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Asia's Economic Transformation: Where to, How, and How Fast?

Key Indicators for Asia and the Pacific 2013
Special Chapter

Asian Development Bank

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Foreword

The *Key Indicators for Asia and the Pacific 2013* (*Key Indicators 2013*) special chapter on "Asia's Economic Transformation: Where to, How, and How Fast?" analyzes the direction and pace of Asia's transformation during recent decades and sketches the main contours of economic transformation that can be expected in coming decades.

During the last 4 decades, Asia has grown faster than any other developing region, and a few of its economies have undergone a rapid and remarkable transformation. However, the pace of economic transformation of other economies has been slow. In many of them, agriculture is still the largest employer and workers are moving from agriculture into low-productivity services, bypassing industrialization.

The chapter highlights facts and insights that are important for developing Asia to consider in moving ahead: (i) agriculture needs to be modernized by deploying infrastructure, introducing technological improvements, developing agribusiness, and increasing linkages to global value chains; (ii) industrialization is a step that, in general, is difficult to bypass on the path to becoming a high-income economy; (iii) the service sector is already the largest source of employment and this trend will continue; (iv) basic education of high quality matters for industrial upgrading and, in general, for the development of new industries that can compete internationally; and (v) although it is important for countries to exploit their comparative advantages, some form of government intervention may be necessary and unavoidable to expedite economic transformation.

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Contents

Foreword iii
Abbreviations and Acronyms ix
Highlights of *Asia's Economic Transformation: Where to, How, and How Fast?* x

Asia's Economic Transformation: Where to, How, and How Fast?

Structural transformation: What is it and why does it matter? **3**
Five components of structural transformation 3
The variable pace of structural transformation 5
Structural transformation: A key to Asia's future 6

The transformation of Asia's economies **8**
Changes in sectors' shares 8
Agriculture: Declining output share but still the largest employer in many Asian economies 9
Industrialization: Different patterns of manufacturing across economies 13
Services: Asia's service sector follows a two-wave pattern, and the share of complementary services is increasing 21
Most labor productivity growth has been within sectors; less has come from reallocating labor across sectors 25
Diversifying and upgrading the complexity of exports have been uneven across Asian economies 27
Conclusions 30

Asia's future transformation **32**
Asia's agriculture sector needs upgrading and modernizing 32
The importance of industrialization 34
Becoming a high-income economy generally requires industrialization 36
What role will technology play in the coming decades? 39
Linking to global value chains 44
Services and manufacturing complement each other 50
The service sector is the major absorber of employment in Asia 52
Conclusions 59

How does education contribute to export diversification? **62**
Years of schooling and diversification are positively related and the quality of education matters more than the quantity 63
The quality of education helps reduce path dependence, and "teleportation" into the most complex products is practically impossible 64
Discussion and implications 67

Priorities for Structural Transformation **70**
Key patterns of structural transformation in Asia 70
The future of Asia's transformation 71
Priorities for Asia's transformation in the coming decades 73

Endnotes **74**
Appendix **81**
References **86**

Tables

Table 2.1 Largest sector in Asia economies (latest year) ... 9
Table 2.2 Estimated manufacturing output and employment shares at the turning points for population levels and trade ratios ... 15
Table 2.3 Peak manufacturing share in output and employment, Asian economies ... 17
Table 2.4 Industrialization, deindustrialization, and nonindustrialization in Asia ... 17
Table 2.5 Shares of high-tech and non high-tech subsectors in total manufacturing output and employment (%) ... 18
Table 2.6 Asian economies: The two waves of the service sector ... 23
Table 3.1 Matrix of economies' status of industrialization in output and in employment, and whether they are high income or low and middle income ... 37
Table 3.2 Determinants of high-income status (economy with per capita income more than $15,000 in 2010) ... 39
Table 3.3 Percentage point change in the share of employment between 2009 and 1995 ... 53
Table 3.4 Decomposition of employment (number of workers engaged) growth in Asian countries, 2000–2008 (%) ... 55
Table 3.5 Average labor productivity growth in Asia's Manufacturing and Services, 1974–2004 (% per annum) ... 56
Table 4.1 Diversification and education ... 64
Table 4.2 Education and revealed comparative advantage (2010) ... 66

Appendix Table A1 Output and employment shares of agriculture, industry, and services ... 81
Appendix Table A2 Agriculture output and employment shares in Asia: Speed of reduction ... 82
Appendix Table A3 Annualized growth rates of GDP, agricultural GDP, land productivity, and area indeveloping economies, 1970–2009 (%) ... 82
Appendix Table A4 Yield and yield growth of primary cereals, developing Asia, 1970 and 2010 ... 83
Appendix Table A5 Peak manufacturing share in output and employment, OECD countries ... 83
Appendix Table A6 Economic complexity index, 20 Asian economies ... 84
Appendix Table A7 Projections of agricultural output and employment shares for 2040 ... 84
Appendix Table A8 Actual values of the control variables, 2007 ... 85

Figures

Figure 1.1 Output and employment shares in agriculture, industry, and services ... 4
Figure 1.2 Changes in sector employment shares in developed countries ... 6
Figure 2.1 Output and employment shares in Asia (% of GDP and total employment, latest year) ... 8
Figure 2.2 Percentage point decline in agriculture output and employment shares, and percent decline per annum ... 10
Figure 2.3 Gross value-added per agricultural worker (in constant $ of 2000, and annualized growth, 1980–2010) ... 11
Figure 2.4 Yield of primary cereals and their share in agricultural output, developing Asia, 1970 and 2010 ... 12
Figure 2.5 Composition of agricultural output (constant $), developing Asian countries, 1970 and 2010 (%) ... 12
Figure 2.6 Stages of agricultural development in developing Asia, Timmer's classification, 1980–2010 ... 13
Figure 2.7 Manufacturing output and employment shares ... 14
Figure 2.8 Asia's deindustrializers and nonindustrializers ... 16
Figure 2.9 High-tech and non high-tech subsectors: Bangladesh, Indonesia, and the Republic of Korea (% of total manufacturing output and employment) ... 19
Figure 2.10 Services and development in Asia, sectors' shares: A two-wave pattern (Lowess regressions) ... 22

Figure 2.11 The rising share of complementary services 24
Figure 2.12 Urbanization and structural transformation 25
Figure 2.13 Shift–share analysis: Decomposition of labor productivity growth, overall economy, 1974–2004 (% contribution of each component) 26
Figure 2.14 Export diversification in Asia 29
Figure 2.15 Economic complexity index (ECI), 20 Asian economies, 1995 and 2010 30
Figure 3.1 Agricultural output and employment shares, latest and projected for 2040 and stage of agricultural development (Timmer's classification) 35
Figure 3.2 Share of industries' value-added retained by economy and by overseas suppliers, 2000 (%) 49
Figure 3.3 The intensity of services in six Asian economies 52
Figure 3.4 Decomposition of changes in sectors' and subsectors' shares: Productivity and demand effects 54
Figure 3.5 Shift–share analysis: Decomposition of labor productivity growth in services, 1974–2004 (% contribution of each component) 57
Figure 3.6 Productivity growth and change in employment shares: Six Asian economies 58
Figure 3.7 Globalization of manufacturing and services employment 60
Figure 4.1 Education and Export Diversification (2000) 64

Box Figure 1 Sectoral output of selected Pacific island countries, 1995–1997 to 2007–2009 40
Box Figure 2 Tourist arrivals, 6 Pacific island countries, 2000–2010 ('000) 41
Box Figure 1 How do sectors rank in terms of educational attainment? (1 = most educated sector, 15 = least educated sector) 69

Boxes

Box 2.1 The role of demographic and geographic variables 18
Box 2.2 Lack of depth in the Philippine manufacturing subsector: The legacy of old, incoherent policies and attempts to correct them 21
Box 2.3 Shift–share analysis of productivity growth 26
Box 2.4 Economic transformation in India 27
Box 2.5 Why does diversification matter for structural transformation? 28
Box 2.6 Diversification and complexity measures 28
Box 3.1 Manufacturing has strong linkages with the rest of the economy 36
Box 3.2 Options for the Pacific Islands 40
Box 3.3 Frugal innovation and 3D manufacturing 43
Box 3.4 Country examples of global value chains in agriculture 45
Box 3.5 Services contribute to the competitiveness of manufacturing 51
Box 3.6 The world input–output tables 51
Box 3.7 Baumol's Disease 57
Box 4.1 The capabilities demanded by the most desirable products are only learned by doing 67
Box 4.2 Where is the knowledge economy? 68

Abbreviations and Acronyms

km	kilometer
ADB	Asian Development Bank
ECI	economic complexity index
FDI	foreign direct investment
FRB	financial intermediation, real estate, renting, and business activities
GDP	gross domestic product
GGDC	Groningen Growth and Development Centre
GIPC	Government of India Planning Commission
GVC	global value chain
HCI	heavy and chemical industries
ICT	information and communications technology
ILO	International Labour Organization
Lao PDR	Lao People's Democratic Republic
NIE	newly industrialized economy
OECD	Organisation for Economic Co-operation and Development
PCSP	public, community, social, and personalservices
PRC	People's Republic of China
R&D	research and development
RCA	Revealed comparative advantage
ST	structural transformation
THR	trade (wholesale and retail), hotel, and restaurant services
TSC	transport, storage, and communication services
UNIDO	United Nations Industrial Development Organization
US	United States
WDI	World Development Indicators

Highlights

Asia's transformation during the last 4–5 decades has been unprecedented but heterogeneous

- Developing Asia has experienced significant structural change during the last 4–5 decades, but it has been very uneven. Five economies—Japan; Hong Kong, China; the Republic of Korea; Singapore; and Taipei,China—underwent the greatest transformation and became modern industrial and service economies. In many other Asian economies, structural transformation is taking place slowly and without significant deepening.

- In general, labor productivity growth due to intersectoral relocation of labor into higher-productivity sectors has been less important than the growth of labor productivity within sectors.

- Agriculture's share of total output has declined significantly, but agriculture is still the sector with the lowest productivity. The share of employment in agriculture has also fallen, but the sector still engages over 700 million workers—42.82% of Asia's total employment.

- Many Asian economies have attained high manufacturing output shares (hence the term "Factory Asia," especially applied to the People's Republic of China [PRC]). Asia's most advanced economies have industrialized when measured by employment shares, but most of the other economies have not. Some Asian economies appear to not have industrialized significantly and to have weak supply chains. As a consequence, their economic structure has not deepened.

- Measured by gross domestic product (GDP) shares, Asia is a service region, but the service sector is heterogeneous with both traditional, low-productivity services and modern, high-productivity services. In many Asian economies, structural transformation appears as a shift from agriculture into not low-productivity service subsectors.

- The export baskets of Asia's advanced economies have become more diversified and more sophisticated, but this is not the case in many other economies. Global value chains are a mechanism for firms and farms in developing countries to access the world market and advanced technologies, but only a few Asian countries are strongly linked to these chains. The share of value added Asian countries retain from their exports varies significantly.

- More diversified economies are more inclusive—they have lower Gini coefficients.

Several priorities merit consideration for Asia's continuing transformation

- Developing Asia needs to make a significant qualitative leap in structural transformation and to focus on transferring labor from sectors of low productivity (typically agriculture) into sectors of high productivity.

- But future transformation will most likely not resemble in pace and direction that seen in Japan and the newly industrialized economies during the second half of the 20th century, as the overall economic environment is very different today. The rest of developing Asia may not be likely to transform as quickly as this group.

- Policymakers ought to focus on facilitating firms and workforces to develop the capabilities they need to manufacture new products, to enter new markets, and to move up the development ladder (i.e., to make and provide increasingly sophisticated and complex products and services).

- Developments in agriculture will be key for Asia's future, in particular for the low-income economies. Agriculture has to "industrialize" (i.e., develop agribusiness and adopt modern methods) for the sector to achieve productivity levels similar to those in the economy as a whole. Increases in agricultural productivity allow for wage increases, which lead to

investments in farm and human capital that are key for poverty reduction and, ultimately, for inclusive growth. During the coming decades, agriculture's share of GDP is likely to decline in most Asian economies to levels similar to those in developed countries, while agriculture's employment share will still be high in some countries. Technological advances in agriculture will help increase its productivity, and links to global agricultural value chains can facilitate the adoption of new technology.

- History suggests that manufacturing is important and that industrialization has been nearly essential for an economy to achieve high income levels. No country has achieved high-income status without its manufacturing sectors reaching at least an 18% share of total employment. Modern industrial and service economies have manufacturing at their core. We estimate that an economy where the shares of manufacturing in total employment and output are at least 18% has a 42% probability of achieving high income levels, but the probability of an economy with a small manufacturing sector (in both output and employment) achieving high-income status is less than 5%.

- Other factors are also important. Results also indicate that a country that industrializes in output and (i) has 17 kilometers of road per 1,000 persons has a 44.5% chance of being high income, (ii) has liquid liabilities representing 75% of GDP has a 43.5% chance of being high income, (iii) where workers have 9 years of average schooling has a probability of 48.5% of being a high income, (iv) with a share of high-tech manufacturing output representing 52% of total manufacturing GDP has a 75% chance of being high-income, and (v) with a share of high-tech manufacturing employment representing 49% of total manufacturing employment has also a 75% chance of being high-income.

- These conclusions about the importance of manufacturing imply that a diversified manufacturing base remains important for economic development, so that labor does not simply move from low-productivity agriculture into low-productivity services.

- Upcoming inventions may revolutionize manufacturing, but they are likely to benefit developed countries first and foremost. Upcoming inventions tend to be very technology-intensive and will not create the millions of jobs that developing Asia needs. Factory Asia may continue to thrive for some time, but manufacturing will not be able to absorb 25%–30% of the region's workforce.

- The experience so far with global value chains is that if countries get stuck in the least desirable stages of the chains, they will not serve as a springboard for fast development.

- Countries that have based their industrial development strategies on foreign direct investment and disregarded the importance of local firms, can lack industrial deepening.

- Services will become the largest employer in most countries. Like manufacturing, some services have displayed high productivity growth (e.g., modern business services and finance), but others have not. In many countries, services provide significant employment, but much of it is of lower productivity than that in manufacturing. Policymakers need to identify niches of high labor productivity within services to ensure growth, implement reforms to increase the sector's competitiveness, and encourage the expansion of labor-intensive services to accommodate employment.

- Provision of primary education and education of high quality facilitate export diversification. However, the process of diversification is "path dependent"—economies cannot readily jump from exporting unsophisticated products such as t-shirts to exporting very sophisticated ones such as cars; rather they need to progress through gradual steps along the path. Education achievement alone does not help countries leapfrog into significantly more sophisticated products than those they currently export, but the provision of good quality education reduces path dependence.

- Countries need to implement policies and develop institutions that facilitate desirable structural

transformation. These are needed to promote mobility across occupations and sectors and movement into high-productivity activities.

The analytical results have different implications for different country profiles

- Countries with large shares of employment in agriculture (such as Bangladesh, the PRC, India, Pakistan, and Thailand) need to develop industries and services that absorb labor. Concomitantly, the countryside will have to industrialize.

- The PRC and India are investing in science and engineering. So far, their efforts have been directed toward making inexpensive versions of existing goods. Over time, their role as innovators has to increase.

- For India and other economies that have bypassed industrialization or are experiencing transition from agriculture into low-quality services, the recommendation is to develop a deeper and broader industrial base.

- For the advanced Southeast Asian economies, the main recommendation is to focus on upgrading, as they are already quite diversified. Countries such as Malaysia and Thailand have developed institutional capacity to diversify their economies, but need to deepen and upgrade their industries to avoid being caught in the middle-income trap. To escape this trap, the Philippines needs to develop a much deeper industrial base to complement its service sector.

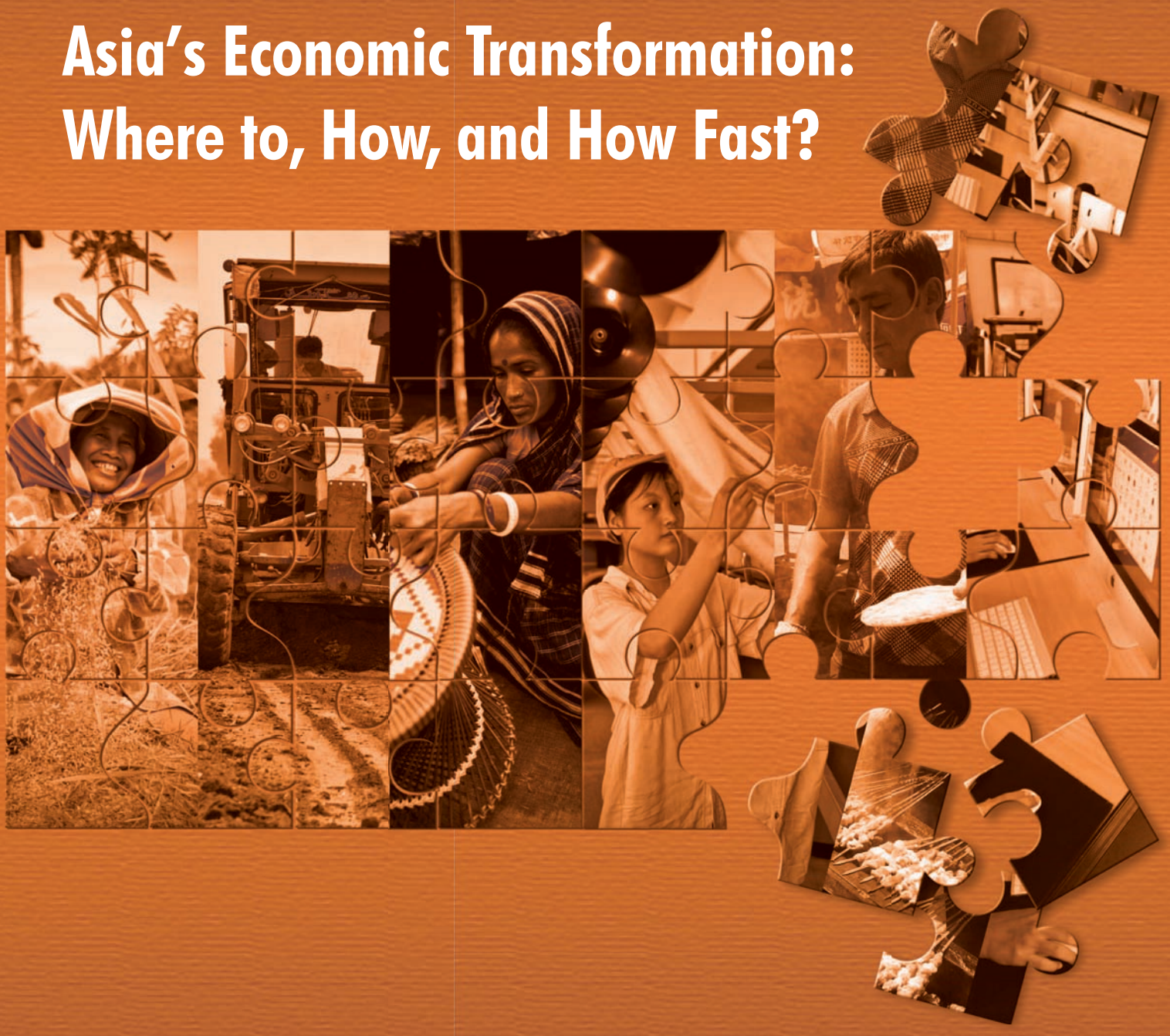
- Small, low-income economies such as Cambodia, the Lao People's Democratic Republic, and Nepal can benefit from their comparative advantage in labor-intensive activities. But they should also implement policies and develop institutions that facilitate the accumulation of capabilities, foster diversification and upgrading, and target specific activities in more advanced industries, in order to progress from the simplest products into complex products and services.

- Most islands in the Pacific subregion will have difficulty industrializing. For them, the future lies in developing niches in some services.

- Economies that are rich in natural resources (e.g., Kazakhstan) need to manage those resources well and think about diversification.

- Countries that are just embarking on a deep reform process, such as Myanmar, can benefit from the experiences of other countries that have gone through the process.

Asia's Economic Transformation: Where to, How, and How Fast?



Structural transformation: What is it and why does it matter?

The Asia and Pacific region has not only grown rapidly during the last 4 decades but also has changed dramatically in many aspects. In the mid-1970s, over 60% of Asian workers were employed in agriculture. By 2010, the share had declined to slightly over 40% (more than 700 million people). In 1970, Asia's urban population amounted to 442 million people—an urbanization rate of 22%. By 2010, the region's urban population had increased to almost 1.6 billion, an urbanization rate of 40%. During the first decade of the 21st century, the People's Republic of China (PRC) added over 120 million nonfarm jobs in its expanding manufacturing and service sectors. India has followed a similar path but at a slower pace. And India created about 67 million nonfarm jobs—enough to keep pace with labor force growth but not sufficient to decrease the number of workers in agriculture by moving more of them into more productive jobs.[1] In the 1960s and 1970s, most of Asia's exports were simple, labor-intensive products; today some of its economies export a wide range of very sophisticated products. Finally, Asia's fertility rate has declined from almost 6 births per woman in 1960 to 2.4 today. What are the implications of these changes? Have all countries across the region changed the same way? Will the changes continue in the coming decades, and, if yes, how?

A well-established body of literature argues that development is about transforming the productive structure of the economy and accumulating the capabilities necessary to undertake this process (Kaldor 1967, Chenery et al. 1986, Kuznets 1966). According to this literature, development is a process in which new activities emerge, old ones disappear, resources shift from less productive activities (most often agriculture) to more productive ones, and the weight of economic sectors and patterns of interaction change in regular ways. Development is distinct from aggregate growth, which can occur without significant transformation, as has happened in some oil-rich economies.

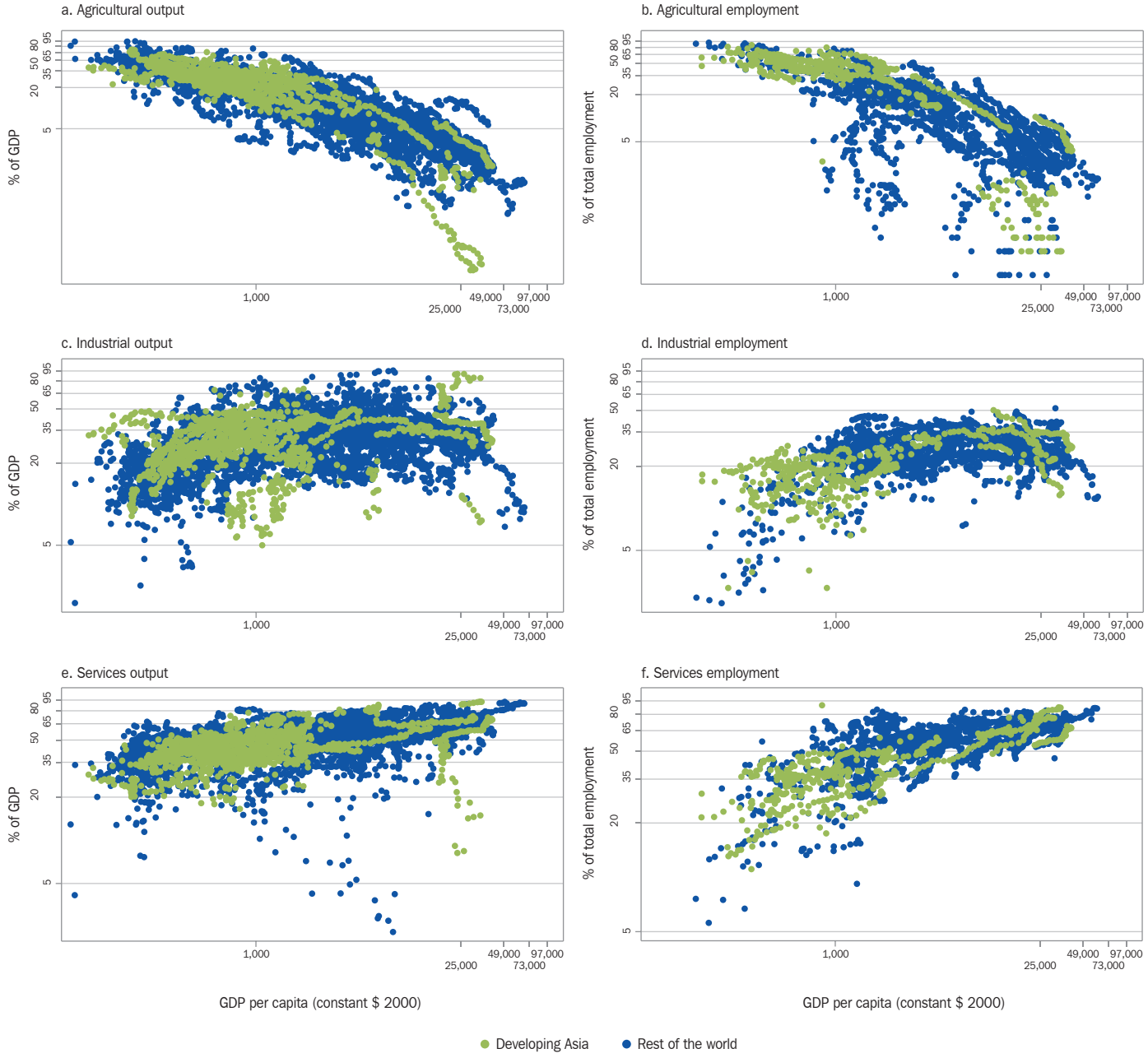
The shift to sustained per capita income growth, a process known as "modern development," started with the Industrial Revolution in the United Kingdom and extended to the rest of today's developed world. The most salient feature of this process was the change in the structure of the economy, especially the decline in agriculture's shares of both output and employment, with a concomitant increase in the corresponding shares of industry and services. The literature refers to this process as "economic transformation," and more generally as "structural transformation" (ST), as economic changes are often accompanied by other changes. In most parts of Asia, modern development did not start until the second half of the 20th century. This process appears to have been completed in a few economies like Japan and the newly industrialized economies (NIEs), but the process is still under way in some other Asian economies and has barely started in quite a few. [2]

Five components of structural transformation

ST is a process that can be best described by five key components: reallocation of factors of production; diversification, upgrading, and deepening of the production and export baskets; use of new production methods and processes and different inputs; urbanization; and social changes.

- *Reallocation of the factors of production across sectors of different productivity*. Historically, as income per capita increased, the reallocation involved (i) a decline in the share of agriculture (where productivity is in general lower than in industry and services), (ii) an increase in the share of industry up to a point (the industrialization phase) followed by a decline (the deindustrialization phase), and (iii) an increase in the share of services. These patterns are shown in Figure 1.1. Using data since 1970, the graph shows output and employment shares worldwide against income per capita. The patterns in Figure 1.1 imply that in many low-income economies, economywide (average) labor productivity is significantly higher than labor productivity in agriculture, and the opposite is generally true for industry and services. (Labor productivity is defined as value added divided by the number of people employed.) The gaps between output and employment shares diminish as income per capita increases, approaching zero for high income levels, which implies that labor productivity in agriculture, industry, and services is about the same.

Figure 1.1 **Output and employment shares in agriculture, industry, and services**



Source: World Bank. WDI. http://data.worldbank.org/data-catalog/world-development-indicators (accessed September 2012).

- *Diversification, upgrading, and deepening of the production and export baskets.* Diversification of the economic structure is probably the most conspicuous feature of economic development, and is a chief difference between it and aggregate economic growth. Upgrading refers to the capacity to produce higher quality, more distinctive, and more complex products. Deepening involves the formation of local linkages and complementarities by creating a robust local supplier base and expanding ancillary services.

- *Use of new production methods and processes and different inputs.* Examples are steam and railroads during the first Industrial Revolution (1750–1830) and electricity and chemicals during the second (1870–1900). The impacts of modern information and communications technology (ICT)

as a potential third industrial revolution are still in the formative stages.

- *Urbanization, a key feature of modern development.* Nearly all countries become at least 50% urbanized before they reach middle-income status, and the urbanization rate of the high-income countries is 70%–80%.

- *Social changes.* Changes such as in family structure and in the role of women occur. It is impossible to become a modern economy with social structures that do not favor change.

In this special chapter, we discuss the economic aspects of ST, and we refer to urbanization, but not to the social aspects, which go beyond the scope of the chapter. We will most often use the term "structural transformation"; sometimes we use "economic transformation"; and only occasionally, "industrial transformation," when referring to changes within manufacturing.

The literature indicates that a variety of factors affect the direction and pace of ST of an economy. First, ST is driven by demand and supply factors. On the demand side are effects related to increases in income per capita. As income increases, the relative demand for food and agricultural products decreases, while that for more income-elastic goods and services increases. On the supply side, differences in the capital stock per worker and in education and skills drive productivity differentials across sectors. Productivity is lowest in agriculture at low income levels, but this differential closes as workers shift to higher productivity sectors. Second, demographic and geographic variables (such as population density and resource endowments) and country size shape the pattern of ST across countries. Third, good organizational capabilities allow faster ST, but lack of essential capabilities leads to stagnation. Capabilities encompass all the tacit knowledge necessary to produce a good or deliver a service.[3] Fourth, specific policies and actions (e.g., those that pertain to education and the technological learning needed to compete internationally); institutions (that have developed historically and facilitate or retard ST); and politics often work jointly to determine the direction and pace of ST.

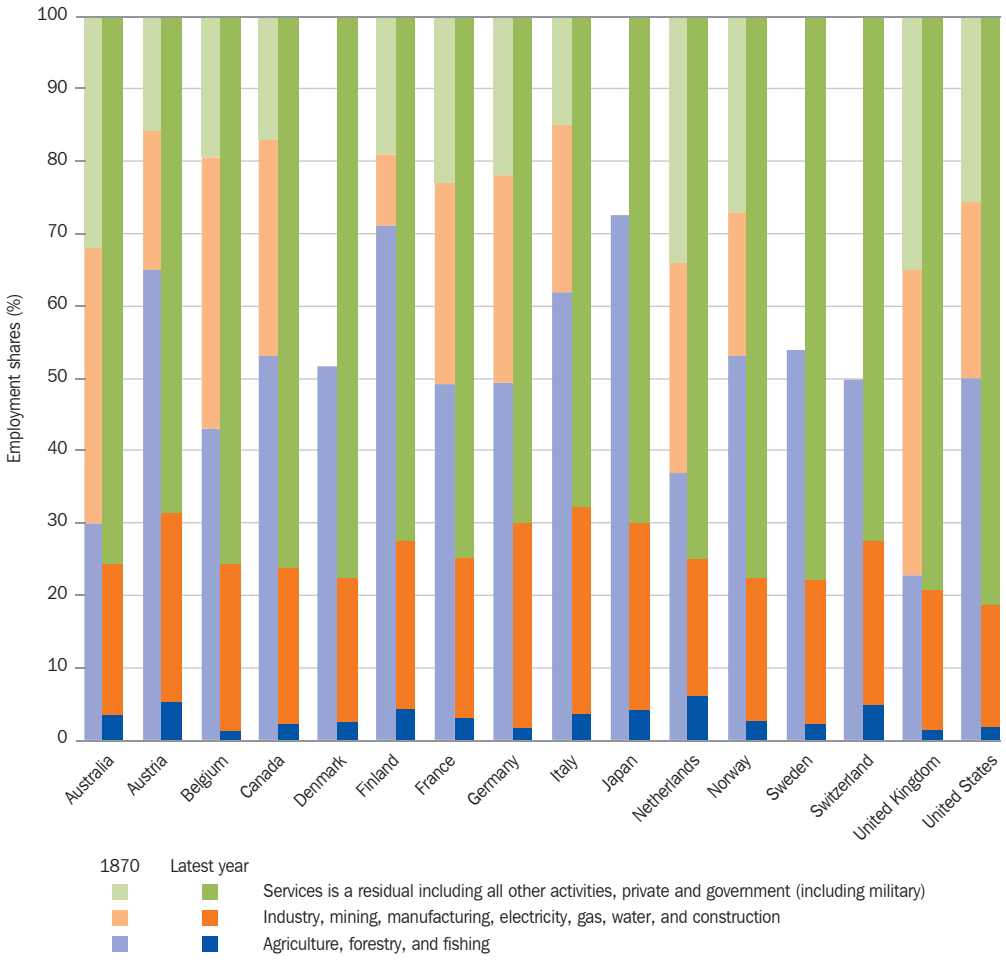
The variable pace of structural transformation

Countries' ST patterns differ in both direction and pace. When ST creates a virtuous circle (i.e., the transfer of labor from traditional agriculture and low-productivity informal activities into modern sectors), it leads to higher growth and higher income per capita and these induce further changes in the structure of the economy. We refer to this as "desirable transformation." However, if the pace of ST is too slow, if resources do not shift to activities of higher productivity, or if there is no upgrading or deepening, the economy stagnates.

The arrival of modern development and the consequent ST was a slow process in the economies that are currently termed "developed"—a process that lasted until well into the 20th century. In 1700, agriculture was the largest employer across the world. For example, in 1700 in the United Kingdom, 60% of all employment was in agriculture. With the Industrial Revolution, the share declined to 40% in 1820 and to 16% in 1890. And it took another 90 years to shrink to 2.5% (Maddison 1982). Agriculture played a fundamental role in propelling the take-off, as agricultural development freed resources for the birth of new industries and services and lowered production costs outside agriculture. Agricultural development bred the skills and social capital necessary for the nonfarm economy to develop and influenced the sociopolitical tissue of societies. Today, in most developed countries, the shares of agriculture in gross domestic product (GDP) and in employment are below 5% (Figure 1.2).

As previously noted, although Asia has registered high growth during the last 4 decades, only five of its economies—Japan; Hong Kong, China; the Republic of Korea; Singapore; and Taipei,China—have undergone full modern development. The distinguishing feature of the last four economies is that they achieved very high standards of living in about 30 years.[4] Japan, the Republic of Korea, and Taipei,China followed a pattern of ST similar to that of the developed countries. Concurrently with the decline in their shares of agriculture, their shares of industry (especially manufacturing) increased, and now they are deindustrializing. At the same time, their share of services increased and now is the largest in both output and employment.

Figure 1.2 **Changes in sector employment shares in developed countries**



Sources: Maddison (1982) for 1870 (in some cases Maddison does not provide the three shares); World Bank. WDI. http://data.worldbank.org/data-catalog/world-development-indicators (accessed September 2012).

But this is not the pattern that many other Asian economies are currently following, where the share of employment in manufacturing is rather small. The PRC and India, the two most populous economies, are undergoing significant STs, though at different paces and in different directions. At the other end of the spectrum are countries in the region where the "farm-to-factory" transition is very slow (e.g., Pakistan). Such economies have not transformed.

Structural transformation: A key to Asia's future

This chapter is about what has happened and what is expected to happen in the next 2–3 decades, the medium and long-run. It argues that the region's future course will depend on its ability to engineer fast and successful ST. First, the region is home to over 700 million workers employed in agriculture (about 40% of all employment). Indeed, agriculture is still the largest employer in many Asian economies and, for them to undergo modern development, farm workers will have to shift into activities of higher productivity. Second, in the 21st century, knowledge will become increasingly important as a source of productivity growth. How to increase the stock of productive and organizational capabilities to promote the generation and exploitation of knowledge and ideas will be a key challenge for ST.

Third, Asian economies face different challenges to further ST. The East Asian NIEs are already modern

industrial and service economies. As high-income economies, their challenge is to maintain growth and successfully develop a high-quality service sector and knowledge economy, and to continue upgrading their industry sector. The challenge for some Southeast Asian economies is to avoid being stuck in the middle-income trap. These economies have developed some industrial base and fairly large service sectors, but they remain middle income. Should they try to push industrialization further? What should the role of the agricultural sector be, given the new trend of food prices? How can they upgrade their service sector? The PRC has undergone significant ST during the last 4 decades and created a very large manufacturing sector. Moving forward, however, the PRC needs to think about how to transition into a modern industrial and service economy, as agriculture is still the PRC's largest employer. India is transitioning at a slower pace than the PRC, and from agriculture into services while possibly skipping the industrialization phase. Can India skip industrialization and still become a high-income economy? Can it create significant high-productivity subsectors without industrialization? Countries rich in natural resources face the imperative of diversification. And small isolated economies, such as many in the Pacific, need to find niche markets. The important question is whether the environment of the 21st century will allow the poorer Asian countries to emulate the successful Asian economies of the 20th century or devise alternative development paths.

A discussion of these questions requires analyzing the direction and pace of ST along four interrelated axes:

- What economic transformation has Asia experienced during the last 4 decades?
- Where is the region going, i.e., what type of transformation is expected to take place in the coming decades?
- How will this transformation happen?
- How fast will Asia continue changing?

The transformation of Asia's economies

In this section we analyze in some detail the direction and pace of change of ST in Asia during the last 4 decades. To do so, we (i) document how aggregate sectoral shares (agriculture, industry, and services) have evolved; (ii) decompose economywide productivity growth into that due to intrasector growth and that due to structural change; and (iii) analyze changes in diversification and complexity of exports. Together, these three analyses provide an overview of the changes that have taken place in the region during the last 4 decades, and allow us to explore differences across economies.

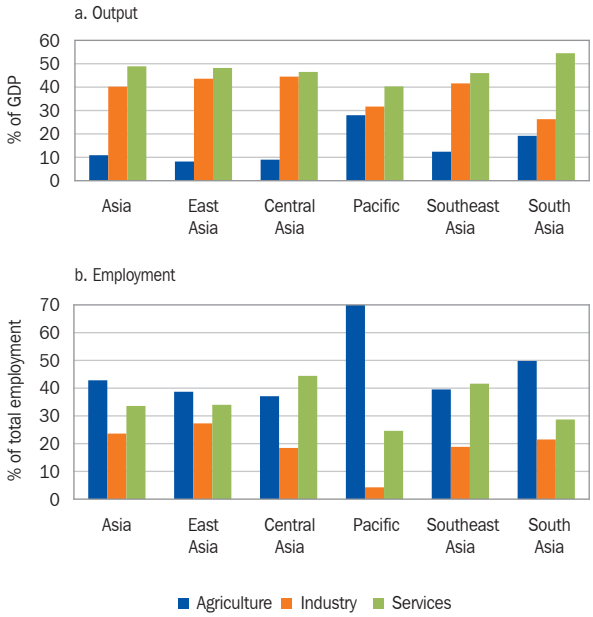
Changes in sectors' shares

The most salient feature of modern development is a secular decline in the shares of agriculture in both output and employment, with the consequent increase in the combined share of industry and services (Figure 1.1). Figure 2.1 shows today's shares of agriculture, industry, and services in GDP and in total employment, by subregion; Table 2.1 shows which sector is the largest in output and in employment, by economy; and Appendix Table A1 provides shares in GDP and in total employment of agriculture, industry, and services for Asian economies in the 1970s (or the earliest available year) and 2010 (or the latest year).

Several patterns stand out.

- *Agriculture.* Agriculture's shares of both GDP and employment have declined all over the region. Agriculture is no longer the largest contributor to GDP in any of the economies, but is still the largest employer in developing Asia. Although the regional share of employment in agriculture has declined by over 20 percentage points since the mid-1970s, agriculture still accounts for 42.8% of total employment. Agriculture is the top employer in the Pacific, East Asia, and South Asia subregions, while the service sector is the largest employer in Central Asia and Southeast Asia. Agriculture is the largest employer in 17 economies for which we have data. In Bhutan, Cambodia, Georgia, India, Myanmar, Nepal, Papua New Guinea, Tajikistan, Vanuatu, and Viet Nam, agriculture's share in total employment exceeds 50%. Moreover, in some countries (such as India), the absolute number of people employed in agriculture is still rising.

Figure 2.1 **Output and employment shares in Asia (% of GDP and total employment, latest year)**



GDP = gross domestic product.
Notes:
(i) Shares are for the latest years available, they are not necessarily the same across countries.
(ii) Output shares are weighted by gross national income and employment shares are population-weighted.
(iii) Japan is not included.
Source: World Bank. WDI. http://data.worldbank.org/data-catalog/world-development-indicators (accessed September 2012).

- *Services.* In Asia, the service sector already accounted for the largest share of GDP in the 1970s. Many economies are not following a transition from agriculture into industry and finally into services—the path taken by East Asia and, before, Japan and the Western countries. In the mid-1970s, the service sector already contributed the largest (43.3%) share to GDP, not agriculture (22.8%). During the last 4 decades, agriculture's share has declined to 10.9% of the region's GDP, industry's share has increased from 33.8% to 40.2%, and the service sector now accounts for 48.9% of Asia's GDP (weighted by gross national income). The service sector is the largest sector in all five of ADB's subregions.

- *Industry.* Industry's employment share is, on average, the smallest of the three sectors. This has been true since the 1970s, and today industry is not the largest employer in any Asian economy.[5] In fact, industry has never been Asia's largest employer: in the mid-1970s, industry employed 16% of the region's labor force and today it employs about 23%. Since the 1970s, the share of employment in services has doubled, from 17% to 34%. Thus, across Asia during the last 4 decades, labor has been reallocated from agriculture mostly into services. Industry's share of GDP is the largest in only a few economies: Azerbaijan, Bhutan, the PRC, Indonesia, Papua New Guinea, Thailand, Turkmenistan, and Viet Nam—and in several of these, the industry category is dominated by oil and gas or minerals.

- *The path and pace of structural change.* ST in Japan and the NIEs has followed a path similar to that of the Western countries, but at a much faster pace in the NIEs. (As noted earlier, agriculture has long been a minor contributor to GDP in two economies—Hong Kong, China and Singapore.) In three economies—Japan; the Republic of Korea; and Taipei,China—the shares of agriculture declined, while those of industry (and in particular manufacturing) and services increased. This happened very quickly during the 1970s and 1980s. Currently, as in most other developed economies, Japan and the NIEs are deindustrializing, with labor moving from industry into services. The consequence is that the service sector is larger than industry.

Agriculture: Declining output share but still the largest employer in many Asian economies

Agriculture played an important role in launching the period of high growth in Japan; the Republic of Korea; and Taipei,China. Success in raising agricultural productivity underpins the entire process of industrialization. Getting agriculture right implies addressing problems of asset ownership as well as investing in irrigation, roads, technology, and other infrastructure.

In Japan, labor productivity in agriculture doubled between 1881–1890 and 1911–1920.[6] In Taipei,China, labor productivity in agriculture increased 130%–160% between 1901–1910 and 1931–1940, as agricultural research underpinned the development and selection of higher-yielding varieties, application of fertilizers increased, and farm practices improved (Johnston and Mellor 1961, Timmer 1995). And in the Republic of Korea and Taipei,China, post-1945 land reform allowed rural productivity to surge. In these economies, the link between agricultural development and poverty reduction showed that rapid growth can be achieved through a development strategy that emphasizes the role of the rural economy. Both governments put a huge effort into rural development, focusing on using technology to boost both land and labor productivity to release surplus labor to work at urban factories. The two governments also nurtured small-scale industries close to farming communities to create nonfarm earning opportunities (e.g., the *saemaul* movement in the Republic of Korea).

Table 2.1 **Largest sector in Asian economies (latest year)**

	Agriculture	Industry	Services
Largest sector in GDP	None	Azerbaijan, Bhutan, PRC, Indonesia, PNG, Thailand, Turkmenistan, Viet Nam	Afghanistan; Armenia; Bangladesh; Bhutan; Cambodia; Fiji; Georgia; Hong Kong, China; India; Japan; Kazakhstan; Kiribati; Korea, Rep. of; Kyrgyz Rep.; Lao PDR; Malaysia; Maldives; Mongolia; Myanmar; Nepal; Pakistan; the Philippines; Samoa; Singapore; Solomon Islands; Sri Lanka; Taipei,China; Tajikistan; Timor-Leste; Tonga; Uzbekistan; Vanuatu
Largest sector in total employment	Armenia, Bangladesh, Bhutan, Cambodia, PRC, Georgia, India, Myanmar, Nepal, Pakistan, PNG, Samoa, Tajikistan, Thailand, Uzbekistan,Vanuatu, Viet Nam	None	Azerbaijan; Hong Kong, China; Indonesia; Japan; Kazakhstan; Kiribati; Korea, Rep.of; Kyrgyz Rep.; Malaysia; Maldives; Mongolia; Philippines; Singapore; Sri Lanka; Taipei,China

GDP = gross domestic product, Lao PDR = Lao People's Democratic Republic, PNG = Papua New Guinea, PRC = People's Republic of China, WDI = World Development Indicators.

Notes: This table is based on Appendix Table A1 and does not reflect WDI's latest update of sectors' shares, according to which Thailand's largest sector in total employment is agriculture.

Source: Authors based on World Bank. WDI. http://data.worldbank.org/data-catalog/world-development-indicators (accessed September 2012).

