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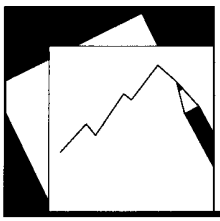

IMF Working Paper

Asia Rising: A Sectoral Perspective

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Asia Rising: A Sectoral Perspective

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Abstract

This paper undertakes a cross-country analysis of productivity growth at both the aggregate and sectoral level. It finds that Asia's remarkable output growth over the past 40 years reflected both high investment, and rapid productivity increases. These factors were in turn supported by the region's relatively strong institutional and policy environment, which encouraged resource shifts from low- to high-productivity sectors. Looking ahead, sustaining rapid growth requires meeting a number of key challenges: (i) implementing reforms to boost productivity in the increasingly important, but currently lagging, service sectors; (ii) providing policy support for continuing the shift of resources from agriculture to industry and services; (iii) strengthening policy frameworks in late-developing countries.

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Contents Page

I. INTRODUCTION

Asia's striking growth performance has long attracted the interest of both policymakers and researchers. For several decades, growth has been very strong in the region as a whole—even spectacular in the newly industrialized economies (NIEs)[2] and, more recently, China. Between 1981 and 2001, the number of people living in extreme poverty has declined dramatically in East Asia (by over 400 million in China alone). At the same time, given the presence of both early and late developers, Asia continues to display wide disparities in per capita income, ranging from over $33,000 in Singapore to $2,000 in Bangladesh. Average income levels in developing Asia as a whole are still well below those in other regions. This paper looks at relative growth performance across Asia, with a focus on the following questions:

- To what extent is the development path blazed by Japan, and later the NIEs, now being followed by the ASEAN-4,[3] China, India, and the newly emerging economies, such as Vietnam? Are there systematic differences between East Asia and the rest of Asia? Or between Asia and other regions of the world?[4]

- What have been the sources of growth differences, both within Asia, and compared with other regions? What has been the role of policies in achieving strong outcomes in Asia?

- How can Asia's exceptionally high growth rates be sustained? What policy measures would help to maintain strong growth? Have the reforms introduced after the Asian financial crises already had a detectable impact on growth and productivity?

In sharp contrast with the overwhelming majority of the existing literature, the paper examines developments at both the aggregate and sectoral level. Further, it analyzes the determinants of resource shifts from low- to high-productivity sectors.

Overall, the paper finds that Asia's remarkable growth performance reflected strong total factor productivity (TFP) growth, as well as rapid accumulation of both physical and human capital. In addition, TFP growth depended importantly on both the overall shift of labor from agriculture toward industry and services, and the continuing move within manufacturing toward higher value-added products. In turn, all these accomplishments were driven by a

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[2]Comprising Hong Kong SAR, Korea, Singapore, and Taiwan Province of China.

[3]Comprising Indonesia, Malaysia, the Philippines, and Thailand.

[4]This paper focuses on the following Asian countries and subregions: Japan; the NIEs; the ASEAN-4; China; India; and "Other Asia" (Bangladesh, Cambodia, Laos, Myanmar, Pakistan, Sri Lanka, and Vietnam). "Asia" is defined as comprising all the above countries; "developing Asia," all the above countries except Japan and the NIEs; "East Asia," all the above countries except Japan, India, Pakistan, and Sri Lanka. Asia as a whole is contrasted with the following regions: advanced economies excluding Asia; Latin America and the Caribbean; and other developing economies. All regional and subregional averages refer to unweighted means, unless otherwise noted.

more favorable institutional and policy environment than observed in other developing economies, including in particular greater trade openness, macroeconomic stability, financial development, and in many cases educational attainment. Looking ahead, further improvements in policies and institutional quality would help to sustain high sectoral productivity growth rates and facilitate the continued shift of resources from agriculture to industry and services, hence supporting sustained rapid growth, convergence toward advanced-economy income levels, and the elimination of poverty across the region.

II. ASIA'S ECONOMIC SUCCESS

Asia's real income per capita rose sevenfold between 1950 and 2005 (Figure 1), significantly reducing its gap relative to the United States. Asia's success stands in marked contrast with the failure of Latin America and other developing economies to catch up with advanced economies.

Within Asia, there have been significant, well-known differences across countries in the timing of their initial "takeoff" into sustained growth and, more broadly, the start of their "integration" into the world economy.[5] Later developers, including China, appear to have started their takeoff at lower income levels than Japan or the NIEs. At the same time, the overall pace of growth in later developers does not appear significantly different from that experienced by Japan and the NIEs at similar stages of the integration process.

A similar story emerges when looking at broader development indicators. Asia's share of world trade more than doubled during 1970–2005, whereas Latin America's decreased (Figure 2). Within Asia, all regions have captured a rising share of world trade, but the rapid expansion in China's trade over the past decade stands out, even though it started from a very low base. Asia has also enjoyed an especially rapid increase over the last half century in levels of educational attainment.

Declining dependency ratios (a measure of nonworking age to total population) have certainly been supportive of growth in Asia, but not significantly more so than in other developing regions (Figure 2). However, the heterogeneity within Asia is very striking. In the NIEs and China, population aging will likely cause dependency ratios to start rising again within the next five years, whereas in India the demographic transition started only relatively recently.

Strong policy frameworks have been a key element behind Asia's success stories.[6] Over the last several decades, Asian fast developers have been characterized by a broadly stable macroeconomic environment. Inflation has been contained within relatively narrow bands,

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[5]This paper defines the growth takeoff as occurring in 1955 for Japan; 1967 for the NIEs; 1973 for ASEAN-4; 1979 for China; 1982 for India; and 1990 for Other Asia. The first four dates follow Chapter II of the April 2004 *World Economic Outlook*; the dating for India follows Hausmann, Pritchett, and Rodrik (2005); the dating for Other Asia is somewhat arbitrary, but in any case data for much of this group are not available before 1990.

[6]See World Bank, 1993, for a fuller discussion of the policy record, including with respect to industrial policy.

with the exception of the periods following the oil-price shocks and the 1997 Asian Crisis. Related to this, while some high-performing Asian economies ran substantial fiscal deficits, their high savings and rapid growth enabled them to avoid inflationary debt financing. More broadly, Asia has benefited from continued institutional strengthening, financial development, and in many cases more open trade policies.

Nevertheless, while considerable progress has been made, many developing Asian countries still have far to go before their income and development levels approach those in advanced economies. Indeed, almost 700 million Asians, or 20 percent of the total population, still live in extreme poverty, a substantial proportion of them in rural areas (Chen and Ravallion, 2004). To get a sense of whether and to what extent Asia's growth is indeed likely to be sustained over the long run, the paper undertakes a systematic analysis of this growth performance. It first examines the sources of growth, and then considers the role that policies have played in achieving these outcomes.

III. PERSPIRATION OR INSPIRATION?

Asia's strong growth performance can be analyzed in terms of demographic developments, the movement of labor and capital from low- to high-productivity sectors, within-sector factor accumulation, and technological progress. To the extent that growth reflects increases in total factor productivity as well as, say, capital accumulation, it is more likely to prove sustainable over the long term. To explore this issue, the respective contributions of the various sources of growth are calculated using different growth accounting exercises, first at the aggregate level and then at the sectoral level. The findings are then related to policy variables to help understand what underlies the observed trends.

As a first step, growth in output per capita is decomposed into changes in: (1) labor productivity (output per worker); (2) participation rates;[7] and (3) the age structure of the population.[8] The results show that, during 1970–2005, growth differences—both across regions and within Asia—were driven mainly by labor productivity (Figure 3). That said, in both Asia and Latin America, demographic developments provided an important boost to growth. In a few countries, such as Indonesia, Korea, and Taiwan Province of China, the demographic growth impact amounted to more than 1 percentage point per year.

Next, growth in labor productivity can be decomposed into: (1) capital deepening (i.e., increases in physical capital per worker); (2) rising labor quality; and (3) growing TFP.[9] The

[7]Defined as the ratio of labor force to working-age population. "Working age" is defined throughout this paper as ages 15–64 inclusive.

[8]Specifically, the ratio of working-age population to total population, or one minus the total dependency ratio.

