3). In 2014 investment accounted for 19.5% and 19.1% of final demand in the US and the EU15, respectively, compared with 36.6% for the Asia24. Australia's investment level has been closer to the level of the APO20 than the US/EU15. In 2014 it accounted for over a quarter of final demand. The share of investment in China is the biggest final demand component of GDP since 2004. At 47.2% in 2014, it is likely unsustainable in the long term. East Asia has the highest investment ratio among the Asian regions. While South Asia caught up with them in 2007, since then the paths of the two regions diverged in opposite directions.

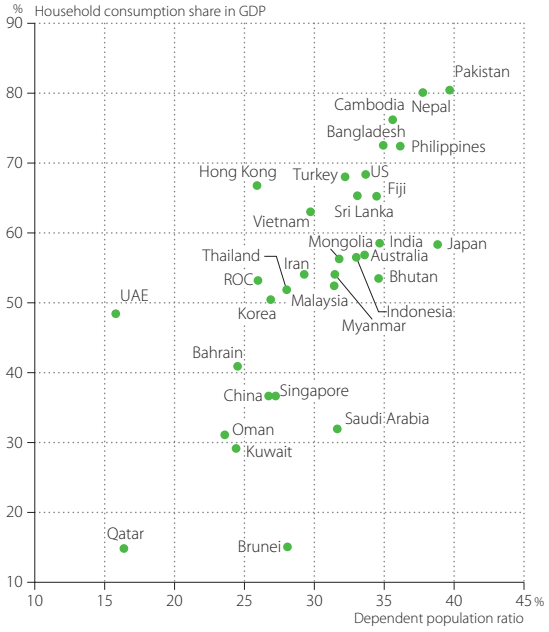

Figure 25 Ratio of Dependent Population and Consumption Share in GDP, 2014

——Shares of dependent population (age under 14 and over 65) to total population and consumption share in GDP at current market prices

Sources: Population data by national statistical office in each country; World Bank, *World Development Indicators 2015*; official national accounts in each country with author estimates.

Compared to other components of final demand, the contribution of net exports to the Asian economy has always been more volatile. Having increased in the Asia24 between 1990 and 2000 from –0.0% to 2.6%, the contribution of net exports decreased to 1.1% in 2014. This compares with the oil-exporting GCC countries at 9.2% in 1990, rising to 18.8% in 2010 and further to 26.1% in 2013.[31] In the US, there is an observable trend of persistent deficit between exports and imports, which has considerably expanded from the beginning of the 1980s to 5.6% in 2006 before narrowing to 3.1% in 2014. South Asia is the only Asian region that consistently has run a fluctuating trade deficit over the years. Lately, it is historically sizable at 7.4% of GDP in 2012, narrowing to 3.9% in 2014.

The regional averages disguise the great variation displayed by individual countries. Figure 24 shows the cross-country comparisons of final demand shares in current-price GDP in 1995 and 2014. Countries are arranged in descending order of their household consumption shares. Although most

31: The recent increase is mainly due rise in price of crude oil to over USD 100 per barrel since 2010 and held until the middle of 2014. See Figure 94 in Section 7.1 (p. 131). In 2014 the contribution of net exports decreased to 19.7%.

countries fall to the right of the US, there are a handful of Asian countries that have a higher consumption ratio than the US. Bangladesh, Cambodia, Nepal, Pakistan, and the Philippines fell to the left of the US in both years of comparisons. The high consumption rate in these countries could be partly explained by the difference in demographic conditions. Figure 25 shows that countries with a high proportion of dependent population (age under 14 and over 65) tend to have a high household consumption share in their GDP. The aforementioned five countries have higher shares of dependent population with over 36% in 2014. On the other hand, the variation of consumption rates is also related to the income level. Countries with a low income will struggle to defer consumption. It is no coincidence that countries clustered on the left of Figure 24 tend to be those in the bottom income groups among the countries studied in this report (see Table 16 in Section 6.1, p. 101).[32]

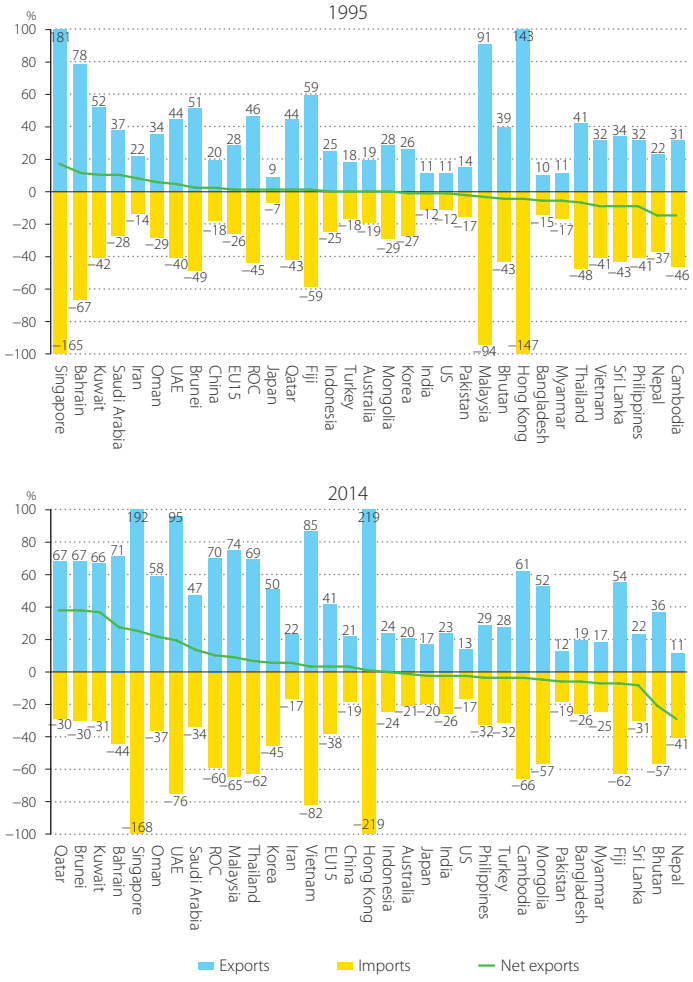

Figure 26 Export and Import Shares in GDP, 1995 and 2014
——Share of exports and imports with respect to GDP at current market prices

Sources: Official national accounts in each country, including author adjustments.

A deficit in net exports can be associated with high household consumption. At the other end of the spectrum, GCC and other oil-exporting countries tend to cluster at the low end of household consumption share of GDP in both years of comparison. The average of household consumption share for GCC countries has been squeezed by net exports (which in turn are dominated by erratic oil revenues), from 49.1% in 1995 to 33.5% in 2014, as shown in Figure 24.[33] Given that a large part of GCC countries' GDP is not sustainable income, it may in fact be prudent for oil-exporting countries not to consume beyond their sustainable levels and instead purposefully invest to generate a steady income stream in the eventuality of oil

32: The Lao PDR is also in the bottom income bracket and the share of dependent population is the highest among Asian countries (40%); it is, however, omitted from Figures 24 and 25 because of a lack of final demand data.

33: It should also be noted that the shares are calculated in current market prices. Revenues from oil exports are notoriously erratic. It is possible that a sudden surge in export revenues relative to imports can squeeze the shares of other components of final demand without any real change in the underlying behavior in the economies. For example, Qatar has the smallest share of household consumption, which shrank from 32.5% in 1995 to 14.8% in 2014, while over the same period, net exports swung from 1.0% to 37.5%. Similarly, net exports for GCC countries as a whole swung from 8.1% to 19.7%, squeezing household consumption from 49.1% in 1995 to 33.5% in 2014.

depletion, regardless of how distant this may seem now. Among the non-oil-exporting Asian countries, Singapore had the smallest household consumption share. Since 2002, however, China has replaced Singapore in that position, with a share of 36.7% in 2014.

Figure 26 presents the export and import shares in GDP as a decomposition of net exports in 1995 and 2014. Net exports are particularly important in a handful of economies. In 2014 the shares in Singapore exports were at 192%, and that in Hong Kong 219%, reflecting their port function in Asia. This explains why the total values of exports and imports are exceptionally high, relative to the size of GDP in these economies.[34]

4.2 Consumption and Investment

Figure 27 shows the long-term trends of household consumption share of GDP for Asian economies and some country groups. Countries are grouped according to the levels of per-capita income in 2014.[35] The Asian Tigers have been the consistent high performers, coming at the top for most of the level indicators presented in Chapter 3. As seen in Figure 27.1, Singapore and Korea showed the most rapid relative retrenchment in household consumption as a share of GDP in their initial stage of development of the 1970s and 1980s. While the downward trend continues in Singapore, it has halted and been mildly reversed in Korea since the late 1980s. Between 1970 and 2014 the household consumption share of GDP fell from 69.0% of GDP to 36.8% and from 73.5% to 50.3% in Singapore and Korea, respectively.

In contrast, household consumption as a share of GDP, at 66.6% in 2014, has been rising in Hong Kong since the mid-2000s. It did fall from 66.2% in 1970 to nearly 55% in the late 1980s, but it was subsequently reversed. Similarly, the relative household consumption in the ROC fell from 55.9% in 1970 to under 50% in the mid-1980s. Since then, it has been on an upward climb until the 2000s when it stabilized at around 55%. The consumption share in Japan has been rising slowly since 1970, from just under 50% in 1970 to 58.4 in 2014. With a rapidly aging population, this rising trend can be expected to continue. Japan's share of dependent population stood at 38.7% in 2014 (Figure 25), nearly 60% of which was accounted for by the over-65 age group.

Figure 27.5 illustrates the observations of Table 8, plotting Asian group averages against those of the reference countries. The US household consumption share has been climbing since the mid-1980s to over 68% of GDP since 2008, from a level of around 62%. Today the US level is more than 10% higher than that of the EU15 and the APO20.[36] The share in the EU15 has been stable, fluctuating within a narrow range between 57% and 60% since the mid-1990s. In 1970, household consumption accounted for around 60% of GDP in APO countries. In contrast, the consumption share for the Asia30 declined rapidly from 57.0% to below 50% over the past decade. This largely reflects China's recent household consumption behavior (Figure 22) as it gained gravity in the regional economy.

34: The 2008 SNA requires that the trade values should be recorded to reflect a change in ownership of goods, rather than accounting for goods moved for processing without incurring actual transactions. Singapore and Hong Kong already introduced the 2008 SNA, the revisions from the 1993 SNA on the export and import data were very minor.

35: Table 16 in Section 6.1 (p. 101) defines four levels of per capita GDP groups in 2014: Group-L1, with per capita GDP above 60% of the US; Group-L2, from 20% to under 60%; Group-L3, from 10% to under 20%; and Group-L4, below 10%. They are presented in Figure 27.1, Figure 27.2, Figure 27.3, and Figure 27.4, respectively. The same country groups are applied in Figures 30 and 34.

36: It is worth noting that the GDP share of government consumption in the EU15 was higher than the average of the Asia24 by 7.8 percentage points in 2014 (Table 8). In fact, when it comes to welfare measurement, actual individual consumption, as opposed to household consumption, is preferred because the former takes into account expenditures by NPISHs and government expenditures on individual consumption goods and services (such as education and health) in addition to household consumption.

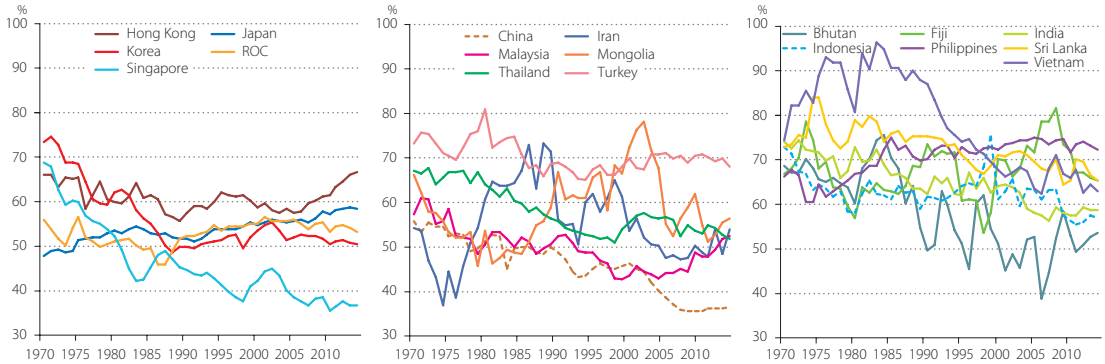

Figure 27.1 Figure 27.2 Figure 27.3

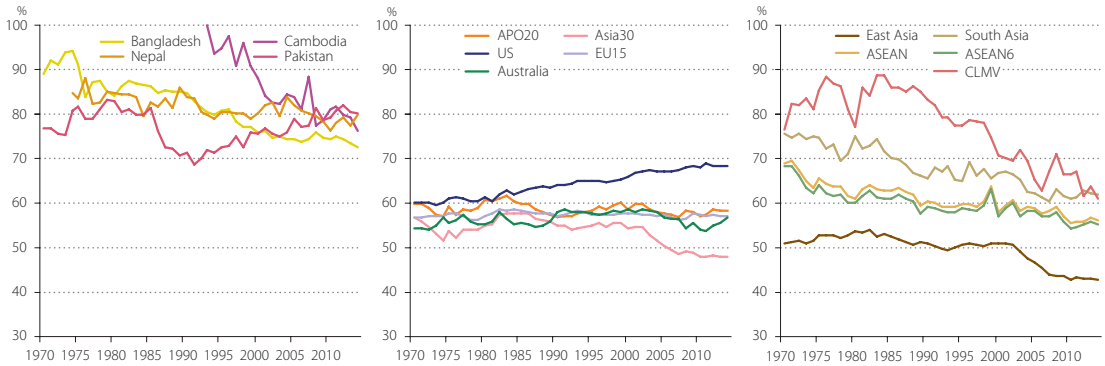

Figure 27.4 Figure 27.5 Figure 27.6

Figure 27 Long-Term Trend of Household Consumption Share in GDP, 1970–2014
——Share of household consumption with respect to GDP at current market prices

Sources: Official national accounts in each country, including author adjustments.

The decomposition of household consumption reveals a huge diversity of consumption patterns among individual countries, partly reflecting their income levels and partly the idiosyncratic characteristics of the society. Figure 28 illustrates the cross-country version of Engel's Law, which states that basic necessities will account for a high proportion of household consumption for a lower per capita income group and vice versa. More specifically, countries where food and non-alcoholic beverages account for a large proportion of consumption tend to have low income (i.e., in groups L3 or L4 in Table 16 in Section 6.1, p. 101). The other end of the spectrum is occupied by the rich Asian countries, namely, the Asian Tigers and Japan.

Figure 29 traces the decreasing long-term path of Japan's Engel's Curve during the period 1949–2014. The countries' levels in 2014 are mapped against Japan's experience (as circles). Among the selected countries, it is staggering to note that in 2014, 52.8% of Bangladesh's household consumption was spent on food and non-alcoholic beverages at one end of the spectrum, compared with only 6.6% in the US at the other end. This suggests the fact that low-income countries spend 30–50% of their GDP on food and non-alcoholic beverages corresponds to Japan's experience in the 1950s and the 1960s. Besides food and non-alcoholic beverages, housing/utilities and transportation are the other two large spending categories. In rich economies, these two categories account for bigger shares in household consumption than food and non-alcoholic beverages. Idiosyncratic spending, such as education in Korea and Cambodia accounting for 5.8% and 5.0% of household consumption, respectively, and health in the US, accounting for one-fifth of consumption, are not reflected in other countries.

Figure 30 compares the long-term trend of investment share (including R&D investment) in GDP among countries. Historically, an investment share in the region of 40% or above seems to be unsustainable in the long run. We see that Japan's investment share of GDP steadily declined over the past decades from 40.3% in 1970 to 24.7% in 2014 (Figure 30.1).[37] In the initial period of our observation, Singapore also sustained an investment share of 40% or above. Since the mid-1980s, however, it has seen a downward trend, in spite of its fluctuations. In 2014 it was 28.9%.[38] The investment share hit around 40% in the ROC and Korea at different times but these were nothing more than temporary spikes (Figure 30.1).

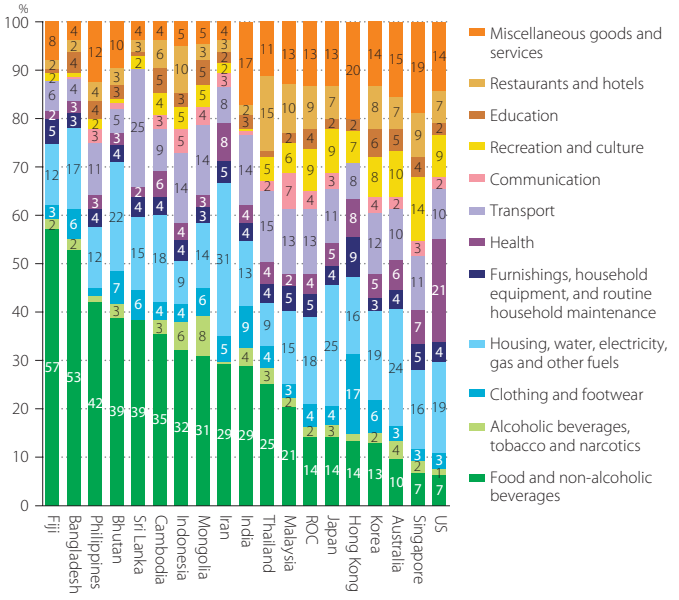

Figure 28 Household Consumption by Purpose, 2014

Sources: Official national accounts in each country.
Note: For data of Hong Kong, transportation includes communication; recreation and culture includes hotels; miscellaneous goods and services include restaurants. For data of Sri Lanka, transportation includes communication; food and non-alcoholic beverages includes alcoholic beverages, tobacco and narcotics. For Fiji, the observation periods are 2009, respectively.

In contrast, the investment share in China and India has been rising. India in particular has been investing very aggressively since 2000, approaching China's 41.7% share in 2007, with the gap of 4.2 percentage points. Since then, the gap has widened to 14.0 percentage points in 2014 as investment in India softened (Figure 30.3). At 47.2% in 2014, China's investment share reached a level previously unseen in Asia, except tentative achievements in small countries.[39] If history is any guide, the contribution of investment to final demand in China will drop eventually. ASEAN's investment share was previously around 35%, but it fell sharply to the lowest point of 18.0% in 1999 in the aftermath of the Asian financial crisis. Since then, it has been slowly inching up, reaching 29.2% in 2014. In the past two and a half decades, the investment share in GCC countries has fluctuated between 15–30% of GDP (Figure 30.6).

The role of foreign direct investment (FDI) differs considerably among Asian countries. Figure 31 shows the FDI inflows as a percentage of GFCF during 2000–2014, for the Asian economies with some EU countries for comparison. In almost half of the Asia30 (13 countries), the FDI inflows are over a 10% share of GFCF. In particular, they are outstanding in the two global cities of the Asian Tigers, Hong Kong (105% of GFCF) and Singapore (69%), both recording a remarkable achievement in

37: Japan's current share of gross investment is almost equivalent to the share of consumption of fixed capital (CFC) in GDP. Thus the net investment is close to zero.
38: Although Singapore's investment ratio in 2014 is higher than that of Japan, it is of note that Singapore has succeeded in sustaining a higher ex-post rate of return on capital (13.5% for the period 2010–2014, based on our estimates in Table 22 in Appendix 3) than that of Japan (4.1% for the same period). Korea is another country which confronts the decreases in the ex-post rate of return on capital. In 2010–2014, Korea's rate of return reached 6.8%, which is similar to that of Japan in the early 1990s.
39: In Mongolia the two world-class large mines (coal and copper) started production in 2010, sparking a resources boom. The country's capital investment ratio jumped from 30% of GDP in 2009 to 58% in 2011 (Figure 30.2). In Bhutan the investment booms shown in Figure 30.2 reflect the construction of large-scale hydropower plants, i.e., Tala hydropower plant (1020 MW) has operated since 2006 and other plants to be commissioned by 2017–2019.

economic growth in the 2000s. Nepal (0.9%) and Japan (0.6%), whose FDI inflows are extremely small in this period, should consider a domestic reform for lowering barriers to entry, therefore encouraging international investment.

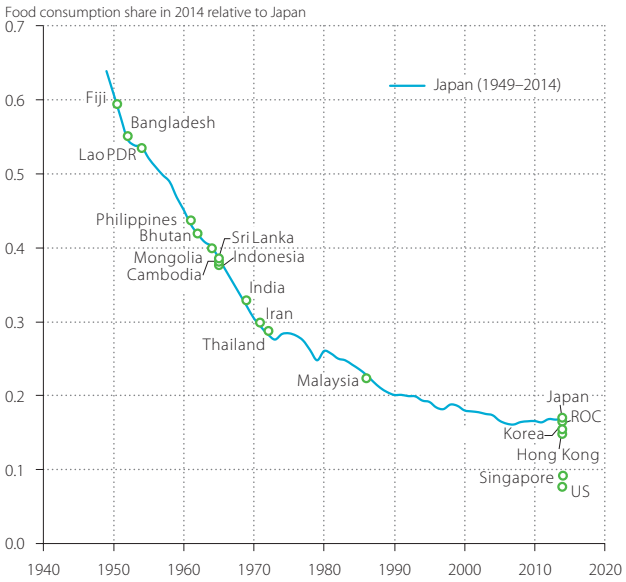

Figure 29 Engel Curve of Japan during 1949–2014 and Levels of Asian Countries in 2014
——Share of food in household consumption

Sources: Official national accounts in each country. The historical data of Japan is based on JSNA by ESRI, Cabinet Office of Japan.
Note: Food is defined as sum of food and non-alcoholic beverages and alcoholic beverages, tobacco and narcotics. For Fiji and the Lao PDR, the observation periods are 2009 and 2005, respectively.

It is an important policy target for low-income countries to create a business-enabling environment, just as it is important for middle-income countries to improve various business environments. Based on the EIU's (Economist Intelligence Unit, *The Economist*) ranking 2014–2018 (covering 82 countries in the world),[40] Singapore (1st) and Hong Kong (3rd) are in the top 10% of the covered countries. In contrast, Bangladesh (69th), Pakistan (74th), and Iran (81th) are in the bottom 10%. Figure 32 plots this business environment score and the FDI inflows ratio in the countries presented in Figure 31 (excluding the countries in which the FDI inflows ratio is over 25%). There is a positive correlation between these two. Improving business environment is a necessary condition for attracting FDI.

Figure 33 focuses on investment components, showing the nominal investment share of seven types of assets for some selected countries.[41] For most countries, investment is still very much construction-based (i.e., in dwellings, non-residential buildings, and other structures). However, the expansion of IT capital in the past four decades is significant in the US, Japan, the Asian Tigers, and Malaysia – even at the current price comparisons. The real-term comparisons are conducted at the flow and stock levels in Chapter 5. The ROC, Korea, Japan, and the US invested in R&D activities by more than 13% of total investment in 2014. Among the Asian Tigers, however, the two global cities (Singapore and Hong Kong) have a smaller share of R&D in GFCF – 9.3% and 3.1%, respectively, in 2014.

Figure 34 plots the long-term trend of net export share in GDP from 1970 to 2014. Net exports, which were previously a huge drag on the Asian Tigers, Singapore, and Korea in the 1970s, have improved

40: The EIU's business rankings model examines 10 separate criteria or categories, covering the political environment, the macroeconomic environment, market opportunities, policy towards free enterprise and competition, policy towards foreign investment, foreign trade and exchange controls, taxes, financing, the labor market and infrastructure. Each category contains a number of indicators that are assessed by the EIU for the last five years and the next five years. The number of indicators in each category varies from 5 (foreign trade and exchange regimes) to 16 (infrastructure), and there are 91 indicators in total. Each of the 91 indicators is scored on a scale from 1 (very bad for business) to 5 (very good for business).

41: The investment data by type of assets includes our own estimates for the countries where data is not available. Although our estimates are constructed based on 11 classifications of assets (see Table 20 in Appendix 2), including the R&D investment (see Appendix 1), they have been aggregated into seven assets for the purposes of this table. The IT capital is defined as IT hardware, communications equipment, and computer software.

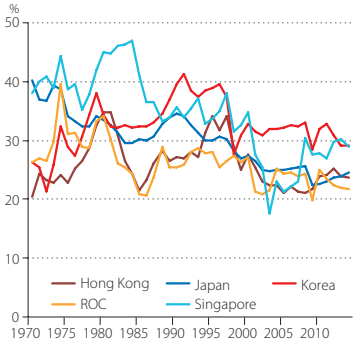

Figure 30.1

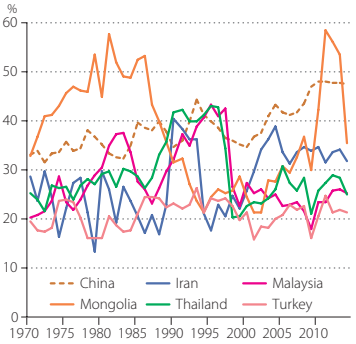

Figure 30.2

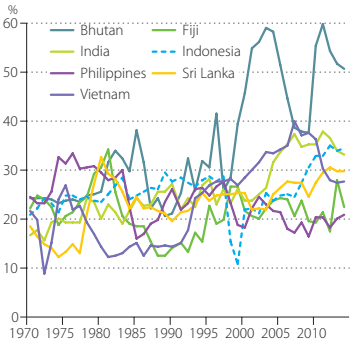

Figure 30.3

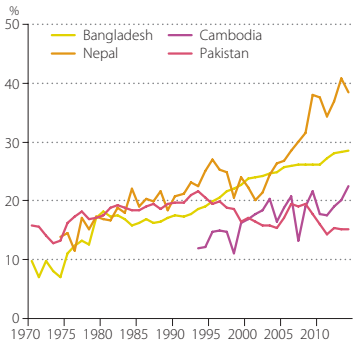

Figure 30.4

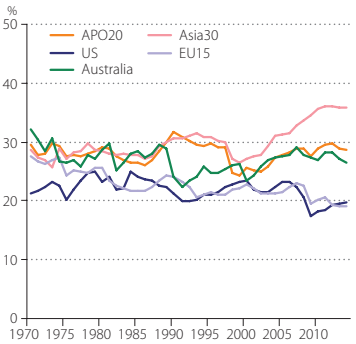

Figure 30.5

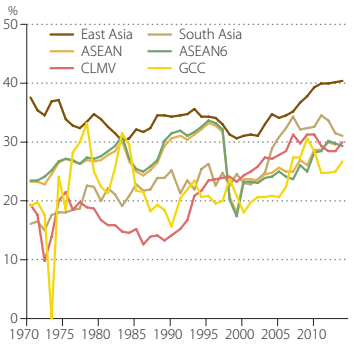

Figure 30.6

Figure 30 Long-Term Trend of Investment Share in GDP, 1970–2014
——Share of investment with respect to GDP at current market prices

Sources: Official national accounts in each country, including author adjustments.

their position rapidly. In recent years, net exports are making a positive contribution to GDP for all of the Asian Tigers. The share of net exports in Singapore is particularly large, at 24.4% in 2014, compared with 5.3%, 10.3%, and 0.1% for Korea, the ROC, and Hong Kong, respectively (Figure 34.1). China is another country that has changed its net export position, transforming it into a significant positive

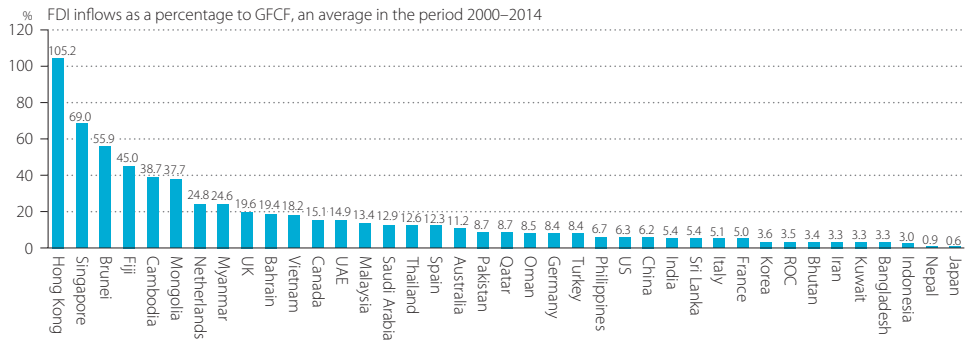

Figure 31 FDI Inflows, 2000–2014
——FDI inflows as a percentage of GFCF, an average of the ratios during the period 2000–2014

Source: United Nations Conference on Trade and Development (UNCTAD), *World Investment Report 2015*.

contribution to final demand. The net export share of GDP peaked at 8.6% in 2007. Since then, it has lagged to 2.7% in 2014.

Japan had enjoyed a trade surplus for most of the period compared, but recently its trade balance has turned negative amounting to –0.9% in 2011 deepening to –3.0% in 2014 (Figure 34.1). In the aftermath of the triple disaster (earthquake, tsunami, and nuclear) in 2011, Japan had to increase the imports of natural gas and coal to meet the increase of thermal power generation as a result of the shutdown of its nuclear power plants. This trend may change in response to its new energy policy, which will in turn reduce imports.

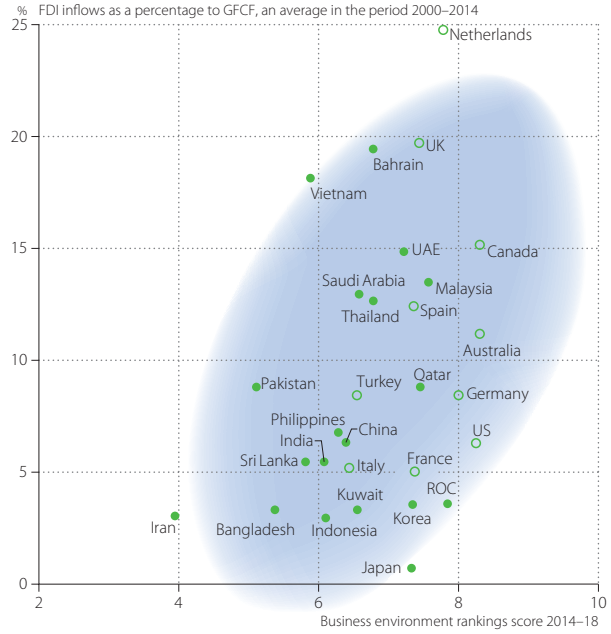

Figure 32 FDI Inflow Ratio and Business Environment, 2000–2014

——FDI inflows as a percentage of GFCF and business environment score

Sources: United Nations Conference on Trade and Development (UNCTAD), *World Investment Report 2015*; The Economist Intelligence Unit (2014)

Figure 34.3 illustrates the external imbalance of the world's major economies. Both the US and the EU15 faced a trade deficit at the beginning of this period. While the EU15 managed to recover, being in surplus since the early 1990s (within a range of 0–2% of GDP), the US position has significantly deteriorated since the middle of the 1990s, despite a tremendous effort to restore its trade balance in the late 1980s. In 2014 the size of the US trade deficit stood at 3.1% of its GDP, compared to its recent dip to 5.6% of GDP in 2006. Australia has been running a trade deficit for most of this period. Only in the past few years has its trade balance been in surplus. In contrast, Asia30's

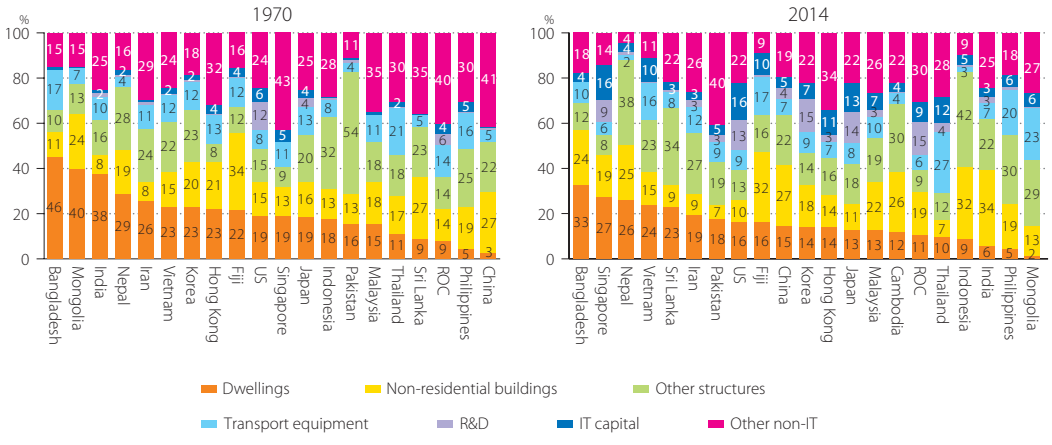

Figure 33 Investment Share by Type of Asset, 1970 and 2014

Sources: Official national accounts in each country, including author adjustments based on input–output tables and trade data.

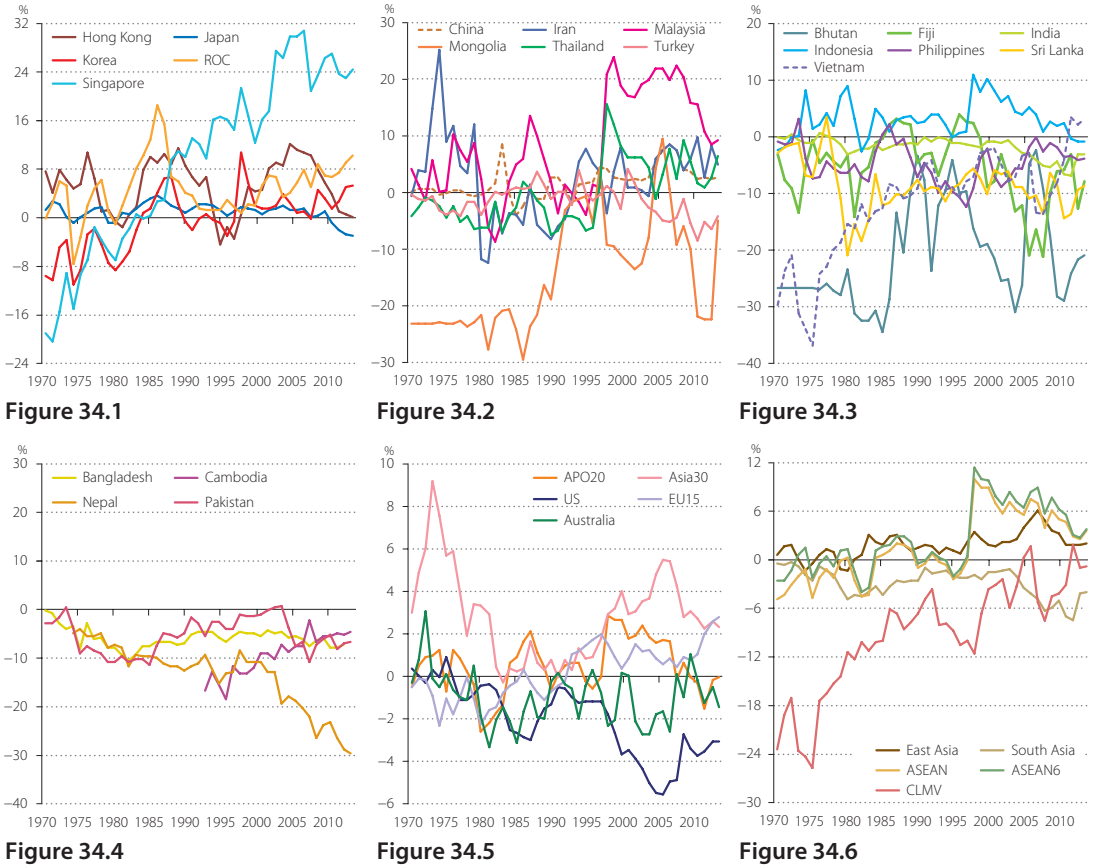

Figure 34.1 Figure 34.2 Figure 34.3

Figure 34.4 Figure 34.5 Figure 34.6

Figure 34 Long-Term Trend of Net Export Share in GDP, 1970–2014
——Share of net exports with respect to GDP at current market prices

Sources: Official national accounts in each country, including author adjustments.

trade has been in surplus continuously and a near mirror-image of the US. Asia30's net exports share of GDP was 2.3%, compared to the recent peak of 5.5% in 2006. Addressing this external imbalance has been highlighted as a necessary step to healthy and sustained growth in the world economy.

The time series of ASEAN's trade balance has a clear structural break which is marked by the Asian financial crisis of 1997 (Figure 34.4). The impact was a trade balance spike in 1998 at 10.0%, up from –0.1% in the previous year. Trade balance moderated over time to the more normal level of 3.7% in 2014. In recent years the trade balance of CLMV is in surplus for the first time during these four decades.[42] Its improvement has been rapid, from a deficit of 7.5% in 2008 to a surplus of 1.8% in 2012. This should not be a surprise when CLMV is picking up the slack from China as the workshop of the world. If the time series of China's net exports is any guide, CLMV's trade surplus could continue to expand for years to come.

42: The huge deficit of CLMV in the 1970s was due to the impact of the Vietnam War.

4.3 Expenditure-Side Growth Decomposition

Figure 35 shows the decomposition of the average annual economic growth by final demand for the periods 1990–2000 and 2000–2014, respectively. Here, the Asia30 grew faster in the latter period than in the former (at 5.3% on average per annum compared with 4.8%, as presented in Table 2).[43] The earlier period embodied the economically atypical event of the Asian financial crisis, which caused some erratic contributions by the final demand components observed in some countries in the late 1990s. In the 1990s overall, the engine of growth for most countries in Asia was household consumption, while investment growth was more subdued.[44]

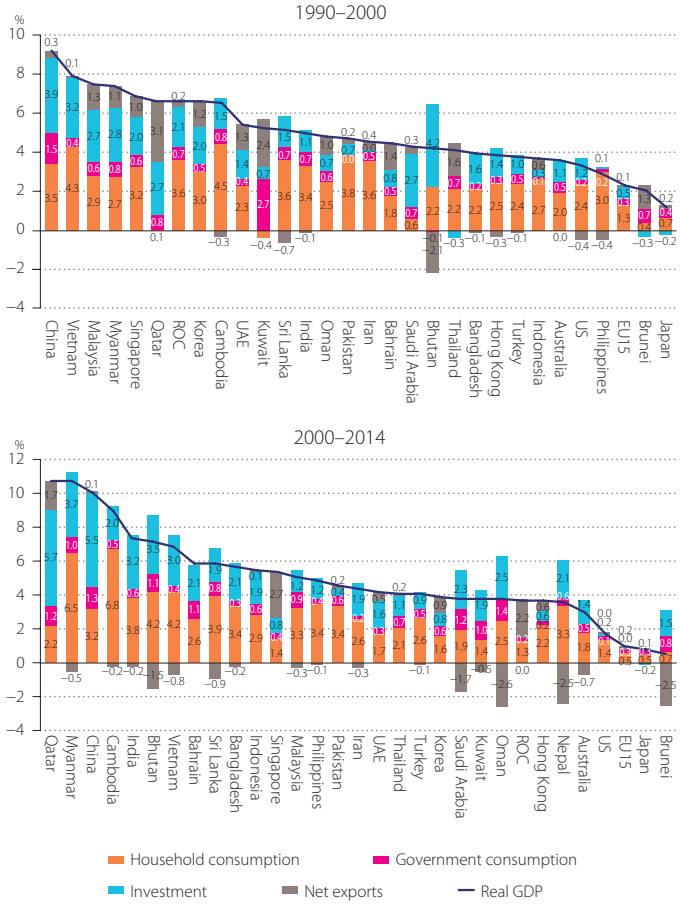

Figure 35 Final Demand Contributions to Economic Growth, 1990–2000 and 2000–2014
——Decomposition: Average annual growth rate of GDP at constant market prices

Sources: Official national accounts in each country, including author adjustments.
Note: The starting period for Cambodia is 1993.

On the back of the Asian financial crisis, investment growth surged strongly. Its impact on real GDP growth became more significant in Asia in the 2000s, especially in the fast-growing economies. For example, investment contributed 5.5 percentage points in China, 3.7 percentage points in Myanmar, 3.2 percentage points in India, and 3.0 percentage points in Vietnam. China grew by 10.1% on average per year in the latter period. The role of investment became significant with its contribution to economic growth expanding between the two periods from 42.5% to 55.0%, while squeezing the contribution of net exports from 3.3% to 0.7% and that of household consumption from 37.6% to 31.6%. However, for Singapore and the ROC, the strength of net exports

43: The Törnqvist quantity index is adopted for calculating the growth of real GDP. Using this index, the growth of real GDP into the products of contributions by final demands can be decomposed:
$\underbrace{\ln\left(GDP^{t} / GDP^{t-1}\right)}_{\text{Real GDP growth}} = \sum_i \underbrace{(1/2)\left(s_i^{t} + s_i^{t-1}\right)\ln\left(Q_i^{t} / Q_i^{t-1}\right)}_{\text{Contribution of final demand } i}$ where Q_i^t is quantity of final demand i in period t and s_i^t is expenditure share of final demand i in period t. Thus, the real GDP growth may diverge from the official estimates or those presented in Table 3 in Section 3.1 (p. 24).

44: The exceptions are some of the oil-producing countries, which enjoyed a positive contribution from net exports higher than most countries, and China, which experienced the fastest economic growth among the countries studied, averaging 9.2% per year, 42.5% of which was driven by investment, compared with 37.6% by household consumption. This compares with average annual growths of 3.4% in the US and 2.3% in the EU15. The contribution from household consumption was 70.3% and 56.7%, whereas investment growth accounted for 35.2% and 23.0% of overall growth in the US and the EU15, respectively.

Box 3 System of National Accounts in Asia

Understanding data comparability is essential for the construction of an international database, and requires continuous effort and expert knowledge. Between December 2015 and March 2016, the APO Productivity Database project conducted the Metadata Survey 2016 on the national accounts and other statistical data required for international comparisons of productivity among the APO member economies.

Broadly speaking, cross-country data inconsistency can arise from variations in one or more of the three aspects of a statistic: definitions, coverage, and methodology. The international definitions and guidelines work to standardize countries' measurement efforts. However, country data can deviate from the international best practice and vary in terms of omissions and coverage achieved. Countries can also vary in their estimation methodology and assumptions in benchmark and/or annual revisions. This may account for part of the differences observable in the data, as well as interfere with comparisons of countries' underlying economic performance.

Most of the economic performance indicators in this report are GDP-related. The surveys therefore put much emphasis on discerning countries' GDP compilation practices. In the Databook 2016, the 2008 SNA is used as the standard, noting how countries' practices deviate from it. Since there are differences between the 2008 SNA and its predecessors (1993 SNA or 1968 SNA) in some concepts and coverage, it is important to know in which year the data series definitions and classification started to switch over. This allows identification in breaks in the time series. Figure B3 presents the current situation in compilations and data availability of the backward estimates based on the 1968 SNA, the 1993 SNA, and the 2008 SNA (including the future plan for introducing the 2008 SNA), based on our Metadata Survey 2016. For example,

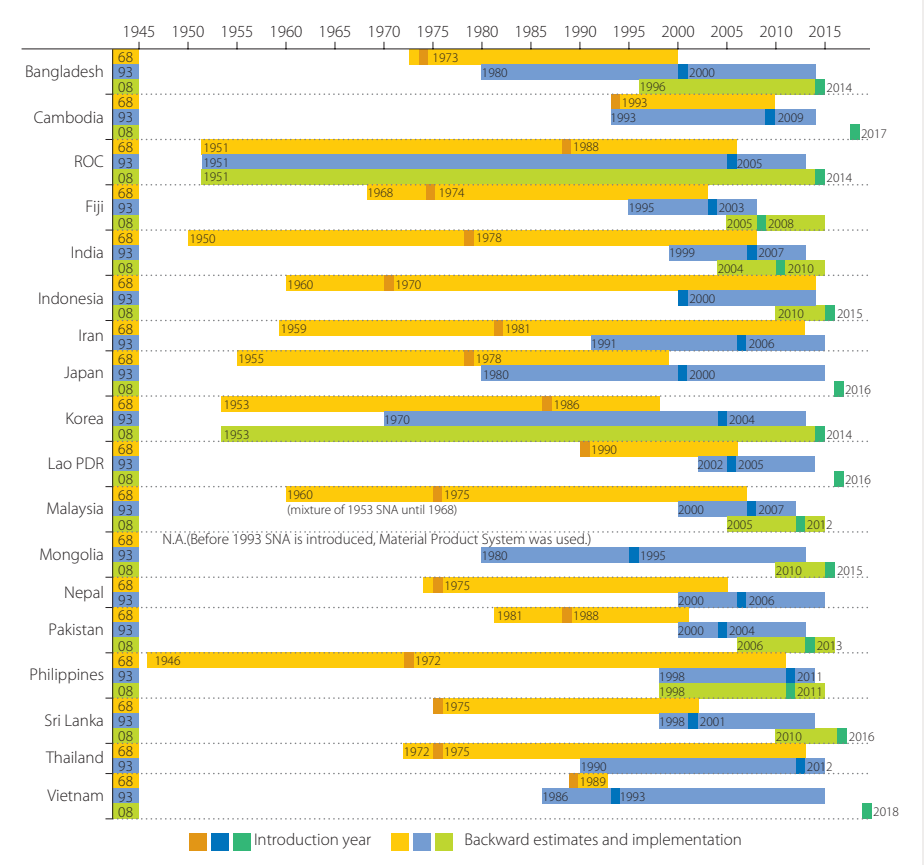

Figure B3 Implementation of the 1968, the 1993, and the 2008 SNA

Source: APO Metadata Survey 2016.

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Japan started to publish national accounts based on the 1968 SNA in 1978 (backward estimates based on the 1968 SNA are available from 1955 at present) and national accounts based on the 1993 SNA in 2000 (backward estimates based on the 1993 SNA are available from 1980 at present), and plans to introduce the 2008 SNA as of the end of 2016.

As Figure B3 suggests, countries differ in their year of introduction, the extent of implementation, and backward estimates available. According to the survey response, 12 countries are currently 2008 SNA compliant (partly or fully). While there are movements toward upgrading the SNA, Cambodia, the Lao PDR, and Nepal have yet to fully introduce the 1993 SNA. The starting year of the official 2008 or 1993 SNA compliant time series varies a great deal across countries, reflecting the differences in the availability of backward estimates. Countries may have adopted the 2008/1993 SNA as the framework for their national accounts, but the extent of compliance in terms of coverage may also vary. The APO Productivity Database tries to reconcile the national accounts variations based on the metadata information and our investigation, and provide harmonized estimates for international comparison. See Appendix 1 for details of the adjustments.

was the real economic story, accounting for 50.7% and 60.5% of their economic growth on average per year between 2000 and 2014, respectively.[45] Even in the other two Asian Tigers, net exports accounted for 23.2% and 16.9% of Korea's and Hong Kong's economic growth, respectively (Figure 36). In contrast, net exports have been a drag on economic growth in India over both periods, making a negative contribution of –2.2% and –3.3%, respectively.

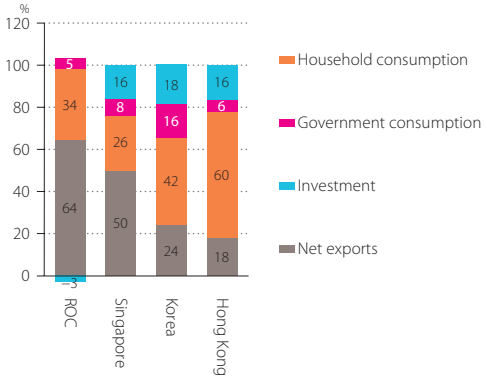

Figure 36 Final Demand Contribution Shares to Economic Growth of the Asian Tigers, 2000–2014

——Shares of final demand contributions to growth rate of GDP at constant market prices

Sources: Official national accounts in each country, including author adjustments.

In some of these economies, the contribution of household consumption to economic growth was squeezed – for example, from 37.6% in 1990–2000 to 31.6% in 2000–2014 in China, from 36.7% to 26.3% in Singapore, and from 54.1% to 34.8% in the ROC. In contrast, the role played by household consumption in economic growth increased in the US and Japan, from 70.3% to 81.1% and from 61.1% to 68.1%. Overall economic growth in Japan slowed from 1.2% to 0.7% between the two periods compared. This was a sluggish performance, especially relative to the acceleration that most Asian economies experienced. Also, in the latter period net exports made negative contributions in more countries than previously, with its impact in certain oil-exporting countries particularly large.

Figure 37 shows the impacts of the global financial crisis and countries' path of recovery from the viewpoint of final demand between 2007 and 2012. The adverse impact of the crisis was felt through investment in most countries, and to a lesser extent, through net exports. Drastic contraction in investment became commonplace in countries from 2008–2009. China's robust growth in investment was a result of prompt active policy intervention in the face of the potential detrimental effects of the crisis on the economy, and shrinking net exports. Hong Kong and Japan also suffered from the negative impact of net exports on growth. Investment rebounded strongly in 2009–2010 with favorable policy levers, but moderated in the subsequent years when the effects of policy faded out. Only China and Singapore sustained their robust investment growth.

45: In the real income term, the trading gain effect ran counter to welfare for those countries. See Figure 93 in Section 7.1 (p. 131).

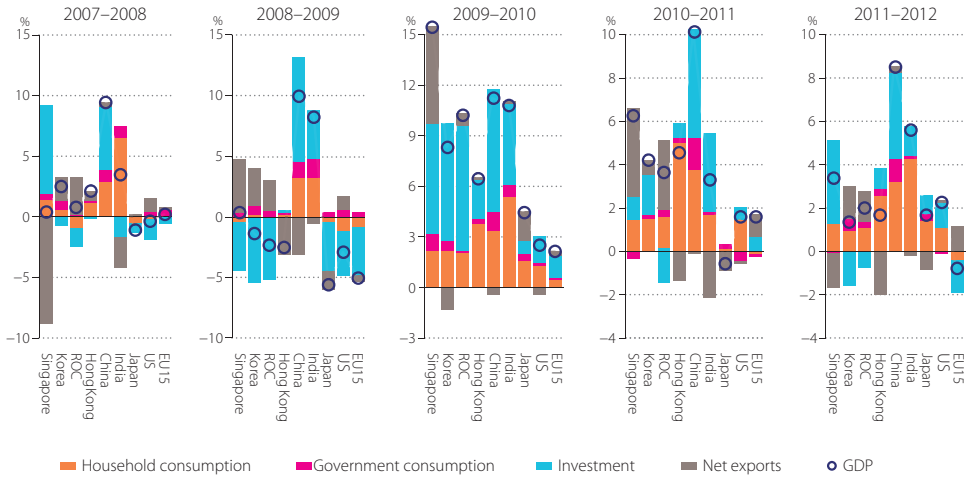

Figure 37 Impacts of Global Financial Crisis and Recoveries, 2007–2012
——Annual growth rate of GDP at constant market prices and contributions of final demands

Sources: Official national accounts in each country, including author adjustments.

In comparison, the impact of the Asian financial crisis was more contained. Figure 38 suggests that the impact was contained within Asia, except for the handful of countries affected, it marked an exceptional time. In 1998, investment took a nosedive in Indonesia, Korea, Malaysia, Singapore, and Thailand. Household consumption also fell, albeit to a lesser extent. The crisis however, greatly boosted these countries' net exports, likely to have benefitted from the rapid devaluation of the Asian currencies, except the Japanese yen at the time of the crisis. This helped bolster the impacted economies against the retrenchment in other components of final demand.

Figure 39 shows how the contribution of economic growth by final demand varies across countries and over time for the period 1970–2014. The immediate impact of the global financial crisis in 2007–2008 is represented in the data. Most countries felt an adverse impact in 2008 and 2009, with the exception of India where in 2009 growth rebounded strongly from a slowdown in the previous year. The impact on the Asian countries varied both in magnitude and nature. Japan's recession was particularly deep with the economy falling by 1.1% and 5.6% in 2008 and 2009, respectively, compared with 2.2% growth in 2007. The economic retrenchment in Japan was deeper than the –2.9% in the US and –4.9% in the EU15 in 2009. Besides Japan,

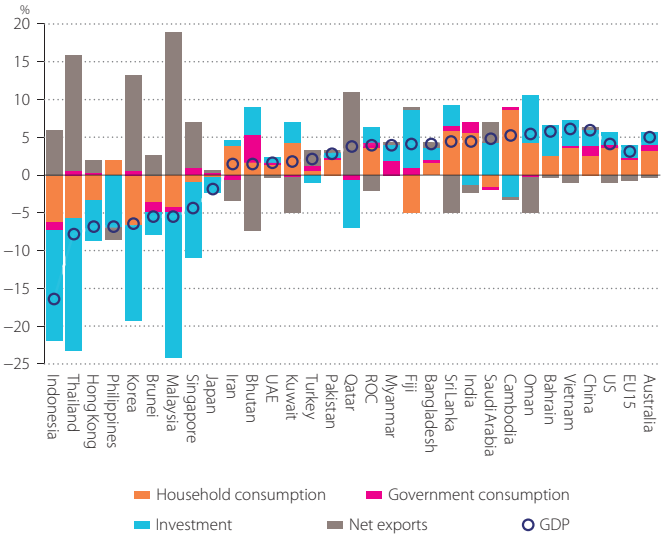

Figure 38 Impacts of Asian Financial Crisis, 1997–1998
——Annual growth rate of GDP at constant market prices and contributions of final demands

Sources: Official national accounts in each country, including author adjustments.

other Asian countries either experienced a mild recession or a growth slowdown. Moreover, relative to their rapid growth the magnitude of the impact could still be substantial. For example, the growth in the ROC slowed from 6.7% in 2007 to 0.8% in 2008 before moving into the negative zone of –2.2% in 2009.

The channels through which economic growth was adversely impacted also varied across countries. Japan's recession in 2009 was largely accounted for by a sharp fall in investment (4.0 percentage points) and, to a lesser extent, a fall in net exports (1.6 percentage points). Meanwhile the 0.4% growth of government spending canceled out the 0.4% fall in household consumption. Similarly, in the ROC, investment fell by 5.2% in 2009, while household consumption and net exports grew, albeit more slowly than previously. Hong Kong took a hard hit in terms of net exports in 2009, which fell by 3.0 percentage points. Household consumption growth slowed considerably in 2009 to 0.1 percentage point before bouncing back to its normal range of 3–5%.

It is difficult to understand the oil-exporting economies fully without analyzing the oil market in parallel. Its volatility can be observed clearly from Figure 39, with huge peaks and valleys, particularly in the 1970s. The oil booms of the 1970s brought benefits, but the downturn was a detriment. Net exports remain erratic, but overall volatility seems to have reduced in the past two decades. Qatar experienced the fastest GDP growth among the oil-exporting countries in recent years with very strong investment growth. However, its economy remains very dependent on oil and gas and related industries, which accounted for 49.3% of its GDP in 2014 (Figure 72 in Section 6.1, p. 102) – roughly 80% of its export earnings, and 70% of government revenues in the 2000s.[46] In contrast, Bahrain has diversified into a regional banking and financial center and benefited from the regional boom in recent years. Petroleum production and processing accounted for 25% of its GDP in 2014 (Figure 72) – about 60% of export earnings, and 75% of government revenues in the 2000s.[47]

46: Data from the series of *Annual Statistical Abstract*, State of Qatar.
47: Data from the Ministry of Finance, Kingdom of Bahrain.