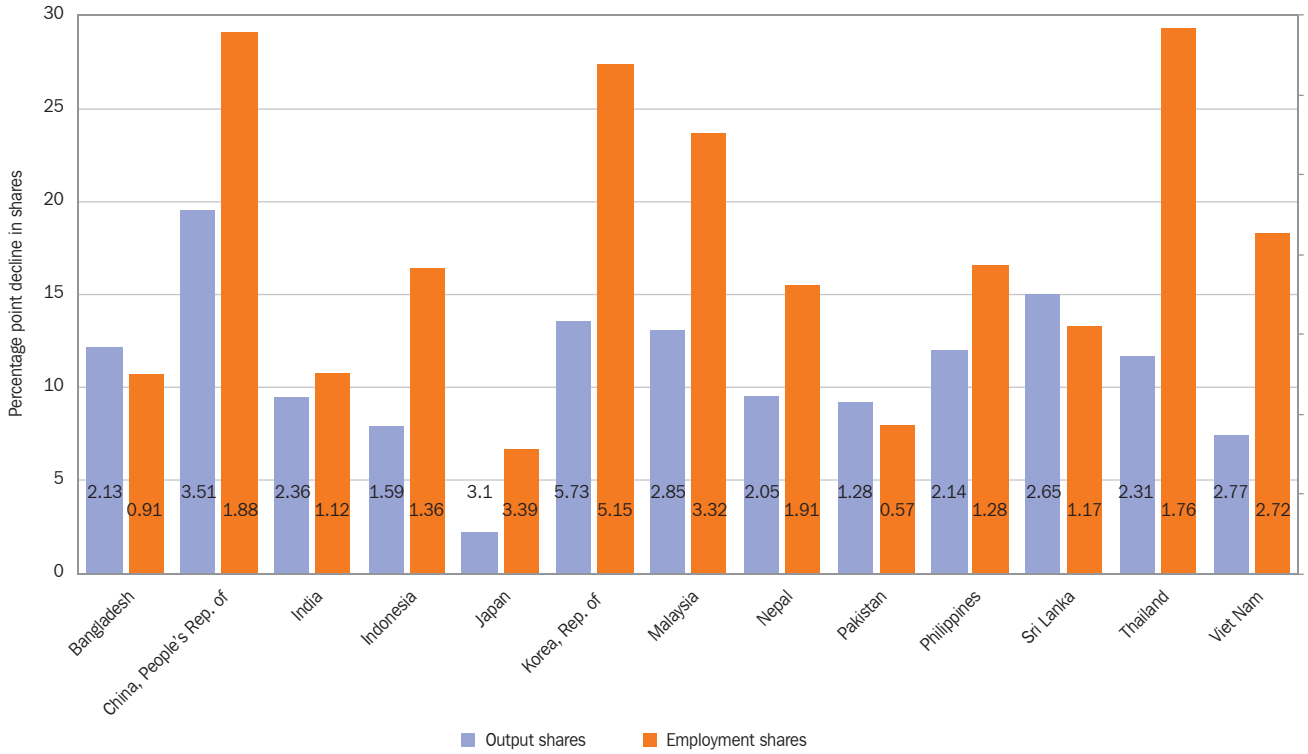
More recently, Indonesia (after 1966), the PRC (after 1978), and Viet Nam (after 1989) tilted investment priorities toward rural growth, which accelerated structural transformation and led to significant poverty reduction. However, the transformation of agriculture in other Asian countries, e.g., India and Pakistan, has been very slow.

Asia's agriculture has changed during the last several decades in five important aspects: the share of its output is declining faster than its share of employment, the productivity of agricultural labor has increased rapidly, productivity of the land has grown fast, technology has led to better yields, and farmers are shifting to high-value crops.

First, agriculture's share of total output is declining faster than its share of total employment. While Asia's share of agriculture in GDP has declined since the 1970s at about 2.51% per annum (faster than the world's average), the share of employment in agriculture has declined at about 1.71% per annum (slower than the world's average).[7] This implies that labor productivity in agriculture remains below the economywide average (but not that labor productivity in agriculture has declined). Figure 2.2 and Appendix Table A2 show the annual rate of decrease in the share of agriculture in both output and employment in selected Asian economies. The fastest declines in both shares were registered by the Republic of Korea, at about 5%–6% per annum. The pace at which the shares, especially that of employment, are declining in other countries is much slower—e.g., in Bangladesh and Pakistan, annual rates of decline are less than 1%.

An important explanation for the employment shares declining more slowly than the output shares is that agriculture is a sink for surplus labor. In most Asian developing countries, the point at which the shift from labor surplus to labor shortage in agriculture is reflected in rising agriculture wages is yet to be reached.[8] The current rate of population growth in developing Asia is an important factor—it is much faster than that in the industrialized countries when they were at a comparable

Figure 2.2 **Percentage point decline in agriculture output and employment shares, and percent decline per annum**

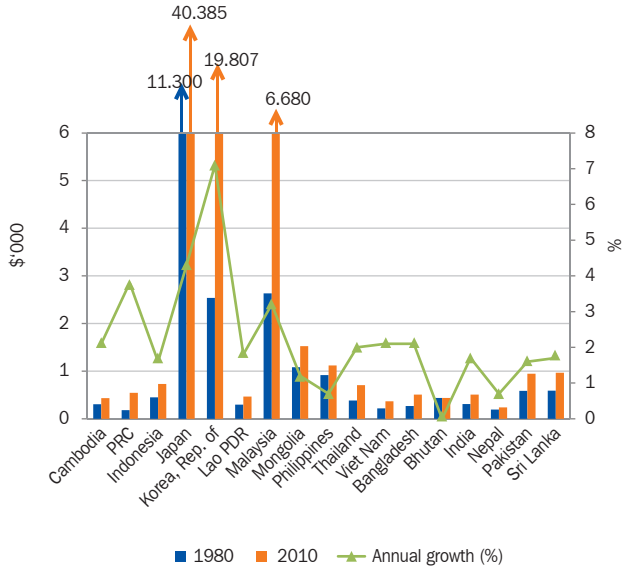


Notes: Height of the bars represents the percentage point decline in the share between the initial and the final year. Numbers inside the bars correspond to the percent decline per annum. Periods covered are as follows: Bangladesh (1984–2005); People's Rep. of China and Pakistan (1980–2008); India (1994–2010); Indonesia (1985–2010); Japan, Malaysia, Philippines, and Thailand (1980–2009); Rep. of Korea (1980–2010); Nepal (1991–2001); Sri Lanka (1981–2009); Viet Nam (1996–2006).
Source: Authors based on World Bank. WDI. http://data.worldbank.org/data-catalog/world-development-indicators (accessed September 2012).

stage of development. Asia's high population growth rate exacerbates the labor absorption problem.

Second, the productivity of agricultural labor has grown faster in Asia than in other developing regions. Figure 2.3 shows that agricultural output per worker has risen fast in developing Asia. The average growth in Asia was 2.2% per year during 1980–2010, while in Sub-Saharan Africa it was only 0.6% and in Latin America and the Caribbean it was 1.8%. Within Asia, agricultural output per worker grew most rapidly in the PRC, Japan, the Republic of Korea, and Malaysia. Conversely, in Bhutan, Nepal, and the Philippines, labor productivity in agriculture has grown at Sub-Saharan Africa rates, or lower.

Figure 2.3 **Gross value added per agricultural worker (in constant $ of 2000, and annualized growth, 1980 and 2010)**



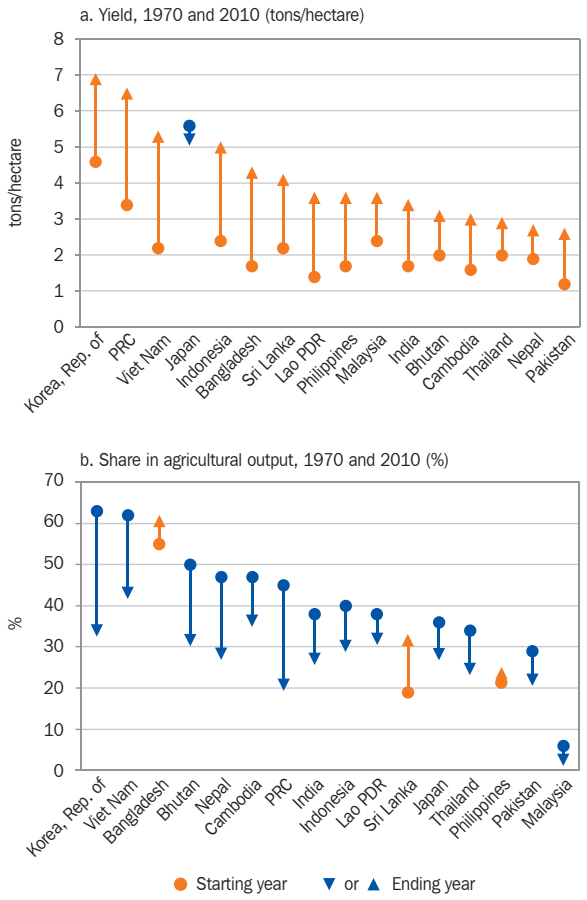
Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China
Notes: The growth rate is computed on an annualized basis between starting and ending years.
Source: Basic data from World Bank. WDI. http://data.worldbank.org/data-catalog/world-development-indicators (accessed September 2012).

Third, land productivity has grown faster in Asia than in other developing regions. During the last 4–5 decades, the scope worldwide for expanding farmland has narrowed considerably, and the land constraint is most acute in Asia: its annual growth rate of agricultural area of arable land and permanent crops has been only 0.49% since 1980—less than in Latin America (0.61%) and Sub-Saharan Africa (0.89%). As shown in Appendix Table A3, in Asia during 1970–2009, annual growth in land productivity averaged 2.24%, compared with 1.51% in Sub-Saharan Africa and 1.84% in Latin America. The share of land productivity growth in agricultural output growth is 82% in Asia, but only 62% in Sub-Saharan Africa and 75% in Latin America. Within developing Asia, only Indonesia, the Lao People's Democratic Republic (Lao PDR), Malaysia, and Viet Nam have benefited from expanding the land frontier since 1980. The implications of increasing the productivity of land for the future of Asia's agriculture will be analyzed in the section "Asia's future transformation."

Fourth, technological change in agriculture since the 1960s led to significantly improved yields of traditional crops. Figure 2.4 and Appendix Table A4 show the yield improvement in the most important cereal staple for a selected sample of Asian economies. The fastest yield growth since the 1970s was registered in Bangladesh, the Lao PDR, Pakistan, and Viet Nam, which all started out from a relatively low base. The PRC and the Republic of Korea, which have had good yield levels since 1970, attained sustained improvement and reached 6.5 tons per hectare of rice or better—among the highest yields worldwide. Next are Indonesia and Viet Nam, at 5 tons per hectare or more. The increased cereal yield was achieved through the Green Revolution—breeding and adopting modern varieties, which give higher yields in response to inputs (e.g., chemical fertilizer and water) than do traditional varieties. Improved wheat and rice varieties were pioneered at international research institutions in Mexico and the Philippines in the 1950s, and disseminated in the 1960s and 1970s throughout Asia. By the 1980s, modern varieties comprised about 60% of the rice Asia grew and 80% of its wheat.

Fifth, agriculture in developing Asia is shifting from traditional to high-value products. Increasing yields in traditional crops, especially cereals, is critical but not sufficient for growth, and continued growth in agriculture has been achieved in part by structural change within the sector. In developing Asia, the rapid growth of agriculture is increasingly being driven by expanding demand for livestock products and high-value crops, which are also more labor-intensive than traditional crops (World Bank 2009). Since 1970, the composition of agricultural output in developing Asia has shifted dramatically (Figure 2.5), albeit with country-specific differences. The PRC and the Republic of Korea have shifted from cereals to livestock products,

Figure 2.4 **Yield of primary cereals and their share in agricultural output, developing Asia, 1970 and 2010**



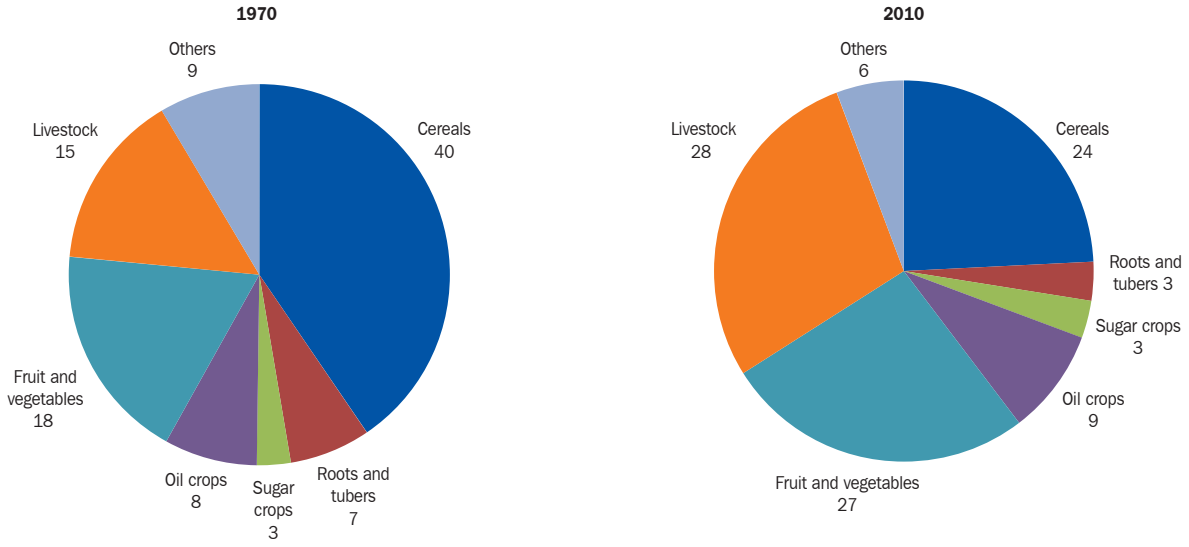
Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
Notes: The share of primary cereals in agricultural output is measured in constant $ of year 2000. The primary cereal is rice, except for Pakistan, where the primary cereal is wheat.
Source: Based on data from FAOSTAT. http://faostat.fao.org (accessed September 2012).

and, at a more moderate rate, so have India, Pakistan, Sri Lanka, and Viet Nam. Significant shifts toward oil crops are observed in Indonesia and Malaysia, and toward miscellaneous other crops in Thailand. Only in Bangladesh and the Philippines is the share of cereals in agricultural output rising. The difference in value per hectare between high-value agricultural products and traditional staples can be dramatic—tobacco and oranges earn about 10 times as much per hectare as rice, and the ratio is over 30 for bananas.

Increasing global trade is a key driver behind these trends. The share of developing Asia in global agricultural exports has increased from 12% to 17% since 1970. The composition of export trade has changed, away from traditionally grown tropical products (including coffee, cocoa, tea, sugar, spices, and nuts) toward horticulture production, seafood, and processed products (Humphrey and Memedovic 2006, Jongwanich 2009). Developing countries are typically net exporters of oilseeds and products, coffee and cocoa, sugar, and fruits and vegetables, and net importers of dairy products and cereals (Diaz-Bonilla and Reca 2000).

The change in the composition of agricultural output has occurred within a broader diversification—the "agribusiness transition." The transition involves input providers (farm equipment producers, logistics firms, and other business service providers) as well as agriprocessors, distribution companies, and retailers. Agricultural transformation therefore involves a parallel development of industry (agriprocessing) and

Figure 2.5 **Composition of agricultural output (constant $), developing Asian countries, 1970 and 2010 (%)**



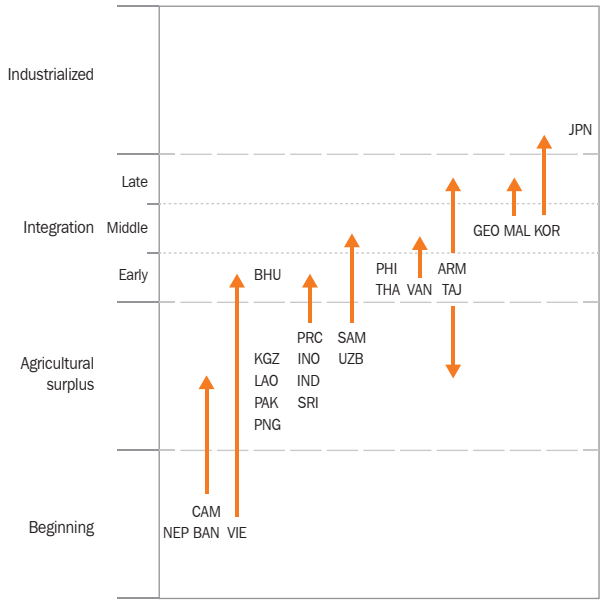
Source: FAOSTAT. http://faostat.fao.org (accessed September 2012).

services (finance, logistics, marketing, etc.). In general, as a country's per capita income rises, the share of its agribusiness in GDP becomes higher than that of agriculture. The World Bank (2003) reports shares of agribusiness in GDP for Indonesia and Thailand at 33% and 43% (in the late 1990s), respectively. And Balisacan et al. (2011) indicate the share of agribusiness in GDP in the Philippines at 15% (in 2005–2010).[9]

One way to characterize the degree of transformation in Asia's agriculture is to follow Timmer's (1988) four phases: beginning, agricultural surplus, integration, and industrialization. This provides a summary of the state of agriculture, a comparison across economies, and the basis for a proper assessment of the sector's prospects (discussed in the section, Asia's future transformation). In the beginning phase, the productivity of agricultural labor starts to increase. Eventually, the productivity rises sufficiently to enable a transition to the second phase—agricultural surplus. The surplus allows industry and services to grow by mobilizing labor, savings, and tax revenues from the agriculture sector. In the integration phase, industry and services become increasingly significant—agricultural development depends on its being progressively linked to the rest of the economy through improved infrastructure and the development of markets. When integration is successfully completed, the economy is deemed industrialized. At this phase, the surplus labor in agriculture has been absorbed by the other sectors of the economy and agriculture's labor productivity is like that of industry and services.

Figure 2.6 shows developing Asian economies' stages in these four phases in 1980 and in 2010. The phases are defined based on per capita income and agricultural output per worker, and according to the qualitative description of Timmer's phases and the cross-section profile of developing countries.[10] The integration phase is divided into early, middle, and late stages. The demarcation of phases is described in the note to the figure. In 1980, only Japan had reached the industrialized phase. But during the next 30 years, most countries progressed. The most striking advances were made by Armenia, the Republic of Korea (which reached the industrialized phase), and Viet Nam. The PRC, India, Indonesia, and Thailand are still in the early integration stage; and Nepal, the Philippines, Thailand, and several others remain in the same phase after 30 years. The reason is that the productivity of agricultural labor in these economies (given their income per capita) has not increased significantly.[11]

Figure 2.6 **Stages of agricultural development in developing Asia, Timmer's classification, 1980 and 2010**



▲ ▼ Indicates movement from 1980 to 2010. No arrow indicates no movements.

ARM = Armenia, BAN = Bangladesh, BHU = Bhutan, CAM = Cambodia, GEO = Georgia, GDP = gross domestic product, IND = India, INO = Indonesia, JPN = Japan, KOR = Republic of Korea, KGZ = Kyrgyz Republic, LAO = Lao People's Democratic Republic, MAL = Malaysia, NEP = Nepal, PAK = Pakistan, PHI = Philippines, PNG = Papua New Guinea, PRC = People's Republic of China, SAM = Samoa, SRI = Sri Lanka, TAJ = Tajikistan, THA = Thailand, UZB = Uzbekistan, VAN = Vanuatu, VIE = Viet Nam.

Notes:
(i) Output per worker is measured in constant 2000 dollars; per capita income is measured in constant 2005 purchasing power parity (PPP)-adjusted dollars.
(ii) 2010 represents either 2010 or the final year for which data are available; 1980 represents 1980 or the earliest year for which data are available. For details see Appendix Table A.1.
(iii) High income = GDP per capita above $15,000; middle income = $2,500–$15,000 GDP per capita; low income = less than $2,500 GDP per capita. Middle income can be demarcated further as upper middle, at GDP per capita above $6,125.
(iv) The substages under the integration stage are as follows: middle-income economies with labor productivity of $1,750 or below are in the early integration phase; those between $1,750 and $3,300 are in the middle integration phase; and those above $3,300 are in the late integration phase.

Source: Authors based on World Bank. WDI. http://data.worldbank.org/data-catalog/world-development-indicators (accessed September 2012).

Industrialization: Different patterns of manufacturing across economies

A feature of Asia's ST has been the fast growth of manufacturing value added that led to relatively high shares of manufacturing in some economies' GDP (e.g., the PRC; Malaysia; the Republic of Korea; Taipei,China; and Thailand). A result is that some people speak of "Factory Asia,"[12] especially in reference to the PRC. This

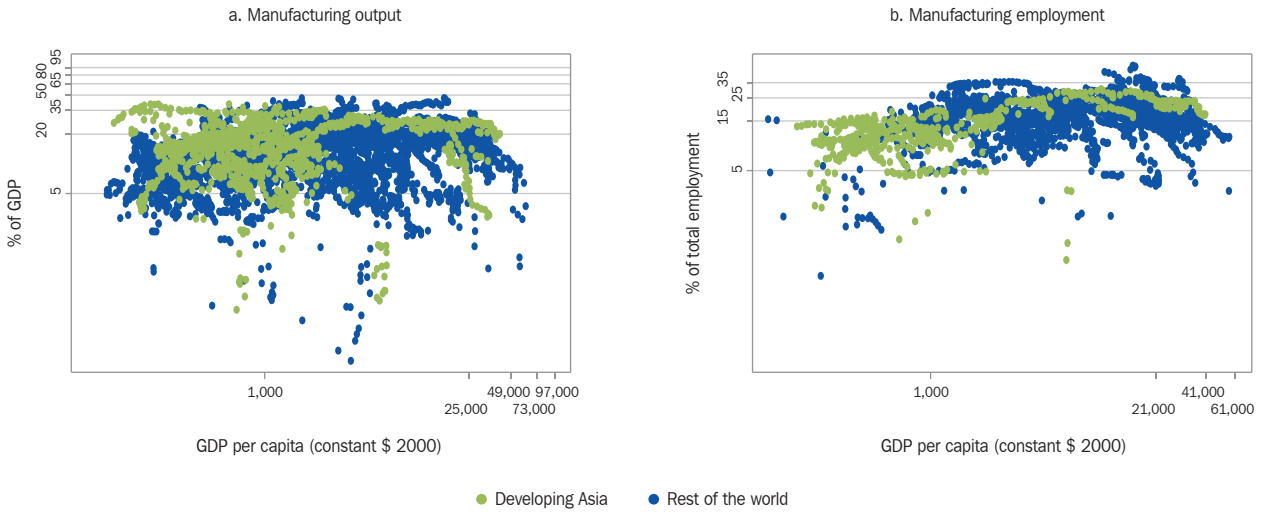
characterization of Asia reflects three factors. First was the rapid industrialization in the four NIEs, which had started during the second half of the 1960s. Next came the wave of industrialization that spread throughout Southeast Asia during the second half of the 1980s and was driven by large Japanese overseas investments. This wave led to the emergence of regional value chains in the 1990s (discussed in the section, "Asia's future transformation"), opening up opportunities for local firms in East Asia. Third was the incorporation of the PRC into the global economy, also during the 1990s.

While these factors have been key drivers of industrialization in parts of Asia, two other factors are important. First, industry (including the manufacturing subsector) is not Asia's largest employer. While manufacturing has reached high shares of GDP in a number of Asian economies, the shares of employment in manufacturing are much smaller, except in a few economies. Moreover, the employment shares are much smaller than they were decades ago in what are today's developed countries. Second, except in a few economies, manufacturing has not been upgraded and deepened, i.e., it has not moved toward the high-tech subsectors. We review these two issues in the following text.

The East Asian economies industrialized but in many other Asian economies, the shares of employment in manufacturing remain low. To analyze the degree of industrialization across developing Asia, we first graph manufacturing output and employment shares against real GDP per capita.These are shown in Figure 2.7. The patterns appear to follow an inverted U-shape, as noted in the introductory section of this chapter and shown in Figure 1.1. This means that the employment and output shares first increase up to a specific level of income per capita (the industrialization phase) and then decline (the deindustrialization phase) .[13] The pattern is driven by the demand and supply factors that drive ST. The composition of the demand side changes—as reflected in the declining proportion of income spent on food as per capita income rises. The change leads to a shift in the pattern of demand from agricultural products (in poor countries, especially food) to manufactured products and services. The supply-side factor is the growth of labor productivity in agriculture, due to a whole range of technical innovations, freeing up more labor to move out of agriculture. The combined effect of demand- and supply-side factors is a large-scale shift of employment into manufacturing in the industrialization phase of the development process.

As the country develops further, demand shifts increasingly toward services, and the share of expenditure devoted to manufactures stabilizes and then ultimately falls in relative terms. The share of employment in manufacturing should also stabilize and eventually fall. The secular shift of employment from manufacturing toward services (the deindustrialization phase) has not been associated with any significant shift in the pattern of expenditures between the two sectors.

Figure 2.7 **Manufacturing output and employment shares**



GDP = gross domestic product.
Sources: ILO. LABORSTA. http://laborsta.ilo.org (accessed September 2012); World Bank. WDI. http://data.worldbank.org/data-catalog/world-development-indicators (accessed September 2012).

Instead, deindustrialization appears to reflect mainly the impact of the different growth of labor productivity between manufacturing and services. If labor productivity in manufacturing increases consistently faster than that in services, then services will have to absorb an ever greater share of total employment just to keep its output rising in line with that of manufacturing. The consequence is that the continuous increase in the share of employment in services reflects both the shift in employment from agriculture to services during the industrialization phase, and later, from manufacturing to services.

There is another reason for the shift in employment: as economic specialization and automation increase with economic growth, it becomes efficient for services once provided within a firm or household to be contracted out to experts outside the organization. Legal, accounting, and data processing services are examples for firms; day care, housekeeping, and restaurants are examples for households. This may mean two things. First, that the same volume of services is being provided as before, but that these services are now measured as a separate market activity. Second, increased specialization can lead to higher quality and/or lower average costs for some services, which would increase the demand for and production of such services.

At what level of income does deindustrialization start? This obviously varies across countries and depends on the interaction among the drivers of ST. But we can estimate statistically (through regression analysis) the expected output and employment shares of manufacturing given income per capita and other relevant variables such as country size (proxied by population) and openness (measured by the trade ratio). We can then derive the maximum expected output and employment shares and the corresponding income levels at which they occur (i.e., the turning point that marks the start of deindustrialization).[14] Table 2.2 summarizes the statistical analysis. The maximum manufacturing shares differ depending on population size and the trade ratio—11%–24% for output and 16%–22% for employment. Smaller economies and those with smaller trade ratios have their turning points at lower shares, and the opposite holds for larger countries and those with larger trade ratios. Table 2.2 indicates that the manufacturing share peaks at about 18% for a trade ratio of 50% and population of about 22 million. The peak occurs at about $8,000 per capita income, and the result is similar for both manufacturing output and employment. This is the share we use to analyze industrialization and deindustrialization patterns in Asia.

The analysis allows us to classify economies into three groups:

- Economies that have industrialized and deindustrialized (in output and in employment). Such economies satisfy two criteria. First, a country industrialized if any 7-year moving average of manufacturing shares in output and employment are at least 18% each. This is to ensure that industrialization was sustained for a significant number of years and not just achieved for a very short period. Second, a country deindustrialized if the difference between the maximum of the series and the average during 2000–2010 (or the maximum number of years available during the last decade of available data) is at least 5 percentage points. This is to ensure that deindustrialization truly occurred, as opposed to a small decline in the shares.

- Economies that have industrialized but not deindustrialized. Such economies satisfy the industrialization criterion but not the deindustrialization criterion.

Table 2.2 **Estimated manufacturing output and employment shares at the turning points for population levels and trade ratios**

Population	**3 million**			**12.5 million**			**22 million**			**60 million**		
Trade ratio (%)	**25**	**50**	**75**	**25**	**50**	**75**	**25**	**50**	**75**	**25**	**50**	**75**
Manufacturing output share												
Turning point ($)	6,029			7,238			7,782			8,850		
Estimated maximum manufacturing output share (%)	10.9	12.3	13.3	14.4	16.4	17.7	16.2	18.4	19.8	19.8	22.5	24.2
Manufacturing employment share												
Turning point ($)	9,239			8,612			8,376			7,972		
Estimated maximum manufacturing employment share (%)	15.7	16.3	16.6	17.7	18.4	18.8	18.6	19.3	19.8	20.3	21.1	21.6

Source: Authors.

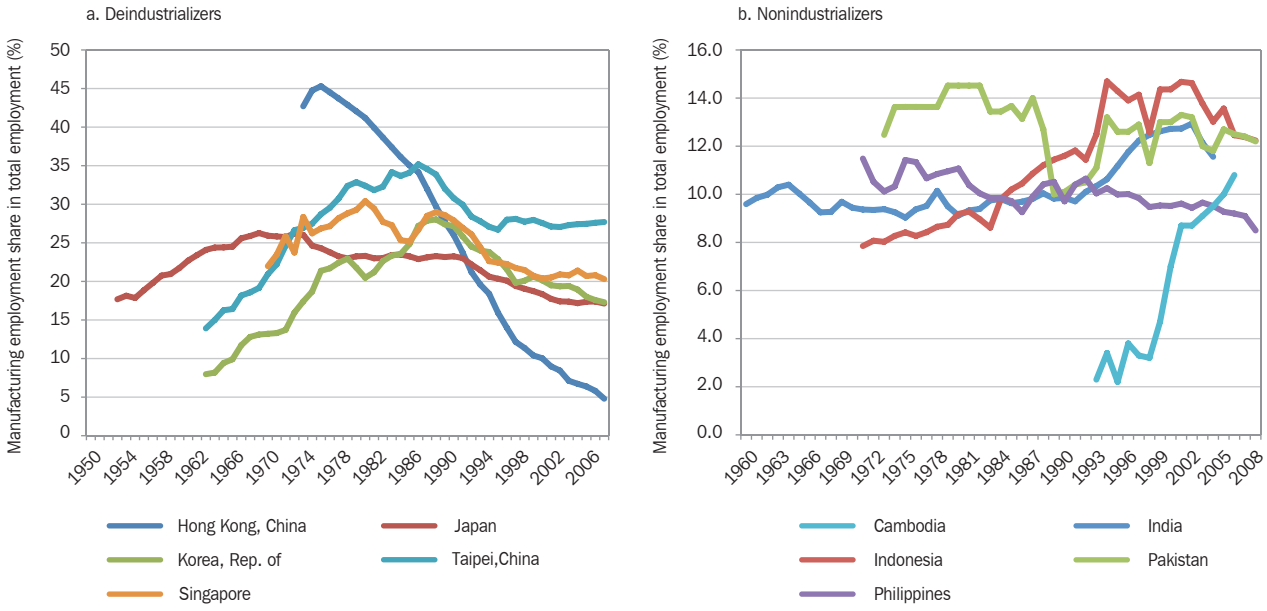
- Economies that never industrialized. In this group, the share of manufacturing never reached 18% on a sustained basis.

The members of the Organisation for Economic Co-operation and Development (OECD) industrialized long ago and have clearly deindustrialized during the last 3 decades or so. Their manufacturing output and employment shares peaked at about 25% during the 1970s—in some cases reaching 30% and above (Appendix Table A5). The share then declined to about half of that.

The situation across Asia is mixed (Figure 2.8 and Tables 2.3 and 2.4). Table 2.3 shows when Asian economies reached peak shares. Although the peak shares for manufacturing output are comparable to and slightly higher than those of the OECD, the peaks for the employment share are significantly lower by an average of 5 percentage points (Appendix Table A5). A significant group of Asian economies industrialized in output, and some of them have deindustrialized. But only Azerbaijan has both industrialized and deindustrialized in employment, apart from Japan and the four NIEs (Table 2.3);[15] and only Malaysia and Sri Lanka have industrialized but not deindustrialized in employment. The rest of the economies for which we have data never industrialized in employment: that is, the share of manufacturing employment in total employment never reached 18% for a sustained period.[16] This includes the PRC, where the share of manufacturing in GDP reached about 41% in 1978 (Table 2.3) but the share of manufacturing employment in total employment is much smaller, about 13% after peaking at almost 16% in the late 1980s. This amounts to a very large number of workers in absolute terms (about 115 million), but it is not a large proportion of the PRC's total employment.[17]

This analysis indicates that, except for Japan and the NIEs, which emphasized employment creation, many other economies across developing Asia have problems generating enough employment in manufacturing to absorb new entrants into the labor force (Felipe and Hasan 2006). Consequently, many new entrants into the labor market are being absorbed by low-productivity service activities. While the share of manufacturing output is high in some Asian economies, the share of manufacturing in total employment is much smaller and only a few Asian economies can be said to have properly industrialized.

Figure 2.8 **Asia's deindustrializers and nonindustrializers**



Source: GGDC. 10-Sector Database. www.ggdc.net (accessed September 2012).

Table 2.3 **Peak manufacturing share in output and employment, Asian economies**

Economy	Output			Employment		
	Data since	Year when highest share was obtained	Value of highest share	Data since	Year when highest share was obtained	Value of highest share
Azerbaijan	1990	1992	23.9	1983	1983	18.3
Bangladesh	1980	2011	18.2	1984	1989	13.9
Cambodia	1993	2004	19.9	1993	2006	10.8
China, People's Rep. of	1965	1978	40.5	1978	1988	15.9[a]
Hong Kong, China	1970	1970	29.6	1974	1976	45.3
India	1960	1979	17.3	1960	2002	12.9
Indonesia	1960	2001	29.1	1971	1994	14.7
Korea, Rep. of	1965	1988	30.7	1963	1989	28.7
Kyrgyz Rep.	1990	1992	33.7	1986	1990	17.0
Malaysia	1960	1999	30.9	1975	1997	27.6
Pakistan	1970	2008	19.7	1973	1982	14.5
Philippines	1960	1973	26.6	1971	1971	11.5
Singapore	1975	2004	27.5	1970	1981	30.4
Sri Lanka	1960	1977	23.1	1990	2006	19.2
Taipei,China	1960	1986	39.2	1963	1987	35.2
Thailand	1960	2007	35.6	1960	2007	16.4
Average			**27.8**			**20.8**
OECD			**25.9**			**25.7**

OECD = Organisation for Economic Co-operation and Development.

a This refers to both urban and rural manufacturing employment. Available data for employment is only up to 2002. The share of urban manufacturing employment in total manufacturing employment is about 28% (for 2000–2010).

Notes: OECD output and employment averages refer to 23 countries. See Appendix Table 5.

Sources: Authors based on ILO. LABORSTA. http://laborsta.ilo.org (accessed September 2012); GGDC. 10-Sector Database. www.ggdc.net (accessed September 2012); World Bank. WDI. http://data.worldbank.org/data-catalog/world-development-indicators (accessed September 2012).

Table 2.4 **Industrialization, deindustrialization, and nonindustrialization in Asia**

Industrialized and deindustrialized	Industrialized and not deindustrialized	Not industrialized
Output		
Armenia; Azerbaijan; China, People's Rep. of; Hong Kong, China; Japan; Kyrgyz Rep.; Mongolia; Taipei,China; Tajikistan	Cambodia; Indonesia; Korea, Rep. of; Malaysia; Pakistan; Philippines; Singapore; Sri Lanka; Thailand; Viet Nam	Bangladesh, Georgia, India, Kazakhstan, Nepal, PNG
Employment		
Azerbaijan; Hong Kong, China; Japan; Korea, Rep. of; Singapore; Taipei,China	Malaysia, Sri Lanka	Armenia, Bangladesh, Cambodia, PRC, Georgia, India, Indonesia, Kazakhstan, Kyrgyz Rep., Mongolia, Nepal, Pakistan, PNG, Philippines, Tajikistan, Thailand, Viet Nam

Lao PDR = Lao People's Democratic Republic, PNG = Papua New Guinea.

Source: Authors.

Finally, demographic and geographic variables affect the development of the manufacturing subsectors (Box 2.1). Such variables help explain, for example, why it is so difficult for island economies to industrialize. The Maldives and the Pacific islands are unique in developing Asia because of their small sizes, small populations, and remoteness. Overall, growth in the Pacific islands during the last 4 decades has been slow, leading to unemployment and joblessness. In addition, several of the island economies face serious environmental problems as a consequence of climate change and rapid urbanization. The Pacific island subregion is also impacted by high population growth, poor education, weak governance, poverty, and poor infrastructure. The public sector provides a high share of total employment, although many public employees are highly underemployed; and many of the island economies depend heavily on transfer payments related to aid, military bases, and workers' remittances.

East Asia's manufacturing has upgraded and deepened, but this has not occurred in many other Asian economies. Table 2.5 divides 18 manufacturing subsectors into high tech and non high tech and shows the resulting output and employment shares in 12 economies. This follows the classification of Antweiler and Treffler (2002) and Ng (2002), based on technological levels. The classification is also consistent with that of Felipe et al. (2010) of almost 800 products. High-tech subsectors are chemicals and chemical products; fabricated metal products; office, accounting, computing machinery, and machinery and equipment;

Box 2.1 **The role of demographic and geographic variables**

A series of recent papers have studied how different manufacturing subsectors evolve as income per capita increases. Some important conclusions are as follows:

Country size. Industrialization usually takes off earlier in small and mid-size countries than in large countries, but industrialization lasts longer in the latter. Although industries such as food and beverages, tobacco, textiles, wearing apparel, wood products, printing and publishing, coke and refined petroleum, nonmetallic minerals and furniture, are the first to develop (i.e., "early industries") in all countries, they reach their maximum value added per capita first in small and medium size countries. But such industries also slow down first in these countries. At high income levels, capital- and technology-intensive industries (e.g., chemicals) become the largest, across all country size groups. Large countries tend to sustain the growth of these industries longer than medium and small countries.

Population density. Higher population density has a positive impact on the development of high-tech industries, especially chemicals, motor vehicles, and machinery and equipment industries.

Natural resources. Countries that are well endowed with natural resources and receive significant foreign exchange for them may lack the incentives to diversify their economies. This can negatively affect the development of manufacturing. An example is Papua New Guinea—over 70% of its exports are natural resources and its manufacturing is underdeveloped. This effect can hamper the development of industries that play a key role in deepening and sustaining industrialization from the upper middle-income stage on, such as electrical machinery and apparatus, motor vehicles (in large countries only), and chemical industries. Countries richly endowed with natural resources need to manage them well to avoid undue currency appreciation from exporting natural resources and they need to invest in physical and human capital, which are both necessary for a continuous shift in the manufacturing structure.

Food, drink, and clothing. Food and beverages, textiles, and wearing apparel are major contributors to employment. These industries (especially the first two) are the largest manufacturing employers up to very high income per capita, and food and beverages remain the most important employer at all levels of income per capita. Most industries that develop early on during industrialization employ fewer workers than do industries that develop later. When employment in the "early industries" starts to slow, other industries have to contribute to employment generation. Given that the early industries provide substantially more employment than those that emerge later, a developing country will need to develop simultaneously several industries that develop during the middle (i.e., paper, basic metals, fabricated metals, and precision instruments) and late (i.e., chemicals, rubber and plastic, machinery and equipment, electrical machinery and apparatus, and motor vehicles) stages to compensate for the declining employment in the early industries.

a The exception is nonmetallic minerals industries: domestically oriented industries that produce building materials for construction and serve a relatively income inelastic demand.

Sources: Haraguchi and Rezonja (2010, 2011a, 2011b); Haraguchi (2012a, 2012b).

Table 2.5 **Shares of high-tech and non high-tech subsectors in total manufacturing output and employment (%)**

Economy	Output[a]				Employment[b]			
	Initial year		Latest year		Initial year		Latest year	
	High-tech	Non high-tech	High-tech	Non high-tech	High-tech	Non high-tech	High-tech	Non high-tech
Bangladesh	14.76	85.24	23.97	75.92	12.98	87.02	6.17	93.83
China, People's Rep. of	39.96	60.12	45.99	53.93	51.79	48.21	45.29	54.71
India	38.04	61.96	37.98	62.06	28.20	71.80	22.98	77.02
Indonesia	11.15	88.85	31.21	68.85	10.12	89.88	18.68	81.32
Korea, Rep. of	24.33	75.67	63.69	36.35	22.81	77.19	45.57	54.43
Malaysia	21.02	78.98	50.12	49.84	19.64	80.36	43.75	56.25
Pakistan	17.03	82.97	25.45	74.57	21.44	78.56	15.54	84.46
Philippines	23.28	76.72	47.47	52.53	18.43	81.57	44.37	55.63
Singapore	38.94	61.06	89.68	10.32	36.36	63.64	82.92	17.08
Sri Lanka	27.38	72.62	14.43	85.56	27.33	72.67	6.67	93.33
Taipei,China	32.62	67.45	51.42	48.58	...	...	...	...
Thailand	37.12	62.88	51.67	48.34	17.77	82.23	33.29	66.71

... = no data available, PRC = People's Republic of China.

a For output, the initial year for all economies is 1970, except for the PRC (1980) and Taipei,China (1979). The latest years are as follows: the PRC, Indonesia, Malaysia, and Singapore: 2007; India and Sri Lanka: 2008; Bangladesh: 1998; Pakistan, Philippines, and Thailand: 2006; Taipei,China: 1996. For Indonesia in 1970, there are no data on the following categories: petroleum, and nuclear fuel; basic metals; and medical, precision, and optical instruments. For Thailand in 1970, there are no data on coke, petroleum, and nuclear fuel; and medical, precision, and optical instruments. For Singapore in 2007, there are no data on food and beverages and tobacco products.

b There are no data for Taipei,China. The initial year for all economies 1970, except for the PRC (1977), India (1980), and Singapore (1969). The latest years are: the PRC and Indonesia: 2009; India, the Republic of Korea, Malaysia, Singapore, and Sri Lanka: 2008; Pakistan, the Philippines, and Thailand: 2006; Bangladesh: 1998. For Indonesia in 1970, there are no data for coke, refined petroleum, and nuclear fuel; and basic metals. For Thailand in 1970, there are no data for coke, refined petroleum, and nuclear fuel. For India and the Republic of Korea in 2008, there are no data for office, accounting, computing machinery, machinery and equipment; communication equipment, electrical machinery and apparatus; and medical, precision, and optical instruments. For Singapore in 2008, there are no data for food and beverages, and tobacco products. For Pakistan in 2006, there are no data for office, accounting, computing machinery, machinery and equipment.

Sources: Authors based on ILO. LABORSTA. http://laborsta.ilo.org (accessed September 2012); GGDC. 10-Sector Database. www.ggdc.net (accessed September 2012); World Bank. WDI. http://data.worldbank.org/data-catalog/world-development-indicators (accessed September 2012).

communication equipment, electrical machinery and apparatus; medical, precision, and optical instruments; and motor vehicles. Non high-tech subsectors are food and beverages; tobacco products; textiles; wearing apparel, fur and leather products, and footwear; wood products; paper and paper products; printing and publishing; coke, refined petroleum, and nuclear fuel; rubber and plastic products; nonmetallic mineral products; basic metals; and furniture.

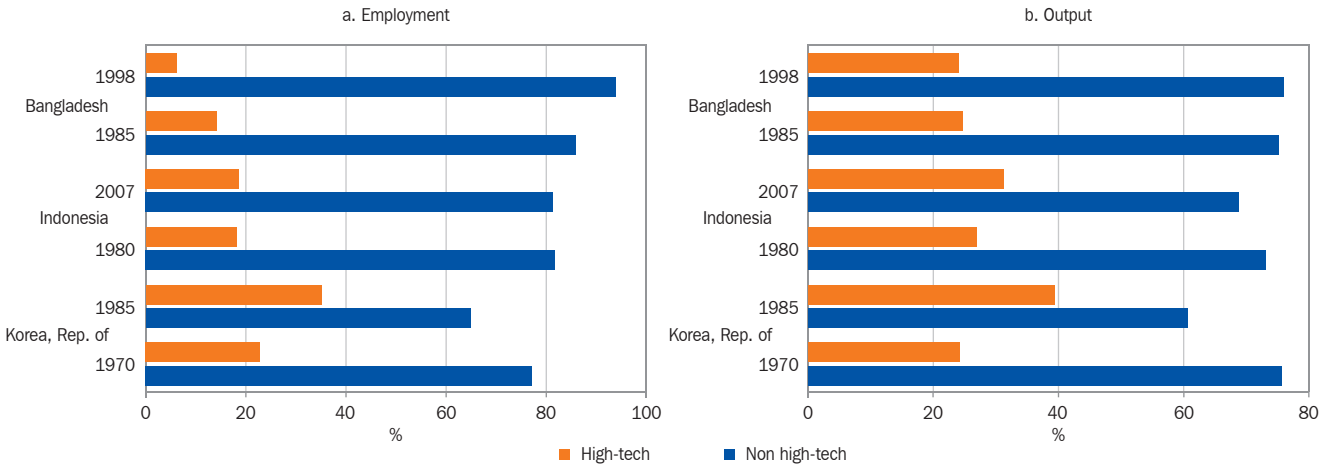
The shares of high-tech subsectors in manufacturing output has increased since 1970 in the East Asian economies, while the increase in South Asia has been very small and even declined in India and Sri Lanka. The shares of high-tech subsectors in manufacturing employment have declined in Bangladesh, the PRC, India, Pakistan, and Sri Lanka.

Figure 2.9 compares the change in high-tech and non high-tech manufacturing output and employment shares in the Republic of Korea in 1970 (before the start of the Heavy and Chemical Industry [HCI] drive) and 1985; in Indonesia in 1980 and 2007–2009; and in Bangladesh in 1985 and 1998. While the Republic of Korea's manufacturing underwent profound upgrading during 1970–1985 (with high-tech manufacturing reaching almost 40% of both output and employment), the change in Indonesia was smaller and in Bangladesh employment in high-tech manufacturing even declined. Singapore and Taipei,China could be similarly compared with Malaysia, the Philippines, and Thailand.

Precisely why certain actions and policies (or lack of them) led to the successful industrialization of East Asian economies, while others failed, is difficult to ascertain. It is even more difficult to establish causality. For example, the governments of Japan, the Republic of Korea, and Singapore were relentlessly committed to industrializing, and all three used industrial policies extensively. Japan created the Ministry of International Trade and Industry in 1951. With the Ministry of Finance, it exerted tremendous authority over corporate Japan, although not without open resistance from the latter. The Ministry of International Trade and Industry targeted industries and the Ministry of Finance directed the flow of resources. While both institutions accepted that market forces should direct the country's scarce resources into the businesses in which Japan had clear advantages, they also wanted to develop new comparative advantages (Hayashi 1990).