[9]See Jorgenson, Ho, and Stiroh, 2005, and Jorgenson, forthcoming, for a discussion and summary of the relevant growth-accounting methodology. Estimates of physical capital are based on Nehru and Dhareshwar, 1993, updated as in Fajnzylber and Lederman, 1999, using *World Economic Outlook* data on gross fixed capital formation. Estimates of human capital are based on Barro and Lee, 2000. In line with much of the literature, the capital share in income is assumed equal to 0.35. The main results are robust to estimating its value. See Sarel,

(continued…)

precise role of TFP growth in the "Asian miracle" has been the subject of much controversy since Young (1995). The focus in this paper is not so much on estimating TFP growth in Asian countries, as on comparing their performance with other economies, and in particular other developing economies. Our results indicate that during 1970–2005 Asia enjoyed both faster physical capital accumulation and faster TFP growth than other developing economies; in contrast, Asia's catch-up with advanced economies largely reflected capital accumulation. More specifically, physical capital accumulation contributed 1.75 to 3 percentage points to growth in fast-developing Asian countries, much more than observed in other regions (Figure 3). Rising education levels were also important, boosting Asian growth on average by ½ percentage point. TFP contributed 0.75 to 2 percentage points to growth in India, Japan, the NIEs, and Thailand. Parenthetically, our results for the NIEs are broadly similar (over comparable periods) to those reported in Young, 1995, with the exception that TFP growth for Singapore through 1990 is estimated at over 1 percentage point, rather than 0.2 percentage points. In Japan, TFP growth declined steadily after the initial takeoff. In the ASEAN-4, low average TFP growth masks significant cross-country heterogeneity, with the Philippines having performed relatively poorly (see also IMF, 2005a, 2006a). In China, strikingly, both capital accumulation and TFP growth were substantially higher than in other Asian fast developers, both when compared over the same period, and at similar stages of their integration process.[10]

The growth literature has recently devoted much attention to the impact of investment in information and communications technology, or ICT (see, for instance, Jorgenson and Vu, 2005). Key questions are whether the accelerated decline in ICT prices that characterized the 1990s led to a surge of investment in ICT equipment and software, and whether this had a significant impact on productivity. These issues are analyzed using a smaller cross-country dataset covering the period 1989–2005.[11] The results suggest that economy-wide investment in ICT capital indeed had an impact on growth, averaging about ½ percentage point in the NIEs and China (Figure 4). However, Asia does not stand out along this dimension, and the impact of non-ICT capital accumulation is much larger.[12]

Regarding the effects of the Asian Crisis, growth rates have typically recovered to pre-crisis levels.[13] In contrast, investment rates in those countries most severely impacted by the crisis

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1996, for a general discussion of the robustness of growth-accounting estimates with respect to alternative assumptions.

[10]Estimates for TFP growth in China may be influenced by inaccurate investment price deflators. See also Young, 2003, for a discussion of Chinese statistics.

[11]This is an updated version of the dataset in Jorgenson and Vu, 2005.

[12]The ICT revolution can also affect aggregate productivity more directly, through TFP growth in ICT-producing sectors themselves. These sectors account for 10 percent or more of total value added in several Asian countries, including Korea, Malaysia, the Philippines, Singapore, and Taiwan Province of China. However, it did not prove possible to estimate TFP growth within these sectors.

[13]See, for instance, Cerra and Saxena, 2003. Studies of a broader sample of financial and currency crises also typically find that such crises do not have long-term effects on growth (Barro, 2001; and Park and Lee, 2001).

are still below pre-crisis levels (IMF, 2005b), suggesting that increases in TFP may now be playing a more important role. That said, the empirical results in this paper indicate that it is still too early to detect any statistically significant post-crisis shift in trend TFP growth.[14]

IV. Sectoral Effects: Cross-Sector Shifts or Within-Sector Growth?

This section gauges to what extent strong Asian productivity growth reflects sectoral shift and composition effects, as opposed to pure within-sector productivity growth. The sectoral shift effect refers to the increase in average labor productivity that results as labor and capital move over time from lower- toward higher-productivity sectors, in response to economic incentives and policies. The sectoral composition effect captures the higher aggregate productivity growth that follows from having a higher share of sectors with intrinsically high productivity growth. Importantly, sectoral shifts are not mechanical processes: their speed and extent reflect the willingness and ability of labor and capital to move toward higher-productivity uses, all of which are strongly affected by the policy environment.

The analysis is performed at two levels of aggregation. First, a distinction is made between agriculture, industry, and services (using data from the World Bank, 2006, *World Development Indicators*). The second decomposition focuses on sectoral effects within manufacturing (the main component of industry), and draws a distinction between high-skill and low-skill subsectors (here, the UNIDO Industrial Database is the main source of data). Throughout, the focus is on labor productivity, rather than TFP, owing to the limited data available on sectoral capital stocks.

A. Across Agriculture, Industry, and Services

Sectoral composition and its evolution

This section examines the relative importance of agriculture, industry, and services in Asian economies compared to other countries as well as compared to what fundamentals, such as output per capita and the size of the economy, would predict. Following Kochhar and others, 2006, the latter comparison is based on a regression of the actual share of each sector in value added (or, alternatively, employment) on the logs of output per capita (in PPP U.S. dollars), geographic size, and population, and a dummy variable for Asia or the Asian subregions. The cross-country regressions are estimated by ordinary least squares[15] using the latest available data for the sectoral shares and a broad sample of advanced and developing economies. The predicted value for the sectoral share of value added is then calculated as the difference between the actual share and the value of the dummy variable for that region.

[14]It bears emphasizing that the available data are plagued by severe measurement problems, especially with respect to capital stocks. For instance, it remains unclear to what extent the effective write-off of capital after the financial crises of the mid-1990s is reflected in the national accounts, an issue that may be especially relevant for the ASEAN-4.

[15]Using a generalized linear model, and imposing that the share be between 0 and 100, yields similar results.

Asia currently stands out as having a relatively high share of value added in industry, and a low share in services (Figure 5).[16] This holds true whether Asia is compared to the United States, to Latin America, or to the levels predicted on the basis of its fundamental characteristics.[17] However, there is significant variation within Asia. Japan and the NIEs are advanced economies and they share the sectoral composition of similarly placed economies in other regions. In contrast, China and to a lesser extent the ASEAN-4 are characterized by an exceptionally high share of value added in industry and an exceptionally low share in services, compared to both other countries and predicted levels; the opposite holds true for India.

In addition, developing Asia in general, and China and India in particular, have a much higher employment share in agriculture (and a correspondingly lower share in services) than predicted based on fundamental characteristics. Combining the information on value added and employment suggests relatively low agricultural productivity throughout developing Asia. In contrast, productivity levels are relatively high in industry for China and the ASEAN-4 and in services for India.

Although still large, the relative importance of agriculture has in fact declined sharply in Asia over the last three decades (Figure 6).[18] The shift was larger than observed in other regions, and proved especially strong in China, the ASEAN-4, Korea, and Taiwan Province of China. For instance, agriculture accounted for about a third of Korea's and Taiwan Province of China's economies in the 1960s, but less than one-tenth by the 1980s. Throughout developing Asia, the movement of labor into the service sector was at least as large as that toward industry. Also, while in most of Asia the share of industry in total employment is still growing, in Japan and the NIEs a movement from industry to services is well underway.

Trends in productivity levels and productivity growth rates

The effect of sectoral shifts on aggregate productivity depends on the intersectoral differences in productivity levels. For the world as a whole, labor productivity in nonagricultural sectors is about three times higher than in agriculture; in Asia, the differential is even larger, consistent with the finding that agricultural productivity is lower than predicted (Figure 7).[19] As a result, the shift from agriculture to industry and services has had a significant positive effect on Asian productivity levels (see below). Intersectoral productivity differentials remained high at the end of the period; indeed, they have widened over time in both China and India, reflecting strong productivity growth in, respectively,

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[16]Services include wholesale and retail trade; hotels and restaurants; transport; telecommunications; financial and insurance services; other business services; and community, social, and personal services.

[17]Including income per capita, country size, and population.

[18]The employment share of agriculture declined by an average 0.6 percentage point per year.

[19]While the measurement of productivity, especially in services, is subject to many caveats, these intersectoral gaps appear sufficiently large to reflect real productivity differences.

industry and services. This suggests further potential growth benefits from future intersectoral resource movements.

Turning to sectoral composition, its effect on aggregate productivity depends on the sector-specific rates of productivity growth (Figure 8). A general pattern, observed across all regions of the world during 1980–2004, is that productivity growth in both industry and agriculture exceeded that in services. For Asia, three other facts stand out.