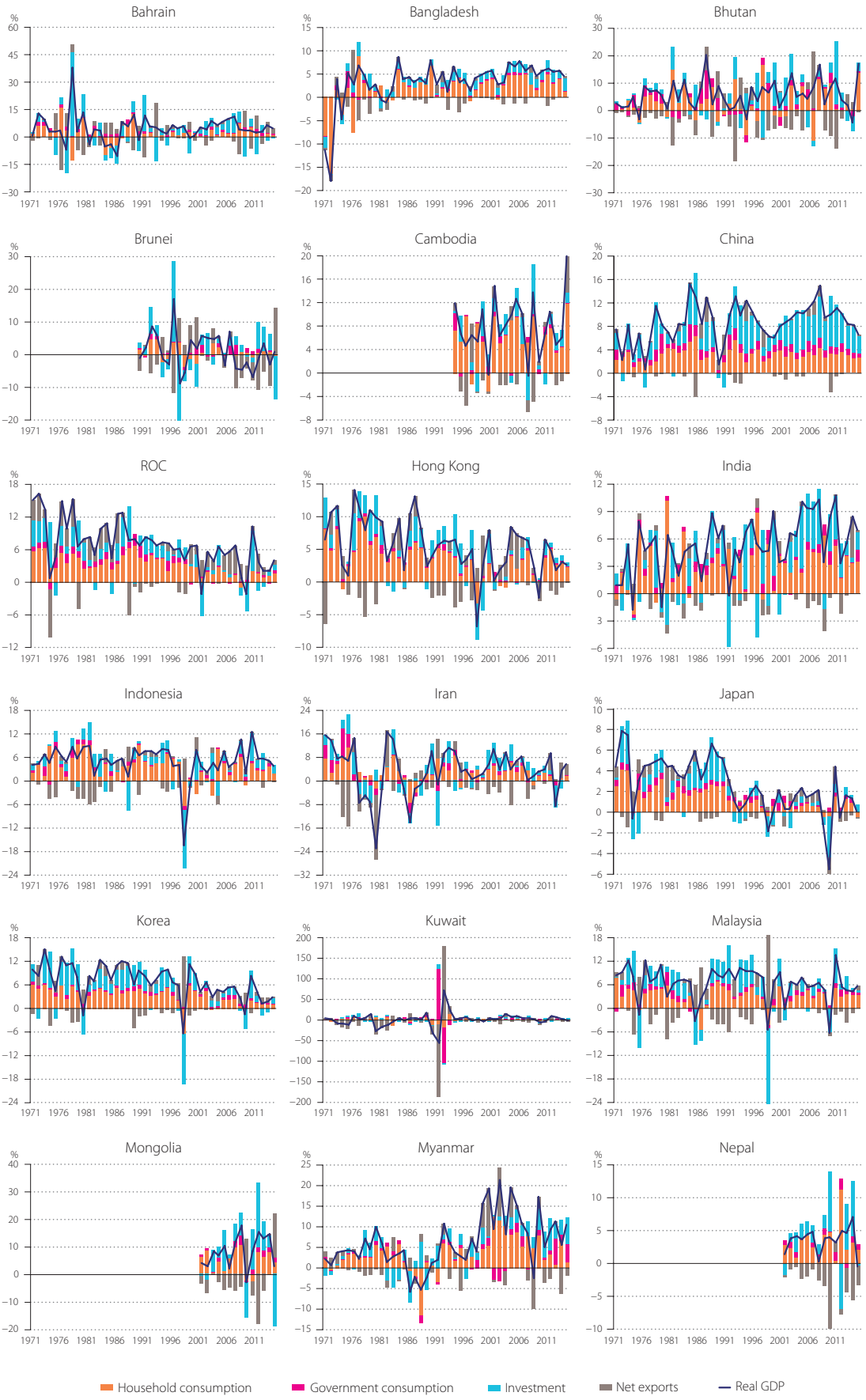
Bahrain
Bangladesh
Bhutan
Brunei
Cambodia
China
ROC
Hong Kong
India
Indonesia
Iran
Japan
Korea
Kuwait
Malaysia
Mongolia
Myanmar
Nepal
%
1971 1976 1981 1986 1991 1996 2001 2006 2011
Household consumption
Government consumption
Investment
Net exports
Real GDP

Figure 39 Final Demand Decomposition of Real GDP Growth, 1970–2014

Sources: Official national accounts in each country, including author adjustments.

Box 4 Size of the Informal Sector

The definition of "the informal sector" varies depending on the purposes and the context of discussion. One statistical definition of the informal sector is provided by the 15th ICLS resolution of the International Labour Organization (ILO) in 1993 as follows:

> *The informal sector units are divided into two subsets:*
> *(a) Informal own-account enterprises. These are household enterprises owned and operated by own-account workers, either alone or in partnership with members of the same or other households, which may employ contributing family workers and employees on occasional basis but do not employ employees on a continuous basis.*
> *(b) Enterprises of informal employers. These are household enterprises owned and operated by employers, either alone or in partnership with member of the same or other households, which employ one or more employees on a continuous basis. Enterprises may be considered informal if they meet one of the following criteria: (a) small size of the enterprise in terms of employment, (b) non-registration of the enterprise, and (c) non-registration of its employees* (ILO, 2013, pp. 249–250).

Examples of the informal sector include unpaid work in a family enterprise, casual wage labor, home-based work, and street vending.

The informal sector in less developed countries (LDCs) is huge. Compared with workers in the formal sector, those in the informal sector are typically paid poorly and supply labor in low-quality working conditions without legal protection or official social protection. Some part of the informal sector exists for the purpose of tax evasion, but the dominant portion in LDCs provides "the only opportunity for many poor people to secure their basic needs for survival" (ILO, 2013, p.3). Encouraging labor movements from the informal sector to the formal sector is one of the most important developmental issues in many LDCs.

How far the informal sector is counted in the national accounts depends on the country. The size of the informal sector is not directly comparable across countries. However, we can loosely grasp the significance of the informal sector by looking at "the number of employment" and "the number of employees."

The number of employment is estimated so as to be consistent with the national accounts, which tries to capture economic activities of the whole economy, though some part of workers in the informal sector would be missing. On the other hand, the data for the number of employees seem to be drawn from official labor surveys and thus are likely to exclude most of the employment in the informal sector. Therefore, a difference between the number of employment and the number of employees is loosely regarded as employers/self-employed workers in the formal sector and workers in the informal sector. Although statistical problems are evident, particularly for the treatment of the employment data in the agricultural sector, we can still clearly see that the number of employees is substantially lower than the number of employment in LDCs.

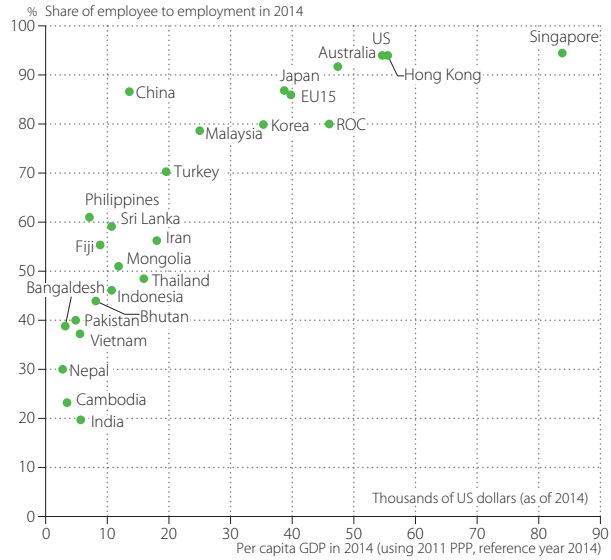

Figure B4 Employee Share and GDP Level, 2014

Sources: Official national accounts in each country, including author adjustments; APO Productivity Database 2016.

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Figure B4 plots the ratio of the number of employees to the number of employment (the vertical axis) against PPP-adjusted per capita GDP (the horizontal axis) in 2014 for a number of countries. Employee ratios tend to be higher as countries have higher income. However, even among LDCs, employee ratios have substantial variation; low in most of the South Asian countries while relatively high in ASEAN Member States.

The policy implication is profound. First, LDCs with low employee ratios are likely facing difficulties in encouraging labor movements from informal to formal sectors. The reasons could be on the demand side, the supply side, or the combination of both. The growth of the formal sector, particularly the manufacturing sector and modern services sectors, may not create enough jobs. The gap of human capital between informal and formal sectors may be too large. Urban living conditions may be too harsh and expensive to attract rural people to urban areas. Governments must find and resolve bottlenecks to make labor movements smoother.

Second, raising minimum wages is recently a popular policy in many countries including Thailand, Indonesia, and Cambodia, but may deter labor movements from informal to formal sectors. Minimum wages are typically enforced only in the formal sector, and wage levels in the informal sector remain low. Raising minimum wages too high may reduce the labor demand in the formal sector, make labor movements more difficult, and in the end negatively impact people in the informal sector. Although the betterment of labor conditions is certainly important, raising minimum wages too high may cause adverse effects for economic development.

5 Productivity

Labor productivity can be measured in a number of ways, depending on the definitions of output and labor input measures. In this chapter Section 5.1 presents the labor productivity measure in terms of GDP per worker.[48] As workers in high-performing Asian countries tend to work longer hours on average than those in the US, the worker-based labor productivity gaps, in this instance, cast the Asian countries in a particularly favorable light. Section 5.2 sees the focus shift to alternative estimates of labor productivity measure, namely GDP per hour worked.

The sources of economic growth in each economy are further decomposed to factor inputs of labor and capital and total factor productivity (TFP), based on the growth accounting framework.[49] In Sections 5.3 and 5.4, capital input is included as another key factor of production and the TFP estimates are presented for the 20 Asian countries and the US, based on the estimates of capital services (see Appendix 3).[50] Section 5.5 presents the estimates of energy productivity, which is becoming an important policy target for pursuing sustainable growth of the Asian countries.

5.1 Per-Worker Labor Productivity

Figure 40 presents the cross-country comparisons of per-worker labor productivity levels in 2014, measured as GDP per worker in US dollars. The countries naturally bundle into groups. On this measure, Singapore is the leading economy, more than 10% larger than the US level.[51] Hong Kong and the ROC follow at some distance. While Iran is close to the top, it is worth noting that it has the lowest employment rate in Asia (Figure 21 in Section 3.3, p. 37). Japan took the fourth place, with productivity levels at 34% below the US. Iran, Korea, and Malaysia followed.[52] Thereafter, a number of countries from among the Asia group followed with labor productivity levels at less than 25% of the US, pulling down the average performance of the group to 21% for the APO20, 21% for the Asia30, and 19% for the ASEAN. Bringing up the rear were China and India, with productivity levels that were 19% and 12% of the US level, respectively.[53]

Table 9 presents the comparison of the per-worker labor productivity level. In 2000–2014, the APO20 as a group achieved little change in its labor productivity relative to the US, stagnating at around 20%, while Asia24's rose from 12% to 20%. In 2000, Hong Kong sustained a productivity gap of 20% with the US, but by 2014 the gap narrowed to around 5%. In contrast, the relative productivity level of

48: GDP is valued at basic prices in this chapter, as opposed to GDP at market prices used in the previous chapters. GDP at basic prices is defined as GDP at market prices, minus net indirect taxes on products. As most Asian countries do not provide official estimates for GDP at basic prices in their national accounts, they are calculated based on available tax data. See Appendix 1 for the methods employed for our calculations.

49: The growth accounting approach is based on the microeconomic production theory and the nominal accounting balance of input and output of production. See OECD (2001) for a presentation of definitions, theoretical foundations, and a number of practical issues in measuring productivity.

50: In this edition of the Databook, the TFP estimates were newly developed for Nepal and some country groups such as the ASEAN6 and South Asia. Another important improvement in this edition is that the estimates of labor input and its compensation were revised in some countries, reflecting our work-in-progress estimates on number of workers, hours worked per worker, and hourly wages, cross-classified by gender, education attainment, age, and employment status, which has been developed for the past few years at KEO. In Bangladesh, Pakistan, Sri Lanka, and Vietnam, the COE (compensation of employees) data is not available in their national accounts in some years. These were interpolated/extrapolated based on our estimates of COE.

51: Cross-country level productivity comparisons are notoriously difficult to make and hence subject to much data uncertainty. Estimates should therefore be taken as indicative for broad groupings rather than precise ranking. The level of labor productivity in Singapore was slightly lower than the US level in 2011, in the Databook 2013, which was based on the 2005 benchmark PPP. However, in this Databook, it was upwardly revised by 16% due to the use of the new 2011 benchmark PPP (See Box 1, p. 22).

52: Note that the workers aged over 65 are excluded from labor input in Malaysia, due to the definition in labor survey in Malaysia. This edition of the Databook does not adjust the difference in coverage of workers, which can be defined differently among countries. Thus readers should mind that our estimates of the labor productivity for Malaysia in Figure 40 would be underestimated at least by 1%, if the omitted workers were included.

53: Comparing productivity among cities may provide a better picture for understanding a productivity gap among countries, which consists of a number of cities with different scales (See Box 6, p. 68).

Japan against the US has deteriorated over the last two decades.

China and India are the two giant and fast-emerging economies in Asia. China began with one-third of India's productivity levels in 1970. Four decades later it shows signs of pulling ahead of India, as shown in Figure 41. China's relative performance against the US moved up from 2% in 1970 to 7% in 2000 and 19% in 2014, compared with the corresponding figures of 5%, 7%, and 12% for India.[54]

The figures for GCC countries and Brunei are uncharacteristically high, especially in 1970. There are noticeable variations within the country group. The atypically high figures in the early period reflect the natural resource rents (the value of the resource over and above the cost of extraction) which are erroneously included in the GDP of these countries. The extent of exaggeration appears to be proportional to their oil production. Saudi Arabia has the largest proven oil reserves in the world and is the largest world oil exporter. Kuwait has the fourth-largest oil reserves in the world. In addition, Qatar has become the fourth-largest exporter of liquefied natural gas. In contrast, Bahrain has the smallest oil reserves compared to its peers. Its dependence on oil is therefore considerably lower. Consequently, it has worked to diversify its economy over the past decade (see Figure 87 in Section 6.2, p. 118).[55]

Table 10 presents the growth comparison of per-worker labor productivity. When labor productivity growth is compared, the ranking of countries is substantially reshuffled. In the 2000s there was a surge in labor productivity growth among low-income countries. While they were scattered in the earlier periods, by 2000–2005 the seven countries with the fastest labor productivity growth were all from Group-L4 (as defined in Table 7 in Section 3.2, p. 34). In the latest period 2005–2014, five out of the top six were from Group-L4 and one from Group-L3. Among them, China has sustained rapid productivity growth in the past two decades.[56] Its growth accelerated to an average of 9.0% per year in 2005–2014 from 7.1% per year in 1995–2000 and 8.7% per year in 2000–2005. This compares with India at 6.0%, 4.2%, and 4.7% over the same periods. Labor productivity growth among the

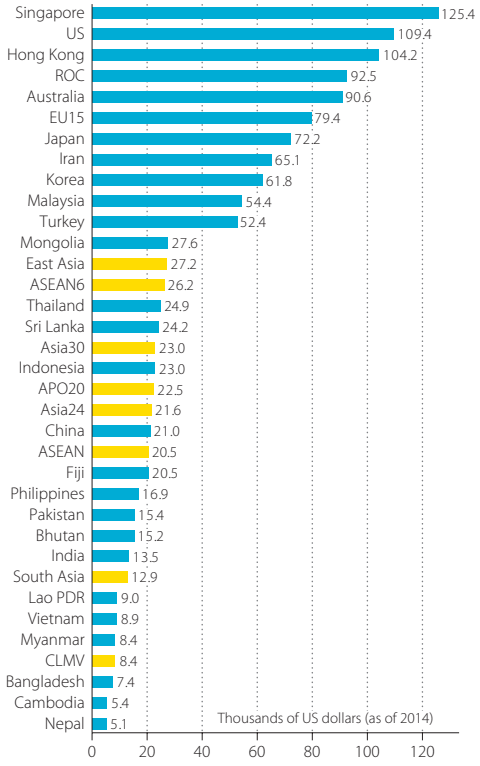

Figure 40 Labor Productivity Level by Per-Worker GDP, 2014
——GDP at constant basic prices per worker, using 2011 PPP, reference year 2014

Source: APO Productivity Database 2016.

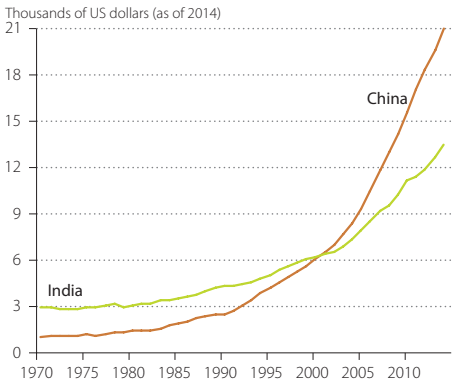

Figure 41 Labor Productivity Trends of China and India, 1970–2014
——GDP at constant basic prices per worker, using 2011 PPP, reference year 2014

Source: APO Productivity Database 2016.

Table 9 Per-Worker Labor Productivity Levels, 1970, 1980, 1990, 2000, 2010, and 2014

——GDP at constant basic prices per worker, using 2011 PPP, reference year 2014

1970		(%)	1980		(%)	1990		(%)	2000		(%)	2010		(%)	2014		(%)
Iran	38.3	100.0	Singapore	44.8	100.0	Singapore	66.8	100.0	Singapore	98.5	100.0	Singapore	119.0	100.0	Singapore	125.4	100.0
Singapore	31.7	82.8	Iran	41.3	92.1	Japan	58.4	87.4	Hong Kong	71.9	73.0	Hong Kong	98.9	83.2	Hong Kong	104.2	83.1
Japan	28.1	73.4	Japan	40.2	89.8	Hong Kong	58.1	87.0	Japan	64.6	65.6	ROC	86.7	72.9	ROC	92.5	73.8
Hong Kong	23.1	60.4	Hong Kong	36.5	81.4	Iran	41.3	61.8	ROC	63.0	64.0	Japan	71.0	59.7	Japan	72.2	57.5
Fiji	14.7	38.4	ROC	21.5	48.0	ROC	37.5	56.2	Iran	46.0	46.7	Iran	66.9	56.2	Iran	65.1	51.9
Malaysia	12.8	33.3	Malaysia	20.3	45.3	Malaysia	26.5	39.6	Korea	42.2	42.9	Korea	58.8	49.4	Korea	61.8	49.3
ROC	11.0	28.7	Fiji	17.2	38.5	Korea	25.1	37.6	Malaysia	38.8	39.4	Malaysia	50.2	42.2	Malaysia	54.4	43.4
Philippines	9.4	24.6	Korea	13.0	29.0	Fiji	16.7	25.1	Fiji	17.4	17.7	Thailand	22.4	18.9	Mongolia	27.6	22.0
Korea	7.8	20.3	Philippines	11.4	25.4	Mongolia	13.1	19.6	Thailand	16.4	16.6	Sri Lanka	20.0	16.8	Thailand	25.5	20.3
Mongolia	7.4	19.3	Mongolia	11.1	24.9	Thailand	11.7	17.5	Sri Lanka	14.7	14.9	Indonesia	19.5	16.4	Sri Lanka	24.2	19.3
Sri Lanka	6.8	17.7	Sri Lanka	8.8	19.6	Sri Lanka	11.2	16.8	Indonesia	13.5	13.7	Mongolia	18.7	15.7	Indonesia	23.0	18.3
Thailand	5.7	14.8	Indonesia	8.4	18.7	Indonesia	10.5	15.8	Mongolia	12.6	12.8	Fiji	18.3	15.4	China	21.0	16.8
Indonesia	5.3	13.7	Thailand	7.6	17.1	Philippines	10.5	15.7	Pakistan	12.5	12.7	China	15.6	13.1	Fiji	20.5	16.3
Pakistan	5.1	13.3	Pakistan	6.0	13.4	Pakistan	9.4	14.1	Philippines	11.9	12.1	Pakistan	14.5	12.2	Philippines	16.9	13.5
Bangladesh	3.5	9.2	Bhutan	3.3	7.4	Bhutan	6.9	10.3	Bhutan	9.3	9.4	Philippines	14.4	12.1	Pakistan	15.4	12.3
Bhutan	3.1	8.2	Bangladesh	3.2	7.2	India	4.3	6.5	India	6.2	6.3	Bhutan	13.5	11.3	Bhutan	15.2	12.1
India	2.9	7.6	India	3.0	6.8	Bangladesh	3.5	5.3	China	6.1	6.2	India	11.2	9.4	India	13.5	10.8
Vietnam	2.1	5.5	Nepal	2.4	5.3	Nepal	3.4	5.1	Vietnam	4.8	4.8	Vietnam	7.6	6.4	Lao PDR	9.0	7.2
China	1.0	2.6	Vietnam	2.1	4.8	Lao PDR	3.3	4.9	Lao PDR	4.7	4.8	Lao PDR	7.4	6.2	Vietnam	8.9	7.1
			Myanmar	1.6	3.7	Vietnam	2.7	4.1	Bangladesh	4.6	4.7	Myanmar	6.7	5.6	Myanmar	8.4	6.7
			China	1.4	3.1	China	2.5	3.7	Nepal	4.2	4.3	Bangladesh	6.3	5.3	Bangladesh	7.4	5.9
						Myanmar	1.6	2.4	Cambodia	2.9	3.0	Nepal	4.8	4.0	Cambodia	5.4	4.3
									Myanmar	2.5	2.5	Cambodia	4.4	3.7	Nepal	5.1	4.1
Bahrain	134.4	350.9	Bahrain	121.8	271.7	Bahrain	90.3	135.2	Bahrain	107.5	109.2	Bahrain	74.5	62.7	Bahrain	82.9	66.1
Kuwait	675.9	1765.1	Kuwait	264.9	591.0	Kuwait	108.2	162.0	Kuwait	208.9	212.2	Kuwait	155.8	130.9	Kuwait	156.4	124.7
Oman	121.7	317.8	Oman	166.0	370.4	Oman	177.4	265.5	Oman	153.4	155.8	Oman	109.2	91.8	Oman	76.9	61.3
Qatar	311.6	813.8	Qatar	264.0	589.0	Qatar	169.8	254.1	Qatar	227.2	230.8	Qatar	189.2	159.0	Qatar	220.3	175.7
Saudi Arabia	250.2	653.4	Saudi Arabia	251.6	561.5	Saudi Arabia	138.9	207.9	Saudi Arabia	155.1	157.5	Saudi Arabia	148.2	124.5	Saudi Arabia	146.2	116.6
UAE	99.2	259.1	UAE	365.8	816.1	UAE	227.3	340.2	UAE	196.1	199.2	UAE	145.4	122.2	UAE	158.1	126.1
			Brunei	457.9	1021.6	Brunei	219.9	329.2	Brunei	197.4	200.6	Brunei	177.3	149.1	Brunei	168.8	134.6
(regrouped)			(regrouped)			(regrouped)			(regrouped)			(regrouped)			(regrouped)		
APO20	7.8	20.4	APO20	9.7	21.6	APO20	12.9	19.3	APO20	15.6	15.9	APO20	20.5	17.2	APO20	22.5	17.9
Asia24	4.8	12.6	Asia24	5.9	13.1	Asia24	7.9	11.8	Asia24	11.1	11.3	Asia24	18.2	15.3	Asia24	21.6	17.2
Asia30	5.4	14.1	Asia30	6.9	15.4	Asia30	8.7	13.0	Asia30	12.1	12.3	Asia30	19.4	16.3	Asia30	23.0	18.4
East Asia	4.9	12.7	East Asia	6.3	13.9	East Asia	8.6	12.9	East Asia	12.7	12.9	East Asia	22.2	18.6	East Asia	27.2	21.7
South Asia	3.3	8.7	South Asia	3.5	7.8	South Asia	4.8	7.3	South Asia	6.8	6.9	South Asia	11.0	9.3	South Asia	12.9	10.3
ASEAN	6.6	17.1	ASEAN	8.1	18.1	ASEAN	10.0	15.0	ASEAN	12.9	13.1	ASEAN	17.9	15.0	ASEAN	20.6	16.4
ASEAN6	7.5	19.6	ASEAN6	10.7	23.8	ASEAN6	12.9	19.3	ASEAN6	16.9	17.1	ASEAN6	22.8	19.2	ASEAN6	26.2	20.9
CLMV	3.6	9.3	CLMV	2.3	5.0	CLMV	2.7	4.0	CLMV	4.0	4.1	CLMV	7.1	5.9	CLMV	8.4	6.7
GCC	309.4	807.8	GCC	271.7	606.2	GCC	151.9	227.4	GCC	171.3	173.9	GCC	146.4	123.1	GCC	145.3	115.9
(reference)			(reference)			(reference)			(reference)			(reference)			(reference)		
US	57.2	149.4	US	63.4	141.5	US	74.1	110.9	US	89.6	91.0	US	107.6	90.4	US	109.4	87.3
EU15	40.4	105.5	EU15	52.2	116.4	EU15	62.4	93.5	EU15	73.4	74.5	EU15	78.0	65.6	EU15	79.4	63.3
									EU28	65.6	66.7	EU28	71.7	60.2	EU28	73.4	58.6
Australia	50.4	131.5	Australia	57.8	128.9	Australia	62.2	93.1	Australia	77.8	79.0	Australia	85.2	71.6	Australia	90.6	72.2
						Turkey	28.3	42.4	Turkey	35.8	36.4	Turkey	50.3	42.3	Turkey	52.4	41.7

Unit: Thousands of US dollars (as of 2014).
Source: APO Productivity Database 2016.

54: If the comparisons were with the region's leader at different times, India's relative labor productivity has actually fallen, while China has managed to make a substantial leap to close in on the leader, albeit from a very low level.

55: The GCC countries have also been experiencing high population growth, especially in the late 1970s and the early 1980s. In 2000–2014, this has somewhat stabilized at around 3.8% per year, except in the Qatar and the UAE where the population grew at 8.8% and 7.9%, respectively. The working-age population has been expanding accordingly. Employment is erratic from one year to another, and this will be reflected in the labor productivity figures.

56: See footnote 27 in Section 3.3 (p. 36) for the reliability of the data in Myanmar.

Table 10 Per-Worker Labor Productivity Growth, 1990–1995, 1995–2000, 2000–2005, and 2005–2014
——Average annual growth rate of GDP at constant basic prices per worker, using 2011 PPP

1990–1995		1995–2000		2000–2005		2005–2014		1990–2000		2000–2014	
Kuwait	13.0	China	7.1	Myanmar	10.4	China	9.0	China	8.9	China	8.9
China	10.6	Oman	6.4	China	8.7	Myanmar	7.8	Kuwait	6.6	Myanmar	8.7
Malaysia	6.6	Qatar	5.5	Vietnam	5.6	Mongolia	7.2	Vietnam	5.6	Mongolia	5.6
Indonesia	6.5	Vietnam	5.4	Cambodia	4.9	India	6.0	Korea	5.2	India	5.5
Thailand	6.5	Myanmar	5.3	India	4.7	Lao PDR	4.9	ROC	5.2	Lao PDR	4.6
Vietnam	5.8	ROC	4.8	Lao PDR	4.1	Bhutan	4.6	Myanmar	4.3	Vietnam	4.4
Korea	5.8	Korea	4.6	Indonesia	4.0	Sri Lanka	4.2	Singapore	3.9	Cambodia	4.3
ROC	5.5	India	4.2	Thailand	3.8	Cambodia	4.0	Malaysia	3.8	Indonesia	3.8
Cambodia	5.0	Lao PDR	3.9	Malaysia	3.6	Vietnam	3.8	India	3.7	Sri Lanka	3.6
Bhutan	4.8	Singapore	3.5	Iran	3.5	Bangladesh	3.8	Cambodia	3.7	Bhutan	3.5
Singapore	4.2	Cambodia	3.2	Hong Kong	3.3	Indonesia	3.7	Lao PDR	3.5	Bangladesh	3.4
Pakistan	4.0	Bangladesh	3.0	Korea	3.2	Philippines	3.2	Thailand	3.4	Thailand	3.1
Hong Kong	3.8	Philippines	2.6	ROC	3.2	Thailand	2.8	Bhutan	3.0	ROC	2.7
Sri Lanka	3.7	Nepal	1.7	Singapore	3.2	ROC	2.5	Qatar	2.9	Korea	2.7
Myanmar	3.3	Pakistan	1.7	Pakistan	3.0	Korea	2.4	Pakistan	2.8	Hong Kong	2.7
India	3.1	Mongolia	1.7	Bangladesh	2.8	Hong Kong	2.3	Sri Lanka	2.7	Philippines	2.5
Lao PDR	3.1	Sri Lanka	1.6	Mongolia	2.7	Iran	1.9	Bangladesh	2.6	Iran	2.5
Bahrain	2.9	Saudi Arabia	1.6	Sri Lanka	2.5	Malaysia	1.8	Indonesia	2.5	Malaysia	2.4
Nepal	2.5	Japan	1.4	Bhutan	1.6	Nepal	1.8	Hong Kong	2.1	Singapore	1.7
Bangladesh	2.2	Bhutan	1.3	Fiji	1.3	Fiji	1.1	Nepal	2.1	Pakistan	1.5
Iran	1.4	Malaysia	1.1	Japan	1.3	Singapore	0.9	Bahrain	1.7	Nepal	1.3
Japan	0.6	Fiji	1.0	Philippines	1.2	Pakistan	0.7	Philippines	1.3	Fiji	1.1
Saudi Arabia	0.6	Iran	0.7	Oman	1.1	Japan	0.5	Saudi Arabia	1.1	Japan	0.8
Qatar	0.3	UAE	0.7	Kuwait	0.8	Qatar	0.1	Iran	1.1	Qatar	–0.2
Philippines	–0.1	Bahrain	0.6	Nepal	0.5	Bahrain	–0.2	Japan	1.0	Saudi Arabia	–0.4
Brunei	–0.2	Hong Kong	0.4	Saudi Arabia	0.0	Saudi Arabia	–0.7	Fiji	0.4	Brunei	–1.1
Fiji	–0.2	Thailand	0.3	Brunei	–0.7	Brunei	–1.4	Mongolia	–0.3	UAE	–1.5
Mongolia	–2.3	Kuwait	0.2	Qatar	–0.8	UAE	–1.4	Brunei	–1.1	Bahrain	–1.9
UAE	–3.7	Indonesia	–1.5	UAE	–1.8	Kuwait	–3.7	Oman	–1.5	Kuwait	–2.1
Oman	–9.3	Brunei	–2.0	Bahrain	–4.8	Oman	–8.3	UAE	–1.5	Oman	–4.9
(regrouped)		(regrouped)		(regrouped)		(regrouped)		(regrouped)		(regrouped)	
APO20	2.3	APO20	1.5	APO20	2.4	APO20	2.7	APO20	1.9	APO20	2.6
Asia24	4.0	Asia24	2.8	Asia24	4.3	Asia24	5.0	Asia24	3.4	Asia24	4.7
Asia30	3.9	Asia30	2.8	Asia30	4.2	Asia30	4.8	Asia30	3.3	Asia30	4.6
East Asia	4.4	East Asia	3.4	East Asia	4.8	East Asia	5.8	East Asia	3.9	East Asia	5.4
South Asia	3.0	South Asia	3.6	South Asia	4.1	South Asia	5.0	South Asia	3.3	South Asia	4.6
ASEAN	4.8	ASEAN	0.3	ASEAN	3.5	ASEAN	3.2	ASEAN	2.5	ASEAN	3.3
ASEAN6	5.4	ASEAN6	0.0	ASEAN6	3.3	ASEAN6	3.0	ASEAN6	2.7	ASEAN6	3.1
CLMV	3.2	CLMV	4.8	CLMV	6.2	CLMV	4.8	CLMV	4.0	CLMV	5.3
GCC	0.5	GCC	1.9	GCC	–0.4	GCC	–1.6	GCC	1.2	GCC	–1.2
(reference)		(reference)		(reference)		(reference)		(reference)		(reference)	
US	1.5	US	2.3	US	2.2	US	1.0	US	1.9	US	1.4
EU15	1.9	EU15	1.3	EU15	0.9	EU15	0.4	EU15	1.6	EU15	0.6
		EU28	1.8	EU28	1.3	EU28	0.5	EU28	1.8	EU28	0.8
Australia	2.4	Australia	2.1	Australia	1.3	Australia	1.0	Australia	2.2	Australia	1.1
Turkey	1.3	Turkey	3.4	Turkey	5.9	Turkey	0.9	Turkey	2.4	Turkey	2.7

Unit: Percentage.
Source: APO Productivity Database 2016.

Asian Tigers was steady, ranging from 3.1% to 3.3% on average per year in 2000–2005. This performance was sustained in 2005–2014, except in Singapore. While Singapore's average annual productivity growth slowed significantly to 0.9%, the others experienced growth of about 2.4% in 2005–2014. The 2000s were an era when labor productivity deteriorated in GCC countries. The decline accelerated from –0.4% to –1.6% between the two halves of the 2000s.

Box 5 Turning Point in China

The Lewis model (Lewis, 1954) or the Fei-Ranis model (Fei and Ranis, 1964), which established development economics as a respectable academic discipline in the late 1950s and 1960s, proposed the concept of a turning point, where a developing economy transforms itself from an unskilled-labor-abundant economy with seemingly unlimited supply of labor, to a labor-scarce industrial economy. The Chinese economy seems to have reached its turning point in the latter half of the 2000s, based on the APO Productivity Database 2016.

Figure B5 presents the price of labor, relative to capital in China, Japan, and the Asian Tigers. The price of labor is defined as the average wage (total labor compensation, including our estimates of wages for self-employed and family workers) over total hours worked. The price of capital is estimated by the ex-post approach for measuring user cost of capital (see Appendix 3). The relative price index of labor on capital is normalized as 1.0 in 1970 in each country.

In Japan the price of labor increased at the beginning of the 1970s. The price of labor increased for Korea and the ROC in the late 1980s and the beginning of the 1990s, respectively. In these periods, China's low price of labor could be a main source of superior price competitiveness in labor-intensive manufacturing. The turning point was around 2008, when the price of labor started to increase very sharply, relative to capital. Such a turning point emerges when a country makes effective movements on labor from agricultural/rural/informal sectors to industrial/urban/formal sectors. This turn was a great achievement for China, addressing the serious concern of income disparity and working toward alleviation of poverty. The Chinese economy has overcome its first-round of economic development issues and now faces new challenges to move beyond the upper middle-income plateau.

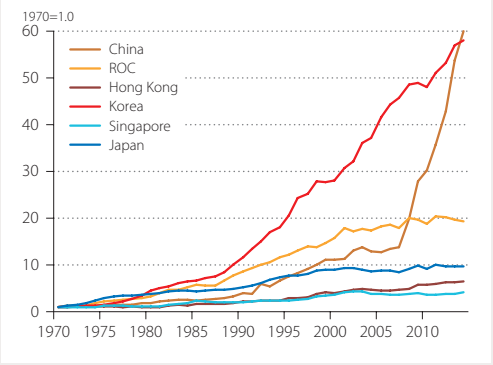

Figure B5 Price of Labor Relative to Capital in China, Japan, and the Asian Tigers, 1970–2014

Source: APO Productivity Database 2016.

As a group, the Asia24 achieved the highest labor productivity growth in recent years, reaching 4.7% on average per year in 2005–2014, up from 4.3% in 2000–2005. Within Asia, labor productivity growth has been accelerating in both South Asia and East Asia, to 5.0% and 5.8% in 2005–2014, respectively. South Asia displayed a newfound vigor in recent years. In contrast, average annual productivity growth in the US slowed abruptly to 1.0% between 2005 and 2014, after a decade of over 2.0% growth per year. The EU15 shows signs of weakening as well, slowing in every successive period from 1.9% in the first half of the 1990s to 0.4% in the most recent period of 2005–2014. Japan's labor productivity growth performed closer to that of other mature economies. Having managed to grow at 1.4% on average per year for a decade in 1995–2000, labor productivity growth in Japan has slowed to 0.5% per year on average since 2005.

Figure 42 shows labor productivity levels relative to the US (=100) for Asian countries. The same grouping, as in Table 7 in Section 3.2 (p. 34), based on the speed of catch-up with the US in per capita GDP, is used here. Broadly speaking, countries that are catching up faster with the US in per capita GDP (Group-C1) are also faster catching up in labor productivity (Figure 42.1). Similarly, countries with deteriorating relative per capita GDP (Group-C4) also present signs of deterioration of or little change against the US in terms of labor productivity (Figure 42.4).

Box 6 Productivity of City

International comparison provided in the Databook is based on an economic territory of each country. Although the two global cities in Asia, Singapore and Hong Kong, achieved much higher per capita GDP (Table 6 in Section 3.2, p. 31) and per-worker labor productivity (Figure 40 and Table 9 in Section 5.1, pp. 64–65), this may be a result of the cities fully incorporating benefits of an urban environment, e.g., economies of agglomeration. Singapore's population is 5.5 million, which is only 4.3% of that in Japan, 10.8% of Korea, and 0.4% of China. It may be more comparable to Tokyo metropolitan (13.4 million), Seoul city (10.0 million), Beijing (21.5 million) and Shanghai (24.3 million). Comparing productivity among cities may provide a better picture for understanding a productivity gap among countries, which consist of a number of cities with different scales.

Our project began developing a database on productivities of cities in Asia. Figure B6 gives a first look of our preliminary estimates on the per-worker labor productivities in 2014 among Asian cities with populations of more than 3 million, compared to some large cities in non-Asian countries. The average per-worker labor productivity level in Tokyo, which is defined as Tokyo metropolitan with population of 13.4 million (not as the greater metropolitan area with 37.0 million), is 118,000 US dollars, which is 63% higher than the country average of Japan (72,000). This indicates that Tokyo's productivity has an almost equivalent (6% lower) to that in Singapore (125,000), although the per capita GDP in Tokyo is smaller by 18% than that in Singapore, which has higher employment rate. The productivity in Osaka, which is the largest city of West Japan, is behind that in Nagoya in terms of labor productivity. Seoul, which is defined as Seoul city with a population of 10.0 million (not as the greater metro area with 24.6 million), is on the 6th position in this chart. The gap in labor productivity between Seoul and the country average of Korea is only 10%, which may indicate relatively less concentration to the capital in Korea.

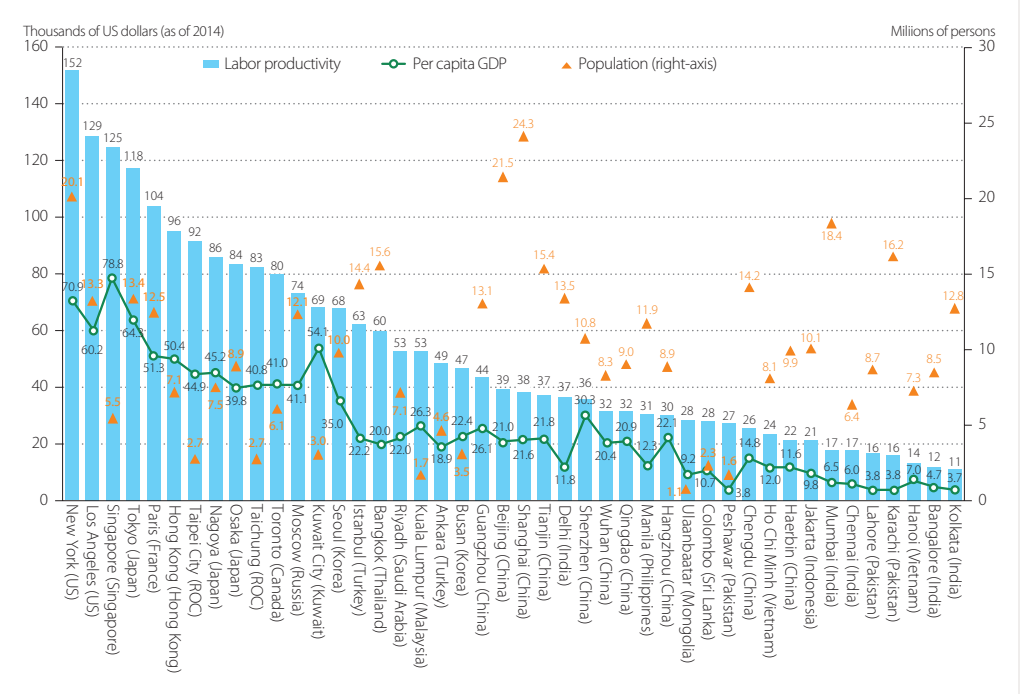

Figure B6 Per-Worker Labor Productivity Levels of Asian Cities, 2014
——GDP at constant basic prices per worker, using 2011 PPP, reference year 2014

Unit: Thousands of US dollars (as of 2014).
Sources: Official national accounts, Population census and Labor force survey in each country, including author adjustments; The Brookings Institution, *Global Metro Monitor 2014*.
Note: For Colombo and Ulaanbaatar, the observation periods are 2011 and 2010, respectively.

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In this ranking, a number of Chinese cities emerged to the middle class of the chart. Compared to the country average of Chinese per-worker labor productivity which is only 17% of the Singapore level, the productivities in Guangzhou, Beijing, Shanghai, and Tianjin are twice larger than the country average of China and reached to 30–35% of the Singapore level, regardless of these cities' larger populations, which are 13.1, 21.5, 24.3, and 15.4 million, respectively. These Chinese cities are flowed by Delhi, Manila, Ulaanbaatar, Colombo, and Peshawar. For better policies to foster nation-wide productivity growth, observing the improvement in city's productivity may play a key role. Our database is scheduled to be expanded to observe the changes over periods and to include smaller cities in Asia.

Among the countries that are catching up with the US in per capita GDP (Group-C1 and Group-C2), the Asian Tigers have made a tremendous effort in improving their relative labor productivity over the past four decades. Singapore passed the US in the middle of the 1990s and Hong Kong closed the gap from 60% in 1970 to 5% in 2014 (Figures 42.1 and 42.2). Similarly, the ROC and Korea reduced a gap of around 80% initially to 15% and 44% by 2014, respectively (Figure 42.1). Malaysia is making steady progress, raising its relative productivity level from 22% of the US in 1970 to 50% in 2014 (Figure 42.2). The rest of the countries in these two groups all display an initial relative labor productivity level of below 15%, but have shown signs of a strong and promising start in their catch-up process in the past decade.

Countries that have managed a modest catch-up with the US (Group-C3) or have a declining per capita GDP against the US (Group-C4) are also those with stagnant or deteriorating relative labor

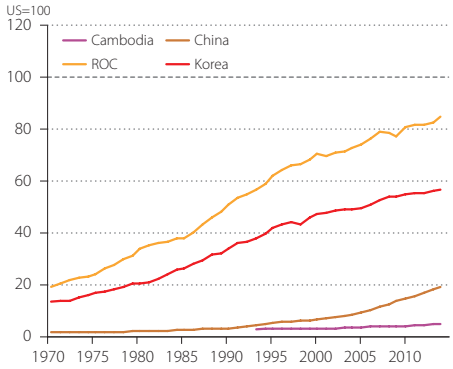

Figure 42.1: Group-C1 Countries

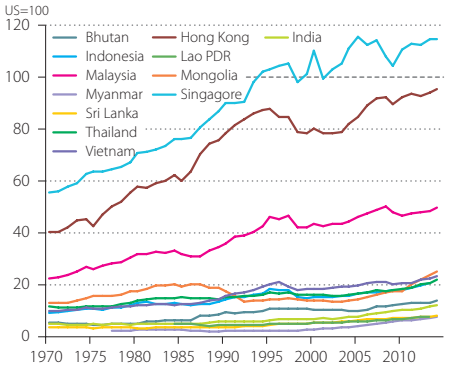

Figure 42.2: Group-C2 Countries

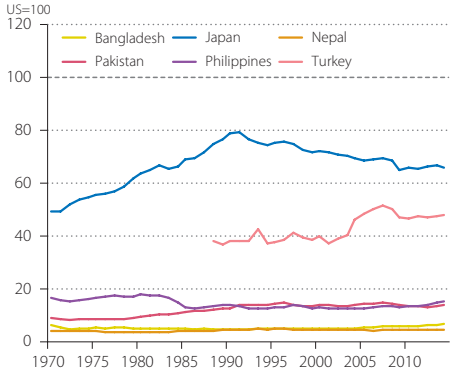

Figure 42.3: Group-C3 Countries

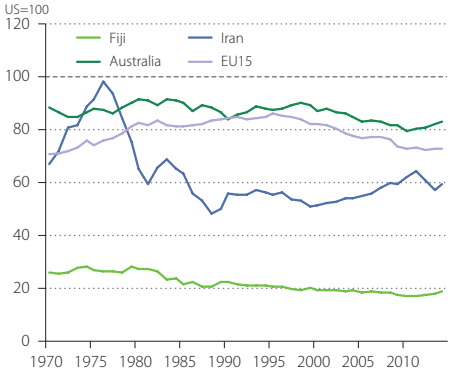

Figure 42.4: Group-C4 Countries

Figure 42 Labor Productivity Level Relative to the US, 1970–2014
——Indices of GDP at constant basic prices per worker, using 2011 PPP

Source: APO Productivity Database 2016.
Note: Countries are grouped based on Table 7 in Section 3.2 (p. 34).

productivity. Japan is the only high-income Asian country in this group, while the rest (except Iran) are all low-income countries with per capita GDP less than 30% of the US. Japan showed strong catch-up behaviors in the earlier period, with relative labor productivity peaking at 79% of the US in 1991. Since then, the gap has widened again to over 30% in 2014. Similarly the EU15, a reference economy with high income, has seen its productivity gap double against the US since 1995, from 14% to 27% in 2014; whereas the low-income countries have managed little catch-up (Figure 42.3) or a declining relative productivity level (Figure 42.4). Iran (a Group-L2 country) experienced a drastic decline in its relative labor productivity from its former peak of 98% in 1976 to 48% in 1988, before recovering to 64% in 2011. As a result of the strengthened sanctions against Iran, however, labor productivity to date declined drastically.

5.2 Per-Hour Labor Productivity

The per-worker-based labor productivity gaps presented in Section 5.1 are most likely conservative estimates, since workers in high-performing Asian countries tend to work longer hours than those in the US on average. To adjust for this discrepancy, total hours worked are constructed in our database for the 21 Asian countries, although the quality of the estimates may vary considerably across countries.[57] Figure 43 shows how the productivity gap against the US in 2014 varies depending on which measure of labor productivity is used.[58] The productivity gap with the US widens for all Asian countries when the differences in working hours are taken into account. However, for 14 of these countries, the adjustments are within 1–5 percentage points, and hence are not deemed as statistically significant. In contrast, the choice of labor productivity measure makes a significant difference for the previously high-performing countries in their relative performance. On a per-hour GDP basis, the labor productivity gap with the US widens by 13–32 percentage points for the Asian Tigers. Europeans generally work fewer hours. This

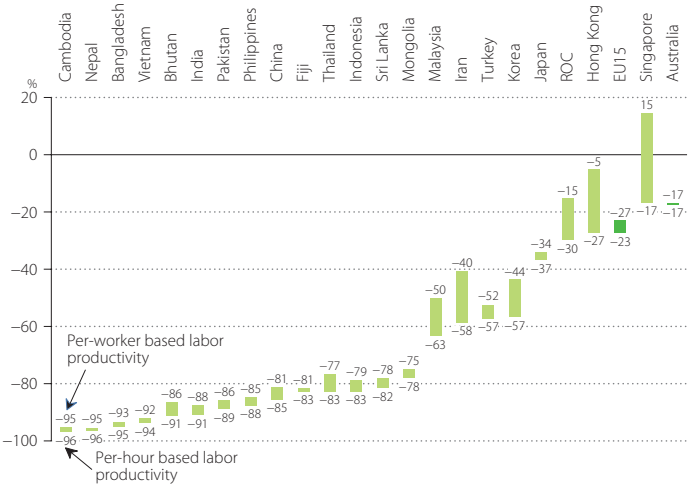

Figure 43 Labor Productivity Gap by Per-Worker and Per-Hour GDP Relative to the US, 2014

——GDP at constant basic prices per worker and hour, using 2011 PPP

Source: APO Productivity Database 2016.
Note: Light green is used for the countries in which per-hour labor productivity is lower than per-worker labor productivity.

57: Cross-country comparisons of hours worked are notoriously difficult, not least because harmonized data is rarely readily available. In the countries studied, three published their total hours worked as part of their official statistics, but not for the whole period studied in this report, and the publications may have been constructed based on different methodologies. Some countries only published estimates for average weekly hours worked, which required estimates of number of weeks worked to derive the total average hours worked per worker. Others may have only estimated benchmark hours worked available, which are then extrapolated to form a series. Consequently, growth of employment and growth of total hours worked become identical, as in the case of China and Thailand. In reading the results, it is therefore important to bear in mind the data limitations. This edition of the Databook uses new and improved time-series estimates of average hours worked, considering the changes in the compositions of workforces. See Appendix 4 for an explanation of the estimation procedure of total hours worked.

58: The labor productivity gap for country x is country x's labor productivity divided by the US's labor productivity in Figure 43.

Table 11 Per-Hour Labor Productivity Levels, 1970, 1980, 1990, 2000, 2010, and 2014

——GDP at constant basic prices per hour, using 2011 PPP, reference year 2014

1970		(%)	1980		(%)	1990		(%)	2000		(%)	2010		(%)	2014		(%)
Iran	14.9	100.0	Singapore	21.1	100.0	Singapore	29.5	100.0	Singapore	41.0	100.0	Singapore	51.2	100.0	Singapore	54.4	100.0
Singapore	14.5	97.2	Japan	19.2	91.0	Japan	28.9	98.0	Japan	35.3	86.1	ROC	43.2	84.3	Hong Kong	47.9	88.0
Japan	12.7	85.4	Iran	16.4	78.0	Hong Kong	25.5	86.6	Hong Kong	30.8	75.1	Hong Kong	43.0	83.9	ROC	46.0	84.6
Hong Kong	8.2	55.2	Hong Kong	14.3	67.9	ROC	17.6	59.7	ROC	30.0	73.2	Japan	40.3	78.6	Japan	41.4	76.0
Fiji	8.2	55.0	ROC	9.7	46.2	Iran	16.3	55.2	Iran	18.2	44.5	Iran	28.1	54.9	Korea	28.4	52.2
Malaysia	5.6	37.6	Fiji	9.6	45.8	Malaysia	11.6	39.3	Malaysia	16.8	41.0	Korea	26.2	51.1	Iran	27.2	50.0
ROC	5.2	34.6	Malaysia	8.9	42.2	Fiji	9.6	32.7	Korea	16.8	40.8	Malaysia	21.9	42.8	Malaysia	24.2	44.5
Philippines	4.1	27.6	Mongolia	5.9	28.2	Korea	9.4	31.8	Fiji	9.6	23.3	Fiji	10.2	19.9	Mongolia	14.6	26.8
Mongolia	3.9	26.5	Philippines	5.1	24.0	Mongolia	7.0	23.6	Sri Lanka	7.6	18.6	Sri Lanka	10.2	19.8	Sri Lanka	12.0	22.1
Sri Lanka	3.7	24.7	Korea	4.8	22.9	Sri Lanka	5.9	20.0	Indonesia	7.1	17.2	Mongolia	9.9	19.3	Indonesia	11.5	21.0
Korea	2.9	19.4	Sri Lanka	4.6	21.8	Indonesia	5.5	18.6	Mongolia	6.7	16.4	Thailand	9.5	18.6	Thailand	11.3	20.8
Indonesia	2.9	19.1	Indonesia	4.4	21.0	Philippines	4.8	16.2	Thailand	6.5	16.0	Indonesia	9.5	18.6	Fiji	11.3	20.8
Thailand	2.3	15.5	Thailand	2.8	13.4	Thailand	4.5	15.3	Pakistan	5.7	14.0	China	7.2	14.1	China	9.6	17.6
Pakistan	2.3	15.4	Pakistan	2.8	13.3	Pakistan	4.3	14.7	Philippines	5.5	13.4	Philippines	6.8	13.4	Philippines	8.2	15.0
Bangladesh	1.7	11.6	Bangladesh	1.6	7.5	Bhutan	2.4	8.2	Bhutan	3.3	7.9	Pakistan	6.8	13.3	Pakistan	7.4	13.5
India	1.3	8.9	India	1.4	6.6	India	2.0	6.7	China	2.9	7.1	India	5.0	9.8	India	6.0	11.1
Nepal	1.2	8.4	Nepal	1.2	5.8	Bangladesh	1.8	6.1	India	2.8	6.9	Bhutan	4.9	9.7	Bhutan	6.0	11.0
Bhutan	1.1	7.4	Bhutan	1.2	5.5	Nepal	1.7	5.7	Vietnam	2.1	5.2	Vietnam	3.4	6.6	Vietnam	4.2	7.7
Vietnam	1.1	7.3	Vietnam	1.1	5.2	China	1.3	4.3	Nepal	2.1	5.1	Bangladesh	2.8	5.5	Bangladesh	3.3	6.1
China	0.5	3.4	China	0.7	3.3	Vietnam	1.3	4.3	Bangladesh	2.0	4.9	Nepal	2.4	4.6	Nepal	2.5	4.6
									Cambodia	1.3	3.1	Cambodia	1.8	3.6	Cambodia	2.3	4.3
(reference)			(reference)			(reference)			(reference)			(reference)			(reference)		
US	32.2	215.8	US	37.2	176.5	US	43.8	148.6	US	53.0	129.1	US	65.0	126.9	US	65.5	120.4
									EU15	44.6	108.7	EU15	49.0	95.6	EU15	50.4	92.5
			Australia	31.5	149.4	Australia	35.0	118.6	Australia	43.7	106.6	Australia	50.4	98.4	Australia	54.5	100.1
						Turkey	15.2	51.5	Turkey	18.5	45.1	Turkey	26.8	52.4	Turkey	28.1	51.7

Unit: US dollar (as of 2014).
Source: APO Productivity Database 2016.

is reflected in comparisons of hourly labor productivity showing the EU15 in a more favorable light against the US, albeit only marginally.

Based on GDP at constant basic prices per hour worked, the US labor productivity has been able to sustain a big lead over even the Asian high performers (Table 11).[59] In 1970, the US productivity level was nearly 2.5 times that of Japan. This gap was reduced to around 34% in 1990. Since 1990, Japan's pace in closing the gap has slowed. By 2014, a sizable gap of 37% remained. The gap between the US and the Asian leader, Singapore, has been narrowing with a very slow pace and the productivity gap of 17% still remains in 2014. This is in contrast with the picture painted by the per-worker productivity measure, in which the Asian leaders have overcome or almost closed the gap with the US (Table 9 and Figure 42).

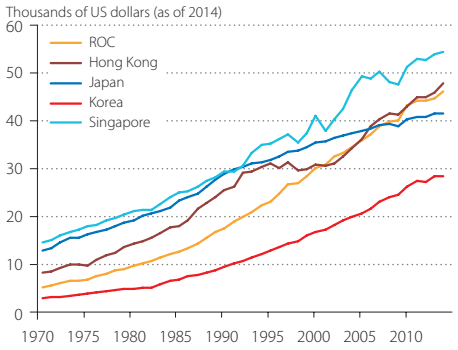

Figure 44 Labor Productivity Trends in Japan and the Asian Tigers, 1970–2014

——GDP at constant basic prices per hour, using 2011 PPP, reference year 2014

Unit: Thousands of US dollars (as of 2014).
Source: APO Productivity Database 2016.

59: Note that the differentials in the labor quality per hour worked among countries have not been accounted for in this comparison: labor productivity will tend to be overestimated if labor quality has been rising, and vice versa. The estimates for Bhutan, Fiji, and Mongolia are newly added in this edition of the Databook.

The levels of labor productivity for the top five economies – Japan and the four Asian Tigers – maintained their relative positions for almost four decades. The progress of labor productivity in these countries during 1970–2014 is shown in Figure 44. Within four decades, GDP per hour has more than tripled for Japan and Singapore. Hong Kong and the ROC have improved by six and nine times in this period and have overcome Japan in 2006 and 2008, respectively. They were ahead of Korea, despite the effort in catching up with Japan by 2.5% per year on average over the past four decades (1970–2014). If they were to maintain this effort at the same pace, it would take Korea 15 years to finally draw level with Japan.

Over the entire observation period (1970–2014), hourly labor productivity growth ranged from 0.7% (Fiji) to 6.7% (China) on average per year, compared with the US at 1.6%, as shown in the left chart of Figure 45. Among the 21 Asian countries compared, only Bangladesh, Fiji, Iran, Nepal, and the Philippines grew slower than the US. Between the two sub-periods (1970–1990 and 1990–2014), there is a notable deceleration in the hourly productivity growth for 10 of 20 Asian countries (excluding Cambodia). For example, 3.0 percentage points and 2.6 percentage points were shaved off productivity

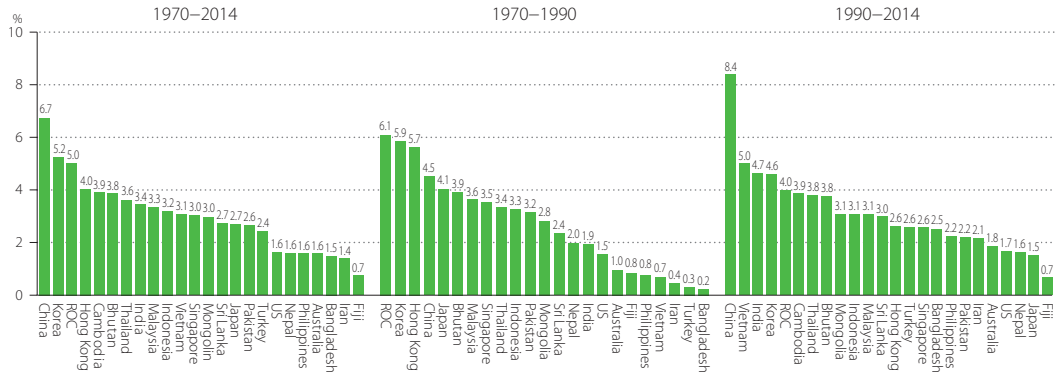

Figure 45 Labor Productivity Growth, 1970–2014, 1970–1990, and 1990–2014
——Average annual growth rate of GDP at constant basic prices per hour

Source: APO Productivity Database 2016.
Note: The starting periods for Australia, Cambodia, and Turkey are 1978, 1993, and 1988, respectively.