Starting in the second half of the 1960s, the Republic of Korea made conscious and concerted efforts to move into higher-value-added areas through complementary investments in human capital and infrastructure. In 1973, President Park launched the

Figure 2.9 **High-tech and non high-tech subsectors: Bangladesh, Indonesia, and the Republic of Korea (% of total manufacturing output and employment)**



Note: High-tech subsectors include the following: chemicals and chemical products; fabricated metal products; medical, precision, and optical instruments; motor vehicles, trailers, semi-trailers, and other transport equipment; office, accounting, computing machinery, machinery and equipment not elsewhere classified; and radio, television, and communication equipment, electrical machinery, and apparatus. Non high-tech subsectors include the following: basic metals; coke, refined petroleum products, and nuclear fuel; food and beverages; furniture; manufacturing not elsewhere considered; nonmetallic mineral products; paper and paper products, printing, and publishing; rubber and plastics products; textiles; tobacco products; wearing apparel, fur, leather, leather products, and footwear; and wood products (excluding furniture).

Source: Authors based on UNIDO. http://www.unido.org/resources/statistics/statistical-databases.html (accessed September 2012).

HCI drive. The objective was to achieve, by 1981, $10 billion in exports (which Japan had reached in 1967) and $1,000 per capita income. The HCI subsector was to account for at least 50% of manufacturing value added and contribute 60.5% of manufacturing exports. Macroeconomic imbalances as well as political problems forced the government to call off the HCI drive in 1979. Despite the problems, the HCI drive helped build the foundation of many of the country's leading industries, such as steel, shipbuilding, machinery, electronics, and petrochemicals. The drive also strengthened backward and forward linkages among them and related industries such as automobiles (Lim 2012).

Singapore has virtually no natural resources beyond a natural harbor and, when it split from Malaysia in 1965, Singapore's unemployment was 14% and it had only 2 million people, a very small number to support any industry. The government concluded that, given these conditions, it had to be bold and devise a unique approach to industrialization and job creation, the key to economic development. But unlike in Japan and the Republic of Korea, bureaucrats in Singapore did not focus on nurturing Singaporean firms run by local entrepreneurs. When the Singapore government wished to enter a new area, it did so directly. In this sense, the government's degree of intervention in the economy was greater than that in Japan or the Republic of Korea; but, at the same time, Singapore was the most open of the three to the forces of globalization and the most promarket. The essence of the model was to achieve industrialization by attracting foreign investment. Singapore's economic team targeted types of multinational companies that could create the largest number of jobs, import new technologies, train Singaporeans in advanced technical and managerial skills, and generate exports. As in Japan and the Republic of Korea, Singapore also entrusted the development of master plans to a group of bureaucrats, by establishing in 1961 the Economic Development Board (Schuman 2009).

In contrast, several factors help explain why the Philippines failed to industrialize, despite attempts to do so during the 1980s. Both the Republic of Korea and the Philippines embarked on building an industrial base at the same time, struggled through worldwide economic recessions caused by two oil price shocks, selected a common set of industries to nurture, followed nearly identical development blueprints for the selected sectors, utilized the same set of policy instruments to channel resources to targeted sectors, and relied heavily on external borrowing to fund domestic investment. But the Korean economy weathered and recovered much more quickly from economic slowdowns and price shocks than did others—a testament to its successful industrial transition—whereas the Philippines' shallow industrial base was nearly decimated by the ensuing internal and external crises (Box 2.2).

Haraguchi (2012a) examines the speed with which manufacturing developed in large countries that have some similar characteristics. His aim was to analyze why some countries have successfully hastened the transformation of their manufacturing while others have not. He finds that the real value added per capita of the Republic of Korea's manufacturing increased 20 times faster on average than Malaysia's, while most of Malaysia's industries grew faster than those of Sri Lanka. Haraguchi argues that, because the Republic of Korea's and Sri Lanka's economies are similar in terms of population density (above the world median) and resource endowment per capita (below the world median), differences are likely to be explained by country-specific conditions that relate to a country's capabilities, such as the ability of the state to promote diversification, deepening, and upgrading, and relate to other unique circumstances that enhance a country's infrastructure, institutions, and relative cost level.

Felipe (2012a, 2012b) finds that the Republic of Korea succeeded in achieving new comparative advantage in products that were significantly different from those it exported 5 years earlier. By comparison, Malaysia, and even more so the Philippines, acquired new comparative advantage in products that were very similar to the ones already exported.

In Malaysia's case, an analysis of the tasks conducted by electronics firms across the country concluded that they lag behind firms in Singapore and Taipei,China, in every stage of the process (i.e., assembly, manufacturing, product design, etc.). Malaysian firms are highly involved in assembly and product manufacturing and much less involved in high value-added activity (reported by Samel 2012). And using Malaysia's input–output tables, Tham and Loke (2011) concluded that efforts to deepen the country's manufacturing have

Box 2.2 **Lack of depth in the Philippine manufacturing subsector: The legacy of old, incoherent policies and attempts to correct them**

Former Philippine policymakers tried to steer the economy by implementing industrialization policies. Like other developing countries, the Philippines embarked on an industrialization program based on an inward-looking import substitution strategy during the 1960s, and then shifted to an export-oriented regime in the mid-1970s. During the 1980s, the country developed an aggressive industrialization strategy based on 11 major industrial programs. The plan was to spur the growth of supporting manufacturing activities. By locating major industries across the country, the government intended to disperse economic activities and generate rural employment. Financing was to come from external loans, foreign equity, and suppliers' credits.

Yet, unlike its East and Southeast Asian neighbors that managed to catapult their economies into the league of industrial nations, the Philippines remains constrained by narrow export specialization, import dependence, and a shallow knowledge base. The reasons include macroeconomic policies, flawed incentive structures, and lack of nationalism among the "captains" of industry. In addition was the discord in trade, investments, domestic regulation, human resources, and science and technology policies that were supposed to complement the industrial programs during the 1960s–1980s.

The overall lack of policy coherence during the 1980s as well as poor implementation left the Philippines with a much weaker economic structure than that in some of its East and Southeast Asian neighbors. This is reflected in broken supply linkages that prevented the development of a robust domestic industrial structure. In many Philippine industries, labor is the only local input. For example, the lack of materials processing has affected the parts and supplies industries and hampered high-tech industries from moving up the value ladder. As a result of weak backward linkages within manufacturing, automotive and electronics continue to rely on imported parts and remain at the assembly stage of the supply chain. Iron and steel is also critical for the development of manufacturing, but the country does not locally manufacture the metals that many industries require (e.g., for refrigerators). With the closure of Global Steel, local production of hot-rolled coils and sheets, cold-rolled coil sheet, tin plates, and wire rods has been totally taken over by imports. The tool and die industry has to compete against imported dies and molds. Most raw materials, equipment, and software have to be imported.

To remedy these problems, and in consultation with the private sector, the Department of Trade and Industry and the Board of Investments are formulating a comprehensive manufacturing industry roadmap. The objective is to enable manufacturing firms to upgrade and spearhead growth. The overall plan includes a roadmap for the automotive industry. The automotive subsector has a very large multiplier effect (through backward linkage), as it demands a wide range of inputs from other industries, including raw materials, energy, construction, and services.

Sources: Abrenica (2013), Aldaba (2013), Balisacan and Hill (2003).

not succeeded in nurturing a critical mass of domestic entrepreneurs with indigenous innovative capacities, as the country's industrialization depends on imported technology and capital. The electrical and electronics subsector has weaker backward linkages than other subsectors in the economy.

The output mix has to be upgraded to raise wages in the long term, to create niches, and to move away from the most competitive low-wage and low-profit segments of the world market. Export unit values are the prices per unit that can be secured on the export market, a proxy for quality. The highest export value is referred to as the "frontier," the goal to be achieved. Research indicates that export unit values tend to converge rapidly across countries. This means that countries that enter a new sector and start well below the export unit values of the advanced economies (i.e., the frontier) raise both their unit values and per capita income faster (Hwang 2006). Poor countries converge to rich countries unconditionally within the set of goods they produce, but most poor countries have not grown because the range of goods they produce and in which convergence can occur has been limited. In other words: an important difference between the slow-growing and the fast-growing countries is that the lagging countries are producing in sectors where the frontier—the highest value to be reaped—is not very far ahead of the value they are currently securing, so there is little potential for growth through catch-up. Conversely, fast-growing countries have managed to get into sectors where the frontier is further ahead.

Services: Asia's service sector follows a two-wave pattern, and the share of complementary services is increasing

Because many developing Asian economies have skipped the industrialization stage, their service sector is the largest in GDP and in employment (Appendix Table

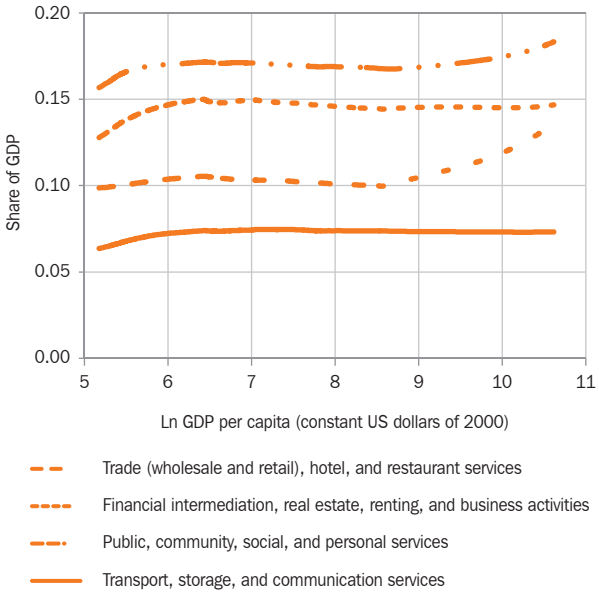
A1), at relatively low per capita income. The service sector is difficult to analyze because it is heterogeneous (ADB 2012a). Traditional services (e.g., barbershops and neighborhood retailing) are generally low productivity activities, but some services, based on new technology and standardization of delivery, permit substantial productivity gains. For example, transport services, financial operations, wholesale trade, and renting services are often complementary to industrialization and are a significant aspect of the ST process that leads the creation of a modern industrial and service economy. We document two features of Asia's service sector—first, the two-wave path of its subsectors; second, the rise of the share of financial intermediation, real estate, renting, and business activities.

The two-wave pattern of services. Eichengreen and Gupta (2013) found a two-wave pattern in the growth of the service sector. The sector's output share in total GDP rises at a decelerating rate at relatively modest GDP per capita and then it rises again at a later level of GDP per capita. This finding challenges the somewhat conventional wisdom that the service sector only becomes important when countries reach a high level of per capita income, and explains the observation that many developing countries have sizeable service sectors (Appendix Table A.1 and Table 2.1). Several reasons account for this.

- First, governments aim to provide a minimum level of services to their constituencies, e.g., jobs for the urban middle classes, which organized industry cannot fully absorb.
- Second, the service sector has extensive disguised unemployment.
- Third, in countries relatively closed to foreign competition, the main activity of the urban middle and upper classes is wholesale and distribution.
- Fourth, in some developing countries, comparative cost considerations play an important role in determining the share of the service sector, e.g., the tourism industry in the Maldives and in some Pacific islands.
- Fifth, the composition of services in developing economies is very different from that in advanced economies. For example, ADB (2012a) reports that the share of business services in total employment in countries such as the United Kingdom and the United States was over 20% in 2007—significantly higher than in most Asian economies.

In terms of the service sector's potential for stimulating economic development, it is important to understand the roles the service subsectors play during the phases of development. Figure 2.10 replicates the analysis of Eichengreen and Gupta (2013) with data for 23 Asian economies (using GDP per capita in constant dollars of 2000), disaggregated into four subsectors for the period 1974–2010: (i) public, community, social, and personal (PCSP) services; (ii) trade (wholesale and retail), hotel, and restaurant (THR) services; (iii) financial intermediation, real estate, renting, and business (FRB) activities; and (iv) transport, storage, and communication (TSC) services. The THR and TSC subsectors only have

Figure 2.10 **Services and development in Asia, sectors' shares: A two-wave pattern (Lowess regressions)**



GDP = gross domestic product, US = United States.

Notes: Lowess = locally weighted regression, a curve-fitting technique that provides a generally smooth curve, while making no prior assumption about the relationship; this is in contrast to "standard" ordinary least squares (OLS) regression analysis, which assumes that the relationship is represented by a straight line. The 23 economies are Azerbaijan; Brunei Darussalam; China, People's Republic of; Hong Kong, China; India; Indonesia; Japan; Kazakhstan; Kiribati; Korea, Republic of; Kyrgyz Republic; Lao People's Democratic Republic; Malaysia; Nepal; Pakistan; Papua New Guinea; Philippines; Singapore; Sri Lanka; Thailand; Tonga; Tuvalu; and Viet Nam. The four subsectors are trade (wholesale and retail), hotels, and restaurants (50–55); transport, storage, and communication (60–64); financial intermediation, real estate, renting, and business activities (65–74); and public, community, social, and personal services (75–99). Numbers in parentheses refer to International Standard Industrial Classification (ISIC), rev. 3 codes. The average shares in GDP for each subsector (across all economies and time) is 15%, 7%, 10%, and 17%, respectively; and the average of the overall service sector is 49%.

Source: Authors.

one inflection point, implying that they grow quickly at lower GDP per capita, and their shares stabilize above about $560 and $580, respectively. FRB has two inflection points, the first at $600 and the second at $5,500. PCSP also has two inflection points, at $600 and $6,000.

These results lead to the conclusion that the service sector matters at all levels of development, and not just at high levels of income per capita. In the first phase (the first wave), all four service subsectors increase their share of GDP (and consequently grow fast), but especially THR, TSC, and PCSP. During the second phase (between approximately $625 and $5,675), we observe roughly constant shares of the four service subsectors. The third phase (the second wave) is characterized by rising shares of FRB and PCSP. The second wave starts around $5,675, and FRB is key to understanding the second wave of the service sector.

Table 2.6 uses the estimated regressions for the four service subsectors in Figure 2.10 to position the Asian economies in the two waves at five points in time. The table shows when countries passed by each of the two waves. For example, Thailand moved out of the first wave between 1975 and 1980; the PRC, Indonesia, and Sri Lanka, between 1990 and 2000; and India, Pakistan, and Viet Nam, between 2000 and 2010. Of the economies covered, only the Republic of Korea moved into the second wave, which it did between 1980 and 1990, joining Brunei Darussalam; Hong Kong, China; Japan; and Singapore.

The rise of complementary services. The share of services in total output has changed in many Asian countries, as has the composition within services. Figure 2.11 shows time series of the shares of the four service categories in total services. In particular, service sector activities have become increasingly commercialized, which has led to the rise of complementary services, especially FRB activities.

FRB activities are complementary to manufacturing as concomitants to urbanization, are necessary links to the process of modern production, and are enablers of greater specialization and division of labor. FRB activities allow firms to focus on their core competencies and make more use of specialist subcontractors to provide accounting, human resource management, and other services that were previously provided in-house. TSC (transport, storage, and communications, the other important type of complementary service), varies more across countries than the other subsectors, but overall, the share of FRB plus that of TSC has increased in most economies. Only in Japan, the Philippines, and Thailand has FRB's share not changed; and in India, it has declined (in India, the gainer has been THR).

Urbanization and services. An important aspect of ST in Japan and the NIEs has been substantial urbanization; other economies across the region are urbanizing fast. Between 1970 and 2010, Asia's urban population increased fourfold, to almost 1.6 billion people. By 2050, Asia's urban population is expected

Table 2.6 **Asian economies: The two waves of the service sector**

	Phase 1 (first wave) Subsectors with fastest growth in this wave: Trade (wholesale and retail), hotel, and restaurant services; Public, community, social, and personal services	**Phase 2**	**Phase 3 (second wave)** Subsector with fastest growth in this wave: Financial intermediation, real estate, renting, and business activities
1975	PRC, India, Indonesia, Nepal, Pakistan, Sri Lanka, Thailand	Kiribati; Korea, Rep. of; Malaysia; PNG; Philippines	Brunei Darussalam; Hong Kong, China; Japan; Singapore
1980	PRC, Indonesia, India, Nepal, Pakistan, Sri Lanka	Kiribati; Korea, Rep. of; Malaysia; PNG; Philippines; Thailand; Tonga	Brunei Darussalam; Hong Kong, China; Japan; Singapore
1990	PRC, India, Indonesia, Kyrgyz Rep., Lao PDR, Nepal, Pakistan, Sri Lanka, Viet Nam	Kazakhstan, Kiribati, Malaysia, PNG, Philippines, Thailand, Tonga, Tuvalu	Brunei Darussalam; Hong Kong, China; Japan; Korea, Rep. of; Singapore
2000	India, Kyrgyz Rep., Lao PDR, Nepal, Pakistan, Viet Nam	PRC, Indonesia, Kazakhstan, Kiribati, Malaysia, PNG, Philippines, Sri Lanka, Thailand, Tonga, Tuvalu	Brunei Darussalam; Hong Kong, China; Japan; Korea, Rep. of; Singapore
2010	Kyrgyz Rep., Lao PDR, Nepal	PRC, India, Indonesia, Kazakhstan, Kiribati, Malaysia, Pakistan, PNG, Philippines, Sri Lanka, Thailand, Tonga, Tuvalu, Viet Nam	Brunei Darussalam; Hong Kong, China; Japan; Korea, Rep. of; Singapore

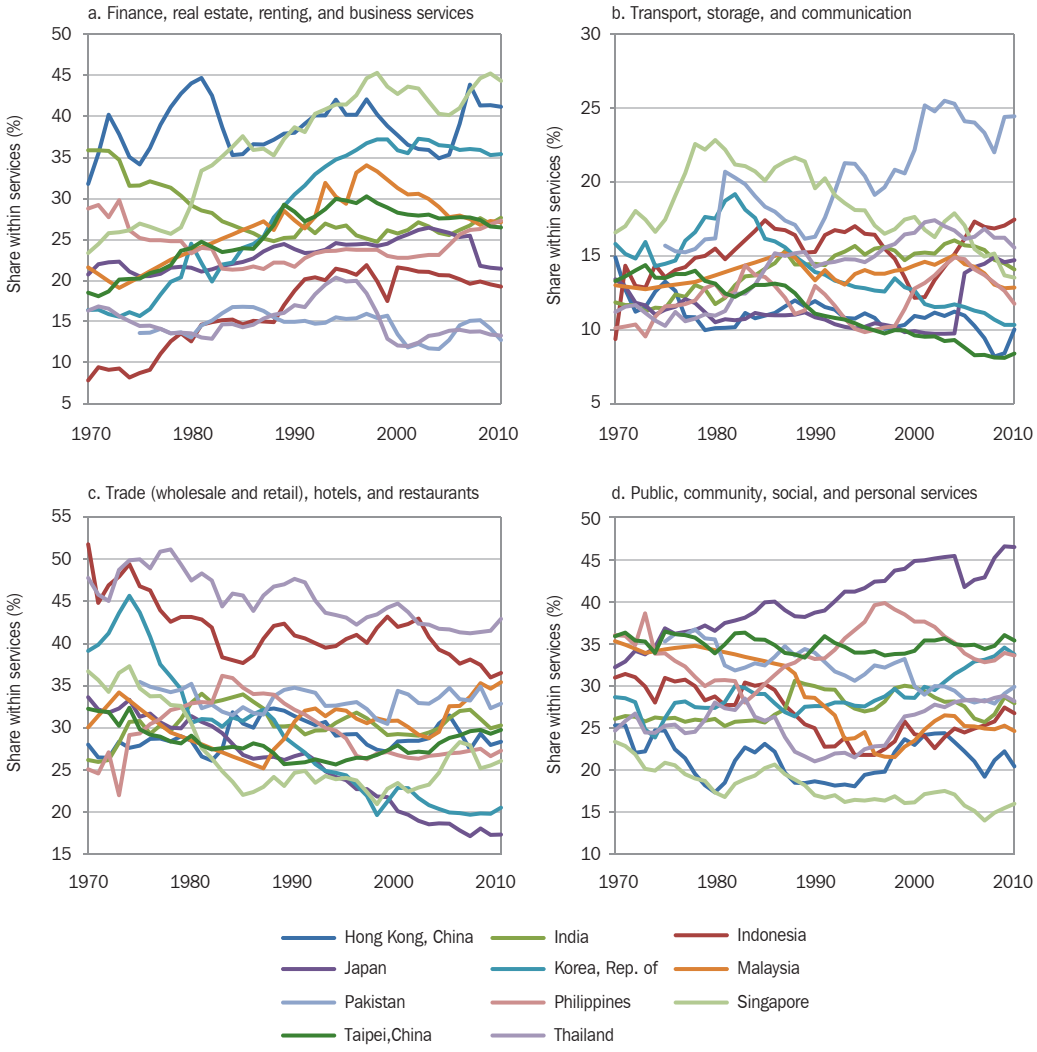
Lao PDR = Lao People's Democratic Republic, PNG = Papua New Guinea, PRC = People's Republic of China.
Note: Underlined entries refer to the first occurrence for the economy.
Source: Authors.

to reach almost 3 billion people—63% of the total population (Kohli et al. 2011). And urban centers produce services. Figure 2.12 documents the statistically significant relationship between the urbanization rate and (i) the share of employment in services, and (ii) the shares of manufacturing and services in GDP. The shares of manufacturing and services are higher in the more urbanized societies.

The result is that urbanization and GDP per capita tend to move in sync as countries develop, thus creating a consuming class that drives demand. In all known cases of high and sustained growth, urban manufacturing and services led the process, while increases in agricultural productivity freed up labor to move to the cities.

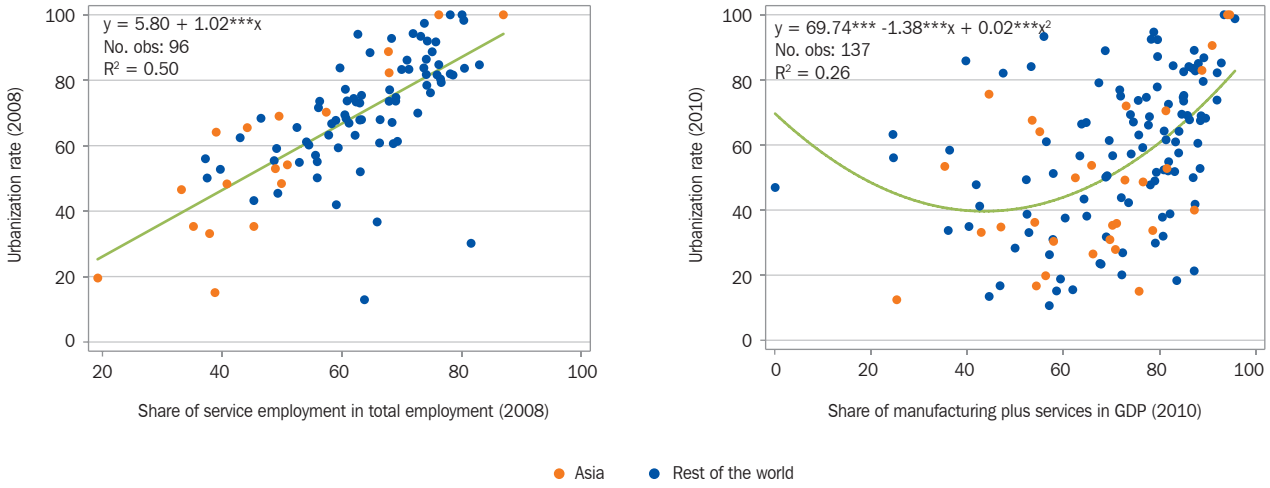
Urbanization's contribution to growth comes from two sources: the difference between rural and urban productivity levels, and more rapid productivity change in cities. In the high-growth cases Spence et al. (2009) examines, the average productivity of a worker in manufacturing or services is 3–5 times that of a worker in agriculture, and sometimes much more. In the early stages of development, when the majority of the population is still rural, the jump from rural to urban employment makes a big contribution to growth. As cities grow, the second effect—more rapid productivity change in cities—begins to dominate. Anything that slows the transfer of workers out of agriculture into activities in cities is likely to slow growth.

Figure 2.11 **The rising share of complementary services**



Source: ADB. SDBS. https://sdbs.adb.org (accessed September 2012).

Figure 2.12 **Urbanization and structural transformation**



*** = significant at the 1% level.
Source: World Bank. WDI. http://data.worldbank.org/data-catalog/world-development-indicators (accessed September 2012).

Because urbanization is one of the most important enablers of rapid growth, countries that want to grow fast must learn how to make urbanization work well. The first challenge is to foster the growth of high-productivity activities that benefit from agglomeration and scale economies in developing-country cities. The second involves managing the likely side effects of the economic success of cities, i.e., urban poverty, pollution, congestion, and high prices of land and housing, as well as regional inequality. Meeting this second challenge is essential for mitigating the divisive impacts of successful economic growth and spreading the benefits of higher economic productivity widely (ADB 2012b).

The growth of business services is inextricably linked with urbanization, globalization, and the intertwining of modern industrial and service activities. They have grown rapidly in all developed and developing countries in recent years, both in terms of employment and value added. Services provide important inputs to production in all sectors, especially manufacturing. Three features of business services are a trend toward their spatial concentration, the increasing level of internationalization, and their contribution to improving the efficiency of manufacturing and other service industries.

Most labor productivity growth has been within sectors; less has come from reallocating labor across sectors

In this subsection, we analyze productivity growth. To do this, we decompose the growth of labor productivity between two periods into (i) the "within effect"—its contributions within each sector; (ii) the "between effect"— the contribution from changes in the allocation of labor between sectors; and (iii) the "dynamic effect"—the interaction between changes in labor productivity and labor shares in individual sectors (Box 2.3). The last two effects reflect structural change.

The manufacturing sector registered the highest growth of labor productivity during 1974–2004 in all economies except India (where the labor productivity of the service sector grew the fastest), Malaysia, and the Philippines (where the fastest growth was registered by agriculture). Taipei,China attained the highest overall labor productivity growth, at 332%, and Philippines the lowest, at 20%.

Box 2.3 **Shift–share analysis of productivity growth**

The shift–share method decomposes the growth rate of labor productivity into three components:

- the contribution from changes in the reallocation of labor between sectors, weighted by the initial value of labor productivity (positive if sectors of high productivity increase their employment share, and negative if they decrease their employment shares)—termed the "between effect;"
- the interaction between changes in labor productivity and labor shares in individual sectors—termed the "dynamic effect;" and
- the contribution of productivity growth within each sector, weighted by the initial share of each sector in total employment—termed the "within effect."

Algebraically (with each term ordered in the sum), this is expressed as:

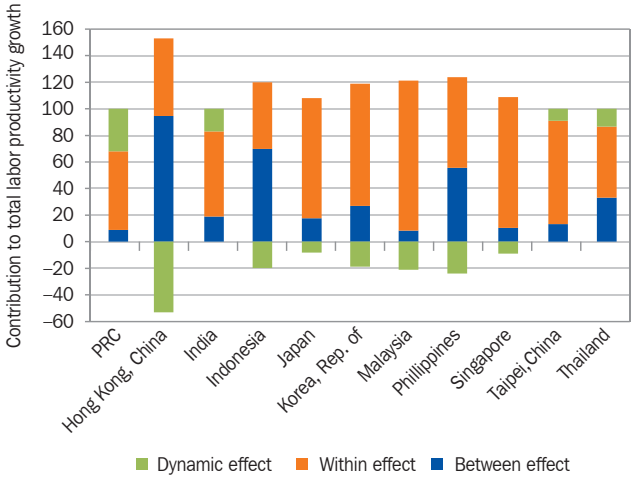
$$\dot{\pi}_N = \frac{\pi_{N,t} - \pi_{N,t-n}}{\pi_{N,t-n}} = \frac{\sum_{i=1}^{N} \pi_{i,t-n}\left(s_{i,t} - s_{i,t-n}\right) + \sum_{i=1}^{N}\left(\pi_{i,t} - \pi_{i,t-n}\right)\left(s_{i,t} - s_{i,t-n}\right) + \sum_{i=1}^{N}\left(\pi_{i,t} - \pi_{i,t-n}\right)s_{i,t-n}}{\pi_{N,t-n}}$$

where π is labor productivity, t–n is the initial year, t is the final year, N is the number of sectors, i corresponds to each economic sector, and s is each sector's weight in employment.

Source: Maroto-Sanchez and Cuadrado-Roura (2009).

Figure 2.13 displays the shift–share decomposition for 11 Asian economies. The sum of the within, between, and dynamic effects is equal to the change in labor productivity growth for 1974–2004. The analysis considers nine sectors (some of them subsectors within industry and within services): agriculture; manufacturing; public utilities; mining and quarrying; construction; wholesale and retail trade and accommodation; transport and communications; FRB; and personal and government services.

Figure 2.13 **Shift–share analysis: Decomposition of labor productivity growth, overall economy, 1974–2004 (% contribution of each component)**



PRC = People's Republic of China.
Note: The "within effect" is the contribution of productivity growth within each sector, weighted by the initial share of each sector in total employment; the "between effect" is the contribution from changes in the reallocation of labor between sectors, weighted by the initial value of labor productivity; and the "dynamic effect" is the interaction between changes in labor productivity and labor shares in individual sectors.
Source: Authors.

To understand what the within effect measures, suppose that there was no change in the sectors' shares, and that productivity growth rates were the ones observed. Then this effect measures what productivity growth would have been in this case. In the case of the between effect, suppose that productivity growth rates in each sector had been zero and that one observed the sectors' shares changing as they did. Then this effect measures what productivity growth would have been in this case.

Labor productivity growth within each sector was the most important contributor to overall labor productivity growth in most cases. The two exceptions are Hong Kong, China and Indonesia, where the highest contributor was the between effect.[18] The within effect is also somewhat important in Indonesia, the Republic of Korea, the Philippines, and Thailand. Although not shown, in four economies (Japan; Hong Kong, China; the Philippines; and Singapore), manufacturing's contribution to the between effect was negative—the employment share of manufacturing fell; and in the Republic of Korea and Taipei,China, manufacturing's contribution to the between effect, while positive, was small, i.e., the employment share of manufacturing increased only marginally.

The structural change effects—comprising the between and the dynamic effects—are dominated by a positive between effect. This implies that employment shifted toward sectors of higher productivity. But in absolute terms, the between effect in most economies was weaker than the within effect.

Except in four economies (the PRC; India; Taipei,China; and Thailand), the dynamic effect was negative—with overall changes in the sectors' employment shares and changes in labor productivity moving in opposite directions (i.e., a sector's share in total employment increased while its labor productivity declined, or vice versa).

The analysis shows that overall labor productivity growth in many Asian economies during 1974–2004 resulted mainly from productivity growth within sectors, while the between effect—the reallocation of labor from sectors of lower into those of higher productivity—had a smaller effect. In India during the period considered, within-sector productivity growth accounted for 64% of total labor productivity growth, labor reallocation into higher productivity sectors accounted for 19%, and the dynamic effect—the interaction between changes in labor productivity and changes in sectors' shares—accounted for 17%. That is, labor shifted toward industries with fast productivity growth (Box 2.4). The corresponding shares for the PRC are 59%, 32%, and 9%. This means that labor reallocation across sectors was, in percentage terms, smaller than the within effect. But this does not mean that it was not large in absolute terms. The between effect is small in percentage terms in the PRC because the within effect was very large in absolute terms—over 350% (with significant contributions from agriculture and especially manufacturing), much larger than the between effect, at 54% (the same as the average of the other economies shown in Figure 2.13). Agriculture's reallocation effect was negative (the sector's share declined), while the contribution of the other subsectors to this effect was positive. Finally, the dynamic effect accounted for 191% of overall productivity growth. What this suggests is that in many Asian economies there is plenty of room for the labor reallocation effect to play a significantly larger role as a contributor to overall productivity growth. We return to this issue in the section, Asia's future transformation.

Box 2.4 **Economic transformation in India**

India's situation reveals what many Asian economies face in generating desirable economic transformation. Recent research shows that India's rapid economic growth of about 8.7% per annum from 2004–2005 to 2009–2010 had little impact on the process of economic transformation. Agriculture's share in total employment declined significantly, by about 4 percentage points, with 15 million workers migrating to towns and cities. But the manufacturing and service sectors did not fully absorb them. Manufacturing in fact shed 5 million jobs, while services recruited 3.5 million workers. Increased construction pulled workers out of agriculture. The Government of India Planning Commission (2012) argues that many workers are shifting from informal agriculture to informal work outside agriculture, instead of being absorbed by manufacturing and services.

Sources: Government of India Planning Commission (2012), Mehrotra et al. (2012), Thomas (2012).

Diversifying and upgrading the complexity of exports have been uneven across Asian economies

In this subsection, we analyze changes in export baskets during 1995–2010. To do so, we use the concepts of diversification and complexity introduced by Hidalgo et al. (2007) and Hausmann et al. (2011) to complement our discussion of upgrading.[19]

The key concept is complexity, which combines the ideas of diversification and ubiquity. Diversification refers to the variety of products that a country exports (Box 2.5). The variety is larger in countries that have accumulated more knowledge (e.g., about production), and, in general, complex economies are more diversified than economies that are not complex.[20]

Using export data for 1,240 products for 1995–2010, we calculate the total number of products that a country exports with revealed comparative advantage and refer to it as a country's level of diversification (Box 2.6). When compared across countries and across time, this measure also indicates export competitiveness.

Figure 2.14 documents the level of diversification of 20 Asian economies at 5-year intervals during 1995–2010. The graphs show three levels of diversification in the economies' export baskets: economies that are well diversified and today have comparative advantage in over 700 products; economies that today have comparative advantage in 100 to 350 products; and economies that today have comparative advantage in 80 products or fewer.

Complexity is a measure of both product and economic sophistication. Complexity is calculated using information on how diversified an economy is and how unique the products that it exports are. This information can be combined to jointly generate an

economic complexity index (ECI) for countries and a product complexity index for products (Box 2.6). Not surprisingly, the most complex products are chemicals and machinery, while the least complex are raw minerals and simple agricultural products (Felipe et al. 2012).

Box 2.5 **Why does diversification matter for structural transformation?**

The key difference between modern and premodern economies is not that the modern economies have more of the same things, but rather that they have a significantly larger number of different things, many of which were not available in earlier times. The increase in diversification is probably the most conspicuous aspect of economic development, and is a chief difference between the complex process of economic development and the aggregate process of economic growth. The economies and employment of countries or regions that export a diverse set of products grow faster, in part because they hold a varied set of industries and, through them, a larger number of productive capabilities. A diverse set of industries and capabilities, in turn, creates inter- and intra-industry spillovers that give rise to clusters of productive activities in which the competiveness of each firm is connected to the existence of other firms.

Export diversification matters because it can lower volatility and instability in export earnings. Such effects can help hedge against the risk inherent in a market with uncertain returns. Economic downturns are shorter lived in more diversified economies. Diversified exports reduce the possibility of overreliance on income from abundant natural resources (the "Dutch disease"),[a] institutional degradation, or reluctance to implement growth-enhancing reforms.

However, it is not very easy to diversify exports. Venturing into a new activity entails significant uncertainty about the profitability of the new venture. The new activity may have high social returns, but the risks are private.

Finally, diverse and more complex economies are more inclusive, as the Gini coefficient (a measure of inequality) and diversification (controlling for income) are significantly related. This implies that economies that are more diverse and more complex tend to be less unequal, even after controlling for income.

a "Dutch disease" refers to appreciation of the exchange rate due to significant current account surpluses resulting from exports of natural resources. This appreciation usually harms the development of the manufacturing sector.

Sources: Haraguchi and Rezonja (2010, 2011a, 2011b); Haraguchi (2012a, 2012b).

Box 2.6 **Diversification and complexity measures**

Revealed comparative advantage and diversification. For each country and product, we calculate the exports per capita and then compare this ratio to the same one at the worldwide level (i.e., world exports of the product divided by the sum of the populations of all the countries that export the product). We denote this ratio as the index of revealed comparative advantage, and write it as $RCA(pop)_{c,p}$ (where the subscripts c and p denote country and product, respectively). Specifically, we argue that a country exports a product with revealed comparative advantage if $RCA(pop)_{c,p}>0.25$, and the number of products exported with $RCA(pop)_{c,p}>0.25$ is a country's level of diversification. Algebraically:

$$\text{RCA(pop)}_{c,p} = \frac{\text{exports}_{c,p}/\text{population}_c}{\sum_c \text{exports}_{c,p}/\sum_c \text{population}_c}$$

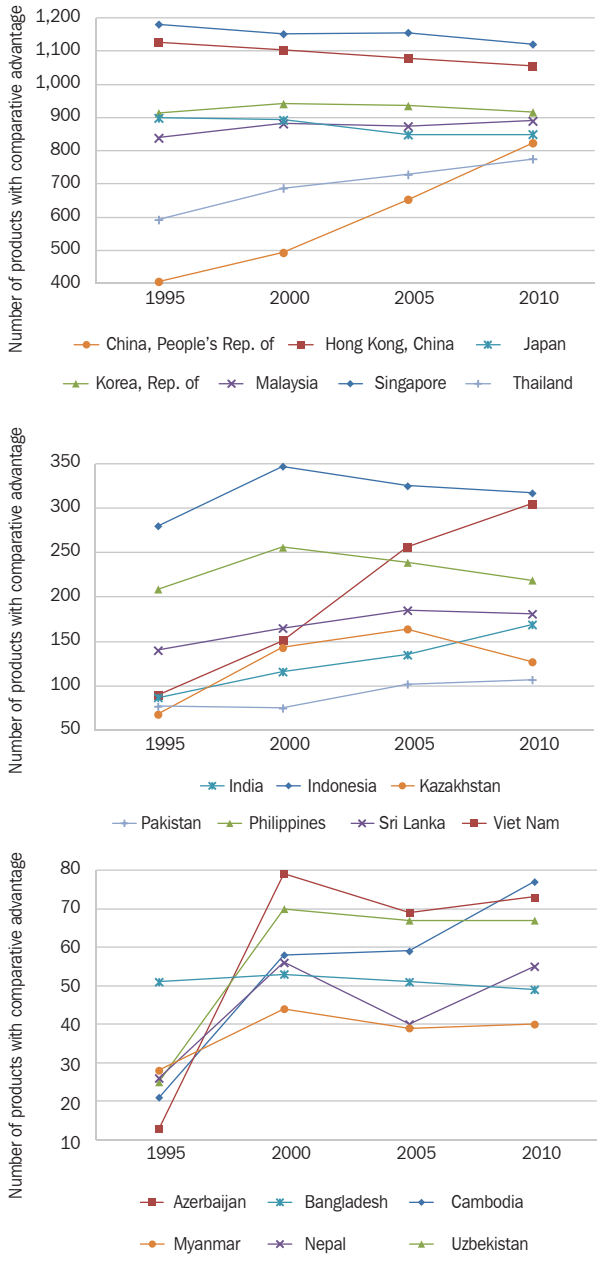
for exporter c and product p.

The threshold $\text{RCA(pop)}_{c,p}>0.25$ requires that a country's exports per capita are larger than 25% of the world's exports per capita of the product, and ensures that a country is a significant exporter of the product. If we make this threshold substantially larger, e.g., $\text{RCA(pop)}_{c,p}>1$, no country satisfies it for many products.

Complexity. To calculate this measure, we use information on the diversification of a country and on how unique a product is (i.e., how many other countries also export it with revealed comparative advantage). The latter is referred to as the "ubiquity" of a product. A product that is exported by only a few countries is more unique, or less ubiquitous. Complex products require more knowledge to produce, so we may expect them to be less ubiquitous. Independently, diversity and ubiquity provide significant information about the variety of capabilities available in a country, or required by a product; but used jointly they provide more information. For example, only a few countries possess diamonds, which may give the impression that these countries are complex economies. However, countries that possess diamonds may not have many other products (i.e., their diversification is low). Two countries may be equally diversified but their products differ in terms of ubiquity; for example, one may manufacture medical devices produced by very few countries, and the other one, plastic buckets that are very standard and produced worldwide. This way, diversity can be used to correct the information conveyed by ubiquity, and likewise, ubiquity can be used to correct the information that diversity conveys; and so on until the process converges and there is no difference between successive iterations. Specifically, for a country, the method calculates the average ubiquity of the products that it exports and the average diversity of the countries that export those products. Conversely, for a product, the method calculates the average diversity of the countries that export them and the average ubiquity of the other products that these countries make. The result of these iterations is an economic complexity index for countries and a product complexity index for products.

Sources: Hausmann et al. (2011), Felipe et al. (2012).

Figure 2.14 **Export diversification in Asia**



Note: The table shows the number of products exported with RCA(pop)c, p>0.25 (Box 2.5). The maximum possible is 1,240 products.
Source: Authors.

Figure 2.15 and Appendix Table A6 show time series for 1995–2011 for the ECI for 20 Asian economies. Values have been standardized for each year so that the mean of the distribution is zero. Therefore, for example, a value of 0.5 indicates that the country's ECI is half a standard deviation above the mean. The most complex economy in the region (and in the world) is Japan, at 1.22 standard deviations above the mean, followed by the Republic of Korea; the PRC; Hong Kong, China; and Singapore. The least complex is Myanmar, at 1.61 standard deviations below the mean.

The ECI has increased during 1995–2011 in economies such as Azerbaijan and Cambodia (both starting from about 1.5 standard deviations below the mean); Nepal (from 0.7 standard deviations below the mean to about the mean); and the Philippines, India, Thailand, and Viet Nam (from about 0.5 standard deviations below the mean to slightly above the mean). This is a sign of progress. In the most advanced economies, the ECI did not change (values were already high). And the ECI declined significantly in Kazakhstan, mostly because its export structure lacks diversification. As noted in Box 2.1, ample natural resource endowment can have a negative effect on the development of most manufacturing subsectors.

Transformation of export diversification and complexity. We comment briefly on the changes of export diversification and complexity, but do not cover each economy.

The PRC and India, the two economies with the largest populations, show marked differences in the diversification and complexity of their exports. The PRC's total exports of $1.77 trillion in 2010 dwarf India's at $238 billion. Between 1995 and 2010, the PRC more than doubled the number of products it exported with revealed comparative advantage (RCA), from 407 to 824; particularly significant are the increases in chemical and allied industries (from 46 to 109 products), machinery and electrical (from 26 to 117 products), and metals (from 48 to 110 products). While India nearly doubled its exports of products with RCA, the number was from 87 to 169. Of the 407 products that the PRC exported with RCA in 1995, 176 belonged to the bottom tercile of product complexity (43% of the total) and 85 were in the top tercile (9%); by 2010, the PRC exported 323 products that were in the top product complexity tercile (39% of the total). In the case of India, 71 of the 87 products that it exported with RCA in 1995 (82% of the total) belonged to the bottom product complexity tercile and only 2 products belonged to the top tercile; by 2010, the bottom tercile remained the largest group, containing 104 products (61% of the total), and India only exported with RCA 16 products that belonged to the top product complexity tercile.[21]

Countries such as Malaysia, Thailand, and Viet Nam have done very well. Between 1995 and 2010, Thailand increased the number of products exported with RCA from 593 to 776. In 2010, it exported 246 products that

belonged to the top product complexity tercile (32% of the total). Malaysia had already achieved a high level of diversification by 1995: 840 products. Between 1995 and 2010, the number of products Malaysia exported with RCA increased only to 890 (with 288 products in the top complexity tercile). Viet Nam registered an impressive increase in the number of products exported with RCA, from 90 to 305; and although in 2010 it still exported many products that belonged to the bottom complexity tercile, its products in the top product complexity tercile had increased from zero in 1995 to 53 in 2010.

On the other side of the spectrum are countries such as Kazakhstan and Pakistan, where most products exported with RCA are in the bottom tercile of the complexity range.

Conclusions

This section has provided an overview of the direction and pace of ST across developing Asia during the last several decades. The six most important conclusions are as follows:

During the last 4 decades, Asia's economies have transformed structurally; however, the pace and extent have been very uneven. Desirable ST has taken place only in five Asian economies: Japan; Hong Kong, China; the Republic of Korea; Singapore; and Taipei,China. Often, references to "Asia's success" mask very wide differences within the region. The PRC has experienced significant ST, but it still has a long way to go, especially because agriculture is still the largest employer. India lags well behind in the extent and pace of its ST. Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam have experienced ST in terms of diversification, upgrading, and deepening (and with important differences among the four economies). The rest of the region lags far behind, including large economies such as Bangladesh and Pakistan.

Figure 2.15 **Economic complexity index (ECI), 20 Asian economies, 1995 and 2010**

Source: Authors.

The shares of agriculture in output and employment have declined, but at different speeds, and agriculture remains the largest employer in Asia. In Japan; the Republic of Korea; and Taipei,China, increased agricultural productivity played key roles in releasing labor and capital for ST into higher productivity activities. However, many economies have not yet reached the turning point where the shift from surplus labor in agriculture to labor shortage is reflected in a rising agriculture wage. And in some economies, the process of reallocating labor from agriculture has scarcely begun. In the more dynamic economies, there has been ST within agriculture, upgrading to higher value products and integrating farms into agribusiness networks so that the sector becomes more like secondary industry.

Manufacturing's output share has increased in many countries, and only the economies that industrialized early on have reached the deindustrialization stage. But manufacturing absorbs much less employment than agriculture and services. Moreover, except in Japan and the NIEs, the share of employment in manufacturing is significantly smaller than it was in the OECD countries before they deindustrialized. Most Asian countries have not industrialized in employment, and only a few have experienced significant deepening in manufacturing, i.e., with a significant increase in high-tech subsectors.

Economic transformation in many Asian economies is a shift from agriculture into services. The service sector is the largest in many economies, but is difficult to analyze due to its heterogeneity. The development of the service sector follows a two-wave path: the first wave up to about $600 GDP per capita, and the second from about $5,500, led by finance, real estate, renting, and business activities, which complement increased complexity in agribusiness or manufacturing. Higher-productivity services are often associated with urbanization.