First, productivity growth was highest in industry—with the exception of India, where productivity grew most rapidly in services. A number of reasons have been put forward for India's performance, including advances in communications technology, which have allowed India to exploit its comparative advantage in services (especially its plentiful supply of trained English-speaking personnel); the successful deregulation of services sectors such as communications;[20] privatization and opening up to foreign direct investment (FDI); and financial sector reforms (Gupta, 2005; and Kochhar and others, 2006).

Second, productivity growth in Asia in both industry and (until recently) services far exceeded that in other regions of the world, consistent with Asia's faster aggregate productivity growth, and implying a catch-up in sectoral productivity toward U.S. levels. Within Asia too, countries with higher productivity growth in one sector tended to have higher productivity growth in other sectors. This suggests that growth is importantly influenced by country-specific factors, which affect similarly the performance of all sectors of an economy.

Third, after the initial takeoff, productivity growth eventually decelerated, especially in services—although this process has not yet begun in China nor India (Figure 9). Indeed, while Asian countries on average continue catching up to advanced-economy industrial productivity levels, in services this process may be coming to a halt before full convergence has been achieved, and in agriculture little catch up has been observed since the end of the Green Revolution. To offset this, as discussed later in the paper, determined policy action is needed to tackle barriers to productivity growth.

Sectoral decomposition of productivity growth

This section attempts to isolate the contributions of sectoral effects and within-sector productivity growth to aggregate labor productivity growth. As mentioned before, the analysis focuses on two types of sectoral effects:

- The sectoral reallocation effect: when a country reallocates labor from a low-productivity to a high-productivity sector, this contributes to raising its aggregate labor productivity (and hence temporarily boosts labor productivity growth).

[20]Productivity levels in the less protected software and telecommunications sectors are about 40–50 percent of U.S. levels. In contrast, productivity levels in the more sheltered retail and retail banking sectors are only, respectively, 6 and 12 percent of U.S. levels. See McKinsey Global Institute, 2001 and 2006.

- The sectoral composition effect: when a country has a higher value added share of high-productivity growth sectors, this will also raise its aggregate labor productivity growth.

The methodology used here builds on the existing "within-country" methodology, which distinguishes between within-sector productivity growth and sectoral reallocation effects, by adding a cross-country, sectoral composition effect. Specifically, aggregate labor productivity growth for any given country and year can first be decomposed as follows:

$$\frac{dy_t}{y_{t-1}} = \sum_j ds_{j,t} \frac{y_{j,t}}{y_{t-1}} + \sum_j \frac{dy_{j,t}}{y_{j,t-1}} s^Y_{j,t-1}.$$

where first difference are denoted by *d,* labor productivity by *y*, employment shares by *s*, value-added shares by s^Y, and sectors by *j*. The first term on the right is the sectoral reallocation effect, where the change in the employment share of a sector is weighted by its productivity (scaled by initial aggregate productivity), while the second term is the contribution of within-sector productivity growth, as measured by the sector's productivity growth weighted by the initial value added share of the sector. Other studies that have used similar decompositions include Denison (1962, 1967) and, more recently, Bloom, Canning, and Malaney (1999) and Dekle and Vandenbroucke (2006).

The second part of the derivation introduces a cross-country dimension, by focusing on the differential in aggregate labor productivity growth between the examined country and a comparator country, say the United States. In this case, the second term, the contribution of within-sector productivity growth can be further decomposed into a sectoral composition effect and a new cross-country measure of the contribution of within-sector productivity growth:

$$\frac{dy_t}{y_{t-1}} - \frac{dy_{US,t}}{y_{US,t-1}} = \left[\sum_j ds_{j,t} \frac{y_{j,t}}{y_{t-1}} - \sum_j ds_{US,j,t} \frac{y_{US,j,t}}{y_{USt-1}} \right]$$
$$+ \left[\sum_j \left(s^Y_{j,t-1} - s^Y_{US,j,t-1} \right) \left(\frac{1}{2} \right) \left(\frac{dy_{j,t}}{y_{j,t-1}} + \frac{dy_{US,j,t}}{y_{US,j,t-1}} \right) \right] + \left[\sum_j \left(\frac{dy_{j,t}}{y_{j,t-1}} - \frac{dy_{US,j,t}}{y_{US,j,t-1}} \right) \left(\frac{s^Y_{j,t-1} + s^Y_{US,j,t-1}}{2} \right) \right].$$

The first term is now simply the difference between the sectoral reallocation effects of the country and the United States; this is called the "sectoral reallocation" effect in the paper. The second term is the sectoral composition effect, measured by the difference between the sector's value added shares in the examined country and the United States, weighted by the average productivity growth of the sector in the two countries. Finally, the last term measures the contribution from within-sector productivity growth, as the difference between the sector's productivity growth in the examined country and the United States, weighted by the average sector's share in value added in the two countries.

This decomposition is carried out for each year of the sample period[21] and then a geometric average of the contributions is calculated for the whole period. The average annual contributions are rescaled to add up to the average aggregate labor productivity growth. It should be noted that the use of average labor productivity (instead of marginal productivity) to evaluate the effect of the reallocation of employment from one sector to the other (the first term) rests on the simplifying assumption that the ratio of marginal labor productivity to average labor productivity is the same in all sectors. Some other studies have used alternative (regression-based) approaches to circumvent the absence of data on marginal labor productivity when estimating the sectoral reallocation effect (e.g., Poirson, 2000 and 2001). Although samples and data sources are different, the order of magnitude obtained in these studies for the sectoral reallocation effect is broadly comparable to the one obtained in this paper.

Thus, the gap in average labor-productivity growth between any given country and, say, the United States can be decomposed into three components, reflecting differences in sectoral shifts; sectoral composition; and within-sector productivity growth. Such a decomposition suggests that sectoral shifts have in general helped Asia catch up to U.S. productivity levels, both because labor moved out of agriculture at a faster rate in Asia, and because the initial intersectoral productivity differentials were higher in Asia (Figure 10).[22] Specifically, sectoral shifts boosted productivity growth in Asia relative to the United States by ½ percentage point per year, out of a total observed differential of 2 percentage points. Regression analysis confirms the potentially large productivity-enhancing effect of employment moving from agriculture to other sectors,[23] in line with existing estimates for developing countries.[24] All Asian subregions except Japan benefited substantially over the last three decades from sectoral shifts, especially China. By contrast, in Latin America, sectoral shifts were too weak to help promote convergence toward the United States.

Turning to the sectoral composition effect, this is positive, though relatively modest, for both Asia and Latin America, reflecting the smaller share of services (where productivity has grown relatively slowly) in these countries than in the United States. Within Asia, the composition effect was especially large in China and the ASEAN-4, reflecting the very high share of industry in their value added.

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[21]This implicitly rebases the sectoral structure in each year, allowing a more precise decomposition of the respective contributions of sectoral effects and productivity than if only the initial and end points of the sample were used.

[22]In the United States, most of the reallocation occurred from industry to services.

[23]Over a broad panel, a 1 percentage point reduction in the average annual change in the agricultural employment share is associated with a 1.5 percentage points increase in average annual labor productivity growth (after controlling for initial productivity and the initial agricultural share in employment).

[24]See, for instance, Poirson (2000 and 2001) and Bloom, Canning, and Malaney (1999). Dekle and Vandenbroucke (2006) find also that labor reallocation from the public to the private nonagricultural sector has played an important role in China's growth in recent years.

Altogether, sectoral shift and composition effects account for about 40 percent of Asia's productivity catch-up toward U.S. levels. Thus, the greater part of Asia's catch-up reflects strong productivity growth *within* both industry and services. Conversely, Latin America's relative stagnation and divergence from the United States largely reflect lagging productivity growth within both industry and services. The key question, to which we return below, is what are the deeper fundamentals, including policy variables, that explain these differences in outcomes.