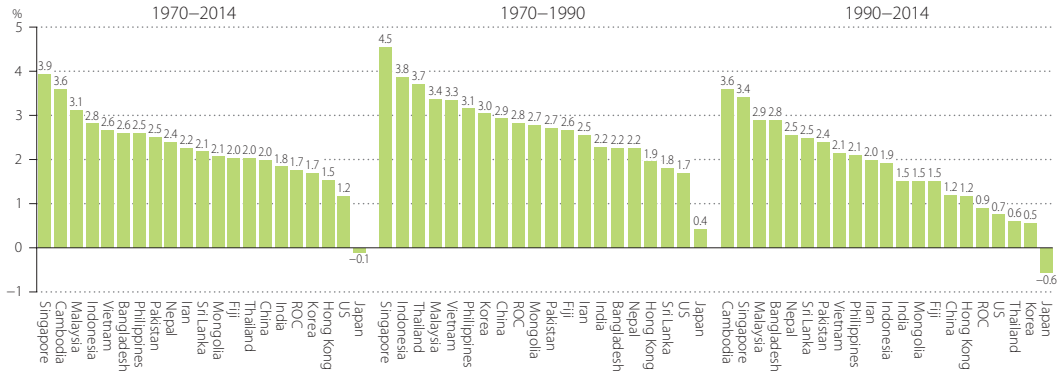

Figure 46 Labor Input Growth, 1970–2014, 1970–1990, and 1990–2014
——Average annual growth rate of total hours worked

Source: APO Productivity Database 2016.
Note: The starting period for Cambodia is 1993.

Table 12 Per-Hour Labor Productivity Growth, 1990–1995, 1995–2000, 2000–2005, and 2005–2014
——Average annual growth rate of GDP at constant basic prices per hour, using 2011 PPP

1990–1995		1995–2000		2000–2005		2005–2014		1990–2000		2000–2014	
China	10.3	China	6.3	China	7.7	China	9.0	China	8.3	China	8.6
Malaysia	6.4	Korea	5.3	Vietnam	6.7	Mongolia	7.0	Korea	5.8	Mongolia	5.5
Korea	6.2	ROC	5.2	Thailand	5.2	India	5.8	ROC	5.4	India	5.4
Thailand	6.2	Vietnam	4.9	India	4.7	Bhutan	5.0	Vietnam	5.3	Vietnam	4.8
Indonesia	6.2	India	4.1	Korea	4.3	Cambodia	4.4	Malaysia	3.7	Bhutan	4.3
Vietnam	5.7	Singapore	3.1	Cambodia	4.2	Sri Lanka	4.1	Thailand	3.7	Cambodia	4.3
ROC	5.5	Philippines	2.3	Iran	3.7	Bangladesh	3.9	India	3.6	Thailand	3.9
Cambodia	5.0	Cambodia	2.2	Singapore	3.7	Vietnam	3.8	Singapore	3.3	Korea	3.8
Bhutan	4.8	Japan	2.1	Indonesia	3.6	Korea	3.5	Cambodia	3.0	Bangladesh	3.5
Hong Kong	4.0	Pakistan	1.9	ROC	3.5	Philippines	3.4	Bhutan	3.0	Indonesia	3.5
Sri Lanka	4.0	Mongolia	1.7	Pakistan	3.2	Indonesia	3.4	Pakistan	2.8	Sri Lanka	3.3
Pakistan	3.6	Nepal	1.7	Bhutan	3.1	Thailand	3.2	Sri Lanka	2.6	Hong Kong	3.1
Singapore	3.6	Bangladesh	1.6	Hong Kong	3.1	Hong Kong	3.2	Indonesia	2.5	ROC	3.0
India	3.1	Bhutan	1.2	Malaysia	3.1	ROC	2.8	Nepal	2.1	Iran	2.9
Nepal	2.4	Sri Lanka	1.2	Mongolia	2.8	Iran	2.4	Japan	2.0	Philippines	2.8
Japan	2.0	Thailand	1.2	Bangladesh	2.7	Malaysia	2.3	Hong Kong	1.9	Malaysia	2.6
Iran	1.5	Malaysia	1.0	Sri Lanka	1.8	Nepal	1.7	Philippines	1.4	Singapore	2.0
Bangladesh	0.8	Iran	0.8	Philippines	1.8	Fiji	1.5	Bangladesh	1.2	Pakistan	1.8
Philippines	0.5	Fiji	0.5	Japan	1.4	Singapore	1.1	Iran	1.1	Nepal	1.3
Fiji	−0.7	Hong Kong	−0.2	Fiji	0.8	Pakistan	1.0	Fiji	−0.1	Fiji	1.2
Mongolia	−2.5	Indonesia	−1.2	Nepal	0.6	Japan	1.0	Mongolia	−0.4	Japan	1.1
(reference)		(reference)		(reference)		(reference)		(reference)		(reference)	
US	1.5	US	2.3	US	2.5	US	1.0	US	1.9	US	1.5
		EU15	1.7	EU15	1.2	EU15	0.7	EU15	1.7	EU15	0.9
Australia	2.2	Australia	2.3	Australia	1.9	Australia	1.4	Australia	2.2	Australia	1.6
Turkey	1.2	Turkey	2.8	Turkey	6.0	Turkey	1.3	Turkey	2.0	Turkey	3.0

Unit: Percentage.
Source: APO Productivity Database 2016.
Note: The annual average growth rate for Cambodia during 1990–1995 replicates their annual average growth rates of 1993–1995 due to absent data.

growth in the earlier period in Hong Kong and Japan, respectively. Nine Asian countries managed to accelerate their productivity improvement after 1990. Among these, the performances in China and Vietnam are outstanding, with a productivity acceleration from 4.5% to 8.4% in China and from 0.7% to 5.0% in Vietnam, respectively, between the two sub-periods.

The deceleration of labor productivity growth between the two sub-periods reflects weaknesses in output growth in most countries. Figure 46 shows all countries except three South Asian countries, as Bangladesh, Nepal, and Sri Lanka, experienced a slowdown in hours-worked growth between the sub-periods, which should have worked to boost labor productivity growth, all other things being equal.[60] For labor productivity growth to slow implies that output growth must have been decelerating more than labor input in percentage points. In China, output growth was reinforced by the slower pace of labor input growth to result in an extraordinary surge in labor productivity growth in Figure 45. Labor input growth slowed to 1.2% per year on average in the latter period, from 2.9% in the previous period. Japan was the only economy in Asia to experience an actual fall in labor input in the period from 1990 to 2014. This served to compensate for a sluggish output growth during said period; and sustain a positive labor productivity growth of 1.5% per year on average.

60: By definition, positive labor productivity growth occurs when output grows faster than labor input. Figures 45 and 46 therefore tend to have an inverse relationship, namely that the higher the labor input growth, the lower the labor productivity growth, other things being equal.

Table 12 more closely examines the sub-period from 1990–2014, providing the growth rates of per-hour-based labor productivity since 1990. The growth patterns of individual countries generally follow their counterparts closely in per-worker productivity growth, as illustrated in Table 10. In some countries the two measures diverge greatly and are not at all consistent through the periods compared.[61] This contrast was particularly stark in the first half of the 1990s, when Japan's hourly productivity growth was 2.0% compared with 0.6% in per-worker productivity growth. However, the divergence narrowed to 0.3 percentage points in the period 2000–2014. Korea is another country in which hourly productivity growth was consistently higher than its per-worker counterpart. Instead of narrowing, the divergence widened to 1.1 percentage points after 2000. Hours worked in the ROC have also grown at a slower rate than number of workers.

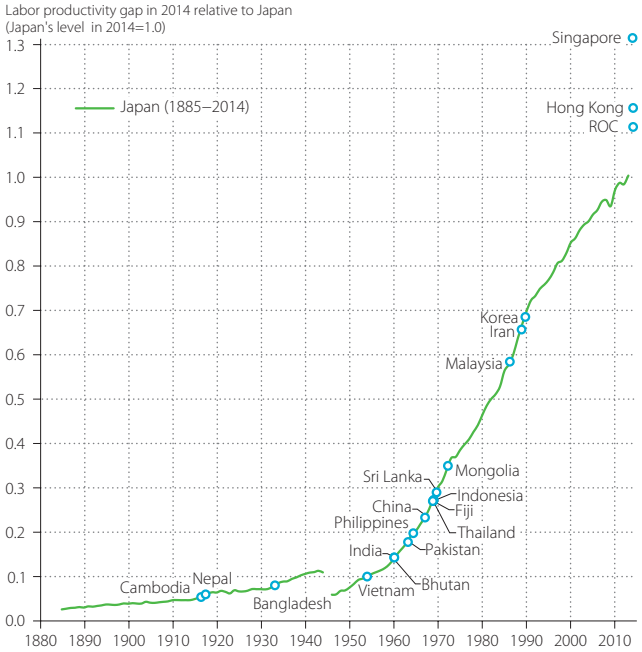

Figure 47 Labor Productivity Trends of Japan in 1885–2014 and Levels of Asian Countries in 2014
——GDP at constant basic prices per hour, using 2011 PPP

Sources: For historical data of Japan, the sources of GDP are Long-Term Economic Statistics by Ohkawa, Takamatsu, and Yamamoto (1974) during 1885–1954 and the JSNA by ESRI, Cabinet Office of Japan, during 1955–2014 (including author adjustments). Hours worked data is based on KEO Database, Keio University, during 1955–2014. During 1885–1954, the average hours worked per person are assumed to be constant. For the labor productivity level of Asian countries in 2014, it is based on the APO Productivity Database 2016.

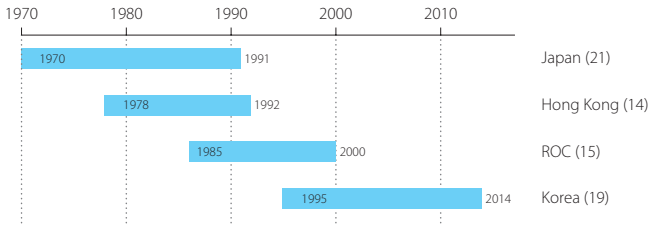

Figure 48 Time Durations Taken to Improve Labor Productivity by Japan and the Asian Tigers

Source: See Figure 47.

One can identify where countries are today in terms of their hourly productivity performance against a backdrop of Japan's historical experience. Figure 47 traces the long-term path of Japan's per-hour labor productivity for the period 1885–2014 along the green line, expressed as relative to Japan's 2014 level (set equal to 1.0).[62] A structural break is observed during World War II when output collapsed. Countries' relative hourly productivity levels against Japan in 2014 are then mapped against Japan's growth experience (as circles). By so doing, a corresponding year can be located when Japan's hourly productivity level was the closest to the

61: For China and Thailand, both measures give the same productivity growth. This is a result of a statistical construct in our current database rather than the underlying trend.
62: While mindful that level comparisons of productivity among countries and over periods, are subject to a great degree of data uncertainty, they should provide a rough sketch of the productivity divergence in Asia.

country in question. The two countries with the lowest hourly productivity in 2014 (Cambodia and Nepal) see levels corresponding to Japan's in the 1920s. Even if they manage Japan's long-term productivity growth of 2.7% on average per year, this means it will take them over a century to catch up with the Asian leader's current position (Singapore, Hong Kong, the ROC, and Japan). Most Asian countries are clustered around Japan's level in the 1960s and early 1970s. Among them, China has been leading the catch-up effort, with productivity growing three times faster than Japan's long-term average (Table 12), followed by Mongolia, India, and Vietnam.

In pole position are the Asian Tigers, of which Singapore, Hong Kong, and the ROC have already surpassed Japan. Figure 48 compares the time spans taken by each country to raise its labor productivity from 30–70% of Japan's level today (unit of measurement on the y-axis of Figure 47). What Japan had achieved in the 21 years from 1970 to 1991, Hong Kong, the ROC, and Korea managed to achieve in 14, 15, and 19 years, respectively (Figure 48). Although the speed of catch-up for latecomers is increasing somewhat, most Asian countries will take a long time to catch up with the leaders, currently clustered near Japan's 1970 levels in Figure 47.

5.3 Total Factor Productivity

Labor productivity in the previous sections is only a one-factor or partial-factor productivity measure and does not provide a full perspective of production efficiency. An observation of low labor productivity could suggest production inefficiency, but it could also reflect different capital intensities in the chosen production method under the relative labor-capital price faced by the economy concerned. By observing movements in labor productivity alone, it is not easy to distinguish which is the case. In populous Asian economies, which are relatively abundant in low-skilled labor, production lines may be deliberately organized in a way to utilize this abundant, and hence relatively cheap, resource. It follows that the chosen production method is most likely to be (low-skilled) labor-intensive and with little capital, manifested in low labor productivity and high capital productivity. This is why economists analyze TFP, which is GDP per unit of combined inputs, to arrive at an overall efficiency of a country's production.[63]

Measuring capital input is a key factor for determined TFP. It is defined by capital services – the flow of services from productive capital stock, as recommended in the 2008 SNA.[64] The required basis for estimating capital services is the appropriate measure of (productive) capital stock. The SNA recommends constructing the national balance sheet accounts for official national accounts. However, this is not a common practice in the national accounts of many Asian countries.[65] Even where estimates of net capital stocks are available for the entire economy, assumptions and methodologies can differ considerably among countries. In response to this challenge, harmonized estimates for productive capital stocks and capital services have been constructed and compiled within the APO Productivity Database, built on the same methodology and assumptions.[66] In this methodology, changes in the quality of capital are incorporated into the measurement of capital services in two ways: changes in the composition are captured by explicitly differentiating assets into 11 types and; an appropriate and

63: Different types of inputs and outputs are aggregated by using index numbers, and TFP is calculated as the output quantity index divided by the input quantity index. In this edition of the Databook, the Törnqvist index is used for aggregating labor and 11 types of capital inputs (the classification is provided in Table 20 in Appendix 2).

64: See the chapter on capital services and the national accounts of the 2008 SNA (United Nations, 2009). The second edition of the *OECD Capital Manual* (2009) provides a comprehensive framework for constructing prices and quantities of capital services.

65: Based on our metadata survey, half of APO member economies do not estimate the balance sheet accounts within the official national accounts; these countries are Bangladesh, the ROC, Indonesia, Korea, the Lao PDR, Mongolia, Nepal, Sri Lanka, and Vietnam (but the National Wealth Survey is available in the ROC and Korea for some selected years).

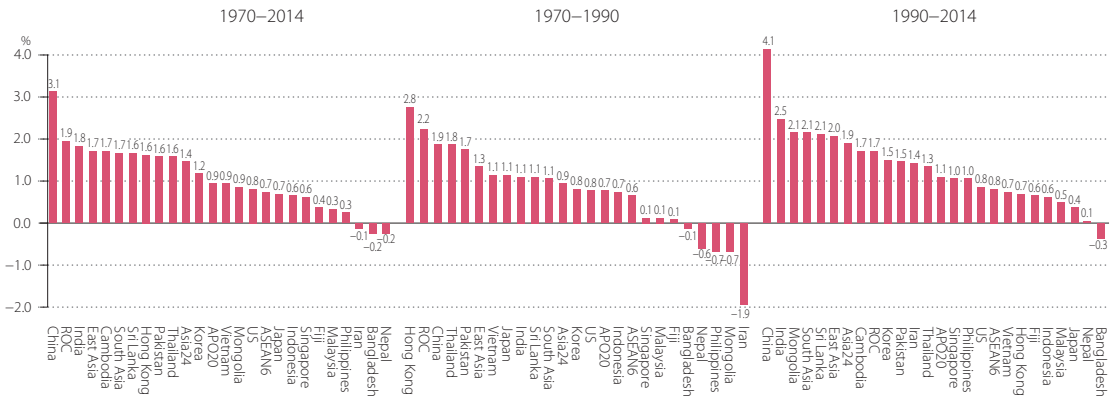

Figure 49 TFP Growth, 1970–2014, 1970–1990, and 1990–2014

Source: APO Productivity Database 2016.
Note: The starting period for Cambodia is 1993. See footnote 70 for the country-exception in the country groups.

harmonized deflator is used for IT capital to reflect the rapid quality change embodied in IT-related assets (see Appendix 2).

The APO Productivity Database 2016 estimates capital services and TFP for the 20 Asian economies for which long-time investment data by type of asset are available or estimated.[67] Their economic growth is decomposed into sources from factor inputs and TFP based on the methodology developed by Jorgenson and Griliches (1967). The Databook defines output as GDP at constant basic prices, and factors inputs as labor, IT capital, and non-IT capital.[68] Labor input is measured by total hours worked, without adjustments for changes in labor quality.[69]

Cross-country comparisons of TFP growth for the 20 Asian countries and the US are shown in Figure 49 for the period 1970–2014, and the two sub-periods 1970–1990 and 1990–2014. In addition, the regional growth accounts are developed for some country groups: the Asia24, the APO20, East Asia, South Asia, and the ASEAN6.[70] The average annual growth rate of TFP during the entire observation period ranges from almost 0–2%, with the exception of China which has achieved considerably high growth of TFP over 3%. Taking the US as the reference economy, with TFP growth of 0.8% on average per year, 11 Asian economies achieved higher TFP growth than the US.

66: The Department of Statistics Malaysia developed a new set of comprehensive capital stock statistics in April 2011 following the *OECD Capital Manual* (2009). The correlations between these official estimates (Department of Statistics Malaysia, 2014) and our estimates for the period of 1970–2014 are high; they are 89.1% and 99.3% for the growth rates of net and productive capital stock, respectively. In the Databook, capital input is defined as capital services computed from our estimates of productive capital stock, so as to ensure that the same methodology and same asset classification are applied for the 20 Asian countries compared.

67: In measuring TFP, income generated from domestic production should be separated into labor and capital compensations. The national accounts readily provide the estimates of compensation of employees as a component of value added; compensation for the self-employed is not separately estimated but is combined with returns to capital in mixed income, except China, where labor remuneration in the national accounts includes labor income for the self-employed (Holz, 2006). In the Databook, it is assumed that the per-worker wages for self-employed and contributing family workers are 5% to 70% of the per-worker wage for employees in the countries where the appropriate wage data is not available, in order to measure total labor compensation. See Box 7 for sensitivity of our assumptions to the TFP results.

68: IT capital is defined as a composite asset of IT hardware (computers and copying machines), communications equipment, and computer software.

69: The hours worked were newly estimated for Fiji and Mongolia in this edition. The failure to take into account improvements in labor quality leads to TFP overestimation. The harmonized estimates of labor quality changes are planned to be incorporated in the next edition of the Databook (See Box 8, p. 123).

70: In sections 5.3 and 5.4 the Asia24 does not include Bhutan, Brunei, Myanmar, and the Lao PDR, the APO20 does not include the Lao PDR, South Asia, and the ASEAN6 does not include Brunei.

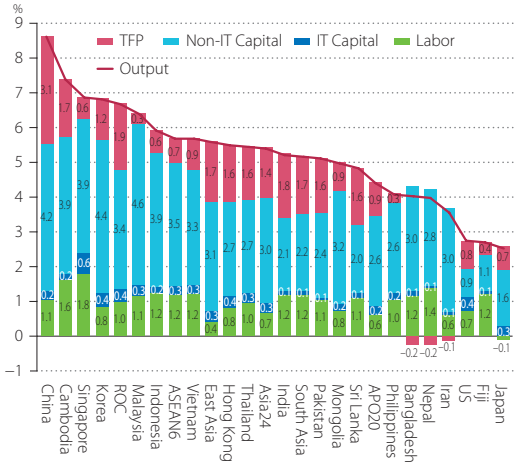

Figure 50 Sources of Economic Growth, 1970–2014

Source: APO Productivity Database 2016.
Note: The starting period for Cambodia is 1993. See footnote 70 for the country-exception in the country groups.

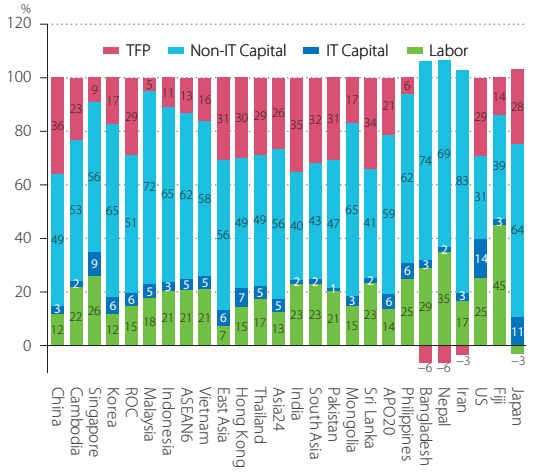

Figure 51 Contribution Shares of Economic Growth, 1970–2014

Source: APO Productivity Database 2016.
Note: The starting period for Cambodia is 1993. See footnote 70 for the country-exception in the country groups.

Looking at the sub-periods (1970–1990 and 1990–2014), one can discern that the two were not identical and, in fact, had quite significant differences in terms of the magnitude of growth and countries' relative performance. Eleven of the 20 Asian countries experienced acceleration in TFP growth. Iran and Mongolia achieved considerable recoveries from negative TFP growths: from –1.9% to 1.4% and from –0.7% to 2.1%, respectively.[71] More modestly, the TFP growths in China and India improved from 1.9% on average per year in the earlier period to 4.1% since 1990 and from 1.1% to 2.5%, respectively. The three countries that saw their productivity growth more than halved are Hong Kong and Japan.

In terms of its contribution to economic growth, TFP has played a significant role in some fast-growing Asian economies over the past decades. Figures 50 and 51 present the sources of economic growth and those contribution shares, respectively, for the entire observation period 1970–2014. Countries are arranged according to their long-run economic growth. In this period, China achieved the fastest output growth of 8.6% on average per year. This is followed by Singapore and Korea, growing at 6.9% on average per year. From these GDP growths, the TFP contribution accounted for over 25% of economic growth in eight of the 20 Asian economies compared. Among them, TFP contribution was the largest in China (36%), India (35%), Sri Lanka (34%), Pakistan (31%), and Hong Kong (30%) with over 30%, followed by the ROC (29%), Thailand (29%), and Japan (28%). In contrast, TFP performance was very modest in Singapore, resulting in its relatively small contribution of only 9% to economic growth over the same period (0.6% on average per year as the TFP growth rate). In Korea the TFP contribution in GDP growth was 17% (1.2% on average per year), which was outperformed by the whole Asia of 26% (1.4% on average per year).[72]

71: In Iran and Mongolia, subsoil assets may have a significant impact on the TFP growth. Note that they are omitted in our measures of capital inputs.
72: Compared to preceding studies on measuring TFP in Korea, it should be noted that economic growth in Korea has been revised upward considerably in the Korean System of National Accounts (KSNA) published in 2010. The main revisions stem from the introduction of a chain index in KSNA. As a result, Korea's GDP growth at constant market prices has been revised up from 7.0% to 8.6% on average in the 1970s, from 8.4% to 9.3% in the 1980s, and from 5.9% to 6.3% in the 1990s. In addition, by the KSNA revision based on the 2008 SNA, these are further revised to 8.8%, 9.4%, and 6.7%, respectively.

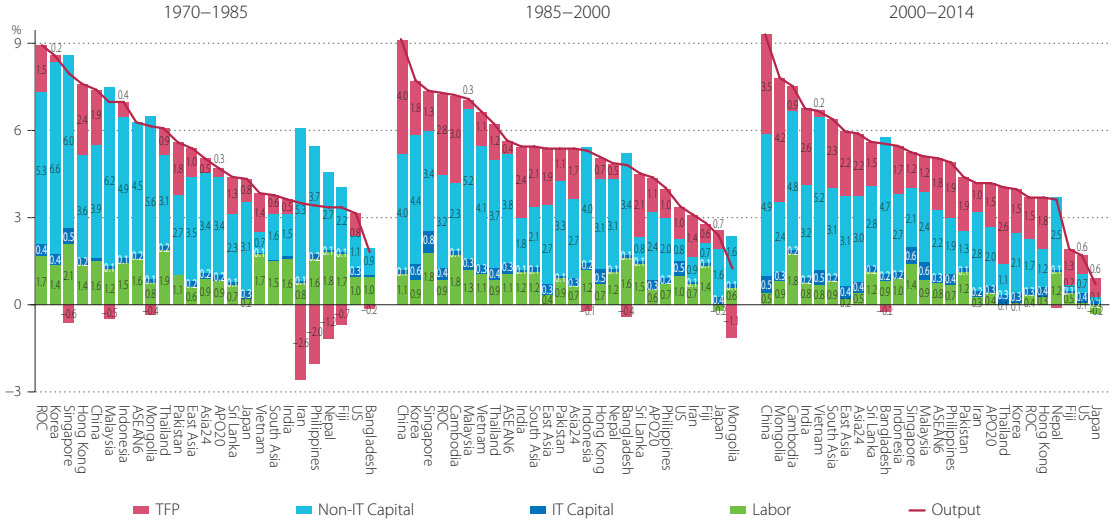

Figure 52 Sources of Economic Growth, 1970–1985, 1985–2000, and 2000–2014

Source: APO Productivity Database 2016.
Note: See footnote 70 for the country-exception in the country groups.

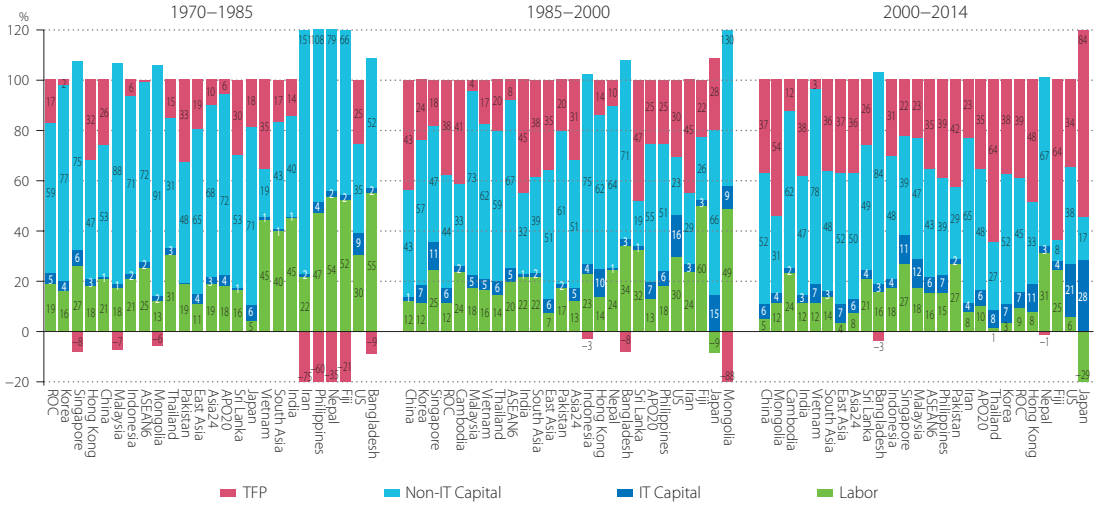

Figure 53 Contribution Shares of Economic Growth, 1970–1985, 1985–2000, and 2000–2014

Source: APO Productivity Database 2016.
Note: See footnote 70 for the country-exception in the country groups.

China's productivity performance was outstanding in this period. The average TFP growth was 3.1% per year during 1970–2014 (Figure 49). This compares with the long-run estimates of 3.8% during 1978–2005 in Holz (2006) and also 3.8% during 1978–2004 in Bosworth and Collins (2008). The Chinese experience of long-term TFP growth of about 3.0% is not unprecedented in Asia. According to Jorgenson and Nomura (2005), Japan achieved an annual TFP growth of 3.1% during 1960–1973, even after improvements in labor quality had been taken into account in the estimation of labor growth (and, as such, eliminating overestimation in TFP).[73]

Looking at the breakdown of the period in Figure 52, one can see Iran, the Philippines, Nepal, and Fiji were running an overall negative TFP growth in the period 1970–1985, at –2.6%, –2.0%, –1.2%, and –0.7% on average per annum, respectively.[74] Negative TFP growth can be caused by many things, including a rapid, temporary decline in demand or the inefficient use of resources by political interventions to the economy. This is unlikely to be sustainable in the long run. As shown in the year-on-year changes of growth decomposition in each country (Figure 59), the Philippine's TFP fell severely in the beginning of the 1980s, in which the economy declined by 15.6% for two years, from 1983–1985, under the regime of Ferdinand Marcos. In Mongolia, negative TFP growths are observed before the transition to market economy in 1992 in Figure 59, which induced a negative TFP growth in the period 1985–2000 (–1.1% on average), as shown in the center chart of Figure 52.

It is obvious in Figure 51 that economic growth was predominantly explained by the contribution of capital input in most of the Asian countries, which ranged from 41% in Fiji to 86% in Iran. Among the Asian Tigers, the contribution of capital services ranged from 56% in Hong Kong to 65% in Singapore, whereas in China and India, it accounted for 52% and 42% of economic growth, respectively. This compares with 45% in the US, of which 14 percentage points were contributed by IT capital, a share unmatched by the Asian countries. Japan has been leading Asian countries in terms of contribution from IT capital (11% of economic growth) whereas in other Asian countries it has been 1–9%, with China and India trailing behind.

One prevalent characteristic of the Asian countries is their investment intensity as a share of GDP (Figure 30 in Section 4.2, p. 50), and in turn its contribution to economic growth (Figures 51 and 53). There is policy significance in identifying the driver(s) behind the rapid economic growth in the Asian countries. If growth has been driven by capital accumulation more than assimilation of existing technologies from the advanced economies, the Asian model may prove to be too expensive for many less well-off countries to emulate. According to our findings (Figures 52 and 53), it is true that, historically, capital accumulation has played a much more significant role in the Asian countries than in the US. However, the relative contribution shares are not constant across countries and over time. There have been periods when (and in some countries where) assimilation as reflected in TFP growth also contributed significantly toward driving growth.

As show in Figure 53, capital accumulation was the dominant factor in the early period 1970–1985, typically explaining two-thirds to three-quarters of economic growth achieved. In Vietnam, Pakistan, Hong Kong, Sri Lanka, and China, however, the contribution of TFP growth was still significant, accounting for 26–35% of their respective economic growth.[75] In the subsequent periods, the contribution of capital input became progressively smaller, falling to a share of below 56% on average in 2000–2014 from 71% in 1970–1985 in the whole Asia, while the contribution of TFP became progressively more significant, rising to a share of above 36% from 10%. Reflecting on these results, capital accumulation appears to be a necessary step to economic growth, especially in the early period of development. Although a prerequisite, capital accumulation does not guarantee TFP growth.

73: In the same period 1960–1973, the average annual contribution rate of labor quality improvement to growth is measured as 0.54% in Jorgenson and Nomura (2005). As a measure of the TFP contribution that is comparable with the estimates in this Databook, their estimate can be recognized as 3.6% per year during the same period.

74: Negative TFP growth for these countries is also observed in other studies. Baier, Dwyer, and Tamura (2006) estimate the average annual growth rate of TFP of Fiji at –0.75% during 1960–2000. Cororaton (2002) shows that the average annual TFP growth of the Philippines was –1.09% during 1970–2000.

75: The estimates of TFP growth in Vietnam were revised downwardly in this edition; from 2.6% (in the previous edition of the Databook) to 1.1% (in this edition) in 1985–2000 and from 1.3% (in 2000–2013) to 0.2% in 2000–2014. It is mainly due to the downward revisions on the estimates for compensation of employees (COE) over the whole observation periods by more than 20%. In the Vietnamese system of national accounts only the totals of COE and mixed income are published during 1995–2002. In this edition these were separated using our time-series estimates of COE, based on the newly developed labor data on hours worked and hourly wages.

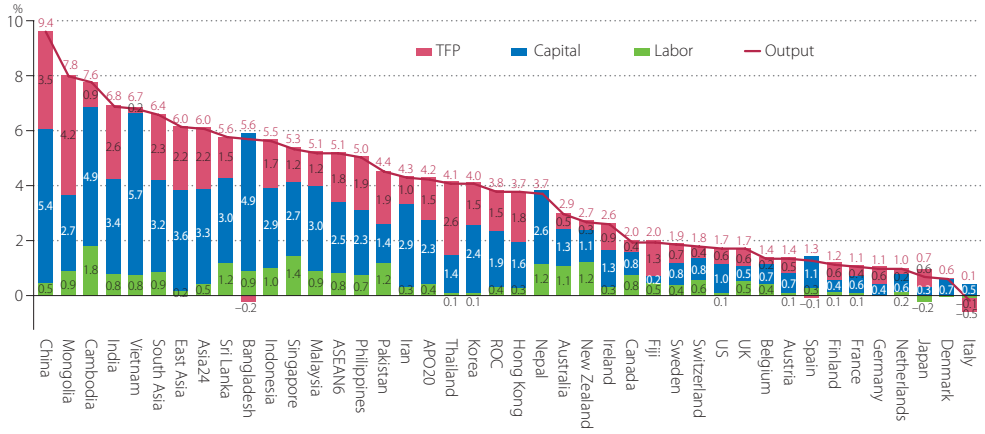

Figure 54 Comparison of Sources of Economic Growth with OECD Countries, 2000–2014

Sources: APO Productivity Database 2016 for APO member economies and China and the US. OECD Stat (Dataset: Multi-Factor Productivity) and OECD (2016a) for OECD countries (except Japan and Korea).
Note: The ending year for Ireland, Portugal, and Spain is 2013. See footnote 70 for the country-exception in the country groups.

Some countries may be more capable than others in reaping the benefits through assimilation of technologies.

Figure 54 places our estimates among those of OECD for 17 other OECD countries to give readers a wider perspective.[76] Countries are arranged according to their average economic growth per annum for the period 2000–2014, in descending order. In so doing, the wedge in economic growth is clearly displayed, with all Asian countries (barring Fiji and Japan) having been filtered out to occupy the top end. Asian countries are also among those that experienced the fastest TFP growth in 2000–2014: 4.2% in Mongolia, 3.5% in China, 2.6% in Thailand[77] and India, 1.9% in the Philippines and Pakistan, and 1.8% in Hong Kong.

Though growing at a more subdued pace, the contribution made by TFP in the slower-growing, mature economies should not be underestimated. Figure 55 plots per capita GDP levels in 2014 and the TFP contribution shares in the period 2000–2014, for 20 Asian countries with comparison of OECD countries (as circles). The roles of TFP contribution are also large in some mature economies, rather than some low-income countries in CLMV and South Asia. TFP accounted for more than one-third of economic growth in Japan, Germany, Finland, Austria, Sweden, the UK, France, and the US in this period.

76: The multi-factor productivity in the OECD Productivity Database (OECD, 2016a), referred to as TFP in this report, defines total input as the weighted average of the growth rates of total hours worked and capital services. Comparing OECD's TFP estimates for the whole economy with ours, there are mainly two differences in assumptions. Firstly, capital services of residential buildings are included in our estimates of capital input in order to be consistent with output that includes the imputed cost of owner-occupied housing. Secondly, the compensation of capital is defined in our estimates as the residual of the value added and the compensation of labor (compensations for employees, self-employed persons, and contributing family workers), whereas the OECD defines it as the imputed value of capital services based on the assumptions of an ex-ante rate of returns on capital. Thus, although both apply the same Törnqvist index, the weights to aggregate labor and capital can differ. Other than these, our methodology and assumptions in measuring capital services are designed to be largely consistent with the OECD methodology, and the impact of the differences in assumptions on the volume estimates of capital services is judged to be limited.

77: Warr (2006) shows that the average annual TFP growths of Thailand were 2.0% in the period of economic boom (1986–1996), –9.0% during the Asian financial crisis (1996–1998), and 1.6% in the period of recovery (1998–2002). These compare with our estimates of 2.7%, –9.3%, and 2.7%, respectively. The contribution rates of TFP and labor quality (to economic growth) in Vu (2013) are estimated as 0.7% and 0.3%, respectively, on average per year during 1990–2010. The sum of both (1.0%) is comparable with our estimate of TFP growth of 1.2% in 1990–2010.

Table 13 and Figure 56 show the growth accounting decomposition for individual countries in five-year intervals covering the period 1970–2014. The relative importance of drivers behind economic growth changes over time. It is a common experience in most countries that a large part of the vibrant growth in the initial period is driven by input growth. TFP growth becomes more prominent and makes a steady contribution in the later periods. Hong Kong's TFP growth peaked at 5.4% in 1975–1980, and was robust at 3.8% in 1985–1990, when TFP growth also peaked in the ROC,[78] Korea, Singapore, and Japan, at 4.3%, 2.7%, 2.3%, and 2.1%, respectively. Thereafter, TFP growth slowed until recent years when countries experienced productivity growth resurgence. This resurgence is also shared by Malaysia and the Philippines. TFP growth in Mongolia has been particularly strong since 1995. It also has bounced back in Indonesia[79] and Thailand[80] from a negative standing, following the Asian financial crisis of the late 1990s, but has lapsed again since 2005. In contrast, the US experienced a surge in TFP growth in the second half of the 1990s, which was sustained into the early 2000s before the adverse cyclical effect hit in 2005–2014.

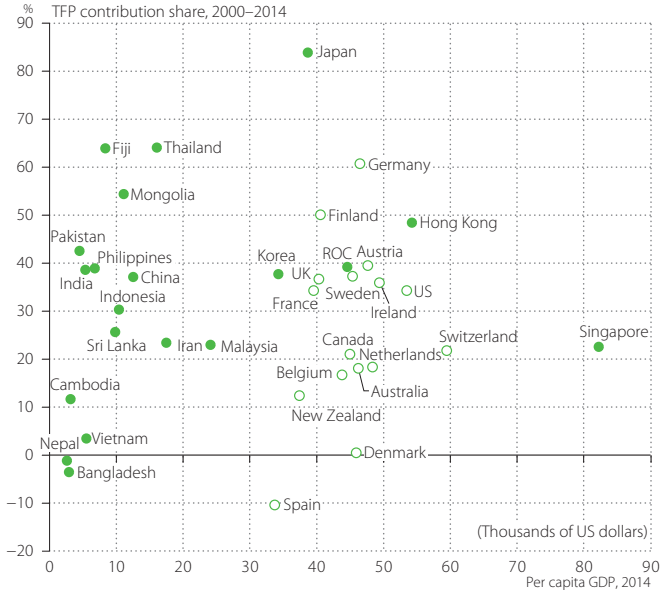

Figure 55 Comparison of TFP Contribution Shares with OECD Countries, 2000–2014

Sources: APO Productivity Database 2016 for APO member economies and China and the US. OECD Stat (Dataset: Multi-Factor Productivity) and OECD (2016a) for OECD countries (except Japan and Korea).
Note: The ending year for Ireland and Spain are 2013.

Looking at the decomposition of economic growth in China and India, the two key drivers have been non-IT capital input growth and TFP growth. While the contribution from non-IT capital has been relatively stable in terms of percentage points, it is TFP performance that has more bearing in determining the overall economic growth over time. For example, the low economic growth that China experienced in 1985–1990 was explained largely by the lack of TFP growth. Similarly, when output growth slowed from its peak in the latter half of the 1990s, it was due to the slowdown in TFP growth from 7.2% on average per annum in the previous period to 2.9%. Thereafter, output growth has accelerated to reflect the pickup in TFP growth in the 2000s. In India, TFP growth was a drag in the 1970s. Since then, it has accelerated and has increasingly accounted for a greater proportion of economic growth. In 2005–2010, India achieved TFP growth of 3.5% – its highest in the past four decades. Through trial and error, China and India invested first and then learned how to combine inputs efficiently. Both have

78: The National Statistics, Republic of China, published the TFP estimates for the period 1982–1999, although it is not updated (http://eng.stat.gov.tw/). The correlation of TFP growth rates between their estimates and ours is 0.82 for this period. For 1985–1999, our estimate is 2.8%, compared to their estimate of 3.6%.

79: Van der Eng (2008) provides estimates of capital stock for Indonesia and Van der Eng (2009) shows that annual average TFP growth increased from –4.4% during 1995–2000 to 1.7% during 2000–2007 in Indonesia. Warr (2006) also finds that TFP growth increased from –8.4% during 1996–1998 to 1.5% during 1998–2002.

80: Bosworth (2005) shows that annual average TFP growth increased from –4.6% during 1996–1999 to 2.1% during 1999–2004 in Thailand. Warr (2006) also finds that TFP growth increased from –9.0% during 1996–1998 to 1.6% during 1998–2002.

Table 13 Output Growth and Contributions of Labor, Capital, and TFP, 1970–2014

		Output	Labor		Capital				TFP	
					IT		Non-IT			
Bangladesh	1970–1975	−2.0	−0.2	(8)	0.0	(−1)	0.2	(−10)	−2.1	(104)
	1975–1980	3.7	1.9	(51)	0.0	(1)	0.7	(20)	1.0	(28)
	1980–1985	3.7	1.2	(33)	0.1	(2)	1.8	(50)	0.6	(16)
	1985–1990	4.4	1.4	(33)	0.1	(2)	2.9	(66)	0.0	(−1)
	1990–1995	5.0	1.9	(38)	0.1	(3)	3.2	(64)	−0.3	(−5)
	1995–2000	5.1	1.5	(30)	0.2	(3)	4.2	(83)	−0.9	(−17)
	2000–2005	5.0	1.0	(20)	0.2	(3)	4.6	(93)	−0.8	(−16)
	2005–2010	5.9	0.9	(16)	0.2	(3)	4.8	(81)	0.0	(0)
	2010–2014	6.1	0.8	(12)	0.2	(4)	4.8	(79)	0.3	(5)
	1970–2014	4.0	1.2	(29)	0.1	(3)	3.0	(74)	−0.2	(−6)
China	1970–1975	5.8	1.4	(24)	0.0	(1)	4.2	(73)	0.1	(2)
	1975–1980	6.3	1.4	(22)	0.0	(1)	4.0	(64)	0.8	(13)
	1980–1985	10.1	1.9	(19)	0.0	(0)	3.4	(34)	4.8	(47)
	1985–1990	7.6	1.3	(17)	0.1	(1)	4.4	(58)	1.8	(24)
	1990–1995	11.6	0.8	(7)	0.1	(1)	3.6	(31)	7.2	(62)
	1995–2000	8.3	1.3	(15)	0.2	(2)	4.0	(48)	2.9	(35)
	2000–2005	9.4	1.0	(10)	0.6	(7)	4.3	(46)	3.5	(37)
	2005–2010	10.7	0.1	(1)	0.5	(5)	5.6	(52)	4.4	(41)
	2010–2014	7.8	0.4	(5)	0.4	(5)	4.8	(62)	2.2	(29)
	1970–2014	8.6	1.1	(12)	0.2	(3)	4.2	(49)	3.1	(36)
Fiji	1970–1975	5.6	2.1	(37)	0.1	(2)	2.5	(45)	0.9	(16)
	1975–1980	3.7	1.5	(39)	0.1	(2)	2.4	(66)	−0.3	(−7)
	1980–1985	0.7	1.7	(243)	0.0	(7)	1.7	(237)	−2.7	(−387)
	1985–1990	3.7	1.2	(33)	0.1	(2)	0.1	(2)	2.3	(62)
	1990–1995	2.7	1.9	(71)	0.1	(5)	1.2	(43)	−0.5	(−20)
	1995–2000	2.0	1.1	(53)	0.0	(−1)	0.9	(46)	0.0	(2)
	2000–2005	2.0	0.7	(36)	0.1	(5)	0.5	(25)	0.7	(34)
	2005–2010	0.7	0.2	(22)	0.1	(14)	0.1	(14)	0.4	(51)
	2010–2014	3.5	0.6	(17)	0.0	(0)	−0.2	(−6)	3.1	(88)
	1970–2014	2.7	1.2	(45)	0.1	(3)	1.1	(39)	0.4	(14)
India	1970–1975	2.8	1.8	(62)	0.0	(1)	1.3	(47)	−0.3	(−10)
	1975–1980	3.1	1.7	(56)	0.0	(1)	1.6	(51)	−0.2	(−7)
	1980–1985	5.0	1.4	(29)	0.0	(1)	1.5	(29)	2.1	(41)
	1985–1990	5.8	1.3	(23)	0.0	(1)	1.6	(28)	2.8	(49)
	1990–1995	5.0	1.2	(25)	0.1	(1)	1.7	(35)	1.9	(38)
	1995–2000	5.7	1.0	(17)	0.1	(2)	2.0	(34)	2.6	(46)
	2000–2005	6.5	1.1	(17)	0.1	(2)	2.1	(32)	3.2	(49)
	2005–2010	7.8	0.5	(7)	0.2	(3)	3.6	(46)	3.5	(44)
	2010–2014	5.7	0.7	(12)	0.2	(3)	4.1	(71)	0.8	(13)
	1970–2014	5.3	1.2	(23)	0.1	(2)	2.1	(40)	1.8	(35)
Iran	1970–1975	9.5	0.4	(5)	0.1	(1)	6.0	(63)	3.0	(31)
	1975–1980	−2.8	1.0	(−36)	0.1	(−2)	7.1	(−248)	−11.0	(386)
	1980–1985	3.8	0.8	(21)	0.0	(1)	2.8	(73)	0.2	(4)
	1985–1990	1.3	0.8	(62)	0.1	(4)	0.3	(25)	0.1	(9)
	1990–1995	3.7	0.5	(15)	0.1	(2)	1.0	(28)	2.0	(55)
	1995–2000	4.1	0.8	(20)	0.1	(3)	1.3	(31)	1.9	(47)
	2000–2005	6.9	0.8	(11)	0.2	(3)	2.8	(41)	3.0	(44)
	2005–2010	5.0	0.0	(−1)	0.2	(3)	3.4	(68)	1.4	(29)
	2010–2014	0.1	0.2	(191)	0.1	(101)	1.9	(-)	−2.1	(-)
	1970–2014	3.6	0.6	(17)	0.1	(3)	3.0	(83)	−0.1	(−3)
Korea	1970–1975	9.4	1.6	(17)	0.2	(3)	7.0	(75)	0.5	(6)
	1975–1980	7.5	1.4	(19)	0.5	(6)	8.1	(107)	−2.4	(−32)
	1980–1985	8.9	1.2	(13)	0.4	(4)	4.8	(55)	2.5	(28)
	1985–1990	9.8	1.7	(17)	0.6	(6)	4.8	(49)	2.7	(27)
	1990–1995	8.1	1.0	(13)	0.5	(6)	5.0	(62)	1.6	(20)
	1995–2000	5.3	0.0	(−1)	0.6	(11)	3.5	(66)	1.2	(23)
	2000–2005	4.7	0.2	(5)	0.6	(12)	2.4	(51)	1.5	(32)
	2005–2010	4.2	−0.3	(−6)	0.2	(4)	2.0	(48)	2.3	(55)
	2010–2014	3.0	0.5	(17)	0.1	(3)	1.8	(60)	0.6	(20)
	1970–2014	6.9	0.8	(12)	0.4	(6)	4.4	(65)	1.2	(17)
Mongolia	1970–1975	6.5	0.6	(9)	0.1	(1)	5.2	(81)	0.6	(10)
	1975–1980	5.4	0.9	(17)	0.1	(3)	5.7	(105)	−1.3	(−25)
	1980–1985	6.6	0.9	(13)	0.1	(2)	6.0	(91)	−0.4	(−6)
	1985–1990	3.8	1.6	(43)	0.1	(3)	3.8	(99)	−1.7	(−45)
	1990–1995	−2.8	−0.1	(4)	0.1	(−3)	0.9	(−32)	−3.6	(131)
	1995–2000	2.7	0.3	(12)	0.1	(5)	0.2	(8)	2.0	(75)
	2000–2005	6.3	1.3	(20)	0.2	(4)	0.2	(3)	4.6	(73)
	2005–2010	6.4	0.5	(8)	0.4	(6)	3.0	(47)	2.5	(39)
	2010–2014	11.5	0.9	(8)	0.3	(2)	4.4	(38)	6.0	(52)
	1970–2014	5.0	0.8	(15)	0.2	(3)	3.2	(65)	0.9	(17)
Pakistan	1970–1975	3.6	1.4	(38)	0.0	(1)	2.4	(66)	−0.2	(−4)
	1975–1980	5.8	0.9	(16)	0.0	(0)	2.4	(41)	2.5	(43)
	1980–1985	7.4	0.9	(13)	0.0	(0)	3.3	(44)	3.2	(43)
	1985–1990	6.6	1.0	(15)	0.1	(2)	4.1	(63)	1.4	(21)
	1990–1995	5.5	0.8	(14)	0.1	(2)	3.5	(63)	1.2	(21)
	1995–2000	4.0	1.0	(26)	0.0	(1)	2.3	(57)	0.6	(15)
	2000–2005	5.9	1.3	(21)	0.1	(2)	1.5	(25)	3.1	(52)
	2005–2010	3.7	1.5	(40)	0.1	(3)	1.7	(47)	0.4	(10)
	2010–2014	3.6	0.8	(21)	0.1	(1)	0.5	(13)	2.3	(64)
	1970–2014	5.1	1.1	(21)	0.1	(1)	2.4	(47)	1.6	(31)

		Output	Labor		Capital				TFP	
					IT		Non-IT			
Cambodia	1970–1975									
	1975–1980									
	1980–1985									
	1985–1990									
	1990–1995	7.6	1.1	(15)	0.1	(1)	1.1	(15)	5.3	(69)
	1995–2000	7.0	2.0	(28)	0.1	(2)	2.8	(40)	2.1	(29)
	2000–2005	9.0	2.3	(25)	0.2	(2)	4.0	(44)	2.6	(29)
	2005–2010	6.5	1.8	(28)	0.2	(3)	5.5	(84)	−0.9	(−14)
	2010–2014	7.0	0.5	(7)	0.2	(3)	4.7	(68)	1.6	(23)
	1970–2014	7.4	1.6	(22)	0.2	(2)	3.9	(53)	1.7	(23)
ROC	1970–1975	9.3	2.0	(22)	0.5	(5)	6.7	(72)	0.1	(1)
	1975–1980	10.6	1.9	(18)	0.4	(4)	5.2	(49)	3.0	(28)
	1980–1985	6.9	1.1	(16)	0.4	(5)	3.9	(57)	1.5	(22)
	1985–1990	8.9	1.2	(14)	0.3	(4)	3.1	(35)	4.3	(48)
	1990–1995	7.2	1.0	(14)	0.3	(4)	3.5	(48)	2.4	(33)
	1995–2000	5.8	0.3	(5)	0.7	(12)	3.2	(55)	1.6	(28)
	2000–2005	4.0	0.2	(5)	0.6	(14)	2.2	(55)	1.0	(26)
	2005–2010	4.2	0.2	(6)	0.1	(3)	1.6	(39)	2.2	(53)
	2010–2014	3.0	0.7	(23)	0.1	(3)	1.1	(37)	1.1	(37)
	1970–2014	6.7	1.0	(15)	0.4	(6)	3.4	(51)	1.9	(29)
Hong Kong	1970–1975	6.3	2.0	(32)	0.2	(3)	2.8	(44)	1.4	(22)
	1975–1980	10.9	1.6	(14)	0.2	(2)	3.7	(34)	5.4	(50)
	1980–1985	5.6	0.6	(10)	0.3	(5)	4.2	(76)	0.5	(9)
	1985–1990	7.4	0.2	(2)	0.4	(6)	3.1	(41)	3.8	(51)
	1990–1995	5.2	0.6	(11)	0.4	(9)	3.4	(67)	0.7	(14)
	1995–2000	2.6	1.4	(55)	0.7	(27)	2.9	(111)	−2.4	(-93)
	2000–2005	4.1	0.5	(13)	0.5	(13)	1.4	(34)	1.7	(41)
	2005–2010	3.8	0.2	(5)	0.3	(8)	1.2	(32)	2.1	(55)
	2010–2014	3.0	0.2	(6)	0.3	(10)	1.0	(34)	1.5	(51)
	1970–2014	5.5	0.8	(15)	0.4	(7)	2.7	(49)	1.6	(30)
Indonesia	1970–1975	8.3	1.6	(19)	0.0	(0)	3.8	(46)	2.9	(35)
	1975–1980	7.8	1.3	(17)	0.2	(2)	5.5	(70)	0.9	(11)
	1980–1985	4.8	1.5	(32)	0.2	(3)	5.5	(115)	−2.4	(−50)
	1985–1990	7.5	2.1	(28)	0.2	(2)	3.7	(50)	1.5	(20)
	1990–1995	7.6	0.7	(9)	0.3	(3)	4.4	(58)	2.3	(30)
	1995–2000	0.8	0.9	(122)	0.2	(22)	3.9	(498)	−4.2	(−542)
	2000–2005	4.9	0.6	(13)	0.2	(3)	2.3	(47)	1.8	(37)
	2005–2010	6.2	1.8	(29)	0.2	(4)	2.8	(45)	1.4	(23)
	2010–2014	5.5	0.4	(8)	0.2	(4)	3.0	(54)	1.9	(34)
	1970–2014	5.9	1.2	(21)	0.2	(3)	3.9	(65)	0.6	(11)
Japan	1970–1975	4.4	−0.3	(−7)	0.4	(8)	4.8	(110)	−0.5	(−11)
	1975–1980	4.3	0.6	(15)	0.2	(5)	2.5	(58)	1.0	(22)
	1980–1985	4.3	0.3	(7)	0.2	(5)	1.9	(44)	1.9	(44)
	1985–1990	4.9	0.4	(7)	0.4	(9)	2.0	(41)	2.1	(43)
	1990–1995	1.4	−0.3	(−21)	0.3	(22)	1.8	(125)	−0.4	(−26)
	1995–2000	0.9	−0.7	(−77)	0.3	(34)	1.0	(108)	0.3	(35)
	2000–2005	1.2	−0.1	(−11)	0.4	(31)	0.4	(31)	0.6	(49)
	2005–2010	0.3	−0.5	(−141)	0.2	(52)	0.1	(39)	0.5	(150)
	2010–2014	0.7	0.0	(−2)	0.0	(7)	−0.2	(−27)	0.8	(123)
	1970–2014	2.5	−0.1	(−3)	0.3	(11)	1.6	(64)	0.7	(28)
Malaysia	1970–1975	7.7	1.2	(16)	0.1	(1)	5.7	(73)	0.8	(10)
	1975–1980	8.2	1.2	(15)	0.1	(1)	5.8	(70)	1.1	(14)
	1980–1985	5.1	1.3	(25)	0.1	(2)	7.0	(139)	−3.4	(−67)
	1985–1990	6.9	1.3	(19)	0.2	(3)	3.5	(51)	1.9	(27)
	1990–1995	9.3	1.1	(11)	0.3	(3)	6.5	(70)	1.4	(15)
	1995–2000	4.9	1.4	(28)	0.5	(11)	5.5	(112)	−2.5	(−51)
	2000–2005	5.2	0.7	(14)	0.7	(14)	2.4	(47)	1.3	(25)
	2005–2010	5.0	1.0	(20)	0.7	(13)	2.1	(43)	1.2	(25)
	2010–2014	5.2	1.0	(20)	0.4	(8)	2.8	(54)	1.0	(19)
	1970–2014	6.4	1.1	(18)	0.3	(5)	4.6	(72)	0.3	(5)
Nepal	1970–1975	2.9	2.1	(72)	0.1	(2)	2.0	(69)	−1.3	(−43)
	1975–1980	3.1	2.4	(77)	0.1	(3)	2.6	(87)	−2.0	(−67)
	1980–1985	4.1	0.9	(23)	0.1	(2)	3.3	(81)	−0.2	(−5)
	1985–1990	4.9	0.6	(11)	0.1	(1)	3.2	(66)	1.1	(22)
	1990–1995	4.9	1.3	(27)	0.0	(1)	3.2	(66)	0.3	(6)
	1995–2000	4.8	1.7	(35)	0.1	(2)	2.9	(62)	0.1	(2)
	2000–2005	3.0	1.3	(41)	0.1	(2)	2.4	(80)	−0.7	(−24)
	2005–2010	4.1	1.0	(23)	0.1	(2)	2.6	(65)	0.4	(9)
	2010–2014	4.0	1.3	(32)	0.1	(3)	2.3	(57)	0.3	(7)
	1970–2014	4.0	1.4	(35)	0.1	(2)	2.8	(69)	−0.2	(−6)
Philippines	1970–1975	5.7	2.0	(36)	0.2	(3)	3.0	(53)	0.5	(8)
	1975–1980	5.9	1.4	(24)	0.1	(2)	4.4	(75)	−0.1	(−1)
	1980–1985	−1.4	1.4	(−102)	0.2	(−13)	3.6	(−265)	−6.5	(480)
	1985–1990	5.3	0.8	(14)	0.1	(3)	1.0	(18)	3.4	(65)
	1990–1995	2.8	0.9	(33)	0.1	(3)	2.3	(79)	−0.4	(−15)
	1995–2000	3.9	0.5	(13)	0.5	(12)	2.9	(75)	0.0	(0)
	2000–2005	4.5	0.9	(19)	0.6	(14)	2.0	(45)	1.0	(22)
	2005–2010	4.8	0.8	(17)	0.3	(6)	1.8	(37)	2.0	(41)
	2010–2014	5.7	0.6	(10)	0.1	(3)	2.0	(35)	3.0	(53)
	1970–2014	4.1	1.0	(25)	0.2	(6)	2.6	(62)	0.3	(6)