In many Asian economies, productivity growth within sectors has contributed more to overall productivity growth than has the reallocation of labor into sectors of higher productivity. This suggests that in many cases labor released from agriculture has moved to relatively low-productivity services. A lesson for future ST is the importance of reallocating labor to manufacturing and higher-productivity services.

The complexity of export baskets varies across economies. The export baskets of Japan, the NIEs, and some other East Asian economies have become increasingly complex, diversified, and unique, implying that they have moved up the quality ladder. However, the complexity of many other Asian countries' export baskets remains low.

Asia's future transformation

The analysis and conclusions in the previous section, "The transformation of Asia's economies," clearly indicate that Asia's future development will have to involve further economic transformation in many economies. The development will need to permit the transfer of workers out of agriculture into activities of higher productivity, and upgrading of the economic structure.

The key questions we address in this section pertain to how this transformation will take place (if it does transpire), how fast, and, ultimately, where it will take developing Asia. The environment in which Asia's new industrial economies began to thrive during the 1960s and 1970s was a booming global economy in which many low-wage countries were pursuing inward-oriented development, leaving the few and small outward-oriented countries an almost unlimited demand for their labor-intensive manufactured exports. This state of affairs is unlikely to be repeated, even though many countries, including some with large pools of rural labor, now seek to follow that crowded path. Some patterns of ST will prevail in the future (such as a decline in agriculture's shares in both GDP and employment), but ST in the next decades will differ from that in which Japan and the NIEs thrived during the last half century. Aging populations, the fast-growing global middle class, globalization, and the impact of the 2007–2009 recession and the subsequent slowdown will affect the direction and speed of developing Asia's ST. And the role and impact of technology as a driver of future global growth is not clear.

This section and the next two discuss and outline the main contours of the region's future economic transformation and shed light on the "where to, how, and how fast" questions. This section uses the same aggregate sectors—agriculture, industry (including manufacturing), and services—used in the previous section to look at the last 4 decades. Doing so allows continuity in the analysis and arguments. The disadvantage of using the same sectors is that many modern activities have features that make the standard classification of output and employment not very helpful in understanding ST in the 21st century. Indeed, the difference between goods and services is becoming blurred: often the two cannot be distinguished, with the consequence that "manufacturing" is increasingly being interpreted in a wider sense, including business services and sometimes infrastructure relevant to producers.[22] Even agriculture becomes less distinctive at higher income levels with capital-intensity and research and development (R&D) greater than in many other productive sectors and extensive service inputs, especially if we consider the broader agribusiness subsector. However, with a few exceptions, comparable statistics for countries and time series are still presented in the traditional classification.

In this section, first, we argue that many Asian economies cannot afford to neglect agriculture, given the key functions that it plays in development and that the sector is the largest employer in many Asian economies. The secular decline in the share of employment in agriculture is a key feature of ST. Second, we inquire whether Asian economies can bypass industrialization and still achieve high-income status. Third, we discuss the roles of technology and global value chains (GVCs) in agriculture and in manufacturing. Will they contribute to developing Asia's industrialization efforts in the 21st century? Fourth, we document the complementarity between manufacturing and services. Finally, we elaborate on the implications of ST based on shifting resources into the service sector.

Asia's agriculture sector needs upgrading and modernizing

Agriculture is still the largest employer in many Asian countries, including Bangladesh, Cambodia, the PRC, India, Pakistan, Papua New Guinea, Thailand, and Viet Nam. The bulk of the poor are still found in rural areas, where the primary source of employment is agriculture. An important pillar of the success of three economies—Japan; the Republic of Korea; and Taipei,China—was agricultural development through land reform and infrastructure. Thus, discussion of developing Asia's future ST cannot neglect the agricultural sector. This is obvious for countries where the ST process has far to go—such as in Bhutan, Cambodia, Myanmar, and Nepal, where the share of agriculture in employment remains above 60%. In the rest of developing Asia, even though agriculture's shares of output and employment have

declined over time, the reduction of the employment share lags behind that of the output share, implying relatively low levels of labor productivity in agriculture. None of the developing countries can therefore afford to neglect the transformation of agriculture.

The scope for large transfers of agricultural workers to industry and services is limited in some economies, as low-skilled, rural-based workers find it difficult to find high-productivity occupations outside the farm. Hence, productivity growth must increase within agriculture. The resulting income boost will allow farm households to increase their investment in human capital, which consequently will enable family members to find employment outside the farm. Therefore, at least in the short- to medium-term, a large part of the additional employment opportunities will have to be generated within agriculture. In the 1960s, Ranis and Fei (1961) and Johnston and Mellor (1961), and recently Studwell (2013), emphasized technological change and the multiple functions of agriculture in overall development—providing food for the nonagricultural labor force, supplying labor, providing savings to invest in manufacturing, saving foreign exchange by reducing agricultural imports, and expanding the market for nonagricultural goods. These functions will remain important for developing Asia in the coming decades.

Asia's agriculture needs to successfully address a series of challenges—resource depletion, climate change, and market instability (Briones and Felipe 2013). But the future of the sector lies in transforming it by taking advantage of new technologies; in making the transition to high-value products and to agribusiness (including the development of services such as finance, logistics, marketing, etc.); and in linking GVCs.

Resource depletion, climate change, market instability, and the long-term challenges for Asia's agriculture

More than 40% of Asia's agricultural area suffers from some form of soil degradation. Freshwater supply per capita in Asia is about half the world's average, and water scarcity is expected to worsen. Meanwhile, climate change is amplifying the frequency and intensity of extreme events such as floods, cyclones, and droughts.

The food price crisis of 2007–2008 placed market instability high on the development agenda. Rising commodity prices may seem favorable to Asia's farmers, but even agricultural producers shun high price volatility. Whether commodity markets have moved permanently into a more volatile price regime is unknown. What will most likely happen is that episodes of price crises similar to those of the early 1970s and late 2000s will recur as climate change increases the frequency of extreme weather events large enough to damage crop production on a global scale.

These challenges have two major implications—the yield growth of major crops will slow, and food prices will rise. First, yield growth of major crops in Asia and the rest of the world will decrease between now and 2050. Overall during this period, crop production in South Asia and in East Asia will grow by 1.3% per year. The growth will be achieved mostly through increases in yields, but at rates lower than those of the last half of the 20th century. For example, while wheat yield in South Asia during 1961–2007 grew by 40 kilograms per hectare (kg/ha) annually, the yield between 2005–2007 and 2050 is projected to grow yearly by only 32 kg/ha. Naturally, there will be large variations across areas. Relative to the 2000s, major improvements are still possible in developing countries such as Cambodia and the Lao PDR, where agricultural land and labor productivity are well below those of Japan and the Republic of Korea. Climate change, however, introduces considerable uncertainty in this outlook, and Asia is among the regions facing the greatest risk to sustained yield growth.[23]

Second, food prices will trend upward during the first few decades of the 21st century. Compared with the baseline prices in 2003–2005, food prices in real terms in 2050 are likely to be somewhere between the baseline and crisis levels of 2007–2008. This trend is the result of the slowdown in yield growth and rising demand. The demand will be driven by higher food requirements due to larger populations and higher incomes, and by the increasing demand for biofuels. The rising cost of fossil fuels has improved the financial viability of crops as an alternative energy source. Currently, the largest biofuel producers in Asia are the PRC, India, Indonesia, Malaysia, the Philippines, and Thailand, all of which have implemented biofuel policies through mandates, subsidies, and procurement through state enterprises.

Price increases that are driven by demand (for food and bioenergy) will benefit Asia's farmers, but higher food prices will harm future generations of poor consumers across developing Asia.

Agricultural output and employment shares in 2040

The ideal path of agricultural transformation involves sustained growth of output and output per worker in agriculture. This is accompanied by faster growth of output outside agriculture; hence, a declining share of agriculture in output. And due to the transfer of labor across sectors, agriculture's share of employment should also fall.

The current overall direction of agriculture's ST will likely continue during the next few decades. This means that as per capita incomes continue to rise, agriculture's shares of output and total employment will continue to fall, but the latter at a slower pace. Only at a mature stage of development will the employment share catch up with the output share (Figure 1.1), and this will be accompanied by an accelerated growth of agricultural labor productivity (as seen in the experiences of Japan and the Republic of Korea). Given the estimated elasticities of the output and employment shares of agriculture with respect to income per capita (as noted in the previous section, "The transformation of Asia's economies"), we expect that agricultural output shares in many Asian countries will fall below 5% during the next 30 years. This level is similar to that in the developed countries today. However, employment shares will remain significantly higher due to insufficient employment outside agriculture. As previously indicated, agriculture's employment and output shares tend to equalize as per capita income increases, and, for high-income countries, both shares are about 5% or less. Of the 42 countries with 2010 per capita income above $20,000 adjusted for purchasing power parity, in 34, the share of employment in agriculture is less than 5% of total employment, and in 35, agriculture's output is less than 5% of total output.[24]

Figure 3.1 and Appendix Table A7 present the outlook for agricultural transformation for countries in developing Asia. The outlook is discussed in terms of Timmer's four phases—beginning, agricultural surplus, integration, and industrialization (Figure 2.6)—and projected output and employment shares of agriculture. These are based on extrapolations of agriculture's elasticities at different income levels. During the 3-decade span considered, most countries will move to the next phase of agricultural transformation. This is particularly true for the largest developing economies in the region—the PRC and India—where agriculture will still account for between one-fifth and one-third of total employment. In other countries, where agriculture is today the largest employer—such as Bangladesh, Pakistan, and Viet Nam—employment shares are projected to remain over one-third. And in some countries, agriculture will still be the largest employer by 2040, e.g., Cambodia, the Lao PDR, and Papua New Guinea. The exception is Thailand, where both output and employment shares are expected to decline to below 5%.

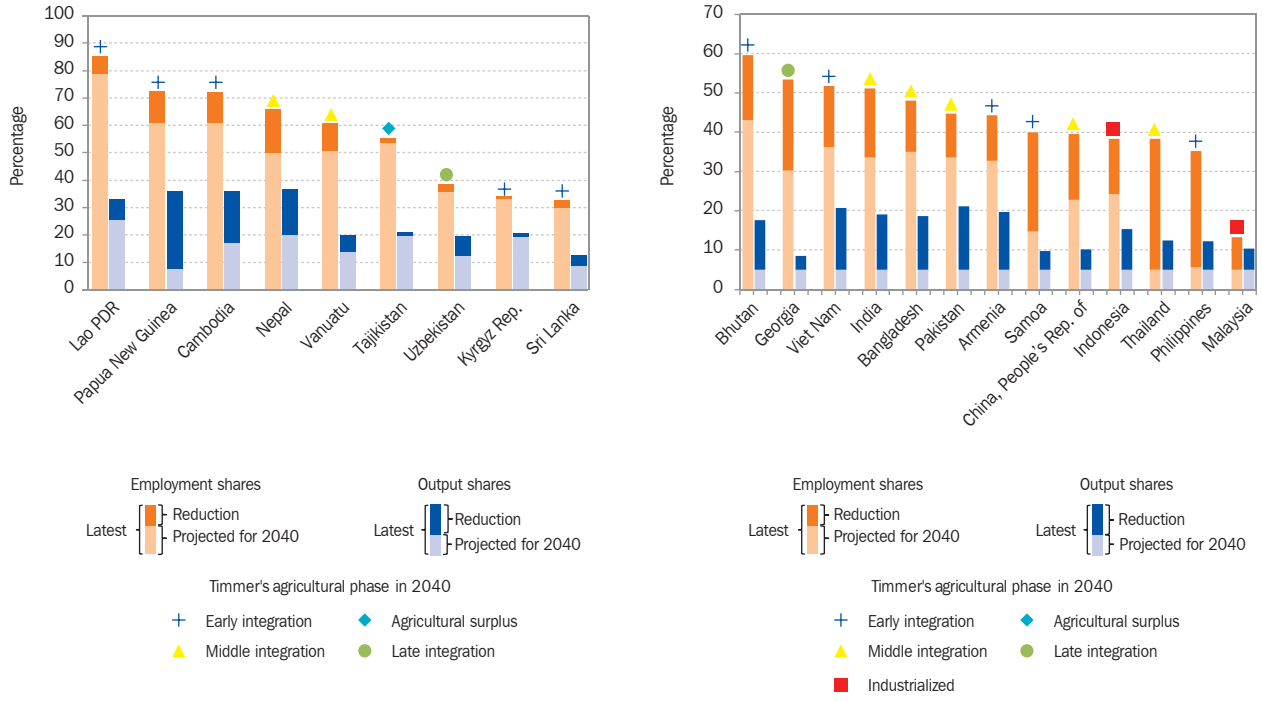
The lag in the decline between output and employment shares implies a relatively slow increase in labor productivity. Our estimations are that, among the developing Asian economies, only Malaysia will achieve industrialized agriculture status during the next 3 decades. Compared with the high-income countries today, the disproportionately large employment share and low labor productivity in agriculture is unprecedented. It is the legacy of the delay in ST, even during the period of fairly rapid economic growth during the last few decades.

Summing up, even a fairly extended time span (3 decades) will not suffice to complete the process of agricultural transformation in developing Asia. To expedite the process, many Asian countries will need to dedicate significant sums of money to improving their basic agricultural infrastructure. Simultaneously, they will need to adopt new technologies and conduct R&D. And, to move up in the value chain, countries will need to support the agribusiness transition and enable farmers to produce the types of products to the quality and standard demanded by GVCs.

The importance of industrialization

The previous section ("The transformation of Asia's economies") showed that most Asian economies have not industrialized from the employment point of view (i.e., the manufacturing employment share did not reach 18% for a sustained period) and that only in a few of the economies did the manufacturing sector

Figure 3.1 **Agricultural output and employment shares, latest and projected for 2040 and stage of agricultural development (Timmer's classification)**



Lao PDR = Lao People's Democratic Republic.
Note: Projected output and employment shares for 2040 are less than 5% for Thailand. The countries with less than 5% projected output shares for 2040 are Armenia; Bangladesh; Bhutan; China, People's Rep. of; Georgia; India; Indonesia; Malaysia; Pakistan; the Philippines; Samoa; and Viet Nam.
Source: Authors.

shift toward the high-tech subsectors. Should this be a matter of concern as for Asia's policymakers?

Traditionally, development has been associated with industrialization, and in particular with a rising share of manufacturing. In modern times, this idea goes back to the "engine of growth hypothesis," which states that the faster that manufacturing output grows, the faster GDP grows (Kaldor 1967). In Kaldor's view, manufacturing growth induces the growth of both GDP and labor productivity. This is because manufacturing products and services have (on average) a higher income elasticity of demand than do other products. And on the supply side, the growth rate of productivity in manufacturing rises with the growth rate of manufacturing output, but such that it allows employment in manufacturing to grow. This implies that productivity growth is higher in manufacturing than in services, and tends to have a greater impact on aggregate output and productivity. An implication is that manufacturing grows faster than overall output, and therefore the share of manufacturing in output increases. Also on the supply side, employment growth in industry leads to a higher rate of productivity growth in agriculture as the former absorbs employment. Likewise, manufacturing "pulls along" aggregate economic growth as it offers special opportunities for economies of scale and for technical progress. Both opportunities are linked to strong learning-by-doing effects (which allow the development and mastery of capabilities). Finally, manufacturing is thought to have significant linkages with the rest of the economy, in general more so than other sectors of the economy (Box 3.1). These points are at the center of policy discussions in Asia about the need to industrialize and whether countries can bypass the industrialization stage and base future growth on the creation of a large service sector. Research shows that manufacturing is critical for economic development (e.g., Amable 2000, Fagerberg 2000, Peneder 2003, Szirmai 2012, Szirmai and Verspagen 2011).

In addition to manufacturing's growth and linkages, it is essential due to its substantial and disproportionate role in innovation (e.g., the roles played by companies such as Boeing, Mitsubishi, Siemens, and Sony). About 70% of private sector R&D spending in the United States (US) and 90% of US patents issued today are manufacturing-related. Moreover, manufacturing

Box 3.1 **Manufacturing has strong linkages with the rest of the economy**

Sectors' linkages can be measured through the input–output tables, forward linkages (by how much changes in final demand in other sectors affect a given sector), and backward linkages (by how much changes in final demand in a sector affect other sectors). The World Input–Output Database indicates that, in the United States, manufacturing has the largest backward linkage effect among all sectors: every $1 of final demand in the sector required in 2008 $2.04 of gross production, directly or indirectly, in all other sectors. The backward linkages of services and public utilities are $1.60 and $1.45, respectively. Manufacturing's higher backward linkage is due to the complexity of manufacturing production. Two subsectors within manufacturing—food and beverages, and tobacco—together have the strongest backward linkage effect. Most United States economic sectors are involved and connected in delivering to these subsectors, from primary metal to wholesale trade, and from banks and credit intermediation to management services: in 2008, manufacturing required $2.43 of gross production to fulfill each dollar of final use. In Japan, the backward linkage of manufacturing is $2.25, also higher than in other sectors (transport equipment is the highest); and in the People's Republic of China, it is $2.59 (textiles, footwear, and leather being the highest).

In the Philippines (2000 input–output tables), manufacturing has the highest forward linkage index (the ratio of a sector's linkage to the average of all sectors), at about 3.0. This indicates that a unit increase in all sectors' final demand will stimulate an above-average increase in output in manufacturing and reflects manufacturing's significant role as a supplier of inputs to the rest of the economy. However, manufacturing's backward linkage index is significantly smaller, about 1.2–1.3 (indicating that a unit change in manufacturing final demand will stimulate an above-average increase in activity in the rest of the economy); but nevertheless it was the highest among the backward linkages of all subsectors. Other industry subsectors (such as construction; electricity, gas, and water; and mining) have much lower linkages (especially forward ones). The agriculture, fishery, and forestry group is still an important input supplier, but its forward linkage is declining and is just above 1; and its backward linkage is less than 1. The forward and backward linkages of the rest of the subsectors are lower. Finance, trade, real estate, and government services have forward and backward linkages below 1. In 2000, both forward and backward linkages of the private sector (which includes private education, health and social services, business services, hotels and restaurants, recreational services, personal services, and other private services) moved above 1. Within manufacturing, resource-intensive (e.g., food and beverages) and scale-intensive (e.g., paper) subsectors have both forward and backward linkages above 1. Differentiated goods (e.g., machinery), labor-intensive (e.g., textile), and science-based (e.g., professional and scientific equipment) manufacturing also have backward linkage indexes above 1.

Sources: Magtibay-Ramos et al. (2011) and Timmer (2012).

is a fundamental source of commercial innovation and is essential for innovation in the services sector. Manufacturing makes up about 11% of the US GDP, but is responsible for about 68% of R&D spending by domestic US companies. In 2009, manufacturing R&D in the US amounted to $195 billion. Manufacturing industries such as pharmaceuticals, transport equipment, communications equipment, and semiconductors each account for at least 5% of the nation's domestic company R&D. The only nonmanufacturing industries in which companies spend this much on R&D in the US are software and professional, scientific, and technical services. According to the National Science Foundation's 2008 Business R&D and Innovation Survey, in the US during 2006–2008, 22% of manufacturing companies but only 8% of other companies introduced a new or significantly improved good or service or used a new production, distribution, or support activity process (cited in Helper et al. 2012). McKinsey (2012) estimates that in the PRC, Japan, and the Republic of Korea, manufacturing shouldered 87%–89% of business R&D expenses in 2008.

Most developing countries still see manufacturing as the pathway to higher living standards, and building a manufacturing sector is considered to be a necessary step in national development. This includes countries such as India and the Philippines, which have had less success at building a manufacturing sector. India's National Manufacturing Policy, adopted in 2011, aims to raise the share of manufacturing in GDP from about 16% today to 25% by 2022. The policy also calls for setting up manufacturing zones to create 100 million manufacturing jobs. And the Philippines is working on a comprehensive manufacturing industry roadmap to develop a robust manufacturing sector (Box 2.2).

Becoming a high-income economy generally requires industrialization

We now investigate whether developing countries can bypass the industrialization step in their quest to become high-income economies. To answer this question, we proceed in two steps.

Industrialization in output and employment. First, we classify 109 economies with data for both manufacturing output and employment shares for 1970–2010 into eight groups, according to whether they were high income or low and middle income in 2010, and whether they had industrialized during the last 40 years (as defined in the section, "The transformation of Asia's economies"). An economy is defined as "high income" if in 2010 it had a real GDP per capita of at least $15,000 (in dollars of the year 2000) and as "low and middle income" if its income per capita was below $15,000. The variables of interest—"industrialization in output" and "industrialization in employment"—have two states: either the economy had industrialized during 1970–2010 or it had not.

The most salient aspects of the tabulation shown in Table 3.1 are as follows:

- Of 25 high-income economies, 23 industrialized in both output and employment. Only one such economy, the United Arab Emirates (a small oil economy), did not industrialize in output or in employment. Only one high-income economy, Israel, industrialized in employment but not in output. And no high-income economy industrialized in output but not in employment.

- Of 84 low and middle-income economies, 32 industrialized in both output and employment and 23 have not industrialized in output or employment. Only 4 low and middle-income economies industrialized in employment but not in output, and 25 industrialized in output but not in employment.

These results lead to three important conclusions.

First, the (conditional) probability of being a high-income economy in 2010, given industrialization in both output and employment during the last 40 years (i.e., that a 7-year moving average of the manufacturing share in GDP and of the manufacturing employment in total employment was 18% or above), is 23/55 = 41.82%; and the (conditional) probability of being a high-income economy in 2010 given no industrialization in output or in employment during the last 40 years is 1/24=4.17%.[25]

Table 3.1 **Matrix of economies' status of industrialization in output and in employment, and whether they are high income or low and middle income**

		Output	
		Industrialized	Did not industrialize
Employment	**High income**		
	Industrialized	Austria; Australia; Belgium; Canada; Denmark; Finland; France; Germany; Hong Kong, China; Ireland; Italy; Japan; Korea, Republic; Netherlands; Norway; Puerto Rico; Singapore; Spain; Sweden; Switzerland; Taipei,China; United Kingdom; United States	Israel
	Did not industrialize		United Arab Emirates
	Low and middle income		
	Industrialized	Argentina, Belarus, Bolivia, Bulgaria, Colombia, Costa Rica, Croatia, Czech Republic, Dominican Republic, El Salvador, Guatemala, Hungary, Latvia, Lithuania, Macedonia, Malaysia, Mexico, Moldova, Morocco, New Zealand, Peru, Poland, Portugal, Romania, Serbia, Slovak Republic, Slovenia, Sri Lanka, Tunisia, Turkey, Ukraine, Uruguay	Greece, Iran, Paraguay, Russia
	Did not industrialize	Albania; Armenia; Azerbaijan; Brazil; Cambodia; Cameroon; Chile; China, People's Republic of; Egypt; Honduras; Indonesia; Kyrgyz Republic; Lesotho; Mongolia; Nicaragua; Pakistan; Philippines; South Africa; Syria; Tajikistan; Thailand; Venezuela; Viet Nam; Yemen; Zambia	Algeria, Angola, Bangladesh, Botswana, Cuba, Ecuador, Ethiopia Georgia, India, Iraq, Jamaica, Kazakhstan, Madagascar, Mali, Namibia, Nepal, Nigeria, Oman, Panama, Papua New Guinea, Saudi Arabia, Sierra Leone, Tanzania

Sources: Authors based on data for income per capita, from World Bank. WDI. http://data.worldbank.org/data-catalog/world-development-indicators (accessed September 2012); for manufacturing shares, from UNIDO (2012).

Second, industrialization is, for all practical purposes, necessary to become a high-income economy: of 25 such economies, all but 2 had industrialized in both output and employment.

Third, industrialization is not sufficient for an economy to become a high-income one. This follows from the fact that, of the 55 economies that industrialized in both output and employment, 32 were not high income.

Given industrialization, what else helps achieve high income? In the second step, we ask: What characteristics of an economy (measured at the time of its most recent industrial peak), when combined with an industrialized status, improve our prediction of whether it will become high income?

We answer this question with the help of a probit regression. This statistical model allows us to determine the probability of a country having a high income if it has industrialized, when other variables are included.[26] The dependent variable of this model takes two values: 1 for high-income countries, with real GDP per capita above $15,000 (in dollars of the year 2000) in 2010; and 0 for low- and middle-income countries, with GDP per capita below this threshold. The key dependent variable is whether the country industrialized or not in output during the last 40 years. This dummy variable takes on a value of 1 if the economy industrialized and 0 if it did not.

We ask: What other characteristics (variables) of an economy, combined with industrialization in output, help predict whether it will achieve high-income status?[27] The analysis now covers the 137 countries with population over 2 million in 2010 and with data on manufacturing output shares. (We do not have employment data for 28 countries, which are thus not part of Table 3.1.) The additional (control) variables in the regressions are roads per capita, financial development, schooling, share of manufacturing in high-tech subsectors (in both value added and employment), population, inflows of foreign direct investment (FDI), openness (and share of exports), and resource intensity. These variables are not measured in the year 2010 (when the dependent variable is measured), but at the time the country achieved its industrialization peak.

Table 3.2 summarizes the results. Appendix Table A8 provides the actual values for the variables that are statistically significant in the regression analysis, for the Asian economies and for several others, in 2007.

The probabilities shown (of being a high-income economy) are predicted from (probit) regressions including the "industrialization in output" dummy and each control variable introduced one at a time.[28] Each row in the table shows the predicted probabilities of being a high-income economy at three percentiles of the distribution of each control variable: the 10th, 50th, and 90th. The table also shows the actual values of the control variables at the three percentiles of the distribution of 137 countries.[29] For example, economies in the 90th percentile of the distribution of roads per 1,000 persons have 17.04 kilometers (km) of roads per 1,000 persons; and the share in GDP of liquid liabilities in the financial system for economies in the 50th percentile of the distribution of this variable is 36.62%.

Table 3.2 indicates that a country that has industrialized in output, and that is

- at the 10th percentile in the distribution of kilometers of road per capita (1.3 km/1,000 persons) at the time it reached its industrial peak, has only a 16.0% chance of being high income;
- at the 50th percentile (4.4 km/1,000 persons), has a 20.2% probability of being high income; and
- at the 90th percentile (17.0 km/1,000 persons), has a 44.5% chance of being high income.

Financial development (plus industrialization) is also statistically significant and with estimated probabilities at the three percentiles similar to those of roads per capita. The three variables associated with knowledge and industrial upgrading are also strongly associated with being high income. Variations in years of schooling (plus industrialization) influence whether countries will become high income: the probability at the 10th percentile is 6.0% and at the 90th percentile it is 48.5%. The shares of manufacturing value added and employment at the time of peak industrialization that came from the high-tech manufacturing sectors are excellent predictors of being high income: 1.6% and 0.8% probability, respectively, at the 10th percentile; but 75.3% and 75.4%, respectively, at the 90th.

FDI inflows, openness, exports, and resource intensity are not associated with achieving high-income status when added to industrialization. This is a somewhat surprising result. One possible interpretation might be that openness and exports are important for the transition from low- into middle-income status, but their contribution then declines significantly for

the transition to the high-income level, and to avoiding the middle-income trap. That is, countries need more than opening to reach the high-income status. The same logic could apply to FDI inflows. They might be important for low-income countries. But FDI alone does not necessarily bring effective technology transfer.

The road to high income. We conclude that economies that aim to become high income generally need to industrialize—in particular, they need to create manufacturing jobs. And industrialization alone is not sufficient to become a high-income economy. Infrastructure, financial development, education, and sizable high-tech manufacturing contribute to becoming a high-income economy.

Some economies may have great difficulty industrializing. Indeed, for the Pacific islands to develop a wide range of competitive manufacturing activities will be very hard because of their remoteness and small populations. Although Papua New Guinea, Solomon Islands, and Vanuatu have developed small manufacturing subsectors, they are far from what is required to induce high and sustainable growth. Fiji had a garment industry, but it has been in decline since the end of the Multi Fibre Arrangement. Fiji also developed a small sugar industry and recently has started bottling mineral water. Samoa has a small automotive harnessing industry. Overall, the future of the Pacific island region depends largely on the performance of the rest of Asia (Box 3.2).

Table 3.2 **Determinants of high-income status (economy with per capita income more than $15,000 in 2010)**

Industrialization (in output) and:		Percentile		
		10th	50th	90th
Roads per capita (km/'000 persons)	actual value	1.267	4.359	17.045
	probability	16.00%	20.20%	44.50%
Financial development (liquid liabilities as % of GDP)	actual value	17.37	36.625	75.74
	probability	14.40%	22.30%	43.50%
Schooling (average number of years)	actual value	2.631	6.186	9.853
	probability	6.00%	21.00%	48.50%
Share of manufacturing value added in high-tech sectors (% of manufacturing value added)	actual value	10.507	36.128	52.389
	probability	1.60%	33.80%	75.30%
Share of manufacturing employment in high-tech sectors (% of manufacturing employment)	actual value	13.226	34.402	49.395
	probability	0.80%	27.5%	75.40%

GDP = gross domestic product, km = kilometer.

Note: The probit regressions include (i) the "industrialization" dummy, which takes on the value 1 if the output manufacturing share reached, during some 7-year period in the last 40 years, at least 18% on average; and 0 otherwise; and (ii) "The additional (control) variable in each regression was measured in the midyear. We added to the regression one variable at a time. The exceptions are roads and resource intensity, only measured as far back as 1990 and 1995, respectively. These two variables are, therefore, measured at the latest of these years, or at the year peak industrialization was reached. We report the predicted probability that a country is rich in 2010, given that it industrialized during the last 40 years, and that the additional variable in question is observed at the 10th, 50th, and 90th percentile.

In all regressions, the two variables included are statistically significant. Sample size varies across regressions, from 59 data points to 117.

Source: Authors.

What role will technology play in the coming decades?

We now discuss the roles of technology and GVCs in agriculture and manufacturing. Given the low productivity of developing Asia's agriculture, technology will have to play an important role in the coming decades. Likewise, given the relevance of manufacturing for becoming a high-income economy, the obvious question is: Will Asia's developing countries be able to industrialize? The results in Table 3.2 are based on an analysis of the past, and extrapolating into the future is always risky. It could be argued that developing Asian economies may become high income in the 21st century without achieving 18% of its employment in manufacturing. The economic environment today is different from that of the second half of the 20th century, so that "latecomer" countries may not need to follow the same path that today's high-income economies followed. And perhaps services could be a springboard, like manufacturing in the 1970s and 1980s.

New technologies will help modernize Asia's agriculture

Improvements in infrastructure, water management, irrigation, and crop varieties introduced during the Green Revolution were instrumental for increasing yield growth. Economies for which agriculture still represents a large share of total output or employment (e.g., Cambodia, the PRC, India, Myanmar, Nepal, and

Box 3.2 **Options for the Pacific Islands**

The Pacific islands are unique in developing Asia, as they face disadvantages due to their small size, low population, and remoteness (Duncan 2013). As a result, scale economies are almost nonexistent for both economic activities and provision of basic public services, making them more expensive to undertake.

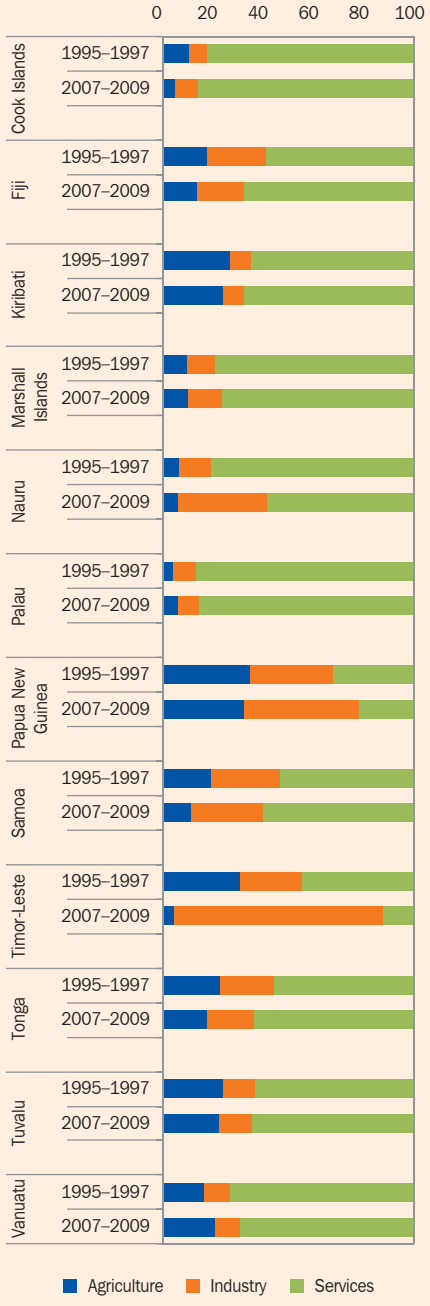
Overall, growth during the last several decades has been slow in the Pacific islands, leading to unemployment and joblessness. In addition, several of the economies face serious environmental problems as a consequence of climate change and rapid urbanization. The Pacific subregion also suffers from high population growth, poor quality education, weak governance, poverty, and poor infrastructure.

Box Figure 1 provides a snapshot of the economic structure of Pacific economies in terms of output. The high share of services mostly reflects the role that the public sector plays in the economies. Many of the employed people are, however, highly underemployed; and many of the islands in the region are heavily dependent on transfer payments related to aid, military bases, and workers' remittances. This is particularly true for Kiribati, the Marshall Islands, the Federated States of Micronesia, Nauru, Palau, and Tuvalu.

How can the Pacific economies generate structural change and thus growth in these circumstances? Progress in three areas is fundamental. First, most of them need more private sector investment. This requires tackling a number of problems, such as political instability, lack of law and order, and corruption. The subregion also needs to develop its financial systems, reform its legal and regulatory approaches, and revamp its state enterprises. Second, land reform, however sensitive an issue, is necessary in many countries. Given the importance of customary ownership, a gradualist approach must be taken. Improving both record keeping for land rights and land administration services will prove crucial. Third, strengthening political governance is required (the 2006 coup in Fiji, and civil unrest in the Solomon Islands and Timor-Leste, spring to mind), and cannot be postponed. Strengthening political governance will involve strengthening parliaments and electoral systems as well as developing partnerships with civil society.

Although up to a level the fate of the region is linked to developments in the rest of Asia, how can economic transformation help deliver higher growth? As we argue in this chapter, policymakers have to try to identify the new activities that a country can develop—activities that exploit the existing capabilities (markets, inputs, institutions). This is especially important for relatively backward economies, because creating new activities that require factors and capabilities that an economy does not have is very difficult. For this reason, developing a wide range of competitive traditional manufacturing activities is next to impossible in most of these island countries. Papua New Guinea has a very high resource intensity (over 70% of its exports are natural resources) and its export diversification is very low, at only 34 products. The economies of Papua New Guinea,

Box Figure 1 **Sectoral output of selected Pacific island countries, 1995–1997 to 2007–2009**



Sources: Duncan (2013); ADB (2012c).

Solomon Islands, and Vanuatu have developed some small manufacturing sectors. Still, these activities are far from what is required to induce high and sustainable growth. Fiji had a garment industry, but this has been in decline since the end of the Multi Fibre Arrangement. It also developed a small sugar industry and

continued on next page

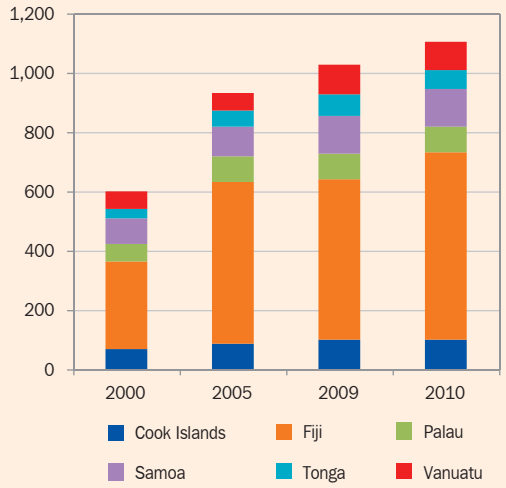
Box 3.2 **Options for the Pacific Islands** *continued*

recently has started bottling mineral water. Samoa has a small export-oriented automotive harnessing industry and has been able to take advantage of the preferential market access offered under the South Pacific Regional Trade and Economic Cooperation Agreement (SPARTECA).

What can the Pacific economies therefore do? Agriculture is still their largest employer, and so it has to be developed. In particular, agricultural productivity has to increase. Poor infrastructure is a binding constraint, and farmers' access to the latest technologies has to increase. Given the Pacific economies' vast oceanic and coastal resources, fisheries offer good opportunities, but proper management of coastal resources is essential for sustainability and climate adaptation. Forestry also offers opportunities, but logging has to be properly managed, as the current rates of exploitation are unsustainable. Plantations also offer opportunities, but establishing large plantations will require land reform and community involvement. Papua New Guinea and Timor-Leste have significant petroleum reserves, but they have to be managed adequately and with transparency, especially as they may generate substantial revenues. Mining also has potential but, like logging, needs to be managed so that it continues to be a source of future income streams. Because the opportunities available to the Pacific are based on natural resources, their coordinated management will be key to ensuring a better future for the region.

Finally, tourism is an activity in which the Cook Islands, Fiji, Palau, Samoa, Tonga and Vanuatu have a natural advantage. The geographic area is vast, and offers up-market venture and exploration possibilities. The number of arrivals into these six economies increased significantly, from about 600,000 in 2000 to over 1,000,000 in 2010 (over half of them to Fiji). However, to attract more tourists, infrastructure has to improve, as well as the quality of tourism professionals. Pacific countries that have benefited from increased tourism have implemented reforms that brought down air travel costs by privatizing or liberalizing the air transportation industry, and by implementing measures to encourage investments in tourism infrastructure such as resorts and accommodation.

Box Figure 2
Tourist arrivals, 6 Pacific island countries, 2000–2010 ('000)



Sources: Duncan (2013); ADB (2012c).

Source: Duncan (2013).

Viet Nam) will still need to deploy large amounts of basic agricultural infrastructure and irrigation during the coming decades. The development and introduction of high-yielding cereal varieties, rice varieties tolerant to drought, and new varieties of fruit and vegetables will continue to be an important source of productivity growth. For less favorable farm areas to be productive, work in adaptive plant breeding (such as producing drought- and pest-resistant varieties) and research in sustainable management practices will need to continue.

In favorable areas, however, productivity growth will increasingly involve new discoveries in frontier technologies, such as animal feed made from agricultural waste and bio-based products such as biofertilizers, biotechnology based on molecular genetics (Huang et al. 2002), vertical farming, nanotechnologies, biosensor technologies, and precision agriculture.[30] Middle-income countries in developing Asia are already adopting these technologies. Genetically-modified crops are widely sown in countries such as Argentina, Brazil, Canada, the PRC, India, and the United States. Currently, implanted traits mainly include pest resistance and herbicide tolerance, and genomics and molecular techniques are being applied to accelerate even conventional breeding programs, with concomitant cost reduction. Scholars agree that the trend is for genetically modified crops such as cotton and corn to be disseminated more widely throughout Asia and Africa, with currently high regulatory costs anticipated to fall (Fischer et al. 2009).

The information revolution has reached the level of the individual farmer. Market information is being disseminated via electronic and mobile phone networks, reducing transaction costs throughout the supply chain. Examples are seen in the management of contract growers, and farmers using information to match their output with demand and find the best current market price for their harvest. Variations in vulnerability to pests and disease, soil properties, terrain, etc., can now be pinpointed within a field using global positioning systems (GPS), facilitating the targeted application of inputs under precision agriculture. Nanotechnologies are beginning to be applied using nanomaterials and nanosensors, and promise to revolutionize precision agriculture and controlled environment systems in the next few decades (Gruere 2012). Around urban centers, food companies will pioneer very specialized "hyper niches" of high-tech urban production, e.g., vertical farming and hydroponics (US Grains Council 2011). Fisheries systems (marine fish farming and seaweed plantation) will expand to take over from today's capture systems.

New technologies may change manufacturing but are not likely to create many manufacturing jobs in the short run

To modernize developing Asia's agriculture requires providing infrastructure, introducing new technologies, and linking farmers to GVCs to shift to agribusiness. This will increase productivity and incomes and ultimately will drive surplus workers out of agriculture, with the consequent decline in its share in total employment. In the case of manufacturing, however, the issue is slightly different. Productivity increases will lead to higher wages, but many Asian countries have not industrialized in employment. What will be the effect of technological progress?

Brynjolfsson and McAfee (2011) argue that the last several decades have seen significant technical progress and that the digital revolution is accelerating.[31] Moreover, some sources argue that new manufacturing technologies will revolutionize the world in the near future. This process started in the 1980s following advances in information and communication technology (ICT). Gratton (2011), for example, paints a not-too-distant world of robots. And Anderson (2012) thinks that the mix of technological innovation and globalization, including "frugal innovation" and "3D manufacturing" (Box 3.3), is ushering in a new Industrial Revolution. There are high expectations that these technologies will affect the way products are created and distributed. McKinsey (2012, 2013) argues that innovation in materials (e.g., nanomaterials), product design (e.g., computer intelligence), production processes (e.g., industrial robotics), manufacturing information systems (e.g., Big Data), manufacturing business models (e.g., frugal innovation), and, generally, in the way production is organized, will bring significant productivity gains during the coming decades. Law and financial companies are examples of beneficiaries of this boom.

While these new technologies will bring about significant changes that could be labeled revolutionary in some respects, we have yet to see how they compare with the breakthrough inventions of the Industrial Revolutions or with the impact of innovations such as the aircraft, radio, highways, or penicillin (Cowen 2011, Friedman 2011).[32] Moreover, though the technological level of some developing countries is increasing fast, most new technologies are being created in the developed countries, which will benefit first from these technological advantages. Thus, we may witness a revival of manufacturing in high-income countries. How the new technologies will be transferred to and adapted by the developing countries is not clear. In fact, technology transfer in the coming decades may not be very different from that in the 20th century.

Also, many new technologies are labor saving. Thus, they are creating markets from which innovators, investors, and consumers—not workers—derive significant benefits. This has important implications for Asia's developing countries. Brynjolfsson and McAfee (2011) argue that there is a good chance that the new technologies will displace more labor than they create. And, most likely, they will not create the millions of manufacturing jobs that developing Asia needs. Digital technologies already possess the skills that used to belong to humans alone (e.g., computers that drive vehicles, review documents, or serve as virtual assistants).

McKinsey (2013) argues that today there are 12 potentially disruptive technologies with important implications for employment: mobile internet, automation of knowledge work, internet of things,

Box 3.3 **Frugal innovation and 3D manufacturing**

"Frugal innovation" consists of reinventing products by reducing complexity in production and stripping out all unnecessary frills, thus enabling firms to sell the products at extremely affordable prices. Frugal innovation is based on shorter launch cycles, innovation through commercialization, and reverse engineering. The trend is flourishing in the developing world, especially in the People's Republic of China (PRC) and India, where the idea is to adapt successful foreign products or business models to local markets, innovating and bringing products to markets quickly.

General Electric (GE) has established "local growth teams" in the PRC and India to customize objects based on local conditions and preferences. Also, due to the success of frugal innovation, ideas and products from emerging markets (such as the outputs of GE's local growth teams) are spreading to the West. For example, the price of a conventional ultrasound machine in 2002 was more than $100,000, so sales in the PRC were very low. Because a large percentage of the PRC's population relies on poorly-funded hospitals or basic clinics, GE's local growth team in the PRC used GE's resources to develop a portable ultrasound machine that took the price down to about $30,000. Additional development in the ultrasound machine brought the price down further, to $15,000 in 2007, so sales in the PRC took off and GE was able to tap a global market for the product. Other firms in the PRC and India are also undertaking frugal innovation. In India, Tata Motors has produced the Tata Nano (the world's cheapest car, at $2,000); Tata Chemicals has produced a cheap water filter made from rice husks; Godrej & Boyce has produced a refrigerator that runs on batteries; First Energy has produced a wood-burning stove that consumes less energy and produces less smoke than a regular stove; and Mahindra & Mahindra has produced small trucks suitable to local Indian conditions. In the PRC, Build Your Dreams (BYD) has produced previously expensive lithium-ion batteries at a reduced price (only 30% of the original cost), and Haier has produced inexpensive air-conditioners, washing machines, wine coolers, etc. (which are now being heavily advertised in the United States market).

New advances in manufacturing technology are enabling firms to produce highly specialized goods in small quantities through the use of 3D printers. Most 3D printers work as follows: once a product is designed with software, the file is sent to a 3D printer. This contains a cartridge of plastic, metal, or ceramics, in a fine powder of gel-like texture. The 3D printer then uses a beam of ultraviolet light to solidify thin layers of the material in the cartridge and does the process repeatedly to build actual objects, layer by layer. Although 3D printers have been around for 2 decades, they are now gaining acceptance. Because no molds are needed and the 3D templates are made by a computer program, 3D printers can bring the cost of production down by a significant margin. They are used mainly in three fields: medical, industrial, and consumer goods. For example, 3D printers are being used to make personalized dental crowns and hearing aid shells, and to create blood vessel systems out of sugar. In industry, companies use 3D printers to develop specialized metals, robotics, and bioengineering, and to make parts of the F/A-18 and the Airbus 380. In the consumer goods area, 3D printers open a whole world of creativity by allowing people to build virtually anything—jewelry, home decor, etc. Other applications that researchers are testing are toilets and water collectors, which can be of immense help to poor people.