V. WITHIN MANUFACTURING

A similar analysis was performed to determine to what extent shift and composition effects affected productivity *within* the manufacturing sector. For this purpose, manufacturing was divided into skill-intensive and nonskill-intensive sectors.[25] Asia, and in particular the NIEs, China, and India, stand out as having a relatively large share of manufacturing value added and employment in skill-intensive sectors. This holds compared to both Latin America and (in most cases) the levels that would be predicted based on fundamentals such as income per capita, country size, and population (Figure 11).[26] Since the mid-1960s,[27] the rate at which labor has moved from nonskill to skill-intensive sectors has been about the same as in the United States and other advanced economies, and much higher than in Latin America (although the magnitudes involved are much smaller than is the case for the shift out of agriculture) (Figure 12). The data confirm that both productivity levels and productivity growth are higher in skill-intensive than in nonskill-intensive sectors (Figure 13).[28]

Aggregate manufacturing productivity grew faster in Asia than the United States. However, the differential was smaller than in the case of overall productivity; indeed, manufacturing productivity in the ASEAN-4 and India actually grew more slowly than in the United States (Figure 14). Most of Asia's catch-up in manufacturing productivity was attributable to high productivity growth within skill-intensive sectors. The contribution of sectoral shifts was generally small.[29] Driving this, both the magnitude of labor shifts across manufacturing subsectors, and the productivity differentials between these subsectors, were smaller than

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[25]Specifically, the 28 manufacturing subsectors in the UNIDO database were aggregated into skill-intensive versus non-skill-intensive sectors. Each aggregate contained 14 subsectors. The definition of skill intensity was based on the income share of skilled labor, calculated using the input-output matrix for South Africa (Kochhar and others, 2006).

[26]Hausmann, Hwang, and Rodrik (2005) and Rodrik (2006) also find that China and India export an abnormally high share of products that are typically produced by higher-income countries. Note also that when population is not included as a control, the difference between Asia's actual and predicted skill-intensive employment share rises to 10 percentage points.

[27]For China, reliable data are only available since 1990.

[28]The average gap over the period amounts to, respectively, 35 percent and 0.6 percentage points per year.

[29]This holds even when the analysis is carried out on the full 28 subsector dataset, rather than on just the two broad aggregate sectors.

between agriculture and the nonagricultural sector. The contribution from sectoral composition was actually negative and quite significant for Asia, at close to ½ percentage point per year. This result was driven mostly by Indonesia and Other Asia, where the share of skill-intensive, high productivity-growth sectors is substantially smaller than in the United States. Unlike Asia, Latin America experienced a decline over time in manufacturing productivity relative to the United States, above all because of slower productivity growth within nonskill-intensive sectors, combined with a relatively large share of such sectors in overall manufacturing.

VI. Policy Determinants of Productivity Growth

The analysis so far suggests that Asia's strong productivity performance has in good part reflected differences in within-sector productivity growth rates. Further, those countries that have performed well across countries in a sector also have tended to perform well in other sectors, and this is not purely related to catch-up effects. All this is consistent with a significant role for country-specific factors, such as strong institutions and favorable macroeconomic policies—an issue now examined in greater detail. Intersectoral resource movements have also contributed significantly to Asia's growth, and this section goes on to examine how the policy environment has facilitated such shifts of resources.

In recent years, the large empirical literature on cross-country differences in output growth[30] has emphasized the key role of institutional quality and human capital. The empirical literature on determinants of TFP growth across broad samples of countries is more limited,[31] and has generally emphasized the importance of trade openness.[32] Following the literature, the analysis in this paper examines the following policy and institutional variables:

- Trade policy stance: measured as the fraction of years in which the country was considered as open according to the Welch-Wacziarg, 2003, index;

- Financial sector development: proxied by the private credit extended by deposit money banks and other financial institutions as a percent of GDP from Beck, Kunt, and Levine, 2000;

- Education levels: measured by the average schooling years from Barro and Lee, 2000;

[30]For surveys, see the IMF *World Economic Outlook,* April 2003, Chapter III, and Bosworth and Collins, 2003.

[31]There is, however, a substantial literature on the determinants of productivity differences across industrial countries, as well as national studies on the sources of inter-industry productivity differences.

[32]For instance, Edwards (1998) uses alternative openness indicators to demonstrate that more open countries experience faster TFP growth; Coe, Helpman, and Hoffmaister (1997) show that developing countries that trade with R&D intensive industrial countries have higher productivity growth; and Miller and Upadhyay (2000) find that human capital boosts TFP in low-income countries only when these countries achieve certain levels of openness.

- Institutional quality: measured alternatively by the index of government effectiveness from Kaufmann and Kraay, 2005, in the cross-sectional period-average regression, and by the Cato Institute Index of Economic Freedom, in the decadal regressions;

- Cost of starting a business: expressed as a share of per capita income and taken from the World Bank's Doing Business database.

Initial levels of financial sector development and education are used to minimize endogeneity problems. For the Kaufmann-Kraay institutional index, and the cost of starting a business variable, values are only available for the end of the sample period.

Simple correlations using this paper's dataset tend to confirm previous findings from the literature. Over the period 1965–2005, cross-country differences in productivity growth, as proxied by either labor productivity or TFP growth, were closely related to variables that capture key aspects of the policy environment (Figure 15). In particular, countries with higher productivity growth also tended to have relatively strong institutions, a better-developed financial system, a generally more favorable business climate (as measured by lower costs of starting a business), less restrictive trade policies, higher education levels, and a lower initial share of agricultural employment.

Turning to a more formal econometric analysis, specifications are defined for aggregate labor productivity growth, aggregate TFP growth, industry labor productivity growth, services productivity growth, and labor shifts from agriculture to non-agricultural sectors (one specific source of aggregate productivity growth). In addition to the policy and institutional variables, the productivity growth regressions include the initial productivity level (aggregate or sectoral) to capture possible convergence effects (see Barro, 1997). The aggregate regressions (for labor productivity and TFP) also control for the initial share of employment in agriculture to capture sectoral composition effects. Finally, the specification for intersectoral labor shifts controls for the initial employment share in agriculture, its square (to capture possible nonlinearities), and includes the rates of accumulation of physical and human capital, in line with previous studies (see Poirson, 2000 and 2001). It excludes initial education (which was not significant).

The dataset covers the period 1965–2005, and the model is estimated using two separate approaches. First, cross-country regressions covering the whole period are estimated using weighted least squares (with robust standard errors).[33] Table 1 shows results for a basic model that omits institutions and the cost of starting a business. These suggest that strong productivity growth relies importantly on:

- A convergence effect. This is indicated by a negative and significant coefficient on initial productivity in all regressions. In addition, the regressions for aggregate labor productivity suggest that countries with a larger initial share of agricultural employment

[33]Each country's variance is assumed inversely proportional to the number of years for which the country's data are available.

tend to experience slower growth. Unsurprisingly, the initial employment share in agriculture is also a major determinant of the magnitude of labor shifts.

- Trade openness and financial sector development. Both variables are strongly significant determinants of aggregate and within-sector productivity growth. They also have a significant impact on stimulating employment shifts out of agriculture, which suggests that they may boost productivity to a large extent through sectoral reallocation. Greater financial development is likely to promote the movement of labor toward industry and services by, in particular, alleviating liquidity constraints facing current and potential entrepreneurs (see Rajan and Zingales, 1998).

- Education. Initial education levels are most significant, both economically and statistically, in the regressions for within-sector productivity growth. For labor shifts from agriculture, the small and only weakly significant effects from human and physical capital accumulation may reflect that these variables are themselves endogenous to other determinants of labor shifts, and have little separate effect (see also Poirson, 2000 and 2001).

In Table 2, the model is augmented with the measures of institutions and business climate. The results underscore the importance of these variables. In particular, the cost of starting a business has an economically and statistically significant impact on productivity growth in all regressions. Controlling for this variable tends to lower the significance of financial sector development in the regressions. In the equation for labor shifts, no significant effect of start-up costs is found. However, a more general specification allowing for an interaction term between the cost of starting a business and financial sector development suggests that the latter matters to the extent that it reduces the negative effects of start-up costs.

Institutions also have a significant impact on productivity growth at the sectoral level.[34] However, controlling for this variable weakens the significance of the openness and initial schooling variables (in line with earlier results from the literature, and subject to the earlier caveat about possible endogeneity of the institutional variable). As argued in Chapter III of the September 2005 *World Economic Outlook*, openness and education may affect growth outcomes in part precisely through their impact on institutional quality. Other fundamentals (such as the quality of macroeconomic policies and foreign direct investment) were not significant once these main determinants were controlled for, and were thus omitted from the regressions.

In addition, cross-country regressions covering separately each decade during 1975–2004 were also estimated using SUR. The sample here included those 27 countries for which observations on all variables were available for 3 decades, and coefficients were constrained to be equal across decades.[35] The results (see Tables 3 and 4) were broadly similar to those

[34]No significant effect of institutional quality on intersectoral labor shifts was found and the coefficient has the wrong sign.

[35]These constraints were broadly accepted for the first two decades. In the last decade, coefficients often appeared to be significantly different, although no clear pattern could be detected.

discussed above, except that the time-varying measure of institutional quality used here (the Cato Index of Economic Freedom) performed quite poorly. The results were also robust to expanding the number of countries, by including all those for which observations were available for 2 decades.