		Output	Labor		Capital				TFP	
					IT		Non-IT			
Singapore	1970–1975	9.1	2.6	(29)	0.5	(6)	7.0	(78)	−1.1	(−12)
	1975–1980	8.3	2.4	(29)	0.4	(5)	5.1	(62)	0.4	(5)
	1980–1985	6.6	1.4	(21)	0.6	(9)	5.7	(86)	−1.1	(−17)
	1985–1990	8.3	2.2	(26)	0.8	(10)	3.0	(36)	2.3	(28)
	1990–1995	8.3	2.1	(26)	0.8	(10)	3.4	(41)	2.0	(24)
	1995–2000	5.5	1.1	(20)	0.7	(13)	3.9	(72)	−0.3	(−5)
	2000–2005	4.8	0.5	(11)	0.7	(14)	2.0	(42)	1.6	(33)
	2005–2010	6.5	2.5	(38)	0.5	(7)	2.0	(30)	1.6	(24)
	2010–2014	4.4	1.2	(28)	0.6	(14)	2.3	(53)	0.2	(5)
	1970–2014	6.9	1.8	(26)	0.6	(9)	3.9	(56)	0.6	(9)
Thailand	1970–1975	5.5	1.0	(19)	0.1	(2)	3.6	(65)	0.8	(15)
	1975–1980	7.4	3.2	(43)	0.2	(3)	3.1	(41)	1.0	(13)
	1980–1985	5.3	1.3	(25)	0.2	(4)	2.8	(52)	1.0	(19)
	1985–1990	9.8	1.9	(20)	0.3	(3)	3.0	(30)	4.6	(47)
	1990–1995	8.1	0.9	(11)	0.6	(7)	5.4	(66)	1.2	(15)
	1995–2000	0.7	−0.2	(−28)	0.3	(42)	2.8	(369)	−2.1	(−283)
	2000–2005	5.3	0.1	(1)	0.2	(4)	0.7	(13)	4.3	(82)
	2005–2010	3.7	0.6	(16)	0.4	(11)	1.3	(34)	1.4	(39)
	2010–2014	3.0	−0.6	(−20)	0.3	(11)	1.4	(45)	1.9	(64)
	1970–2014	5.5	1.0	(17)	0.3	(5)	2.7	(49)	1.6	(29)
US	1970–1975	2.6	0.5	(18)	0.2	(8)	1.3	(49)	0.6	(24)
	1975–1980	3.6	1.6	(44)	0.2	(7)	1.1	(31)	0.6	(17)
	1980–1985	3.3	0.8	(25)	0.4	(13)	0.9	(28)	1.1	(34)
	1985–1990	3.3	1.2	(37)	0.5	(15)	0.9	(29)	0.6	(20)
	1990–1995	2.6	0.7	(26)	0.4	(16)	0.6	(24)	0.9	(35)
	1995–2000	4.2	1.2	(27)	0.7	(17)	0.8	(19)	1.5	(36)
	2000–2005	2.5	0.0	(−1)	0.5	(22)	0.9	(34)	1.1	(45)
	2005–2010	0.8	−0.5	(−63)	0.3	(42)	0.7	(97)	0.2	(23)
	2010–2014	1.9	1.0	(52)	0.2	(9)	0.3	(16)	0.4	(23)
	1970–2014	2.8	0.7	(25)	0.4	(14)	0.9	(31)	0.8	(29)
Asia24	1970–1975	5.1	0.7	(14)	0.2	(4)	4.0	(79)	0.2	(4)
	1975–1980	4.6	1.2	(25)	0.2	(3)	3.5	(76)	−0.2	(−4)
	1980–1985	5.4	1.0	(18)	0.2	(3)	2.8	(51)	1.5	(28)
	1985–1990	6.0	1.0	(17)	0.3	(5)	2.7	(44)	2.1	(35)
	1990–1995	5.7	0.5	(9)	0.2	(4)	2.8	(50)	2.1	(36)
	1995–2000	4.3	0.5	(12)	0.3	(7)	2.6	(61)	0.9	(20)
	2000–2005	5.8	0.6	(11)	0.4	(7)	2.4	(42)	2.3	(40)
	2005–2010	6.6	0.3	(5)	0.3	(5)	3.3	(50)	2.6	(39)
	2010–2014	5.3	0.4	(7)	0.3	(5)	3.2	(61)	1.4	(27)
	1970–2014	5.4	0.7	(13)	0.3	(5)	3.0	(56)	1.4	(26)
South Asia	1970–1975	2.5	1.6	(61)	0.0	(1)	1.4	(55)	−0.4	(−17)
	1975–1980	3.5	1.6	(46)	0.0	(1)	1.6	(47)	0.2	(6)
	1980–1985	5.2	1.3	(25)	0.0	(1)	1.8	(34)	2.1	(40)
	1985–1990	5.7	1.3	(22)	0.1	(1)	2.0	(36)	2.4	(41)
	1990–1995	5.1	1.2	(24)	0.1	(2)	2.1	(41)	1.7	(33)
	1995–2000	5.4	1.1	(20)	0.1	(2)	2.1	(39)	2.1	(39)
	2000–2005	6.3	1.1	(18)	0.1	(2)	2.1	(34)	2.8	(45)
	2005–2010	7.1	0.7	(10)	0.2	(3)	3.4	(48)	2.8	(40)
	2010–2014	5.5	0.7	(13)	0.2	(3)	3.7	(67)	0.9	(17)
	1970–2014	5.1	1.2	(23)	0.1	(2)	2.2	(43)	1.6	(32)

		Output	Labor		Capital				TFP	
					IT		Non-IT			
Sri Lanka	1970–1975	2.9	0.8	(30)	0.0	(1)	1.8	(63)	0.2	(7)
	1975–1980	5.4	1.0	(19)	0.0	(1)	2.2	(40)	2.1	(39)
	1980–1985	5.0	0.3	(6)	0.1	(2)	3.0	(60)	1.6	(32)
	1985–1990	3.3	1.5	(46)	0.0	(1)	1.3	(40)	0.4	(13)
	1990–1995	5.3	0.8	(14)	0.0	(1)	0.8	(14)	3.8	(71)
	1995–2000	4.9	2.1	(43)	0.1	(3)	0.4	(9)	2.2	(46)
	2000–2005	4.0	1.1	(29)	0.2	(6)	1.6	(40)	1.0	(25)
	2005–2010	6.2	1.2	(19)	0.3	(5)	2.8	(45)	1.9	(31)
	2010–2014	7.0	1.3	(18)	0.1	(1)	4.2	(60)	1.5	(21)
	1970–2014	4.8	1.1	(23)	0.1	(2)	2.0	(41)	1.6	(34)
Vietnam	1970–1975	1.8	1.6	(90)	0.0	(0)	0.4	(25)	−0.3	(−15)
	1975–1980	3.5	1.2	(34)	0.1	(2)	1.2	(34)	1.1	(30)
	1980–1985	6.2	2.4	(38)	0.1	(1)	0.5	(8)	3.3	(53)
	1985–1990	4.4	1.2	(27)	0.2	(6)	2.5	(56)	0.5	(11)
	1990–1995	8.1	1.1	(13)	0.2	(3)	3.8	(47)	3.0	(36)
	1995–2000	7.3	1.0	(14)	0.4	(6)	6.0	(82)	−0.1	(−1)
	2000–2005	8.0	0.5	(7)	0.4	(5)	5.6	(70)	1.5	(18)
	2005–2010	6.2	1.6	(26)	0.6	(10)	5.5	(89)	−1.6	(−25)
	2010–2014	5.7	0.0	(1)	0.5	(8)	4.3	(76)	0.9	(16)
	1970–2014	5.7	1.2	(21)	0.3	(5)	3.3	(58)	0.9	(16)
APO20	1970–1975	5.0	0.6	(12)	0.2	(4)	4.0	(80)	0.2	(4)
	1975–1980	4.3	1.1	(26)	0.2	(4)	3.4	(79)	−0.4	(−9)
	1980–1985	4.7	0.8	(18)	0.2	(4)	2.7	(57)	1.0	(22)
	1985–1990	5.7	0.9	(16)	0.3	(5)	2.3	(40)	2.2	(38)
	1990–1995	4.3	0.5	(11)	0.3	(6)	2.6	(62)	0.9	(20)
	1995–2000	3.0	0.3	(9)	0.3	(10)	2.2	(73)	0.2	(8)
	2000–2005	4.3	0.5	(11)	0.3	(8)	1.7	(39)	1.8	(42)
	2005–2010	4.5	0.4	(9)	0.2	(5)	2.2	(49)	1.7	(37)
	2010–2014	3.7	0.4	(11)	0.2	(5)	2.2	(60)	0.9	(23)
	1970–2014	4.4	0.6	(14)	0.2	(6)	2.6	(59)	0.9	(21)
East Asia	1970–1975	5.0	0.2	(4)	0.3	(6)	4.8	(96)	−0.3	(−5)
	1975–1980	5.2	0.9	(17)	0.2	(4)	3.2	(62)	0.9	(17)
	1980–1985	6.0	0.7	(12)	0.2	(4)	2.6	(43)	2.5	(42)
	1985–1990	6.2	0.7	(12)	0.4	(6)	2.9	(48)	2.1	(35)
	1990–1995	5.5	0.2	(4)	0.3	(5)	2.8	(50)	2.3	(41)
	1995–2000	4.5	0.2	(5)	0.3	(7)	2.6	(57)	1.3	(30)
	2000–2005	5.6	0.4	(8)	0.6	(10)	2.6	(46)	2.0	(36)
	2005–2010	6.8	0.0	(0)	0.4	(6)	3.5	(52)	2.9	(42)
	2010–2014	5.6	0.3	(5)	0.3	(5)	3.3	(59)	1.7	(30)
	1970–2014	5.6	0.4	(7)	0.3	(6)	3.1	(56)	1.7	(31)
ASEAN6	1970–1975	7.4	1.6	(22)	0.1	(1)	3.9	(53)	1.7	(23)
	1975–1980	7.7	1.7	(22)	0.2	(2)	4.8	(62)	1.0	(13)
	1980–1985	3.8	1.4	(38)	0.2	(5)	4.8	(127)	−2.7	(−70)
	1985–1990	7.6	1.8	(24)	0.2	(3)	3.1	(41)	2.5	(33)
	1990–1995	7.4	0.9	(12)	0.3	(5)	4.5	(61)	1.6	(22)
	1995–2000	2.0	0.7	(36)	0.3	(16)	3.7	(187)	−2.8	(−139)
	2000–2005	5.0	0.5	(11)	0.3	(7)	1.9	(38)	2.2	(44)
	2005–2010	5.4	1.4	(25)	0.3	(6)	2.2	(41)	1.5	(27)
	2010–2014	4.9	0.4	(8)	0.3	(6)	2.5	(50)	1.8	(36)
	1970–2014	5.7	1.2	(21)	0.3	(5)	3.5	(62)	0.7	(13)

Unit: Average annual growth rate (percentage), contribution share in parentheses.
Source: APO Productivity Database 2016.
Note: See footnote 70 for the country-exception in the country groups.

reaped the benefits of their efforts in robust TFP growth, while the contribution from labor input growth dwindles over time in the two countries.

Tracking the size and growth of IT capital has become a standard practice in productivity research, following attempts to establish the driving force behind productivity resurgence in developed economies. This started with the US in the 1990s. Unlike technological advancements in the past, which were largely confined to manufacturing, IT is a technology that can permeate the economy and bring about significant production gains in, for example, wholesale and retail, banking and finance, and transportation and telecommunications (service sectors that have traditionally struggled with slow productivity growth). Given the share of the service sector in the economy (Figure 75 in Section 6.1, p. 104), the potential and implications for economic development and productivity gains could therefore be immense. A frequent question asked by policymakers and researchers is how best to capitalize on the productivity potential invited by this IT revolution. As with non-IT capital, it involves a

process of accumulation and assimilation. IT capability becomes a factor which determines an economy's long-term growth prospects.[81]

Japan has been leading Asian countries in terms of IT capital contribution to economic growth (Figures 51 and 53). Japan's shift in capital allocation took off in earnest in the mid-1990s, with the

81: The 2008 SNA formally acknowledges the IT sector's importance to the modern economy and has made it more identifiable and separable in industry classification and asset type.

Figure 56 Individual Countries' Growth Accounting Decomposition, 1970–2014

Source: APO Productivity Database 2016.
Note: See footnote 70 for the country-exception in the country groups.

contribution of IT capital to capital input growth rising from a low of 12% in 1995 to a peak of 64% in 2009 (Figure 57).[82] It took place in a period when Japan's overall investment growth slowed significantly after the economic collapse of the early 1990s (Figure 39 in Section 4.3, p. 58). After years of excesses, Japan shifted away from non-IT to IT capital as a profitable investment. In contrast, the US started its shift toward IT capital much earlier than any Asian economy and over a longer period of time. For two decades (between 1983 and 2004), IT capital accounted for over 30% of US capital input growth, reaching a height of over 50% in the late-1990s and the late-2000s. In recent years, the slowdown in total capital growth has concentrated more on non-IT capital, resulting in spikes in the contribution of IT capital in both Japan and the US. The findings here are in accordance with Jorgenson, Ho, and Stiroh (2005). Based on their measurement, IT capital in the 1980s contributed 31.9% of the growth of total capital inputs in the US, but only 13.5% in Japan.[83] Since 1995, the Japanese economy

82: Japan's capital services recorded negative growth in 2009–2014, for the first time after World War II, although IT capital services increased. This period has been omitted from our calculations of the IT capital contribution share in total capital input in Figure 57.

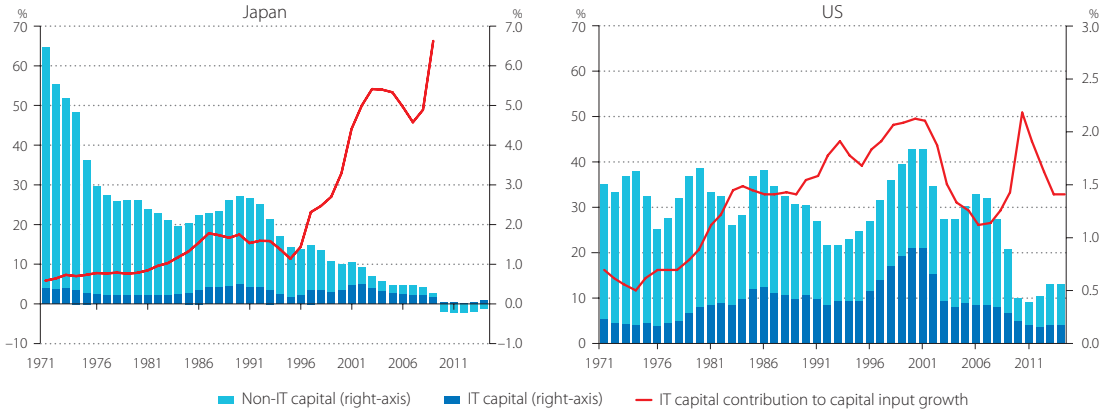

Figure 57 IT Capital Contribution to Capital Input Growth of Japan and the US, 1970–2014

Source: APO Productivity Database 2016.

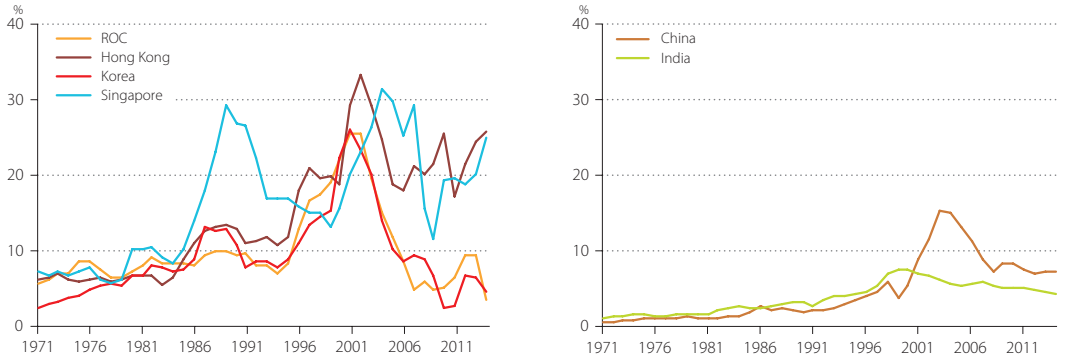

Figure 58 IT Capital Contribution to Capital Input Growth of the Asian Tigers, China, and India, 1970–2014

Source: APO Productivity Database 2016.

had been rapidly shifting its capital allocation from non-IT to IT capital. In 2002, the contribution of IT capital in Japan rose to 50.4%, which is higher than the 44.0% for the US.

A similar allocation shift to IT capital is also found in the Asian Tigers (Figure 58).[84] In Korea, the ROC, and Hong Kong, the contribution of IT capital to total capital input peaked at about 30% at the turn of the millennium, from a share of 10% or below before 1995. In contrast, Singapore had two local peaks

83: Our estimates in the same period show that IT capital contributes 32.7% in the US and 14.1% in Japan to the growth of total capital input.

84: The quality of the data on investment for IT capital (IT hardware, communications equipment, and computer software) varies considerably among countries. If the official estimates are not available in their national accounts, the investment data by type of asset in benchmark Input–Output Tables (IOT) and the time-series IOTs (if available) are used to separate IT capital investment from GFCF in the national accounts. In the years when the IOTs are not available, domestic production and import data (UN Comtrade Database) for IT hardware and communication equipment is used to interpolate the estimates of IT investments. Thus, data inconsistency could pose a problem. Where software is excluded from the GFCF definition compliant to the 1968 SNA, software investment is estimated as described in Appendix 1. In addition, the constant-quality prices for IT capital are hardly available for most Asian countries. If they are not available, the prices for IT capital are estimated by harmonizing Japan's price indices, as described in Appendix 2. Thus, readers are cautioned about data uncertainty and should expect that the decompositions of contributions of capital services into IT and non-IT capital may be considerably revised for some countries, when more reliable data sources for estimation become available.


Bangladesh
Cambodia
China
ROC
Fiji
Hong Kong
India
Indonesia
Iran
Japan
Korea
Malaysia
Mongolia
Nepal
Pakistan
Philippines
Singapore
Sri Lanka
%
1971 1976 1981 1986 1991 1996 2001 2006 2011
TFP
Non–IT capital
IT capital
Labor
Output

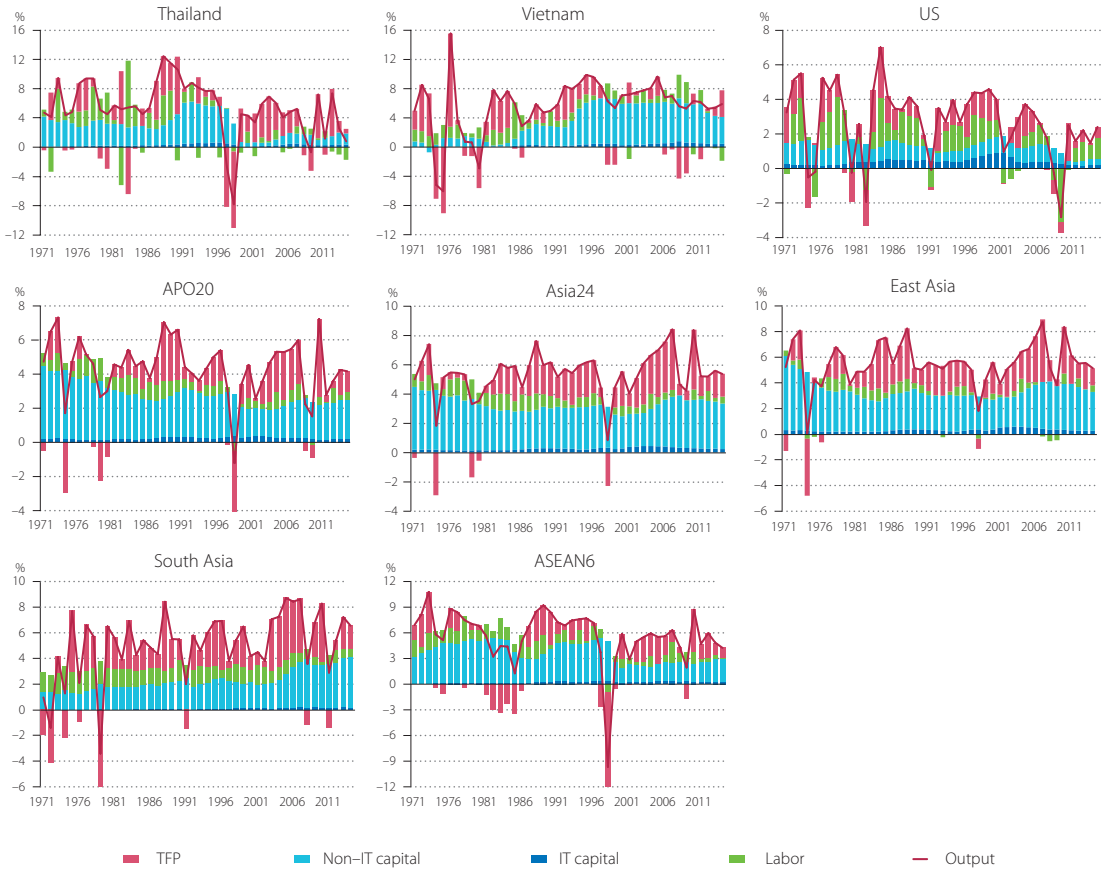

Figure 59 Individual Countries' Growth Accounting Decomposition (year-on-year), 1970–2014

Source: APO Productivity Database 2016.
Note: See footnote 70 for the country-exception in the country groups.

– the first at the end of 1980s when the contribution of IT capital reached 29%; the second in 2003–2004 when it peaked again at 31%. China was a latecomer in terms of investing in IT capital with a surge in its contributions only taking off around 2000 and peaking at 15% in the early 2000s. There has not been as big a drive in IT pickups in India as in other Asian countries. Rather, the process has been gradual with a clear step-up in effort from a minimal level in the early 1990s. The share of IT capital reached 8% in the early 2000s before recently decreasing.

5.4 Sources of Labor Productivity Growth

Although TFP more accurately measures how efficiently an economy utilizes its factor inputs, labor productivity and its drivers are of interest because of the close link to GDP per capita. Within the same growth accounting framework, average labor productivity growth at the aggregate level can be broken down into effects of capital deepening (as measured by capital input per hour worked), which reflects the capital–labor substitution, and TFP. In other words, these factors are key in fostering labor productivity.

Capital deepening has been taking place in all of the countries compared, albeit to various degrees (Figure 60). Experience of countries suggests that capital deepening is an accompanying process of

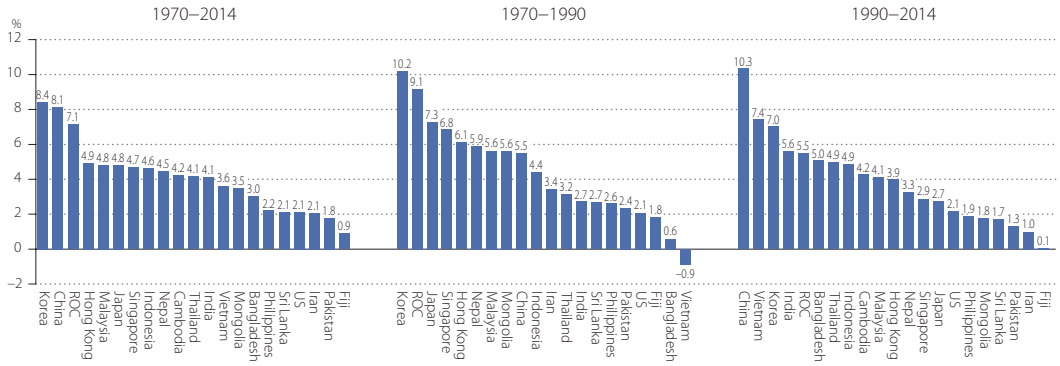

Figure 60 Capital Deepening, 1970–2014, 1970–1990, and 1990–2014

Source: APO Productivity Database 2016.
Note: The starting period for Cambodia is 1993.

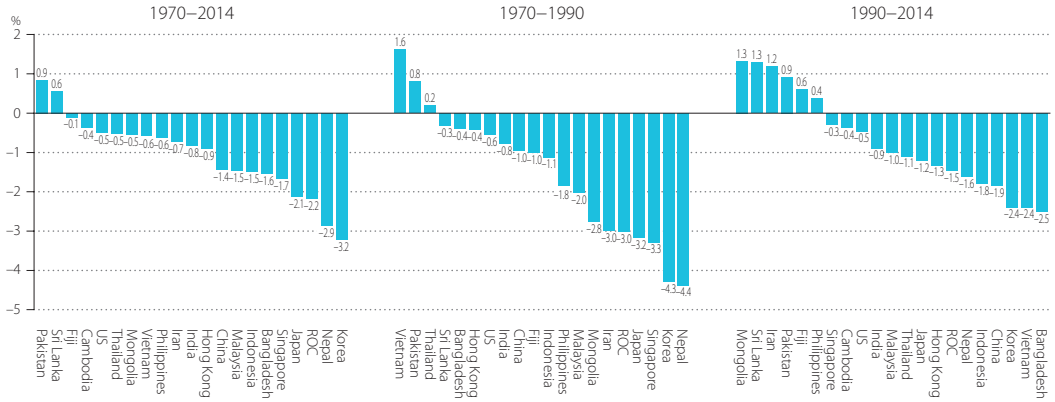

Figure 61 Capital Productivity Growth, 1970–2014, 1970–1990, and 1990–2014

Source: APO Productivity Database 2016.
Note: The starting period for Cambodia is 1993.

rapid economic development. The relatively early starters (Japan and the Asian Tigers) underwent more rapid capital deepening than the other countries compared; and in the earlier rather than the latter period. The reverse is true for the emerging Asian economies, where concerted efforts were made to increase capital intensity in the latter period. In 1990–2014, China, Vietnam, India, Bangladesh, Thailand, and Indonesia moved up to occupy the top spots among the Asian Tigers, while Singapore and Japan stepped down in the rankings. In 1970–1990, the capital–labor ratio was rising by 10.2% and 9.1% on average per year in Korea and the ROC, respectively. Over the subsequent two decades it slowed to 7.0% and 5.5% respectively. Meanwhile, China's pace doubled between the two periods, from 5.5% to 10.3% on average per year. In Vietnam, it has accelerated to 7.4% since 1990. In the US, the pace of capital deepening was stable at 2.1% between the two sub-periods.

While labor productivity steadily improved for all countries as shown in Figure 45 in Section 5.2, the growth rate of capital productivity (as the other measure of partial productivity) remains negative for almost all countries during 1970–2014, shown in the left chart of Figure 61. Although rates of capital deepening in Korea and the ROC were outstanding, at 8.4% and 7.1% per year, on average during

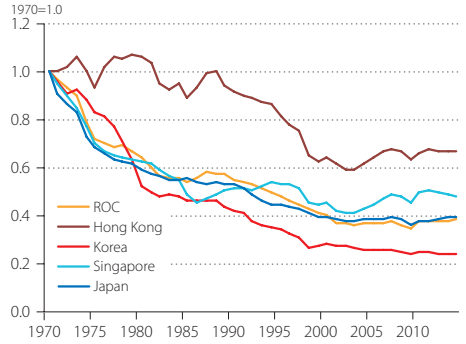

Figure 62 Capital Productivity Trends in Japan and the Asian Tigers, 1970–2014

Source: APO Productivity Database 2016.

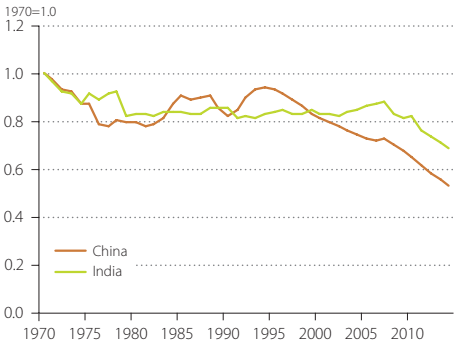

Figure 63 Capital Productivity Trends in China and India, 1970–2014

Source: APO Productivity Database 2016.

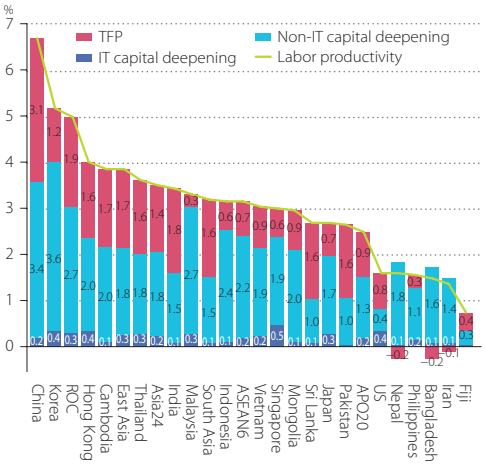

Figure 64 Sources of Labor Productivity Growth, 1970–2014

Source: APO Productivity Database 2016.
Note: The starting period for Cambodia is 1993. See footnote 70 for the country-exception in the country groups.

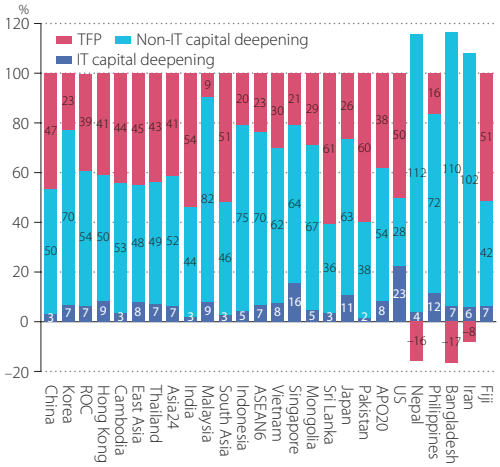

Figure 65 Contribution Shares of Labor Productivity Growth, 1970–2014

Source: APO Productivity Database 2016.
Note: The starting period for Cambodia is 1993. See footnote 70 for the country-exception in the country groups.

this period, their capital productivity experienced the sharpest decline of 3.2 and 2.2% per year, respectively. Figure 62 presents the declining trends in Japan and the Asian Tigers. They are pretty similar except in Hong Kong.

In contrast, the deterioration of capital productivity (by 1.4%) was relatively mild in China as shown in Figure 61, despite its fast capital deepening of 8.1% shown in Figure 60. Looking at the two sub-periods of 1970–1990 and 1990–2014, overall the rate of deterioration in capital productivity for all countries was slower in the latter period. China's performance is particularly impressive. Its acceleration in capital deepening in the latter period did not compromise its capital productivity as much as the early starters (Figure 63). In 1990–2014, China's capital-labor ratio rose by 10.3% whereas its capital productivity fell by 1.9%. This compares with Korea's performance in 1970–1990 when its capital-labor ratio rose by 10.2% while capital productivity fell by 4.3%.

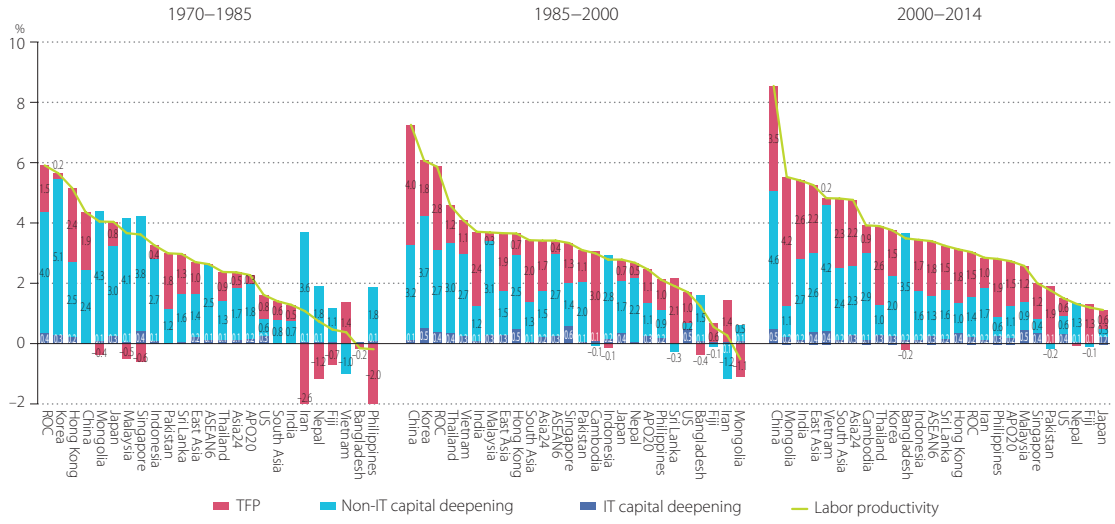

Figure 66 Sources of Labor Productivity Growth, 1970–1985, 1985–2000, and 2000–2014

Source: APO Productivity Database 2016.
Note: See footnote 70 for the country-exception in the country groups.

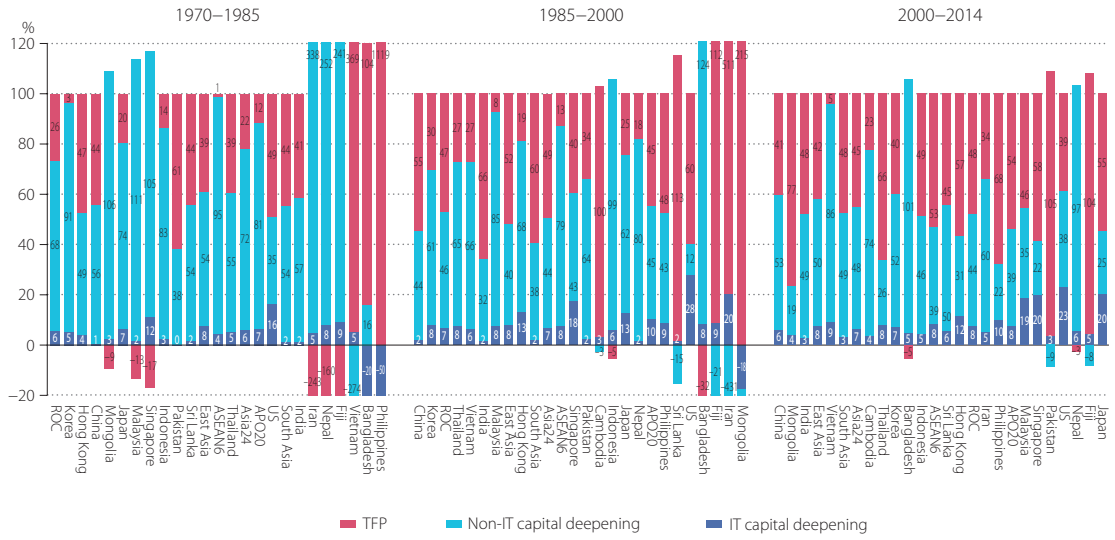

Figure 67 Contribution Shares of Labor Productivity Growth, 1970–1985, 1985–2000, and 2000–2014

Source: APO Productivity Database 2016.
Note: See footnote 70 for the country-exception in the country groups.

Labor productivity growth can be decomposed into contributions from capital deepening and TFP growth. Capital deepening should raise labor productivity, all other things being equal. It remains the prime motor of labor productivity growth, generally explaining 50% of it. Taking the US as the reference economy, with contribution share of capital deepening to labor productivity growth of 50.2% on average in 1970–2014, it has been a main engine to enhance labor productivity in 12 Asian countries (Figure 65). The exceptions to this observation are Fiji, India, Sri Lanka, and Pakistan, in which the role of TFP has been more significant.

Within this long period, the composition of labor productivity growth has seen substantial shifts (Figures 66 and 67). In the earlier period 1970–1985, TFP growth was enjoyed by 11 out of the 19 Asian countries compared (excluding Cambodia). It was a significant drag on labor productivity growth in eight countries (Iran, the Philippines, Nepal, Fiji, Singapore, Malaysia, Mongolia, and Bangladesh). During the middle period 1985–2000, all countries (except Bangladesh, Indonesia, and Mongolia) achieved positive TFP growth to bolster labor productivity growth. By 2000–2014, TFP growth had become the dominant driver of labor productivity growth in 7 of the 19 countries compared. At the same time, the contribution from IT capital deepening was also strengthening, from a range of 0–12%

Figure 68 Decomposition of Labor Productivity Growth, 1970–2014

Source: APO Productivity Database 2016.
Note: See footnote 70 for the country-exception in the country groups.

in 1970–1985, to 2–20% in 1985–2000, and 3–20% in 2000–2014. This may have accounted for a boost of countries' TFP performance. In the mid period 1985–2000, the contribution of IT capital deepening in the US was ahead of Asian countries accounting for 28% of labor productivity growth. Coincidentally, this was also the period when the share of TFP growth was the largest, at 60%.

Figure 68 and Table 14 show the decomposition of labor productivity growth for individual countries in five-year intervals covering the period 1970–2014. Productivity is procyclical in nature. In turn, it is difficult to discern fundamental shifts from short-term fluctuations. However, over a period spanning four decades, it can be observed that labor productivity growth in the two fast-growing emerging Asian economies (China and India) is accelerating. China has clearly leapt from a growth rate of around 3% in the 1970s to a rate of 8–10% in the 2000s, with its transition period in the early 1990s. India's passage to accelerating labor productivity growth is more gradual than China's, from almost zero in the 1970s to 6.9% in 2005–2010. In contrast, the early starters (Japan and the Asian Tigers) have been experiencing a slowdown in labor productivity growth since their heights of the late 1980s. In both

Table 14 Role of TFP and Capital Deepening in Labor Productivity Growth, 1970–2014

		Labor Productivity	Capital deepening				TFP	
			IT		Non-IT			
Bangladesh	1970–1975	−1.7	0.0	(−1)	0.3	(−20)	−2.1	(121)
	1975–1980	0.0	0.0	(-)	−1.1	(-)	1.0	(-)
	1980–1985	1.3	0.0	(4)	0.6	(51)	0.6	(45)
	1985–1990	1.3	0.1	(5)	1.3	(98)	0.0	(−3)
	1990–1995	0.8	0.1	(13)	1.0	(120)	−0.3	(−33)
	1995–2000	1.6	0.1	(9)	2.3	(147)	−0.9	(−56)
	2000–2005	2.7	0.1	(5)	3.3	(124)	−0.8	(−29)
	2005–2010	3.7	0.2	(4)	3.6	(96)	0.0	(0)
	2010–2014	4.2	0.2	(5)	3.7	(88)	0.3	(7)
	1970–2014	1.5	0.1	(7)	1.6	(110)	−0.2	(−17)
China	1970–1975	2.9	0.0	(1)	2.8	(95)	0.1	(4)
	1975–1980	3.5	0.0	(1)	2.6	(76)	0.8	(23)
	1980–1985	6.6	0.0	(1)	1.8	(27)	4.8	(72)
	1985–1990	5.1	0.1	(2)	3.2	(63)	1.8	(35)
	1990–1995	10.3	0.1	(1)	3.0	(29)	7.2	(70)
	1995–2000	6.3	0.2	(3)	3.2	(51)	2.9	(46)
	2000–2005	7.7	0.6	(8)	3.6	(47)	3.5	(45)
	2005–2010	10.5	0.5	(5)	5.5	(53)	4.4	(42)
	2010–2014	7.2	0.4	(5)	4.6	(64)	2.2	(31)
	1970–2014	6.7	0.2	(3)	3.4	(50)	3.1	(46)
Fiji	1970–1975	2.0	0.1	(3)	1.1	(52)	0.9	(45)
	1975–1980	1.2	0.0	(3)	1.4	(119)	−0.3	(−22)
	1980–1985	−1.9	0.0	(−2)	0.9	(−46)	−2.7	(148)
	1985–1990	1.9	0.1	(3)	−0.5	(−30)	2.3	(126)
	1990–1995	−0.7	0.1	(−18)	−0.3	(40)	−0.5	(78)
	1995–2000	0.5	0.0	(−7)	0.5	(98)	0.0	(9)
	2000–2005	0.8	0.1	(9)	0.0	(2)	0.7	(89)
	2005–2010	0.5	0.1	(18)	0.1	(10)	0.4	(71)
	2010–2014	2.7	0.0	(−1)	−0.4	(−16)	3.1	(117)
	1970–2014	0.7	0.0	(7)	0.3	(42)	0.4	(51)
India	1970–1975	0.3	0.0	(4)	0.6	(178)	−0.3	(−82)
	1975–1980	0.6	0.0	(1)	0.8	(28)	−0.2	(71)
	1980–1985	2.9	0.0	(1)	0.8	(28)	2.1	(71)
	1985–1990	3.9	0.0	(1)	1.0	(26)	2.8	(73)
	1990–1995	3.1	0.1	(2)	1.1	(36)	1.9	(62)
	1995–2000	4.1	0.1	(3)	1.4	(34)	2.6	(63)
	2000–2005	4.7	0.1	(2)	1.4	(30)	3.2	(68)
	2005–2010	6.9	0.2	(3)	3.2	(47)	3.5	(50)
	2010–2014	4.5	0.2	(4)	3.6	(79)	0.8	(17)
	1970–2014	3.4	0.1	(2)	1.5	(44)	1.8	(54)
Iran	1970–1975	7.9	0.1	(1)	4.9	(61)	3.0	(38)
	1975–1980	−6.0	0.0	(−1)	4.9	(−83)	−11.0	(184)
	1980–1985	1.3	0.0	(3)	1.1	(85)	0.2	(12)
	1985–1990	−1.5	0.0	(−2)	−1.6	(110)	0.1	(−8)
	1990–1995	1.5	0.1	(3)	−0.6	(−37)	2.0	(133)
	1995–2000	0.8	0.1	(9)	−1.2	(−163)	1.9	(253)
	2000–2005	3.7	0.2	(4)	0.5	(13)	3.0	(83)
	2005–2010	5.0	0.2	(3)	3.4	(68)	1.4	(29)
	2010–2014	−0.8	0.1	(−14)	1.2	(−160)	−2.1	(274)
	1970–2014	1.4	0.1	(6)	1.4	(102)	−0.1	(−8)
Korea	1970–1975	5.7	0.2	(3)	5.1	(88)	0.5	(9)
	1975–1980	4.5	0.4	(9)	6.5	(145)	−2.4	(−54)
	1980–1985	6.7	0.3	(5)	3.9	(58)	2.5	(37)
	1985–1990	6.6	0.5	(8)	3.4	(51)	2.7	(41)
	1990–1995	6.2	0.4	(6)	4.2	(68)	1.6	(26)
	1995–2000	5.3	0.6	(11)	3.5	(66)	1.2	(23)
	2000–2005	4.3	0.6	(13)	2.2	(52)	1.5	(35)
	2005–2010	4.7	0.2	(4)	2.2	(47)	2.3	(49)
	2010–2014	2.0	0.1	(3)	1.4	(68)	0.6	(29)
	1970–2014	5.2	0.4	(7)	3.6	(70)	1.2	(23)
Mongolia	1970–1975	5.1	0.1	(1)	4.3	(86)	0.6	(13)
	1975–1980	3.1	0.1	(4)	4.3	(138)	−1.3	(−42)
	1980–1985	3.9	0.1	(3)	4.2	(107)	−0.4	(−10)
	1985–1990	−0.8	0.1	(−10)	0.9	(−107)	−1.7	(217)
	1990–1995	−2.5	0.1	(−3)	1.0	(−42)	−3.6	(145)
	1995–2000	1.7	0.1	(7)	−0.4	(−22)	2.0	(116)
	2000–2005	2.8	0.2	(6)	−1.9	(−68)	4.6	(162)
	2005–2010	4.9	0.3	(7)	2.1	(42)	2.5	(51)
	2010–2014	9.7	0.2	(2)	3.5	(36)	6.0	(62)
	1970–2014	3.0	0.1	(5)	2.0	(66)	0.9	(29)
Pakistan	1970–1975	0.1	0.0	(14)	0.2	(234)	−0.2	(−148)
	1975–1980	3.9	0.0	(0)	1.4	(36)	2.5	(64)
	1980–1985	5.0	0.0	(0)	1.8	(37)	3.2	(63)
	1985–1990	3.7	0.1	(2)	2.2	(60)	1.4	(38)
	1990–1995	3.6	0.1	(2)	2.4	(65)	1.2	(32)
	1995–2000	1.9	0.0	(1)	1.3	(67)	0.6	(31)
	2000–2005	3.2	0.1	(2)	0.1	(3)	3.1	(94)
	2005–2010	0.3	0.1	(25)	−0.2	(−53)	0.4	(128)
	2010–2014	1.8	0.0	(2)	−0.5	(−27)	2.3	(125)
	1970–2014	2.6	0.0	(2)	1.0	(38)	1.6	(60)

		Labor Productivity	Capital deepening				TFP	
			IT		Non-IT			
Cambodia	1970–1975							
	1975–1980							
	1980–1985							
	1985–1990							
	1990–1995	5.0	0.1	(1)	−0.3	(−7)	5.3	(105)
	1995–2000	2.2	0.1	(5)	0.0	(1)	2.1	(94)
	2000–2005	4.2	0.1	(3)	1.5	(36)	2.6	(62)
	2005–2010	3.1	0.2	(5)	3.9	(125)	−0.9	(−30)
	2010–2014	6.0	0.2	(3)	4.2	(70)	1.6	(27)
	1970–2014	3.9	0.1	(3)	2.0	(53)	1.7	(44)
ROC	1970–1975	5.6	0.4	(8)	5.0	(90)	0.1	(2)
	1975–1980	7.2	0.3	(5)	3.8	(53)	3.0	(42)
	1980–1985	5.0	0.3	(6)	3.2	(63)	1.5	(30)
	1985–1990	6.8	0.3	(4)	2.3	(34)	4.3	(62)
	1990–1995	5.5	0.3	(5)	2.8	(51)	2.4	(44)
	1995–2000	5.2	0.7	(13)	2.9	(57)	1.6	(31)
	2000–2005	3.5	0.5	(15)	2.0	(56)	1.0	(29)
	2005–2010	3.7	0.1	(2)	1.4	(39)	2.2	(59)
	2010–2014	1.6	0.0	(3)	0.5	(30)	1.1	(68)
	1970–2014	5.0	0.3	(7)	2.7	(54)	1.9	(39)
Hong Kong	1970–1975	3.0	0.2	(5)	1.5	(50)	1.4	(45)
	1975–1980	8.0	0.2	(3)	2.3	(29)	5.4	(68)
	1980–1985	4.4	0.3	(7)	3.6	(83)	0.5	(11)
	1985–1990	7.1	0.4	(6)	2.9	(41)	3.8	(53)
	1990–1995	4.0	0.4	(10)	2.9	(71)	0.7	(18)
	1995–2000	−0.2	0.6	(−267)	1.6	(−719)	−2.4	(1086)
	2000–2005	3.1	0.5	(16)	1.0	(31)	1.7	(54)
	2005–2010	3.5	0.3	(9)	1.1	(31)	2.1	(60)
	2010–2014	2.7	0.3	(11)	0.9	(33)	1.5	(57)
	1970–2014	4.0	0.4	(9)	2.0	(50)	1.6	(41)
Indonesia	1970–1975	4.5	0.0	(0)	1.6	(35)	2.9	(64)
	1975–1980	4.3	0.1	(12)	3.3	(328)	0.9	(−240)
	1980–1985	1.0	0.1	(12)	3.3	(328)	−2.4	(−240)
	1985–1990	3.3	0.1	(4)	1.7	(50)	1.5	(46)
	1990–1995	6.2	0.2	(4)	3.7	(60)	2.3	(36)
	1995–2000	−1.2	0.1	(−12)	2.9	(−250)	−4.2	(362)
	2000–2005	3.6	0.1	(4)	1.6	(45)	1.8	(51)
	2005–2010	2.4	0.2	(7)	0.8	(34)	1.4	(60)
	2010–2014	4.7	0.2	(4)	2.6	(55)	1.9	(41)
	1970–2014	3.2	0.1	(5)	2.4	(75)	0.6	(20)
Japan	1970–1975	4.9	0.4	(7)	5.0	(102)	−0.5	(−10)
	1975–1980	3.3	0.2	(6)	2.1	(65)	1.0	(29)
	1980–1985	3.9	0.2	(6)	1.8	(45)	1.9	(49)
	1985–1990	4.3	0.4	(10)	1.8	(42)	2.1	(49)
	1990–1995	2.0	0.3	(17)	2.0	(102)	−0.4	(−19)
	1995–2000	2.1	0.3	(17)	1.4	(68)	0.3	(15)
	2000–2005	1.4	0.4	(27)	0.4	(31)	0.6	(42)
	2005–2010	1.2	0.2	(18)	0.5	(40)	0.5	(42)
	2010–2014	0.7	0.0	(7)	−0.2	(−24)	0.8	(117)
	1970–2014	2.7	0.3	(11)	1.7	(63)	0.7	(26)
Malaysia	1970–1975	4.4	0.1	(1)	3.6	(82)	0.8	(17)
	1975–1980	4.9	0.1	(2)	3.7	(75)	1.1	(23)
	1980–1985	1.7	0.1	(5)	5.0	(290)	−3.4	(−195)
	1985–1990	3.5	0.1	(4)	1.5	(42)	1.9	(54)
	1990–1995	6.4	0.3	(4)	4.7	(73)	1.4	(22)
	1995–2000	1.0	0.4	(42)	3.1	(297)	−2.5	(−239)
	2000–2005	3.1	0.6	(21)	1.1	(37)	1.3	(43)
	2005–2010	2.2	0.5	(24)	0.5	(21)	1.2	(56)
	2010–2014	2.5	0.3	(12)	1.2	(49)	1.0	(39)
	1970–2014	3.3	0.3	(8)	2.7	(82)	0.3	(9)
Nepal	1970–1975	−0.1	0.0	(−33)	1.1	(−867)	−1.3	(1000)
	1975–1980	−0.3	0.1	(−24)	1.7	(−550)	−2.0	(674)
	1980–1985	2.6	0.1	(3)	2.8	(106)	−0.2	(−8)
	1985–1990	3.9	0.1	(1)	2.8	(72)	1.1	(27)
	1990–1995	2.4	0.0	(1)	2.1	(87)	0.3	(12)
	1995–2000	1.7	0.1	(4)	1.5	(91)	0.1	(6)
	2000–2005	0.6	0.1	(10)	1.3	(209)	−0.7	(−119)
	2005–2010	2.0	0.1	(4)	1.5	(77)	0.4	(19)
	2010–2014	1.4	0.1	(7)	1.0	(73)	0.3	(21)
	1970–2014	1.6	0.1	(4)	1.8	(112)	−0.2	(−16)
Philippines	1970–1975	1.4	0.1	(5)	0.8	(62)	0.5	(33)
	1975–1980	2.8	0.1	(3)	2.7	(99)	−0.1	(−2)
	1980–1985	−4.7	0.1	(−3)	1.7	(−37)	−6.5	(140)
	1985–1990	3.6	0.1	(3)	0.0	(0)	3.4	(97)
	1990–1995	0.5	0.0	(8)	0.9	(174)	−0.4	(−82)
	1995–2000	2.3	0.4	(18)	1.9	(81)	0.0	(0)
	2000–2005	1.8	0.5	(29)	0.3	(15)	1.0	(55)
	2005–2010	2.6	0.2	(7)	0.5	(18)	2.0	(75)
	2010–2014	4.4	0.1	(2)	1.3	(29)	3.0	(68)
	1970–2014	1.6	0.2	(12)	1.1	(72)	0.3	(16)

		Labor Productivity	Capital deepening				TFP	
			IT		Non-IT			
Singapore	1970–1975	4.3	0.4	(10)	4.9	(115)	−1.1	(−26)
	1975–1980	3.2	0.3	(9)	2.6	(79)	0.4	(12)
	1980–1985	3.3	0.5	(16)	3.9	(117)	−1.1	(−33)
	1985–1990	3.4	0.6	(19)	0.5	(14)	2.3	(68)
	1990–1995	3.6	0.6	(16)	1.0	(29)	2.0	(55)
	1995–2000	3.1	0.6	(18)	2.8	(90)	−0.3	(−9)
	2000–2005	3.7	0.6	(17)	1.5	(40)	1.6	(43)
	2005–2010	0.8	0.1	(17)	−0.9	(−118)	1.6	(201)
	2010–2014	1.5	0.5	(30)	0.9	(56)	0.2	(14)
	1970–2014	3.0	0.5	(16)	1.9	(64)	0.6	(21)
Thailand	1970–1975	3.0	0.1	(3)	2.1	(71)	0.8	(27)
	1975–1980	1.0	0.1	(12)	−0.1	(−13)	1.0	(101)
	1980–1985	3.1	0.2	(6)	1.9	(62)	1.0	(32)
	1985–1990	6.3	0.3	(4)	1.5	(23)	4.6	(73)
	1990–1995	6.2	0.5	(8)	4.5	(72)	1.2	(20)
	1995–2000	1.2	0.3	(29)	3.0	(255)	−2.1	(−184)
	2000–2005	5.2	0.2	(4)	0.6	(12)	4.3	(84)
	2005–2010	2.4	0.4	(15)	0.6	(25)	1.4	(60)
	2010–2014	4.3	0.4	(9)	2.0	(46)	1.9	(45)
	1970–2014	3.6	0.3	(7)	1.8	(49)	1.6	(43)
US	1970–1975	1.9	0.2	(11)	1.0	(55)	0.6	(34)
	1975–1980	1.0	0.2	(20)	0.2	(19)	0.6	(61)
	1980–1985	1.9	0.4	(20)	0.4	(23)	1.1	(57)
	1985–1990	1.3	0.4	(32)	0.3	(19)	0.6	(49)
	1990–1995	1.5	0.4	(25)	0.2	(15)	0.9	(60)
	1995–2000	2.3	0.6	(28)	0.1	(6)	1.5	(66)
	2000–2005	2.5	0.5	(22)	0.9	(34)	1.1	(45)
	2005–2010	1.6	0.4	(23)	1.0	(66)	0.2	(11)
	2010–2014	0.2	0.1	(48)	−0.3	(−149)	0.4	(201)
	1970–2014	1.6	0.4	(23)	0.4	(28)	0.8	(50)
Asia24	1970–1975	2.6	0.2	(7)	2.2	(85)	0.2	(8)
	1975–1980	1.9	0.1	(7)	1.9	(104)	−0.2	(−11)
	1980–1985	2.6	0.1	(5)	1.0	(36)	1.5	(58)
	1985–1990	3.6	0.2	(6)	1.3	(36)	2.1	(58)
	1990–1995	4.0	0.2	(5)	1.8	(44)	2.1	(51)
	1995–2000	2.6	0.2	(10)	1.4	(56)	0.9	(34)
	2000–2005	4.1	0.4	(9)	1.4	(35)	2.3	(56)
	2005–2010	5.7	0.3	(6)	2.8	(49)	2.6	(46)
	2010–2014	4.5	0.2	(5)	2.8	(62)	1.4	(32)
	1970–2014	3.5	0.2	(7)	1.8	(52)	1.4	(41)
South Asia	1970–1975	0.2	0.0	(9)	0.6	(374)	−0.4	(−283)
	1975–1980	0.9	0.0	(2)	0.7	(75)	0.2	(23)
	1980–1985	3.1	0.0	(1)	1.0	(32)	2.1	(67)
	1985–1990	3.7	0.1	(1)	1.3	(35)	2.4	(64)
	1990–1995	3.0	0.1	(2)	1.2	(41)	1.7	(56)
	1995–2000	3.6	0.1	(3)	1.4	(39)	2.1	(58)
	2000–2005	4.3	0.1	(3)	1.4	(31)	2.8	(66)
	2005–2010	5.9	0.2	(3)	2.8	(49)	2.8	(48)
	2010–2014	4.2	0.2	(4)	3.1	(74)	0.9	(22)
	1970–2014	3.2	0.1	(3)	1.5	(46)	1.6	(51)

		Labor Productivity	Capital deepening				TFP	
			IT		Non-IT			
Sri Lanka	1970–1975	1.1	0.0	(2)	0.9	(80)	0.2	(18)
	1975–1980	3.4	0.0	(1)	1.2	(36)	2.1	(63)
	1980–1985	4.4	0.1	(2)	2.8	(62)	1.6	(36)
	1985–1990	0.6	0.0	(0)	0.1	(24)	0.4	(76)
	1990–1995	4.0	0.0	(1)	0.2	(4)	3.8	(95)
	1995–2000	1.2	0.1	(7)	−1.1	(−98)	2.2	(191)
	2000–2005	1.8	0.2	(12)	0.6	(35)	1.0	(54)
	2005–2010	3.9	0.3	(7)	1.7	(44)	1.9	(49)
	2010–2014	4.3	0.1	(1)	2.7	(64)	1.5	(34)
	1970–2014	2.7	0.1	(3)	1.0	(36)	1.6	(61)
Vietnam	1970–1975	−1.3	0.0	(2)	−1.0	(77)	−0.3	(21)
	1975–1980	1.2	0.0	(4)	0.1	(9)	1.1	(87)
	1980–1985	1.2	0.0	(4)	−2.1	(−180)	3.3	(277)
	1985–1990	1.7	0.2	(13)	0.9	(57)	0.5	(30)
	1990–1995	5.7	0.2	(4)	2.5	(44)	3.0	(52)
	1995–2000	4.9	0.4	(7)	4.7	(95)	−0.1	(−2)
	2000–2005	6.7	0.4	(5)	4.9	(73)	1.5	(22)
	2005–2010	2.4	0.5	(22)	3.4	(144)	−1.6	(−66)
	2010–2014	5.5	0.4	(8)	4.2	(76)	0.9	(16)
	1970–2014	3.1	0.2	(8)	1.9	(62)	0.9	(30)
APO20	1970–1975	2.6	0.2	(7)	2.2	(85)	0.2	(8)
	1975–1980	1.9	0.1	(7)	1.9	(104)	−0.2	(−11)
	1980–1985	2.6	0.1	(5)	1.0	(36)	1.5	(58)
	1985–1990	3.6	0.2	(6)	1.3	(36)	2.1	(58)
	1990–1995	4.0	0.2	(5)	1.8	(44)	2.1	(51)
	1995–2000	2.6	0.2	(10)	1.4	(56)	0.9	(34)
	2000–2005	4.1	0.4	(9)	1.4	(35)	2.3	(56)
	2005–2010	5.7	0.3	(6)	2.8	(49)	2.6	(46)
	2010–2014	4.5	0.2	(5)	2.8	(62)	1.4	(32)
	1970–2014	3.5	0.2	(7)	1.8	(52)	1.4	(41)
East Asia	1970–1975	2.6	0.3	(10)	2.6	(100)	−0.3	(−11)
	1975–1980	2.6	0.2	(7)	1.5	(59)	0.9	(35)
	1980–1985	2.9	0.2	(6)	0.2	(8)	2.5	(86)
	1985–1990	3.8	0.3	(8)	1.4	(36)	2.1	(56)
	1990–1995	4.4	0.3	(6)	1.9	(43)	2.3	(52)
	1995–2000	2.8	0.3	(10)	1.2	(41)	1.3	(48)
	2000–2005	4.1	0.5	(13)	1.6	(38)	2.0	(49)
	2005–2010	6.7	0.4	(6)	3.4	(51)	2.9	(43)
	2010–2014	5.0	0.3	(5)	3.1	(61)	1.7	(34)
	1970–2014	3.8	0.3	(8)	1.8	(48)	1.7	(45)
ASEAN6	1970–1975	3.8	0.1	(2)	2.0	(53)	1.7	(45)
	1975–1980	3.5	0.1	(4)	2.3	(67)	1.0	(29)
	1985–1990	0.6	0.2	(27)	3.1	(525)	−2.7	(−451)
	1985–1990	4.0	0.2	(5)	1.4	(34)	2.5	(61)
	1990–1995	5.6	0.3	(6)	3.7	(65)	1.6	(29)
	1995–2000	0.6	0.3	(48)	3.1	(515)	−2.8	(−463)
	2000–2005	3.6	0.3	(9)	1.2	(32)	2.2	(60)
	2005–2010	2.5	0.3	(10)	0.7	(30)	1.5	(60)
	2010–2014	4.3	0.3	(6)	2.2	(52)	1.8	(41)
	1970–2014	3.1	0.2	(7)	2.2	(70)	0.7	(23)

Unit: Average annual growth rate (percentage), contribution share in parentheses.
Source: APO Productivity Database 2016.
Note: See footnote 70 for the country-exception in the country groups.