Sources: ADB (2010), *Economist* (2012a, 2012b), Immelt et al. (2009), MacIver (2012), McKinsey (2012), *Time* (2012).

cloud technology, advanced robotics, autonomous and near-autonomous vehicles, next-generation genomics, energy storage, 3D printing, advanced materials, advanced oil and gas exploration recovery, and renewable energy.[33] Advanced robotics, for example, could make more manual tasks subject to automation, including in services where automation has so far not had much impact. Moreover, the foregoing list suggests that today's emerging technologies will likely automate some jobs entirely. Some of the victims of disruption will be workers who are currently considered highly skilled. This phenomenon is both broad and deep, and will have profound economic implications. Certainly, such new technologies will have positive effects, as digital innovation increases productivity, reduces prices (sometimes to zero), and expands the size of the economy. But modern technologies are also changing how overall output is distributed. As new technologies are labor saving, they can leave many people behind.

Nevertheless, a correct assessment of the net employment derived from the introduction of a new technology is not simply the result of counting the new jobs gained and the ones destroyed. Indeed, one could expect that new technologies will disrupt production and employment in commodity-based industries such as shoes, clothing, chemicals, and electronics. But jobs might be created around the high-tech innovation areas (nanotechnology, biotechnology, information technology and networks, and neurotechnology) and in pharmaceuticals, health, energy, new areas in manufacturing, communications, transport, security, entertainment media, education and learning, knowledge engineering, and smart materials. The new jobs would result from expansionary effects on the economy that depend on increases in productivity. Revolutionary new technologies can create the basis for a virtuous circle of growth in which investment is high and labor productivity grows fast but output grows

faster, resulting in net growth of employment. Whether such growth takes place and is sustained depends on macroeconomic, trade, regulatory, and employment policies. Such a virtuous circle occurred during the Industrial Revolutions, and during the 1950s and 1960s in Europe, Japan, and the United States.

Our view, however, is that this state of affairs is not likely to be repeated in the short run. This does not mean that we are fundamentally pessimistic about the long-run employment implications of the information–knowledge society for developing Asia. Lessons of history—over the long-run—show that the introduction of new technologies is compatible with increases in labor productivity and wages, and with new employment opportunities. This may happen again, but it will take time. Rather, our messages for Asia's policymakers are:

- first, that the opportunities that the new technologies will bring about in the coming decades will need to be seized, and countries will need to design and implement policies so as absorb them and not to be left behind; and

- second, that these technologies, by rearranging industry structures, will have a positive impact on productivity, but, in doing so, they will be disruptive for labor, at least in the short-run.

The evidence indeed indicates that technological progress has a significant effect on employment. In the coming decades, developing Asia may face higher unemployment rates, caused by the introduction of highly labor-saving technologies, and difficulties generating a significant number of high-quality (high-wage) jobs. As a consequence, Asia may witness in the next decades increasing inequality that results from having a group of well-trained professionals with the "right" skills who get well-paid jobs and having millions of workers employed in jobs that require only simple skills. Indeed, evidence indicates that technology is changing the incomes of skilled versus unskilled workers, "superstars versus the rest," and capital versus labor (Brynjolfsson and McAfee 2011, ADB 2012c).

Linking to global value chains

To upgrade, Asia's agriculture needs agribusiness transformation and linkages to global value chains

Asia's agriculture needs to be modernized and upgraded. The objective is to transform agriculture by using new technologies and market-oriented enterprises. The agribusiness transformation could deliver great benefits. Rising demand for fruit and vegetables, livestock products, and other goods with a relatively high income elasticity of demand stimulates product and process innovations and the development of stronger backward and forward linkages within the agrifood system. It also leads to investments that improve productivity, reduce product losses, and utilize by-products and waste products as inputs into agriculture and industries.

Today, agriculture and related agribusiness activities are being increasingly organized in GVCs. Supply chains link production, processing, and distribution centers, often driven by FDI in the food and retail sectors of developing countries. GVCs favor production and distribution systems that meet volume requirements and address quality and safety standards. Hence, organized supply chains are displacing traditional arrangements such as spot markets and integrated plantations (Box 3.4). Small farmers in developing Asia could realize dramatic income increases by joining these supply chains, especially if they can upgrade their farming and postharvest practices.

Key drivers of agricultural GVCs are international trade arrangements, including agriculture being brought into the World Trade Organization since 1995, domestic market liberalization, and technological change. But the fundamental driver of the formation of GVCs in agriculture is the transition in demand toward high-quality processed or packaged foods, associated with the growing global middle class and with social trends such as urbanization, increased female participation in the formal workforce, and single-adult households.

As incomes rise, food preferences shift toward products with higher income elasticities of demand. Middle- and upper-income consumers are willing to pay more for products that comply with phytosanitary

Box 3.4 **Country examples of global value chains in agriculture**

The exploitation of many tropical export crops is changing from large, vertically integrated plantations into smallholder systems. Examples include sugarcane in Guyana, rubber in India, oil palm and rubber in Indonesia, and tea and coffee in Kenya.

In Sri Lanka, independent tea producers increased their share of total tea output from 11% in the 1960s to 60% by 2004. Small farmers sell green leaves to collectors or directly to processors. Green tea leaves are processed into black tea, most of which is sold in the world's largest tea auction, in Colombo. The world's tea trade is dominated by global brands such as Unilever (Lipton) and Tata (Tetley), which pack and distribute the tea worldwide in tea bags. Production is labor intensive and subject to minimal scale economies, but, given a prolonged gestation period, investment in tea plantations was historically unattractive to smallholders. Since the 1980s, unionization of plantation labor together with the government's price stabilization policy made tea raising attractive to smallholders.

In the People's Republic of China (PRC), by contrast, vegetable production never passed through a period of capitalist consolidation (before 1979, vegetables were farmed in collectives). The shift to the household responsibility system enabled rapid agricultural growth. Vegetable production quadrupled during 1991–2003 as land resources were moved toward products with high domestic demand, reflecting the PRC's comparative advantage in labor-intensive and land-scarce activities. The largest horticultural region in the PRC is in Shandong Province. In Shandong's Laiyang County, export buyers determine vegetable varieties, production practices, and processing requirements. Up to half of the county's output is exported.

Because household land parcels are fragmented, village authorities consolidate farmers' parcels for lease to food processors. Production may follow a contract farming scheme in which the processor provides inputs and imposes delivery, quality, and management standards, while farmers supply labor. Larger buyers tend to be foreign-owned or foreign–domestic joint ventures, and the main export destinations are the European Union, Japan, the Republic of Korea, and the United States. Harvests from small farms go to processors for sorting, cleaning, and packing (in the case of fresh produce), and are then distributed to supermarket outlets such as Carrefour and Wal-Mart.

Sources: Herath and Weersink (2009), van der Wal (2008).

standards, and that meet their expectations for taste, packaging, and appearance. The demand transition is also being driven by urbanization and increased female labor participation, placing a premium on easy-to-prepare "convenience" foods. In the 20th century, these trends were largely limited to the old industrial countries, but economic growth in the 21st century is creating a vast global middle class—households with daily per capita expenditure of $10–$100 purchasing-power-parity-adjusted US dollars. In 2009, 1.8 billion consumers were in the middle class, and they had an annual purchasing power of $21.3 trillion globally. By 2030, the global middle class may comprise 4.9 billion people spending $55.7 trillion annually, and Asia will account for two-thirds of them and three-fifths of their spending (Kharas 2010).

GVCs have penetrated even to the retail level, as in the "supermarket revolution" that swept through developing Asia in the 2000s. In the PRC, India, and Viet Nam, the annual growth of supermarket retail sales has averaged 28%–50% during the 2000s (Reardon et al. 2012). Meanwhile, new technologies have drastically reduced processing costs, logistics, communications, and information management. They have also introduced greater capital requirements, intensifying economies of scale along the chain. Large buyers or suppliers, typically operating as global companies, occupy key nodes of GVCs.

Smallholder systems will continue to dominate agricultural production in developing Asia in the next 2 decades (Lipton 2006). The growth of agricultural output per worker will increasingly depend on linking small farmers to expanding GVCs, with farmers meeting the requirements (e.g., quality, volume, and timing) specified by agriprocessors and modern retail outlets.

Finally, we must not forget that agricultural GVCs are not a panacea. Consolidation of chains around a few players renders small farmers vulnerable to the demands of big buyers, and offers neither security nor an equitable share of the value created along the chain. Unlike the case of many manufacturing GVCs (where the lowest value added occurs in the middle stages—assembly), in agribusiness GVCs, the lowest value added often accrues at the earliest stages, unless farmers have a unique niche based on soil, climate, or other special natural conditions or capabilities. Nevertheless, for self-employed farmers in a low-wage, labor-surplus setting, GVCs can provide access to premium export markets and hasten innovation, promoting agro-industrial modernization.

Global value chains are a mechanism for upgrading manufacturing but many Asian economies are only marginally integrated into them

Can GVCs help countries across developing Asia to industrialize and, more generally, to climb the development ladder? The idea of specialization within production has been around for centuries, but the most recent spate of specialization started in Asia and accelerated with the entry of the PRC into global production during the late 1980s and early 1990s. Today, the most quoted case is Factory Asia. Indeed, one of the most remarkable developments since the 1990s has been the emergence of GVCs. They have opened up opportunities for local firms in East Asia, a key factor in some Asian countries' industrialization. Baldwin (2012) even identifies GVCs as the defining feature of the "second globalization"; in 19th century globalization, international trade separated producers and consumers on a global scale, while in 21st century globalization, the production process itself has been unbundled on a global scale. As discussed earlier, the revolution of manufacturing that could take place in developed countries in the coming decades may affect Asia's developing economies positively if they manage to link to, and upgrade within, GVCs. If not, they might end up being bypassed by another wave of industrialization.

With production of parts, components, services, and tasks dispersed geographically and shipped to assembly lines elsewhere, countries may not need to develop complete products and services at home. For example, decades ago, countries produced virtually all parts and components of a car in the domestic market. This created linkages all over the economy and led to high manufacturing output and employment shares. Now, however, GVCs are a source of opportunity for developing countries, which can start their outward-oriented ST by finding one niche in the chain rather than having to produce an entire finished product. The question is whether this mechanism will allow developing countries to progress fast, or whether it will simply keep them in the assembly stages.

We examine briefly (i) the evidence on the scale of GVCs in Asia, (ii) the advantages and disadvantages of developing economies participating in GVCs, and (iii) the learning and upgrading needed in GVCs to develop high-tech manufacturing.

How strong are global supply chains in Asia? World market integration has led to the fragmentation of production across countries, forming global supply chains in the process. Production networks and vertical trade—the trade that happens as products move between the manufacturing stages and the customer—have expanded rapidly in the global economy, especially since the early 1990s. The PRC is at the forefront of this rapid expansion, and, during the 2000s, has become a global manufacturing hub.

International trade statistics generally report gross value, not the value added by the segment of the production process in the exporting country. Therefore, official statistics are unsuitable for tracing value added and suffer from a double counting problem. To remedy this deficiency, various authors have come up with different solutions that have yielded important insights into the nature of global production networks. Ferrarini (2013) adds to this literature using product-level bilateral trade flows for 2006 and 2007 for 75 countries participating in global production networks. The analysis distinguishes parts and components trade among more than 5,000 products. The author provides a visualization of production networks and vertical trade in the form of network maps. This technique allows a graphical analysis of vertical trade. Ferrarini measures the intensity of bilateral vertical trade between countries participating in global production sharing through a network trade index.[34]

Ferrarini identifies three global centers of vertical trade: PRC–Japan, Germany, and the US. A second important finding is that most developing countries outside Asia and Mexico are not yet fully integrated in the global production networks. The paper reports the top 15 country pairs according to the average aggregate network trade index, of which 5 are pairs in which both are Asian economies: PRC–Japan (the top world network); PRC–Hong Kong, China; Thailand–Japan; PRC–Republic of Korea; and Republic of Korea–Japan. India, the other Asian giant, is outside the main global production networks, and its link is only with the PRC. The other 10 pairs are mostly European and US networks—the US–Mexico pair is the second most important in the world.

Vertical trade is more pronounced in the electric, electronics, and automotive industries. The East Asian networks clustered around PRC–Japan dominate the

electric and electronics industries, the PRC being their assembly hub. Of the top 15 pairs in these industries, 11 involve Asian economies. In 8 pairs, both economies are Asian (PRC–Hong Kong, China; PRC–Japan; PRC–Republic of Korea; Malaysia–PRC; Malaysia–Singapore; Republic of Korea–Japan; Philippines–Japan; Thailand–Japan), and 3 pairs entail Asian and non-Asian economies (PRC–US; Mexico–PRC; Slovakia–Republic of Korea). The US has close ties to these East Asian electric and electronics networks. East Asia's automotive industries are relatively less developed; they are dominated by Europe and North America. Only 3 of the top 15 pairs in these industries come from Asia: PRC–Japan, Republic of Korea–Japan, and Thailand–Japan.

In sum, GVCs are heavily regionalized around Factory Asia, EU networks, and US–Mexico. Within the Asian region, the picture is of the PRC's centrality in final assembly, and participation of a handful of other countries (Japan, the Republic of Korea, Malaysia, Singapore, and Thailand). Hong Kong, China often plays an important coordinating role. The rest of the region is little touched by GVCs, with limited participation of some South Asian or other Southeast Asian countries (e.g., the Philippines), and virtually no involvement of the majority of economies in the Asian and Pacific region.

Value chains are a more recent phenomenon in services than in goods, but since the early 2000s, they have experienced tremendous growth. This includes offshoring of technical, administrative, and professional services. India and the Philippines are world centers of ICT outsourcing, which includes a wide range of activities known as business process outsourcing, knowledge process outsourcing, and R&D. The difference between value chains in services and in manufacturing is that the former requires neither physical interaction with the customer nor local knowledge. Gereffi and Fernandez-Stark (2010) argue that changes in the world economy have facilitated the explosion of GVCs in services and that this change will be permanent for three reasons: (i) ICT now allows quick and easy information transfer so that any developing country with basic ICT infrastructure can export services; (ii) company operations such as human resources management, customer support, accounting and finance, and procurement operations can be performed in developing countries at a fraction of the labor cost in developed countries (e.g., business process outsourcing activities in the Philippines); and (iii) in recent years, even activities such as R&D have begun to move offshore (e.g., the PRC and India are offering their services to giant pharmaceutical companies). This reflects the increasing capabilities of some developing countries entering GVCs.

India and the Philippines are mature providers of offshore services, with more than 50 centers in each country. The main reasons behind their success are low labor costs and an abundant supply of workers proficient in English. In 2009, employment in service GVCs in the Philippines was close to 500,000 workers (of about 38 million total employment), with revenues of about $7.2 billion; in India, such employment was close to 2.5 million workers (out of a total employment of about 450 million workers) with revenues of about $47 billion. The Philippines is one of the world's leading destinations for call centers, as well as finance and accounting outsourcing. India is the global leader of offshore services. The industry in India has evolved steadily and has been able to upgrade from lower value-added activities to R&D services, engineering, and software products. Other jobs GVCs perform are professional services such as reading X-rays, carrying out laboratory experiments for new drug discovery, developing engineering design, administering payrolls, and preparing documents for filing patents (Sako 2013).

The evidence on value addition in global value chains. It is difficult to estimate accurately the value addition that takes place in developing countries. Recent empirical work by Oikawa (2011) on the international distribution of value added using input–output tables for six industries in 10 economies shows they retained significant shares of value added, although the distribution of gains among the economies and sectors is uneven. These significant shares contrast with the very low percentages accrued to countries such as the PRC in some product-level studies. For example, Kraemer et al. (2011) conducted a product-level economic analysis of the Apple iPad as a way to understand who captures the value in its global supply chain. They concluded that only about $8 per unit, or only 1.6% of the iPad's $499 selling price, accrues to the PRC. The main reason for the significant difference with Oikawa's study is that input–output analyses consider the value added embodied in the intermediate inputs.[35] Indeed, if the iPad's hard drive is manufactured in the PRC (as it probably is, given that such components are likely to be made near the assembly point for logistics reasons), value added

would be created not only in the countries that supply the components (as gross profit) but also in the PRC in the form of wages and other intermediate inputs such as metal parts, wires, electric power, and various inputs that are locally produced. Unless one uses the input–output tables, all these seem to be subsumed into the cost of inputs, and assigned to Korean and Japanese firms, for example.[36]

Figures 3.2a and 3.2b summarize Oikawa's results. They show the percentage of value added retained by the local industry and by other economies (the rest, to 100%, is freight, insurance costs, or tariffs). The values indicate, for example, that in 2000, the PRC retained about 85% of the total value added generated by its local automobile industry; while almost 9% was retained by the overseas suppliers. The iPad uses sophisticated components largely provided by overseas suppliers, the analysis of which biases the external contribution. There are many much simpler electronic products that rely on domestically-sourced parts. A recent review of the PRC's upgrading by Kujis and Qiu (2013) indicates that the domestic value-added component of the PRC's exports increased from 63% in 2004 to 76% in 2012. This reflects a move away from pure assembly and a deepening of domestic supply chains in tradables.

Oikawa's analysis indicates that economies where industrialization has depended on multinational corporations do not capture much of the value added, corroborating Tham and Loke's (2011) findings for Malaysia. These results have important lessons for countries following export-led, FDI-led strategies for their industrial development. Local firms play a key role in capturing the gains of integration through GVCs, and the rise of these firms' capabilities matters for economic development. Examples are the Republic of Korea and Taipei,China, where FDI was assigned a secondary role in obtaining advanced technologies. In contrast, Malaysia, Singapore, Thailand, and Viet Nam have largely depended on multinational corporations. Their dominance of the high-tech sectors of these Southeast Asia's economies is explained by the absence of competitive local firms. Oikawa's results support the view that different industrial strategies have resulted in different economic results.

Moving up global value chains from low- to high-tech manufacturing is not easy. Successfully catching up with and developing an advanced manufacturing base is not easy. How can countries use GVCs to develop a high-tech manufacturing base? For low-income countries, the initial niche ought to be the low-skilled, labor-intensive phases in traditional industries such as textiles and garments, toys, or perhaps the assembly of simple electronic products. To upgrade from such industries, opportunities have to be seized and learning has to be fast. This has to be supported by policies that facilitate learning and assimilation, education, and the development of a domestic manufacturing base.

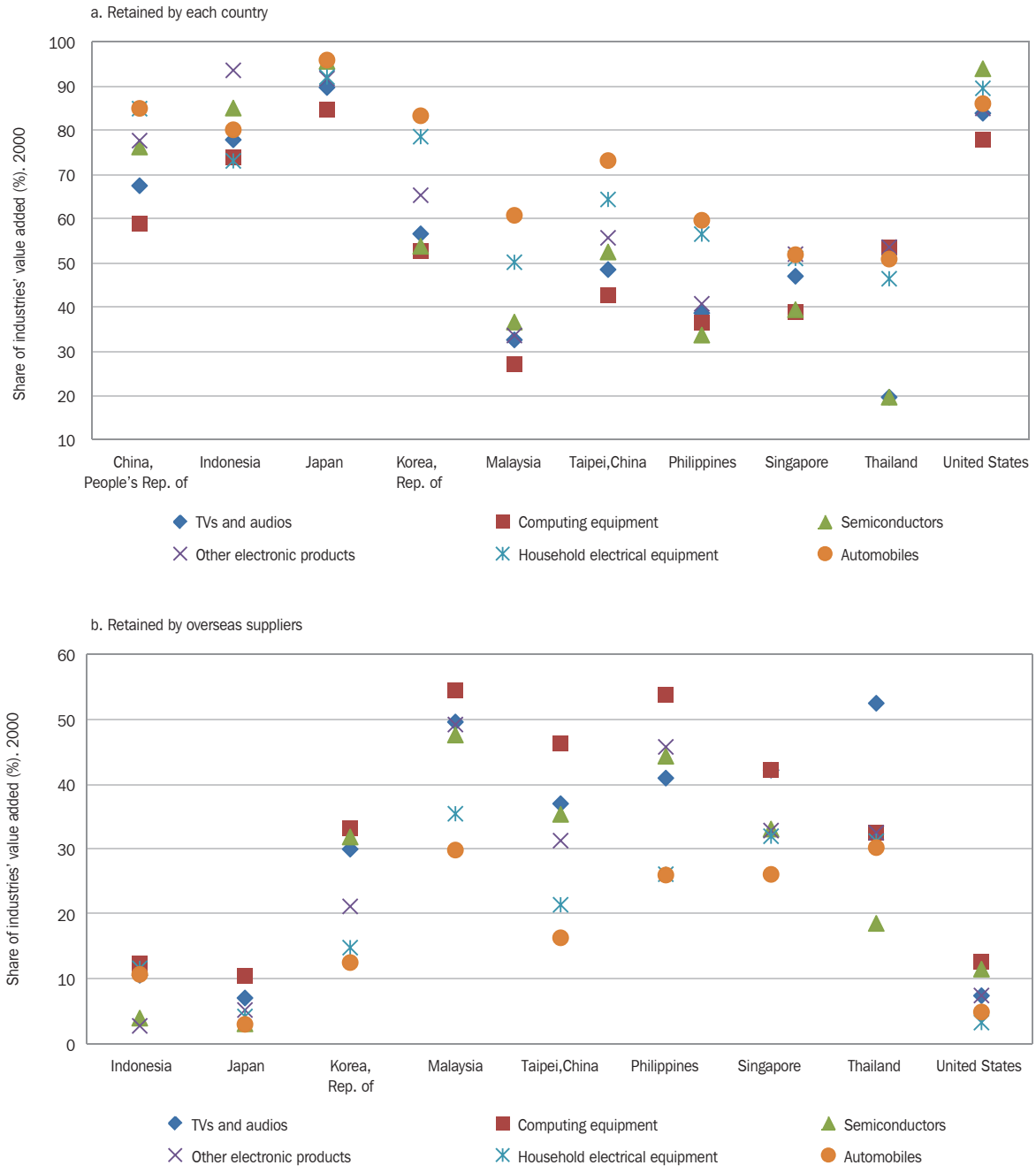
After entering a GVC (at a low-tech stage), the goal should be to move up and, ultimately, to be able to innovate. To do this, countries need to create a local institutional and infrastructural environment conducive to technological upgrading and to integrated industrial production. For example, countries need to support the accumulation of labor skills, provide adequate transport and communications infrastructure, develop appropriate supporting industries, find the right balance of government regulations, and so on. This requires both continued upgrading within the same industry and successive entries into other industries (Lee and Mathews 2012).

GVCs today are very different from those in the 1980s and 1990s, when they probably searched primarily for low-wage locations. Today, wage costs are not the primary driver of firms' strategies in many GVCs. Their requirements are much more complex due to a shift from mass production to mass customization. In this environment, firms search for locations that allow them to meet demand volatility (to handle large swings in production demand), to respond very quickly to their customers ("deliver the products yesterday") and in an unpredictable environment, and to have flexible production methods based on multiskilled workers and flexible equipment.

The rise of firms' capabilities in GVCs is determined by the interaction between two sets of strategies: (i) learning strategies of latecomer firms in developing economies, and (ii) outsourcing strategies of lead firms from developed economies (Kawakami and Sturgeon 2011). In-depth research summarized by Sturgeon and Linden (2011) indicates that moving up in GVCs is possible, but very costly. Some supply chains allow learning (e.g., a captive supply relationship

with the local affiliate of a multinational corporation). However, if information, knowledge, and value capture are geographically partitioned and tacit knowledge matters a lot, learning will not occur. Also, suppliers in latecomer economies operate within constraints. After all, knowledge lies with the managers of lead firms elsewhere. Likewise, the oligopolistic market power in some industries matters (such as for cellular phone firms such as Nokia, Motorola, and Samsung), as it allows powerful firms to negotiate on their own terms. Standards also play an important role in determining the structure and trajectory of GVCs. Finally, GVC strategies vary according to the nationality of the lead firms.

Figure 3.2 **Share of industries' value-added retained by economy and by overseas suppliers, 2000 (%)**



Source: Oikawa (2011).

In recent decades, the best examples of successful catch up by latecomers are provided by East Asian economies, especially in the semiconductors and electronics clusters, as well as in some high-tech industries (Lee and Mathews 2012). Their progress up the development ladder has been explained in terms of accumulating capabilities that have allowed the firms to move progressively toward more stages of production (by first implementing, then assimilating, and finally improving). They often achieve this by taking advantage of the opportunities offered by GVCs (Hobday 1995a, 1995b). The common factor among successful firms is that they made tremendous efforts to master capabilities by progressive, often slow, learning. In a dynamic setting, being successful refers to increasing wage rates, diversifying into more complex activities, and increasing technological and organizational capabilities.

Otherwise, there is a risk of being stuck in stages of the chain that compete exclusively on price. Such a strategy will not allow upgrading of the production structure and wages will not increase. Unfortunately this is the experience of many firms across the world, including firms in Asia. For example, Malaysia's well-documented success in electronics since the early 1970s seems to have reached a plateau (Henderson and Philips 2007, Samel 2012).[37]

Services and manufacturing complement each other

We mentioned earlier that the difference between goods and services is becoming blurred. As many production processes have been fragmented in recent decades, firms seen as producing goods are in fact increasingly focused on service activities such as design and marketing (e.g., Apple). Likewise, decades ago, manufacturing companies had service departments such as finance, marketing, distribution, customer support, and R&D. The jobs and outputs of these departments were counted as part of the industrial sector, given that the final output of the company, was classified in industry. This continues to be the case.

But many manufacturers do not have such departments any more, and instead contract these services to newly created companies that specialize in them. The result is a decline in the share of manufacturing employment that is partly a "statistical artifact" rather than a reality. Moreover, service-like activities have become a larger share of what the manufacturing companies actually do today. This is because manufacturing requires many support services that were previously done within manufacturing companies (e.g., accounting, compliance management, and some types of logistics). Indeed, an increasing proportion of what we consider as manufacturing jobs are actually white-collar jobs. Services such as telecommunications and travel, logistics, banks, and ICT provision are complementary to manufacturing.[38] Indeed, the evidence indicates that the linkage between manufacturing and services is increasing and that services are important inputs to manufacturing (Box 3.5).

The sectoral data available allow us to approximate the linkages between services and manufacturing. We use the input–output multipliers obtained from the world input–output tables (Timmer 2012), which take into account both direct (within a sector) and indirect (through the linkages with other sectors) effects (Box 3.6).[39] These tables contain data for six Asian economies (the PRC, Indonesia, India, Japan, the Republic of Korea, and Taipei,China) in 1995 and in 2008.

Figure 3.3 shows the dollar increase in value added of the service sector that results from a $1 increase of final demand (consumption and investment) in three other sectors—primary, manufacturing, and public utilities and construction—in 1995 and in 2008.[40] Two findings are worth highlighting. First, among the three sectors, services add the greatest value in manufacturing (between $0.23 and $0.45 in 2008). In Taipei,China in 2008, for example, a $1.00 increase of final demand in manufacturing led to a $0.456 increase in value added in services. Second, except in India and Indonesia, the value services added to the three other sectors increased between the 2 years considered. The implication is that an important part of the service-sector value added comes from demand from manufactured goods. For example, automobile manufacture induces value added in services because car manufacturers use services such as insurance.

Box 3.5 **Services contribute to the competitiveness of manufacturing**

That certain services are crucial for manufacturing has long been known. Recent work has studied and estimated quantitatively the role that service quality plays using three indicators of manufacturing competitiveness: (i) the degree of product differentiation, measured by the Grubel-Lloyd index; (ii) prices obtained in export markets; and (iii) the duration of trade. The service indicators used in the analysis are telephone density, interest spread between bank deposit and lending rates, transport costs, the total time to export and the total time to import goods and services, reliability of electricity supply, average years of schooling, number of procedures to enforce a contract, foreign direct investment restrictions, product market regulations in telecommunications and air transport, and tariffs.

Product differentiation increases as the quality of these indicators increases, although there are differences across sectors and country groups (by income). Manufacturers do better, in terms of product differentiation and export prices, in countries with good access to high-quality transport, telecommunications, electricity, and financial services. And their exports tend to be more resilient over time. Policy distortions in service markets spill over to manufacturing export markets, and the higher the level of development, the larger the negative marginal impact on manufacturing export performance. Likewise, high-tech industries are more business-service intensive than other sectors. Finally, better services, alone, do not have a discernible impact on product differentiation in sectors where a country is far from the technological frontier or does not have comparative advantage. But better services are important for moving up the value chain in sectors where countries already have an advantage.

These findings are very important for all countries, but especially for low-income countries, as they need to work on all fronts, that is, to reduce tariffs, improve education, improve contract enforcement, reduce time for exports and imports, improve the reliability of electricity supply, and open up the service sectors. Reforms in these areas, which should not be very costly, can help low-income countries move up the value chains for clothing and electronics.

Source: Nordås and Kim (2013).

Box 3.6 **The world input–output tables**

The input–output system that we use contains 41 economies (40 economies plus the "rest of the world") and 35 sectors, and covers 1995–2009. Of the 41 economies considered, we concentrate on 6 Asian economies—the People's Republic of China, India, Indonesia, Japan, the Republic of Korea, and Taipei,China—and 6 others—Brazil, France, Germany, the Russian Federation, the United Kingdom, and the United States.

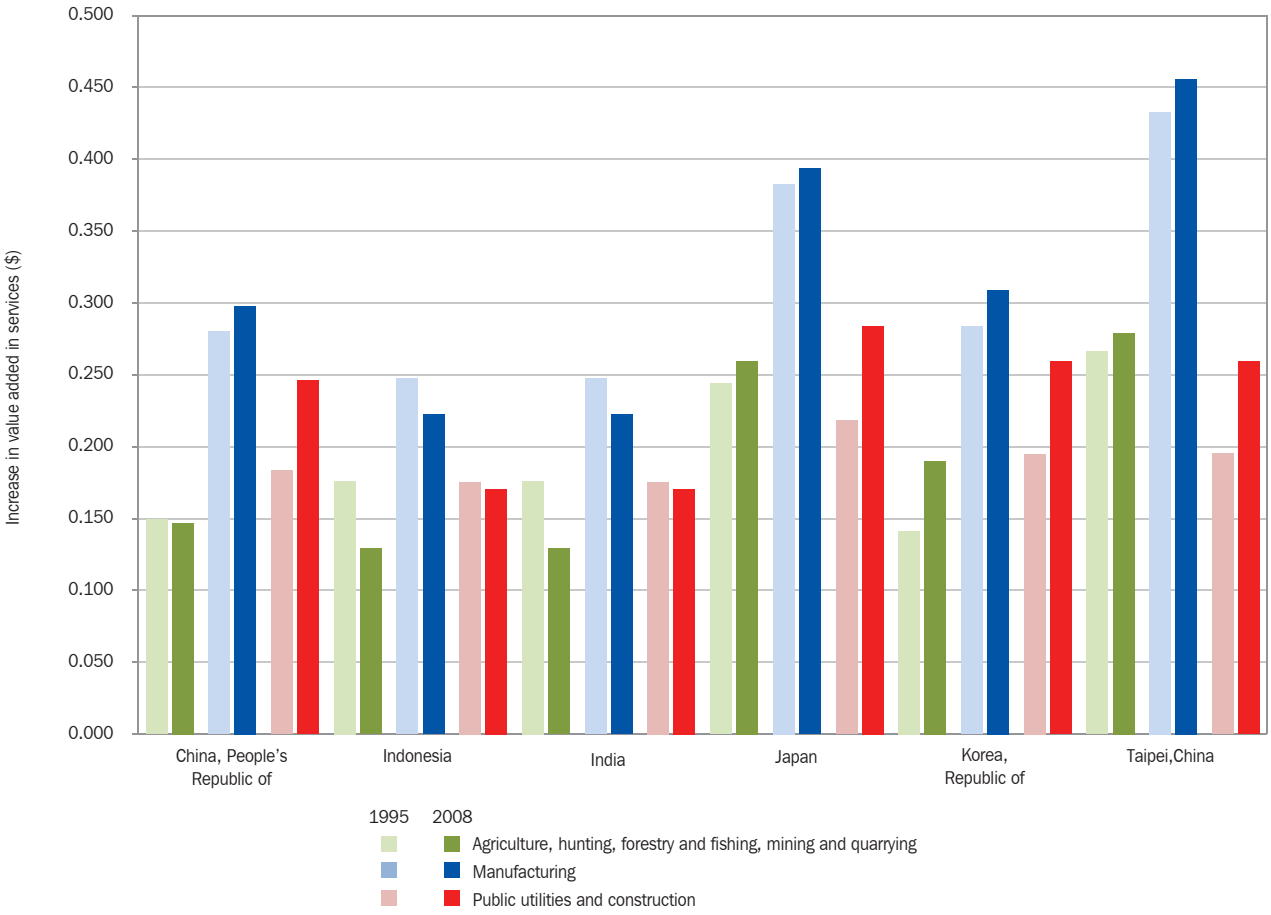
This input–output system is truly global in the sense that it contains 35 sectors and 41 countries, but also in the sense that it tracks all deliveries between those sector–country combinations. The input–output tables record all intermediate deliveries of a sector–country combination to all other sector–country combinations (e.g., Japanese steel to Korean car makers). The tables also record deliveries of all industry–country combinations to final demand categories (consumers, gross fixed capital formation, and government) in all 41 countries. This means that, for every sector in each country, we have deliveries to 41x40=1,640 separate destinations: 41x35=1,435 industries (including itself) and 205 final demand categories.

Algebraically and in matrix notation, it works as follows: $Q = Mf = [I\text{-}A]^{-1}f$ gives total gross output (Q) as a function of f (column vector of total final demand, domestic deliveries, and exports) and the matrix $M = [I\text{-}A]^{-1}$, where M is the inverse Leontief matrix (I is the identity matrix, A the matrix of output coefficients). The matrix M reflects how much incremental gross output is induced directly and indirectly by a unit increase in final demand, where "indirectly" refers to the recursive increase in output due to sectoral interdependence. In other words, the matrix M contains the multipliers or backward linkages of the global value chain.

To obtain employment instead of gross output (for the exercises in the following subsection of the main text), we use $n = LQ = LMf$, where n is the vector of employment levels and L is a diagonal square matrix with labor coefficients (employment in the sector, n_j, divided by gross output, Q_j) on the main diagonal and zeros otherwise. The off-diagonal elements of LM measure the indirect employment effects in the other sectors, other than where final demand originates. Gross output, therefore, results from two sources: final demand (exercised as consumption, investment, government consumption, or foreign final demand) and intersectoral multipliers.

Source: Timmer (2012).

Figure 3.3 **The intensity of services in six Asian economies**



Source: Authors based on World Bank. WDI. http://data.worldbank.org/data-catalog/world-development-indicators (accessed September 2012).

The service sector is the major absorber of employment in Asia

The service sector is effectively the largest absorber of employment in Asia. What lies behind this fact? This section analyzes a series of issues relevant to it. First, to understand employment dynamics, we decompose changes in sectors' employment shares into a productivity effect and a demand effect. Second, we use the same decomposition to analyze what drives employment growth and we delve into the question of whether there is technical progress in services or not. Third, we decompose service sector productivity growth into intra- and inter-sectoral change effects. Fourth, we analyze whether the service subsectors creating employment are highly productive. Fifth, we analyze whether service sector employment is becoming more globalized.

The share of employment in agriculture is declining and that of services is increasing

The shift of employment in Asia into the service sector is a generalized phenomenon that largely reflects that industrialization is being bypassed. Table 3.3 summarizes percentage point changes in employment shares of the primary sector, manufacturing, construction and public utilities, and four service subsectors, in six Asian economies. The table corroborates that the share of employment in the primary sector is decreasing and that of services is increasing. The share of manufacturing employment either decreased during 1995–2009, or registered small increases, the same as that of construction and public utilities. And within services, the most important absorbers of employment are public, community, social, and personal services in the PRC, Japan, the Republic of Korea, and Taipei,China (in the last two, finance also absorbed a significant amount

of employment). And in India and Indonesia, the largest absorber was trade.

Table 3.3 **Percentage point change in the share of employment between 2009 and 1995**

Sector/ subsector	PRC	Indonesia	India	Japan	Korea, Rep. of	Taipei,China
Primary	–14.7	–7.4	–8.8	–2.2	–4.5	–5.0
Manufacturing	3.7	–1.5	1.4	–5.6	–6.0	0.9
Construction and public utilities	1.7	0.6	3.3	–1.6	–1.5	–3.0
Services	9.3	8.3	3.5	9.3	11.9	6.8
THR	2.5	5.6	2.6	–1.9	–2.1	–0.2
TSC	0.8	1.3	1.5	0.1	1.1	–0.6
FRB	0.2	0.8	1.0	2.9	5.4	3.6
PCSP	5.8	0.6	–1.6	8.2	7.5	3.9

FRB = financial intermediation, real estate, renting, and business activities; PCSP = public, community, social, and personal services; PRC = People's Republic of China; THR = trade (wholesale and retail), hotel, and restaurant services; TSC = transport, storage, and communication services.
Notes: (i) The "primary" sector includes agriculture, hunting, forestry and fishing, and mining and quarrying; (ii) a negative sign (–) denotes a decrease in the sector's share in total employment.
Source: Timmer (2012).

What lies behind the changes in the sectors' shares documented in Table 3.3? To answer this question, we use again the world input–output tables (Box 3.6), and decompose (additively) the change in a sector's share into a part due to labor productivity changes and another due to changes in demand. The changes in demand are decomposed into final direct demand and derived demand. We define direct demand as deliveries of a sector to consumers (including government) and to investment demand by firms. This is decomposed into final domestic demand and final export demand. Derived demand refers to intermediate deliveries of intermediate goods (raw materials or semi-finished products) to other sectors, i.e., demand that serves other industries for their current production. Derived demand is closely associated with the idea of GVCs—the partition of the production of a single good into smaller, specialized parts, often undertaken in different countries. For example, a car produced in Japan may use steel produced in the PRC, which uses iron ore from Australia.[41]

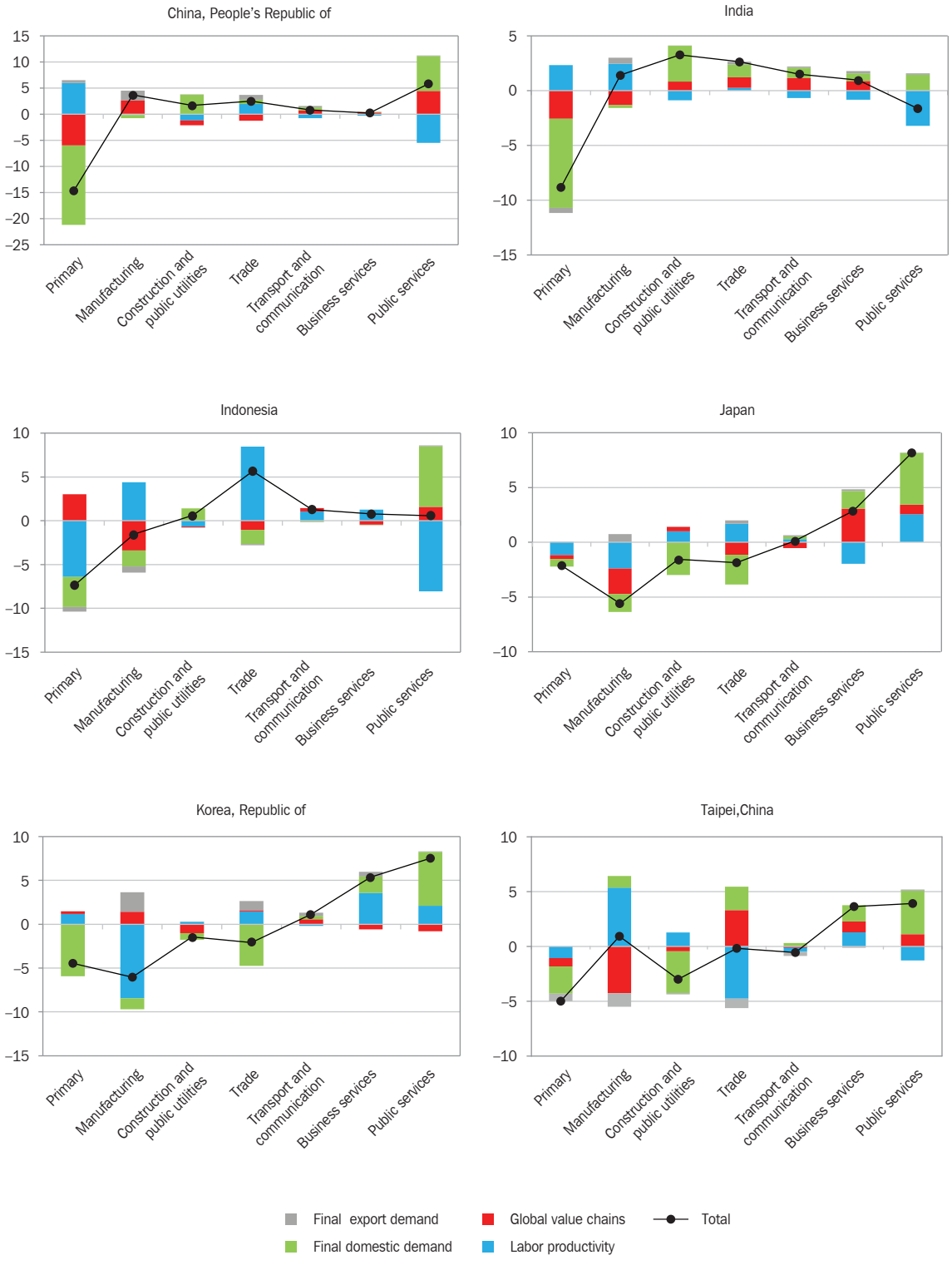
Underlying the decomposition is the fact that when labor productivity grows faster in sector A than in other sectors, sector A's employment share will decline as sector A will need a smaller share of total employment to fulfill demand. At the same time, the share of employment in the other sectors will increase. And, if demand in a sector grows rapidly (relative to other sectors), that sector's share in total employment will tend to rise.[42]

Results of this decomposition are shown in Figure 3.4. Here, we focus on the most salient points. The main contributor to the 14.7 total percentage-point decline in the primary sector's share of employment in the PRC was final domestic demand, which contributed 15.2 percentage points to the decline. The main reason was that the share of primary products in the PRC's total final domestic demand declined drastically because expenditures on goods and services from other sectors grew much more rapidly than expenditures on primary products. In addition, the share of imports in direct PRC demand for primary products is very low (although it increased a bit over this period). The total 3.7 percentage-point increase in the PRC's manufacturing share is mainly due to two factors: 2.6 percentage points from GVCs, and 1.9 percentage points from final export demand. This points to the strong and positive impact of globalization on PRC manufacturing employment. The other two economies where the share of manufacturing employment increased—India and Taipei,China—display a rather different profile from the PRC's: in both, slow labor productivity growth (relative to that in other sectors) is the main factor behind the increase in the manufacturing employment share.

Focusing on services, in five of the six economies analyzed, the contribution of direct domestic demand was larger than the contributions of the other three factors (i.e., final export demand, GVCs, and labor productivity). The Republic of Korea is the exception, where labor productivity growth was the largest contributing factor (i.e., labor productivity grew more slowly in services than in other sectors).

The impact of labor productivity, final export demand, and GVCs on the share of service employment varied across economies and subsectors. When aggregated across the four service subsectors, labor productivity changes had (i) a moderately positive impact in Indonesia and Japan, i.e., labor productivity in services increased more slowly than in other sectors; (ii) a large positive impact in the Republic of Korea; and (iii) a somewhat large negative impact in the PRC, India, and Taipei,China. The GVC effect was large and positive in the PRC, India, Japan, and Taipei,China. The increasing share of employment in services in these economies is the result of their services sectors' higher capacity to attract relatively more indirect demand than the other sectors (i.e., they are serving more intermediate demand).

Figure 3.4 **Decomposition of changes in sectors' and subsectors' shares: Productivity and demand effects**



Note: Vertical axes measure the percentage point change in the sector's employment share due to each effect.
Source: Authors based on Timmer (2012).

Thus, services are the main absorber of employment in the economies analyzed. They absorb employment by attracting a larger share of direct domestic demand than the other sectors. Effects such as GVCs are important in some economies for some service subsectors.

Employment growth in Asia is driven by significant productivity and direct domestic demand effects moving in opposite directions

The foregoing analysis looked at sectors' shares in total employment and compared trends across different sectors of the economy. Here we analyze the effects of labor productivity and globalization on employment growth. To do this, we apply the same decomposition as above, but now to the change in the number of people employed, for 2000–2008. Because we now decompose changes in the number of people employed, productivity increases will always have a negative effect on employment. From this point of view, the challenge of development is to achieve fast growth of labor productivity while generating sufficient employment through GVCs, final direct domestic demand, and final direct export demand so that aggregate employment grows. This analysis also allows us to discuss the somewhat controversial question of whether there is productivity growth in Asia's services.

Results for the total economy and for the manufacturing and service sectors are shown in Table 3.4.

The figures in the column and rows, labeled "total" give the percentage change in total employment (persons engaged) during 2000–2008. The figures in the "Services" rows give the percentage change in employment in services. All economies except Japan registered double-digit positive employment growth, and in most, the growth of employment in services was large.

The second column shows the productivity growth effect. As expected, it is always negative—strongly so in the PRC, India, and Indonesia, and moderately so in the Republic of Korea and Taipei,China. Productivity growth is strongly negative in the service sector. Except in Japan, services' productivity comprises a sizable part of the total, which indicates that labor productivity grew strongly in services.