VII. THE ASIAN STORY

Figure 16 shows that Asia performs better than Latin America and other developing countries on most of the above determinants of productivity, and especially with regard to institutional quality, trade openness, and financial sector development, suggesting that these have been important factors behind Asia's strong productivity growth. That said, the quality of Asia's institutions, business climate, and policies do not yet match those of advanced economies. In this context, it is worth underscoring that the quality of a country's institutions are not a given, and can be strengthened by reforms, even within relatively short periods.[36]

The econometric analysis allows quantifying the contributions of various determinants to productivity growth (Figure 17). Apart from initial conditions—which are the main factor explaining differences in productivity growth—trade openness, institutional quality, and to a lesser extent the ease of starting a business explained about 40 percent of the positive productivity growth differential between Asia and other developing economies, while they reduced the positive productivity growth differential between Asia and other advanced economies in half. Trade openness acts mostly by stimulating employment shifts from agriculture to other sectors of the economy,[37] while institutional quality and the ease of starting a business mostly affect within-sector productivity growth.

Regional aggregates, however, can mask significant intraregional variations. Most prominently, trade liberalization played an important role in supporting the structural transformation process, and encouraging the movement of labor out of agriculture, in Japan, the NIEs, and the ASEAN-4. In contrast, relatively low openness in China and India significantly slowed this process. Financial development also helped promote the movement of labor toward industry and services in both Japan and the NIEs, but less so elsewhere (especially in India). Finally, institutional quality and the ease of starting a business contributed to stimulate within-sector productivity growth in Japan and the NIEs, while the lower performance of India and Other Asia on these indicators exerted a drag on their productivity growth.

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[36]For instance, the Korean civil service was radically transformed during the 1960s, through, among other moves, the introduction of merit-based systems in recruitment and promotion, eventually becoming a well-regarded bureaucracy by the 1970s (World Bank, 1993, Box 4.4).

[37]Due to sectoral data availability, the sample period in the panels for changes in the agriculture employment share and productivity growth in industry and services is shorter than for aggregate productivity growth. Over this shorter sample period, trade openness was actually slightly higher on average in other developing economies than in Asia.

Cross-country datasets can, admittedly, only provide crude indications of the factors behind individual countries' performance.[38] For example, while the cross-country analysis above does not explain well China's remarkable productivity growth, more detailed, country-specific studies confirm a strong link to its post-1979 reforms. These involved, among other moves, the substantial development of property rights, whose impact was most dramatically felt in agriculture; the opening of markets; the removal of barriers to capital and labor mobility; and the setting up of Special Economic Zones (see Tseng and Rodlauer, 2003, in particular Chapter II; and the April 2005 IMF *World Economic Outlook*). In contrast, slow TFP growth in the ASEAN-4, and especially in the Philippines, may have reflected, among other things, weaknesses in the quality of institutions and of infrastructure (IMF, 2005a and 2006a).

As discussed, productivity growth in Asia has been relatively slow in service sectors. Indeed, productivity in services relative to the United States has stagnated in recent years. Empirical studies suggest that deregulation and further opening to foreign competition would be particularly beneficial in unlocking these sectors' growth potential (see Nicoletti and Scarpetta, 2003, Conway and others, forthcoming, as well as the previous discussion of India). Priorities include steps to promote greater competition in infrastructure-related services, such as telecommunications; further opening the retail and financial sectors to foreign competition (McKinsey Global Institute, 2001 and 2006); and lifting restrictions on entry into social services, including health and education. Increasing the transparency and consistency of regulation and streamlining administrative procedures would also prove advantageous. For instance, in India, where regulation of some sectors is decentralized, harmonizing regulations across states would facilitate greater private sector participation.

Much effort has recently been devoted to improving the quality of Asian corporate governance. Better governance may be expected to yield significant benefits in terms of growth and productivity, particularly for those industries that rely most heavily on external finance (Khatri, Leruth, and Piesse, 2002). Yet, while reforms past the past few years have led to important improvements, the region still lags significantly behind advanced-economy standards (De Nicolò, Laeven, and Ueda, 2006).

Looking ahead, late developers (such as the ASEAN-4, China, and India) will continue to enjoy favorable catch-up effects for the foreseeable future. Nevertheless, this analysis suggests that continued convergence toward advanced-economy income and productivity levels will require further structural reforms to maintain and indeed improve the favorable business climate. In particular, this will require improved corporate governance, as well as further upgrading of education levels and continued trade liberalization, so as to both underpin strong within-sector productivity growth and create incentives for further labor reallocation toward higher-productivity sectors.

[38]Among other issues, cross-country panel data for most institutional measures are not widely available, making it difficult to relate productivity growth to the change in (as opposed to level of) institutional quality.

VIII. CONCLUSIONS

Asia has enjoyed a remarkable growth performance since the end of World War II. Both income per capita and labor productivity in most sectors have rapidly increased toward advanced-economy levels. An analysis of this striking record highlights several key lessons, both for Asian countries aiming to continue converging toward advanced-economy income levels, and for other developing economies seeking to emulate their success.

First, in most of Asia growth has benefited from rapid increases in TFP, as well as fast accumulation of both physical and human capital. In turn, these developments reflected a stronger institutional and policy environment (including with respect to financial development, the business climate, and in many cases trade openness) than observed in other developing economies. Looking ahead, late developers in Asia, and indeed other parts of the world, can draw important lessons from these aspects of the experience of fast-growing Asian economies. In particular, the findings in this paper underline the importance of fostering higher standards of education, so as to support skill- and innovation-based industries and move up the value-added chain, as well as to continue strengthening the quality of corporate and financial-sector governance. Related to this, financial development also plays a critical part in the growth process. Within Asia, financial systems, still heavily centered on banks, will need to be broadened and deepened, for instance through efforts to develop the corporate bond market; among other things, this will facilitate the financing of required infrastructural improvements.

Second, Asia's long-run macroeconomic achievements have also depended importantly on policies that encouraged resource shifts from low- to high-productivity sectors. This applied both to the overall shift from agriculture toward industry and services and to the continuing move within manufacturing toward higher value-added products. Looking ahead, a continuing shift of labor away from the still-large agricultural sector will, especially in lower-income countries, provide an important channel to boost growth and reduce rural poverty. Further efforts to increase trade openness, ensure widespread access to education and health care, and encourage entrepreneurship will help these countries sustain this vital transition. More generally, ensuring significant structural flexibility, including in labor markets, while establishing effective social safety nets will prove increasingly important as Asia strives to maintain its competitive edge, provide growing employment in industry and services, and make significant inroads into poverty eradication.

Third, in Asia (as in many advanced economies) there remains a persistent gap in productivity growth rates between industry and services, partly reflecting the sheltered nature of many service sectors. Further, over time Asian service-sector productivity growth has decelerated markedly, in many cases stalling convergence toward advanced-economy productivity levels; this can be viewed as an indication of missed opportunities. As economies grow wealthier and become ever more focused on services, it will prove increasingly important to encourage competition and productivity growth in this sector, including by removing barriers to entry, streamlining regulations, and strengthening human capital.

REFERENCES

Barro, Robert J., 1997, "Determinants of Economic Growth: A Cross-Country Empirical Study," (Cambridge, Massachusetts: MIT Press).

———, and Jong-Wha Lee, 2000, "International Data on Educational Attainment: Updates and Implications," CID Working Paper No. 42 (Cambridge, Massachusetts: Center for International Development at Harvard University).

———, 2001, "Economic Growth in East Asia Before and After the Financial Crisis," NBER Working Paper No. 8330 (Cambridge, Massachusetts: National Bureau of Economic Research).

Becht, Marco, Patrick Bolton, and Ailsa Roell, 2003, "Corporate Governance and Control," in *Handbook of the Economics of Finance*, ed. by George M. Constantinides, Milton Harris, and Rene M. Stulz, Vol. 1, pp. 1–109 (Amsterdam, Boston: Elsevier/North-Holland).

Beck, Thorsten, Asli Demigüç-Kunt, and Ross Levine, 2000, "A New Database on Financial Development and Structure," World Bank Economic Review 14, pp. 597–605 (Washington: World Bank).

Berglöf, Erik, and Stijn Claessens, 2006, "Enforcement and Good Corporate Governance in Developing Countries and Transition Economies," *The World Bank Research Observer*, Vol. 21, No.1 (Spring), pp. 121–50.