Hong Kong and Korea, labor productivity growth appeared to stabilize in the 2000s, but at a lower rate than previously. Singapore's productivity performance, albeit robust, compared with other mature economies like the US, has been very modest against its Asian counterparts. A recent peak of 3.1–3.6% in the 1990s is compared with over 6% in Hong Kong, the ROC, and Korea in the late 1980s. The US clearly enjoyed a labor productivity growth spurt in the late 1990s (2.3%) and early 2000s (2.5%), the origin of which attracted much research attention at the time. In recent years, it has returned to its long-term average of under 2%.

5.5 Energy Productivity

In 2013, in order to produce 41.2% of the world output in the Asia30 (17.3% and 16.0% in the EU28 and the US, respectively), 42.8% (12.2% and 16.1%) of world energy was consumed and 49.8% (10.3%

and 15.6%) of world CO2 was emitted, as shown in Figure 69. This implies that Asia has lower energy productivity (defined as a ratio of output per energy consumption) and higher carbon intensity of energy at the aggregate level. It is key to improve energy productivity and carbon intensity in the growing economies of Asia in order to reduce CO2 emissions in the world in the long run.

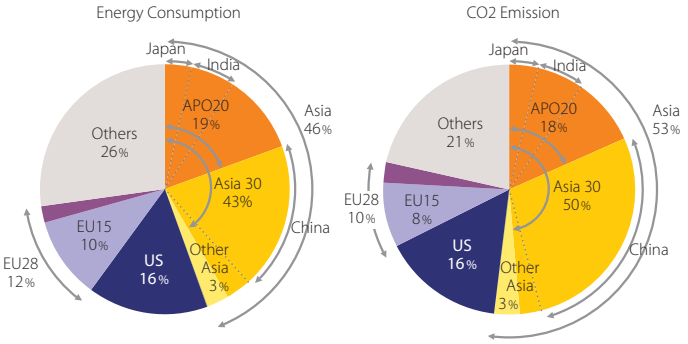

Figure 69 Shares of Asia in World Energy Consumption and CO2 Emission, 2013

Sources: IEA, *CO2 Emissions from Fuel Combustion 2015*; IEA, *Energy Balances of OECD Countries 2015*; IEA, *Energy Balances of non-OECD Countries 2015*.

The average level of energy productivity in Asia was inferior to the EU28 and the US by 32% and 4%, respectively, in 2013. There is considerable diversity in Asia however, reflecting the differences in industrial structure and energy efficiencies of industries and households among economies. Table 15 presents the snapshot level comparisons of energy productivity since 1980. Japan's energy productivity level is almost equivalent to that in the EU15 since 2000, and 37% and 87% higher than the US and China, respectively, in 2013.

Table 15 Energy Productivity Levels, 1980, 1990, 2000, 2010, and 2013
——GDP at constant basic prices per energy consumption, using 2011 PPP, reference year 2014

1980		(%)	1990		(%)	2000		(%)	2010		(%)	2013		(%)
Hong Kong	28.0	100.0	Hong Kong	29.9	100.0	Singapore	24.8	100.0	Hong Kong	41.8	100.0	Hong Kong	43.6	100.0
Singapore	23.1	82.6	Singapore	20.7	69.2	Hong Kong	24.5	98.8	Singapore	23.6	56.3	Philippines	23.8	54.6
Iran	14.5	51.7	Japan	12.7	42.4	Philippines	13.6	54.9	Philippines	21.9	52.3	Singapore	21.2	48.7
Malaysia	13.4	47.9	Malaysia	12.6	42.3	Bangladesh	13.6	54.8	Sri Lanka	17.5	41.8	Sri Lanka	21.1	48.5
Philippines	11.5	41.2	Thailand	12.3	41.2	ROC	12.8	51.5	Bangladesh	15.6	37.4	Bangladesh	17.3	39.7
Thailand	11.0	39.2	Philippines	11.8	39.6	Sri Lanka	12.6	50.6	Japan	14.2	34.0	Indonesia	15.5	35.6
Bangladesh	10.7	38.1	Bangladesh	11.4	38.2	Japan	12.4	50.0	Indonesia	14.1	33.8	Japan	15.1	34.6
Japan	10.2	36.5	ROC	11.0	36.9	Malaysia	12.0	48.5	Malaysia	14.0	33.4	ROC	15.0	34.3
Indonesia	8.7	31.0	Sri Lanka	10.4	34.9	Thailand	10.9	44.1	ROC	13.8	32.9	Malaysia	12.9	29.5
Sri Lanka	8.6	30.5	Indonesia	10.0	33.5	Indonesia	10.0	40.3	India	11.3	26.9	India	11.9	27.2
ROC	8.0	28.4	Iran	9.5	31.7	Pakistan	9.1	36.5	Pakistan	10.7	25.7	Pakistan	11.5	26.5
Pakistan	6.4	23.0	Pakistan	8.0	26.9	India	8.3	33.4	Thailand	10.2	24.4	Thailand	10.1	23.2
Korea	5.9	21.1	Korea	7.3	24.3	Iran	8.1	32.6	Korea	9.1	21.8	Korea	9.4	21.5
India	5.1	18.3	India	6.3	21.1	Vietnam	7.4	29.7	Iran	8.8	21.1	Vietnam	8.7	20.1
Vietnam	3.8	13.7	Vietnam	5.3	17.8	Korea	7.3	29.2	Cambodia	7.9	18.8	Cambodia	8.5	19.5
Nepal	3.5	12.4	Nepal	4.3	14.4	Mongolia	7.0	28.1	Vietnam	7.8	18.7	Mongolia	8.1	18.6
China	1.3	4.8	Mongolia	3.7	12.3	Cambodia	5.6	22.5	China	7.8	18.7	Iran	8.1	18.5
			China	2.4	8.1	China	5.4	21.6	Mongolia	7.2	17.2	China	7.8	17.9
						Nepal	5.0	20.2	Nepal	5.7	13.6	Nepal	6.5	14.9
(reference)			(reference)			(reference)			(reference)			(reference)		
US	5.2	18.5	US	7.3	24.4	US	8.5	34.4	US	10.4	24.8	US	11.0	25.2
EU15	8.9	31.8	EU15	11.0	36.7	EU15	12.3	49.8	EU15	13.8	33.1	EU15	14.8	33.9
						EU28	12.0	48.3	EU28	13.4	32.2	EU28	14.4	33.1
Australia	7.8	27.7	Australia	8.6	28.9	Australia	10.0	40.1	Australia	12.3	29.4	Australia	12.6	29.0
Turkey	12.3	43.8	Turkey	13.4	45.0	Turkey	13.4	53.9	Turkey	14.6	35.0	Turkey	15.3	35.2

Unit: Thousands of US dollars per toe (tonne of oil equivalent) (as of 2014).
Sources: Official national accounts in each country, including author adjustments; IEA, *Energy Balances of OECD Countries 2015*; IEA, *Energy Balances of non-OECD Countries 2015*; APO Productivity Database 2016.

Figure 70 placed countries on the two partial productivity indicators of labor and energy, measured in 2013. Less-developed countries with lower labor productivity (such as the Philippines, Sri Lanka, and Bangladesh) tend to have higher energy productivity. One of the effective strategies to improve labor productivity in such countries is to expand the manufacturing sector (as shown in Figure 73 in Section 6.1 (p. 103), there is a positive correlation between the TFP growth and the manufacturing share). This frequently follows the deterioration in energy productivity.

As a next stage of economic growth, well-developed countries will be able to pay more attention to improving energy productivity by abolishing implicit or explicit subsidies on energy prices, especially in electricity prices, and levying heavier taxes on energy consumptions. The C-shape dynamics found between labor and energy productivities corresponds to the so-called Environmental Kuznets curve, as an inversed U-shape relationship between environmental quality (at the y-axis) and economic development (at the x-axis).

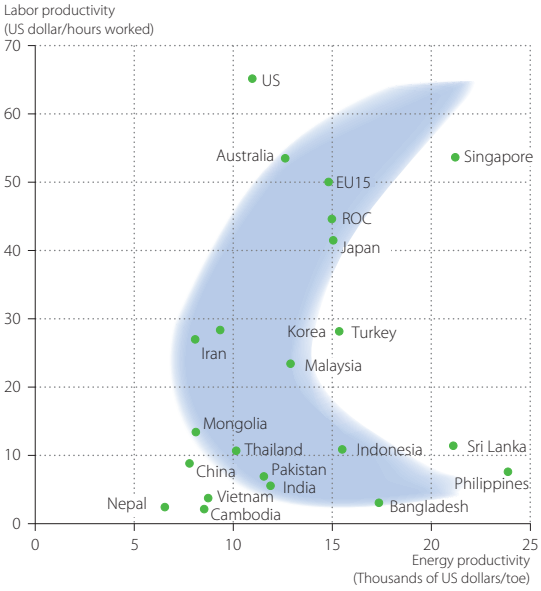

Figure 70 Labor Productivity and Energy Productivity, 2013

Sources: Official national accounts in each country, including author adjustments; IEA, *Energy Balances of OECD Countries 2015*; IEA, *Energy Balances of non-OECD Countries 2015*; APO Productivity Database 2016.

Figure 71 decomposes the sources of CO2 emission growth (from fuel combustion) in the Asian countries during 2000–2013, based on the so-called Kaya identity. The growth in CO2 emissions is decomposed to three components: changes in real GDP; carbon intensity of energy; and energy intensity of GDP (the inverse of energy productivity). In many countries, the production expansion (real GDP growth) is the most significant factor to explain the growth of CO2 emissions. With an exception of Thailand, Iran, and Singapore, energy productivity has been improved in many Asian countries in this period, but these improvements are not enough to offset an expansion of energy consumption (except in the Philippines, Hong Kong, and Japan).

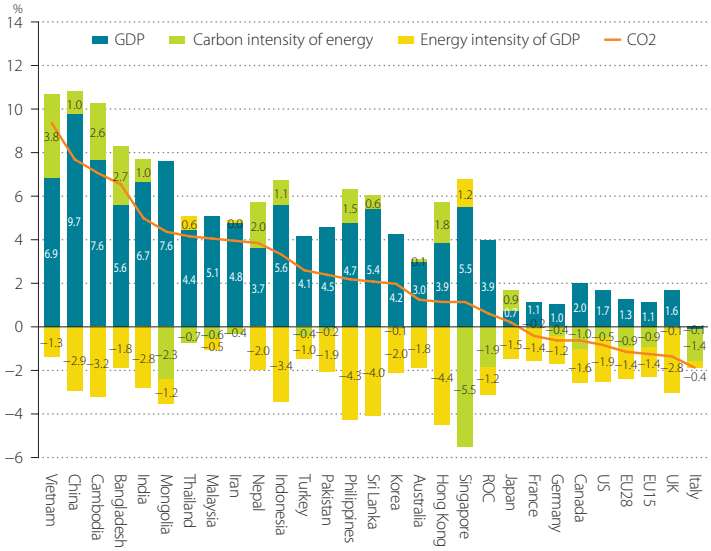

Figure 71 Sources of CO2 Emission Growth, 2000–2013

Sources: Official national accounts in each country, including author adjustments; IEA, *Energy Balances of OECD Countries 2015*; IEA, *Energy Balances of non-OECD Countries 2015*; IEA, *CO2 Emissions from Fuel Combustion 2015*.

On the other hand, in many Asian economies, the carbon intensity of energy has increased, mainly due to an expansion of coal consumption. Japan achieved some improvement in energy efficiency in this period, but the carbon intensity of energy had to be increased due to a very low operation rate of nuclear power plants after the Fukushima Daiichi nuclear disaster in March 2011.[85] Singapore realized a large improvement in carbon intensity of energy by the shift from oil to LNG in electricity power generation.[86] This helped to offset the increases in CO2 emission accompanied by strong economic growth, regardless of some deterioration in energy productivity. In this period, a decoupling in the growths of GDP and CO2 emission seems to be realized in a few developed countries, especially in the EU. However, this may be mainly due to the shift of the energy-consuming production to the Asian countries, in which more energy is required and more CO2 is emitted to produce the same output. For sustainable growth of the world economy, improvements in energy productivity and carbon intensity of energy are recognized as one of the important policy targets in Asia.

85: According to the FEPC (The Federation of Electric Power Companies of Japan), the rate of utilized capacity of nuclear power plants was 67.3% in the fiscal year 2010 (the share of nuclear in power generation was 28.6%), but after the disaster, 23.7% in 2011, 3.9% in 2012, 2.3% in 2013, 0.0% in 2014. A few plants were reactivated in 2015 and the utilization rate was slightly recovered to 2.8%.

86: In Singapore, the share of natural gas in electricity power generation reached to 91.5% in 2013 from 18.5% in 2000, compared to the decrease in the share of oil in power generation from 80.0% in 2000 to 4.9% in 2013 (IEA, *Energy Balances of non-OECD Countries 2015*.).

Box 7 Sensitivity of TFP Estimates

TFP computations, based on the growth accounting framework, depends on data that is sometimes difficult to observe. One difficult data point is calculating the wages for the self-employed and unpaid family workers. As a crude approximation in this report, it is assumed that per-worker wages for the self-employed and contributing family workers are 5–70% of the per-worker wage for employee in the countries where the appropriate wage data is not available. This approximation is made in order to estimate the labor compensation for total employment. The future review on this assumption affects TFP estimates directly through the revision of factor income shares and indirectly through the estimates of the ex-post rate of return and thus the aggregate measure of capital services.

The right panel of Figure B7.1 presents the labor income share (the ratio of compensation of employees to the basic-price GDP) based on the official national accounts (including author adjustments in basic-price GDP for some countries) in 20 Asian countries and the US in 2014. The left panel of the figure illustrates the employee share to total employment. There is a large divergence in labor income share for employees among the Asian countries. This does not necessarily reflect differences in the number of employees in total employment. Although Malaysia and the Philippines have a high employee share of 79% and 61%, the labor income share is only 36% and 37% in 2014, respectively.

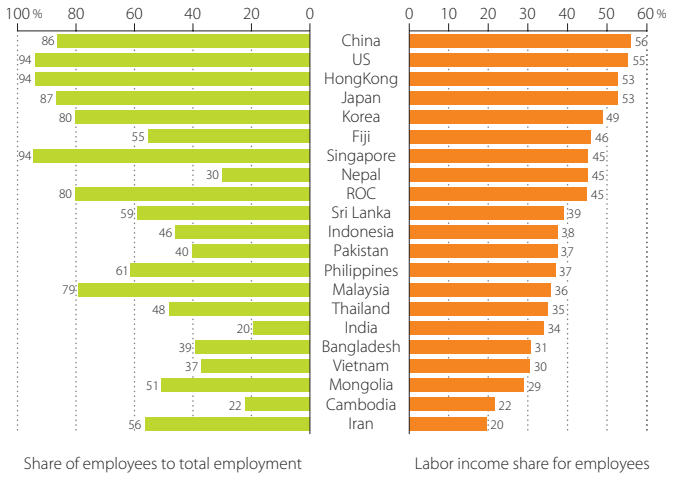

Figure B7.1 Labor Income Share for Employees, 2014

Sources: Official national accounts in each country, including author adjustments.

Figure B7.2 illustrates the sensitivity of TFP estimates by changing the factor income share during the period from 1970 to 2014. In general, the growth rate of capital input is higher than that of labor input, therefore the higher income share of labor results in higher estimates of TFP growth. In other words, labor productivity is improved much faster over a given period than capital productivity, the growth of which tends to be frequently negative (see Figures 45 and 61). The TFP estimate reflects the improvement of labor productivity more when the labor income share increases. In Malaysia, with TFP growth of 0.3% on average during the period 1970–2014, the true estimate could be 0.8% if the current labor income share is underestimated by 10%.

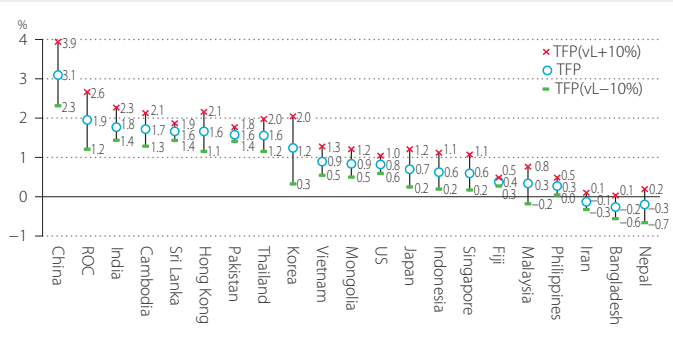

Figure B7.2 Sensitivity of TFP Estimates by the Change of Income Share, 1970–2014

Source: APO Productivity Database 2016.

6 Industry Perspective

This chapter provides an overview of the industry structure of countries. Industry decomposition allows an insight into the source of a country's economic dynamics, which, in turn, determines its overall performance and characteristics, its strengths, and its vulnerabilities. On one hand, a broad industry base reflects diversification and sophistication in the economy, and in turn is more resourceful in weathering economic shocks. On the other hand, reliance on a narrow industry base leaves economies more vulnerable to shocks and more susceptible to volatility. Furthermore, the different composition of economic activities among countries is also one of the main sources of the huge gap in average labor productivity at the aggregate level, as observed in Chapter 5. By analyzing the industry structure of the Asian economies, one can clearly trace the path of economic development and identify countries' respective stages based on their characteristics.[87]

6.1 Output and Employment

Table 7 in Section 3.2 (p. 34) introduces a country grouping according to stages of development (as measured by per capita GDP relative to the US). Table 16 regroups countries based on the same set of criteria as in Table 7, but applies it to 2014 income levels. The difference in relative per capita GDP between the two tables reflects the impact of their catch-up efforts since 1970, or the year of first recorded data.

Countries at the lower rungs of the development ladder tend to have a bigger agriculture sector as a share of value added.[88] Figure 72 shows the industry composition[89] of the Asian economies in 2014, and indicates a broad, negative correlation between the share of the agriculture sector and the relative per capita GDP against the US. Half of the Asian countries compared have an agriculture sector accounting for over 10% of total value added. They all have a relative per capita GDP that is 30% below the US (except Iran). Among them, the five countries with the biggest agricultural share are all in the lowest income group in Table 16 (with a per capita GDP less than 10% of the US). Note also how finance, real estate, and business activities grow in importance as one moves up

Table 16 Country Groups Based on the Current Economic Level and the Pace of Catching Up

——Level and average annual growth rate of per capita GDP at constant market prices, using 2011 PPP

Per capita GDP level to the US in 2014	Annual rate to catch-up to the US			
	(C1) >3%	(C2) 1% <–< 3%	(C3) 0% <–< 1%	(C4) < 0%
(L1) 60% <	ROC, Korea	Hong Kong, Singapore	Japan, Oman	Australia, Bahrain, Brunei, EU15, Kuwait, Qatar, Saudi Arabia, UAE
(L2) 20% <–< 60%	China	Malaysia, Mongolia, Thailand	Turkey	Iran
(L3) 10% <–< 20%		Bhutan, India, Indonesia, Sri Lanka, Vietnam	Philippines	Fiji
(L4) < 10%	Cambodia	Lao PDR, Myanmar	Bangladesh, Nepal, Pakistan	

Sources: Official national accounts in each country, including author adjustments.
Note: The annual catch-up rates are based on the data during 1970–2014. The starting years for some countries are different due to data availability: Cambodia (1987–) and the Lao PDR (1981–).

87: Constructing the industry origins of labor productivity growth requires confronting a large volume of data from different sources. Issues of data inconsistency arising from fragmentation of national statistical frameworks can present enormous hurdles to researchers in this field. The industry data in this chapter is mainly based on official national accounts. Where back data is not available, series are spliced together using different benchmarks and growth rates. Data inconsistencies in terms of concepts, coverage, and data sources have not been fully treated although levels of breakdown are deliberately chosen to minimize the potential impact of these data inconsistencies. In this sense, the industry data in the APO Productivity Database should be treated as a work in progress and it is difficult to advise on data uncertainty. These data will be further developed and examined in the near future. Readers should bear these caveats in mind in interpreting the results.

income levels. The finance sector is especially prominent in Hong Kong (38%), Singapore (32%), and the US (32%). Mining appears to be what defines oil-exporting countries, typically accounting for over 40% of total value added, except in Bahrain (25%), Iran (12%), and the UAE (33%), which are countries that have managed to diversify mining. Finance is the biggest sector in Bahrain, accounting for 21% of total value added, whereas it is the second largest sector (18%) in the UAE, following mining.

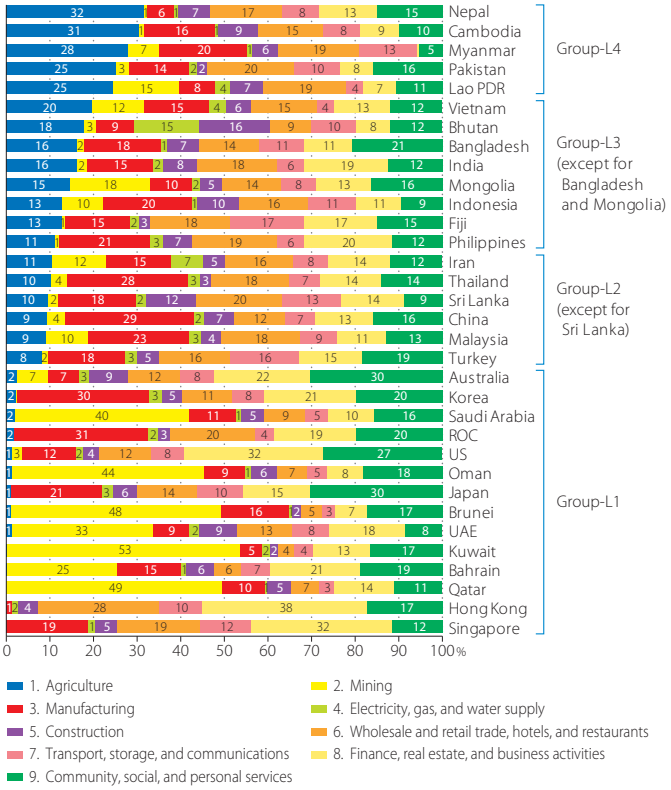

Figure 72 Industry Shares of Value Added, 2014

Sources: Official national accounts in each country, including author adjustments.

For fostering productivity in the less-developed countries, it is important to adopt existing technologies from the advanced economies. In this view of assimilation, manufacturing is a key sector in propelling countries to make a leap in economic development. It accounts for around 20% or more of total value added in nine of the 30 Asian countries compared. Among these, manufacturing is the largest sector in the ROC, Korea, and China equivalent to around 30% of total value added, while in Thailand and Malaysia it accounts for a quarter or more. Figure 73 shows there is a positive correlation between our estimates of TFP growth in Chapter 5 during 2000–2014 and the shares of manufacturing in 2014. Outlier countries are Hong Kong and Mongolia,[90] who have a higher share of services and mining, respectively.

Figure 74 shows the breakdown of the manufacturing sector, comprising nine sub-industries, for 17 selected Asian countries and the US.[91] The dominance of machinery and equipment in Asian manufacturing can be clearly seen, particularly in Singapore (61% of manufacturing's total value added) and the ROC (66%), Korea (52%), and Japan (49%). These compare with 47% in the US. At the other end are

88: In Chapter 5, GDP is adjusted to be valued at basic prices (including our estimates, if the official estimates at basic prices are not available). However, the definition of GDP by industry differs among countries in this chapter due to data availability. GDP is valued at factor cost for Fiji and Pakistan; at basic prices for Cambodia, Hong Kong, India, Korea, the Lao PDR, Mongolia, Nepal, and Singapore; at producers' prices for Iran, the ROC and the Philippines; and at market prices for Bangladesh, Indonesia, Japan, Malaysia, Sri Lanka, Thailand, and Vietnam.

89: The nine industries are 1–agriculture; 2–mining; 3–manufacturing; 4–electricity, gas, and water supply; 5–construction; 6–wholesale and retail trade, hotels, and restaurants; 7–transport, storage, and communications; 8–finance, real estate, and business activities; and 9–community, social, and personal services. See Appendix 6 for the concordance with the ISIC, Revision 3.

90: In Mongolia the two world-class large mines of Tavan Tolgoi (coal mine) and Oyu Tolgoi (copper and gold mine) started producing concentrate from the mine as of the beginning of the 2010s

91: Manufacturing consists of nine sub-industries: 3.1–food products, beverages, and tobacco products; 3.2–textiles, wearing apparel, and leather products; 3.3–wood and wood products; 3.4–paper, paper products, printing, and publishing; 3.5–coke, refined petroleum products, chemicals, rubber, and plastic products; 3.6–other non-metallic mineral products; 3.7–basic metals; 3.8–machinery and equipment; and 3.9–other manufacturing. See Appendix 3 for the concordance with ISIC, Revision 3.

countries dominated by light manufacturing; e.g., the food products, beverages, and tobacco products sector in Sri Lanka (51%), the Philippines (50%), Fiji (49%), and Mongolia (41%); and the textiles, wearing apparel, and leather products sector in Cambodia (65%) and Bangladesh (54%). Coke, refined petroleum products, chemicals, rubber, and plastic products are also a prominent subsector, not least in Kuwait (69%), where they account for two-thirds of the country's manufacturing value added.

Figure 75 shows the industry shares of value added and employment by the four country groups based on 2014 income levels, compared with the Asia30 average and the US for the years 1980, 1990, 2000, and 2014.[92] The first thing to note is that in 2014, the service sector accounted for the largest share of total value added in all country groups, independent of their economic development.[93] That said, Group-L1 has always had the biggest service sector among all Asian countries. This has become much more distinctive as over time the bulk of the economy in this group continues to shift heavily toward services. By 2014, the service sector accounted for 61% of total value added in Group-L1, compared to 79% in the US and 48% in Group-L2.[94] The weight of the service sector is similar in Group-L3 and Group-L4 at 53% to 52%. This reflects the relative importance of manufacturing to the former, and agriculture for the latter, at their particular stages of development.

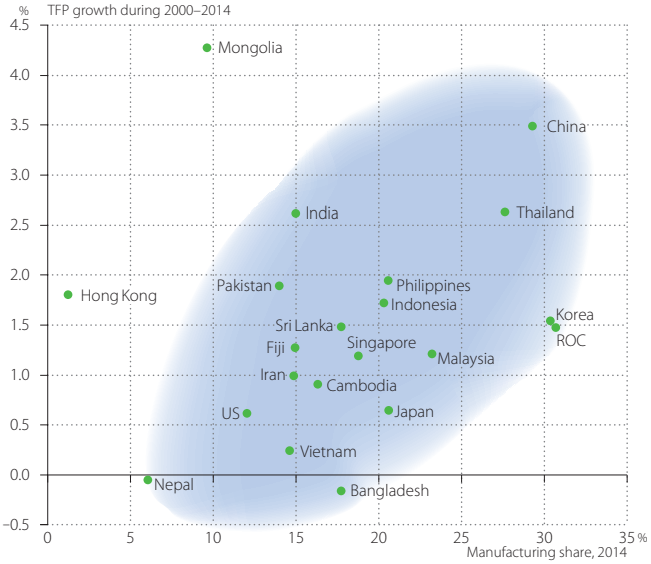

Figure 73 Manufacturing Share and TFP Growth, 2000–2014

Sources: Official national accounts in each country, including author adjustments; APO Productivity Database 2016.

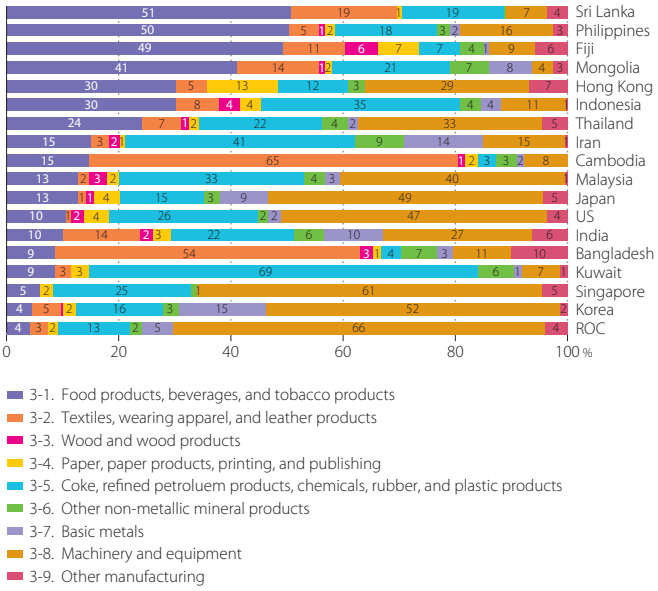

Figure 74 Industry Shares of Value Added in Manufacturing, 2014

Sources: Official national accounts in each country, including author adjustments.

92: The group averages as industry share of value added are based on a country's industry GDP, using exchange rates for the whole economy without consideration of the differences in relative prices of industry GDP among countries.

93: The service sector is defined in this Databook as 6–wholesale and retail trade, hotels, and restaurants; 7–transport, storage, and communications; 8–finance, real estate, and business activities; and 9–community, social, and personal services.

The second noteworthy point is that the Asia30 remains a region dominated by agriculture as far as employment is concerned, despite its downward trend. In the past three decades, the agricultural employment share for the Asia30 dropped from 61% in 1980 to 35% in 2014. In the past three decades, the value-added share of agriculture in Group-L3 has more than halved from 28% in 1980 to 15% in 2014, with the most rapid shift taking place in the 1990s. Employment in the sector also was cut by one-third over the same period. In contrast, the least well-off countries have not been as successful in diversifying away from agriculture, which accounted for 23% of total value added and 47% of employment in 2014, compared with 36% and 64%, respectively, in 1980. In the meantime, the richest economies continued to squeeze agriculture even though it had a share of only 3% in total value added and 16% in total employment in 1980. By 2014, the figures had fallen to 1% and 4%, respectively.

Comparisons of the value added and employment shares also reveal some interesting facts. Agriculture is the only industry sector that consistently has a disproportionately higher employment share than justified by its share in value added across all country groups. This suggests that agriculture is still highly labor-intensive and/or there may be a high level of underemployment in the sector in Asia, both of which imply that the labor productivity level is low compared to other industry sectors.[95] Thus, countries with a big agriculture sector often have low per capita GDP. In these cases, shifting out of agriculture will help boost economy-wide labor productivity. The US is an exception, where its agricultural value-added share and employment share are similar; suggesting that labor productivity in this sector is higher than that experienced in Asian countries. The reverse is true for the sector of finance,

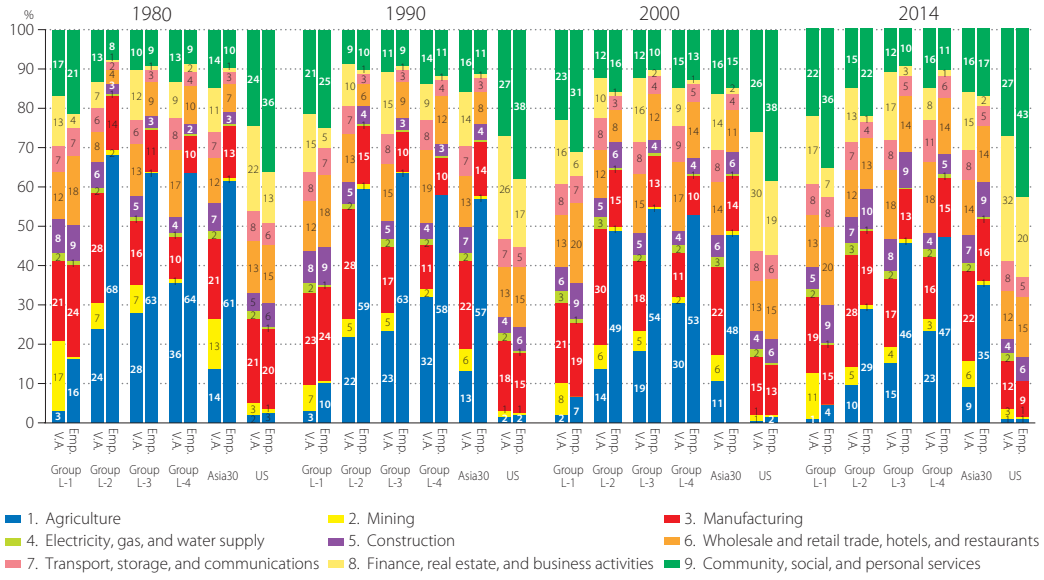

Figure 75 Industry Shares of Value Added and Employment by Country Group, 1980, 1990, 2000, and 2014

Sources: Official national accounts in each country, including author adjustments.

94: If Figure 72 were to rank countries by the size of the service sector, Hong Kong would top the table at 92.7%, followed by the US (78.6%), and other Group-L1 countries, namely the ROC (62.5%), Japan (69.8%), and Singapore (74.5%). Fiji is an exception, with a large service sector share (66.9%) relative to its per capita GDP level.

95: Gollin, Parente, and Rogerson (2004) and Caselli (2005) demonstrate the negative correlation between employment share of agriculture and GDP per worker. They show that the agriculture sector was relatively large in less well-off countries and agricultural labor productivity was lower than that in other sectors.

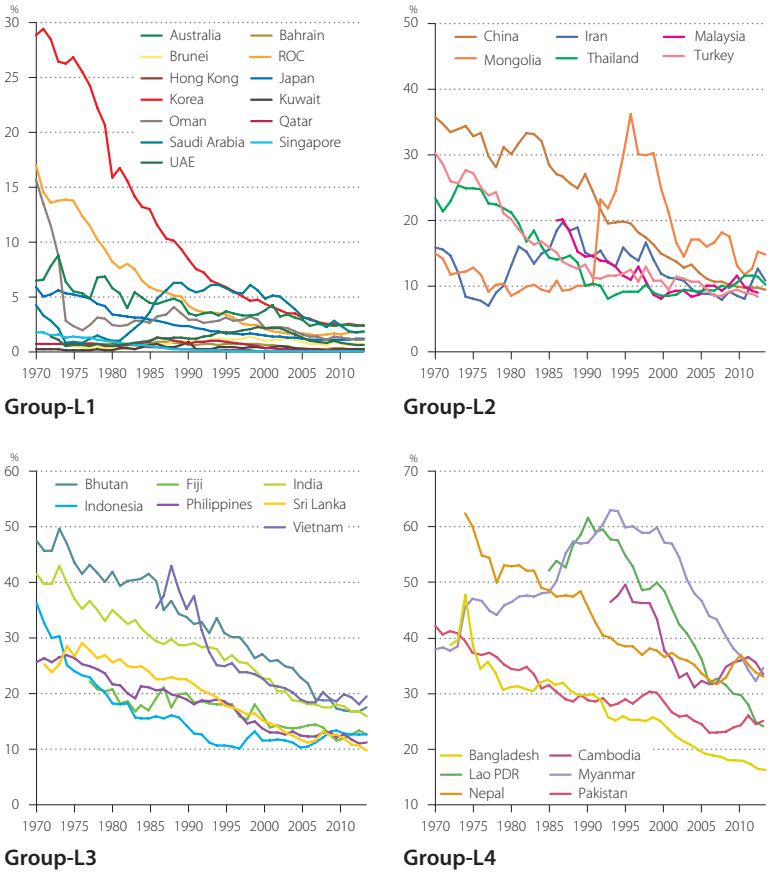

Figure 76 Long-Term Trends of Value-added Share in the Agriculture Sector, 1970–2014

Sources: Official national accounts in each country, including author adjustments.

real estate, and business activities, which often generate a much greater value-added share than suggested by its employment share. In 2014, the sector accounted for 32% of total value added generated by 20% of employment in the US, and 15% and 2%, respectively, in the Asia30. While the value-added share of the sector has grown by 10 percentage points in the US over the past three decades, it has only grown by 4 percentage points in the Asia30.

The third point to note is that the industry structure in Asian countries differs from that in the US regarding the relative importance of manufacturing, even in Group-L1 countries, where manufacturing accounts for 19% of the economies' value added, compared with 12% in the US in 2014. The US economy is highly skewed toward the service sector, accounting for 79% of the total value added, compared with an average of 61% in Group-L1 countries. Certainly, its share of finance, real estate, and business activities at 32% was much larger than the share in Group-L1 countries, at 17%. This suggests that Asian economies could experience further deindustrialization and a shift in prominence toward services as they continue to mature. The relative prominence of manufacturing in the Asian regional economy as a whole is reflected in the fact that income groups are not filtered out by the size of a country's manufacturing sector.[96] In Asia, the manufacturing employment share is typically

96: If Figure 72 were to rank countries by the size of the manufacturing sector, the ROC would lead with a share of 30.7%, followed by Korea and China at 30.3% and 29.2%, respectively.

smaller than the value-added share it generates. Furthermore the value-added share of the sector has been shrinking in the high-income groups (i.e., Group-L1 and Group-L2) whereas in Group-L3 countries it has been relatively stable, and slowly expanding in Group-L4, reflecting their different developmental stage.

Figure 76 shows how the share of the agriculture industry in total value added shrank over time in the Asian economies. This could reflect the actual decline in agricultural output and/or the relatively rapid expansion in other sectors. Despite the broad spread, the downward trend is unmistakable, even for Group-L4 countries. The share of the agriculture sector displays a long-term declining trend in all countries, albeit at different paces and at different starting times. Looking at the available data, the share of agriculture in most Asian countries (excluding the oil-exporting countries) clustered around the 30–50% band in the 1970s, trending down to the 10–20% band by 2014. Vietnam and Mongolia are two countries where the agriculture sector experienced similar declines but within a much shorter period (from the late 1980s and mid-1990s, respectively). The relative decline of agriculture was most rapid in Korea, from 28.9% of total value added in 1970 to 2.3% in 2014. In many countries, the share of the agriculture sector more than halved between 1970 and 2014: for example, from 37% to 13% in Indonesia,

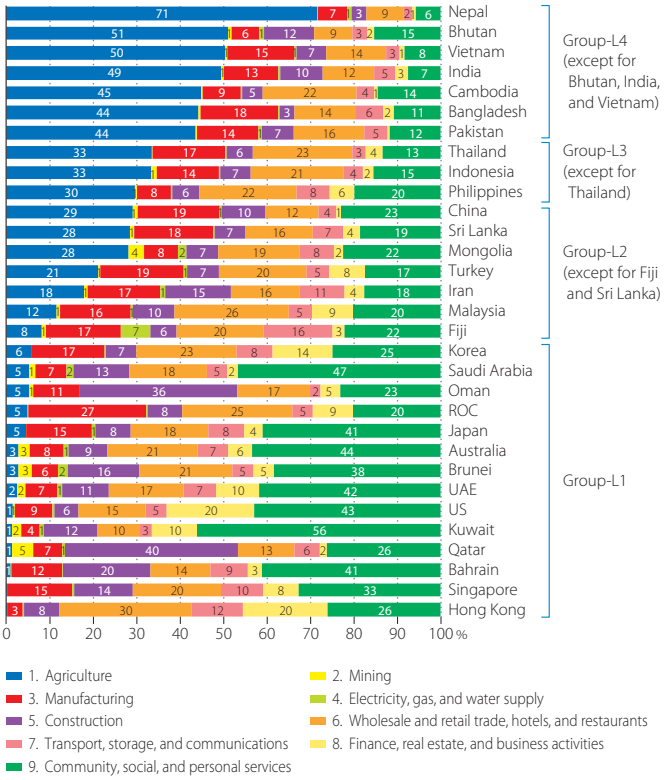

Figure 77 Industry Shares of Employment, 2014

Sources: Official national accounts in each country, including author adjustments.

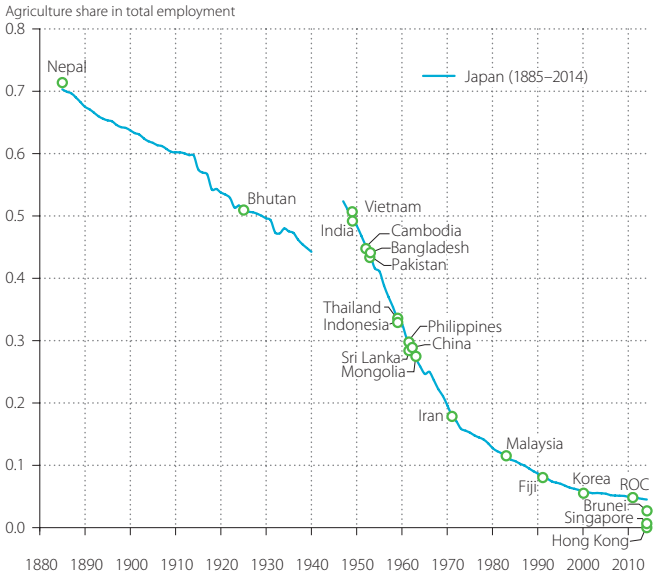

Figure 78 Employment Share of Agriculture in Japan during 1885–2014 and Levels of Asian Countries in 2014

Sources: Official national accounts in each country, including author adjustments. The sources of historical data of Japan are Long-Term Economic Statistics by Ohkawa, Takamatsu, and Yamamoto (1974) during 1885–1954 and population censuses since 1920.

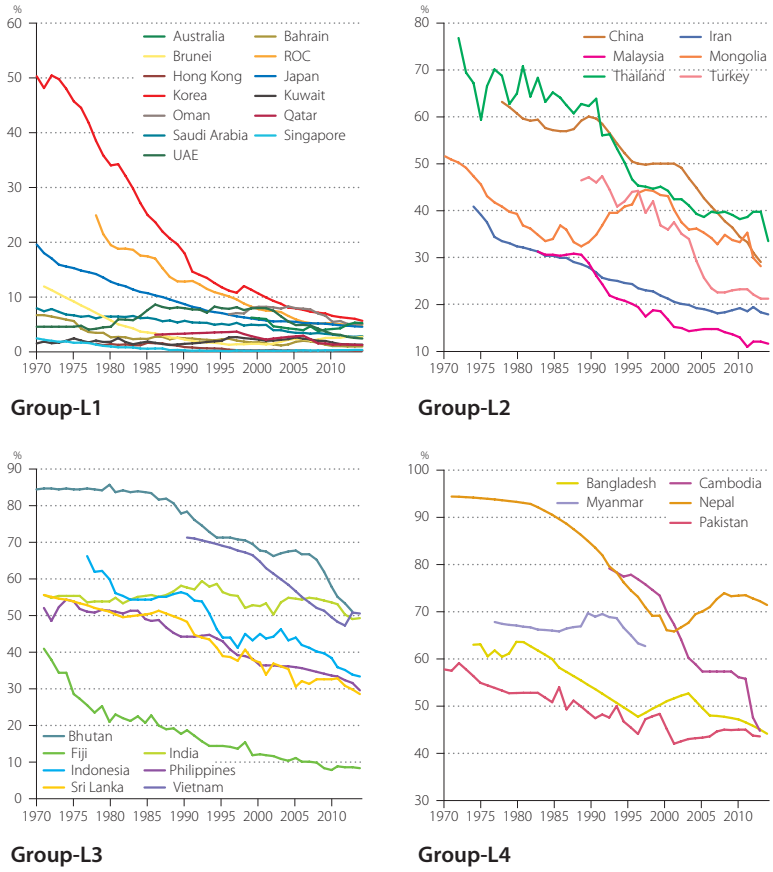

Figure 79 Long-Term Trends of Employment Share in the Agriculture Sector, 1970–2014

Sources: Official national accounts in each country, including author adjustments.

from 42% to 16% in India, and from 39% in 1972 to 16% in Bangladesh. In China, the share of this sector also significantly declined, from 36% in 1970 to 10% in 2014.

Despite the relative decline of agriculture's share in total value added, employment in the sector for Asia as a whole still accounted for 35% of total employment in 2014. Figure 77 shows countries' industry shares in total employment, and ranks them by size of employment in the agriculture sector.[97] Figure 78 traces the historical trajectory of Japan's employment share of agriculture for the period 1885–2014 and the countries' levels in 2014, mapped against Japan's experience (as circles). Large shares of agriculture employment over 30% in 10 countries correspond to Japan's level at the end of the 1950s and the onset of high economic growth. This may indicate there is much room for improving labor productivity and per capita income.

The trend of employment share over time (Figure 79) suggests that the relative decline in the share of agriculture in total value added has been accompanied by a downward trend in its share in total employment.[98] This trend is unmistakable in most of the countries plotted in Figure 79.[99] Between 1970 and 2014, the employment share in agriculture dropped from 50% to 6% in Korea and from 20% to 5%

97: Data for the Lao PDR and Myanmar are unavailable for Figure 77.

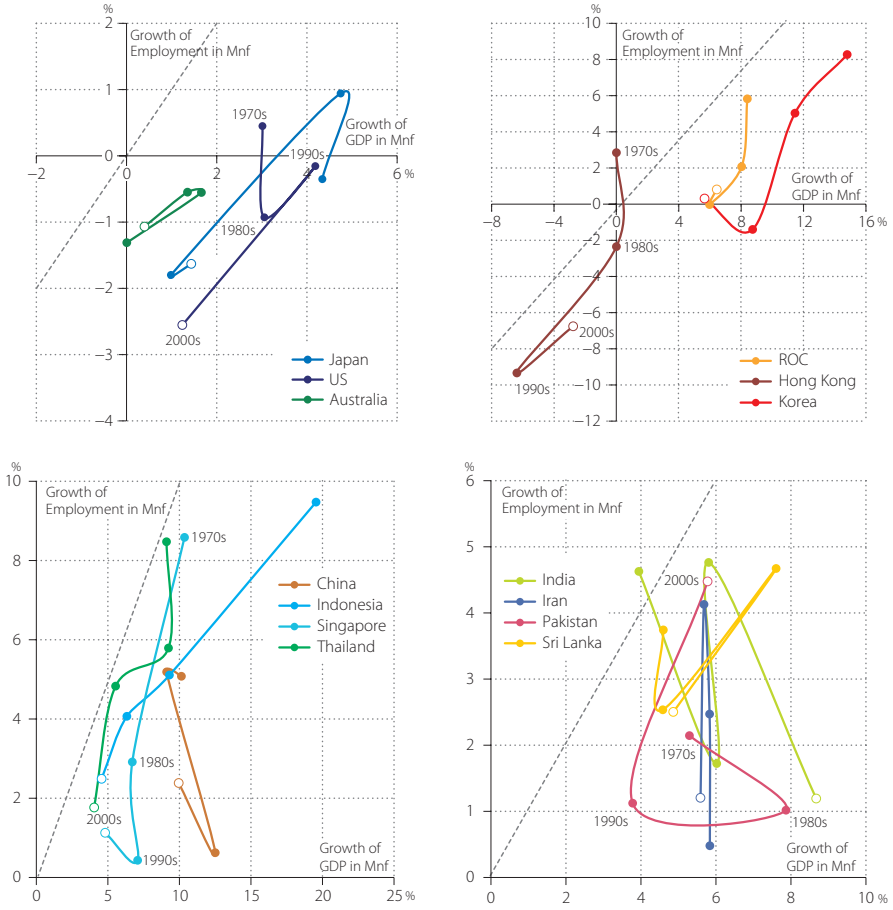

Figure 80 Job Creation in Manufacturing, 1970–2014
——Average annual growth rates of GDP at constant prices and number of employment

Sources: Official national accounts in each country, including author adjustments.
Note: Each dot represents the average annual growth rate in manufacturing (mnf) in the 1970s, 1980s, 1990s, and 2000s (2000–2014). The white dots indicate the rate in the latest decade.

in Japan. Employment in agriculture also fell rapidly in the ROC, from 25% in 1978 to 5% in 2014. In China, the share has declined from 63% in 1978 to 29% in 2014.

It is the manufacturing sector that largely absorbs workers who have been displaced from the agriculture sector, especially in the initial stages of economic development. Figure 80 traces the trajectory of growth rates of GDP and employment in combination with manufacturing for several Asian countries and the US over the past four decades. Each dot represents the average annual growth rate in the 1970s, 1980s, 1990s, and 2000s (2000–2014). The growth rate in the 2000s is illustrated by a white dot.

98: Nepal's employment-by-industry figures are constructed by interpolating benchmark data taken from its labor force survey as well as its population census. Figure 79 indicates that its share of agriculture has increased since 2001. This reflects the employment share of agriculture at 66% in the population census of 2001 and its share of 74% in the labor force survey of 2008.

99: However, the decline in a share does not always reflect an actual fall in employment for the agriculture sector; rather, it could reflect total employment rising faster than employment in agriculture. Countries that have been experiencing a consistent fall in actual employment in the agriculture sector are, for example, the ROC, Hong Kong, Japan, and Korea, whereas in Cambodia, India, Iran, Nepal, and Pakistan, actual employment has been rising. Other countries such as Thailand, Indonesia, Singapore, Malaysia, and Vietnam have no established trend in employment growth. China, however, has seen actual employment in agriculture falling since the turn of the millennium.

If manufacturing GDP and employment grow at the same rate, a dot will be on a 45-degree line through the origin running from the lower left to upper right quadrants. Despite positive gains in manufacturing GDP for the US and Japan, the overall growth in manufacturing employment was negative, except during the 1970s for the US and the 1980s for Japan.

In Korea and the ROC, expansions of manufacturing output could allow for increases of employment in the 1970s and the 1980s, but since the 1990s manufacturing has not been an absorption sector of employment, regardless of the sound expansion of production in this sector (Figure 80). The experiences of Singapore, Indonesia, and Thailand are closer to the 45-degree line through the origin, which implies well-balanced growth of output and employment in the manufacturing sector. The job creation role of manufacturing remains effective or increasingly more important in Indonesia and Pakistan, but it is diminishing rapidly in India and Iran.

6.2 Industry Growth

In Section 3.1, it can be seen that as a region growth in the Asia30 accelerated in the period 2005–2010, averaging 6.5% per annum, up from 5.7% in 2000–2005. China and India have been the two main drivers among the Asian economies, accounting for 46% and 16% of the region's growth during 1990–2014, respectively (Figure 7 in Section 3.1, p. 25). However, looking at the industry composition, the origins of economic growth in China and India are quite different. Bosworth and Collins (2008)

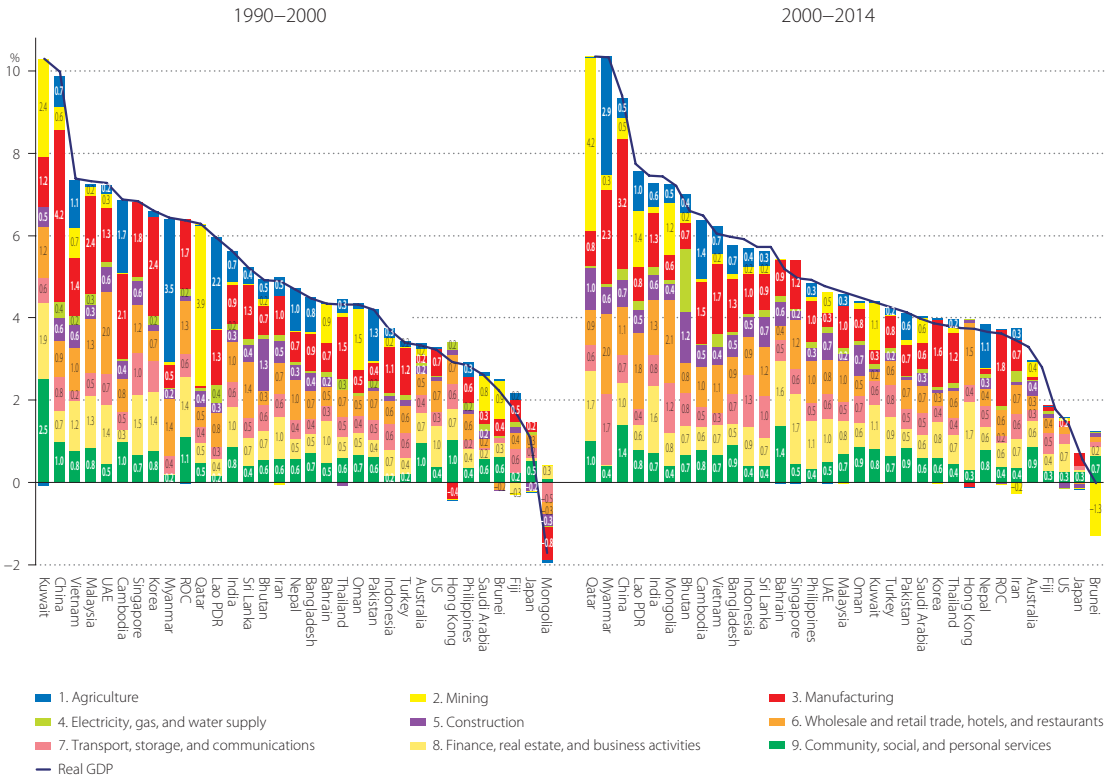

Figure 81 Industry Origins of Economic Growth, 1990–2000 and 2000–2014
——Industry decomposition: Average annual growth rate of GDP at constant prices

Sources: Official national accounts in each country, including author adjustments.