Table 3.4 **Decomposition of employment (number of workers engaged) growth in Asian countries, 2000–2008 (%)**

Change	Total	Productivity growth effect	GVC effect	Final direct domestic demand effect	Final direct export demand effect
China, People's Rep. of					
Total	15	–302	53	222	41
Manufacturing	42	–359	77	220	104
Services	58	–476	131	360	43
India					
Total	22	–109	–10	133	9
Manufacturing	39	–90	–27	125	31
Services	42	–160	13	178	12
Indonesia					
Total	24	–99	13	107	4
Manufacturing	10	–49	–18	69	8
Services	53	–113	16	146	4
Japan					
Total	–13	–5	–3	–7	1
Manufacturing	–37	–15	–13	–11	3
Services	0	–1	0	0	1
Korea, Rep. of					
Total	15	–39	8	37	10
Manufacturing	–14	–77	16	24	23
Services	40	–29	7	54	8
Taipei,China					
Total	10	–24	–3	34	2
Manufacturing	14	–3	–21	29	8
Services	24	–37	9	51	1

GVC = global value chain.
The columns labeled "Productivity growth effect", "GVC effect", "Final direct domestic demand effect", and "Final direct export demand effect" add up to the column "Total" (except for rounding).
Source: Authors' calculations based on Timmer (2012).

The GVC effect, measures the extent to which countries increase their contribution to international flows of intermediate deliveries and is much smaller than the productivity growth. The largest GVC is in the PRC, and it is negative in India, Japan, and Taipei,China. GVC is positive for the service sector in all cases except Japan (where it is zero). This indicates that GVCs also provide employment opportunities for services.

The final direct domestic demand effect is also large, especially in the PRC. In India and Indonesia, it compensates for the strongly negative labor productivity growth. The final direct export demand effect is much smaller, but, unlike the GVC effect, it is positive in all cases.

This analysis leads to the conclusion that employment growth in Asia is driven by increased productivity that is more than offset by increased demand. This is also true for employment in services.

Table 3.4 documents that Asia's services have registered significant productivity growth. Moreover, whenever the absolute value of the "productivity growth" column is larger for services than for manufacturing, it means that the productivity growth is larger in the former. Results indicate that the effect of productivity was larger in services in four of the six economies during 2000–2008. This is compatible with the low productivity level of the service sector in most Asian economies, when compared with the OECD levels (ADB 2012a).[43]

For a long period (1974–2004), labor productivity growth was somewhat stronger in manufacturing than in services (Table 3.4). But these results corroborate that productivity growth in services was significant. Naturally, there are differences across subsectors. The service subsector that registered the highest productivity growth was transport, storage, and communication (which is complementary to manufacturing). During 1995–2004, it grew even faster than that of manufacturing. Conversely, productivity growth was lowest in public, community, social, and personal services.

These results put into question the view that services display no productivity growth, the so-called Baumol's disease (Baumol 1967, Baumol et al. 1985; Box 3.7), although services are a very heterogeneous category and some of them may be truly be characterized as stagnant. Indeed, recent statistical evidence has shown that some services, based on new technologies and standardization of delivery, do register substantial productivity gains (Maroto-Sánchez and Cuadrado-Roura 2009).[44] With the rise of ICT, manufacturing's advantage over services in terms of the capacity to profit from economies of scale may have changed since the 1990s. In certain service subsectors, scale effects have become important, as the marginal costs of providing an additional unit of service have become close to zero. In these modern service sectors, innovation is relatively similar to that in manufactures. This is the case of engineering, R&D, financial, or data processing consulting firms, which have research centers. Google or DHL are examples of this type of innovation—a search engine or the development of social networks, and transport and logistics, respectively. This means that services that are highly dependent on ICT can indeed be engines of growth as they can achieve high productivity growth and they are subject to increasing returns to scale. However, services such as government, medical, education, hairdressing, house cleaning, and personal care are very labor-intensive (and the last three cannot be provided long-distance) and they are not likely to play the engine of growth role. [45]

The foregoing discussion implies that having a relatively large service sector may not be a problem for an economy, provided the services contain a significant share of high productivity (and high productivity growth) subsectors (i.e., that the stagnant activities represent

Table 3.5 **Average labor productivity growth in Asia's Manufacturing and Services, 1974–2004 (% per annum)**

Economy	Manufacturing	Services			
		Trade (wholesale and retail), hotels and restaurants	Transport, storage, and communications	Financial intermediation, real estate, renting, and business activities[a]	Public, community, social, and personal services
China, People's Rep. of	7.91	2.94	5.66	6.40	3.80
Hong Kong, China	7.03	3.62	1.77	–2.24	0.66
Indonesia	4.95	1.59	1.61	4.00	2.12
India	3.05	2.00	4.23	2.68	3.86
Japan (1974–2003)	3.68	3.17	2.10	4.73	0.62
Korea, Rep. of	6.90	2.22	5.00	–4.21	–0.31
Malaysia (1975–2003)	3.34	2.62	3.43	4.43	2.49
Philippines	0.29	0.03	0.08	1.84	–0.17
Singapore	4.77	3.32	5.83	1.68	2.58
Thailand	3.00	0.06	3.58	1.93	1.21
Taipei,China	5.04	4.87	5.99	1.14	3.39
Average of the 11 economies, 1974–2004	4.54	2.40	3.57	2.03	1.84
Average of the 11 economies, 1974–1995	4.66	2.79	3.04	3.05	1.62
Average of the 11 economies, 1995–2004	4.64	1.82	5.32	–0.97	2.12

a Excludes dwellings.

Source: Authors' calculations from data from the GGDC. 10-Sector Database. www.ggdc.net (accessed September 2012); Data for the People's Republic of China compiled by the authors from multiple sources.

Box 3.7 **Baumol's Disease**

The view that many services combine high income elasticities of demand with low productivity growth rates is known as Baumol's disease. This refers to the slackening of economic growth at high levels of income as the result of the service sector's lower productivity, the increase in its share of employment, and reallocation of labor from industry, where productivity growth tends to be higher. Service subsectors may be characterized as stagnant, with low productivity, and as progressive, with high productivity. A country's long-term average productivity is determined by that of the sectors with the lowest productivity growth rate—the more stagnant ones. The reason is that the relative costs and prices in the stagnant activities tend to rise persistently and cumulatively, and if the output proportions of progressive and stagnant sectors remain fairly constant, the share of the inputs used by the stagnant sectors (in the total economy) will tend to increase and potentially reach one. As resources shift toward activities where productivity is growing relatively slowly, the aggregate productivity growth rate will slow down.

Sources: Baumol (1967), Baumol et al. (1985).

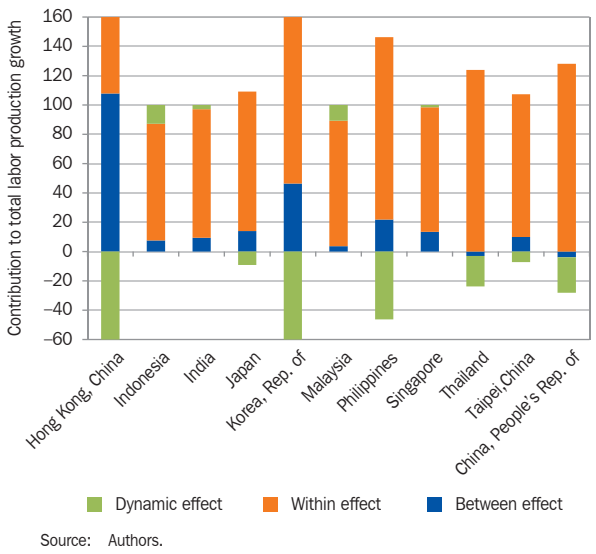
a small share of the economy). For example, a high-income country such as Switzerland, which specializes in providing sophisticated financial, real estate, renting, and business services (FRBs) and personal services (e.g., tourism), as well as in manufacturing sophisticated consumer goods (e.g., watches and chocolates) with high income elasticities, exemplifies of a positive relationship between a large service sector and wealth. However, Switzerland has industrialized and many of the high-productivity services that it developed are complementary to manufacturing.

Most growth of labor productivity within services is due to that within rather than between subsectors

Is labor reallocation within service subsectors contributing to the sector's productivity growth? To answer this question, we decompose productivity growth (through shift–share analysis) in the service sector along the lines of that in Box 2.3 (p.26) for the overall economy, and hence decompose the growth of service sector labor productivity into the "within effect," the "between effect," and the "dynamic effect" (the interaction between changes in labor productivity and in employment shares). The last two are the effects of structural change. We undertake now the same exercise by dividing the service sector into the four subsectors: financial intermediation, real estate, renting, and business activities (FRB); public, community, social, and personal services (PCSP); trade (wholesale and retail), hotel, and restaurant services (THR); and transport, storage, and communication services (TSC).

Figure 3.5 summarizes the results. How large is the between effect? Except for Hong Kong, China, the results confirm the difficulty of creating employment in subsectors that have high productivity. Employment shifts from low- into high-productivity sectors (the between effect) contributed little to overall productivity growth everywhere except in Hong Kong, China and the Republic of Korea. Moreover, these between effect gains are substantially offset by the negative dynamic effects (i.e., changes in labor productivity and in employment shares move in opposite directions) in these two economies, as well as in the PRC, the Philippines, and Thailand. No economy has experienced significant positive dynamic effects in services. The conclusion, like that reached for the overall economy, is that reallocations of labor toward subsectors of higher productivity and productivity growth are not the main driver of labor productivity growth in services.

Figure 3.5 **Shift–share analysis: Decomposition of labor productivity growth in services, 1974–2004 (% contribution of each component)**



Source: Authors.

The sectors with the largest gains in employment shares have generally had positive but relatively low productivity growth

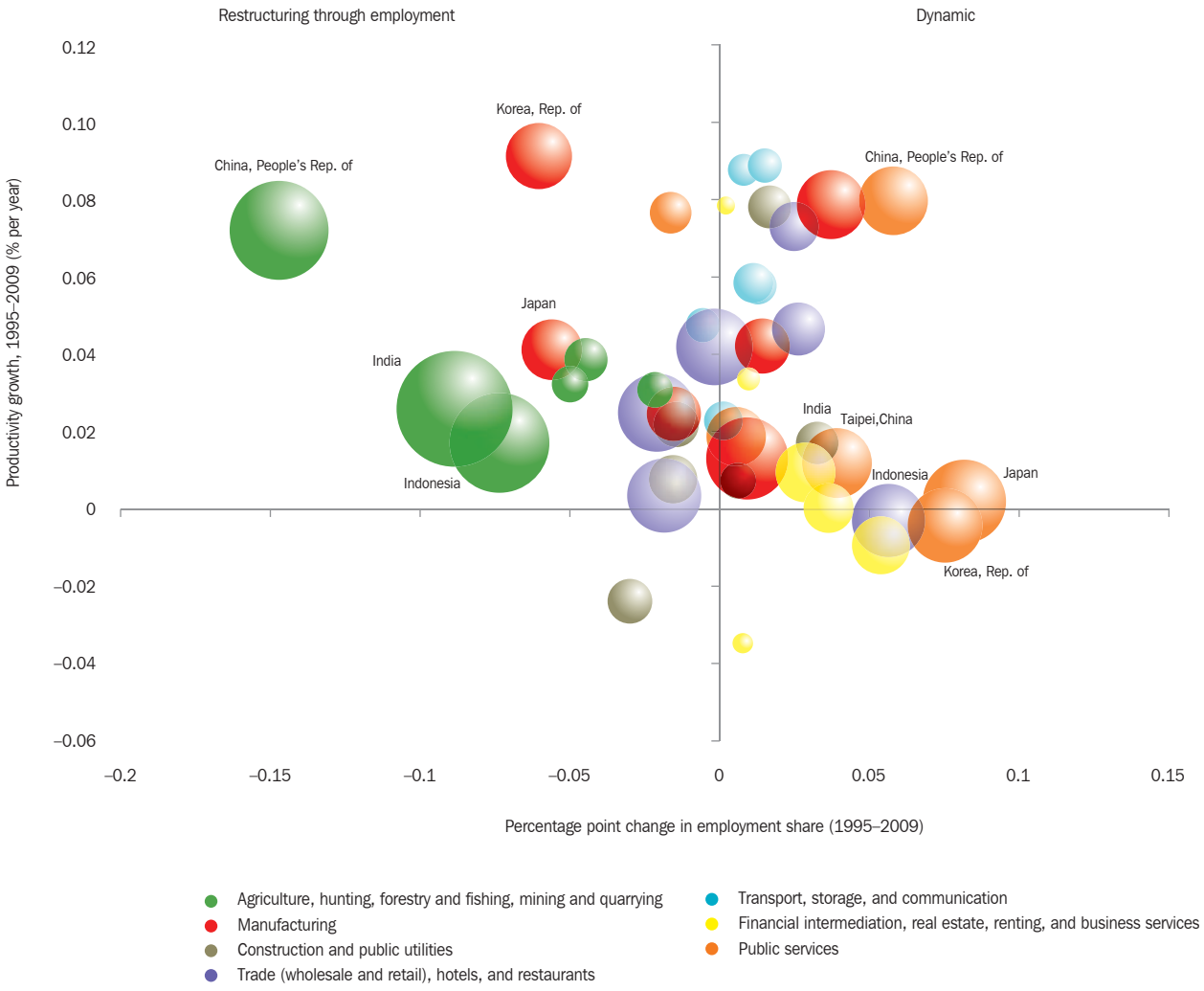
Figure 3.6 graphs productivity growth against changes in employment shares for 1955–2009, again for six Asian

economies and the primary sector, manufacturing, construction and public utilities, and four service subsectors. The size of the bubbles is proportional to the employment share in 2009. Most bubbles are in the first and second quadrants. Sectors in the upper right-side quadrant are labeled "Dynamic"—with both positive productivity growth and increasing employment share. Sectors in the second quadrant are labeled "Restructuring through employment"—and feature positive productivity growth but declining employment share. Agriculture in all economies, manufacturing in two economies, and wholesale and retail trade in three economies, are in the second quadrant. There is a lot of variation in the "Dynamic" quadrant, although it appears that the sectors with the highest productivity growth registered small employment gains (e.g., transport, storage, and communications—TSC), and the sectors that have gained most employment registered relatively small productivity growth (e.g., public services—PCSP).

Service sector employment remains much more dependent on domestic demand than manufacturing employment

Is employment in services becoming more dependent on global factors over time? To answer this question, we compare the impact of foreign demand and foreign production linkages on employment in the service subsectors, to that on employment in manufacturing. Recently, ICT has led to increased productivity growth in services and increased tradability of services (ADB 2012a). Software and call centers are two often-cited examples in the Asian context, especially in India and the Philippines (Gereffi and Fernandez-Stark 2010).

Figure 3.6 **Productivity growth and change in employment shares: Six Asian economies**



Notes: Size of bubbles represents employment share in 2009. Identified bubbles are the sectors with the largest decrease and increase in employment shares for each of the economies used in this data set.
Source: Authors based on Timmer (2012).

To gain insight into whether employment in services is becoming more globalized than that in manufacturing, we again distinguish between direct and derived demand (as defined on p. 53). Using the world input–output tables, we decompose total employment into a part associated with direct export demand and a part associated with direct domestic demand.[46] An example is the PRC paper industry. Assume that it produces 2 million tons of paper per day, of which 1 million tons are supplied to consumers in the PRC (this is direct domestic demand), ½ million tons are supplied to consumers abroad (direct export demand), and ½ million tons are supplied to firms in the PRC and abroad that then resell it (this is derived demand, that is, the GVC effect). If customers of the PRC paper industry increase their production or sales, they will demand more paper, and output and employment in the PRC's paper industry will rise.

Figure 3.7 summarizes the main results of this analysis by graphing the share of manufacturing employment due to direct export demand in each subsector in 2000 and in 2008, for 6 Asian economies (Figure 3.7a) and a group of comparators (Figure 3.7b). The graphs corroborate the fact that, on average, more manufacturing employment is attributable to direct export demand than is the case in most service subsectors. In both graphs, the bubbles associated with manufacturing (in red) are closer to the upper right corner than bubbles of any of the service subsectors, except for those in Figure 3.7a for transport, storage, and communication, corresponding to the Republic of Korea and Taipei,China. All other service subsectors, especially PCSP services, are clustered toward the left lower corner. At the same time, most of the bubbles, including those of the service subsectors, are found above the diagonal line, indicating that the share of employment due to direct export demand generally grew during 2000–2008.

The conclusion is that employment in all service subsectors remains much less due to direct export demand than is the case in manufacturing. This is true both in Asia and elsewhere. Nevertheless, service sector employment due to direct export demand is not negligible, which means that services are tradable, and questions the long-held view that they are not. However, most employment in services remains much more dependent on domestic demand than is the case in manufacturing. The transport, storage, and communications subsector is the only exception, as its share of direct export demand in total employment begins to approximate that observed in manufacturing.

Conclusions

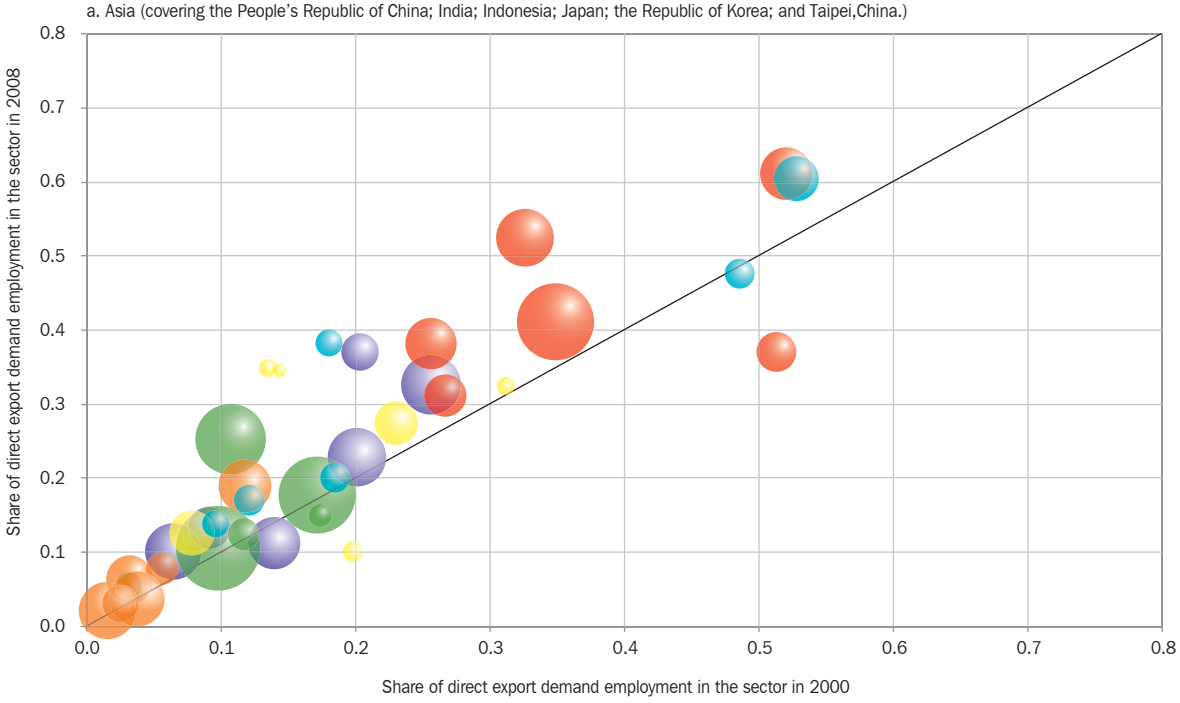
ST during the 21st century will be key to developing Asian economies becoming modern industrial and service economies. We have argued that although some key patterns of economic transformation are likely to persist in the coming decades (e.g., the decline in agriculture's share and the increase in services' share), future transformation is not likely to mimic the patterns traced by Japan and the NIEs in the 20th century, particularly their successful industrialization experience. The main reason is that the overall economic environment has changed substantially.

As Asia's economies continue to develop, and as a result of productivity increases, the service sector will become the largest in both GDP and total employment. Employment growth in Asia, both in general and in services, is mostly driven by changes in direct domestic demand. And the share of employment in services is increasing because this sector attracts a larger share of direct domestic demand than do other sectors of the economy. With variations across subsectors, services have registered significant productivity growth, in some cases on par with manufacturing. And productivity increases are mostly driven by increases within sectors rather than by the reallocation of labor across them. The service subsectors that have gained most employment have registered relatively positive but low productivity growth.

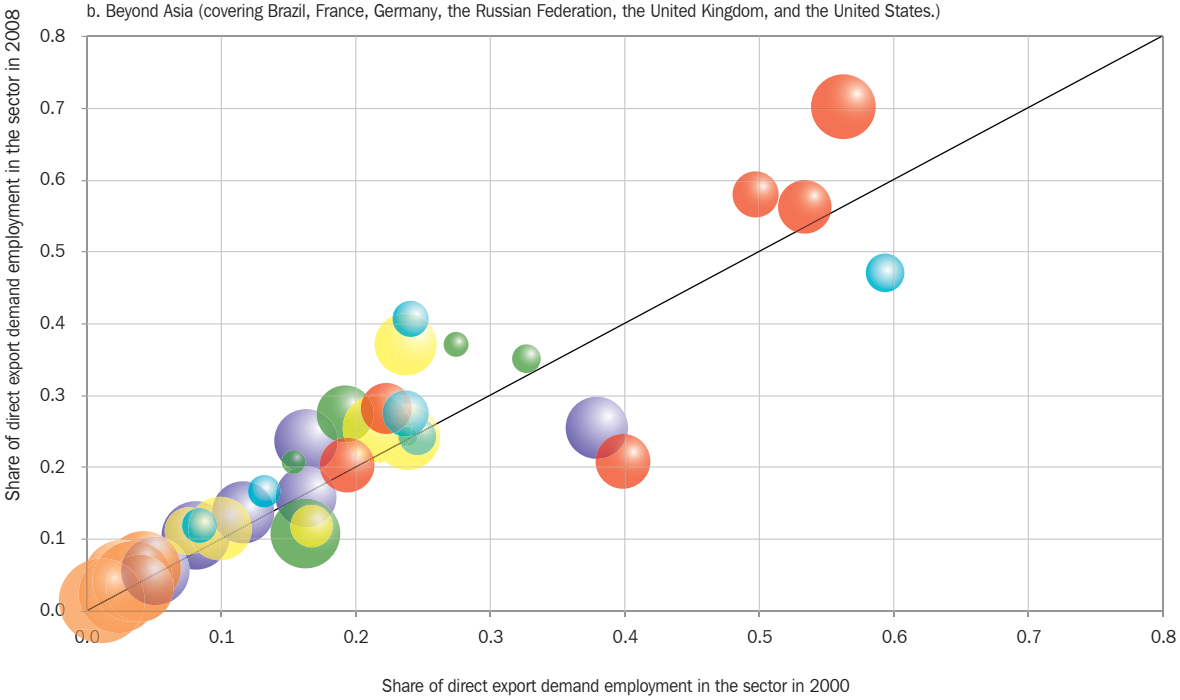
We have concluded that developing Asia needs to nurture niches in high-productivity services that complement manufacturing (e.g., modern transport, logistics, and communications) to ensure growth. But such niches will be very difficult to develop without a solid complementary manufacturing base. Thus, economies that do not industrialize may end up specializing in low-quality services, and it will not be easy for them to become modern industrial and service economies. Simultaneously, Asian economies need to generate employment in labor-intensive activities to accommodate the labor supply.

Figure 3.7 **Globalization of manufacturing and services employment**

a. Asia (covering the People's Republic of China; India; Indonesia; Japan; the Republic of Korea; and Taipei,China.)



b. Beyond Asia (covering Brazil, France, Germany, the Russian Federation, the United Kingdom, and the United States.)



- Agriculture, hunting, forestry and fishing, mining and quarrying
- Financial intermediation, real estate, renting, and business services
- Trade (wholesale and retail), hotels, and restaurants
- Transport, storage, and communication
- Manufacturing
- Public services

Size of the bubble indicates share of total employment in 2008
Source: Authors.

In this transition to become services economies, agriculture will have to play the important roles that it played in past cases of successful ST (i.e., to provide food and demand for other sectors, and to release labor and capital). However, in the first decades of the 21st century, the share of employment in agriculture will remain relatively high in some Asian economies. The countryside will need to modernize (i.e., develop modern logistics, transport, etc.), and for this to happen, agriculture will have to take advantage of new technological developments and the opportunities offered by GVCs for a transition toward agribusiness.

We have also argued that, historically, manufacturing played very important roles in the development of an economy. Our analysis indicates that manufacturing is a developmental stage that generally cannot be bypassed on the road to becoming a high-income economy. Virtually all countries that are rich today industrialized in the past—for a sustained period, their shares of both manufacturing output and manufacturing employment reached at least 18% in GDP and total employment. While many Asian economies have achieved relatively high shares of manufacturing output in GDP, most have not industrialized from the employment point of view, and many seem to be bypassing this industrialization. Except in economies where industrialization is not likely to take off, developing Asia needs to devise policies to create more jobs in manufacturing.

Achieving a relatively high manufacturing share in GDP, however, does not guarantee that an economy will become a high income one. Indeed, a significant level of infrastructure, a high level of financial development, a well-educated population, and a high share of manufacturing in the high-tech subsectors all increase the likelihood of becoming a high-income economy. For example, results indicate that the probability of an economy achieving a high-income level is 41% if it industrializes in both output and employment. But if it industrializes and 50% of its employment in manufacturing is in the high-tech subsectors, then the probability that it will become a high-income economy increases to about 75%.

Industrialization is very relevant to achieving high-income levels, but increasing the share of manufacturing employment will not be easy in the coming decades. This is due to changes in the economic environment since the second half of the 20th century. Given current developments, such as high productivity in manufacturing, and technology-intensive and labor-saving manufacturing, many Asian economies will have difficulty attaining full employment industrialization—that is, their share of manufacturing employment will not reach the 25%–30% range that the advanced economies, Japan, and the NIEs achieved. Not generating sizeable employment in manufacturing is a concern for Asia's policymakers, especially if workers are not absorbed by other sectors of the economy that pay relatively high salaries and that allow the development of skills.

Can GVCs be the engine that will help Asia's developing economies industrialize in the 21st century? The phenomenon of GVCs—ever finer fragmentation of the production process allowing more specific division of labor—provides an opportunity for developing economies to enter the global economy without producing complete finished products. In Asia, only firms in seven economies—the PRC; Hong Kong, China; Japan; the Republic of Korea; Malaysia; Singapore; and Thailand—seem to be strongly connected to GVCs. Manufacturing will continue to be an important sector and, although developed countries may have deindustrialized, they will retain the stages of production that yield the highest value added, e.g., product conception and branding. In this context, Asian countries that expand capacities and move up the quality ladder and do high value-added activities will benefit from GVCs, while economies that remain in low value-added, unskilled-labor-intensive activities will stagnate.

As we noted in the introductory section, a variety of factors affect the direction and pace of ST. One factor that the literature highlights is education. Indeed, as the analysis in this section has found, education increases the odds of becoming a high-income economy. In the next section we inquire about the role of education in facilitating ST.

How does education contribute to export diversification?

Previous sections have discussed Asia's pattern of economic transformation and the future prospects of the agriculture, industry, and service sectors. It is natural to ask what other factors (beside, for example, differentials in productivity across sectors, or geography) are important in driving this transformation. As the pace of innovation picks up globally, the educational achievements of a country's workforce are likely to be an important determinant of its ability to develop new industries that are capable of competing internationally. Hence, the analysis in this section contributes to the discussion of how economic transformation occurs by inquiring what role education plays in industrial development. As noted in the previous section, "Asia's future transformation," industrialization (achievement of a high share of manufacturing in output) alone provides no assurance that a country will become a high income economy, but when industrialization is combined with significant levels of education or a sophisticated industrial structure, the odds of becoming high-income rise substantially. This is consistent with the view that education facilitates industrial upgrading, and that industrial upgrading is crucial for economic success. The analysis in this section contributes to the discussion of how economic transformation occurs.

This section analyzes export data to learn about the relationship between education and industrial upgrading. Export data are useful for this purpose because they restrict attention to the mix of products a country is able to produce well enough to be competitive in global markets. Exports are therefore a preferred indicator of authentic industrial development, and ample evidence indicates that producing a diverse export mix is conducive to upgrading and economic growth (Hausmann et al. 2011).

Anecdotal evidence provides good reason to think that education is important for export diversification. Japan began expanding and diversifying its export mix in the late 1950s, when it had relatively high levels of education. Education levels rose rapidly in the Republic of Korea and Taipei,China between the 1960s and the 1980s as their shares of global markets for many products increased dramatically. The PRC began making inroads in global product markets in the 1980s, when only 29% of its 20–25 year olds had completed secondary school. By 2010, the PRC had lifted this share to 92% and had come to dominate world markets in many products. The successes of Germany and Switzerland, whose exports are among the world's most diverse and sophisticated, are often ascribed to the rigor and practicality of their basic education systems. Conversely, Bangladesh and Pakistan, with low education attainment compared with the rest of Asia, have a relatively narrow mix of exports.

However, recent history shows that education alone is not always enough for industrial upgrading. Although Bangladesh still has relatively low primary and secondary school completion rates, these rates increased rapidly throughout the 1990s and 2000s, even as its exports became increasingly concentrated in one fairly unsophisticated industry—garments. Until recently, the Philippines enjoyed a substantial educational edge over Thailand in years of schooling, and international science and math tests revealed no major difference in the quality of Philippine and Thai education. During the last 3 decades, however, Thailand has been the more successful country in diversifying its export mix. Elsewhere, many Middle Eastern and North African countries have invested heavily in education without successfully diversifying their exports. These examples show that that a country will not successfully diversify its exports by simply having a well-educated workforce. We therefore need to know what complementary conditions and policies enable a country to use education to upgrade its industrial exports and achieve a high income level.

In what follows we ask three questions. First: Is a country's level of industrial diversification related to its population's educational attainment? In this context, we also ask whether it is the quantity or the quality of education that matters, and whether tertiary education is important for developing a well-diversified industrial structure.

The second question is: Does education help reduce path dependence, the need to move progressively from simple to complex manufactures, and how? That it is easier to develop industries similar to those a country already possesses than to develop unfamiliar new industries is well established (Hidalgo et al. 2007). For example, a country that is a successful

exporter of T-shirts will find it much easier to become a competitive exporter of trousers than of computers, because T-shirts and trousers draw on a similar knowledge base and require similar infrastructure and institutions. We say that T-shirts and trousers are "proximate" to each other; while T-shirts and computers are not. A country that successfully exports T-shirts may have to move incrementally from them through a series of increasingly complex products, learning through experience, in order to become good at making complex products such as computers. In theory, a country with a narrowly focused product mix—one from which it is difficult to move naturally toward more sophisticated products—could even experience a development trap, wherein it cannot find a path to sophisticated products.

Education can overcome this path dependence by helping countries to more rapidly assimilate the knowledge that is needed to make incremental transitions to slightly unfamiliar products, thereby permitting a country to move more rapidly through a sequence of products from poor-country products (i.e., less complex ones) to rich-country products (i.e., more complex ones). For example, education may help a country move from T-shirts through shoes, toys, kitchen appliances, and televisions, into computers (as the PRC has done). Or, in the extreme, education may allow a country to bypass the intermediate industries altogether, "teleporting" from simple products (e.g., T-shirts) to complex ones (e.g., computers) without having to develop the intervening industries. Knowing whether teleportation is possible has important policy implications: if it is possible, then a sufficiently educated country wishing to export computers will not require public policies to support the intermediate shoe, toy, kitchen appliance, and television industries. However, if these industries are not supported and incremental movements through intermediate products are required, then the industrialization strategy will fail.

Our third question is: Does education play different roles in the development of products of different levels of sophistication? Of course, the difficulty in building a new industry and the degree of path dependence that a country will encounter as it attempts to build it may vary depending on the type of industry that the country is attempting to build. The role of education in learning how to build cars could be different from the role it plays in learning how to weave fabric. Regardless of whether teleportation is possible or not, learning to produce more sophisticated products may be difficult.

To answer these questions, we combined export data of 1,240 products for 114 countries between 1995 and 2010, with information on national educational attainment, measured in three ways: (i) average years of schooling in the population over the age of 15; (ii) primary, secondary, and tertiary attainment rates for the population over the age of 15; and (iii) a measure of the quality of education. The quality measure is proxied by the cognitive skills of the population with secondary-school education, gleaned from international science and mathematics tests. This is not a perfect measure of the quality of education as it neglects many other aspects that very likely influence quality, but it is widely used and is the only one available.[47,48]

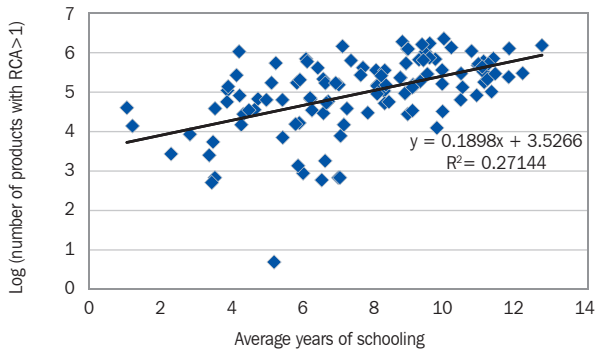
The empirical work in this section measures relative export success in a given product using an index of revealed comparative advantage (RCA).The RCA is calculated as the ratio of a product's share in a country's export basket to that product's share in total global exports.[49] A country's diversification is measured by the number of products that a country exports with RCA greater than 1. For example, in 2010, fiber optic cable represented 0.037% of global exports by value, but 0.049% of India's exports. Thus, India's RCA in fiber optic cable is 1.341 (0.049/0.037). That this number exceeds 1 indicates that India is relatively specialized (or has an RCA) in fiber optic cable. RCA is a measure of relative export success—even a country with very low exports overall must have an RCA in something. Bhutan's exports of copper wire in 2010 were only $29 million (or 0.1% of total copper wire exports), but nevertheless it had an RCA in the product. Among the Asian countries with complete data in 2010, Azerbaijan was the least diversified (specializing in 25 of the 1,240 products), and the PRC was the most diversified (with 525 products).

Years of schooling and diversification are positively related and the quality of education matters more than the quantity

We now turn to our first question—whether diversification is related to educational attainment.

Figure 4.1 plots diversification and countries' average years of schooling, in 2000. The relationship is clearly positive but there is a lot of variation around the regression line. This indicates that, while countries with more years of schooling tend to have a more diverse product mix, other factors are also likely to be influencing diversification.

Figure 4.1 **Education and Export Diversification (2000)**



RCA = revealed comparative advantage.
Source: Authors.

To examine in detail the relationship between education and diversification, we regress diversification on the three sets of education measures, and control for countries' per capita GDP and population. Table 4.1 shows the results. We focus on the sign of the variables and on whether they are statistically different from zero. Both control variables enhance export diversification, consistent with the notion that a larger and richer domestic consumer base can support a wider array of industries. When the total number of years of schooling is the only education measure (column 1), it is found to enhance diversification: a 1 standard deviation improvement in years of schooling is associated with a 50% increase in diversification.

The regression in column 2 introduces our measure of the quality of education, as well as the multiplication (or interaction) between this measure and the number of years of schooling. This is done to test whether there is any effect due to schooling quantity adjusted for quality. Results indicate that the quality rather than the quantity of schooling is important.

When the quantity of schooling is disaggregated by level (column 3), only primary education and quality of education have statistically significant relationships with diversification.[50] Controlling for primary, secondary, and tertiary education attainment are not significantly associated with diversification. These results suggest that basic (primary) education and the quality of education matter significantly for diversification, and that variations in the quantity of tertiary education are not particularly important (the quality of tertiary education could matter, but it is not measured). Our claim about tertiary education refers specifically to its role in the diversification of the economy and does not mean that tertiary education is not important to, for example, upgrading. Box 4.2 shows that workers in services are more educated than in manufacturing.

Table 4.1 **Diversification and education**

Dependent variable: Log–diversification			
	(1)	(2)	(3)
Key control variables			
Years of schooling	0.502***	0.078	
Quality of education		0.315***	0.233**
Years of schooling x Quality of education		–0.024	0.101
Primary attainment			0.460**
Secondary attainment			–0.188
College attainment			–0.093
Other control variables			
Log(per capita GDP)	0.096	0.399	0.282
Log(per capita GDP) squared	–0.012	–0.103	–0.072
Log(population)	0.255***	0.167***	0.188***
Constant	4.229***	4.694***	4.572***
Sample size	111	60	60
R-squared	0.427	0.391	0.474

*** = statistically significant at the 1% level, ** = statistically significant at the 5% level, GDP = gross domestic product.
Note: All three education variables are scaled so that they are distributed with a mean of 0, and a standard deviation of 1. This means that the regression coefficients tell us the percentage increase in diversification for a 1-standard deviation difference in education levels.
Source: Authors.

The quality of education helps reduce path dependence, and "teleportation" into the most complex products is practically impossible

We turn now to the second and third questions, which ask how education may influence the acquisition of comparative advantage in new products. To answer them we use a large sample of industries, where an industry is a country–product pair (e.g., the Cambodian T-shirt industry, the Pakistani ceramics industry, and so forth). The dependent variable now is the change in each product's RCA index between 1995 and 2010. For

example, the PRC's RCA index for socks and stockings grew from 0.29 to 3.16 between 1995 and 2010, indicating that the economy rapidly built an RCA in hosiery.

To assess path dependence in developing new RCAs between two periods, we introduce two measures developed by Hidalgo et al. (2007). The "proximity" between two products is a measure of their "co-exportability" (the overlap between the set of countries exporting the two products).[51] For example, T-shirts are proximate to trousers (as many countries specialize in both), but T-shirts are not proximate to surgical instruments (few countries co-export the two products). Using this measure, we can define an index of a country's "density" around each product. A country will have a high density around product A if it already possesses an RCA in many products that are proximate to A. For example, Bangladesh has a high density around socks because it has an RCA in many other types of apparel and the rest of the apparel sector is proximate to socks.

Density will help us assess path dependence versus teleportation. If the growth of a country's RCA in a given product is higher when the country has a high initial density around that product, then the country faces path dependence: it is easier to acquire comparative advantage in proximate products and hence to start exporting them. However, if the relationship between initial density and a growing RCA is weaker in more educated countries, then education does help reduce path dependence. Teleportation implies that countries can develop new RCA in products that are not proximate as easily as in proximate products.

To assess these effects, we include density as well as the multiplications (i.e., interactions) between density and the education measures as explanatory variables in the regression. If more education reduces path dependence, then one should expect the coefficients of the interaction terms to be negative. And all regressions include measures of the quality of education of secondary school graduates to examine the role of differences in the quality of basic education.

We also include a measure of the "sophistication of the target product" to capture the idea that some products are more technologically advanced than others. We take the average quality of education in economies that have an RCA in a product as a measure of the product's sophistication. For example, the PRC, the Republic of Korea, and the OECD countries dominate the global market for pressurized gas containers, and these economies all have highly educated workers. Therefore, we consider pressurized gas containers to be a sophisticated product. We include this sophistication measure on its own in the regression, and in interactions between it and the education variables (both quantity and quality). This permits us to assess whether it is more difficult to acquire RCA in sophisticated products, and whether education helps to overcome that barrier.

The empirical analysis compares two roles that education may play as countries seek to develop new RCA. The first role examined is whether education may substitute for experience in many related industries (i.e., substitute for density). The second role examined is education's ability to facilitate handling product sophistication (i.e., to overcome the hurdles presented by technological advancement). The rationale for this second possible role is that not all products have the same consequences for development: complex and well-connected products (i.e., products that are proximate to many others) facilitate the development of more and more widely applicable capabilities. In our data set of 1,240 products, 230 products are highly complex and well connected to other products, 232 lack complexity and connectedness, and 778 products are in between. By focusing on these three groups of products separately, our work uncovers differences in the role of education for developing RCA in products of differing significance for development.

Table 4.2 shows the results. The test of the first possible role of education is shown in the table's first two columns. The first column examines the relative role of the quantity and quality of education, and the second examines the role of primary, secondary, and tertiary education attainment. Beginning with the density-related terms, the coefficient on density alone is positive and statistically significant, indicating that the development of new RCA is a path-dependent process for a country with an average level of education.

Increasing the quality of education reduces the importance of density (and thus path dependence) for the development of RCA, regardless of how the quantity of education is measured. The interaction

with secondary education has the expected negative sign but it is only marginally statistically significant; the interaction with tertiary education is insignificant; and the interaction with primary education has a positive sign that is contrary to what we would expect. Thus, after controlling for the quality of education delivered by the end of secondary school, there is no evidence that increasing the quantity of education reduces path dependence. Moreover, based on these regression results, we could reject the possibility of teleportation for all countries.[52] The key findings are that the development of RCA is path dependent—that is, teleportation into the more desirable products is practically impossible—but high quality basic education, by imparting good math and science skills, reduces that path dependence.

These two regressions also show that product sophistication has no effect on the development of new RCA for a country with an average education supply. The small and marginally significant positive coefficient on the interaction term between product sophistication and years of schooling suggests that countries with below average years of schooling may be at a slight disadvantage when attempting to export sophisticated products. Other than this, there is little evidence that education is especially important for learning to produce sophisticated products.

These results therefore indicate that a lack of experience in proximate industries is a more serious barrier to industrial development than is the technological sophistication of the target industry. These results suggest that the key role of education is not to help master advanced technologies, but to help a workforce learn to perform unfamiliar functions.

The test of the second role of education is shown in the last three columns. They reveal stark differences between the three types of products analyzed. Developing new RCA in the most desirable products (i.e., the most complex and best-connected ones) depends

Table 4.2 **Education and revealed comparative advantage (2010)**

	All products (1,240), education effects proxied by		Product type		
			Connectedness to other products and complexity		
	Years and quality of schooling	Years, quality, and level of schooling	High (230 products)	Medium (778 products)	Low (232 products)
Dependent variable: RCA in 2010					
Considerations relating to density					
Density	0.961***	0.767***	1.431**	0.856**	0.682
Density x years of schooling	0.121		–0.255	0.188	0.188
Density x quality of education	–0.450***	–0.448***	–0.366	–0.483**	–0.272
Density x years of schooling x quality of education	0.074	0.300	0.316	0.051	–0.085
Density x primary attainment		0.660***			
Density x secondary attainment		–0.443*			
Density x tertiary attainment		–0.080			
Considerations relating to product sophistication					
Product sophistication	–0.041	–0.025	0.003	–0.034	–0.119*
Product sophistication x years of schooling	0.084**		0.104	0.071*	0.098*
Product sophistication x quality of education	–0.013	–0.001	–0.048	0.007	–0.053
Product sophistication x years of schooling x quality of education	–0.038	–0.045	–0.122	–0.045	0.092
Product sophistication x primary attainment		0.005			
Product sophistication x secondary attainment		0.051			
Product sophistication x tertiary attainment		0.511***			
Control Variable					
Initial RCA (1995)	0.511***	0.511***	0.430***	0.541***	0.543***
Sample size	67,741	67,741	12,474	42,582	12,685
R-squared	0.244	0.244	0.246	0.329	0.122

* = statistically significant at the 10% level, ** = statistically significant at the 5% level, *** = statistically significant at the 1% level,
RCA = revealed comparative advantage.

Note: Ordinary least squares coefficients with robust standard errors. Largest samples are used in all cases. Product sophistication is measured as the average level of cognitive skills (our proxy for the quality of education) among countries that export the product with RCA>1. All education variables have been scaled to have a mean of 0 and a standard deviation of 1.

Source: Authors.

strongly on how many nearby products a country already exports (i.e., density matters). Education, however, does not overcome this—no country in our dataset possesses enough educated workers with high quality education to teleport into the most desirable products (Box 4.1). In contrast, there is no significant evidence of path dependence for the least desirable products (i.e., density is statistically insignificant for this group). Calculations based on the figures in Table 4.2 imply that teleportation into the least desirable products is at least a possibility for all countries. In fact, the statistically significant coefficient of the "product sophistication" variable in the lower part of the table indicates that product sophistication is a barrier to learning how to produce these less desirable products. (That is within the group of low complexity and connectedness, the least sophisticated products are the easiest in which to gain comparative advantage.) But this is surmountable given a modest quantity of education (i.e., the statistically positive interaction between "product sophistication" and "years of schooling"). Products in-between display the same features as those in the wider sample.

Box 4.1 **The capabilities demanded by the most desirable products are only learned by doing**

Regression results in Table 4.2 indicate that countries are unlikely to learn to produce the most complex and well-connected products without first acquiring the requisite capabilities by producing similar goods. This suggests that workers cannot quickly acquire the types of knowledge that are truly important for producing such products, but must instead acquire it through learning by doing. Hyundai's efforts to produce a car, after Mitsubishi refused to provide assistance for fear of creating a rival, provide a clear example of why this might be the case:

"… Hyundai engineers repeated trials and errors for 14 months before creating the first prototype. But the engine block broke into pieces at its first test. New prototype engines appeared almost every week, only to break in testing. …, casting serious doubts even among Hyundai management, on its capability to develop a competitive engine. The team had to scrap 11 more broken prototypes before one survived the test. There were 2,888 engine design changes. Ninety-seven test engines were made ….more than 200 transmissions and 150 test vehicles were created before Hyundai perfected them in 1992."

Source: Kim (1997).

Together, these results suggest that teleportation into desirable products is unlikely, even with large amounts of education. Countries that wish to export the most desirable products must learn how to do so incrementally by producing a succession of products increasingly similar to the desired ones. Education seems to be helpful for adopting off-the-shelf technologies, as has long been suggested (Nelson and Phelps 1966), but this only works for the least desirable products.

Discussion and implications

This analysis has several implications. First, while education is indeed helpful for industrial upgrading, its value seems to derive mostly from the fact that a better educated workforce is more capable than an uneducated one of rapid transitions from one product into another. We find limited evidence that the quantity of education alone is important for learning how to produce sophisticated products. Education is not very helpful for acquiring a target product unless a country already has an RCA in industries that export products that are somewhat proximate to the target. Second, if faster transitions across products are driven by better educated workers' higher capacity for rapid learning, then public–private partnerships can play a very important role in skills' development. The usual prescription from industry is that public education systems should deliver the specific skills that industries need. While this may indeed be helpful, the analysis in this section suggests that it is probably equally important for employers to provide educated workers with the right learning opportunities, so that they may use their education to rapidly acquire skills that they can take up the industrial ladder with them. The implications for policymaking, then, are that governments need to consider

- providing high quality basic education;
- supporting the industries that act as stepping stones to industrial development; and
- ensuring that these industries provide jobs that support continuing learning opportunities.