Bhattachrya, Utpal, Hazem Daouk, and Michael Welker, 2003, "The World Price of Earnings Opacity," *Accounting Review*, Vol. 78 (July), pp. 641–78.

Bloom, David E., David Canning, and Pia N. Malaney, 1999, "Demographic Change and Economic Growth in Asia," CID Working Paper No. 15 (Cambridge, Massachusetts: Center for International Development at Harvard University).

Bosworth, Barry, and Susan M. Collins, 2003, "The Empirics of Growth: an Update," *Brookings Papers on Economic Activity: 2*, Brookings Institution.

Calderon, César, and Luis Serven, 2004, "The Effects of Infrastructure Development on Growth and Income Distribution," World Bank Policy Research Working Paper No. 3400 (Washington: World Bank).

Cerra, Valerie, and Sweta C. Saxena, 2003, "Did Output Recover from the Asian Crisis," IMF Working Paper 03/48 (Washington: International Monetary Fund).

Chen, Shaohua, and Martin Ravallion, 2004, "How Have theWorld's Poorest Fared Since the Early 1980s?" World Bank Research Observer, Vol. 9 No.2 (Fall), pp. 141–69.

Cheung, Stephen, and Hasung Jang, forthcoming, "PECC Macro Corporate Governance Scorecard Project: Evaluation of Corporate Governance in East Asian Economies."

CIFAR, 1993, International Accounting and Auditing Trends, 3rd edition (Princeton: Center for International Financial Analysis and Research, Inc.).

Coe, David T., Elhanan Helpman and Alexander W. Hoffmaister, 1997, "North-South R&D Spillovers," *Economic Journal*, Vol. 107 (January), pp. 134–49.

Coles, Jeffrey, Michael Lemmon, and Felix Meschke, forthcoming, "Structural Models and Endogeneity in Corporate Finance: The Link Between Managerial Ownership and Performance," *Journal of Financial Economics*.

Conway, Paul, Donato De Rosa, Giuseppe Nicoletti, and Faye Steiner, forthcoming, "Regulation, Competition and Productivity Convergence," OECD Economics Department Working Paper (Paris: Organization for Economic Cooperation and Development).

De Nicolò, Gianni, Luc Laeven, and Kenichi Ueda, 2006, "Corporate Governance Quality in Asia: Comparative Trends and Impact," (unpublished; Washington: International Monetary Fund, Research Department).

Denison, Edward F., 1962, "The Sources of Economic Growth in the United States and the Alternatives Before Us," Supplementary Paper of the Committee for Economic Development No. 13 (New York).

———, 1967, "Why Growth Rates Differ; Postwar Experience in Nine Western Countries," (Washington: Brookings Institution).

Dekle, Robert, and Guillaume Vandenbroucke, 2006, "A Quantitative Analysis of China's Structural Transformation," (unpublished; University of Southern California). Available via the Internet at: http://ssrn.com/abstract=902497.

Edwards, Sebastian, 1998, "Openness, Productivity, and Growth: What Do We Really Know?" *Economic Journal*, Vol. 108 (March), pp. 383–98.

Fajnzylber, Pablo, and Daniel Lederman, 1999, "Economic Reforms and Total Factor Productivity Growth in Latin America and the Caribbean (1950–95). An Empirical Note," Policy Research Working Paper No. 2114 (Washington: World Bank).

Fukao, Kyoji, Tomohiko Inui, Hiroki Kawai, and Tsutomu Miyagawa, 2003, "Sectoral Productivity and Economic Growth in Japan: 1970–98: An Empirical Analysis Based on the JIP Database," ESRI Cabinet Office, Discussion Paper Series No. 67 (Tokyo: Economic and Social Research Institute).

Gupta, Poonam, 2005, "Understanding the Growth Momentum in India's Services," Chapter II in *India: Selected Issues*, IMF Country Report No. 05/87 (Washington: International Monetary Fund).

Hausmann, Ricardo, Jason Hwang, and Dani Rodrik, 2005, "What You Export Matters," NBER Working Paper No. 11905 (Cambridge, Massachusetts: National Bureau of Economic Research).

Hausmann, Ricardo, Lant Pritchett, and Dani Rodrik, 2005, "Growth Accelerations," *Journal of Economic Growth*, Vol. 10, No. 4 (December), pp. 303–29.

Hayashi, Fumio, and Edward Prescott, 2002, " The 1990s in Japan: A Lost Decade," *Review of Economic Dynamics*, Vol. 5 (January), pp. 206–35.

Himmelberg, Charles, Glenn Hubbard, and Darius Palia, 1999, "Understanding the Determinants of Managerial Ownership and the Link Between Ownership and Performance," *Journal of Financial Economics*, Vol. 53 (September), pp. 353–84.

IMF, 2005a, *Indonesia: Selected Issues*, IMF Country Report No. 05/327 (Washington: International Monetary Fund).

———, 2005b, *Regional Outlook*, September 2005, Asia and Pacific Department, (Washington: International Monetary Fund).

———, 2006a, *Philippines: Selected Issues*, IMF Country Report No. 06/181 (Washington: International Monetary Fund).

———, 2006b, *Japan: Selected Issues*, IMF Country Report No. 06/276 (Washington: International Monetary Fund).

Jorgenson, Dale W., Mun S. Ho, and Kevin J. Stiroh, 2005, *Productivity: Information Technology and the American Growth Resurgence*, Vol. 3 (Cambridge, Massachusetts: MIT Press).

Jorgenson, Dale W., and Kazuyuki Motohashi, 2005, " Information Technology and the Japanese Economy," *Journal of the Japanese and International Economies*, Vol. 19 (December), pp. 460–481.

Jorgenson, Dale W., and Khuong Vu, 2005, "Information Technology and the World Economy," *Scandinavian Journal of Economics*, Vol. 107 (December), pp. 631–50.

Jorgenson, Dale W., forthcoming, *Accounting for Growth in the Information Age*, in *Handbook of Economic Growth* ed. by Philippe Aghion and Steven Durlauf (Amsterdam: North-Holland).

Kaufmann, Daniel, Aart Kraay, and Massimo Mastruzzi, 2005, "Governance Matters IV: Governance Indicators for 1996–2004," World Bank Policy Research Working Paper No. 3630 (Washington: World Bank).

Khatri, Yougesh, Luc Leruth, and Jenifer Piesse, 2002, "Corporate Performance and Governance in Malaysia," IMF Working Paper 02/152 (Washington: International

Monetary Fund). Also available via the Internet at www.imf.org/external/pubs/ft/wp/2002/wp02152.pdf.

Kochhar, Kalpana, Utsav Kumar, Raghuram Rajan, and Arvind Subramanian, 2006, "India's Patterns of Development: What Happened, What Follows," NBER Working Paper No. 12023 (Cambridge, Massachusetts: National Bureau of Economic Research).

Leuz, Christian, Dhananjay Nanda, and Peter Wysocki, 2003, "Earnings Management and Investor Protection: An International Comparison," *Journal of Financial Economics*, Vol. 69 (September), pp. 505–27.

Maddison, Angus, 2003, *The World Economy: Historical Statistics*, Development Centre Studies (Paris: Organization for Economic Cooperation and Development).

McKinsey Global Institute, 2001, "India: The Growth Imperative," (Washington: McKinsey and Company).

———, 2006, *Accelerating India's Growth through Financial System Reform* (Washington: McKinsey and Company).

Miller, Stephen M., and Mukti P. Upadhyay, 2000, "The Effects of Openness, Trade Orientation, and Human Capital on Total Factor Productivity," *Journal of Development Economics*, Vol. 63 (December), pp. 399–423.

Morck, Randall, Bernard Yeung, and Wayne Yu, 2000, "The Information Content of Stock Markets: Why do Emerging Markets Have Synchronous Price Movements?" *Journal of Financial Economics*, Vol. 58, Issues 1–2, pp. 215–60.

Nehru, Vikram, and Ashok Dhareshwar, 1993, "A New Database on Physical Capital Stock: Sources, Methodology and Results," *Revista de Análisis Económico*, Vol. 8, No. 1 (June), pp. 37–59.

Nicoletti, Giuseppe, and Stefano Scarpetta, 2003, "Regulation andProductivity Growth," *Economic Policy*, No. 36/2.

OECD, 2003, *White Paper on Corporate Governance in Asia.* (Paris: Organization for Economic Cooperation and Development).