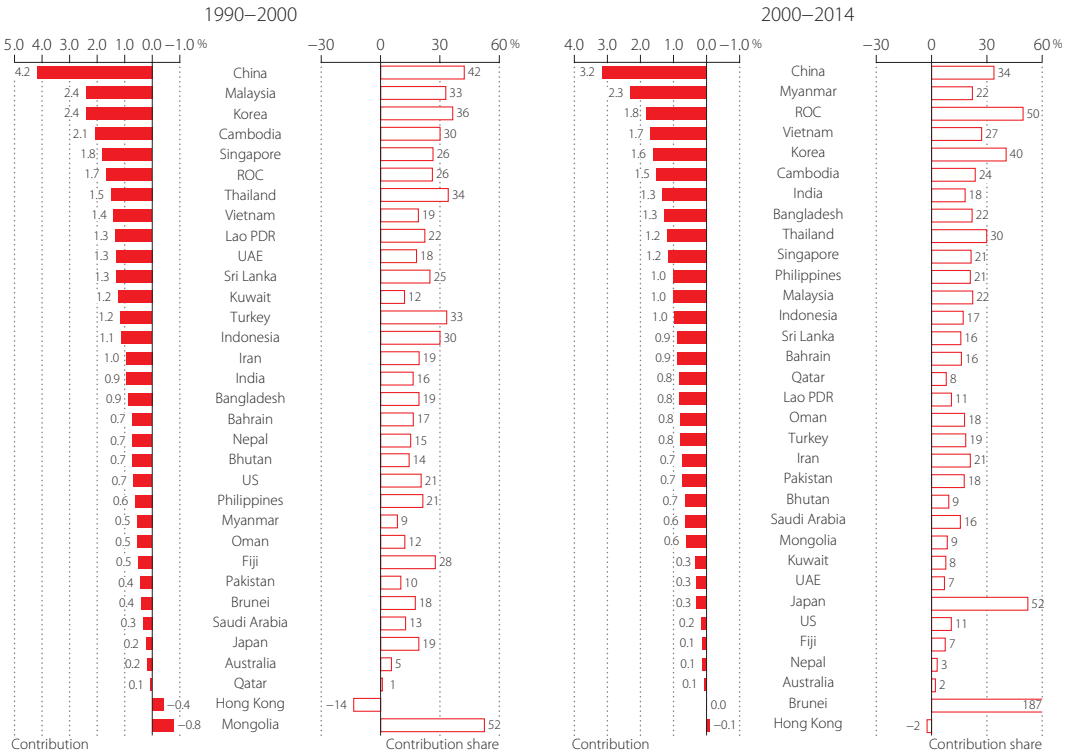

Figure 82 Contribution of Manufacturing to Economic Growth, 1990–2000 and 2000–2014

Sources: Official national accounts in each country, including author adjustments.

indicate that China's economic growth has been fueled by industry sector expansion;[100] whereas India's economic growth has been led by service sector expansion, based on their observation during 1978–2004. Although the findings broadly support their conclusion, it also discerns that the nature of growth in China may have started shifting more toward services in recent years.

Our results show that manufacturing was the biggest contributor to economic growth in China until the 2000s when the service sector overtook manufacturing in this respect (Figure 81).[101] The gap between contributions of manufacturing and services was the widest in the early 1990s; narrowing in the late 1990s until a redress in 2000–2014, with manufacturing and services accounting for 34% (Figure 82) and 46% (Figure 83) of economic growth, respectively. In contrast, economic growth in India always has been dominated by services. Its growth has only become more pronounced over time. The contribution of manufacturing and services to economic growth were 18% (Figure 82) versus 61% (Figure 83) in 2000–2014, compared with 16% and 61% in 1990–2000. The increased prominence of the service sector has weakened, not so much manufacturing's hold, but agriculture's, where the contribution fell from 14% in the late 1990s to 8% in the latest period of comparisons.

100: The industry sector in Bosworth and Collins (2008) is equivalent to industry groups 2–5 in this report.

101: The Törnqvist quantity index is adopted for calculating the growth of real GDP. Using this index, the growth of real GDP into the products of contributions by industries can be decomposed:

$$\underbrace{\ln\left(GDP^{t} / GDP^{t-1}\right)}_{\text{Real GDP growth}} = \underbrace{\Sigma_j\,(1/2)\left(s_j^{t} + s_j^{t-1}\right)\ln\left(Q_j^{t} / Q_j^{t-1}\right)}_{\text{Contribution of an industry } j}$$

where Q_j^t is real GDP of an industry j in period t and s_j^t is the nominal GDP share of an industry j in period t.

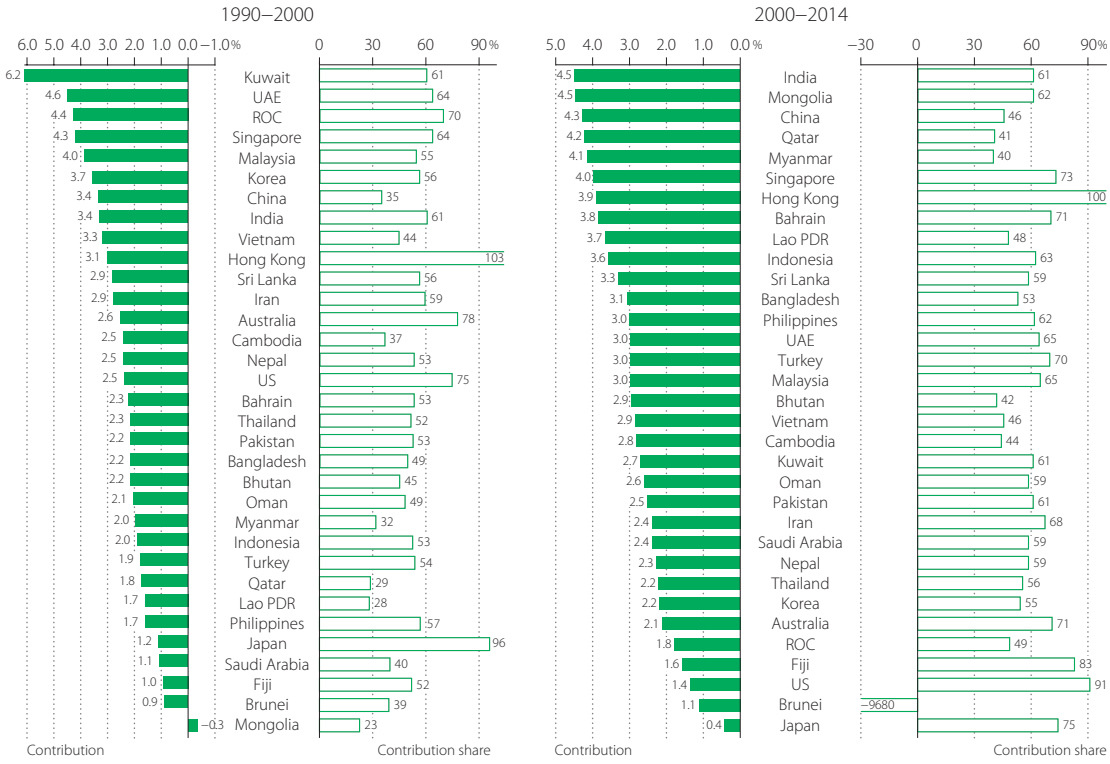

Figure 83 Contribution of Service Sector to Economic Growth, 1990–2000 and 2000–2014

Sources: Official national accounts in each country, including author adjustments.

Manufacturing has sustained its prominence in Thailand, Korea, and the ROC, contributing 30%, 40%, and 50% to economic growth in 2000–2014, respectively. Its importance is modest in Singapore at 21% (Figure 82). In Hong Kong, it has been a drag on economic growth in the past decade or so. During the Asian crisis, the most impaired economies were Thailand and Indonesia, and the sectors which bore the brunt were construction, wholesale and retail trade, hotels, and restaurants, and finance, real estate, and business activities. In contrast, manufacturing played a significant role in bolstering the economy at the time (Figure 82).

The service sector plays an equal, if not more important, role in Asian economic growth. Services made the biggest contribution to economic growth in all Asian countries except the ROC and Qatar (Figure 83). The story behind India's recent growth has been one of services. Modern information and communication technology have allowed India to take an unusual path in its economic development, bypassing a stage when manufacturing steers growth.[102] Within the service sector, contribution is quite evenly spread among the sub-sectors, more recently the iron/steel and motor vehicle sectors have been intensively developed.[103] For further improvement in per capita GDP and to capitalize on the demographic dividend (see Box 2, p. 38), expansion of labor-intensive manufacturing may be required in India for greater job creation.[104]

102: The computer software industry in India depends considerably on export demands. According to India's *Input–Output Table 2006–2007*, 82% of the output in computer and related activities is exported. This export is equivalent to 14.8% of total exports in India and is the second-largest export product (among 130 products in this table).

103: Of the total motor vehicles produced in 2015 (90.8 million), India was the 6th largest producer (4.1), following Korea (4.6), Germany (6.0), Japan (9.3), the US (12.1), and China (24.5), based on a survey by OICA (International Organization of Motor Vehicle Manufacturers). India moved up in the rankings from 15th (0.8) in 2000 to 12th (1.6) in 2005.

Economic growth in the Asian Tigers was also dominated by the service sector, albeit more so in Singapore and Hong Kong than in the ROC and Korea, where manufacturing remained a significant force. The service sector accounted for 49% of growth in the ROC for the period 2000–2014, 55% in Korea, 73% in Singapore, and 100% in Hong Kong, counterbalancing the negative contribution of 2% by manufacturing (Figures 82 and 83). These compare with 91% in the US, to counterbalance the negative contribution of 8% by construction. In the 2000s, growth in Hong Kong was highly skewed toward wholesale and retail trade, hotels, and restaurants, accounting for 39% of growth. This compares with 22% in Singapore and 17% in the ROC. In contrast, the sector contributed only 8% to Korea's growth over the same period. Finance, real estate, and business activities also played an important role, contributing 42% to growth in Hong Kong, 31% in Singapore, and 16% in the ROC.

The oil-exporting countries have different industry structures from other countries, with their reliance on mining for growth. The sector is volatile in nature and could in turn give rise to big swings in its economies from one period to another. In 2000–2014, mining accounted for 41% of economic growth in Qatar, 26% in Kuwait, and 15% in Saudi Arabia (Figure 81). Still, it has been a drain on growth, in some cases a quite significant one. Its contribution was negligible in Bahrain (0.1%) and negative in Brunei and Iran. Bahrain has been successful in branching into finance, real estate, and business activities, which accounted for 29% of the 5.4% overall growth over the same period. Oman also sustained growth of 4.4% on average per year, 59% of which originated from the service sector. Brunei has not managed as well, with dismal growth of –0.01% on average per year between 2000 and 2014. Oil and gas production activities are also reflected in Mongolia and the Lao PDR, where mining accounted for 17% and 18% of overall economic growth, respectively, in the 2000s.

For some Asian countries, agriculture is still the biggest sector. The seven countries in which the agriculture sector has the largest share in total value added are Nepal, Cambodia, Myanmar, Pakistan, the Lao PDR, Vietnam, and Bhutan (Figure 72). For the period 2000–2014, agriculture in Myanmar, Nepal, and Cambodia had the highest contribution to economic growth among all Asian countries, accounting for 28%, 28%, and 22% of growth, respectively.[105] In the latest period, agricultural output continued expanding in the majority of Asian countries, suggesting that the shrinkage in its value-added share (Figure 76) over the recent period is more a result of rapid growth in other sectors than any actual contraction of the sector.

Comparisons across the country groups in Table 17 reveal that Asia enjoyed more vibrant growth than the US in all sectors. It is notable that the US was more directly affected by the global financial crisis of 2008–2009 than Asia. Overall construction retrenched in the US in the 2000s, while growth has been strongest in CLMV and GCC countries at 9.5% and 7.9% per year on average, respectively. Apart from construction, the other fast-growing sectors in CLMV and GCC countries were transportation, storage, and communications (at over 10% per year on average), presumably reflecting their effort in building and upgrading infrastructure for their development needs. Finance, real estate, and business activities also enjoyed robust expansion at 9.0% per year on average in South Asia. Manufacturing has been growing at 10.9% per year on average in CLMV, compared with 4.4% in the ASEAN6.

Figure 84 presents the sub-industry origins of average annual growth of manufacturing GDP for selected Asian countries for the periods 1990–2000 and 2000–2014.[106] Manufacturing in Asia has been

104: The Indian government established the National Manufacturing Competitiveness Council (NMCC) in September 2004 to enhance manufacturing competitiveness. By developing this policy direction, the Prime Minister, Shri Narendra Modi, launched the "Make in India" initiative in September 2014 with an aim to give the Indian economy global recognition.

105: In Myanmar, agriculture accounted for over 27.9% of GDP in 2014. Since 1988, the government has continued its modest steps to liberalize the sector and marketing controls have been made less onerous. As a result, farm production has increased. According to official statistics, the quality of which has been questionable, this sector accounted for 27.7% of GDP growth in 2000–2014.

Table 17 Output Growth by Industry, 2000–2014

——Average annual growth rate of industry GDP at constant prices

	1. Agriculture		2. Mining		3. Manufacturing		4. Electricity, gas, and water supply		5. Construction		6. Wholesale and retail trade, hotels, and restaurants		7. Transport, storage, and communications		8. Finance, real estate, and business activities		9. Community, social, and personal services		Total economy
Bahrain	−0.6	(−0.0)	−0.2	(−0.0)	6.9	(0.9)	11.0	(0.1)	7.2	(0.6)	5.0	(0.4)	8.4	(0.5)	6.2	(1.6)	8.4	(1.4)	5.4
Bangladesh	3.7	(0.7)	7.1	(0.1)	7.9	(1.3)	8.0	(0.1)	7.4	(0.5)	6.5	(0.9)	7.3	(0.7)	4.5	(0.5)	4.7	(0.9)	5.8
Bhutan	2.0	(0.4)	11.3	(0.2)	8.0	(0.7)	10.3	(1.5)	7.6	(1.2)	11.7	(0.8)	7.9	(0.8)	8.8	(0.7)	5.3	(0.7)	7.0
Brunei	2.6	(0.0)	−2.2	(−1.3)	−0.2	(−0.0)	3.2	(0.0)	2.5	(0.1)	4.5	(0.2)	3.5	(0.1)	3.7	(0.2)	3.7	(0.7)	0.0
Cambodia	4.2	(1.4)	18.2	(0.1)	9.9	(1.5)	10.5	(0.0)	9.1	(0.5)	7.4	(1.0)	7.3	(0.5)	8.6	(0.6)	8.6	(0.8)	6.4
China	4.1	(0.5)	10.3	(0.5)	10.0	(3.2)	8.7	(0.3)	11.1	(0.7)	10.9	(1.1)	9.0	(0.7)	10.0	(1.0)	10.0	(1.4)	9.4
ROC	0.5	(0.0)	−5.4	(−0.0)	6.4	(1.8)	4.2	(0.1)	−0.3	(0.0)	3.3	(0.6)	3.2	(0.2)	3.0	(0.6)	1.9	(0.4)	3.7
Fiji	0.1	(0.0)	−2.1	(−0.0)	1.0	(0.1)	2.9	(0.1)	2.6	(0.1)	2.0	(0.4)	3.4	(0.5)	2.3	(0.4)	1.7	(0.3)	1.9
Hong Kong	−2.8	(−0.0)	−2.8	(−0.0)	−2.8	(−0.1)	1.1	(0.0)	1.4	(0.1)	5.5	(1.5)	4.0	(0.4)	4.7	(1.7)	1.8	(0.3)	3.9
India	3.1	(0.6)	5.0	(0.1)	8.7	(1.3)	8.6	(0.2)	8.0	(0.6)	8.1	(1.3)	10.1	(0.8)	10.2	(1.6)	5.5	(0.7)	7.3
Indonesia	3.6	(0.4)	1.5	(0.2)	4.6	(1.0)	7.3	(0.1)	6.8	(0.5)	5.9	(0.9)	11.1	(1.3)	6.7	(0.9)	5.3	(0.4)	5.7
Iran	3.1	(0.3)	−2.1	(−0.2)	5.6	(0.7)	7.3	(0.3)	1.5	(0.1)	4.8	(0.7)	7.8	(0.6)	5.0	(0.7)	2.6	(0.4)	3.5
Japan	−1.3	(−0.0)	−6.8	(0.0)	1.4	(0.3)	−1.8	(−0.0)	−1.5	(−0.1)	0.0	(0.0)	1.3	(0.1)	0.3	(0.0)	0.9	(0.3)	0.6
Korea	1.2	(0.0)	−0.6	(−0.0)	5.6	(1.6)	4.1	(0.1)	0.9	(0.1)	2.8	(0.3)	4.7	(0.4)	4.0	(0.8)	3.4	(0.6)	4.0
Kuwait	4.2	(0.0)	2.5	(1.1)	5.2	(0.3)	4.5	(0.1)	4.1	(0.1)	3.2	(0.2)	11.0	(0.6)	5.5	(1.1)	5.5	(0.8)	4.4
Lao PDR	2.9	(1.0)	32.6	(1.4)	8.7	(0.8)	6.0	(0.2)	9.3	(0.5)	9.6	(1.8)	8.6	(0.4)	8.9	(0.6)	11.8	(0.8)	7.6
Malaysia	2.9	(0.3)	0.3	(0.0)	3.9	(1.0)	4.6	(0.1)	5.4	(0.2)	6.5	(1.0)	6.1	(0.5)	6.6	(0.8)	5.8	(0.7)	4.6
Mongolia	4.0	(0.5)	7.4	(1.2)	7.7	(0.6)	4.1	(0.1)	9.8	(0.4)	10.4	(2.1)	12.2	(1.2)	8.7	(0.8)	3.2	(0.4)	7.3
Myanmar	6.2	(2.9)	14.0	(0.3)	16.8	(2.3)	11.4	(0.1)	16.6	(0.6)	9.1	(2.0)	16.2	(1.7)	27.1	(0.0)	12.1	(0.4)	10.4
Nepal	3.1	(1.1)	4.6	(0.0)	1.9	(0.1)	4.8	(0.1)	4.1	(0.3)	2.5	(0.4)	6.1	(0.5)	4.4	(0.6)	6.8	(0.8)	3.9
Oman	2.5	(0.0)	0.2	(0.1)	8.9	(0.8)	8.9	(0.1)	18.1	(0.7)	5.8	(0.5)	12.1	(0.7)	6.4	(0.6)	6.1	(0.9)	4.4
Pakistan	2.6	(0.6)	4.2	(0.1)	5.2	(0.7)	2.3	(0.0)	2.6	(0.1)	3.3	(0.7)	4.2	(0.5)	4.6	(0.5)	6.2	(0.9)	4.1
Philippines	2.6	(0.3)	8.7	(0.1)	4.6	(1.0)	4.0	(0.1)	5.0	(0.3)	6.0	(1.0)	6.5	(0.5)	6.7	(1.1)	2.6	(0.4)	4.9
Qatar	5.6	(0.0)	8.1	(4.2)	9.4	(0.8)	7.9	(0.1)	19.4	(1.0)	14.5	(0.9)	19.0	(0.6)	15.0	(1.7)	10.6	(1.0)	10.4
Saudi Arabia	1.3	(0.0)	1.5	(0.6)	6.3	(0.6)	6.1	(0.1)	6.2	(0.3)	9.5	(0.7)	12.0	(0.5)	6.1	(0.6)	3.8	(0.6)	4.1
Singapore	−0.8	(−0.0)	0.0	(0.0)	4.8	(1.2)	3.8	(0.1)	5.1	(0.2)	6.3	(1.2)	4.7	(0.6)	6.2	(1.7)	4.5	(0.5)	5.4
Sri Lanka	2.8	(0.3)	12.6	(0.2)	4.9	(0.9)	6.4	(0.1)	9.0	(0.7)	5.4	(1.2)	8.2	(1.0)	5.5	(0.7)	3.8	(0.4)	5.6
Thailand	2.2	(0.2)	4.5	(0.1)	4.1	(1.2)	4.9	(0.1)	2.6	(0.1)	3.4	(0.6)	5.5	(0.4)	6.0	(0.7)	3.3	(0.4)	4.0
UAE	−2.8	(−0.0)	1.4	(0.5)	3.2	(0.3)	8.8	(0.2)	7.5	(0.7)	4.7	(0.8)	7.4	(0.6)	6.5	(1.0)	8.0	(0.5)	4.6
Vietnam (regrouped)	3.5	(0.7)	2.3	(0.2)	9.3	(1.7)	10.1	(0.3)	7.7	(0.4)	7.3	(1.1)	7.6	(0.3)	5.3	(0.7)	6.9	(0.7)	6.3
APO20	2.9	(0.3)	1.6	(0.1)	4.9	(0.9)	4.0	(0.1)	3.8	(0.2)	4.6	(0.7)	6.0	(0.5)	5.2	(0.8)	2.9	(0.5)	4.1
Asia24	3.4	(0.3)	5.1	(0.2)	7.2	(1.7)	5.8	(0.1)	6.4	(0.4)	6.2	(0.9)	7.0	(0.6)	6.3	(0.9)	5.0	(0.8)	5.9
Asia30	3.4	(0.3)	3.7	(0.2)	7.1	(1.6)	5.8	(0.1)	6.5	(0.4)	6.3	(0.8)	7.1	(0.6)	6.4	(0.9)	5.0	(0.8)	5.8
East Asia	3.7	(0.3)	10.0	(0.3)	7.6	(2.1)	5.2	(0.2)	6.2	(0.4)	6.1	(0.7)	5.7	(0.5)	5.2	(0.7)	5.0	(0.9)	6.0
South Asia	3.0	(0.6)	5.2	(0.1)	8.2	(1.2)	7.7	(0.1)	7.8	(0.5)	7.3	(1.2)	8.7	(0.7)	9.5	(1.4)	5.4	(0.7)	6.6
ASEAN	3.9	(0.4)	1.8	(0.1)	5.0	(1.1)	5.9	(0.1)	6.4	(0.3)	5.9	(1.0)	9.3	(0.8)	6.4	(0.9)	4.7	(0.5)	5.4
ASEAN6	3.1	(0.3)	1.5	(0.1)	4.4	(1.0)	5.2	(0.1)	5.8	(0.3)	5.4	(0.9)	8.8	(0.8)	6.5	(0.9)	4.4	(0.5)	5.0
CLMV	4.6	(1.3)	4.0	(0.3)	10.9	(1.8)	10.1	(0.2)	9.5	(0.5)	8.0	(0.7)	11.6	(0.7)	5.7	(0.5)	7.8	(0.6)	6.6
GCC (reference)	1.0	(0.0)	2.0	(0.8)	5.9	(0.6)	7.0	(0.1)	7.9	(0.4)	7.4	(0.6)	10.6	(0.5)	6.8	(0.8)	5.1	(0.7)	4.6
US	2.4	(0.0)	2.2	(0.1)	1.0	(0.2)	−0.5	(−0.0)	−2.5	(−0.1)	1.3	(0.2)	3.4	(0.3)	2.1	(0.7)	1.0	(0.3)	1.5
Australia	2.0	(0.1)	4.4	(0.4)	3.1	(0.1)	1.0	(0.0)	4.7	(0.4)	2.7	(0.3)	3.3	(0.3)	3.1	(0.6)	3.1	(0.9)	3.0
Turkey	1.6	(0.2)	1.6	(0.0)	4.2	(0.8)	4.7	(0.1)	4.1	(0.2)	3.5	(0.6)	5.3	(0.8)	5.9	(0.9)	4.2	(0.7)	4.2

Unit: Average annual growth rate (percentage), contribution in parentheses.
Sources: Official national accounts in each country, including author adjustments.

106: The Törnqvist quantity index is adopted for calculating the growth of real GDP of manufacturing. Using this index, the growth of real GDP of manufacturing into the products of contributions by sub-industries of manufacturing can be decomposed:

$$\underbrace{\ln\left(GDP^{t} / GDP^{t-1}\right)}_{\text{Real GDP growth of manufacturing}} = \sum_{j} \underbrace{(1/2)\left(s_j^{t} + s_j^{t-1}\right) \ln\left(Q_j^{t} / Q_j^{t-1}\right)}_{\text{Contribution of a sub-industry } j},$$

where Q_j^t is real GDP of a sub-industry j in period t and s_j^t is the nominal GDP share of a sub-industry j in period t.

dominated by 3-8 (machinery and equipment) accounting for 40% or more of overall manufacturing growth in half of the Asian countries compared. In the ROC and Korea, it was about 80%. The sub-sector 3-1 (food products, beverages, and tobacco products) is the largest contributor in the Philippines for 2000–2014, accounting for 48% of manufacturing output growth. In Bangladesh and Cambodia, manufacturing growth has been dominated by the sub-sector of 3-2 (textiles, wearing apparel, and leather products), whereas in Kuwait, and to a lesser extent Singapore and Iran, it is 3-5 (coke, petroleum, chemicals, rubber, and plastic products).

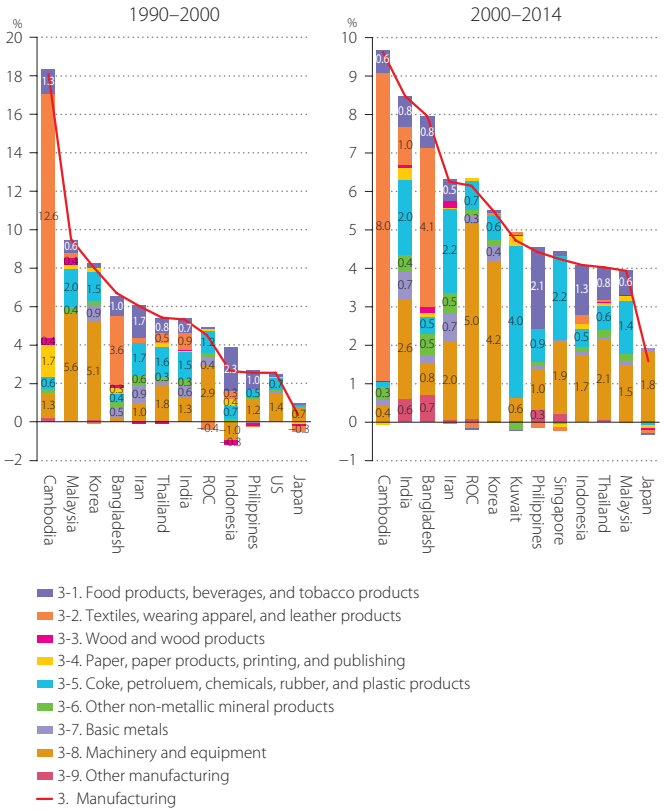

Figure 84 Industry Origins of Output Growth in Manufacturing, 1990–2000 and 2000–2014
——Sub-industry decomposition: Average annual growth rate of GDP at constant prices of manufacturing

Sources: Official national accounts in each country, including author adjustments.

Figure 85 contrasts industry contributions to economic growth for the periods 1990–2000 and 2000–2014, as well as between the US and Asian averages.[107] Even within such a short period, one can see that the industry structure of growth is changing. The first striking feature is the dominance of manufacturing in Asian countries. Between 1990 and 2000, its contribution to economic growth in the Asia24 was 31% compared to 21% in the US. Although its significance has fallen in recent years, it still accounted for 29% of economic growth in the Asia24 between 2000 and 2014, compared with 11% in the US. This, however, masks a divergence within Asia. In the earlier period, manufacturing accounted for 37% of growth in East Asia but only 16% in South Asia. The corresponding figures were 35% and 18% in 2000–2014. The differential is somewhat narrowing.

In the ASEAN, manufacturing's contribution was reduced to 21% in 2000–2014 from 29% in the 1990s, while wholesale and retail trade, hotels, and restaurants increased from 16% to 18%. In the US, the finance, real estate, and business activities sub-sector made the biggest contribution in both periods, accounting for 30% of economic growth in 1990–2000 and rising to 45% in 2000–2014. In contrast, its contribution in the Asia24 was 15% in the period 2000–2014. Mining in GCC countries took a hit in 2008–2009 due to the downturn in the world economy. Consequently, the contribution of mining fell from 26% to 18% between the two periods while construction's share increased from 6% to 9%. Finance, real estate, and business activities became the biggest contributors of economic growth in GCC countries, with its share rising from 13% to 18% between the two periods.

107: Asian averages are calculated using the Törnqvist index to aggregate the growth rates of industry GDP of each country based on the two-period average of each country's shares of industry GDP to the gross regional products as weights.

Figure 86 presents industry contributions to regional economic growth in the Asia30 during 2000–2014, decomposing Figure 7 in Section 3.1 (p. 25) into countries' industry origins.[108] In each industry contribution, the top eight countries are presented. The top four industries in terms of contributions to regional growth were manufacturing (27.8%), finance, real estate, and business activities (15.1%), wholesale and retail trade (14.6%), and community, social, and personal services (13.6%). A total of 28% of Asian economic growth originated from the expansion of its manufacturing sector, two-thirds of which was accounted for by China. In other words, China's manufacturing sector alone accounted for nearly 17% of the region's economic growth. This was followed by China's community, social, and personal services (7.5%) and wholesale and retail trade, hotels, and restaurants (6.2%).

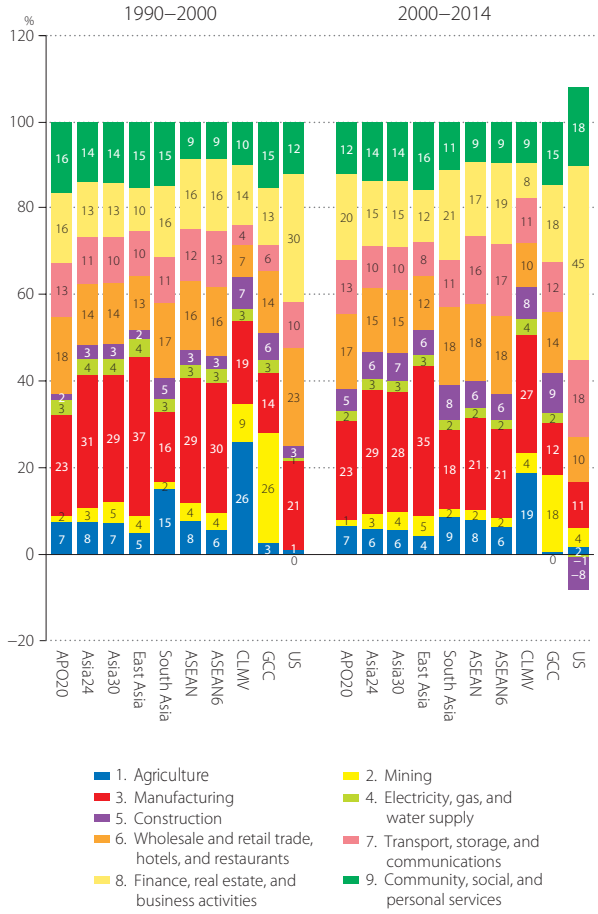

Figure 85 Industry Origins of Regional Economic Growth, 1990–2000 and 2000–2014
——Contribution share

Sources: Official national accounts in each country, including author adjustments.

Over a period of four decades there has been a noticeable shift in the industry origins of economic growth (Figure 87). For the ROC and Korea, manufacturing has been a clear driving force behind economic growth as a whole. In the decade between the mid-1980s and the mid-1990s, however, the importance of manufacturing retreated in the ROC temporarily while the economy developed its service sector. Since the mid-1990s, the role of manufacturing in the ROC has increased again, although compared to its heyday of the 1970s and 1980s its impact in terms of percentage points is much reduced. In Singapore, finance, real estate, and business activities, as well as wholesale and retail trade, hotels, and restaurants are important drivers alongside the manufacturing sector. Working within the data constraints, Hong Kong appears a clear service-driven economy in recent years. While the lack of diversification of the oil-exporting countries cannot be missed; historically, the dominance of the mining sector influenced the economic volatility of these countries. In recent years the GCC countries have been making efforts in diversifying, especially into the service sector, with different degrees of success. Bahrain and Oman are leading the way and have yielded results. The largely agricultural

108: The average growth rate of the Asian economy for 2000–2014 is set at 100%. Asian economic growth is calculated as the sum of the contributions over countries and industries:
$\sum_x (1/2)\left(S_x^t + S_x^{t-1}\right) \underbrace{\sum_j (1/2)\left(s_{x,j}^t + s_{x,j}^{t-1}\right) \ln\left(Q_{x,j}^t / Q_{x,j}^{t-1}\right)}_{\text{Contribution of an industry } j \text{ in a country } x}$ where $Q_{x,j}^t$ is real GDP of an industry j in a country x in period t, $s_{x,j}^t$ is GDP share of an industry j in a country x with respect to GDP of a country x in period t and s_x^t is GDP share of a country x with respect to the regional GDP in period t. All the industries whose contribution is more than 0.25% are shown in Figure 86.

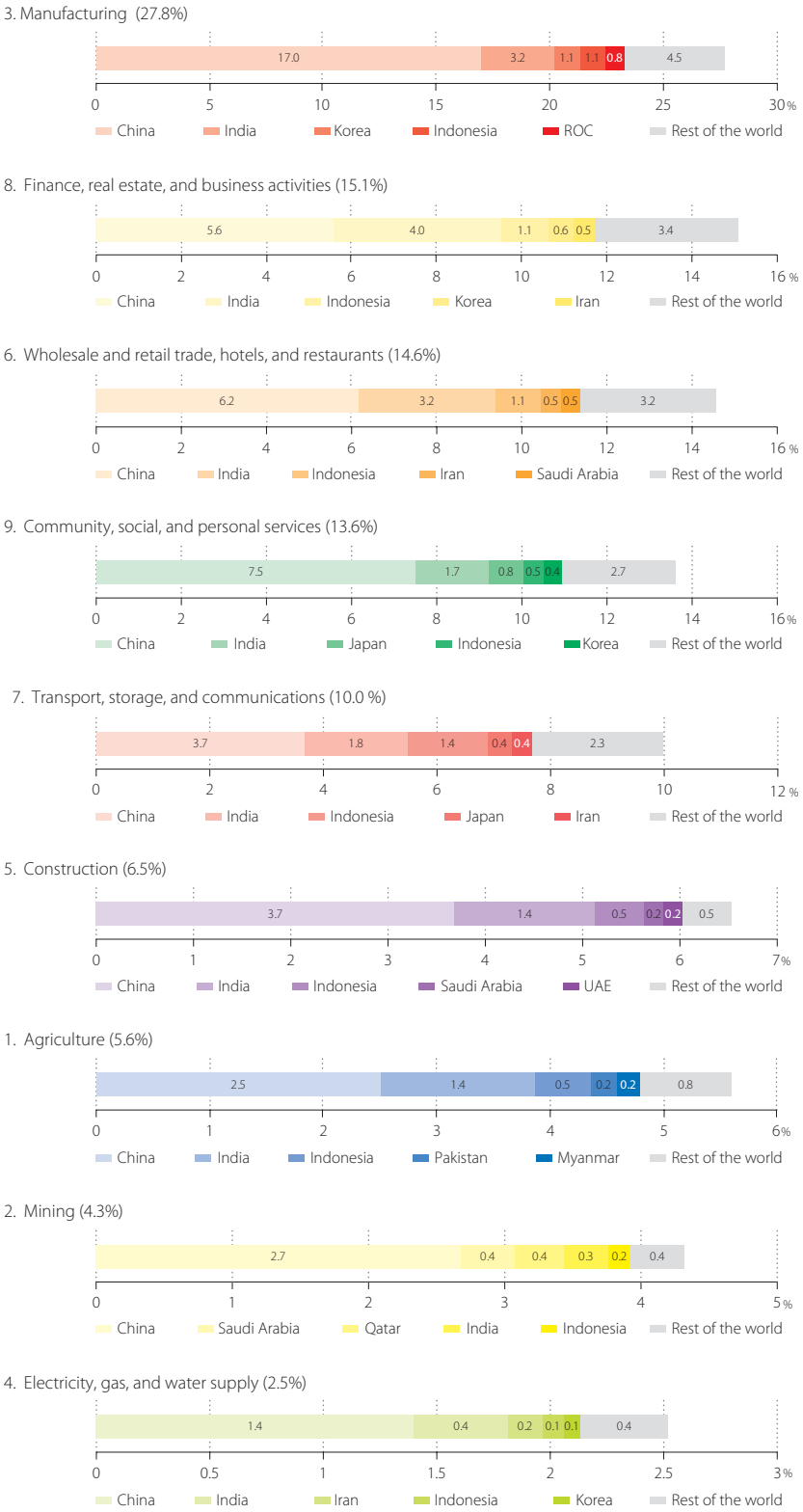

Figure 86 Industry Origins of Asian Economic Growth, 2000–2014
——Contribution to regional growth of GDP at constant prices, using 2011 PPP

Sources: Official national accounts in each country, including author adjustments.

countries are Myanmar, the Lao PDR, Cambodia, Nepal, and Pakistan, and, to a lesser extent, Vietnam and Bangladesh. In the Philippines, construction was driving economic growth in the first half of the period, but it never recovered its dominance after its crash in the mid-1980s. In the second half, economic growth was better balanced, with the development of finance, real estate, and business activities in particular.

6.3 Labor Productivity by Industry

Section 5.1 discusses per-worker measures of labor productivity performance in level terms, and identifies a large gap between Asia as a whole and the US. In 2014, Singapore and Hong Kong were the countries that had labor productivity levels comparable to the US. Besides these two, the best performers in Asia achieved productivity levels that were at least 40% of the US. However, Asia collectively was dragged down by a long tail of countries with labor productivity of less than 25% of the US level. This pulled down the average performance to 21% of the US for the APO20 and 20% for the Asia24 (Table 9 in Section 5.1, p. 65). In growth terms, however, Asia's performance far exceeded the US, allowing the countries to gradually close the gap with the US over time. Labor productivity growth in the Asia24 was 5.0% per year on average between 2005 and 2014, compared to 1.0% in the US (Table 10 in Section 5.1, p. 66).

Table 18 presents cross-country comparisons in labor productivity growth by industry[109] for the period 2000–2014.[110] Positive labor productivity growth was achieved across all sectors for the Asia24. If one focuses on the regional economy, the findings highlight the fact that service industries no longer hamper an economy's productivity performance, but are as capable as manufacturing in achieving productivity growth. In fact, there are no significant differences between manufacturing and some services in the Asia24; i.e., manufacturing (at 4.8% on average per year), electricity (4.5%), agriculture (4.4%), and transport, storage, and communications (4.3%). Construction was the sector with the slowest productivity growth at 1.4%.

Figure 88 shows the industry origins of average labor productivity growth per year in two periods: 1990–2000 and 2000–2014.[111] In the past two decades, the role played by agriculture (both positive and negative) has been diminishing in Asian countries, while the importance of manufacturing has never waned in some countries (e.g., China, the ROC, Korea, and Thailand). In India, although it has not been a major contributor in the 1990s, its contribution has expanded recently.

The manufacturing sector has been a major driving force behind productivity growth in most Asian countries, as shown in Figure 89. In the 1990s, manufacturing accounted for a significant part of labor productivity growth in Hong Kong (98%), Indonesia (32%), and China (46%). Nevertheless, its role has lessened in 2000–2014 to 7%, 17%, and 31%, respectively. In contrast, contributions from

109: Labor productivity growth in Table 18 is defined simply as per-worker GDP at constant prices by industry (v_j). The industry decomposition of labor productivity growth for the whole economy (v) in Figure 88 (industry contribution in Table 18) is based on the equation $v = \sum_j \overline{w}_j v_j^*$ where the weight is the two-period average of value-added shares. In this decomposition, the number of workers as a denominator of labor productivity (v_j^*) is adjusted, weighting the reciprocal of the ratio of real per-worker GDP by industry to its industry average. Thus, the industry contribution ($\overline{w}_j v_j^*$) is emphasized more in industries in which the per-worker GDP is higher than the industry average, in comparison with the impact ($\overline{w}_j v_j$) of using the non-adjusted measure of labor productivity.

110: The data presented in this chapter is subject to greater uncertainty than those in previous chapters and the quality across countries is also more varied. Employment data of the less developed countries often lacks frequency as well as industry details. Neither does the industry classification of employment data necessarily correspond to those of industry output data. Consequently, the quality of labor productivity estimates at the industry level is compromised. Furthermore, estimates of the manufacturing sector should be of better quality than those of the service sector as many countries have occasional manufacturing censuses, but do not have a similar census covering the service sector.

111: Not all Asian countries are included, as employment by industry sector is not available for some countries.


Bahrain
Bangladesh
Bhutan
Brunei
Cambodia
China
ROC
Hong Kong
India
Indonesia
Iran
Japan
Korea
Kuwait
Lao PDR
Malaysia
Mongollia
Myanmar
%
1971 1976 1981 1986 1991 1996 2001 2006 2011
1. Agriculture
2. Mining
3. Manufacturing
4. Electricity, gas, and water supply
5. Construction
6. Wholesale and retail trade, hotels, and restaurants
7. Transport, storage, and communications
8. Finance, real estate, and business activities
9. Community, social, and personal services
Real GDP

Figure 87 Industry Origins of Economic Growth, 1970–2014
——Industry decomposition: Average annual growth rate of GDP at constant prices

Sources: Official national accounts in each country, including author adjustments.

Table 18 Labor Productivity Growth by Industry, 2000–2014
——Average annual growth rate of industry labor productivity

	1. Agriculture		2. Mining		3. Manufacturing		4. Electricity, gas, and water supply		5. Construction		6. Wholesale and retail trade, hotels, and restauants		7. Transport, storage, and communications		8. Finance, real estate, and business activities		9. Community, social, and personal services		Total economy
Bahrain	−4.0	(−0.1)	4.5	(0.0)	2.5	(0.2)	18.4	(0.2)	−5.8	(−1.4)	−1.7	(−0.7)	−2.8	(−0.3)	6.4	(1.6)	0.8	(−1.3)	−1.7
Bangladesh	2.4	(0.1)	2.0	(0.1)	1.5	(0.4)	6.1	(0.1)	3.4	(0.4)	4.9	(0.7)	4.6	(0.5)	−4.6	(0.4)	4.1	(0.9)	3.5
Brunei	−3.9	(−0.1)	−4.2	(−1.3)	0.8	(0.0)	0.6	(0.0)	−5.0	(−1.0)	−0.5	(−0.8)	−0.3	(−0.1)	3.4	(0.2)	4.8	(0.9)	−2.3
Cambodia	4.5	(1.5)	11.4	(0.1)	4.6	(1.3)	−4.9	(0.0)	−4.6	(0.3)	−1.6	(−0.3)	0.2	(0.3)	−0.6	(0.7)	−1.0	(−0.1)	3.8
China	7.3	(1.7)	9.3	(0.5)	7.6	(2.8)	8.3	(0.3)	7.4	(0.4)	7.4	(0.8)	7.1	(0.6)	7.7	(1.0)	7.3	(0.8)	8.9
ROC	2.9	(0.1)	2.4	(0.0)	5.5	(1.7)	4.7	(0.1)	−0.6	(−0.0)	1.6	(0.2)	3.1	(0.1)	0.4	(0.4)	0.5	(0.1)	2.7
Fiji	2.0	(0.2)	−0.2	(0.1)	1.6	(0.3)	−2.8	(−0.2)	−6.4	(−0.3)	0.1	(0.0)	1.7	(0.3)	−2.2	(0.4)	1.5	(0.3)	1.1
Hong Kong	−1.9	(−0.0)	0.0	(0.0)	4.6	(0.2)	2.2	(0.0)	0.4	(0.0)	4.8	(1.1)	2.4	(0.2)	1.3	(1.1)	−0.2	(−0.2)	2.5
India	2.5	(0.1)	4.8	(0.1)	8.2	(1.2)	8.1	(0.2)	−0.9	(0.0)	4.6	(1.0)	7.1	(0.6)	5.6	(1.5)	6.1	(0.7)	5.5
Indonesia	4.0	(0.6)	−3.2	(0.1)	2.1	(0.6)	5.3	(0.1)	0.7	(0.1)	3.9	(0.5)	10.5	(1.2)	−1.9	(0.8)	0.7	(-0.2)	3.8
Iran	2.8	(0.2)	−4.6	(−0.1)	4.1	(0.5)	4.1	(0.2)	−3.3	(−0.4)	2.4	(0.4)	4.4	(0.2)	0.4	(0.6)	2.8	(0.3)	1.9
Japan	0.7	(0.1)	−1.1	(−0.0)	3.2	(0.6)	−2.1	(−0.0)	−0.1	(0.0)	−0.1	(−0.0)	0.8	(0.1)	0.5	(0.1)	0.1	(−0.1)	0.7
Korea	4.1	(0.3)	−0.1	(−0.0)	5.7	(1.6)	1.6	(0.1)	0.2	(0.0)	3.0	(0.3)	2.7	(0.2)	0.1	(0.4)	−0.5	(−0.2)	2.7
Kuwait	1.8	(0.0)	−1.6	(1.2)	0.3	(0.1)	−0.4	(0.1)	1.1	(−0.5)	1.4	(−0.2)	7.7	(0.5)	−5.1	(0.3)	−2.4	(−3.1)	−1.6
Malaysia	2.8	(0.3)	−9.5	(−0.0)	3.8	(1.0)	1.5	(0.1)	0.8	(−0.2)	1.4	(−0.2)	2.1	(0.3)	−0.2	(0.2)	3.6	(0.3)	1.8
Mongolia	3.8	(0.8)	−3.8	(1.1)	7.8	(0.6)	−3.1	(−0.0)	3.1	(0.0)	6.0	(1.2)	9.0	(0.9)	−2.2	(0.7)	0.2	(−0.1)	5.1
Nepal	0.2	(−1.0)	−2.2	(0.0)	1.4	(0.1)	5.2	(0.1)	−0.5	(0.1)	1.9	(0.3)	1.8	(0.5)	1.3	(0.5)	7.7	(0.8)	1.5
Oman	−2.0	(−0.3)	−0.7	(0.1)	0.8	(−0.1)	16.0	(0.1)	−0.8	(−4.1)	−2.0	(−1.0)	8.0	(0.6)	−4.3	(0.1)	3.3	(0.1)	−4.4
Pakistan	0.2	(−0.3)	−3.9	(0.1)	1.1	(0.1)	−2.6	(0.0)	−2.0	(−0.2)	−0.9	(0.1)	0.1	(0.3)	6.3	(0.4)	4.4	(0.6)	1.2
Philippines	1.3	(0.0)	1.3	(0.1)	3.5	(1.0)	3.3	(0.1)	1.4	(0.1)	2.7	(0.4)	3.8	(0.2)	−1.3	(0.8)	−0.2	(−0.3)	2.4
Qatar	−1.0	(−0.2)	−5.3	(3.7)	1.9	(0.1)	2.8	(0.1)	2.8	(−4.8)	3.3	(−0.6)	3.3	(0.0)	8.8	(1.4)	2.2	(−1.0)	−1.4
Saudi Arabia	−2.1	(−0.1)	1.1	(0.7)	3.7	(0.3)	2.4	(0.0)	−2.7	(−0.6)	6.0	(−0.1)	8.5	(0.3)	5.8	(0.4)	−0.3	(−1.3)	−0.4
Singapore	−8.2	(−0.0)	0.0	(0.0)	3.6	(0.9)	1.3	(0.1)	1.8	(−0.2)	2.9	(0.5)	1.4	(0.3)	1.1	(1.3)	0.0	(−0.9)	1.9
Sri Lanka	2.5	(0.2)	9.9	(0.2)	2.0	(0.4)	9.8	(0.2)	4.8	(0.5)	1.5	(0.7)	3.7	(0.7)	−0.8	(0.5)	1.9	(−0.1)	3.3
Thailand	2.0	(0.6)	2.5	(0.1)	3.7	(0.9)	6.5	(0.1)	−0.4	(−0.1)	2.0	(0.2)	6.3	(0.4)	2.9	(0.6)	0.6	(0.1)	3.0
UAE	−0.5	(0.1)	−3.9	(0.5)	−0.1	(0.1)	1.5	(0.1)	6.0	(−0.1)	−1.5	(−0.3)	1.0	(0.1)	−7.1	(0.1)	−0.7	(−2.2)	−1.6
Vietnam (regrouped)	3.0	(0.5)	−0.7	(0.2)	2.7	(0.9)	1.5	(0.3)	−1.0	(0.0)	4.0	(0.7)	6.7	(0.3)	−5.4	(0.6)	3.4	(0.4)	3.9
APO20	2.1	(0.0)	−0.7	(0.0)	2.9	(0.7)	2.3	(0.1)	−2.2	(−0.2)	1.7	(0.3)	3.2	(0.4)	0.5	(0.7)	1.3	(0.3)	2.4
Asia24	4.4	(0.7)	3.3	(0.2)	4.8	(1.4)	4.5	(0.1)	1.4	(0.0)	2.9	(0.5)	4.3	(0.5)	1.9	(0.8)	2.5	(0.4)	4.7
Asia30	4.3	(0.7)	2.0	(0.2)	4.8	(1.3)	4.5	(0.1)	1.5	(0.0)	2.9	(0.5)	4.4	(0.5)	1.9	(0.8)	2.4	(0.4)	4.5
East Asia	7.0	(1.4)	7.9	(0.3)	5.3	(1.7)	4.4	(0.2)	2.9	(0.1)	2.8	(0.4)	3.6	(0.4)	2.8	(0.7)	2.1	(0.4)	5.5
South Asia	1.9	(0.0)	3.8	(0.1)	5.8	(1.0)	5.7	(0.1)	−0.6	(0.0)	3.4	(0.8)	4.9	(0.6)	3.8	(1.3)	5.0	(0.7)	4.7
ASEAN	3.9	(0.5)	−2.8	(0.1)	2.1	(0.8)	2.6	(0.1)	0.9	(0.0)	3.1	(0.4)	7.2	(0.8)	−0.8	(0.8)	0.7	(0.0)	3.4
ASEAN6	3.4	(0.4)	−3.5	(0.1)	2.4	(0.8)	3.6	(0.1)	1.1	(0.0)	2.9	(0.4)	6.7	(0.7)	−0.5	(0.7)	0.5	(−0.1)	3.2
CLMV	4.1	(1.1)	1.2	(0.3)	4.1	(1.2)	1.0	(0.2)	0.5	(0.2)	3.5	(0.2)	9.0	(0.6)	3.3	(0.1)	3.0	(0.3)	4.3
GCC (reference)	−1.5	(−0.1)	−2.3	(0.8)	1.2	(0.2)	1.0	(0.0)	−0.6	(−0.8)	2.3	(−0.2)	4.0	(0.2)	−0.9	(0.5)	−0.4	(−1.5)	−0.9
US	3.1	(0.0)	−1.6	(0.1)	4.0	(0.4)	0.4	(0.0)	−1.7	(−0.1)	1.3	(0.1)	4.3	(0.3)	1.4	(0.5)	−0.1	(−0.2)	1.1
Australia	4.2	(0.1)	−5.5	(0.2)	1.6	(0.2)	−2.8	(−0.0)	1.7	(0.1)	1.4	(0.0)	2.2	(0.2)	0.9	(0.5)	0.3	(−0.3)	1.0
Turkey	4.7	(0.9)	−1.7	(−0.0)	1.9	(0.3)	−0.8	(0.1)	2.0	(0.0)	1.3	(0.1)	3.1	(0.7)	−1.6	(0.5)	1.0	(0.2)	2.9

Unit: Average annual growth rate (percentage), contribution in parentheses.
Source: APO Productivity Database 2016.

manufacturing strengthened from 54% to 59% in Korea, from 33% to 61% in the ROC, and from 56% to 91% in Japan between the two periods. In other economies, however, like Sri Lanka, Nepal, and Mongolia, manufacturing played a negligible role in the 2000s.

Traditionally, it has been difficult for the service sector to realize productivity growth, but modern advancements in information and communication technology have changed this. Many IT-intensive users are located in this sector, which is capable of capturing the productivity benefits arising from IT utilization. The growing importance of these services has been observed in explaining the productivity

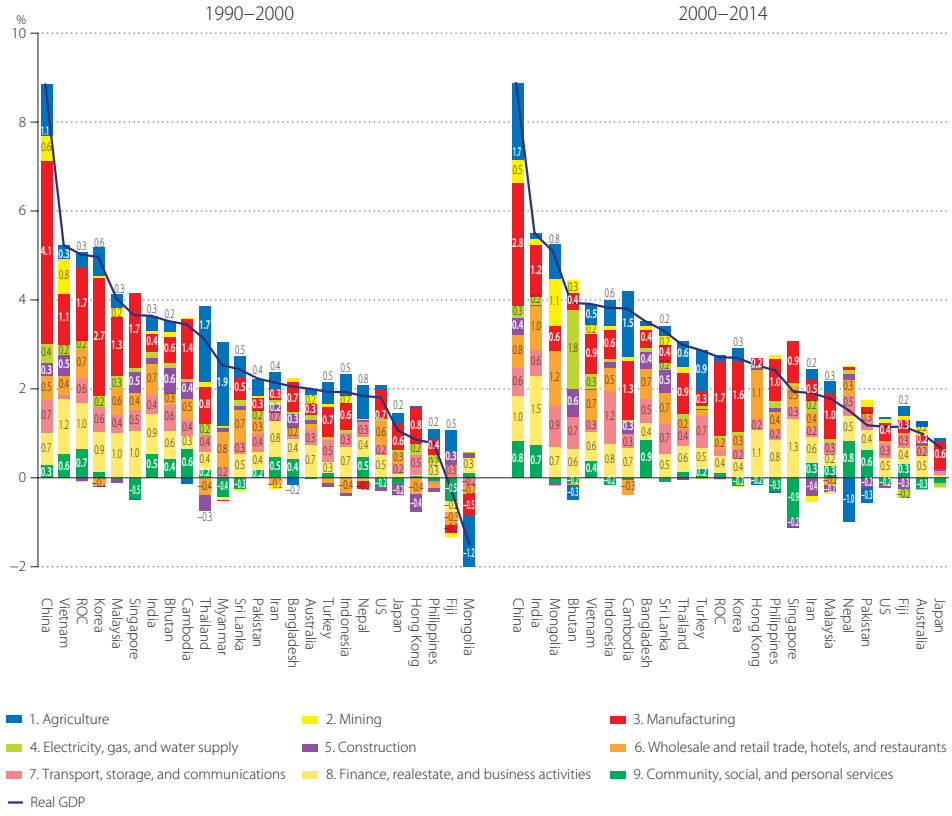

Figure 88 Industry Origins of Labor Productivity Growth, 1990–2000 and 2000–2014
——Industry decomposition: Average annual growth rate of GDP at constant prices

Source: APO Productivity Database 2016.

growth in Western economies of recent decades. In Asia, the contribution from services matches that of manufacturing. Among the four industries in the service sector, three are potentially IT-employing industries: wholesale and retail trade, hotels, and restaurants; transport, storage, and communications; and finance, real estate, and business activities.

Figure 90 presents the contribution of services in labor productivity growth by country. In 2000–2014, services were contributing at least one-third or more to labor productivity growth in most Asian countries. The contribution was predominant in Hong Kong and India, accounting for 90% and 70% of labor productivity growth, respectively. It also accounted for around two-thirds or more of labor productivity growth in Fiji and some South Asian countries like Bangladesh, India, Nepal, and Pakistan. There is an expansion of the role played by services in China between these two periods, from 26% to 36%. Only Japan failed to improve the labor productivity in the period 2000–2014.