Box 4.2 **Where is the knowledge economy?**

Much has been made of the recent importance of the "knowledge economy," and the idea that a country's human capital stock is crucial for its capacity to compete internationally and lift incomes. While knowledge and education have become increasingly important determinants of productivity in some activities, societies that are unable to lift education levels rapidly will need to know which types of activities are most likely to be constrained by low education levels. This box draws together census and labor force survey data from nine developing countries during 2006–2010 to investigate the issue.[a] The questions asked are: Is there a hierarchy of education levels across economic sectors? If yes, is that hierarchy similar across countries? Which sectors of the economy, as distinguished by high education levels, comprise the knowledge economy? and How large is the knowledge economy?
Each sampled worker was assigned by economic activity to one of 15 sectors as defined for this investigation.[b] The percentage difference between each sector's mean years of schooling and the national average was calculated, and the sectors of each country were ranked by the average years of its workers' schooling. Using rank orderings eliminates the need to consider differences in schooling attainment across countries, allowing for a focus on the relative schooling by sector.

The Box Figure depicts the range of the ranking of each sector. The graph reveals a very clear hierarchy, and one that appears quite consistent across economies. Workers in the education sector have the highest or second-highest average years of schooling in every economy. Indeed, they average 59% more years of schooling than the national average. The financial sector is not far behind. Indeed, the graph shows that if the knowledge economy could be defined by sectors, it would include the top six sectors: education, finance, health and social work, government, real estate and business services, and utilities. These six sectors have the most educated workforces in each country studied. Workers in transport and communications, the next most educated sector, average 22% fewer years of schooling than those in the utilities sector. At the other extreme, construction, private household services, and agriculture are consistently ranked the four least educated sectors in all nine countries (i.e., 12th to 15th).

The six sectors with the most educated workforces share two defining features. First, they all produce services, not goods, and most of the services they produce are not widely internationally traded in the countries studied (the key exceptions here are, of course finance and business services). Second, none of the six sectors employ a large number of workers—together they employed 8%–20% of the workforce, depending on the country. Moreover, most of the employment in the top six sectors was in education or the public sector. This suggests that if the knowledge economy could be defined by sectoral education levels, it would involve a great deal of public employment.

What about manufacturing? Box Figure 1 shows that manufacturing workers rank 8th to 12th in the 15 sectors in terms of schooling, and average 7% more years of schooling than the national mean. In our country sample, Mexico and Viet Nam have the most educated manufacturing workforce, but their manufacturing workers have only 16% more years of schooling than the national average. Given that wages do not differ dramatically across industries at this level of aggregation,[c] these results indicate that demand for educated workers is not especially high in manufacturing. If education is crucial for international competitiveness in goods production, these results must indicate that (i) only the education of a minority of manufacturing workers matters (supervisors and managers, perhaps); or (ii) there are auxiliary services that are important for manufacturing competitiveness and that require high levels of schooling.

While this simple descriptive exercise offers little evidence that education alone is important for manufacturing success, the special chapter cautions strongly against over interpreting the result in this box. Knowledge and schooling are not the same thing. Much valuable knowledge is probably acquired on the job, and industries that produce manufactured and other tradable goods are important because they facilitate such learning-by-doing. The knowledge acquired in this way helps, in turn, to develop new industries, facilitating the creation of yet more knowledge. And this entire process is facilitated by an abundant supply of workers with high quality basic education.

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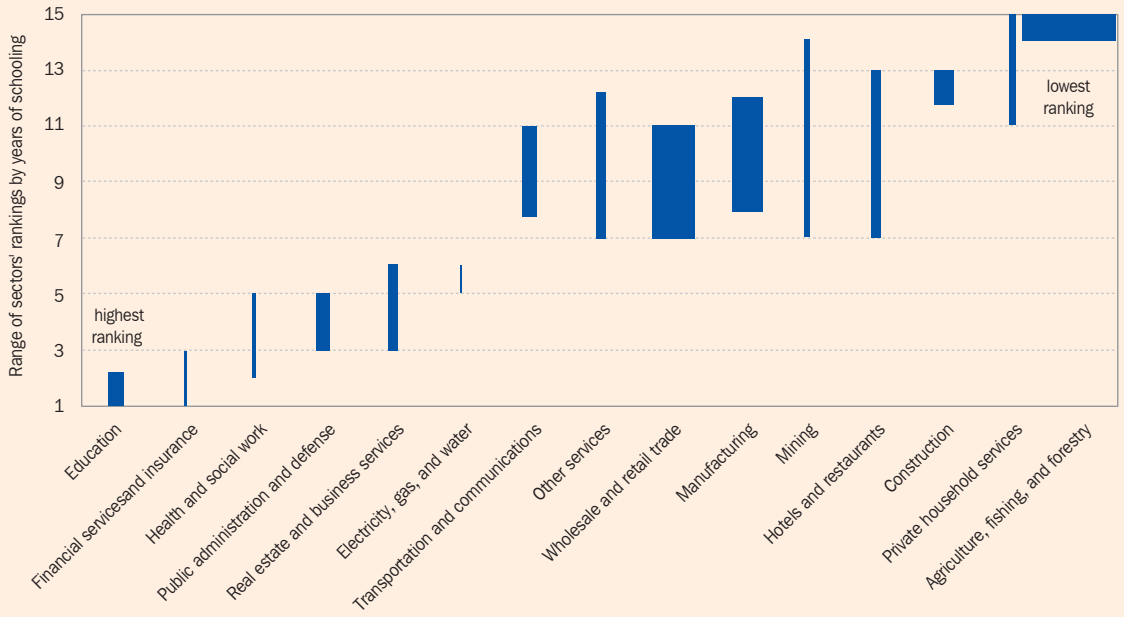
Box 4.2 **Where is the knowledge economy?** *(continued)*

Box Figure 1 **How do sectors rank in terms of educational attainment? (1 = most educated sector, 15 = least educated sector)**



Note: Width of the bars approximates the subsector's share of employment in total employment.
Source: Authors.

a Countries (and years) included in this study are: Cambodia (2008), Egypt (2006), El Salvador (2007), India (2010), Indonesia (2009), Mexico (2010), Peru (2007), the Philippines (2010), and Viet Nam (2009).
b Sectors vary widely in their share of employment in total employment. Agriculture's (mean) employment share is 38%, that of wholesale and retail trade is 15%, and that of manufacturing is 10%. The other sectors have much smaller shares.
c For a review of the literature on interindustry wage differentials in developing countries, see Mehta & Sun (2013).
Source: Authors.

Priorities for structural transformation

This final section first summarizes the main patterns of ST in Asia during the last 4 decades. Second, it discusses priorities for Asia's economies and returns to the questions posed in the first section: What type of transformation is expected in the coming decades? How will this transformation happen? How fast will Asia continue changing?

Key patterns of structural transformation in Asia

Overall, Asia has made great progress. During the last few decades, some Asian economies have undergone extraordinary, historically unprecedented structural changes, with the share of agriculture declining and the shares of industry and services increasing.

But ST has been very heterogeneous and not all economies have moved in the same direction and at the same speed. Only five economies—Hong Kong, China; Japan; the Republic of Korea; Singapore; and Taipei,China—have undergone deep ST and become modern industrial and service economies. Indonesia, Malaysia, Thailand, and even the PRC, have made significant progress but their transformation has not matched that of Japan and the NIEs.

Most other Asian economies are far behind: their shares of employment in agriculture are still high, shares of manufacturing employment are small and concentrated in the least technologically advanced subsectors, employment is shifting from agriculture into low-productivity services, and export baskets are not diversified and sophisticated. To progress, they will need to expedite ST in the decades ahead. Across Asia, over 40% of workers (more than 700 million people) are still employed in agriculture—more than in industry, at 23%, or services, at 33%. Agriculture is still the largest employer in most of the large countries—Bangladesh, the PRC, India, Pakistan, Thailand, and Viet Nam.[53] And in Bhutan, Cambodia, Georgia, India, Myanmar, Nepal, Papua New Guinea, Tajikistan, Vanuatu, and Viet Nam, agriculture's share of total employment exceeds 50%. In output terms, however, agriculture only contributes 11% to Asia's GDP. This difference in the employment and output shares implies that agriculture's labor productivity is well below that of the average of the economy.

During the second half of the 20th century, Japan and the NIEs developed a sizeable manufacturing sector. Manufacturing became significant both as a share of GDP and as a share of total employment, following a pattern similar to that of the advanced Western economies. In all these economies, manufacturing reached 25%–30% of both GDP and total employment at their peak, before deindustrialization set in. And they upgraded their manufacturing significantly (toward high-tech products) and deepened their industrial structures with increasingly diversified and complex export baskets.

In many other Asian economies, manufacturing's share of GDP is high, but its share of total employment is below that achieved by the industrialized Western economies, Japan, and the NIEs. Many Asian economies seem to have failed to industrialize in employment, and workers are shifting from agriculture into low-productivity services. For example, in India the largest sector of the economy is services, at 55% of GDP, while agriculture represents less than 20% of GDP. However, in employment terms, the numbers are almost reversed: 51% of employment is in agriculture and 26% is in services. Industry's shares are very similar: 26% for output and 22% for employment (while the shares of manufacturing are about 16% of GDP and barely 10% of total employment). The Philippines is also experiencing transformation from agriculture into services. Services make up the country's largest sector in both GDP and employment, accounting for over 50% of each. And the country's share of manufacturing in GDP (slightly over 20%) is significantly higher than the employment share (about 9%). In Thailand, agriculture remains a large employer (slightly less than 40% of total employment). Employment in manufacturing is about 15% of total employment but manufacturing's output contributes a very high 35% of GDP.

Asia's service sector adds significantly to the region's GDP, but labor productivity tends to be low in the sector. Services in Asia provide about 49% of the region's overall GDP, ahead of industry (40%) and well ahead of agriculture (11%). However, labor productivity in developing Asia's service sector is less than 20% of that in advanced economies. The low productivity partly reflects the dominant role of traditional service industries such as wholesale and retail trade, real estate,

and personal services. The share of modern services such as finance and business services in GDP is less than 15% of GDP in many economies, below the 20%–25% in advanced economies. Hence, it will be important to focus efforts on raising productivity in these sectors.

In many Asian economies, within-sector productivity growth accounts for a larger share of overall labor productivity growth than does the reallocation of labor. This finding is a salient feature of the region's ST during the last several decades. In some cases, this pattern of transformation is reflected in the transfer of labor out of agriculture into low-productivity services. Decomposition of labor productivity growth corroborates that the transformation is happening. The largest component of overall labor productivity growth in many Asian economies has been within-sector productivity growth. The reallocation of labor across sectors has played a smaller role. In India during 1974–2004, within-sector productivity growth accounted for 64% of total labor productivity growth, labor reallocation across sectors accounted for 19%, and the interaction between changes in labor productivity and changes in sectors' shares accounted for 17% (i.e., overall, labor shifted toward industries with fast productivity growth). The corresponding shares for the PRC are 59%, 32%, and 9%.

The future of Asia's transformation

Agriculture will remain a large employer in many Asian economies in the coming decades. For this reason, industry needs to be promoted, upgraded, and modernized, and services will continue to provide increasing employment. The quality of education (proxied by the international science and mathematics test scores), rather than its quantity (number of years at school), matters for the diversification of the economic structure. Diversification is "path-dependent"—it takes place through a succession of small steps from unsophisticated to sophisticated products. The quality of education workers receive facilitates diversification and helps countries move into new territories. We have argued that it will be difficult for many Asian economies to undergo fast structural transformation in the next decades unless governments implement policies to speed it up.

Low- and middle-income economies cannot neglect agriculture and its coming challenges

Agriculture is still the largest employer in the region, and will remain so in some economies for several decades, as agriculture's employment shares decline more slowly than its output shares. For example, in the PRC, agriculture's share of total employment is forecast to still be above 20% in 2040, and in India, above 30%. Agriculture will also continue to be an important source of labor for the other sectors of the economy and for the development of manufacturing, in particular agribusiness and food processing.

Low- and middle-income economies will have to dedicate significant effort to improve agricultural infrastructure, including agricultural extension services. In some economies, more equitable land distribution is pending, as past efforts suffered from implementation problems. Better infrastructure and more equitable land distribution are needed to ensure that agriculture provides food for the whole population, provides savings to channel into industry, helps mitigate the use of foreign exchange for imports, and facilitates an expanded market for manufactures.

In the coming decades, Asia's agriculture will face challenges from resource depletion, climate change, and market instability. So, in addition to the foregoing, Asia's agricultural output depends on putting to good use the new technologies (e.g., biofertilizers, biotechnology, and precision agriculture); making the transition into high-value products and to agribusiness; and linking to agricultural global value chains (GVCs).

Manufacturing remains important and industrialization generally cannot be bypassed

Manufacturing matters. Historical analysis indicates that, with few exceptions, countries have been unable to achieve a high-income economy without having a significant manufacturing sector. We estimate that to be a high-income economy requires attaining a manufacturing output and employment share of 18% or more for a sustained period. If a country has industrialized both in output and in employment, the probability that it will become a high-income economy is 42%. But without reaching this industrialization threshold in output or employment, the probability is less than 5%. When combined with industrialization, the development of infrastructure, finance, education, and high-tech manufacturing contribute significantly to an economy achieving a high income.

Manufacturing matters because it drives R&D. Manufacturing's productivity growth is higher than that of most other activities of the economy and its modern functioning requires high-quality services such as business, legal, ICT, logistics, and finance. A low-income economy that does not have much experience producing sophisticated manufactures may reach middle-income status, but will face challenges to becoming a knowledge-based high-income country. The future of Asia's manufacturing will depend on the capacity to master technical progress; link firms to GVCs; and, very importantly, move up the value ladder. Technological advances in agriculture will lead to the decline in its share of total employment (historically a sign of development); and technical progress in manufacturing will make it harder to increase manufacturing's share of employment. All the evidence indicates that major technical advances in the coming decades will be highly labor saving. This will make it difficult for many Asian economies to achieve high shares of employment in manufacturing.

Finding and nurturing niches, learning actively. With the increasing importance of the GVCs, fragmentation of production will mean that countries do not have to develop complete products and services. Rather, they need to find niches in the value chain that match their comparative advantages. But this strategy will require active learning so that firms do not get stuck at GVC stages that add the lowest value, such as assembly. Asian firms need to move up to the stages that add more value—product design and marketing. Moving up also requires nurturing local knowledge, which plays a key role in capturing the gains of integration through GVCs. FDI does not necessarily include technology transfer to local firms and, therefore, may not be enough to help a country become a high-income economy, although it can help transform a low-income economy into a middle-income one.

The shift to services continues, with implications for all economies

The trend to shift labor into services will continue, and ultimately services will be the largest sector in both output and employment. Thus, low- and middle-income Asian economies need to nurture niches in high-productivity services to ensure growth. They also need to make sure that enough employment is created in other service areas so as to accommodate employment. Modern services such as business processes enjoy higher productivity, have greater potential for synergies with other sectors, and are more amenable to cross-border trade than traditional services such as barbershops. However, nurturing these niches will prove difficult for countries without a sophisticated and high-tech manufacturing sector, as modern, advanced services tend to complement manufacturing. This is also particularly important for the high-income Asian economies, where regulatory and peoples' skills bottlenecks are holding back service sector development. Excessive regulation that protects incumbent firms and other vested interests keeps markets less competitive and thus undercuts prospects for improved productivity and efficiency.

Basic education and the quality of education are key for diversification

Education matters for industrial upgrading and, in general, for developing new industries that can compete internationally. As shown in the section on education, good quality primary education provides a sound basis for having a workforce capable of facilitating diversification. The analysis indicates that, together, the number of years of primary education and the quality of education have a significantly positive effect on diversification. Achieving primary universal education is therefore very important for low-income countries.

Increasing diversification (i.e., gaining comparative advantage in new products) is path dependent, but the way along the path is facilitated by good quality education. That is, countries that have already developed comparative advantage in some products will find it easier to export products that are proximate (i.e., similar) to the ones in which they already have comparative advantage. But the importance of path-dependence is attenuated by the quality of education. This means that the higher the quality of education, the easier it will be for a country to move on to products that are not so proximate. But efforts at teleportation, or leapfrogging—the opposite of path dependence—are unlikely to be successful. Thus, countries will find it very difficult to readily jump into exporting products that require capabilities very different from those they already have (e.g., from garments to turbines).

Priorities for Asia's transformation in the coming decades

Policies and institutions for transformation are country-specific

There is no one-size-fits-all package of policies that countries can readily implement to develop certain industries. Thus, we do not propose specific policy instruments in discussing priorities for Asia's structural transformation. There are very general policy recommendations, such as maintaining a stable macroeconomic environment, investing in infrastructure and human capital, assuring good governance, facilitating free trade, and supporting a good business environment—which should always be present and should accompany the implementation of more specific policies for transformation. The design and implementation of the more specific policies ought to be timed and sequenced carefully, and to be country-specific.

To expedite economic transformation, government interventions to address market failures (as well as necessary reforms), will be important. In many developing countries public sector action is required to remedy market failures such as insufficient provision of public goods (e.g., education and infrastructure), information and coordination problems, or externalities. Without public action, the market may not sufficiently provide certain goods and/or services of high social value. Direct government intervention in selected sectors and promotion through specific measures such as tax incentives and subsidies can help expedite ST, but the success of these interventions is controversial. Across the world, some of these interventions have succeeded, while others have failed. The success of such interventions depends on many factors, including policy design and supportive institutions, which are also country-specific. Thus, industrial policy is a high-return, high-risk venture. Today, many advanced economies rely on some element of government intervention to support venturing into new industries. The key question is not whether government action is needed, but how to design and implement the action so as to avoid problems such as, for example, rent seeking. Proper implementation of interventions requires putting in place risk management capacities and institutions prior to the activity, (e.g., at the budget level); during it (i.e., monitoring mechanisms); and after, to disseminate lessons and make any needed corrections (e.g., evaluation).

Different economies merit different priorities

The chapter's main findings suggest different priorities for different country profiles.

- Economies that still have significant shares of their employment in agriculture (such as Bangladesh, the PRC, India, Pakistan, or Thailand) need to speed up the transition of labor from agriculture into manufacturing and services. At the same time, these economies will have to industrialize the countryside so that agriculture can catalyze industrial development. Agriculture will not move much further in these economies until enough jobs are created in manufacturing and services to absorb surplus labor from agriculture. Then agricultural productivity will increase and, consequently, so will rural wages. India has to move forward with its manufacturing program (increase the share of manufacturing in the economy and create jobs in the sector). India also needs to address the distortions in the land market, i.e., change the land acquisition law for public use. The change is needed to expedite infrastructure investment, which is essential for the expansion of manufacturing (as well as housing and retailing). For several decades, investment has been tilted toward the capital-intensive industries at the expense of the labor-intensive industries. Indeed, in India, a high percentage of land titles are unclear. Land ownership is a prerequisite for investors to set up a factory.

- Economies that have failed to industrialize in employment (e.g., Bangladesh, India, Pakistan, and the Philippines) and are undergoing a transition from agriculture into low-productivity services need to reassess the importance of industrialization. An advanced and sophisticated manufacturing sector is key for developing advanced complementary services sectors (e.g., logistics, transport, and finance). Such countries may wish to consider continuing to develop these more productive segments of the service sector, while not neglecting manufacturing. In this sense, the Philippines needs to complete and implement successfully its manufacturing roadmap.

- For the upper middle-income Southeast Asian economies (e.g., Malaysia and Thailand) and the PRC, which have developed manufacturing and are quite diversified, the challenge is how to upgrade. These economies have developed the institutional capacity to diversify, but they need industrial deepening and upgrading. They will need to develop domestic capacities to compete internationally and to double their efforts to localize technologies embodied in FDI. In Thailand, investment in high-quality education is essential to upgrade its manufacturing sector. For the PRC, the challenge is how to expand local capabilities to innovate and to develop technologies, rather than to continue relying on FDI.

- Small, low-income economies (e.g., Cambodia and Nepal) that depend heavily on labor-intensive manufacturing (e.g., textile, apparel, leather, furniture, and toy industries) could usefully consider focusing on providing an investment-friendly environment to facilitate the transfer of labor-intensive industries from more advanced Asian neighbors, and to link them to GVCs. Promoting agricultural productivity will be essential for this transition, and the transition will contribute to the improvement of labor productivity.

- Small island economies (e.g., in the Pacific) may have to bypass industrialization. For them, the future lies in developing competitive niches within services.

- Economies rich in natural resources (e.g., Kazakhstan) need to overcome the challenges of managing them properly. High natural resource prices can dampen incentives to diversify the manufacturing base. Moreover, such countries need adequate macroeconomic and exchange-rate policies. The diversification of the economy has to be a gradual, medium-term objective, as it will be difficult to become a high-income economy while depending almost exclusively on natural resources.

Endnotes

1 If a sector's employment share is larger than its output share, then labor productivity in the sector is below the average of the economy.

2 Asia's NIEs are Hong Kong, China; the Republic of Korea; Singapore; and Taipei,China. Japan; the Republic of Korea; and Taipei,China underwent transformation from agriculture into industry and then services. Singapore and Hong Kong, China—small open economies with minimal agriculture—transformed from being ports to manufacturing centers, and then on to offshore financial centers.

3 The recent literature on structural transformation argues that the products and/or services that a firm produces reflect the set of capabilities that it possesses. Capabilities are intangible, firm-specific, locally-situated, and experience-based knowledge assets. They encompass all the tacit knowledge necessary to produce a good or deliver a service—human abilities, technology to ensure sustained growth, and firm-level "know-how," and working and organizational practices held collectively by the group of individuals comprising the firm. The competitiveness of a productive sector ultimately depends on its firms' ability to accumulate technological capabilities in a changing environment. Technology refers to knowledge about raw materials, machines and equipment, engineers and skilled workers, technology management, and markets for technology. Know-how includes the communication, organization, and coordination abilities that provide the capacity to form, manage, and operate activities that involve large numbers of people. These practices are particularly important for developing countries, where they are often in short supply. Chen et al. (2012), Hausmann et al. (2011); Khan (2013); Sutton (2005); Vértesy and Szirmai (2010).

4 Japan is a different case. To understand its experience in catching up with the West, one needs to look before the period of fast growth after World War II. Japan's progress started with the Meiji Restoration (1868), when the government abolished the old social class system and committed itself to building an industrialized country under the slogans "promotion of industry" and "prevention of imports." Part of what happened after the war was a recovery to prewar levels (Hayashi 1990).

5 Industry has been the largest employer in Asia only once, in Hong Kong, China, in 1980.

6 Minami (1994) notes that the Meiji Restoration abolished the old class system and allowed farmers to move from place to place, as well as to move into commerce and industry. During 1876–1880, 59,000 people per year, and during 1881–1885, 73,000 people per year, moved from primary to other industries. The government tried to stimulate agricultural production by transplanting Western agricultural technology, but this failed, except in Hokkaido. In the densely populated country, capital intensive, labor-saving methods could not take root, and farmers continued to use traditional methods. Minami argues that agriculture had expanded considerably before industrialization took place and that growth continued into the early period of industrialization. This was instrumental for Japan's success. Minami highlights that this is also true in the case of the United Kingdom.

7 We have estimated the elasticities of the shares of agricultural output and employment with respect to income per capita (in constant United States dollars of 2000). The estimated elasticities are –0.68 for output and –0.47 for employment (regressions include time and country fixed effects). However, the squared term of income per capita is statistically significant, indicating that the elasticities vary with the level of income per capita (and hence by country). Logarithmic regressions of the share of agriculture (in GDP and in total employment) on GDP per capita and GDP per capita squared (and both time and country fixed effects) yield the following results:

ln(output share) = 1.39 + 1.20*ln(GDP per capita) – 0.13*[ln(GDP per capita)]^2 + $\sum_i^N \hat{\alpha}_i D_i + \sum_t^M \hat{\beta}_t D_t$, where D_i and D_t are country and time dummies, respectively. No. of observations: 5,076; $R^2 = 0.76$

ln(employment share) = –3.26 + 2.27*ln(GDP per capita) – 0.18*[ln(GDP per capita)]^2 + $\sum_i^N \hat{\alpha}_i D_i + \sum_t^M \hat{\beta}_t D_t$, where D_i and D_t are country and time dummies, respectively. No. of observations: 2,403; $R^2 = 0.50$.

The output elasticities vary from –0.19 for Nepal to –0.93 for Malaysia (at current income per capita). For employment, they vary from about –0.10 for countries like Bangladesh, India, Kyrgyz Republic, and Nepal to -0.69 for Malaysia (at current income per capita).

8 Taipei,China seems to have reached the point at which the shift from labor surplus to labor shortage in agriculture is reflected in rising agricultural wages (the "Lewis turning point") in the 1960s and the Republic of Korea in the 1970s. Ranis (2012) suggests that the PRC reached the turning point around 2000, but Indonesia had not yet reached it then, and Bangladesh and India are still in the surplus labor stage. Several studies using wage trends argue that the PRC has passed the Lewis turning point, but other studies using other information (production functions, employment data) or applying more controls (e.g., worker characteristics) indicate that the turning point is yet to be reached. Institutional restrictions on rural–urban migration are imposing local scarcities, which account for recent wage increases. Nevertheless, the critics concur that the turning point is fast approaching.

9 World Bank (2003) defines agribusiness as manufacturing activities closely related to agriculture: food and beverage, cotton ginning, tobacco processing, leather processing, woodworking, fertilizer manufacturing, agrichemical production, and agricultural machinery production, as well as the imputed component of food-related trade (based on the share of food in household expenditure) and transport and logistical services (based on the average of the food expenditure share and the share of agriculture and food in total exports). Data were obtained from FAOSTAT, World Bank WDI, and UNIDO databases. Other countries' shares reported by the World Bank (2003) are Argentina (29%), Brazil (30%), Cameroon (17%), Chile (34%), Cote d'Ivoire (26%), Ethiopia (30%), Ghana (19%), Kenya (23%), Mexico (27%), Nigeria (16%), South Africa (16%), Tanzania (21%), Uganda (23%), United States (13%), and Zimbabwe (21%). Balisacan et al.'s (2011) definition is different. The initial list of agribusiness subsectors was obtained from the official Philippine 240-sector input–output table. This list was narrowed down by eliminating subsectors below a cutoff (based on a composite indicator equal to a weighted average of the subsector's input–output

coefficient, its employment share, and its share in gross value added). Agribusiness subsectors include milling industries, food preservation, processing of agricultural raw materials, wood industries, jewelry and related articles, other rubber product manufactures, wood carving, restaurants, and wholesale and retail trade. Sample weights from a contemporaneous survey of business establishments conducted by the Philippine National Statistics Office were used to aggregate the value added of the final list of subsectors. Disaggregated information from the same survey was also used to estimate the agri-related component of wholesale and retail trade.

10 Because Timmer (1988) only provided a qualitative description of the four stages, there is an element of subjectivity in our assessment.

11 A least squares regression indicates that output per agricultural worker in Thailand is only 21% of what is expected given its level of per capita income, that of the PRC is only 19%, and those of Indonesia and India are only 50%. In contrast, Malaysia is close to its predicted level of output per agricultural worker (97%), as is the Philippines (92%).

12 The term "Factory Asia" is used to refer to both the significant increase since the 1990s in the world's share of manufacturing value added that comes from Asia and the model of regional production networks connecting factories in different Asian economies, especially firms in East Asia (ADB 2013).

13 In the analysis of deindustrialization, Rowthorn and Ramaswamy (1997, 1998) focus exclusively on the employment aspect. Tregenna (2009), however, argues that this is incomplete and that a proper analysis of deindustrialization should also consider the decline in manufacturing output.

14 These turning points are derived from regressions of the logarithm of the manufacturing output and employment shares (of GDP and total employment, respectively) on the logarithms of income per capita (in constant US dollars of 2000), income per capita squared, population, the interaction between income per capita and population, and the trade ratio. Results are (all variables are statistically significant at the 5% confidence level):

ln(output share) = –2.99 + 0.58*ln(GDP per capita) – 0.04*[ln(GDP per capita)]^2 + 0.10*ln(population) + 0.18*ln(trade ratio) + 0.01*[ln(population)*ln(GDP per capita)]. No. of observations: 4,632; R^2 = 0.32

ln(employment share) = –7.64 + 1.82*ln(GDP per capita) – 0.09*[ln(GDP per capita)]^2+0.17*ln(population) + 0.06*ln(trade ratio) – 0.01*[ln(population)*ln(GDP per capita)]. No. of observations: 5,542; R^2 = 0.30

The statistically significant negative sign of the GDP per capita squared term (i.e., [ln(GDP per capita)]^2) in both regressions shows that the relationship between the share of manufacturing and income per capita follows an inverted U-shape, that is, the share increases up to a maximum and then starts declining.

15 Deindustrialization in these economies need not respond to the same causes. For example, Tregenna (2009) argues that the Republic of Korea's employment deindustrialization resulted from falling labor intensity in manufacturing (that is, the number of jobs in the sector fell as productivity increased, as a result of improved skills or technology), while the manufacturing sector was growing in real terms and increasing its share of GDP. Hong Kong, China's deindustrialization, however, resulted from a decline of the manufacturing share in GDP, and manufacturing shrank in real terms. See also Dasgupta and Singh (2006).

16 Significant data problems must be noted: (i) World Bank (WDI) and UNSTATS data differ for countries such as Bhutan, the Lao PDR, Mongolia, Tajikistan, Turkmenistan, Uzbekistan, and Viet Nam. For consistency with other data, we use the World Bank's database. (ii) We only include economies with populations above 2 million that are not high income. (iii) We do not include informal employment because we do not have reliable data. In some cases, e.g., India, the manufacturing share of employment, including both formal and informal sectors, is likely to be significantly higher than the data indicate. (iv) The Central Asian republics may have achieved high employment shares while they were part of the Soviet Union, given the pretransition bias

toward heavy industry. If this is the case, these economies have undergone deindustrialization that should be interpreted as transition-induced corrections for the distortions of industrial planning.

17 Table 2.3 shows that the PRC's output peak was reached in 1978, at 40.5% of GDP. In evaluating this very high share, it must be noted that the PRC did not follow the Western accounting at the time, with the consequence that services were underestimated. A large part of the economy's output was manufacturing products under nonmarket conditions

18 The manufacturing sector was the largest contributor to the within effect in Hong Kong, China; Indonesia; the Republic of Korea; and Japan. In India, Singapore, and Taipei,China, services was the largest contributor also to the within effect. In Thailand and the Philippines, agriculture was the largest contributor. And in Malaysia, it was public utilities, mining and quarrying, and construction. In Indonesia, public utilities, mining and quarrying, and construction was the largest contributor to the between effect; and in Hong Kong, China, services was the largest contributor to the between effect.

19 The work of Hidalgo et al. (2007) and Hausmann et al. (2011) is summarized in a tool called the Product Space. A visual representation of the product space is available at http://www.chidalgo.com/Papers/HidalgoKlingerBarabasiHausmannScience2007.pdf.

20 The terms "diversification" and "concentration" are not direct opposites of each other. Consider countries A and B. Country A exports 10 products, each with a global market representing a 0.1% share in world trade. Country B exports 9 products (like those of country A) plus oil, which alone represents 5% of world trade. In this case, both countries are equally diversified, but B's exports are more concentrated than those of A. This is not because B has specialized, but because oil is a product with an outsized world market. A true measure of diversification should control for differences in market size, for example, by using the index of revealed comparative advantage in per capita terms (Box 2.6), as we do here. If this control is not done, differences may emerge solely because countries have export baskets composed of products with different market sizes.

21 This is because India is not a top exporter (about $238 billion in 2010 compared to the PRC's $1.77 trillion) and therefore it is penalized by the calculation method of RCA(pop). Nevertheless, India has developed substantial capabilities in high-tech areas. On these two economies, see Felipe, Kumar, and Abdon (2013); Felipe, Kumar, Usui, and Abdon (2013).

22 An industry definition that embraces the production of goods and of services (such as financial, information, and communications technology; logistics; and business services) is already used in the Netherlands (Aiginger 2007).

23 See also Ray et al. (2013) for a recent analysis of yields of major crops (maize, rice, wheat, and soybean) forecasts for 2050. Although crop yields will have to increase to meet projected demands from rising population, diet shifts, and increasing biofuels consumption, they project yields that, in general (with variations across countries, areas, and crops), are lower than those required to meet demand.

24 Examples are Australia, output share=2.28%, employment share=3.30%; Canada, output share=1.91%, employment share=2.40%; France, output share=1.76%, employment share=2.90%; Netherlands, output share=1.96%, employment share=2.80%; and the United States, output share=0.88%, employment share=4.20%.

25 The other related (conditional) probabilities of being a high-income economy in 2010 are as follows: (i) 29% (23/80), if it has industrialized only in output; (ii) 40% (24/60), if it has industrialized only in employment; (iii) 7% (2/29), if it has not industrialized in output; and (iv) 2% (1/49), if it has not industrialized in employment. This implies that the probability of an economy not being a high-income in 2010 if it has not industrialized in employment is almost 100%.

26 The model is based on the following regression: $P[Rich_i = j] = \propto + \beta * Industrialization_i + \Phi' Z_i + \varepsilon_I$, where $\varepsilon_I \approx N[0,1]$, where Z is a vector of control variables.

27 The probit regression cannot be estimated for the manufacturing employment share because every economy other than the United Arab Emirates that has industrialized in employment was at a high-income level in 2010. This leads to numerical

breakdown (specifically, the maximum likelihood estimate of "industrialization in employment" does not exist) if one tries to estimate the regression. Except for the United Arab Emirates, every economy that has industrialized in employment is a high-income economy (i.e., industrialization in employment is sufficient to become high income). In contrast, three high-income economies did not industrialize in output: Israel, Kuwait, and the United Arab Emirates (not included in Table 3.1 for lack of employment data). That there are three economies now eliminates the numerical breakdown that occurs with employment. The coefficients on the additional (to industrialization) right-hand side variables are not simply identified off these three economies, but also off the 63 economies (out of the 137) that industrialized in output but did not become high income.

28 Each regression contains only two right-hand side variables. The reason for including only one additional regressor (at a time) together with industrialization is that adding additional variables creates a numerical problem when one has near perfect prediction. Only a handful of economies that failed to industrialize in terms of output became high income. Under these circumstances, adding more than one additional explanatory variable that is highly correlated with being high income creates a technical problem: when the included explanatory variables become nearly perfect at predicting that a country will not be high income, it becomes impossible to calculate the regression coefficients. We therefore compare the explanatory power of each additional variable by including them one at a time.

29 Now (with 137 countries) the conditional probability of becoming a high-income economy if the country has industrialized in output is 25.9% (29.17% before: see endnote 25). And the conditional probability of becoming a high-income economy if the country does not industrialize in output is 5.8% (10.71% before: see endnote 25).

30 Biosensor technology detects contaminants very quickly, even at very low concentration. Precision agriculture is about monitoring the status of agriculture land in terms of nutrition status and vegetation health using satellite images and unmanned aerial vehicles.

31 Cowen (2011) and Gordon (2012) offer a contrarian view. They argue that the world has been in a state of technological stagnation since the 1970s, when the effects of the second Industrial Revolution (1870–1900) were exhausted.

32 Both Cowen (2011) and Friedman (2011) argue that none of the technologies developed during the last decade has been truly transformative. Friedman (2011) argues that the world will not see major breakthrough technologies until the 2020s and beyond.

33 McKinsey (2013) also notes that other technologies have potentially disruptive effects, including next generation nuclear fission, fusion power, carbon sequestration, advanced water purification, and quantum computing.

34 The network trade index (NTI) is defined as the share of country *j* in country *i*'s parts and components imports in sector *s*, weighted by the share of sector *s* in *i*'s total final goods exports. Individual NTIs are then aggregated across sectors as a geometric average of the sector NTIs. To generate a single NTI, Ferrarini takes the average value of the NTIs for each country pair, i.e., from *i* to *j* and vice-versa. Network relations with NTI values below 0.05 are dropped. This leads to 192 links in total.

35 Input–output analyses only consider manufacturing processes. This means that marketing, R&D, retailing, and other nonmanufacturing processes are excluded from the analysis. However, a large share of value added is created in these downstream segments (e.g., of the iPad value chain), located in developed countries.

36 An additional reason for the different results is the higher level of aggregation in Oikawa's study: major subsectors as opposed to products. For example, the iPad belongs to "other electronic products" in Oikawa's work. This subsector includes various types of products, and the aggregate analysis may mask important differences across products.

37 Despite the seemingly ideal environment for continued upgrading, the Penang electronics firms do not appear to be moving significantly along the value chain toward research, product development, and design. The cluster has not nurtured firms such as Acer, Asus, Hon Hai, Hyundai, LG. TSMC, and Samsung to create a

domestic research infrastructure to support value-added upgrading and diversification. Overall, R&D skills in Malaysia are in short supply, and the innovation system, both local and national, remains weak, so that Penang's firms lag behind those in Singapore and Taipei,China. Penang's firms maintain a high density of assembly and product manufacturing and very low density in high value-added activities. Henderson and Philips (2007) argue that the state's efforts to ensure abundant resources for businesses may have had the perverse effect of constraining upgrading. This refers in particular to the state's implicit guarantee of a labor surplus, achieved by bringing workers from Bangladesh, Indonesia, and Nepal. Samel (2012) argues that the reason local firms do not upgrade is they have adapted to the ups and downs of the semiconductor market. They are comfortable in their niche, are content with the profits they earn, and do not have an incentive to upgrade.

38 McKinsey (2012) estimates that 30%–50% of manufacturing jobs in advanced economies are service-type functions. McKinsey also estimates that about 4.7 million service sector jobs in the United States depend on business from manufacturing. This means that total manufacturing-related employment in the United States is over 17 million people, substantially above official data of slightly above 11 million employed in manufacturing. And the PRC's manufacturers created demand for $50 billion in services, while its service companies created demand for $600 billion in manufactured goods inputs (McKinsey 2012).

39 Nordås and Kim (2013) provide estimates of the service intensity of manufacturing calculated using the OECD input–output tables. However, unlike us, they just calculate the share of intermediate services in gross output and in value added. Therefore, they only take into account direct intermediate services and disregard all indirect effects.

40 The calculations for Figure 3.1 are very similar to those in Box 3.1, with one crucial difference. In the latter, we calculated the effect of a $1 increase in final demand on gross output. Here we calculate the effect of a $1 increase in final demand on value added. So, the difference is between gross output and value added. The classic definition of a backward multiplier (Box 3.1) is in terms of gross output. Here, we use value added because of the property that every $1 increase in final demand in a sector leads to exactly $1 increase in value added, seen from the point of view of the global economy.

41 In terms of the input–output tables, the labor productivity effect is the part of the overall change in industry *i*'s employment share attributed to changes in labor requirements (the inverse of labor productivity) per unit of gross output, between periods 0 and 1. The GVC effect gives the contribution of changes in the Leontief inverse, as this matrix measures the linkages (multipliers) between the different sectors in different countries. The final demand effect represents the part of the change in the industry *i's* employment share that can be attributed to changes in final demand. This can be further subdivided into domestic final demand and foreign (exported) final demand.

42 If the labor productivity effect has a positive sign in a particular sector, it means that the sector has slow productivity growth, and hence needs a larger share of total employment to fulfill demand. Since this is a decomposition of the shares, and we keep the global value chain and final demand effects constant, this factor need not always be negative. What matters for changes in the employment share is whether the productivity change in the industry is above or below the average productivity effect in the country. Hence we will always see some sectors with a positive labor productivity effect and others with a negative effect.

43 There are well-known problems measuring productivity in services. Using local currencies, we have calculated productivity levels for manufacturing and the four service subsectors considered for 11 Asian economies: the China, People's Rep. of; Hong Kong, China; Indonesia; India; Japan; Korea, Rep. of; Malaysia; the Philippines; Singapore; Thailand; and Taipei,China. Results indicate that finance, real estate, renting, and business (FRB) services is the subsector with the highest productivity in 7 of the 11 economies considered; and in most cases, by a wide margin. In the Philippines, labor productivity in manufacturing is significantly higher than in services, but labor productivity in all subsectors has been flat. In Japan and the Republic of Korea, the subsectors with the highest productivity

are manufacturing and transport, storage, and communications. But somewhat surprisingly, in these two countries, FRB is the least productive sector today (in Japan for quite some time). Finally, the productivity of India's FRB subector suffered a serious setback in 1991 (but it remains the subsector with the highest productivity level), and Indonesia's and Thailand's productivity in FRB also suffered a severe decline in 1997–1998.

44 Triplett and Bosworth (2004) and Inklaar et al. (2006) have also questioned Baumol's theory on empirical grounds; and Oulton (2001) argued on theoretical grounds that if the stagnant sectors produce valuable and efficient intermediate inputs (e.g., business services), then aggregate productivity growth may rise rather than fall.

45 The innovation that takes place within traditional services is of very different nature. It tends to be more related to organizational changes and new ways of providing the service, e.g., by taking care of the needs of the clients. One example is Starbucks coffee shops, which changed the concept of "having a coffee," by providing consumers with Wi-Fi connection and merchandising.

46 In doing so, we assume that the employment effects that are attributed to the demand categories are proportional to the production shares. This means that labor productivity does not differ between the demand categories (i.e., firms that export are not more productive than firms that do not). Then we attribute all employment associated with derived demand (i.e., the GVC effect) to the direct demand category (foreign or domestic) that is ultimately associated with this derived demand (i.e., we trace where the direct demand for a product that used paper originated, e.g., the car industry in a foreign country, or the domestic chemical industry). In terms of the PRC paper industry example, note that ¼th of total employment (corresponding to 1/2 million tons of the 2 million tons of paper, as we assume that labor productivity does not differ across types of demand) is associated with derived demand. Our method attributes this to either foreign or domestic final direct demand through the GVC of intermediate deliveries in the world input–output tables (Timmer 2012).

47 Years of schooling and attainment data are drawn from Barro and Lee (2010). Cognitive scores come from (Hanushek and Woessmann 2008).

48 One important caveat on these results is that they do not control for the quality of tertiary education. Given the wide variety of intellectual and pedagogical objectives that tertiary education of different types serve, it is not clear what such a variable should measure, and, anyway, no international measures of college quality exist.

49 Recall the measure of RCA used in Section 2 (Box 2.6), which is slightly different because it takes into account a country's size (population).

50 The years of schooling variable is imputed from the completion rates, so these two different measures of education quantity cannot be included in a regression simultaneously.

51 Formally, proximity between products A and B is defined as the minimum of the two conditional probabilities P(A|B) and P(B|A); where P(A|B) is the conditional probability that a country exports product A given that it exports product B (and vice versa for P(B|A)). For example if 20 countries export computers (product A), 24 countries export wine (product B), and 8 export both, then P(A|B)=8/24 and P(B|A)=8/20. Therefore, the proximity between computers and wine is 8/24=0.3. We choose P(A|B) so as to minimize the number of false positives.

52 To be precise, teleportation means that the expected change in RCA in a product is independent of which other products the country is already exporting with RCA. Technically, we reject the possibility of teleportation if zero lies outside the 95% confidence interval of the derivative of the regression equation with respect to density. Such a rejection does not mean that a country cannot jump into a particular far-away product. It simply means that, statistically, it will find it easier to take on products that are more proximate. Singapore is the exception, i.e., teleportation is possible. This is because it has a labor force of high quality, so that the country will find it as easy to take on products similar to those it is already exporting with comparative advantage as to taking on products that are very different.

53 We noted earlier that in the latest revision of the World Development Indicators, Thailand's largest employer is not agriculture, but services (World Bank WDI).