Park, Yung Chul, and Jong-Wha Lee, 2001, "Recovery and Sustainability in East Asia," NBER Working Paper No. 8373 (Cambridge, Massachusetts: National Bureau of Economic Research).

Poirson, Hélène, 2000, "Factor Reallocation and Growth in Developing Countries," IMF Working Paper 00/94 (Washington: International Monetary Fund).

———, 2001, "The Impact of Intersectoral Labour Reallocation on Economic Growth," *Journal of African Economies*, Vol. 10 (March), pp. 37–63.

———, 2005, "The Tax System in India: Could Reform Spur Growth?" IMF Working Paper 06/93 (Washington: International Monetary Fund).

Rajan, Raghuram, and Luigi Zingales, 1998, "Financial Dependence and Growth," *American Economic Review*, Vol. 88 (June), pp. 559–86.

Rodrik, Dani, 2006, "What's So Special About China's Exports?" NBER Working Paper No. 11947 (Cambridge, Massachusetts: National Bureau of Economic Research).

Sarel, Michael, 1996, "Growth in East Asia: What We Can and What We Cannot Infer," Economic Issues No. 1 (Washington: World Bank). Available via the Internet at: www.imf.org/external/pubs/ft/issues1/index.htm.

Tseng, Wanda, and Markus Rodlauer, 2003, C*hina: Competing in the Global Economy* eds. (Washington: International Monetary Fund).

United Nations, 2003, *World Population Prospects: The 2002 Revision*, Population Division, Department of Economic and Social Affairs, (New York: United Nations).

Wacziarg, Romain, and Karen Horn Welch, 2003, "Trade Liberalization and Growth: New Evidence," NBER Working Paper No. 10152 (Cambridge, Massachusetts: National Bureau of Economic Research).

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

———, 2006, *World Development Indicators* (Washington: World Bank).

Young, Alwyn, 1995, "The Tyranny of Numbers: Confronting the Statistical Realities of the East Asian Growth Experience," *Quarterly Journal of Economics*, Vol. 110 (August), pp. 641–80.

———, 2003, "Gold into Base Metals: Productivity Growth in the People's Republic of China during the Reform Period," *Journal of Political Economy*, Vol. 111 No. 6 (December), pp. 1220–61.

Table 1. Determinants of Productivity Growth and Intersectoral Labor Shifts: Cross-Country OLS Regressions, Excluding Institutions and Investment Climate

(Dependent variable)

	Labor Productivity Growth (1)	TFP Growth (2)	Industry Labor Productivity Growth (3)	Services Labor Productivity Growth (4)	Labor Shift Out of Agriculture (5)
Initial Productivity	-0.021***	-0.0081***	-0.027***	-0.021***	
	(0.003)	(0.0025)	(0.0043)	(0.0049)	
Initial Human Capital[1]	0.0015**	-0.00020	0.0039***	0.0027***	
	(0.00065)	(0.00074)	(0.0011)	(0.0010)	
Trade Openness[2]	0.025***	0.023***	0.027***	0.019*	0.50***
	(0.0045)	(0.006)	(0.0089)	(0.010)	(0.12)
Initial Financial Development[3]	0.0044**	0.0020	0.0073**	0.0055**	0.093**
	(0.0019)	(0.0019)	(0.0031)	(0.0027)	(0.037)
Initial Agricultural Employment[4]	-0.00027**	-0.00018***			0.030***
	(0.00011)	(0.000081)			(0.0037)
Initial Agricultural Employment Squared[4]					-0.00024***
					(0.000049)
Growth of Physical Capital / Labor					0.57
					(0.61)
Growth of Human Capital[1]					6.6*
					(3.5)
Number of countries	50	50	50	50	50
R-squared	0.71	0.47	0.44	0.34	0.81

Notes: All regressions are cross-sectional OLS regressions covering the period from 1965 (or earliest available year) to 2004. White's heteroskedasticity-consistent standard errors are reported between brackets. *, **, and *** denote significance at, respectively, the 10 percent, 5 percent, and 1 percent level. In column (5), the set of independent variables also includes industry's share in total employment; the estimated coefficient proved statistically insignificant.

[1]"Human Capital" is measured using average schooling years, from Barro and Lee (2000).

[2]Fraction of the sample period in which a country is considered open, according to the Wacziarg and Welch (2003) indicator.

[3]Initial private credit extended by deposit money banks and other financial institutions as a percent of GDP. No data for China or Taiwan Province of China.

[4]"Agricultural Employment" refers to agriculture's share in total employment.

Table 2. Determinants of Productivity Growth and Intersectoral Labor Shifts: Cross-Country OLS Regressions, Including Institutions and Investment Climate
(Dependent variable)

	Labor Productivity Growth (1)	TFP Growth (2)	Industry Labor Productivity Growth (3)	Services Labor Productivity Growth (4)	Labor Shift Out of Agriculture (5)
Initial Productivity	-0.018***	-0.0060**	-0.023***	-0.021***	
	(0.0023)	(0.0024)	(0.0042)	(0.0034)	
Initial Human Capital[1]	-0.00012	-0.0012*	-0.00066	-0.00080	
	(0.00068)	(0.00068)	(0.0013)	(0.00085)	
Trade Openness[2]	0.020***	0.019*	0.010	0.0044	0.54***
	(0.0058)	(0.0084)	(0.010)	(0.0078)	(0.13)
Initial Financial Development[3]	0.0013	-0.000080	-0.0012	-0.00081	0.088**
	(0.0015)	(0.0019)	(0.0028)	(0.0022)	(0.036)
Cost of Starting a Business[4]	-0.12***	-0.076**	-0.18**	-0.13**	-1.1
	(0.028)	(0.035)	(0.087)	(0.054)	(1.4)
Government Effectiveness[5]	0.0032	0.0022	0.013***	0.012***	-0.018
	(0.0025)	(0.0030)	(0.0033)	(0.0026)	(0.052)
Initial Agricultural Employment[6]	-0.00017**	-0.00011			0.029***
	(0.000081)	(0.000083)			(0.0044)
Initial Agricultural Employment Squared[6]					-0.00022***
					(0.000061)
Growth of Physical Capital / Labor					0.34
					(0.86)
Growth of Human Capital[1]					7.6*
					(4.0)
Number of countries	50	50	50	50	50
R-squared	0.80	0.54	0.68	0.66	0.82

Notes: All regressions are cross-sectional OLS regressions covering the period from 1965 (or earliest available year) to 2004. White's heteroskedasticity-consistent standard errors are reported between brackets. *, **, and *** denote significance at, respectively, the 10 percent, 5 percent, and 1 percent level. In column (5), the set of independent variables also includes industry's share in total employment; the estimated coefficient proved statistically insignificant.

[1]"Human Capital" is measured using average schooling years, from Barro and Lee (2000).

[2]Fraction of the sample period in which a country is considered open, according to the Wacziarg and Welch (2003) indicator.

[3]Initial private credit extended by deposit money banks and other financial institutions as a percent of GDP. No data for China or Taiwan Province of China.

[4]The cost of starting a business, as a percentage of income per capita, from the World Bank, *Doing Business* database.

[5]From Kaufmann, Kraay, and Mastruzzi (2005).

[6]"Agricultural Employment" refers to agriculture's share in total employment.

Table 3. Determinants of Productivity Growth and Intersectoral Labor Shifts: Cross-Country Decade-Average SUR Regressions, Excluding Institutions and Investment Climate
(Dependent variable)

	Labor Productivity Growth	TFP Growth	Industry Labor Productivity Growth	Services Labor Productivity Growth	Labor Shift Out of Agriculture
	(1)	(2)	(3)	(4)	(5)
Initial Productivity	-0.019***	-0.012**	-0.032***	-0.026***	
	(0.0057)	(0.0048)	(0.0063)	(0.0056)	
Initial Human Capital[1]	0.00042	-0.000058	0.0059***	0.0024*	
	(0.0012)	(0.0010)	(0.0017)	(0.0014)	
Trade Openness[2]	0.019***	0.019***	0.020***	0.015**	0.26***
	(0.0049)	(0.0044)	(0.0078)	(0.0065)	(0.10)
Initial Financial Development[3]	0.0072**	0.0065**	0.0068	0.011***	0.048
	(0.0029)	(0.0027)	(0.0043)	(0.0038)	(0.051)
Initial Agricultural Employment[4]	-0.00014	-0.00014			0.043***
	(0.00020)	(0.00017)			(0.0060)
Initial Agricultural Employment Squared[4]					-0.00046***
					(0.000083)
Growth of Physical Capital / Labor					1.7*
					(0.93)
Growth of Human Capital[1]					6.2**
					(3.1)
Number of countries	27	27	27	27	27
Number of observations	81	81	81	81	81
R-squared	0.23	0.21	0.37	0.36	0.63

Notes: All regressions are repeated cross-sectional regressions covering the period from 1975 to 2004; each decade is estimated separately using SUR, and coefficients are constrained to be equal across decades. White's heteroskedasticity-consistent standard errors are reported between brackets. *, **, and *** denote significance at, respectively, the 10 percent, 5 percent, and 1 percent level. In column (5), the set of independent variables also includes industry's share in total employment; the estimated coefficient proved statistically insignificant.