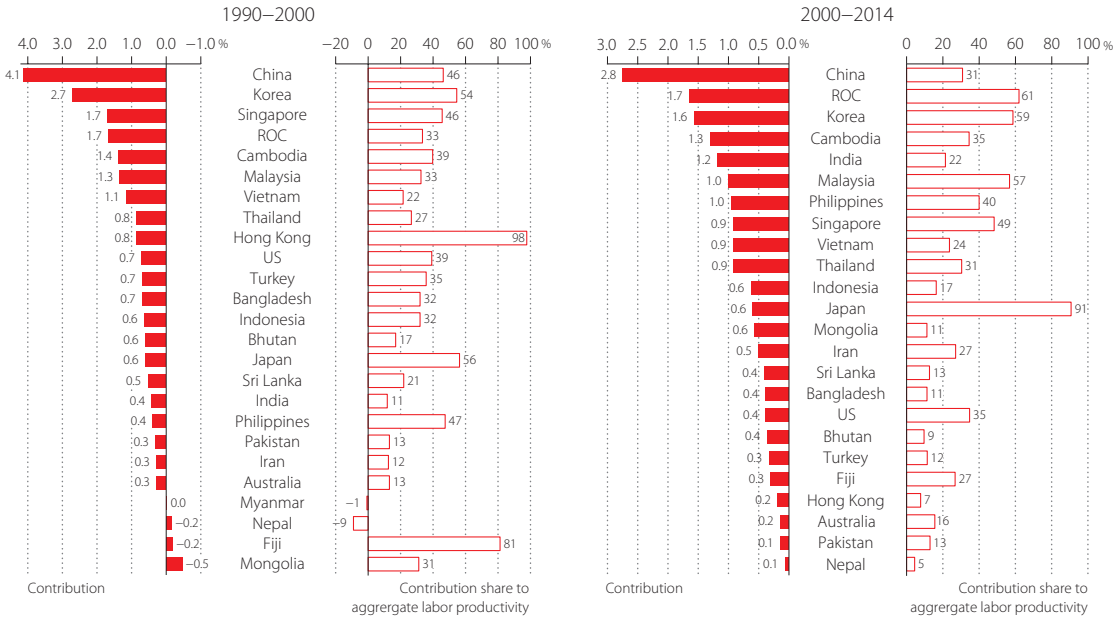

Figure 89 Contribution of Manufacturing to Labor Productivity Growth, 1990–2000 and 2000–2014

Source: APO Productivity Database 2016.

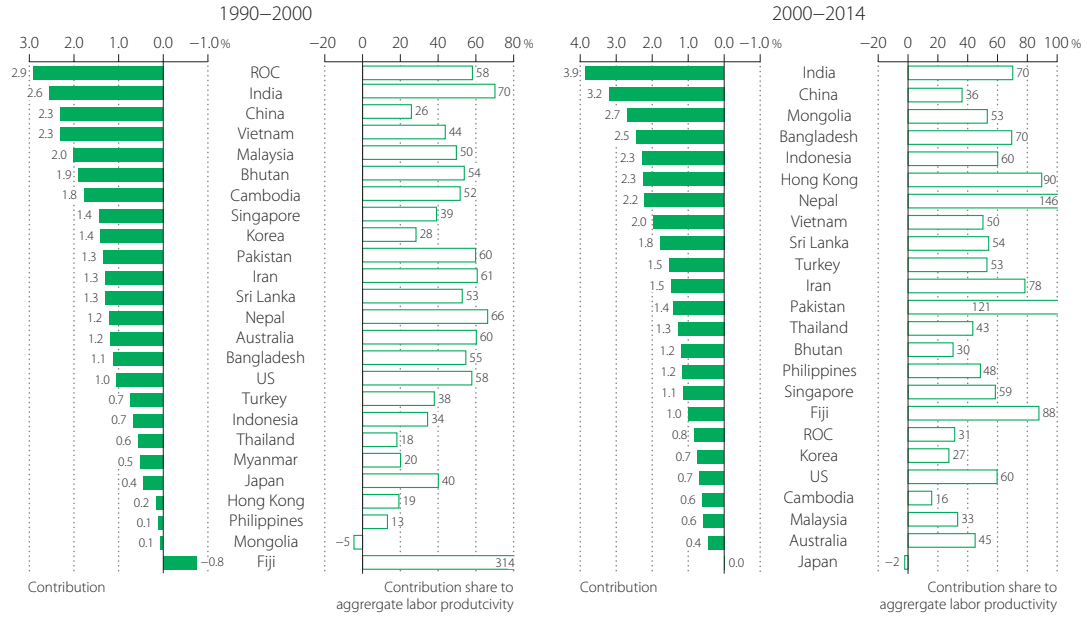

Figure 90 Contribution of Service Sector to Labor Productivity Growth, 1990–2000 and 2000–2014

Source: APO Productivity Database 2016.

Box 8 Labor Quality Changes

This edition of the Databook defines labor inputs as the simple sum of the economy-wide hours worked. The estimates of number of workers and average hours per worker have improved in this edition (see Appendix 4 for the details). In productivity analysis, however, labor inputs are expected to be quality adjusted in order to reflect workforce heterogeneity, as recommended in the SNA 2008 (United Nations, 2009).

In the stage of high economic growth, labor quality growth can be a significant factor as well as the increase in hours worked, improvement in education attainment of workers, and a shift from the self-employed (e.g., in agriculture or informal service sectors) to the employees (e.g. in manufacturing or formal service sectors).

Figure B8.1 shows the contributions of labor quality and hours worked to economic growths in Japan and the US since 1955, by Jorgenson, Nomura, and Samuels (2016). Although the US sustained a steady pace of labor quality contribution of 0.1–0.3% on average per year to economic growth over a half century, the contributions of labor quality were substantially changed in the catching up process of the Japanese economy to the US. The labor quality improvement had a significant contribution to growth by 0.7–1.1% on average per year during 1955–1980. These impacts have decreased, but labor quality changes remain factors that enhanced the growths by 0.3–0.4% for two decades after 1990 even when Japan's hours worked began to decrease.

The TFP growth measured in Chapter 5 includes the contributions of labor quality improvements by definition. On the analogy of the experiences of the Japanese economy, it may be reasonable that the current estimates of TFP growth includes the contributions of labor quality improvements, about 0.5–1.0% per year in the Asian economies. Although it is a very data-demanding exercise, our project has spent several years collecting the official data on number of workers, average hours worked per worker, and hourly wages by type of labor categories for the Asian economies. This data was necessary to develop a harmonized database of quality adjusted labor input (QALI) and to identify an impact of labor quality improvement in TFP growth.

Figure B8.2 presents the time-series comparisons of the average schooling years observed in terms of workers since 1970, based on our work-in-progress estimates. In terms of persons aged 25 years and over, published in the Human Development Index by the United Nations Development Programme (UNDP) (2015), Korea has the longest years of schoolings (11.9 years) among the Asian countries, followed by Japan (11.5 years) and Sri Lanka (10.8 years) in 2014. In our focus on employment shown in Figure B8.2, however, Japan is the leading country (13.2 years), followed by Korea (12.9 years), the ROC (12.9 years), Hong Kong (12.1 years) and Sri Lanka (11.3 years). The reverse reflects the differences in employment rate of highly

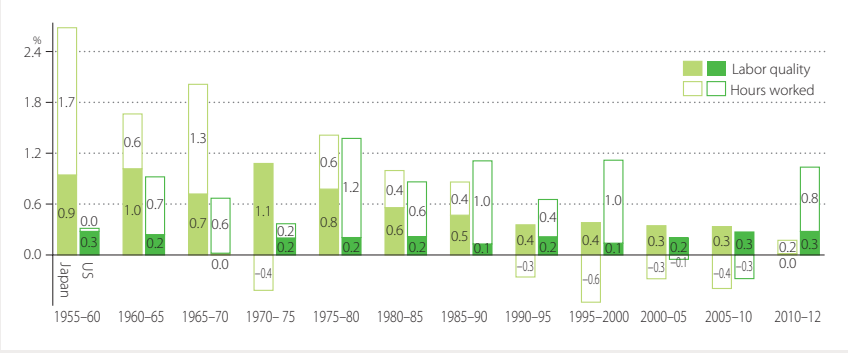

Figure B8.1 Contributions of Labor Quality to Growths in Japan and the US, 1955–2012

Source: Jorgenson, Nomura, and Samuels (2016).

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educated persons, e.g. higher rate of unemployment of educated persons in Korea. Although there is a significant range in 2014 from 4.3 years (Bhutan) to 13.2 years (Japan), the average years have been increased since 1970 in almost all economies in Asia. This improvement in labor quality should be measured in QALI. A first set of the QALI estimates are planned to be published in 2016/2017.

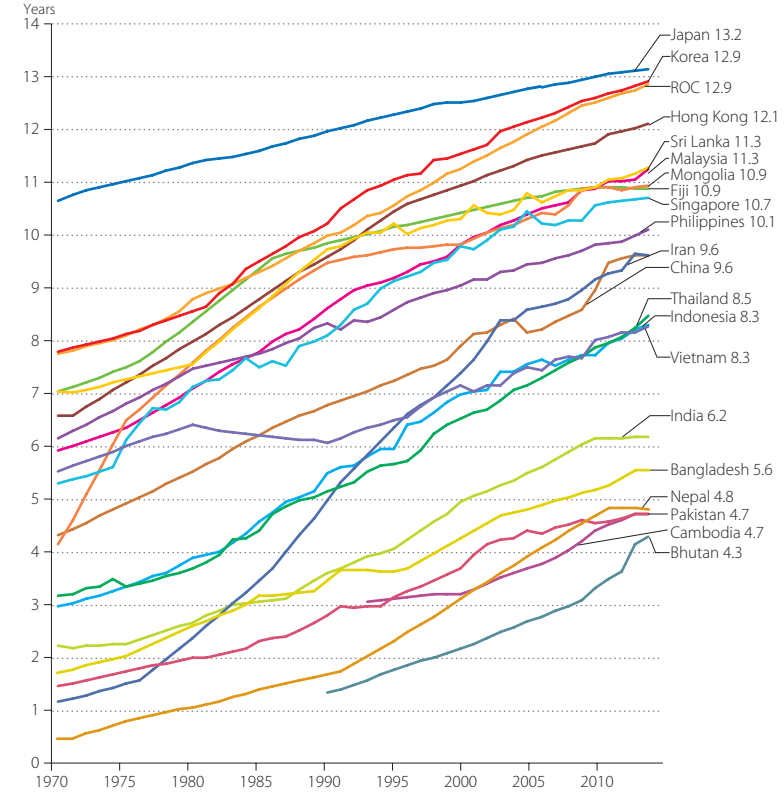

Figure B8.2 Average Schooling Years of Workers, 1970–2014

Sources: Population census and labor survey in each country, including author adjustments

Box 9 Per-Worker Wage and Income Level

Figure B9 plots per-worker average wages for employees against per capita GNI, using annual average exchange rates for selected countries in 2014 (taking the logarithms). The overall trend is a positive association; the higher average wages, the higher the per capita income. Of course, average wages are not equal to GNI per capita. First, some adjustments are needed for the number of workers in one family. Second, income from capital must be counted. If you inspect Figure B9, some countries are off the simple regression line. One outlier is Singapore, which is below the regression line. This likely reflects a large proportion of foreign workers out of total labor force who are paid lower than local workers.

Other off-lines are the ASEAN member states including Cambodia, Vietnam, the Philippines, Thailand, and Malaysia. They have relatively low wages vis-à-vis income levels. Is it because they set unfairly low wages? Probably not. Rather, in these countries, labor movements from the informal to formal sectors or from rural to urban are relatively smooth, which pushes down average wages of employees. These countries indeed gain competitiveness in the manufacturing sector and achieve rapid decreases in the population below the poverty line.

In contrast, the South Asian countries including India, Pakistan, and Nepal are above the regression line perhaps because they face a difficulty in labor movements from informal to formal or from rural to urban. The reasons may reside in both labor supply and demand. Presumably, education gaps between rural and urban are too big, or stunted modernization is too serious in rural areas. Perhaps too, poor urban infrastructure may cause high living costs and poor security conditions in urban areas. In either case, these countries suffer from an unfavorable position for the smooth growth of the manufacturing sector.

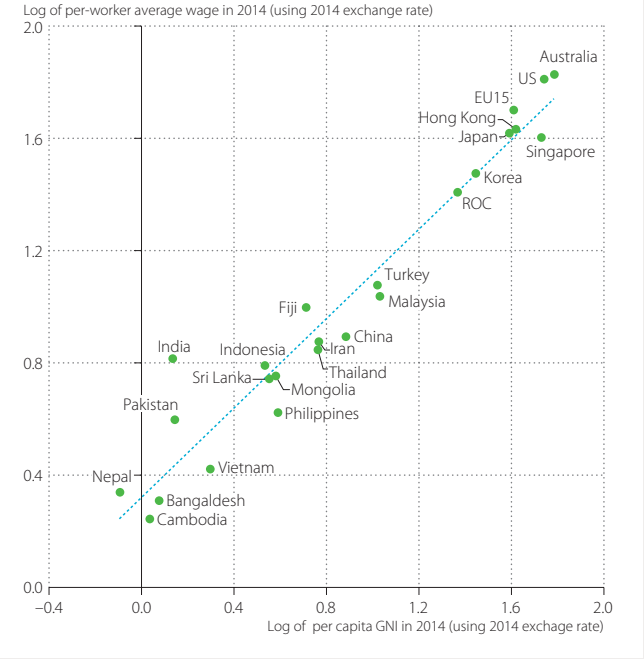

Figure B9 Average Wage and Per Capita GNI, 2014

Sources: Official national accounts in each country, including author adjustments; APO Productivity Database 2016.

7 Real Income

The constant-price GDP captures real production, not real income. An improvement in the terms of trade, which is defined as the relative prices of a country's exports to imports, explicitly raises real income and in turn welfare.[112] In many ways, a favorable change in the terms of trade is synonymous with technological progress, making it possible to get more for less. That is, for a given trade balance position, a country can either import more for what it exports, or export less for what it imports.

7.1 Real Income and Terms of Trade

By focusing on production per se, the real GDP concept does not capture this beneficial effect of the improvement in the terms of trade.[113] In contrast, real income focuses on an economy's consumption possibilities, and in turn captures the impact of a change in the relative price of exports to imports. Real income growth attributed to changes in the terms of trade can be significant when there are large fluctuations in import and export prices and the economy under concern is highly exposed to international trade, as many Asian economies are (see Figure 26 in Section 4.1, p. 45). For example, real income growth for oil-exporting countries was more than double that of real GDP growth in recent years (as in Saudi Arabia and Brunei). Meanwhile, there has been no significant difference between real income growth and real GDP growth in Myanmar, which is a relatively closed economy (see Figure 34 in Section 4.2, (p. 52) and Figure 97 for the expenditure-side and the income-side, respectively). In the 2000s, the trading gain has also driven a significant wedge between real income and real GDP in Australia. That is partly due to a fall in import prices, but owes more to the rising prices of its commodity exports.

The distinction between real income and real GDP lies in the differences between the corresponding deflators. Real GDP is calculated from a GDP deflator aggregating prices of household consumption, government consumption, investment, exports, and imports,[114] while real income is calculated from the prices of domestic expenditure, consisting of household consumption, government consumption, and investment. Therefore, real income can be understood as the amount of domestic expenditure that can be purchased with the current income flow.[115] As such, real income captures the purchasing power of the income flow. Furthermore, the Databook adopts the concept of gross national income (GNI) instead of GDP in its estimation of real income, to take into account net income transfer from abroad. Applying the method proposed by Diewert and Morrison (1986), the annual growth rate of real income can be fully attributed to three components: annual growth rate of real GDP, real income growth attributed to changes in prices of exports and imports (referred to as the trading gain),[116] and the effect of net income transfer.[117]

112: See Diewert and Morrison (1986) and Kohli (2004).

113: Kohli (2004) elaborates: "if real GDP is measured by a Laspeyres quantity index, as it is still the case in most countries, an improvement in the terms of trade will actually lead to a fall in real GDP."

114: The weight for import price changes is negative. Thus, if import prices decrease, this tends to raise the GDP deflator.

115: This definition of real income is the same as in Kohli (2004, 2006). An alternative definition is nominal GDP deflated by the price of household consumption; this is adopted by Diewert, Mizobuchi, and Nomura (2005) and Diewert and Lawrence (2006).

116: The term "trading gain" is used by some authors (Kohli, 2006). This term is adopted in this report.

117: Real income growth can be decomposed into two components as follows:

$$\underbrace{\ln\left(\frac{GNI^t}{GNI^{t-1}}\right)-\ln\left(\frac{P_D^t}{P_D^{t-1}}\right)}_{\text{Real income growth}}=\underbrace{\ln\left(\frac{GNI^t/GDP^t}{GNI^{t-1}/GDP^{t-1}}\right)}_{\text{Income transfer effect}}+\underbrace{\ln\left(GDP^t/GDP^{t-1}\right)-(1/2)\sum_i\left(s_i^t+s_i^{t-1}\right)\ln\left(P_i^t/P_i^{t-1}\right)}_{\text{Real GDP growth}}+$$

$$\underbrace{(1/2)\left(s_X^t+s_X^{t-1}\right)\left(\ln\left(P_X^t/P_X^{t-1}\right)-\ln\left(P_D^t/P_D^{t-1}\right)\right)-(1/2)\left(s_M^t+s_M^{t-1}\right)\left(\ln\left(P_M^t/P_M^{t-1}\right)-\ln\left(P_D^t/P_D^{t-1}\right)\right)}_{\text{Real income growth attributed to changes in the terms of trade (=trading gain)}}$$

where P_i^t is price of final demand i in period t and s_i^t is expenditure share of final demand i in period t. D is domestic expenditure, X is export, and M is import. Note that the real GDP growth based on this formulation may differ from that used in other chapters, since the implicit Törnqvist quantity index is adopted for calculating it.

A general observation is that over a long period of time the trading gain effect is, on average, small, but over a shorter period could be very significant.[118] The findings presented in Table 19 confirm this observation. Excluding the oil-exporting countries, the trading gain effect in 17 out of 22 economies compared, fell within the margin of ±10% of real GDP growth on average for the long period of

Table 19 Real Income, Real GDP and Terms of Trade, 1970–2014, 1995–2000, 2000–2005, and 2005–2014

——Average annual growth rate of real income, real GDP and trading gain, and net primary income transfer from abroad

1970–2014				
	Real income	Real GDP	Trading gain	Net primary income from abroad
China	8.58	8.63	−0.05	−0.01
Singapore	6.86	7.22	−0.22	−0.14
Malaysia	6.83	6.44	0.43	−0.04
Korea	6.52	6.96	−0.41	−0.03
ROC	6.27	7.03	−0.83	0.07
Bhutan	6.16	5.75	0.12	0.29
Indonesia	5.75	5.20	0.59	−0.04
Myanmar	5.74	6.15	−0.34	−0.07
Hong Kong	5.53	5.54	−0.07	0.05
India	5.37	5.42	−0.04	−0.01
Sri Lanka	5.13	5.30	−0.07	−0.09
Thailand	5.10	5.59	−0.37	−0.12
Iran	5.00	3.51	1.37	0.11
Pakistan	4.94	5.10	−0.29	0.13
Philippines	4.48	3.78	−0.01	0.71
Fiji	3.38	2.74	0.41	0.24
Bangladesh	3.29	3.36	−0.20	0.14
Japan	2.37	2.59	−0.31	0.09
Bahrain	5.54	4.88	1.08	−0.42
Kuwait	5.29	0.81	4.05	0.44
Oman	7.89	6.28	1.49	0.12
Qatar	6.75	6.26	0.48	0.01
Saudi Arabia	5.08	3.89	0.63	0.61
UAE	9.93	9.83	−0.22	0.31
(reference)				
US	2.72	2.76	−0.06	0.02
EU15	2.06	2.09	−0.02	−0.01
Australia	3.41	3.27	0.17	−0.03
Turkey	4.15	4.29	−0.12	−0.02

1995–2000				
	Real income	Real GDP	Trading gain	Net primary income from abroad
Bhutan	8.48	6.07	−0.08	2.49
Vietnam	7.37	7.41	0.21	−0.26
China	7.26	7.32	−0.14	0.08
Singapore	6.17	6.30	0.14	−0.27
Philippines	5.84	3.04	1.14	1.66
ROC	5.73	5.90	−0.14	−0.03
India	5.32	5.48	−0.17	0.01
Malaysia	5.27	5.59	0.43	−0.75
Iran	5.20	2.74	2.30	0.15
Cambodia	5.16	5.42	0.04	−0.31
Sri Lanka	4.85	5.07	−0.07	−0.15
Bangladesh	4.15	4.02	0.02	0.10
Myanmar	4.14	9.62	−4.90	−0.61
Pakistan	3.59	3.99	−0.02	−0.38
Korea	3.15	5.16	−1.95	−0.05
Hong Kong	2.75	2.39	0.37	−0.01
Fiji	2.73	2.43	−1.12	1.40
Japan	0.81	0.88	−0.16	0.09
Indonesia	−0.60	−0.39	0.62	−0.81
Thailand	−0.93	0.27	−1.20	−0.01
Bahrain	6.04	3.51	2.87	−0.35
Kuwait	6.39	1.65	4.41	0.34
Oman	7.54	4.04	3.90	−0.38
Qatar	13.46	8.62	5.80	−0.97
Saudi Arabia	4.86	3.13	2.06	−0.34
UAE	8.01	6.56	1.87	−0.42
Brunei	4.83	1.69	3.15	0.00
(reference)				
US	4.28	4.19	0.09	0.00
EU15	2.92	2.90	−0.09	0.11
Australia	4.05	3.78	0.12	0.15
Turkey	3.98	4.36	−0.31	−0.08

2000–2005				
	Real income	Real GDP	Trading gain	Net primary income from abroad
Myanmar	15.58	14.65	0.93	0.00
Mongolia	11.54	6.22	5.54	−0.24
China	11.04	9.94	0.99	0.10
Cambodia	10.11	10.37	0.00	−0.26
Iran	8.90	7.18	2.02	−0.30
Vietnam	8.15	7.68	0.57	−0.09
Malaysia	7.25	5.30	1.19	0.77
Bhutan	7.01	6.91	0.36	−0.26
India	6.99	7.24	−0.32	0.07
Pakistan	5.70	5.85	−0.78	0.63
Sri Lanka	5.54	4.71	0.72	0.11
Philippines	5.40	4.25	−0.28	1.44
Bangladesh	5.35	5.18	−0.05	0.23
Thailand	4.62	5.15	−0.01	−0.52
Singapore	3.92	4.96	0.20	−1.25
Korea	3.82	4.53	−0.70	−0.01
Indonesia	3.67	4.28	−0.99	0.38
Hong Kong	3.06	4.09	−0.98	−0.05
Nepal	2.65	3.17	−0.79	0.07
ROC	2.57	3.81	−1.44	0.21
Fiji	2.09	2.29	0.34	−0.54
Japan	1.07	1.21	−0.33	0.20
Bahrain	7.85	6.53	1.33	−0.02
Kuwait	10.59	7.20	4.56	−1.17
Oman	8.23	3.60	4.43	0.21
Qatar	12.12	9.85	4.57	−2.30
Saudi Arabia	9.14	3.97	5.20	−0.02
UAE	6.37	4.71	1.74	−0.08
Brunei	8.19	3.58	4.61	0.00
(reference)				
US	2.53	2.49	−0.03	0.07
EU15	1.93	1.76	0.07	0.11
EU28	1.77	1.63	0.06	0.08
Australia	4.30	3.36	1.17	−0.22
Turkey	4.68	4.61	0.27	−0.19

2005–2014				
	Real income	Real GDP	Trading gain	Net primary income from abroad
China	10.25	10.15	0.05	0.04
Myanmar	9.31	8.46	0.86	−0.01
Cambodia	8.36	8.23	0.17	−0.04
Mongolia	8.12	9.06	−0.18	−0.77
India	7.27	7.39	−0.07	−0.05
Vietnam	6.88	6.35	0.87	−0.35
Bhutan	6.59	7.32	−0.10	−0.63
Sri Lanka	6.53	6.43	0.24	−0.14
Philippines	5.76	5.24	−0.19	0.72
Bangladesh	5.74	5.89	−0.39	0.24
Indonesia	5.60	6.04	−0.59	0.16
Malaysia	5.44	5.00	0.33	0.12
Singapore	4.77	5.57	−1.00	0.20
Nepal	4.48	3.61	0.78	0.09
Pakistan	3.53	3.80	−0.67	0.40
Thailand	3.29	3.50	−0.16	−0.05
Hong Kong	3.06	3.44	−0.55	0.17
Korea	3.05	3.44	−0.51	0.12
Iran	2.23	2.89	−0.84	0.18
ROC	2.18	3.63	−1.50	0.06
Fiji	1.85	2.06	−0.34	0.13
Japan	0.17	0.47	−0.48	0.18
Bahrain	5.69	5.44	1.98	−1.72
Kuwait	4.32	1.84	2.68	−0.20
Oman	7.09	3.79	3.45	−0.15
Qatar	13.03	11.19	0.83	1.01
Saudi Arabia	5.59	3.66	1.75	0.18
UAE	3.76	3.77	0.15	−0.17
Brunei	4.08	−1.21	5.40	−0.14
(reference)				
US	1.30	1.26	−0.04	0.09
EU15	0.53	0.61	−0.06	−0.02
EU28	0.66	0.74	−0.06	−0.02
Australia	3.19	2.74	0.23	0.21
Turkey	3.37	3.72	−0.36	0.01

Unit: Percentage.
Sources: Official national accounts in each country, including author adjustments.
Note: See footnote 117 for the definition of real GDP growth, real income growth, and trading gain growth. The starting years for some countries are different due to data availability during 1970–2014: Brunei (1989–), Cambodia (1993–), Mongolia (2000–), Nepal (2000–), and Vietnam (1989–).

118: Short-term trends in export and import prices cannot continue indefinitely. Negative and positive trading gain effects in shorter periods cancel each other out. In the end, the accumulated effect over a long period of time often becomes negligible.

1970–2014. Movements in terms of trade have been consistently unfavorable to the ROC and Korea. In the short term, the spread of the trading gain effect is wider across countries. Australia has benefitted from the continual surge in commodity prices since the early 2000s, as such, its terms of trade have been turning strongly in its favor. The trading gain effect in Australia has therefore been rising from 3% on average per year in 1995–2000, to 35% in 2000–2005, and 8% in 2005–2014 of its real GDP growth. In terms of percentage points, the trading gain added 0.12, 1.17, and 0.23 percentage points to real GDP growth in the three consecutive periods. For the oil-exporting countries, the trading gain effect is almost always positive and significant, making it possible to sustain a rise in purchasing power with little real GDP growth in countries, such as Brunei, Kuwait, and the UAE in 2005–2014.

Over the past four decades, net primary income from abroad has not moved outside the margin of ±10% of real GDP growth on average for all 28 countries compared, except for the Philippines, Kuwait, and Qatar. Net primary income from abroad has been a long-term significant contribution to the purchasing power of the Philippines, with remittances from a large number of overseas workers. When its real GDP growth slowed (during the late 1990s), net primary income from abroad played an even greater role in cushioning the real income of Filipinos. Over the past four decades, net primary income from abroad augmented real GDP growth by 3.5% on average per year in Japan. This has grown to be more significant at 38%, as real GDP growth slowed from 2005–2014.

Figure 91 plots the time series of net primary income from abroad as a percentage of GDP. The role of net primary income from abroad has been shifting from negative to positive in Hong Kong, with the transition taking place in the mid-1990s leading up to the handover of Hong Kong from British rule to China in 1997. Since then, net primary income from abroad has been positive. A shift in the role of net primary income from abroad has also taken place in Korea from negative to a more or less neutral position in the 2000s. It has held positive in the ROC, oscillating around +2% of GDP, since 1980. Singapore's net primary income from abroad displayed the largest fluctuations, ranging from +2.0% in 1997 to –7.0% in 2004, but on the whole, it has been more negative than positive. In Japan and the Philippines, net primary income from abroad has risen strongly, albeit at different magnitudes. In Japan, it rose from 0.6% of GDP in 1990 to 3.9% in 2014, compared with 1.5% in 1990 and 34.4% in 2014 in the Philippines. In the US, it has always been positive, fluctuating within +1.6% of GDP, whereas in the EU15 it was marginally negative for the three decades between 1975 and 2005 before turning mildly positive.

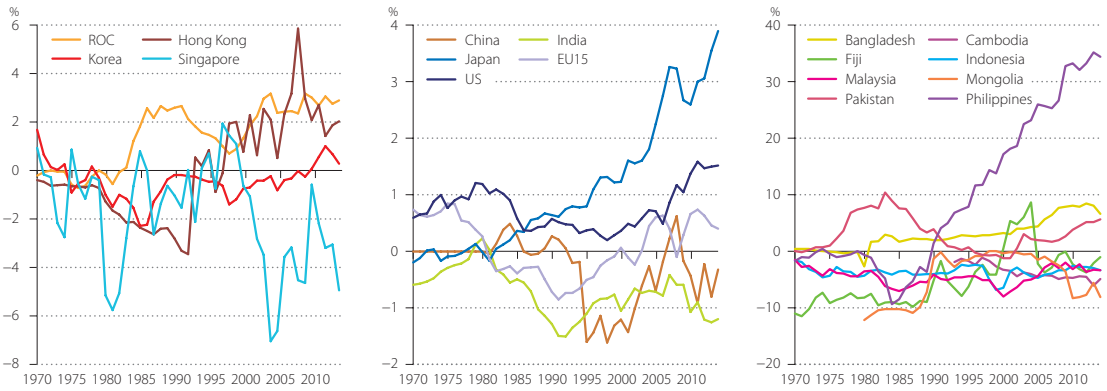

Figure 91 Effect of Net Income Transfer on GDP, 1970–2014

Sources: Official national accounts in each country, including author adjustments.

Combining both the trading gain effect and net primary income from abroad, real income growth for most of the countries compared fell within the margin of ±20% of real GDP growth (Figure 92). Kuwait and Brunei appear to be the outliers, with real income growth being 6.5 times and 3.8 times their respective long-term dismal real GDP growth of 0.8% and 1.1%.[119]

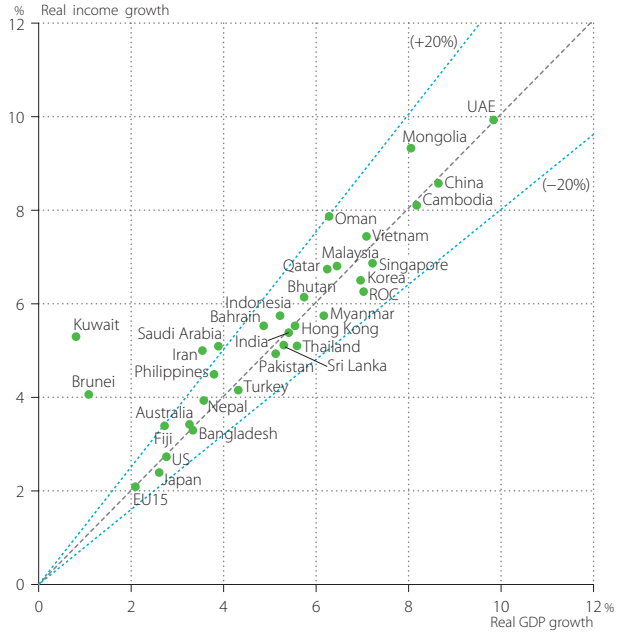

Figure 92 Real Income and Real GDP Growth, 1970–2014
——Average annual growth rate of GDP at constant prices and real income

Sources: Official national accounts in each country, including author adjustments.
Note: The starting years for some countries are different due to data availability during 1970–2014: Brunei (1989–), Cambodia (1993–), Mongolia (2000–), Nepal (2000–), and Vietnam (1989–).

Unlike the oil-exporting countries, at any one time roughly half of the Asian countries compared sustained a negative trading gain effect, albeit to variable extents, whereas the impact from net primary income from abroad was relatively less pronounced. The period of 1995–2000 reflects the impact of the Asian financial crisis. For Thailand, the trading gain effect more than outweighed the small positive average real GDP growth per year (0.3%), giving rise to a marginal fall in real income of –0.9%. In Korea, the negative trading gain also shaved 38% off real GDP growth of 5.2%, producing real income growth of 3.2%. At the start of the 2000s, the Asian economy recovered from the financial crisis, but the trading gain effect ran counter to welfare for some countries, with a negative impact that only intensified after 2005. For example, in the ROC, the trading gain effect caused real income growth to be 38% lower than real GDP growth in the period 2000–2005. However, in the period 2005–2014 it wiped out 41% of the attractive 3.6% real GDP growth on average per year, leaving real income to grow at 2.2%. Similarly, in Korea the trading gain effect caused real GDP growth to overestimate real income growth by 16% in the first half of the 2000s, which increased to 15% in the years 2005–2014 (Table 19 and Figure 93). In Japan, the negative trading gain effect more than wiped out the 0.5 percentage points of real GDP growth, leaving real income to actually fall by 0.2% per year on average in the period 2005–2014.

In contrast, the trading gain worked to counterbalance falling real GDP in Brunei, leaving it with a robust, real income growth of 4.1%, despite its contracting real GDP of 1.2% in the period 2005–2014 (Table 19). In Saudi Arabia, real income growth increased more than 153% faster than its real GDP growth. This takes place against the backdrop of strong oil prices, which spiked in mid-July 2008 to USD 145 per barrel. After dropping sharply to USD 30 per barrel by the end of 2008 (reflecting the fall in demand by the global financial crisis), oil has steadily risen to, and held at, over USD 100 per barrel

119: According to Kohli (2004) study on real income of 26 OECD countries during 1980–1996, the trading gain on average over the entire period varies across countries, from the smallest effect of –0.8% (–30.9% of real income growth) per year in Norway to the largest of 0.63% (29.4% of real income growth) per year in Switzerland.

since 2010 through the middle of 2014 (Figure 94). In the US, the trading gain effect has been unfavorable more often than not, but its positive net primary income from abroad has worked to counterbalance this and the difference between real GDP and real income growth is reduced. For example, in the latest period 2005–2014, the trading gain effect shaved 0.04 percentage points off real GDP growth of 1.26%. It was counterbalanced by the positive effect from net primary income from abroad, which added 0.09 percentage points to real GDP growth, leaving real income growth slightly higher than real GDP.

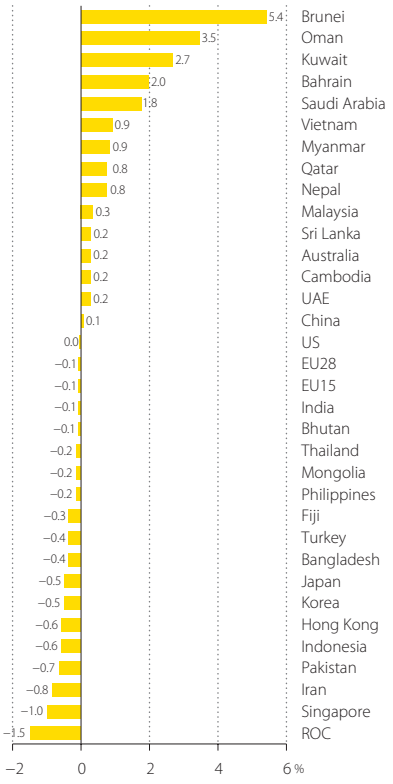

Figure 93 Trading Gain Effect, 2005–2014

——Average annual contribution to real income growth

Sources: Official national accounts in each country, including author adjustments.

Figure 95 provides the results of further decomposition of the trading gain into the terms-of-trade effect and the real exchange rate effect in Asian countries for the period 1970–2014.[120] The terms-of-trade effect is the part of real income growth attributed to the change in the relative price between exports and imports. The real exchange rate effect refers to the part of real income growth attributed to changes in the relative prices of traded goods and domestically consumed goods. By applying this result, real income growth can be decomposed into real GDP growth, terms-of-trade effect, real exchange rate effect, and net primary income from abroad. The first chart in Figure 95 applies this break down to Asian countries for the period 1970–2014. It shows that the real exchange rate effect is generally much smaller than the terms-of-trade effect, implying that the relative prices of traded versus domestically consumed goods have been largely stable in most countries. The exception is Kuwait where the real exchange rate effect accounted for 32% of real income growth. This might have reflected the weight of oil in the composition of their traded goods. The second chart shows the decomposition for the most recent period 2000–2014. It shows that the trading gain, particularly the terms-of-trade effect, is highly significant and favorable for the oil-exporting

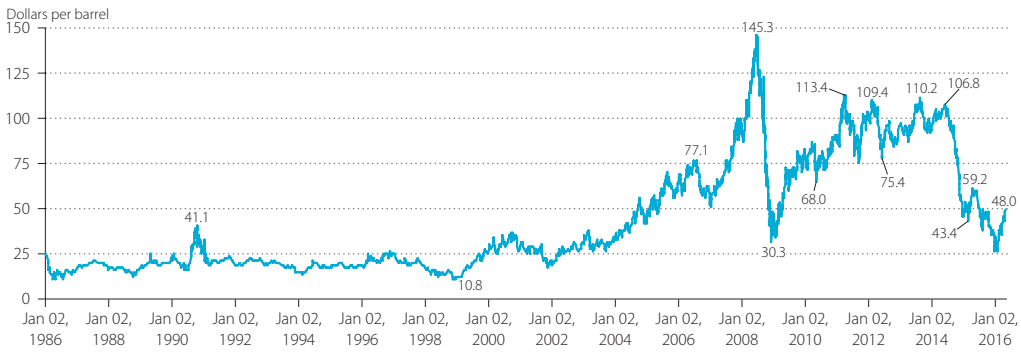

Figure 94 Price of Crude Oil, 1986 January–2016 May

Source: US Energy Information Administration, WTI spot prices FOB (Cushing, Oklahoma).

countries, but is significant and negative in a handful of Asian economies such as the ROC, Hong Kong, Pakistan, Korea, Indonesia, and Japan.

Figure 96 shows the decomposition of average annual real income growth covering two periods of major economic shocks faced by the Asian economies: during 1973–1979, which includes the two oil price hikes in 1974 and 1979; and 1996–1998 to capture the impact of the Asian financial crisis. High oil prices improved the terms for oil-exporting countries, such as Iran and Indonesia, and worsened the terms of trade for oil-importing countries. During the Asian financial crisis, the terms-of-trade effect was still the predominant factor in determining the difference between real income growth and real GDP growth. In Brunei, the terms-of-trade effect further reinforced the negative real GDP growth of –7.3%, reducing its real income growth a further 7.4 percentage points. In Iran, the negative terms-of-trade effect counteracted the 1.0% real GDP growth, giving real income growth of –1.5%. In Indonesia, the trading gain effect worked to counterbalance the contraction in real GDP, whereas in Thailand, it reinforced the negative real GDP growth. In the Philippines, although the strong favorable terms-of-trade effect was moderated by the negative real exchange rate effect, the resulting real income growth more than tripled the real GDP growth.[121]

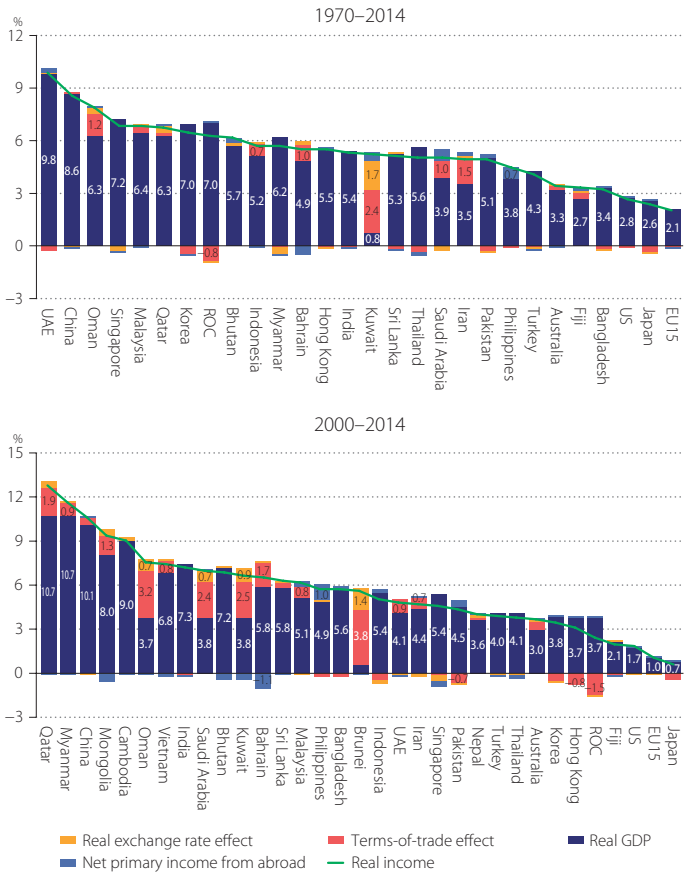

Figure 95 Decomposition of Real Income Growth, 1970–2014 and 2000–2014

Sources: Official national accounts in each country, including author adjustments.

120: Following Kohli (2006), trading gain can be decomposed into two components as follows:

$$\underbrace{(1/2)\left(s_X^t + s_X^{t-1}\right)\left(\ln\left(P_X^t/P_X^{t-1}\right) - \ln\left(P_D^t/P_D^{t-1}\right)\right) - (1/2)\left(s_M^t + s_M^{t-1}\right)\left(\ln\left(P_M^t/P_M^{t-1}\right) - \ln\left(P_D^t/P_D^{t-1}\right)\right)}_{\text{Real income growth attributed to changes in the terms of trade (=trading gain)}} =$$

$$\underbrace{(1/4)\left(s_X^t + s_X^{t-1} + s_M^t + s_M^{t-1}\right)\left(\ln\left(P_X^t/P_X^{t-1}\right) - \ln\left(P_M^t/P_M^{t-1}\right)\right)}_{\text{Terms-of-trade effect}} +$$

$$\underbrace{(1/2)\left(s_X^t + s_X^{t-1} - s_M^t - s_M^{t-1}\right)\left((1/2)\ln\left(P_X^t/P_X^{t-1}\right) + (1/2)\ln\left(P_M^t/P_M^{t-1}\right) - \ln\left(P_D^t/P_D^{t-1}\right)\right)}_{\text{Real exchange rate effect}}$$

121: Kohli (2006) calculated the trading gain, the terms-of-trade effect, and the real exchange rate effect of Canada during 1982–2005. The average annual trading gain over the entire period is very low, at 0.1%. This is small by the standard of the Asian economies. However, the trading gain later became significant, especially for the three years 2002–2005. Over these years, the average trading gain is 1.6% per year. This effect is decomposed into a terms-of-trade effect of 1.4% and a real exchange rate effect of –0.1%.

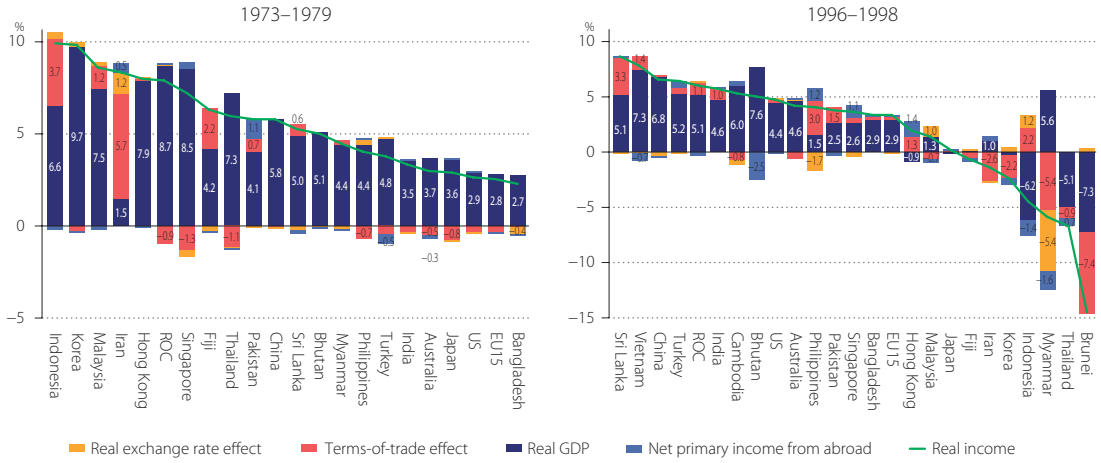

Figure 96 Decomposition of Real Income Growth, 1973–1979 and 1996–1998
——Decomposition: Average annual growth rate of real income

Sources: Official national accounts in each country, including author adjustments.

Figure 97 shows this decomposition of real income in each Asian country, along with the US, the EU15, Australia, and Turkey[122] from 1970, or the year of first data collection for the country in question. The trading gain can be positive or negative, depending on the direction of change in the terms of trade. Its impact is modest for most countries, adding less than ±1 percentage point to annual real GDP growth, except for some oil-rich countries. In the short term, one sees extreme spikes in trading gain. For instance, as a consequence of the first oil price shock, the improvement in the terms of trade was responsible for around 80% of the 40.4% increase in real income in Iran in 1974. The opposite was true in the EU15, where the negative trading gain effect counterbalanced real GDP growth, leaving virtually no growth to real income in the period 1974–1975. The effect of the second oil spike can be seen in the early 1980s. Sri Lanka, Malaysia, and Indonesia also experienced volatile variations in trading gains in the 1970s. The trading gain has been working against Singapore and the ROC's welfare for most of the period covered.

122: There are several studies on the decomposition of real income growth for other countries: Kohli (2004) for 26 OECD countries during 1980–1996, Kohli (2006) for Canada during 1981–2005, and Diewert and Lawrence (2006) for Australia during 1960–2004.


Bahrain
Bangladesh
Bhutan
Brunei
Cambodia
China
ROC
Hong Kong
India
Indonesia
Iran
Japan
Korea
Kuwait
Malaysia
Mongolia
Myanmar
Nepal
%
1971 1976 1981 1986 1991 1996 2001 2006 2011
Real GDP
Trading gain
Net primary income from abroad
Real income

Figure 97 Sources of Real Income Growth, 1970–2014

Unit: Percentage.
Sources: Official national accounts in each country, including author adjustments.

7.2 Trading Gain and Productivity Growth

When the trading gain is highly favorable, it can breed a sense of complacency with productivity performances suffering as a result. Resource-rich economies are susceptible to this pitfall because they are poised to reap some extremely positive trading gains when commodity prices turn in their favor over a sustained period of time. While commodity prices can rise, they can also fall. This is when countries' real income growth could suffer if fundamentals for real GDP growth are weak.

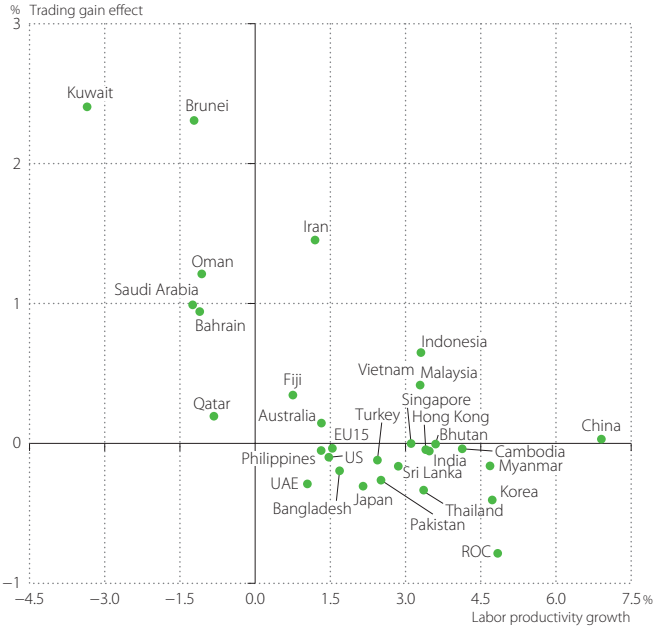

Figure 98 Trading Gain Effect and Labor Productivity Growth, 1970–2014

Sources: Official national accounts in each country, including author adjustments; APO Productivity Database 2016.
Note: The starting years for some countries are different due to data availability during 1970–2014: Brunei (1989–), Cambodia (1993–), Myanmar (1977–), and Turkey (1988–).

Figure 98 plots the labor productivity growth and the trading gain effect for the whole observation period. Over the past four decades, only five countries have enjoyed a favorable trading gain effect of over 1% per year. They are Kuwait, Brunei, Iran, Oman, Bahrain, and Saudi Arabia (all oil-exporting countries). Only Iran among them could achieve a significant positive growth in labor productivity. A resource-rich country can suffer from "Dutch disease," which is a phenomenon in which a country's currency is pushed up by the commodity boom, making other parts of its economy less competitive and potentially increasing the country's dependence on natural resources.[123] This is how resource abundance can easily lead to resource dependence.

Figure 99 illustrates trading gain effects and value-added shares of the mining sector in 1970 and 2014 in select Asian economies. It indicates that large trade gainers typically have dominant mining sectors, petroleum and natural gas in particular. Provided resource prices continuously rise, these countries continue to gain from the positive terms-of-trade effects. However, if resource prices fell, or natural reserves were depleted, then the story of the Dutch disease may appear. Richness in natural resources may become a curse if they do not have competitive industries other than mining. A way to counteract Dutch disease is broad-based, robust productivity growth and industry diversification. Figure 99 shows some of the trading gainers (i.e. Brunei, Oman, Qatar, and UAE) actively reduced their share of the mining sector over time, which could reflect the intention of developing industries other than mining. However, Figure 98 shows that labor productivity growth rates in these countries after 1990 remained low, or even negative. Even if they wanted to start industrialization, their high income and strong local currency would not easily allow them to develop a manufacturing sector or

123: The term was originated by The Economist in 1977 (*The Economist*, 26 November 1977, "The Dutch Disease.") to describe the overall decline of the manufacturing and the subsequent economic crisis in the 1960s in the Netherlands after the discovery of the large natural gas field in the North Sea in 1959.

an internationally competitive service industry. Another concern is their heavy dependence on foreign workers, both skilled and unskilled.

On the other side of coin are the resource/energy-importing economies. Most of these suffered from negative trading gain effects, losing a part of their economic growth due to resource price hikes, particularly in the 2000s (Table 19). However, it has actually strengthened their competitiveness in manufacturing and other productive activities for the future. Figure 98 also shows that many Asian countries have succeeded in achieving high growth of labor productivity while having to accept a deteriorating trading gain over the long run. These countries are typically resource importers whose voracious demand for commodities pushes up their import prices. Meanwhile, export prices tend to fall as a result of their achievement in productivity improvement, resulting in unfavorable movements in terms of trade. This is particularly the case in countries where economic growth is highly dependent on export promotion. In such instances, a negative trading gain is partially a side-effect of productivity success. Although the trading gain effect partly negates their real GDP growth, they are better positioned than before their development took off, and without productivity improvements.

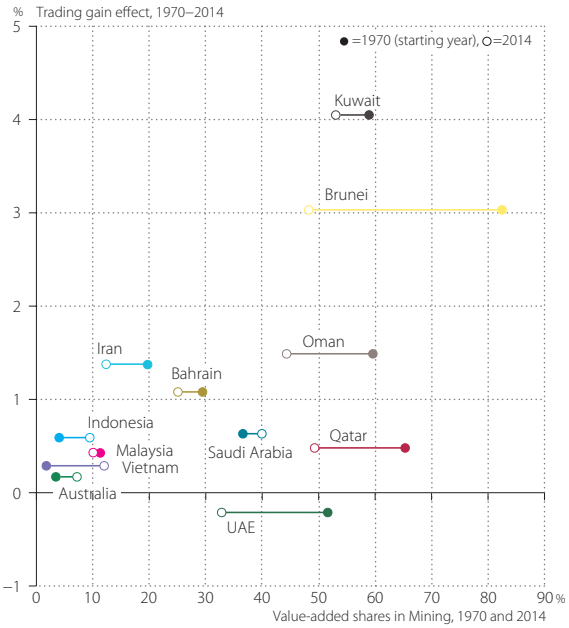

Figure 99 Trading Gain Effect and Value-added Share in Mining Sector, 1970–2014

Sources: Official national accounts in each country, including author adjustments; APO Productivity Database 2016.
Note: The starting years for some countries are different due to data availability during 1970–2014: Brunei (1989–) for trading gain effect, Brunei (1974–), UAE (1972–), Bahrain (1975–), Malaysia (1987–), and Vietnam (1986–) for value-added share of mining sector.

Appendix

A.1 GDP Harmonization

The Databook incorporates some significant revisions to the national accounts. New developments for upgrading their national accounts based on the 2008 SNA have resulted in Bangladesh, Brunei, the ROC, Indonesia, Korea, Mongolia, and Singapore during 2014–2015 and in Sri Lanka as of March 2016. Based on our Metadata Survey 2016 for the APO member economies (see Box 3, p. 54), 11 economies are already 2008 SNA-compliant in Asia and others (Cambodia, Iran, Japan, the Lao PDR, Nepal, Thailand, and Vietnam) are 1993 SNA-compliant, although it should be noted that the extent of compliance in terms of coverage may vary. The different statuses of SNA adaptions among economies are responsible for the huge variations of data definitions and coverage in national accounts, calling for data harmonization to better perform comparative productivity analyses.

This edition largely follows the concepts and definitions of the 2008 SNA and tries to reconcile the national accounts variations, in particular on the difference in the treatment of research and development (R&D), military weapon systems, software investment, and financial intermediation services indirectly measured (FISIM).[124] In order to create long-time series data for the Databook, it is necessary to use the past estimates based on the 1968/1993 SNA, with exceptions in the ROC, Korea, and Singapore who already published the backward estimates based on the 2008 SNA until the 1950s or 1960. In addition, some extra adjustments are necessary to harmonize the long-term estimates of GDP. Procedures for these adjustments are explained below.

1) FISIM

FISIM is an indirect measure of the value of financial intermediation services provided, but for which financial institutions do not charge explicitly (United Nations, 1993: para. 6.124). It represents a significant part of the income of the finance sector. The 1993 SNA recommends that FISIM should be allocated to users (to individual industries and final demands). This is in contrast to the 1968 SNA, where the imputed banking services were allocated exclusively to the business sector. The common practice was to create a notional industry that buys the entire service as an intermediate expense and generates an equivalent negative value added. As such, the imputed banking services have no impact on GDP. Therefore, the 1993/2008 SNA recommendation, if fully implemented, will impact industry GDP and the overall GDP for the total economy (by the part of FISIM allocated to final demands).

Among the 20 APO member economies, four countries – Cambodia, the Lao PDR, Nepal, and Sri Lanka – do not allocate FISIM to final demands in their official national accounts, as a result of them still not following the 1993/2008 SNA recommendation. Thus, the GDP values in these countries are smaller than others by definition. In addition, even in the countries whose national accounts follow the 1993/2008 SNA's recommendation on FISIM, the available data sometimes does not cover the entire periods of our observations. To harmonize the GDP concept among countries and over periods, final demands of FISIM are estimated for those countries in the APO Productivity Database, using available estimates of value added in Imputed Bank Service Charge (IBSC) or financial intermediation (in instances where IBSC data is not available). The ratios of value added of IBSC or financial intermediation

124: The introductions of the 2008 SNA are usually conducted with the benchmark revisions. Thus in some countries there are large revisions in data due to the uses of the newly available survey (e.g. a new survey on services) or of the new benchmark data (e.g. a new development of the supply and use table), not largely due to the revisions from the 1993 SNA. The information required to reconcile the different benchmark-year series is collected for the APO member countries through our questionnaire to the national experts in our project. In March 2016, Sri Lanka published the new national accounts based on the 2008 SNA and some large differences are found in comparison with the past estimates based on the 1993 SNA. However, this edition used the past estimates, since the sources of the difference between the two estimates are not clear and the latest data covers only the period since 2010.

on FISIM allocated to final demand are assumed to be identical with the average ratios observed in the countries in which data is available. Figure 100 describes the countries, years, and methods to adjust FISIM in the official national accounts. As described, in instances where both value added data are not available, the trend of the FISIM share on GDP is applied to extrapolate past estimates (although the impacts on GDP are minor).