Appendix

Appendix Table A1 **Output and employment shares of agriculture, industry, and services**

Subregion and economy	Initial year						Final year					
	Output share			Employment share			Output share			Employment share		
	A	I	S	A	I	S	A	I	S	A	I	S
Central Asia	**24.3**	**35.6**	**40.1**				**9.0**	**44.5**	**46.5**	**37.1**	**18.5**	**44.4**
Armenia							19.5	36.0	44.5	44.2f	16.8f	39.0f
Azerbaijan							5.8	64.7	29.5	38.6	12.9	48.5
Georgia	24.3a	35.6a	40.1a				8.4	23.2	68.4	53.4	10.4	36.2
Kazakhstan							4.8	42.3	52.9	30.2f	18.9f	50.9f
Kyrgyz Rep.							20.7	28.0	51.3	34.0f	20.6f	45.4f
Tajikistan							21.3	22.0	56.7	55.7c	18.0c	26.3c
Turkmenistan							12.0	54.0	34.0			
Uzbekistan							19.5	35.4	45.1	41.4c	20.8c	37.8c
East Asia	**11.7**	**40.6**	**47.7**	**61.2**	**20.5**	**18.3**	**5.4**	**36.4**	**58.2**	**35.3**	**26.7**	**38.0**
East Asia (excludes Japan)	**28.6**	**43.4**	**28.0**	**67.2**	**18.7**	**14.1**	**8.2**	**43.6**	**48.2**	**38.7**	**27.3**	**34.0**
China, People's Rep. of	32.4	45.7	21.9	68.7a	18.2a	13.1a	10.1	46.7	43.2	39.6	27.2	33.2
Hong Kong, China	1.7	33.5	64.8	1.4a	50.2a	48.4a	0.1g	7.4g	92.5g	0.2g	12.4g	87.4g
Japan	4.6	39.4	56.0	10.4a	35.4a	54.2a	1.4g	26.7g	71.9g	3.7	25.6	70.6
Korea, Rep. of	27.1	29.3	43.6	34.0a	29.0a	37.0a	2.5	39.3	58.2	6.6	17.0	76.4
Mongolia	16.7a	25.0a	58.3a				16.2	37.5	46.3	40.0g	14.9g	45.1g
Taipei,China	7.6	45.8	46.6				1.7	32.1	66.2	5.2	35.9	58.9
The Pacific	**24.8**	**19.8**	**55.4**				**28.0**	**31.7**	**40.3**	**71.1**	**4.3**	**24.6**
Fiji	25.6	22.3	52.1				12.1	19.7	68.2			
Kiribati	20.7a	9.0a	70.3a				28.6	9.5	61.9	2.8c	7.4c	89.8c
Papua New Guinea	31.4	30.1	38.5				35.8	44.8	19.4	73.3c	3.7c	23.0c
Samoa							9.8	28.2	62.0	40.6	20.0	39.4
Solomon Islands							38.9	6.1	55.0			
Timor-Leste							25.8	18.5	55.7			
Tonga							20.3	17.8	61.9			
Vanuatu	21.0a	7.5a	71.5b				19.7g	9.9g	70.4g	61.4g	7.1g	31.5g
South Asia	**37.1**	**22.3**	**40.6**	**70.1**	**12.1**	**17.8**	**19.2**	**26.3**	**54.5**	**49.8**	**21.5**	**28.7**
Afghanistan							29.9	22.2	47.9			
Bangladesh	31.6a	20.6a	47.8a				18.5	28.5	53.0	48.1c	14.5c	37.4c
Bhutan	43.5a	14.5a	42.0a				18.7	43.2	38.1	65.4g	6.4g	28.2g
India	38.0	22.5	39.5	72.4a	11.0a	16.6a	19.0	26.3	54.7	51.1	22.4	26.5
Maldives							3.1	14.5	82.4	12.0d	25.4d	62.6d
Nepal	71.8	8.1	20.1				36.1	15.4	48.5	65.8c	13.4c	20.8c
Pakistan	32.0	23.4	44.6	52.8a	20.3a	26.9a	21.2	25.4	53.4	44.7f	20.1f	35.2f
Sri Lanka	30.4	26.4	43.2	48.9a	19.9a	31.2a	12.8	29.4	57.8	33.5	25.8	40.7
Southeast Asia	**27.2**	**32.2**	**40.6**	**56.8**	**13.8**	**29.4**	**12.4**	**41.6**	**46.0**	**39.6**	**18.8**	**41.6**
Cambodia							36.0	23.3	40.7	72.2f	8.6f	19.2f
Indonesia	30.2	33.5	36.3	56.5a	13.1a	30.4	15.3	47.1	37.6	38.3	19.3	42.40
Lao PDR							33.0	30.2	36.8			
Malaysia	28.8	34.0	37.2	37.2a	24.1a	38.7a	10.6	44.4	45.0	13.5g	27.0g	59.5g
Myanmar	47.1	10.7	42.2	67.1a	9.8a	23.1a	36.4	26.0	37.6	62.8c	12.0c	25.2c
Philippines	30.3	35.0	34.7	51.8a	15.4a	32.8a	12.3	32.6	55.1	35.2g	14.5g	50.3g
Thailand	26.9	25.8	47.3	70.8a	10.3a	18.9a	12.3	44.7	43.0	41.6g	19.5g	38.9g
Viet Nam							20.6	41.1	38.3	51.7d	20.1d	28.2d
Singapore	2.2	32.3	65.5	1.3a	35.8a	62.9a	0.0	28.3	71.7	1.1g	21.8g	77.1g
Asia	**17.0**	**38.1**	**44.9**	**63.4**	**17.0**	**19.6**	**7.8**	**35.9**	**56.3**	**42.2**	**23.0**	**34.8**
Asia (excludes Japan)	**22.8**	**33.8**	**43.4**	**66.8**	**16.0**	**17.2**	**10.9**	**40.2**	**48.9**	**42.8**	**23.6**	**33.6**

A = agriculture, GNI = gross national income, I = industry, Lao PDR = Lao People's Democratic Republic, S = services.

Notes:

(i) Subregions in this table do not conform precisely to the country/economy compositions of the Asian Development Bank's official subregions, as Afghanistan and Pakistan are included in the South Asia group on the table.

(ii) Figures in the initial years are for 1975 except as follows: a indicates that figure is for either 1980 or 1981; b indicates that the figure is for 1990. Figures for the last year are for 2010 except as follows: c indicates that figure is for 1998 up to 2005; d indicates that the figure is for 2006; e indicates that the figure is for 2007; f indicates that the figure is for 2008; and g indicates that the figure is for 2009.

(iii) Subregional averages and average for Asia are weighted averages, where the weights are GNI (calculated using the Atlas method) for output shares, and total population for the employment shares. Myanmar is not included in the output weighted share (no GNI data). The average for Central Asia for the initial year for output includes only Georgia.

(iv) Original World Bank, World Development Indicators sectoral data for a number of economies do not add up to 100%. This affects the calculations of the subregional averages as well as Asia's average (i.e., they do not add up to 100%). To solve this problem, we adjusted the figures for these economies so that they add up to 100%. This was done by apportioning the difference to 100% proportionally to each sector's share.

Sources: National Statistics (Taipei,China). www.eng.stat.gov.tw (accessed September 2012); World Bank. WDI. http://data.worldbank.org/data-catalog/world-development-indicators (accessed September 2012).

Appendix Table A2 **Agriculture output and employment shares in Asia: Speed of reduction**

Economy	Period covered (OS - Longest Available)	OS (%)		Speed of Reduction of OS (% per annum)	Period covered (same for OS and ES)	OS (%)		Speed of Reduction of OS (% per annum)	ES (%)		Speed of Reduction of ES (% per annum)
		Start	End			Start	End		Start	End	
Bangladesh	1980–2010	31.6	18.6	1.70	1984–2005	32.3	20.1	2.13	58.8	48.1	0.91
China, People's Rep. of	1961–2010	35.5	10.1	2.48	1980–2008	30.2	10.7	3.51	68.7	39.6	1.88
India	1960–2010	42.8	19.0	1.58	1994–2010	28.5	19.0	2.36	61.9	51.1	1.12
Indonesia	1960–2010	51.5	15.3	2.35	1985–2010	23.2	15.3	1.59	54.7	38.3	1.36
Japan	1970–2009	6.0	1.4	3.57	1980–2009	3.6	1.4	3.10	10.4	3.7	3.39
Korea, Rep. of	1965–2010	39.4	2.6	5.74	1980–2010	16.2	2.6	5.73	34.0	6.6	5.15
Malaysia	1960–2010	34.3	10.6	2.28	1980–2009	22.6	9.5	2.85	37.2	13.5	3.32
Nepal	1965–2010	65.5	36.1	1.29	1991–2001	47.2	37.6	2.05	81.2	65.7	1.91
Pakistan	1960–2010	46.2	21.2	1.52	1980–2008	29.5	20.3	1.28	52.7	44.7	0.57
Philippines	1960–2010	26.9	12.3	1.52	1980–2009	25.1	13.1	2.14	51.8	35.2	1.28
Sri Lanka	1960–2010	31.7	12.8	1.76	1981–2009	27.7	12.7	2.65	45.9	32.6	1.17
Thailand	1960–2010	36.4	12.4	2.09	1980–2009	23.2	11.5	2.31	70.8	41.5	1.76
Viet Nam	1985–2010	40.2	20.6	2.54	1996–2006	27.8	20.4	2.77	70.0	51.7	2.72

ES = the share of employment in agriculture, OS = agriculture's output share.
Source: Authors calculations based on World Bank. WDI. http://data.worldbank.org/data-catalog/world-development-indicators (accessed September 2012).

Appendix Table A3 **Annualized growth rates of GDP, agricultural GDP, land productivity, and area in developing economies, 1970–2009 (%)**

Economy	Area growth (a)	Land productivity growth (b)	Agricultural GDP growth (c) = (a) + (b)
Bangladesh	–0.16	2.29	2.13
Bhutan	–1.34	4.53	3.19
Cambodia	0.36	4.23	4.59
China, People's Rep. of	0.50	3.54	4.04
India	0.07	2.51	2.58
Indonesia	1.27	2.14	3.41
Japan	–0.59	0.22	–0.36
Korea, Rep. of	–0.63	2.64	2.01
Lao PDR	2.00	2.29	4.29
Malaysia	1.39	1.55	2.94
Mongolia	0.66	1.02	1.68
Nepal	0.62	1.96	2.58
Pakistan	0.25	3.18	3.43
Philippines	0.86	1.71	2.57
Sri Lanka	0.35	2.06	2.41
Thailand	0.82	2.17	2.99
Viet Nam	1.70	2.00	3.70
Average Asia	**0.49**	**2.24**	**2.72**

Notes: Agricultural output refers to gross value added in agriculture ($ of year 2000). Area is arable land and permanent crops, in hectares. Land productivity is agricultural output per hectare. Growth is annualized over the available interval from 1970 to 2009; countries with intervals below 20 years were omitted, and below 100,000 hectares in area were omitted.
Sources: Authors based on World Bank. WDI. http://data.worldbank.org/data-catalog/world-development-indicators (accessed September 2012); FAOSTAT. http://faostat.fao.org (accessed September 2012).

Appendix Table A4 **Yield and yield growth of primary cereals, developing Asia, 1970 and 2010**

Economy	Share in agricultural output, 1970 and 2010 (%)	Yield (t/ha)		Annualized yield growth (%)				
		1970	2010	1970s	1980s	1990s	2000s	1970–2000
Bangladesh	55–60.6	1.7	4.3	1.8	2.4	3.1	2.2	2.4
Bhutan	50–31.7	2.0	3.1	0.0	0.5	–2.1	6.3	1.1
Cambodia	47–36.3	1.6	3.0	–2.8	1.2	4.6	3.4	1.6
China, People's Rep. of	45–20.8	3.4	6.5	1.9	3.3	0.9	0.4	1.6
India	38–27.2	1.7	3.4	1.7	2.7	0.9	1.7	1.7
Indonesia	40–30.2	2.4	5.0	3.3	2.7	0.2	1.3	1.9
Japan	36–28.5	5.6	5.2	–0.9	2.1	0.6	–2.5	–0.2
Korea, Rep. of	63–34.0	4.6	6.9	–0.6	3.7	0.8	0.2	1.0
Lao PDR	38–32.0	1.4	3.6	0.6	4.8	2.9	1.6	2.5
Malaysia	6–2.7	2.4	3.6	1.8	–0.3	1.0	1.7	1.1
Nepal	47–28.3	1.9	2.7	–0.1	2.2	1.2	0.1	0.8
Pakistan	29–22.2	1.2	2.6	3.0	1.5	3.2	0.2	2.0
Philippines	22–23.2	1.7	3.6	2.4	3.0	0.3	1.7	1.8
Sri Lanka	19–31.6	2.2	4.1	1.4	1.7	1.2	1.7	1.5
Thailand	34–24.8	2.0	2.9	–0.7	0.4	2.9	1.2	0.9
Viet Nam	62–43.1	2.2	5.3	–0.3	4.3	2.9	2.3	2.3

Lao PDR = Lao People's Democratic Republic.

Notes: The share of primary cereals in agricultural output is measured in constant $ of year 2000. The primary cereal is rice, except for Pakistan, where the primary cereal is wheat.

Source: Authors based on basic data from FAOSTAT. http://faostat.fao.org (accessed September 2012).

Appendix Table A5 **Peak manufacturing share in output and employment, OECD countries**

Country	Output			Employment		
	Data since	Year when highest share was reached	Value of the highest share	Data since	Year when highest share was reached	Value of the highest share
Australia	1970	1970	25.2	1970	1970	26.4
Austria	1976	1976	24.7	1976	1976	25.0
Belgium	1970	1974	29.7	1970	1970	31.7
Canada	1970	1972	21.4	1970	1970	22.9
Denmark	1970	1970	20.5	1970	1970	25.9
Finland	1970	1974	28.1	1970	1974	25.1
France	1970	1971	24.2	1970	1974	25.4
Germany	1980	1980	29.7	1991	1991	27.4
Greece	1970	1973	17.7	1981	1986	19.9
Iceland	1973	1979	26.6	1991	1994	17.5
Ireland	1986	1999	34.3	1970	1974	21.4
Italy	1970	1976	29.9	1970	1979	29.1
Japan	1970	1970	33.5	1953	1969	26.3
Luxembourg	1985	1989	22.6	1970	1970	32.0
Netherlands	1970	1970	24.9	1970	1970	25.7
New Zealand	1971	1983	22.4	1976	1989	21.1
Norway	1970	1974	21.5	1970	1970	22.9
Portugal	1977	1986	21.8	1974	1974	25.5
Spain	1980	1980	27.0	1970	1971	27.5
Sweden	1970	1974	26.9	1970	1970	27.4
Switzerland	1980	1980	24.7	1970	1979	38.2
United Kingdom	1970	1970	32.1	1970	1971	29.9
United States	1970	1970	26.6	1970	1970	22.4
Unweighted Average			**25.9**			**25.7**

OECD = Organisation for Economic Co-operation and Development.

Sources: Authors based on GGDC. 10-Sector Database. www.ggdc.net (accessed September 2012); ILO. LABORSTA. http://laborsta.ilo.org (accessed September 2012); OECD. STAN. http://www.oecd.org/industry/ind/stanstructuralanalysisdatabase.htm (accessed September 2012); World Bank. WDI. http://data.worldbank.org/data-catalog/world-development-indicators (accessed September 2012).

Appendix Table A6 **Economic complexity index, 20 Asian economies**

Economy	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Azerbaijan	–1.46	0.12	0.03	–0.18	–0.39	–0.15	–0.44	–0.45	–0.33	–0.26	–0.32	–0.07	–0.26	–0.24	–0.28	–0.49
Bangladesh	–0.45	–0.72	–0.72	–0.87	–1.02	–0.87	–0.71	–0.68	–0.56	–0.46	–0.41	–0.12	–0.34	–0.44	–0.28	–0.49
Cambodia	–1.54	–1.24	–1.08	–1.06	–1.02	–0.62	–0.67	–0.53	–0.44	–0.36	–0.67	–0.37	–0.57	–0.44	–0.59	–0.34
China, People's Rep. of	0.73	0.63	0.69	0.74	0.76	0.76	0.76	0.87	0.85	0.88	0.92	0.92	0.92	0.96	0.95	1.10
Hong Kong, China	0.98	0.96	0.93	0.98	0.98	0.95	0.96	0.94	0.91	0.91	0.91	0.86	0.86	0.87	0.84	0.97
India	–0.40	–0.68	–0.46	–0.45	–0.28	–0.31	–0.21	–0.11	0.01	–0.06	–0.10	–0.05	0.06	–0.14	–0.03	–0.02
Indonesia	0.17	0.04	0.01	0.06	0.17	0.22	0.18	0.21	0.21	0.15	0.19	0.15	0.20	0.21	0.24	0.23
Japan	1.26	1.26	1.24	1.33	1.31	1.26	1.27	1.28	1.20	1.19	1.19	1.12	1.08	1.09	1.08	1.22
Kazakhstan	0.12	0.56	0.43	0.25	0.11	0.22	0.26	–0.11	0.04	0.03	0.01	0.06	0.08	–0.01	–0.08	–0.42
Korea, Rep. of	1.13	1.12	1.07	1.12	1.12	1.13	1.14	1.15	1.09	1.06	1.06	0.99	0.98	1.00	1.00	1.14
Malaysia	0.89	0.86	0.85	0.85	0.88	0.88	0.89	0.88	0.84	0.81	0.82	0.76	0.75	0.73	0.75	0.85
Myanmar	–1.79	–1.83	–1.75	–2.06	–1.66	–1.49	–1.38	–1.40	–1.49	–1.44	–1.55	–1.38	–1.33	–1.34	–1.41	–1.61
Nepal	–0.67	–0.88	–0.84	–0.73	–0.61	–0.29	–0.46	–0.02	–0.21	–0.19	–0.19	0.00	–0.04	–0.30	0.01	0.02
Pakistan	–0.33	–0.54	–0.59	–0.61	–0.66	–0.63	–0.63	–0.52	–0.37	–0.24	–0.27	–0.16	–0.15	–0.19	–0.21	–0.35
Philippines	0.27	0.20	0.25	0.26	0.35	0.27	0.33	0.33	0.40	0.37	0.35	0.42	0.33	0.29	0.40	0.46
Singapore	0.95	0.93	0.91	0.95	0.95	0.92	0.92	0.91	0.89	0.85	0.85	0.80	0.79	0.79	0.80	0.91
Sri Lanka	–0.15	–0.46	–0.36	–0.28	–0.23	–0.36	–0.10	–0.13	–0.08	–0.09	–0.16	–0.04	–0.10	–0.10	0.02	–0.11
Thailand	0.75	0.66	0.67	0.70	0.76	0.76	0.76	0.78	0.75	0.76	0.76	0.76	0.72	0.74	0.77	0.85
Uzbekistan	–0.57	–0.05	–0.18	–0.39	–0.31	–0.40	–0.64	–0.65	–0.48	–0.42	–0.48	–0.28	–0.15	–0.30	–0.46	–0.58
Viet Nam	–0.46	–0.62	–0.44	–0.49	–0.29	–0.26	–0.21	–0.29	–0.23	–0.02	0.05	0.25	0.23	0.31	0.43	0.33

Source: Authors.

Appendix Table A7 **Projections of agricultural output and employment shares for 2040**

	Projected growth rate of income per capita (%)	Timmer's agricultural phase, 2040	Share elasticities of income per capita		Output shares (%)		Employment shares (%)	
			Output	Employment	Latest	Projected 2040	Latest	Projected 2040
East Asia								
PRC	4.3	Middle integration	–0.55	–0.17	10.1	<5	39.6	22.8
Central and West Asia								
Armenia	2.9	Late integration	–0.57	–0.19	19.6	<5	44.2	32.7
Georgia	2.7	Late integration	–0.70	–0.36	8.4	<5	53.4	30.2
Kyrgyz Rep.	0.7	Early integration	–0.34	–0.10	20.7	19.1	34.0	33.2
Tajikistan	0.8	Agricultural surplus	–0.26	–0.10	21.3	19.8	55.5	53.9
Uzbekistan	1.8	Late integration	–0.51	–0.10	19.5	12.3	38.5	35.6
South Asia								
Bangladesh	4.5	Middle integration	–0.33	–0.10	18.6	<5	48.1	34.9
Bhutan	4.2	Early integration	–0.52	–0.11	17.5	<5	59.5	43.0
India	5.0	Middle integration	–0.38	–0.10	19.0	<5	51.1	33.5
Nepal	4.1	Early integration	–0.19	–0.10	36.5	20.1	65.7	49.9
Pakistan	4.2	Middle integration	–0.43	–0.10	21.2	<5	44.7	33.6
Sri Lanka	1.6	Early integration	–0.54	–0.14	12.8	8.6	32.7	29.9
Southeast Asia								
Cambodia	3.1	Early integration	–0.35	–0.10	36.0	17.1	72.2	61.1
Indonesia	4.8	Industrialization	–0.52	–0.12	15.3	<5	38.3	24.2
Lao PDR	1.8	Early integration	–0.32	–0.10	33.0	25.5	85.4	79.2
Malaysia	3.0	Industrialized	–0.93	–0.69	10.4	<5	13.3	<5
Philippines	4.7	Late integration	–0.64	–0.29	12.3	<5	35.2	5.7
Thailand	4.2	Middle integration	–0.75	–0.44	12.4	<5	38.2	<5
Viet Nam	4.7	Early integration	–0.37	–0.10	20.6	<5	51.7	36.3
Pacific								
PNG	3.1	Early integration	–0.51	–0.10	35.8	7.6	72.3	61.0
Samoa	3.3	Late integration	–0.70	–0.38	9.7	<5	39.9	14.7
Vanuatu	1.2	Middle integration	–0.70	–0.37	19.7	13.8	60.5	50.8

GDP = gross domestic product, Lao PDR = Lao People's Democratic Republic, PNG = Papua New Guinea, PRC = People's Republic of China.
Notes:
(i) Growth projections are based on Felipe et al. 2012, except for Bhutan and Samoa, which are obtained by extrapolating past GDP growth trends.
(ii) Labor productivity is projected to grow at the same rate as real per capita income.
(iii) Projected shares of agricultural output and employment are obtained using elasticities from the regressions of the shares of agricultural output and employment (s) shown in section 2, and then applying the formula of the elasticity: $s^c_{2040}-s^c_{2010}=\varepsilon^c(y^c_{2040}-y^c_{2010})\frac{s^c_{2010}}{y^c_{2010}}$, where c indexes the country, and ε^c denotes the elasticity (i.e., derivative of the log of the share with respect to the log of income per capita in the estimated regressions). Output and employment elasticities are evaluated at the mean of the per capita income distribution of each country.
(iv) In some cases, the estimated employment elasticities were so small that there was no change in the share. In these cases we assumed an elasticity of –0.10.
Source: Authors.

Appendix Table A8 **Actual values of the control variables. 2007**

Economy	Roads per capita (km/'000 persons)	Financial development (liquid liabilities as % of GDP)	Average years of schooling	Share of manufacturing value added in high-tech sectors (% of manufacturing value added)	Share of manufacturing employment in high-tech sectors (% of manufacturing employment)
Asian economies					
Armenia	2.44	18.48	10.41		
Azerbaijan		16.10		17.20	34.91
Bangladesh		56.24	5.44		
Cambodia		25.63	5.95		
China, People's Rep. of	2.72	142.24	7.84	46.03	43.35
Georgia	4.63	19.61		19.04	
Hong Kong, China	0.29	270.78	10.06		
India	3.53	64.53	4.86	37.96	32.13
Indonesia	1.81	38.35	5.93	31.19	15.83
Japan	9.40	198.80	11.39	56.65	53.88
Kazakhstan	6.01	32.12	10.23		26.06
Korea, Rep. of	2.12	61.04	11.62	47.80	45.24
Kyrgyz Rep.	6.45	26.01	8.62	10.31	23.57
Lao PDR	6.21	21.45	4.82		
Malaysia		112.09	9.86	50.14	44.26
Mongolia		38.26	8.13	45.00	5.41
Nepal	0.67	55.66	3.61		
Pakistan	1.58	46.39	5.19		
Papua New Guinea		42.14	3.97		
Philippines		55.70	8.76		
Singapore	0.72	103.70	8.74	89.43	81.67
Sri Lanka		36.31	10.91	8.70	6.86
Tajikistan		17.59	9.31		
Thailand		97.59	7.09		
Turkmenistan					
Uzbekistan					
Viet Nam	1.90	90.78	6.02		19.09
Other Economies					
Australia	38.54	85.59	11.97		
Belgium	14.41	103.79	10.50	50.30	46.73
Brazil		56.16	7.31	39.47	
Canada	42.79	123.24	12.11	53.81	52.80
Chile	4.84		9.90		
France	14.86	74.38	10.14	66.38	61.72
Germany	7.83	108.02	11.83	67.75	61.48
Netherlands	8.27	122.00	10.89	51.04	49.67
Spain	14.86	131.94	9.99	43.46	42.60
United Kingdom	6.89	141.07	9.51	51.02	47.66
United States	21.54	70.85	12.99	57.01	51.86

GDP = gross domestic product, Lao PDR = Lao People's Democratic Republic.
Source: Authors.

References

Abrenica, M. 2013. The Philippine Enigma. Draft Manuscript. Submitted to the Asian Development Bank for RETA 8153: Policies for Industrial and Service Diversification in Asia in the 21st Century). January.

Aldaba, R. 2013. Why a New Industrial Policy for the Philippines is Critical. *Policy Notes* No. 2013-01. Manila: Philippine Institute for Development Studies.

Amable, B. 2000. International Specialisation and Growth. *Structural Change and Economic Dynamics*. 11. pp. 413–31.

Anderson, C. 2012. *Makers: The New Industrial Revolution*. New York: Crown Business.

Antweiler, W., and D. Trefler. 2002. Increasing Returns and All That: A View from Trade. *American Economic Review*. 92(1). pp. 93–119.

Asian Development Bank (ADB). 2010. The Rise of the Middle Class. *Key Indicators for Asia and the Pacific 2010*. Mandaluyong City: ADB.

_____. 2012a. Services and Asia's Future Growth. *Asian Development Outlook Update 2012*. Mandaluyong City: ADB.

_____. 2012b. Green Urbanization in Asia. *Key Indicators for Asia and the Pacific 2012*. Mandaluyong City: ADB.

_____. 2012c. *Key Indicators for Asia and the Pacific 2012*. Mandaluyong City: ADB.

_____. 2013. *Beyond Factory Asia Fuelling Growth in a Changing World.* Mandaluyong City: ADB.

_____. Statistical Database System (SDBS). https://sdbs.adb.org

Baldwin, R. 2012. *Trade and Industrialization After Globalization's 2nd Unbundling: How Building and Joining a Supply Chain are Different and Why It Matters*. Geneva: Graduate Institute Geneva and Oxford University. Downloaded from http://www.nber.org/chapters/c12590.pdf?bcsi_scan

Balisacan, A., N. Fuwa, D. Mapa, S. Piza, M. Sombilla, and C. Santos. 2011. Inclusive Agribusiness Growth in the Philippines: The Role of Direct and Indirect Channels with a Focus on the Labor Market. Report submitted to World Bank. Quezon City: Asia Pacific Policy Center.

Balisacan, A., and H. Hill, eds. 2003. *The Philippine Economy. Development, Policies, and Challenges*. Quezon City: Ateneo de Manila University Press.

Barro, R., and J-W. Lee. 2010. A New Data Set of Educational Attainment in the World, 1950–2010. *NBER Working Paper* 15902. Cambridge, MA: National Bureau of Economic Research (NBER).

Baumol, W. 1967. Macroeconomics of Unbalanced Growth: the Anatomy of Urban Crises. *American Economic Review*. 57(3). pp. 415–25.

Baumol, W., S. Blackman, and E. Wolf. 1985. Unbalanced Growth Revisited: Asymptotic Stagnancy and New Evidence. *American Economic Review*. 75(4). pp. 806–17.

Briones, R., and J. Felipe. 2013. Agriculture and Structural Transformation in Developing Asia: Review and Outlook. *ADB Economics Working Paper Series* No. 363. ADB, Mandaluyong City: ADB.

Brynjolfsson, E., and A. McAfee. 2011. *Race Against the Machine: How the Digital Revolution is Accelerating Innovation, Driving Productivity, and Irreversibly Transforming Employment in the Economy*. Lexington, Massachusetts: Digital Frontier Press.

Chen, J., J. Liu, Y. Shou, and Q. Xu,eds. 2012. *Leverage Innovation Capacity. Application of Total Innovation Management in* [the People's Republic of] *China's SMEs' Study*. Singapore: World Scientific Publishing Co.

Chenery, H., S. Robinson, and M. Syrquin. 1986. *Industrialization and Economic Growth*. New York: Oxford University Press.

Cowen, T. 2011. *The Great Stagnation: How America Ate All the Low-Hanging Fruit of Modern History, Got Sick, and Will (Eventually) Feel Better*. New York: Penguin Group (USA).

Dasgupta, S., and A. Singh. 2006. *Manufacturing, Services and Premature De-industrialization in Developing Countries: A Kaldorian Empirical Analysis*. Center for Business Research, University of Cambridge.

Diaz-Bonilla, E., and L. Reca. 2000. Trade and Agroindustrialization in Developing Countries: Trends and Policy Impacts. *Agricultural Economics.* 23 (3). pp. 219–229.

Duncan, R. 2013. The Structural Transformation of the Pacific Island Economies. Paper prepared for the Asian Development Bank (ADB). Manila: ADB. Unpublished.

Economist, The. 2010. First Break All the Rules: the Charms of Frugal Innovation. 15 April.

_____. 2012a. Asian Innovation: Frugal Ideas are Spreading from East to West. 24 March

_____. 2012b. Solid Print. 21 April.

_____. 2012c. A Third Industrial Revolution. 12 April.

Eichengreen, B., and P. Gupta. 2013. The Two Waves of Service Sector Growth. *Oxford Economic Papers*. 65(1): 96–123.

European Commission (Eurostat). 2013. *Science, Technology and Innovation in Europe*. Belgium: Publications Office of the European Union.

Fagerberg, J. 2000. Technological Progress, Structural Change and Productivity Growth: A Comparative Study. *Structural Change and Economic Dynamics*. 11. pp. 393–411.

FAOSTAT. http://faostat.fao.org/

Felipe, J. 2012a. Tracking the Middle-Income Trap: What is It, Who is in It, and Why? Part 1. *ADB Economics Working Paper Series* No. 306 (March).

_____. 2012b. Tracking the Middle-Income Trap: What is It, Who is in It, and Why? Part 2. *ADB Economics Working Paper Series* No. 307 (March).

Felipe, J., and C. Hidalgo. 2013. The Role of Diversity in the Economy: Implications for Kazakhstan's Development. Mandaluyong City: Asian Development Bank. Draft.

Felipe, J., and R. Hasan, eds. 2006. *Labor Markets in Asia*. New York: Palgrave Macmillan.

Felipe, J., U. Kumar, and A. Abdon. 2010. How Rich Countries Became Rich and Why Poor Countries Remain Poor: It's the Economic Structure . . . Duh! Working Paper No. 644 (December). Levy Institute of Bard College, New York.

_____. 2012. Using Capabilities to Project Growth 2010–2030. *Journal of the Japanese and International Economies.* 26(1) pp. 153-166

_____. 2013. Exports, Capabilities, and Industrial Policy in India. *Journal of Comparative Economics.* 41(3). pp. 939-956

Felipe, J., U. Kumar, A. Abdon, and M. Bacate. 2012. Product Complexity and Economic Development. *Structural Change and Economic Dynamics.* 23(1). pp. 36–68.

Felipe, J., U. Kumar, N. Usui, and A. Abdon. 2013. Why has China Succeeded? And Why It Will Continue To Do So. *Cambridge Journal of Economics.* 37(4). pp. 791–818.

Ferrarini, B. 2013. Vertical Trade Maps. *Asian Economic Journal*. 27(2). pp. 105–23.

Fischer, T., D. Byerlee, and G. Edmeades. 2009. Can Technology Deliver on the Yield Challenge to 2050? In P. Conforti, ed. *Looking Ahead in World Food and Agriculture: Perspectives to 2050*. Rome: FAO.

Friedman, G. 2011. *The Next Decade*. New York: Doubleday.

Gereffi, G., and K. Fernandez-Stark. 2010. The Offshore Services Value Chain: Developing Countries and the Crisis. In O. Cattaneo, G. Gereffi, and C. Starits, eds. *Global Value Chains in a Postcrisis World A Development Perspective.* Washington, DC: World Bank.

Gordon, R. 2012. Is US Economic Growth Over? Faltering Innovation Confronts the Six Headwinds. *NBER Working Paper* 18315. Cambridge, MA: National Bureau of Economic Research.

Government of India Planning Commission (GIPC). 2012. *Twelfth Five-Year Plan (2012–17), Vol. 3. Faster, More Inclusive and Sustainable Growth*. New Delhi: GIPC.

Gratton, L. 2011. *The Shift: The Future of Work is Already Here*. London: Collins.

Groningen Growth and Development Centre (GGDC). 10-Sector Database. www.ggdc.net

Gruere, G. 2012. Implications of Nanotechnology Growth in Food and Agriculture in OECD Countries. *Food Policy* 37(1). pp. 191–98.

Hanushek, E., and L. Woessmann. 2008. The Role of Cognitive Skills in Economic Development. *Journal of Economic Literature*. 46. pp. 607–68. (UNIDO).

Haraguchi, N., and G. Rezonja. 2010. In Search of General Patterns of Manufacturing Development. *Development Policy and Strategic Research Branch Working Paper* 2010/02 UNIDO.

_____. 2011a. Emerging Patterns of Manufacturing Structural Change. *Development Policy and Strategic Research Branch Working Paper* 2010/04 UNIDO.

_____. 2011b. Emerging Patterns of Manufacturing Structural Change. *UNU-WIDER Working Paper* No 2011/43 United Nations University, World Institute for Economics Research (UNU-WIDER).

Hausmann R., C. Hidalgo, S. Bustos, M. Coscia, S. Chung, J. Jimenez, A. Simoes, M. Yildirim. 2011. *The Atlas of Economic Complexity: Mapping Paths to Prosperity*. New Hampshire: Puritan Press.

Hayashi, T. 1990. *The Japanese Experience in Technology*. Tokyo: United Nations University Press.

Helper, S., T. Krueger, and H. Wial. 2012. *Why Does Manufacturing Matter? Which Manufacturing Matters? A Policy Framework*. Washington, DC: Brookings Policy Framework Manufacturing Report.

Henderson, J., and R, Phillips. 2007. Unintended Consequences: Social Policy, State Institutions and the "Stalling" of the Malaysian Industrialization Project. *Economy and Society*. 36(1). pp. 78–102.

Herath, D., and A. Weersink. 2009. From Plantations to Smallholder Production: The Role of Policy in the Reorganization of the Sri Lankan Tea Sector. *World Development*. 37(11). pp. 1759–72.

Hidalgo, C., B. Klinger, A. Barabasi, and R. Hausmann. 2007. The Product Space Conditions the Development of Nations. *Science*. 317. pp. 482–7.

Hobday, M. 1995a. East Asian Latecomer Firms: Learning the Technology of Electronics. *World Development*. 23(7). pp. 1171–93.

_____. 1995b. *Innovation in East Asia: The Challenge to Japan*. Aldershot, UK: Edward Elgar.

Huang, J., C. Pray, and S. Rozelle. 2002. Enhancing the Crops to Feed the Poor. *Nature.* 418 pp. 678–84.

Humphrey, J., and O. Memedovic. 2006. Global Value Chains in the Agrifood Sector. *UNIDO Strategic Research and Economics Branch Working Paper*. Vienna: United Nations Industrial Development Orgnaization (UNIDO).

Hwang, J. 2006. *Introduction of New Goods, Convergence and Growth.* Cambridge, MA: Harvard University Department of Economics.

Immelt, J., V. Govindarajan, and C. Trimble. 2009. How GE is Disrupting Itself. *Harvard Business Review.* October.

Inklaar, R., P. Timmer, and B. Van Ark. 2008. Data for Productivity Measurement in Market Services: An International Comparison. International Productivity Monitor. *Centre for the Study of Living Standards*. (16). pp. 72–81.

International Labour Organization (ILO). LABORSTA Internet. http://laborsta.ilo.org/

Johnston, B., and J. Mellor. 1961. The Role of Agriculture in Economic Development. *American Economic Review*. 51(4). pp. 566–93.

Jongwanich, J., 2009. The Impact of Food Safety Standards on Processed Food Exports from Developing Countries. *Food Policy.* 34 (2009). pp. 447–457.

Kaldor, N. 1967. *Strategic Factors in Economic Development*. Ithaca, NY: New York State School of Industrial and Labor Relations, Cornell University.

Kawakami, M., and T. Sturgeon, eds. 2011. *The Dynamics of Local Learning in Global Value Chains*. New York: Palgrave Macmillan and *IDE-JETRO.*

Khan, M. 2013. Industrial Policy in Kazakshtan: Design and Implementation Challenges. Draft manuscript submitted to ADB.

Kharas, H. 2010. The Emerging Middle Class in Developing Countries. *Working Paper No. 285*. Paris: OECD Development Centre.

Kim, L. 1997. *From Imitation to Innovation: Dynamics of Korea's Technological Learning*. Cambridge, MA: Harvard Business School Press.

Kohli, H, A. Sharma, and A. Sood. 2011. *Asia 2050 Realising the Asian Century*. New Delhi: SAGE Publications India Pvt Ltd.

Kraemer, K., G. Linden, and J. Dedrick. 2013. *Capturing Value in Global Networks: Apple's iPad and iPhone.* http://pcic.merage.uci.edu/papers/2011/Value_iPad_iPhone.pdf

Kuijs, L., and T. Qiu. 2013. Is [the People's Republic of] China Upgrading its Industrial Structure? Hong Kong, China: Royal Bank of Scotland.

Kuznets, S. 1966. *Modern Economic Growth*. CT, New Haven: Yale University. Lee, K., and J. Matthews. 2012. In J. Cantwell and E. Amann, eds. *The Innovative Firms in the Emerging Market Economies*. Oxford: Oxford University Press.

Lim, W, ed. 2012. Heavy and Chemical Industry Drive. In W. Lim (ed.), *Expert Workshop on KDI-MIT-WBI Collaborative Research: Leadership in Industrial Policy in Late-industrializing Countries*. Seoul: Korean Development Institute.

Lipton, M. 2006. Can Small Farmers Survive, Prosper, or Be the Key Channel to Cut Mass Poverty? *Electronic Journal of Agricultural and Development Economics* 3(1). pp. 58–85.

Maddison, A. 1982. *Phases of Capitalist Development*. New York: Oxford University Press.

MacIver, K., 2012. The New Economics of Global Innovation. *Global Intelligence for the CIO*. Issue 14, July–September.

Magtibay-Ramos, N., G. Estrada, and J. Felipe. 2011. Exploring the Philippine Economic Landscape and Structural Change Using the Input–Output Framework. *International Journal of Development Issues*. 10(1). pp. 34–59.

Maroto-Sanchez, A., and J. Cuadrado-Roura. 2009. Is Growth of Services an Obstacle to Productivity Growth? A Comparative Analysis. *Structural*

Change and Economic Dynamics. 20. pp. 254–65.

McKinsey Global Institute. 2012. *Manufacturing the Future: The Next Era of Global Growth and Innovation.* November.

_____. 2013. *Disruptive technologies*: Advances that will Transform Life, Business, and the Global Economy. May.

Mehrotra, S., A. Gandhi, P. Saha, and B. Sahoo. 2012. Joblessness and Informalization: Challenges to Inclusive Growth in India. *IAMR Occasional Paper* No. 9/2012. Institute of Applied Manpower Research.

Mehta, A., and W. Sun. 2013. Does Industry Affiliation Influence Wages? Evidence from Indonesia and the Asian Financial Crisis. *World Development* (51). pp. 47–61.

Minami, R. 1994. *The Economic Development of Japan. A Quantitative Study* (second edition). St. Martin's Press: New York.

National Statistics [Taipei,China]. www.eng.stat.gov.tw (accessed September 2012).

Nelson, R., and E. Phelps. 1966. Investment in Humans, Technological Diffusion, and Economic Growth. *American Economic Review*. 56(1/2). pp. 69–75.

Ng, T. H. 2002. Factor Endowments and the Distribution of Industrial Production Across the World. *Statistics and Information Working Paper* 6, UNIDO, Vienna, February.

Nordås, H., and Y. Kim. 2013. The Role of Services for Competitiveness in Manufacturing. *OECD Trade Policy Papers* No. 148. OECD Publishing.

Oikawa, H. 2011. Inter-country Value Distribution in the East Asian Electronics and Automobile Industries: An Empirical Global Value Chain Approach. In M. Kawakami and T. Sturgeon, eds. *The Dynamics of Local Learning in Global Value Chains*. New York: Palgrave Macmillan and IDE-JETRO.

Organisation for Economic Co-operation and Development (OECD). *STAN Structural Analysis Database (STAN).* http://www.oecd.org/industry/ind/stanstructuralanalysisdatabase.htm

Oulton, N. 2001. Must the Growth Rate Decline? Baumol's Unbalanced Growth Revisited. *Oxford Economic Papers*. 53 pp. 605–27.

Peneder, M. 2003. Industrial Structure and Aggregate Growth. *Structural Change and Economic Dynamics*. 14. pp. 427–48.

Ranis, G. 2012. Labor Surplus Revisited. *Center Discussion Paper* No. 1016. New Haven, CT: Economic Growth Center, Yale.

Ranis, G., and J. Fei. 1961. A Theory of Economic Development. *American Economic Review* 51(4): 533–65.

Ray, D., N. Mueller, P. West, and J. Foley. 2013. Yield Trends are Insufficient to Double Global Crop Production by 2050. PLOS. 8(6, June): 1–9.

Reardon, T., P. Timmer, and B. Minten. 2012. Supermarket Revolution in Asia and Emerging Development Strategies to Include Small Farmers. *Proceedings of the National Academy of Sciences* 109(31). pp. 12332–7.

Rowthorn, R., and R. Ramaswamy. 1997. Deindustrialization: Causes and Implications. *IMF Working Paper*. WP/97/42. Washington, DC: International Monetary Fund.

_____. 1998. Growth, Trade and Deindustrialization. *IMF Working Paper*. WP/98/60. Washington, DC: International Monetary Fund.

Sako, M. 2013. Professionals Between Market and Hierarchy: A Comparative Political Economy Perspective. *Socio-Economic Review.* 11. pp. 1–28.

Samel, H. 2012. *Volatility and Technological Upgrading in Malaysia.* In Wonhyuk Lim, ed. *Expert Workshop on KDI-MIT-WBI Collaborative Research: Leadership in Industrial Policy in Late-industrializing Countries:* 169–202. Korean Development Institute.

Schuman, M. 2009. *The Miracle. The Epic Story of Asia's Quest for Wealth*. New York: HarperCollins.

Spence, M., P. Annez, and R. Buckley, eds. 2009. *Urbanization and Growth.* Washington, DC: Commission on Growth and Development and World Bank.

Studwell, J. 2013. *How Asia Works: Success and Failure in the World's Most Dynamic Region*. London: Profile Books.

Sturgeon, T., and G. Linden. 2011. Learning and Earning in Global Value Chains: Lessons in Supplier Competence Building in East Asia. In M. Kawakami and T. Sturgeon, eds. *The Dynamics of Local Learning in Global Value Chains*, Chapter 7. New York: Palgrave Macmillan and IDE-JETRO.

Sutton, J. 2005. Competing in Capabilities: An informal overview. London School of Economics. Manuscript.

Szirmai, A. 2012. Industrialisation as an Engine of Growth in Developing Countries, 1950–2005. *Structural Change and Economic Dynamics*. 23 (4). pp. 406–20.

Szirmai, A., and B. Verspagen. 2011. Manufacturing and Economic Growth in Developing Countries, 1950–2005. *UNU-MERIT Working Paper* #2011-069. Maastricht Economic and Social Research and Training Centre on Innovation and Technology, United Nations University (UNU-MERIT) and Maastricht University.

Tham, S., and W. Loke. 2011. Industrial Deepening in Malaysia: Policy Lessons for Developing Countries. *Asian Development Review*. 28(2). pp. 88–109.

Thomas, J. 2012. India's Labour Market During the 2000s: Surveying the Changes. *Economic and Political Weekly*, December.

Time. 2012. Made in the USA. 22 April.

Timmer, M., ed 2012. The World Input–Output Database (WIOD): Contents, Sources and Methods. *WIOD Working Paper* No. 10. Griningen: University of Groningen.

Timmer, P. 1988. The Agricultural Transformation. In H. Chenery, and T. Srinivasan, eds. *Handbook of Development Economics*. 1: 176-331.

_____. 1995. Getting Agriculture Moving: Do Markets Provide the Right Signals? *Food Policy.* 20(5). pp. 455–72.

Tregenna, F. 2009. Characterising Deindustrialization: An Analysis of Changes in Manufacturing Employment and Output Internationally. *Cambridge Journal of Economics*. 33. pp. 433–66.

Triplett, J., and B. Bosworth. 2004. *Services Productivity in the United States: New Sources of Economic Growth*. Washington, DC: Brookings Institution Press.

UNIDO (United Nations Industrial Development Organization), 2012. Industrial Statistics Database 2-digit Level, ISIC Revision 3 (INDSTAT2). Vienna.

van der Wal, S. 2008. *Sustainability Issues in the Tea Sector: A Comparative Analysis of Six Leading Producing Countries.* Amsterdam: Centre for Research on Multinational Corporations.

Vertesy, D., and A. Szirmai. 2010. Interrupted Innovation: Innovation System Dynamics in Latecomer Aerospace Industries. *United Nations University Working Paper Series* # 2010-059. Maastricht, the Netherlands: United Nations University.

World Bank. 2003. *Promoting Agro-Enterprise and Agro-Food Systems Development in Developing and Transition Countries: Towards an Operational Strategy for the World Bank Group* Report No. 26032. World Bank, Washington, DC.

_____. 2009. Agriculture for Development. *World Development Report 2008*. Washington, DC: World Bank.

_____. *World Development Indicators Online* (WDI). http://data.worldbank.org/data-catalog

Asia's Economic Transformation: Where to, How, and How Fast?
Key Indicators for Asia and the Pacific 2013 Special Chapter

During the last 4 decades, Asia has grown faster than any other developing region, and a few of its economies have undergone a rapid and remarkable transformation. However, the pace at which some of the region's economies have transformed has been slow. In many of them, agriculture is still the largest employer, industrialization has hardly taken place, and workers are moving from agriculture into low-productivity services. The *Key Indicators for Asia and the Pacific's 2013* special chapter—Asia's Economic Transformation: Where to, How, and How Fast?—reviews the direction and pace of Asia's recent transformation. It also sketches the main contours of economic transformation that can be expected in coming decades. The chapter argues that, for developing Asia to move ahead, (i) agriculture needs to be modernized by deploying infrastructure, introducing technological improvements, developing the agribusiness sector, and increasing linkages to global value chains; (ii) the industrialization step cannot, in general, be bypassed on the path to becoming a high-income economy; (iii) the service sector is already the largest source of employment and this trend will continue; (iv) basic education of high quality matters for industrial upgrading and, in general, for the development of new industries that can compete internationally; and (v) although it is important for countries to exploit their comparative advantages, some form of government intervention may be necessary and unavoidable to expedite economic transformation.

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