Figure 101 plots per capita GDP levels in 2014 and the FISIM share in GDP in the 2000–2014 (including both of the original estimates in the official national accounts and our estimates). In countries where GDPs are adjusted, the proportions by which author adjustments for FISIM increases GDP stand at 0.6–1.2% for Nepal, Brunei, and the Lao PDR and less than 0.4% GDP in others.[125]

2) Software

The 2008 SNA recommends the capitalization of intellectual property products (IPP), which changes not only the size of GDP but also the size of capital input. One of the IPP capitalized in the Databook is computer software, which includes prepackaged software, custom software, and own-account software. Among APO member economies, 11 economies have capitalized all three types of software. Another three countries exclude own-account software in their capitalization and in one country only custom software is capitalized. For the APO Productivity Database, tentative adjustments have been made to harmonize data to include all software.

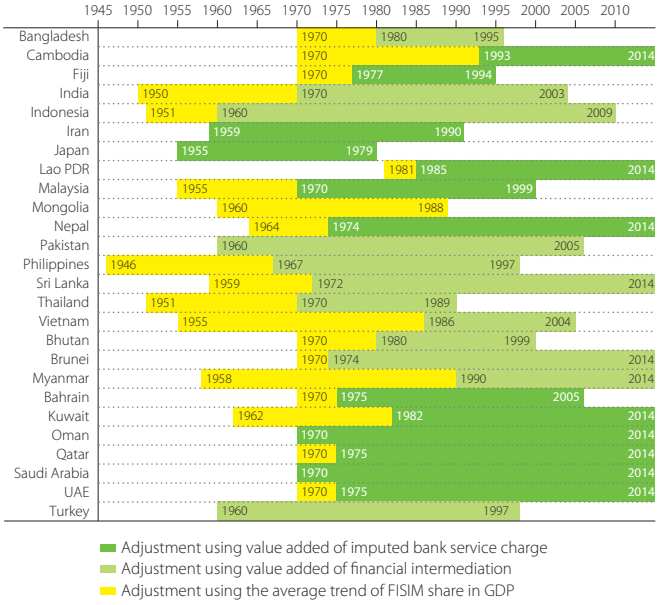

Figure 100 Adjustment of FISIM

Source: APO Productivity Database 2016.

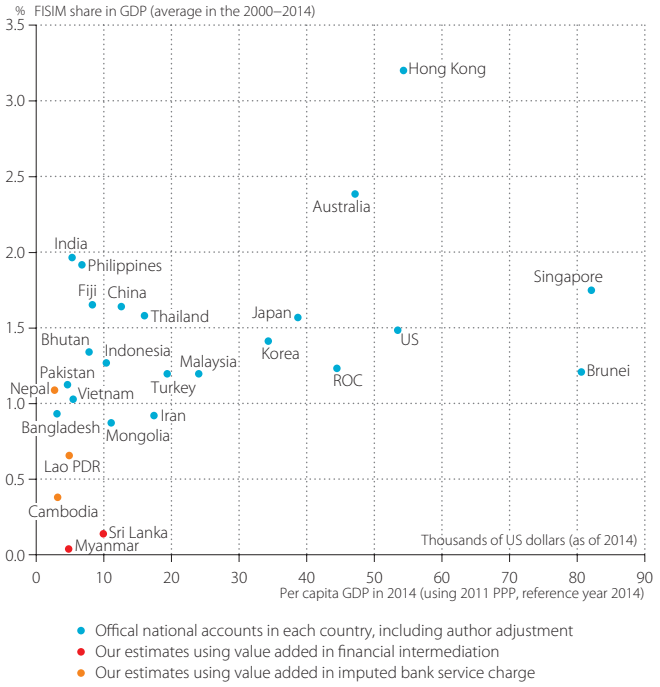

Figure 101 FISIM Share in GDP, 2000–2014

Sources: Official national accounts in each country and author estimates.

125: In this edition of the Databook, our estimates of FISIM are replaced to the official estimates for Bangladesh (revised from 0.5% to 0.9%, as the average share of FISIM on GDP during the period 2000–2014) and Indonesia (from 1.1% to 1.3%).

Among the countries studied, the data for software investment is available for the ROC, Japan, Korea, Mongolia, the Philippines, Singapore, Thailand, and China. To harmonize data, a country's GDP is adjusted to include software investment (through its software industry) by using the ratio between software investment and GDP (software ratio) and the tangible GFCF to GDP ratio (GFCF ratio). Data from the OECD Productivity Database and the APO Productivity Database suggest an inverse relationship between these two ratios (Figure 102). Countries with a low GFCF ratio tend to be those with high per capita GDP, and the observed data suggest that IT tends to play a more important role in these countries than in less developed countries.

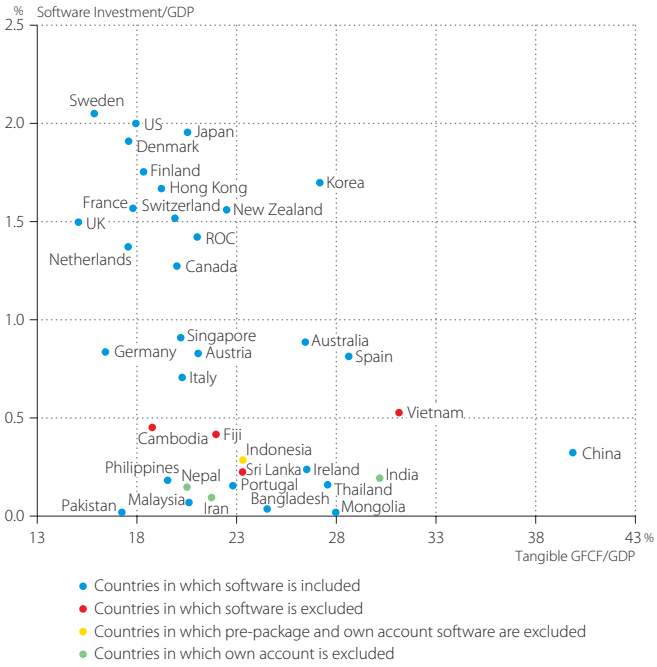

Figure 102 Software Investment Ratio and GFCF Ratio to GDP, 2005

Sources: OECD Productivity Database and author estimates.

The Databook applies the inverse relationship between these two ratios observed from the OECD countries and national accounts in Asian non-OECD countries to estimate the software ratio in 2006 for those APO member economies that do not capitalize software investment. The estimated ratios for individual countries in 2006 gradually taper off as one moves back in time. However, there is an exception. Countries at the very early stage of economic growth are found to have a GFCF ratio as low as countries with high per capita GDP, but for a different reason. The low GFCF ratio is explained by the fact that these countries have not experienced economic development yet, and in turn this does not imply an important role for software investment. In this report, Cambodia, the Lao PDR, and Nepal are regarded as countries at the very early stage of economic development, and are assigned Vietnam's software ratio accordingly, which is the lowest of all APO member economies.

Another problem arises from partial software capitalization. There are three types of software: prepackaged software, custom software, and own-account software. Countries may have capitalized one or two types of software, but software investment data is often not available separately. The Databook attempt's to adjust for the varied level of capitalization across countries by adding the type of software not capitalized to countries' GDP.

3) Valuables

Valuables are defined as "goods of considerable value that are not used primarily for purposes of production or consumption but are held as stores of value over time" (United Nations, 1993: para. 10.7). They are held under the expectation that their prices will not deteriorate and will rise in the long run. Valuables consist of precious stones and metals such as diamonds; artwork such as paintings and sculptures; and other valuables such as jewelry made from stones and metals. In a small number of countries, such as, India, Iran, Mongolia, Vietnam, and Bhutan, net acquisitions of valuables are recorded as a part of gross capital formation. For example, the SNA in India has included it since 1999,

accounting for 1.4% of GDP for India on average during 1999–2014. The current decision is to harmonize the data by excluding net acquisition of valuables from GDP in this edition of the Databook.

4) Consumption of Fixed Capital of Assets Owned by Government

At the end of 2011, Thailand officially switched to the 1993 SNA, and its national accounts became compatible with the 1993 framework for the first time. In this series, government consumption includes the consumption of fixed capital (CFC) owned by the government since 1990. In order to construct the long time-series data in the Databook series, the past data based on the 1968 SNA has been adjusted to be consistent with the new series. In the Databook, government capital stock and its CFC for the period 1970–1989 are estimated and the past government consumption and GDP are adjusted accordingly. A similar adjustment on the CFC of the assets owned by government was conducted for Bangladesh (for the period 1970–1995), Malaysia (1970–1999), and Mongolia (1970–2004).

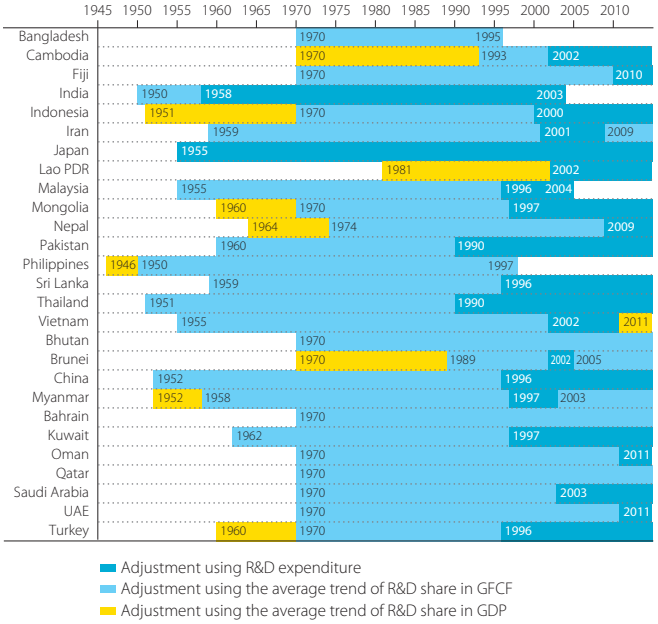

Figure 103 Adjustment of R&D

Source: APO Productivity Database 2016.

5) R&D

The Databook capitalizes the R&D by following the 2008 SNA recommendations. In the countries that still do not follow the 2008 SNA, the R&D expenditures are not allocated to GFCF (but to intermediate uses). As a result the GDP values in these countries are smaller than others by definition. To harmonize the GDP concept among countries and over periods, the R&D investment is estimated for those countries in the APO Productivity Database. As a preferable approach, the data on the R&D expenditure are collected based on the official surveys in each country, in order to estimate the R&D investment.[126] Figure 103 describes the countries, years, and methods to estimate R&D investment and adds it to GFCF in the official national accounts. If the data on R&D expenditures are not available, as a crude estimate, the trend of R&D investment shares on GFCF or GDP are applied to extrapolate past estimates. Figure 101 plots the per capita GDP and the R&D investment share in GDP in 2014. The impacts on GDP by our adjustment of the additional R&D investment are less than 1.0% of GDP for all countries in 2014.

6) GDP at basic prices

GDP can be valued using different price concepts: factor cost, basic prices, and market prices. If the price concept is not standardized across countries, it will interfere with the international comparisons. All the countries covered in this Databook officially report GDP at market prices (or at purchasers'

126: In the case of Japan, in which the official estimates of the R&D investment data are not published yet, the R&D investment series are developed based on the related expenditures in Survey on the Research and Development by the Statistics Bureau of Japan, covering the period of 1952–2014 by Nomura.

prices), but this is not true for GDP at factor cost and GDP at basic prices. International comparisons in Chapter 3 (on economic scale and growth) and Chapter 4 (on final demand) are based on GDP at market prices. However, by valuing output and input at the prices that producers actually pay and receive, GDP at basic prices is a more appropriate measure of countries' output than GDP at market prices for international comparisons of TFP and industry performance, as it is a measure from the producers' perspective. Hence, Chapter 5 on whole-economy productivity performance is based on GDP at basic prices, including our estimates.

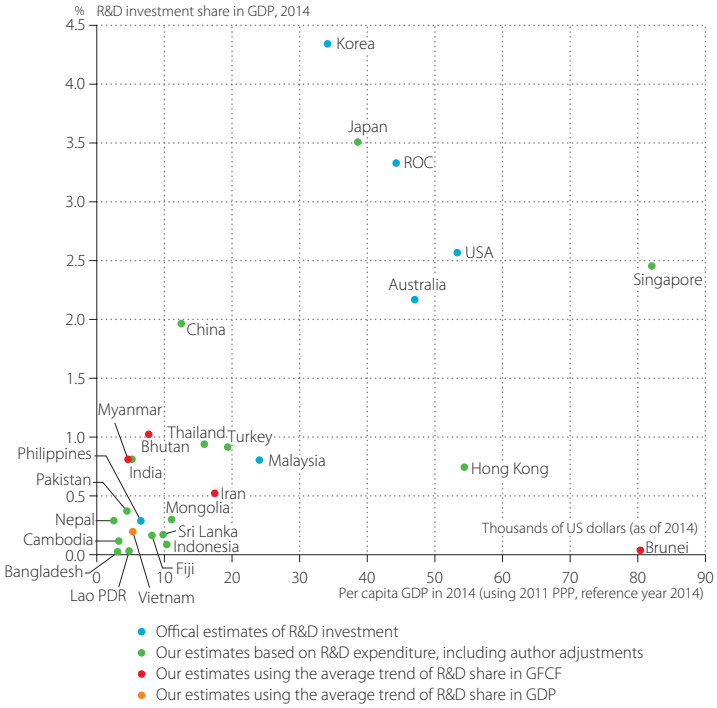

Figure 104 R&D Share in GDP, 2014

Sources: Official national accounts; Surveys on R&D in each country; World Bank, *World Development Indicators 2015*, including author adjustments.

These concepts of GDP differ in the treatment of indirect tax and subsidies (and import duties). The difference between GDP at basic prices and GDP at market prices is "taxes on products" minus "subsidies on products." "Taxes on products" are the indirect taxes payable on goods and services mainly when they are produced, sold, and imported, and "subsidies on products" are subsidies payable on goods and services mainly when they are produced, sold, and imported. Since GDP at basic prices is available for some economies, such as Hong Kong, India, Korea, Mongolia, Nepal, Singapore, and Sri Lanka, a GDP at basic prices calculation, needs to be constructed for all other countries. In order to obtain GDP at basic prices, "taxes on products" and "duties on imports" are subtracted from GDP at market prices, which are available for all the countries studied, and "subsidies on products" is added. The main data sources for estimating "taxes on products" and "subsidies on products" are tax data in national accounts, the IMF's Government Finance Statistics, and the input-output tables in each country.

Readers should bear these caveats in mind in interpreting the results in Chapter 6, since the definition of GDP by industry differs among countries due to data availability. GDP is valued at factor cost for Fiji, and Pakistan, at basic prices for Cambodia, Hong Kong, India, Korea, the Lao PDR, Mongolia, Nepal, and Singapore, at producers' prices for Iran, the ROC, and the Philippines, and at market prices for Bangladesh, Indonesia, Japan, Malaysia, Sri Lanka, Thailand, and Vietnam. In this sense, APO industry data should be treated as a work in progress as it is difficult to advise on data uncertainty. These issues will be developed and examined in the future.

A.2 Capital Stock

At present, half of APO member economies publish estimates of capital stocks in their systems of national accounts. Even where estimates are available, users must be mindful of differences in methodologies and assumptions used to estimate capital stock, as well as a large diversity in the treatment of quality adjustment in price statistics among countries. In the APO Productivity Database 2016, a harmonized methodology has been applied in estimating capital stock and capital services, covering 20 Asian economies: Bangladesh, Cambodia, China, the ROC, Fiji, Hong Kong, India, Indonesia, Iran, Japan, Korea, Malaysia, Mongolia, Nepal, Pakistan, the Philippines, Singapore, Sri Lanka, Thailand, and Vietnam, and the US as a reference country.

Quality changes in the aggregate measure of capital input can originate from two kinds of sources, namely the composition change by type of asset, and the quality change in each type of asset. To take the composition change of assets into account, the current database classifies 11 types of assets (shown in Table 20). For countries in which detailed investment data is not available from national accounts, the 11 types of investment data are estimated based on the benchmark input–output tables and our estimates of the commodity flow data of domestic production and export/import of assets. The input-output tables and supply and use tables are listed in Table 21. The starting years for estimating capital stock based on the perpetual inventory method is 1901 for the US, 1951 for the ROC, 1952 for China, 1953 for Korea, 1955 for Japan, 1960 for Singapore, 1961 for Hong Kong, and 1970 for other countries.

Table 20 Asset Classification and Parameters in Hyperbolic Function

	T	β
1. IT hardware	7	0.50
2. Communications equipment	15	0.50
3. Transportation equipment	15	0.50
4. Other machinery and equipment	15	0.50
5. Residential buildings	30	0.75
6. Non-residential buildings	30	0.75
7. Other construction	40	0.75
8. Cultivated assets	10	0.50
9. R&D	10	0.50
10. Computer software	3	0.50
11. Other intangible assets	7	0.50

Source: APO Productivity Database 2016.

Table 21 Input-Output Tables and Supply and Use Tables

Input-Output Tables and Supply and Use Tables	
Bangladesh	1981/1982, 1993/1994, 2000
ROC	Benchmark (1981, 1984, 1986, 1989, 1991, 1994, 1996, 1999, 2001, 2004, 2006, 2011) Annual (2006–2014)
Fiji	1972, 1982, 2005
India	1993/1994, 1998/1999, 2003/2004, 2006/2007, 2007/2008
Indonesia	1971, 1975, 1980, 1985, 1990, 1995, 2000, 2005
Iran	1999, 2001
Japan	1960, 1965, 1970, 1975, 1980, 1985, 1990, 1995, 2000, 2005, 2011
Korea	Benchmark (1960, 1963, 1966, 1970, 1975, 1980, 1985, 1990, 1995, 2000, 2005, 2010) Updated (1973, 1978, 1983, 1986–1988, 1993, 1998, 2003, 2006–2013)
Malaysia	1978, 1983, 1987, 1991, 2000, 2005, 2010
Mongolia	1970, 1977, 1983, 1987, 2000, 2005, 2010
Pakistan	1975/1976, 1984/1985, 1989/1990, 1990/1991, 1999/2000
Philippines	1961, 1965, 1969, 1974, 1979, 1985, 1988, 1994, 2000, 2006
Singapore	1973, 1978, 1983, 1988, 2000, 2005, 2007, 2010
Sri Lanka	2006
Thailand	1975, 1980, 1985, 1990, 1995, 1998, 2000, 2005
Vietnam	1996, 2000, 2007
China	1987, 1992, 1997, 2002, 2007
Brunei	2005, 2010
Turkey	1973, 1979, 1985, 1990, 1996, 1998, 2002

It is well known that prices of constant-quality IT capital have been falling rapidly. For cross-country comparisons, it has been noted that there is great diversity in the treatment of quality adjustment in price statistics among countries. Cross-country comparisons will be significantly biased if some countries adjust their deflators for quality change while others do not. Price harmonization is sometimes used in an attempt to control for methodological differences in the compilation of price indexes, under the assumption that individual countries' price data fails to capture quality improvements. Assuming that the relative price of IT to non-IT capital in the countries compared is set equal to the IT to non-IT prices relative in the reference country, the harmonized price is formulated as: $\Delta \ln \tilde{P}_{IT}^{X} = \Delta \ln P_{nIT}^{X} + (\Delta \ln P_{IT}^{ref} - \Delta \ln P_{nIT}^{ref})$, where the superscript X denotes the country included in the comparisons, P_{IT} is the price of IT capital, and P_{nIT} is the price of non-IT capital. The price of IT capital in country X, $\tilde{P}_{IT}^{X}$, is

computed by the observed prices P_{IT}^{ref} and P_{nIT}^{ref} in the reference country and P_{nIT}^{X} in X. Schreyer (2002) and Schreyer, Bignon, and Dupont (2003) applied price harmonization to OECD capital services, with the US as a reference country, since the possible error due to using a harmonized price index would be smaller than the bias arising from comparing capital services based on national deflators.

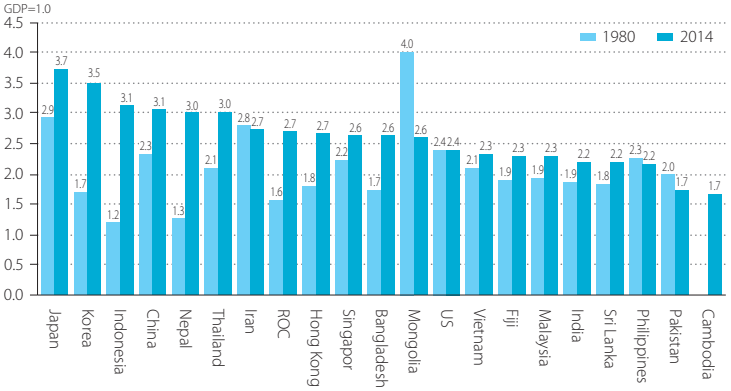

Figure 105 Capital-Output Ratio, 1980 and 2014
——Ratio of the beginning-of-period net capital stock to basic-price GDP at current prices

Source: APO Productivity Database 2016.
Note: The estimate for Cambodia is not available for 1980.

In this Databook, the same price harmonization method is applied to adjust the quality improvement for IT hardware and communications equipment in countries where the appropriate quality-adjusted price data is not available, with Japan's prices as a reference country. A similar procedure was applied in cases where the prices for some assets were not available, to estimate missing data based on the relative price of these assets to total GFCF. In measuring capital services, this Databook largely follows the framework of the OECD Productivity Database.[127] The OECD assumes the truncated normal distribution as profiles for asset discarding (retirement) and the hyperbolic distribution as profiles for asset decaying. The age-efficiency profile is defined as a combined distribution of discard and decay of assets. The age-efficiency profile in each asset is based on the two parameters in the hyperbolic function: T (average service life) and β ($-\infty<\beta\leq 1$). The hyperbolic function becomes one-hoss shay (no decay until T) when $\beta=1$ and linear when $\beta=0$. These two parameters are set, as shown in Table 20. The estimates of productive capital stock by type of asset are used in measuring capital services (see Appendix 3).

Figure 105 presents the estimated capital-output ratio (stock coefficient) that is defined by the ratio of the beginning-of-period net capital stock (all types of produced fixed assets owned by private and public institutions) to the basic-price GDP at current prices. Japan has the highest capital-output ratio among Asian countries, at 3.7. However, the ratio may not work well for cross-country comparisons since the price differential between that for GDP and fixed assets in each country is not calculated. Compared to the 1980 level in each country, all Asian countries except Iran, Mongolia, Pakistan, and the Philippines have an increasing trend of capital-output ratio, unlike the ratio in the US, which is stable.

127: See OECD (2016a) and the website of the OECD productivity statistics (http://www.oecd.org/std/productivity-stats/). The project appreciates Maria Belen Zinni (Statistics Directorate, OECD) for her supports.

A.3 Rate of Return and Capital Services

In the analysis of production and productivity, capital service provides an appropriate concept of capital as a factor of production. The fundamental assumption in measuring capital services is proportionality between the (productive) capital stock and capital services in each type of asset. Thus, the growth rates of capital services can differ from that of capital stock only at the aggregate level. For aggregating different types of capital, the user costs of capital by type of asset should be estimated. This Appendix outlines the methodology of the user cost of capital estimation and presents the estimated results of endogenous rate of return for Asian countries in the APO Productivity Database 2016.

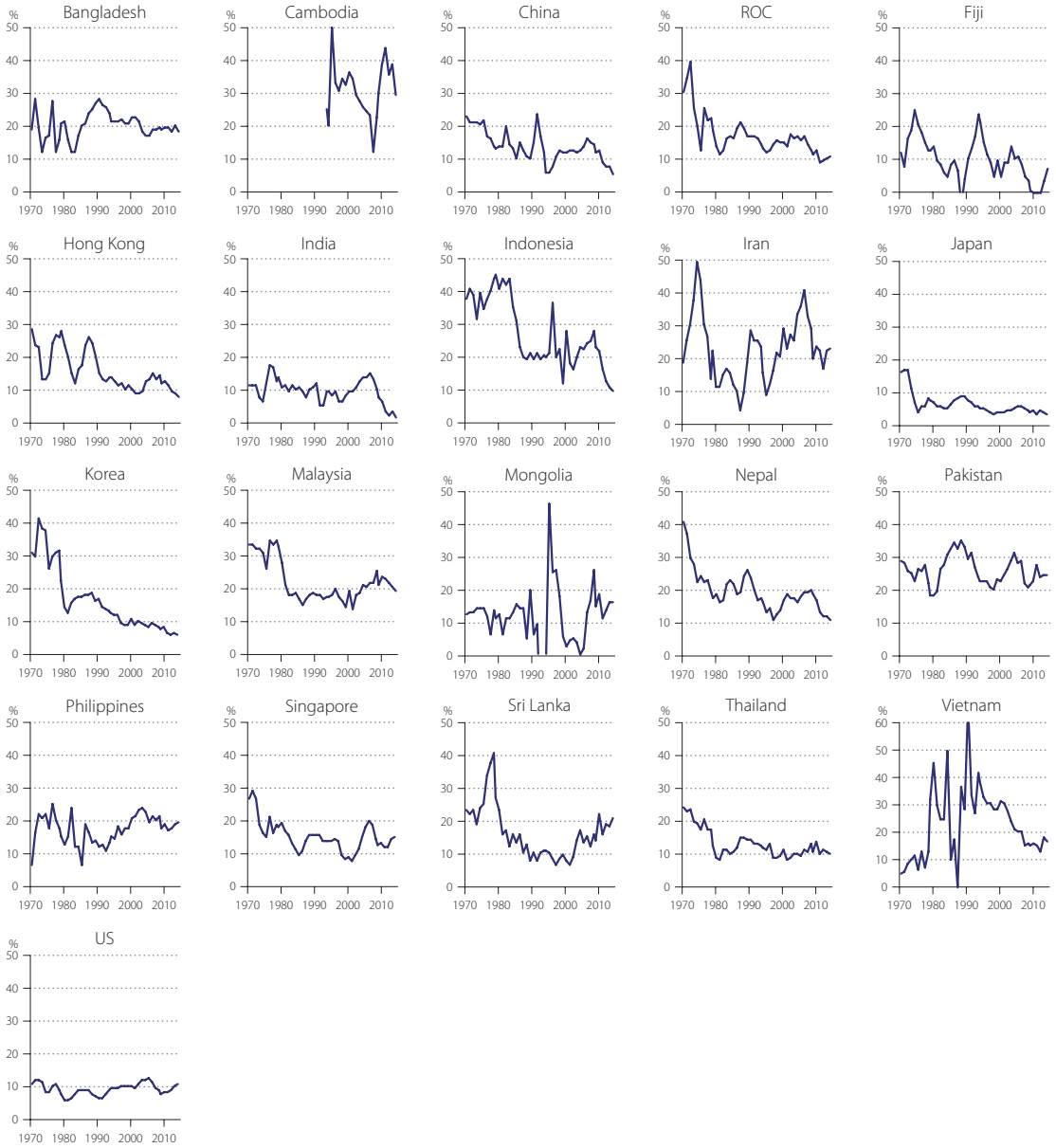

Figure 106 Ex-Post Real Rate of Return in Asia, 1970–2014

Source: APO Productivity Database 2016.

The user cost of capital of a new asset (with type of asset denoted as k of the period t), $u^k_{t,0}$, is defined as $q^k_{t-1,0}\{r_t + (1 + \pi^k_t)\,\delta^k_{P,t,0} - \pi^k_t\}$, where r_t, $\delta^k_{P,t,0}$, and $q^k_{t,0}$ are the expected nominal rate of return, cross-section depreciation rate, and asset price, respectively. The asset-specific inflation rate π^k_t is defined as $(q^k_{t,0} / q^k_{t-1,0} - 1)$. The OECD assumes the country-specific *ex-ante* real rate of return r^* that is constant for the whole period, and defines the nominal rate of return as $r_t = (1 + r^*)(1 + \rho_t) - 1$, where ρ_t represents the expected overall inflation rate, defined by a five-year centered moving average of the rate of change of the CPI (see Schreyer, Bignon, and Dupont, 2003).

One of the main difficulties in applying the ex-ante approach for measuring user cost of capital is obtaining proper estimates for real rates of return, which can differ considerably among countries and over time. On the other hand, the ex-post approach originated by Jorgenson and Griliches (1967) allows an estimation based on observed data. Assuming constant returns to scale and competitive markets, capital compensation can be derived from the summation of the capital service cost V^k_t for each asset, which is defined as the product of the user cost of capital and the productive capital stock (i.e., $V_t = \Sigma_k V^k_t = \Sigma_k u^k_{t,0} S^k_t$). Based on this identity and the n-equations of user cost of capital, the n+1 variables of $u^k_{t,0}$ and r_t are simultaneously determined, using the observed capital compensation V_t as the total sum of V^k_t that is not observable in each asset. Note that the depreciation rate $\delta^k_{P,t,0}$ is not independent of the estimated r_t.

The estimated results of the ex-post real rate of return based on $r^*_t = (1 + r_t) / (1 + \rho_t) - 1$ for 20 Asian countries and the US are shown in Figure 106. Although there are large fluctuations in countries like Thailand, Mongolia, and Vietnam, many Asian countries may exhibit decreasing trends in the (endogenous) real rate of return, while the US holds a stable rate of around 10%. Table 22 presents the five-year averages of the estimated rates for *ex-post* real rate of return during 1970–2014. In 2010–2014, the real rate of return ranged from 4.1% for Japan and 6.8% for Korea to 21.7% in Malaysia and 37.3% for Cambodia. Using these *ex-post* estimates, the aggregate capital services are measured in this report. The difference caused by the *ex-ante* and *ex-post* approaches may provide a modest difference in the growth measure of capital services, regardless of the substantial differences in the rates of return and capital compensations (Nomura, 2004).

Table 22 Average Ex-Post Real Rate of Return in Asia

	1970–1974	1975–1979	1980–1984	1985–1989	1990–1994	1995–1999	2000–2004	2005–2009	2010–2014
Bangladesh	19.1	18.8	15.9	23.5	25.2	21.5	20.6	18.8	19.2
Cambodia					22.8	36.5	30.8	22.7	37.3
China	21.7	16.5	15.2	11.8	14.7	9.9	12.5	14.4	8.6
ROC	30.3	20.2	14.4	18.8	15.8	14.1	15.9	14.2	10.5
Fiji	15.9	16.1	8.4	4.8	17.1	10.1	9.4	5.5	2.1
Hong Kong	20.5	24.2	17.6	22.5	13.7	11.7	10.1	13.8	10.2
India	9.8	14.6	10.7	9.9	8.3	7.8	11.4	12.0	3.6
Indonesia	37.8	40.4	41.3	23.0	20.2	22.5	21.2	24.7	14.3
Iran	32.5	27.6	14.3	11.1	23.9	15.9	27.9	32.0	21.7
Japan	13.9	6.5	5.8	8.1	6.4	4.2	4.6	5.1	4.1
Korea	35.8	28.4	15.6	18.0	14.4	10.5	9.7	8.7	6.8
Malaysia	32.6	32.5	20.9	17.2	17.6	17.4	18.3	22.3	21.7
Mongolia	13.0	11.0	10.6	13.3	–4.0	23.9	2.9	14.0	14.8
Nepal	31.6	21.3	19.4	22.1	19.1	13.0	17.6	19.4	13.2
Pakistan	26.3	24.4	24.5	33.8	27.1	22.1	27.1	24.5	24.9
Philippines	17.6	19.4	15.3	14.1	12.9	16.9	22.5	20.1	18.6
Singapore	23.8	17.9	15.2	13.2	14.7	12.2	10.7	16.7	13.5
Sri Lanka	22.4	32.9	16.9	12.0	10.2	8.7	10.9	14.3	19.3
Thailand	22.4	17.3	10.1	13.6	13.1	10.5	9.9	11.2	11.4
Vietnam	8.0	14.4	35.1	18.4	41.4	30.2	27.1	17.4	15.8
US	10.9	9.3	7.0	8.4	7.9	10.0	10.9	10.1	9.5

Unit: Percentage
Source: APO Productivity Database 2016.
Note: The starting year is 1993 for Cambodia.

A.4 Hours Worked

Labor volume can be measured in three units: number of persons in employment, number of filled jobs, and hours actually worked. Given the variations in working patterns and employment legislation both over time and across countries, hours worked, if accurately measured, offers the most time-consistent and somewhat internationally comparable unit measuring the volume in each of different types of labor. This is the primary underlying reason for the importance of choosing hours actually worked in productivity analysis, but in reality, due to the difficulty in accurately estimating average hours actually worked, it is not always available or comparable across countries. The large variety of data sources, definitions, and methodologies available in estimating these labor market variables often leads to a fragmentation of labor market statistics of an individual country concerned, dubious data quality, and incomparability across countries. Here follows an attempt to outline some of these intricate measuring issues.

Data on labor volume comes from two main statistical surveys on establishment and household, with respective strengths and weaknesses. Establishment surveys are surveys of firms with stratified sample frames by the size of establishments. The concentration of total employment in a relatively small number of establishments means that this sampling strategy is cost effective in delivering high precision labor market estimates with a fairly small sampling error. Questionnaires are designed to be close to the concepts used in company administration. This has both strengths and weaknesses. On the one hand, data collected is of high quality and accuracy. On the other hand, changes in legislation and regulation could be a source of instability to the definitions, and in turn of the data collected. Furthermore data that companies do not collect for administrative purpose, such as unpaid hours and worker characteristics, are unavailable. This greatly limits the varieties of labor market data that can be collected through establishments. Employment as measured is necessarily based on jobs rather than on persons employed, as persons holding multiple jobs with different establishments cannot be identified and will be counted more than once. Information on hours is on paid hours rather than hours actually worked. Certain categories of employment, most notably the self-employed, are not covered. Sometimes small firms, informal employment (occupies more than 50% in some developing Asian countries) or the public sector is also excluded. As a result of these limitations, labor market data from establishment surveys often requires a raft of adjustments for omissions and definition modifications during the compilation process.

Household-based labor force surveys (LFS), in contrast, have full coverage of the economy, although they sometimes incorporate age or geographic exclusions and may have imperfect coverage of the armed forces and other institutional households. Nonetheless, they provide valuable data on certain employment groups such as the self-employed and unpaid family workers, and on the rate of multiple job holding. Employment status in LFS is independently determined and is not subject to the criteria used in company records. Most countries follow the International Labour Organization (ILO) definitions. As LFS are surveys from the socio-economic perspective, they also provide rich data on worker characteristics that are relevant to productivity analysis. The major weakness of the LFS, however, is data precision. By relying on the recollection of the respondents, their response also depends on perception. Response errors could, therefore, arise from confusion of concepts and imprecise recollection of the respondents concerning work patterns and pay during the reference week. Another source of errors originates from proxy response, which relies on the proxy's perception and knowledge of another household's member. A high level of proxy responses could, therefore, reduce the reliability of data collected.

The common practice of statistical offices has been to combine information from both establishment and household surveys, with a view of making use of the most reliable aspects of each of the surveys. This seems to be the most promising avenue forward in improving the quality and consistency of data on labor input. However, statistical offices could still differ a great deal in their methodologies, especially in estimating the annual average hours worked per job/person, depending on their starting points, namely LFS data or enterprise data. All these have to be taken into account in international comparisons of productivity.

In productivity analysis, ideally labor volume should be quality adjusted in order to reflect workforce heterogeneity, as recommended in the SNA 2008. To adjust total hours worked for quality would require information on worker characteristics so as to distinguish the workforce into different types, which are then weighed by their marginal productivity and approximated by their respective shares of total compensation. Deriving a quality adjusted labor input (QALI) measure is a data-demanding exercise. Even if LFS provides the required information, researchers often run into the consistency issues discussed above, as well as sample size problems as they break down the workforce into fine categories.

The APO Productivity Database 2016 defines labor inputs as the simple sum of hours worked. Hours worked are defined as the economy-wide hours worked by employees, the self-employed, and contributing family workers. Japanese and US's national accounts publish estimates of the total hours worked, as recommended by the SNA. Other Asian countries do not publish hours worked in their national accounts. For these countries the procedure of constructing economy-wide annual hours worked consists of two steps; for many Asian countries first, an average weekly hours worked is obtained and the number of workers collated from official statistics, such as LFS. The data used in this edition is listed in Table 23. Some countries do not fully provide the time-series data of average weekly hours worked. This edition of the Databook considered the changes in the composition of workforces (determined by four kinds of attributes; gender, education, age, and status of employment) in the estimation process of the time-series average hours, although the previous editions have used a linear interpolation or a fixed average hour for the

Table 23 Sources of Labor Data

Sources of Labor Data	
Bangladesh	Population and Housing Census, Labour Force Survey
Bhutan	Population Census, Labor Force Survey, Labour Market Information Bulletin, ADB Key Indicators for Asia and the Pacific
Cambodia	General Population Census, Inter-Censal Population Survey, Labor Force Survey, Socio-Economic Survey
China	China Statistical Yearbook, China Labor Statistical Yearbook, Population Census, 1% National Population Sample Survey
ROC	Population and Housing Census, Yearbook of Manpower Survey Statistics in Taiwan Area, Manpower Utilization Survey
Fiji	Census of Population and Housing, Employment and Unemployment Survey, Annual Employment Survey
Hong Kong	Population Census, Population By-Census, General Household Survey, Annual Earnings and Hours Survey, Wage Survey, Women and Men in Hong Kong Key Statistics
India	Census of India, Employment and Unemployment Survey
Indonesia	Population and Housing Census, Labor Force Situation in Indonesia
Iran	National Population and Housing Census, Labour Force Survey
Japan	Labor Force Survey, National Accounts
Korea	Population and Housing Census, Economically Active Population Survey, Employment Structure Survey, Monthly Labor Survey, Survey Report on Wage Structure
Lao PDR	Population Census, ADB Key Indicators for Asia and the Pacific
Malaysia	Population and Housing Census, Labour Force Survey, Economic Report Various issues, Malaysia Economic Statistics-Time Series
Mongolia	Population and Housing Census, Labour Force Survey, Mongolian Statistical Yearbook
Nepal	Population and Housing Census, Labor Force Survey
Pakistan	Population Census, Labor Force Survey, Pakistan Statistical Yearbook, Pakistan Economic Survey
Philippines	Labor Force Survey, Yearbook of Labor Statistics
Singapore	Population Census, Labor Force Survey, Singapore Yearbook of Manpower Statistics, General Household Survey
Sri Lanka	Population and Housing Census, Labor Force Survey, Central Bank of Sri Lanka Annual Report
Thailand	Population and Housing Census, Labor Force Survey
Vietnam	Population and Housing Census, Labor Force and Employment Survey, Statistical Yearbook

periods in which the data is not available without considering the changes in the composition.[128] Multiplying the average hours worked by the number of workers gives economy-wide averages of weekly hours worked. Second, the number of weeks worked is obtained, by counting the number of national holidays in each country as a crude approximation. Multiplying economy-wide average weekly hours worked by the number of weeks worked gives economy-wide annual hours worked. For the Lao PDR total hours worked are not estimated due to data constraints.

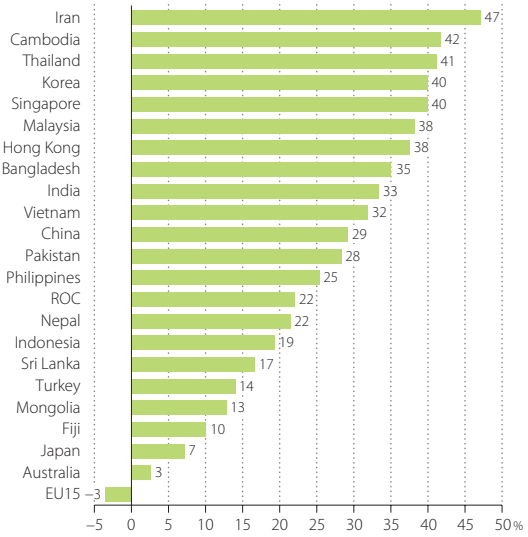

Figure 107 Average Annual Hours Worked Per Worker Relative to the US, 2000–2014

Sources: Official national accounts and labor force survey in each country, including author adjustments.

Figure 107 presents a cross-country comparison of average annual hours worked per worker for 2000–2014, relative to the level of the US. It indicates that workers in Asian countries tend to work much longer hours than those in the US and Europe. In many of the countries sampled, the difference in annual hours worked per person relative to the US is more than 20% of the US level. Prolonged working hours are observed in Asian countries regardless of their stage of development, spanning low-income countries such as Bangladesh and Cambodia to high-income countries such as the ROC and Singapore. An exception is Japan. Workers in Japan are likely to work much shorter hours than those in other Asian countries. However, compared with the EU15, hours worked by workers in Japan are still about 10% longer.

128: The project is developing the QALI database covering the Asian countries. The first set of the QALI estimates is planned to be completed in 2016 and 2017.

A.5 Other Data

For China, multiple data sources have been used; GDP for the whole economy, industry GDP, final demands, employment, and income data are taken from *China Statistical Yearbook* and *China National Income 1952–1995*; time-series data of GFCF during 1952–2014 at current and constant prices are constructed at KEO; the main references for GFCF construction are drawn from *Statistics on Investment in Fixed Assets of China 1950–2000, China Statistical Yearbook*, and *1987, 1992, 1997, 2002, and 2007 Input–Output Tables of China*; and multiple data sources for manufacturing, electrics, and trade data from *China's Customs Statistics* are also utilized.[129]

The data source for the EU15 and the EU28 is the OECD.Stat (http://stats.oecd.org/) and the Eurostat (http://ec.europa.eu/). The data for the US, Australia, Bhutan, and Turkey are taken from the website of the US Bureau of Economic Analysis (http://www.bea.gov), the Australian Bureau of Statistics (http://www.abs.gov.au/), the National Statistics Bureau of Bhutan (http://www.nsb.gov.bt/), and the Turkish Statistical Institute (http://www.turkstat.gov.tr), respectively.

The exchange rates used in this edition are adjusted rates, called the Analysis of Main Aggregate (UNSD database) rates, in the UNSD National Accounts Main Aggregate Database. The AMA rates coincide with IMF rates except for some periods in countries with official fixed exchange rates and high inflation, when there could be a serious disparity between real GDP growth and growth converted to US dollars based on IMF rates. In such cases, the AMA adjusts the IMF-based rates by multiplying the growth rate of the GDP deflator relative to the US.

Tax data of member economies are supplemented by the IMF's Government Finance Statistics. From its tax revenue data, "taxes on goods and services" and "taxes on imports" are used for calculating taxes on products. From its expenditure data, "subsidies" are taken. Data taken from Government Finance Statistics play a key role in adjusting GDP at market prices to GDP at basic prices. The data for energy consumptions and CO2 emissions is based on IEA's *CO2 Emissions from Fuel Combustion, Energy Balances of OECD Countries*, and *Energy Balances of non-OECD Countries*.

129: Holz (2006) provides a useful reference on Chinese official statistics. The project appreciates Meng Ruoyan (Keio University) for her supports on Chinese data.

A.6 Industry Classification

Cambodia, Iran, the Lao PDR, Malaysia, Nepal, the Philippines, Sri Lanka, and China use the International Standard Industry Classification of All Economic Activities (ISIC) Rev.3. Other Asian economies already have switched to the ISIC Rev.4. The concordances between the industry classification used in the Databook and the ISIC Rev.3 and Rev.4 are shown in Tables 24 and 25, respectively.

Table 24 Industry Classification – Concordance with ISIC Rev.3

ISIC Rev. 3 Section	Division		Databook 1st	Databook 2nd
A - Agriculture, hunting, and forestry	01	Agriculture, hunting, and related service activities	1	
	02	Forestry, logging, and related service activities	1	
B - Fishing	05	Fishing, operation of fish hatcheries, and fish farms; service activities incidental to fishing	1	
C - Mining and quarrying	10	Mining of coal and lignite; extraction of peat	2	
	11	Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction excluding surveying	2	
	12	Mining of uranium and thorium ores	2	
	13	Mining of metal ores	2	
	14	Other mining and quarrying	2	
D - Manufacturing	15	Manufacture of food products and beverages	3	3.1
	16	Manufacture of tobacco products	3	3.1
	17	Manufacture of textiles	3	3.2
	18	Manufacture of wearing apparel; dressing and dyeing of fur	3	3.2
	19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness, and footwear	3	3.2
	20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	3	3.3
	21	Manufacture of paper and paper products	3	3.4
	22	Publishing, printing, and reproduction of recorded media	3	3.4
	23	Manufacture of coke, refined petroleum products, and nuclear fuel	3	3.5
	24	Manufacture of chemicals and chemical products	3	3.5
	25	Manufacture of rubber and plastics products	3	3.5
	26	Manufacture of other non-metallic mineral products	3	3.6
	27	Manufacture of basic metals	3	3.7
	28	Manufacture of fabricated metal products, except machinery and equipment	3	3.8
	29	Manufacture of machinery and equipment n.e.c.	3	3.8
	30	Manufacture of office, accounting, and computing machinery	3	3.8
	31	Manufacture of electrical machinery and apparatus n.e.c.	3	3.8
	32	Manufacture of radio, television, and communication equipment and apparatus	3	3.8
	33	Manufacture of medical, precision, and optical instruments, watches, and clocks	3	3.8
	34	Manufacture of motor vehicles, trailers, and semi-trailers	3	3.8
	35	Manufacture of other transport equipment	3	3.8
	36	Manufacture of furniture; manufacturing n.e.c.	3	3.9
	37	Recycling	3	3.9
E - Electricity, gas, and water supply	40	Electricity, gas, steam, and hot water supply	4	
	41	Collection, purification, and distribution of water	4	
F - Construction	45	Construction	5	
G - Wholesale and retail trade; repair of motor vehicles, motorcycles, and personal and household goods	50	Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of automotive fuel	6	
	51	Wholesale trade and commission trade, except of motor vehicles and motorcycles	6	
	52	Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods	6	
H - Hotels and restaurants	55	Hotels and restaurants	6	
I - Transport, storage, and communications	60	Land transport; transport via pipelines	7	
	61	Water transport	7	
	62	Air transport	7	
	63	Supporting and auxiliary transport activities; activities of travel agencies	7	
	64	Post and telecommunications	7	
J - Financial intermediation	65	Financial intermediation, except insurance and pension funding	8	
	66	Insurance and pension funding, except compulsory social security	8	
	67	Activities auxiliary to financial intermediation	8	
K - Real estate, renting, and business activities	70	Real estate activities	8	
	71	Renting of machinery and equipment without operator and of personal and household goods	8	
	72	Computer and related activities	8	
	73	Research and development	8	
	74	Other business activities	8	
L - Public administration and defence; compulsory social security	75	Public administration and defence; compulsory social security	9	
M - Education	80	Education	9	
N - Health and social work	85	Health and social work	9	
O - Other community, social, and personal service activities	90	Sewage and refuse disposal, sanitation, and similar activities	9	
	91	Activities of membership organizations n.e.c.	9	
	92	Recreational, cultural, and sporting activities	9	
	93	Other service activities	9	
P - Private households with employed persons	95	Private households with employed persons	9	
Q - Extra-territorial organizations and bodies	99	Extra-territorial organizations and bodies	9	

Note: "n.e.c." represents "not elsewhere classified."

Table 25 Industry Classification – Concordance with ISIC Rev.4

ISIC Rev. 4 Section	Division		Databook 1st (a)	Databook 1st (b)	Databook 2nd
A - Agriculture, forestry, and fishing	1	Crop and animal production, hunting, and related service activities	1	1	
	2	Forestry and logging		1	
	3	Fishing and aquaculture		1	
B - Mining and quarrying	5	Mining of coal and lignite	2	2	
	6	Extraction of crude petroleum and natural gas		2	
	7	Mining of metal ores		2	
	8	Other mining and quarrying		2	
	9	Mining support service activities		2	
C - Manufacturing	10	Manufacture of food products	3	3	3.1
	11	Manufacture of beverages		3	3.1
	12	Manufacture of tobacco products		3	3.1
	13	Manufacture of textiles		3	3.2
	14	Manufacture of wearing apparel		3	3.2
	15	Manufacture of leather and related products		3	3.2
	16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials		3	3.3
	17	Manufacture of paper and paper products		3	3.4
	18	Printing and reproduction of recorded media		3	3.4
	19	Manufacture of coke and refined petroleum products		3	3.5
	20	Manufacture of chemicals and chemical products		3	3.5
	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations		3	3.5
	22	Manufacture of rubber and plastics products		3	3.5
	23	Manufacture of other non-metallic mineral products		3	3.6
	24	Manufacture of basic metals		3	3.7
	25	Manufacture of fabricated metal products, except machinery and equipment		3	3.8
	26	Manufacture of computer, electronic and optical products		3	3.8
	27	Manufacture of electrical equipment		3	3.8
	28	Manufacture of machinery and equipment n.e.c.		3	3.8
	29	Manufacture of motor vehicles, trailers and semi-trailers		3	3.8
	30	Manufacture of other transport equipment		3	3.8
	31	Manufacture of furniture		3	3.8
	32	Other manufacturing		3	3.9
	33	Repair and installation of machinery and equipment		3	3.9
D - Electricity, gas, steam, and air conditioning supply	35	Electricity, gas, steam, and air conditioning supply	4	4	
E - Water supply; sewerage, waste management, and remediation activities	36	Water collection, treatment, and supply	4	4	
	37	Sewerage		9	
	38	Waste collection, treatment, and disposal activities; materials recovery		9	
	39	Remediation activities and other waste management services		9	
F - Construction	41	Construction of buildings	5	5	
	42	Civil engineering		5	
	43	Specialized construction activities		5	
G - Wholesale and retail trade; repair of motor vehicles and motorcycles	45	Wholesale and retail trade and repair of motor vehicles and motorcycles	6	6	
	46	Wholesale trade, except of motor vehicles and motorcycles		6	
	47	Retail trade, except of motor vehicles and motorcycles		6	
H - Transportation and storage	49	Land transport and transport via pipelines	7	7	
	50	Water transport		7	
	51	Air transport		7	
	52	Warehousing and support activities for transportation		7	
	53	Postal and courier activities		7	
I - Accommodation and food service activities	55	Accommodation	6	6	
	56	Food and beverage service activities		6	
J - Information and communication	58	Publishing activities	7	3	
	59	Motion picture, video, and television programme production, sound recording and music publishing activities		9	
	60	Programming and broadcasting activities		9	
	61	Telecommunications		7	
	62	Computer programming, consultancy, and related activities		8	
	63	Information service activities		8	
K - Financial and insurance activities	64	Financial service activities, except insurance and pension funding	8	8	
	65	Insurance, reinsurance, and pension funding, except compulsory social security		8	
	66	Activities auxiliary to financial service and insurance activities		8	
L - Real estate activities	68	Real estate activities	8	8	
M - Professional, scientific, and technical activities	69	Legal and accounting activities	8	8	
	70	Activities of head offices; management consultancy activities		8	
	71	Architectural and engineering activities; technical testing and analysis		8	
	72	Scientific research and development		8	
	73	Advertising and market research		8	
	74	Other professional, scientific, and technical activities		8	
	75	Veterinary activities		9	
N - Administrative and support service activities	77	Rental and leasing activities	9	9	
	78	Employment activities		9	
	79	Travel agency, tour operator, reservation service, and related activities		7	
	80	Security and investigation activities		9	
	81	Services to buildings and landscape activities		9	
	82	Office administrative, office support, and other business support activities		9	
O - Public administration and defence; compulsory social security	84	Public administration and defence; compulsory social security	9	9	
P - Education	85	Education	9	9	
Q - Human health and social work activities	86	Human health activities	9	9	
	87	Residential care activities		9	
	88	Social work activities without accommodation		9	
R - Arts, entertainment, and recreation	90	Creative, arts, and entertainment activities	9	9	
	91	Libraries, archives, museums, and other cultural activities		9	
	92	Gambling and betting activities		9	
	93	Sports activities and amusement and recreation activities		9	
S - Other service activities	94	Activities of membership organizations	9	9	
	95	Repair of computers and personal and household goods		6	
	96	Other personal service activities		9	
T - Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	97	Activities of households as employers of domestic personnel	9	9	
	98	Undifferentiated goods- and services-producing activities of private households for own use		9	
U - Activities of extraterritorial organizations and bodies	99	Activities of extraterritorial organizations and bodies	9	9	

Note: The concordance (b) is used if the division-level data is available. The concordance (a) is used if only the section-level data is available.

A.7 Data Publication and Visualization

The productivity data used in this Databook is based on the APO Productivity Database 2016, which provides the annual productivity accounts covering Asian countries for the period 1970–2014. The data set is available at the APO website (www.apo-tokyo.org). Timely analysis of the current economic situation is beyond the scope of this Databook. In the meantime, for an insight into the current economic growth, one has to rely on quarterly national accounts (QNA) from each country. Although they are timelier, the QNA are often less precise and subject to frequent revisions as more reliable data become available in their normal estimation cycle. With this trade-off between timeliness and data quality in mind, the APO recognizes the complementary benefits of collating and presenting a country's QNA alongside its database of annual data. As result, the APO developed the Asian Quarterly Growth Map (AQGM) to offer a quarterly growth data map from 2007 until last year. This project attempted to renew and upgrade the AQGM, by expanding its scope on data visualization, and newly developed the Asian Economy and Productivity Map (AEPM) in September 2016. Shown in Figure 108, the AEPM provides an instinctive understanding of recent economic growth, as well as the long-term productivity performances described in this Databook. This is also available at the APO website.

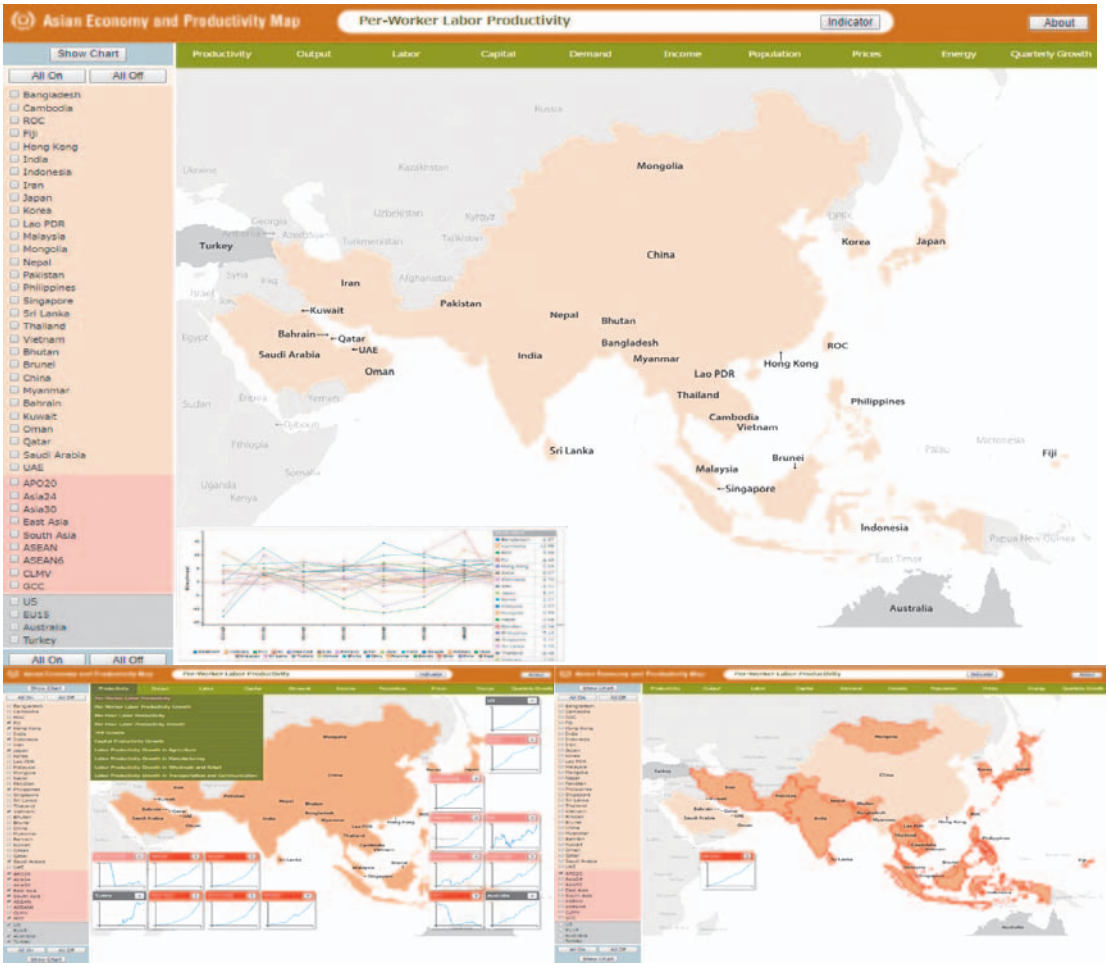

Figure 108 Visualization in Asian Economy and Productivity Map

Source: Asian Economy and Productivity Map, September 2016.

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