[1]"Human Capital" is measured using average schooling years, from Barro and Lee (2000).

[2]Fraction of the sample period in which a country is considered open, according to the Wacziarg and Welch (2003) indicator.

[3]Initial private credit extended by deposit money banks and other financial institutions as a percent of GDP. No data for China or Taiwan Province of China.

[4]"Agricultural Employment" refers to agriculture's share in total employment.

Table 4. Determinants of Productivity Growth and Intersectoral Labor Shifts: Cross-Country Decade-Average SUR Regressions, Including Institutions and Investment Climate
(Dependent variable)

	Labor Productivity Growth (1)	TFP Growth (2)	Industry Labor Productivity Growth (3)	Services Labor Productivity Growth (4)	Labor Shift Out of Agriculture (5)
Initial Productivity	-0.018***	-0.012**	-0.032***	-0.026***	
	(0.0058)	(0.0050)	(0.0063)	(0.0056)	
Initial Human Capital[1]	1.12e-06	-0.00031	0.0057***	0.0021	
	(0.0013)	(0.0011)	(0.0017)	(0.0015)	
Trade Openness[2]	0.019***	0.019***	0.020***	0.015**	0.28***
	(0.0050)	(0.0044)	(0.0078)	(0.0065)	(0.10)
Initial Financial Development[3]	0.0060*	0.006**	0.0061	0.010***	0.054
	(0.0031)	(0.0028)	(0.0045)	(0.0040)	(0.052)
Institutional Quality[4]	0.0028	0.0013	0.0019	0.0030	-0.036
	(0.0021)	(0.002)	(0.0033)	(0.0027)	(0.041)
Initial Agricultural Employment[5]					0.042***
					(0.0062)
Initial Agricultural Employment Squared[5]					-0.00044***
					(0.000086)
Growth of Physical Capital / Labor					1.84**
					(0.93)
Growth of Human Capital[1]					5.7*
					(3.2)
Number of countries	27	27	27	27	27
Number of observations	81	81	81	81	81
R-squared	0.24	0.20	0.30	0.46	0.53

Notes: All regressions are repeated cross-sectional regressions covering the period from 1975 to 2004; each decade is estimated separately using SUR, and coefficients are constrained to be equal across decades. White's heteroskedasticity-consistent standard errors are reported between brackets. *, **, and *** denote significance at, respectively, the 10 percent, 5 percent, and 1 percent level. In column (5), the set of independent variables also includes industry's share in total employment; the estimated coefficient proved statistically insignificant.

[1]"Human Capital" is measured using average schooling years, from Barro and Lee (2000).

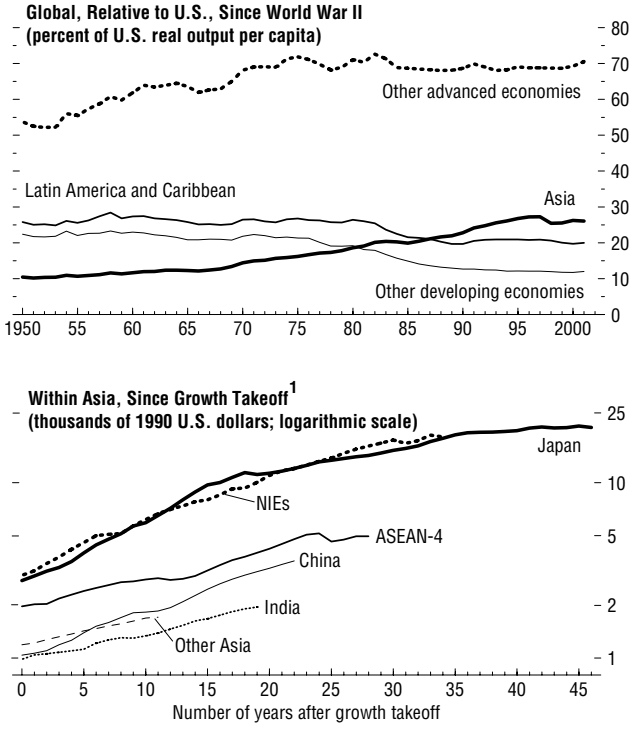
[2]Fraction of the sample period in which a country is considered open, according to the Wacziarg and Welch (2003) indicator.

[3]Initial private credit extended by deposit money banks and other financial institutions as a percent of GDP. No data for China or Taiwan Province of China.

[4]As proxied by the Cato Institute Index of Economic Freedom.

[5]"Agricultural Employment" refers to agriculture's share in total employment.

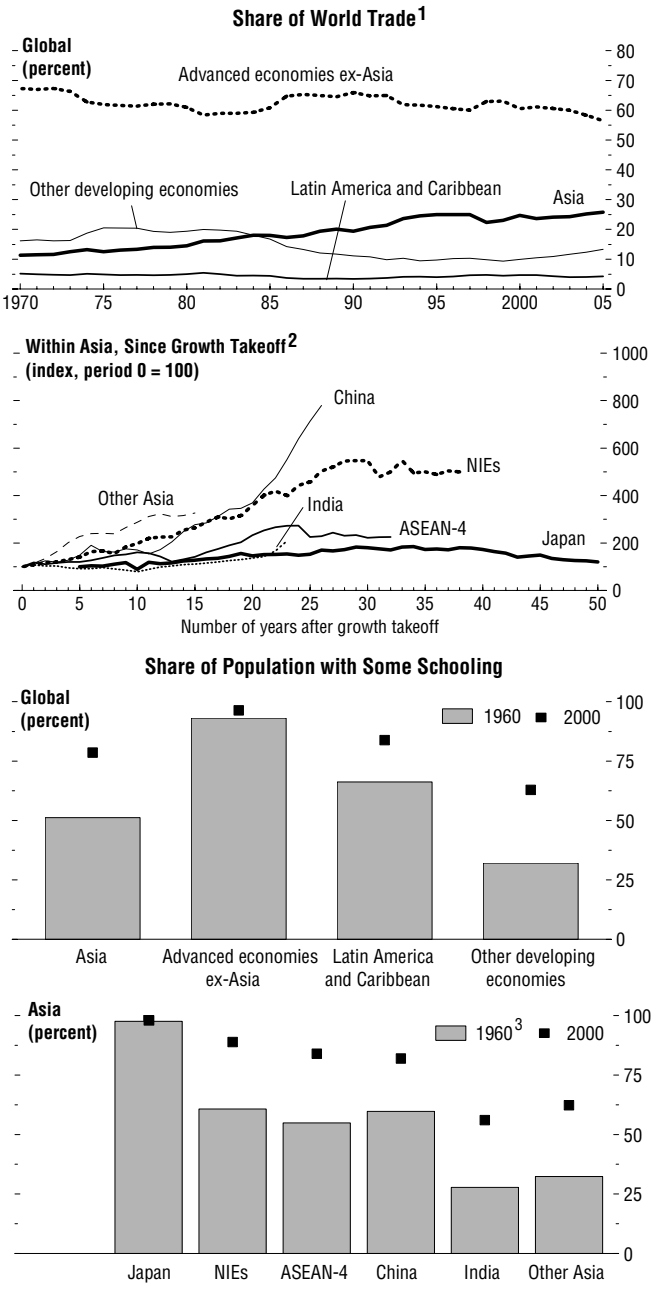
Figure 1. Output Per Capita



Sources: Maddison (2003); and *World Economic Outlook* (WEO) database.

[1]The growth takeoff is defined as occurring in 1955 for Japan, 1967 for the newly industrialized economies (NIEs), 1973 for the ASEAN-4 (Indonesia, Malaysia, the Philippines, and Thailand), 1979 for China, 1982 for India, and 1990 for other Asian economies.

Figure 2. Selected Indicators



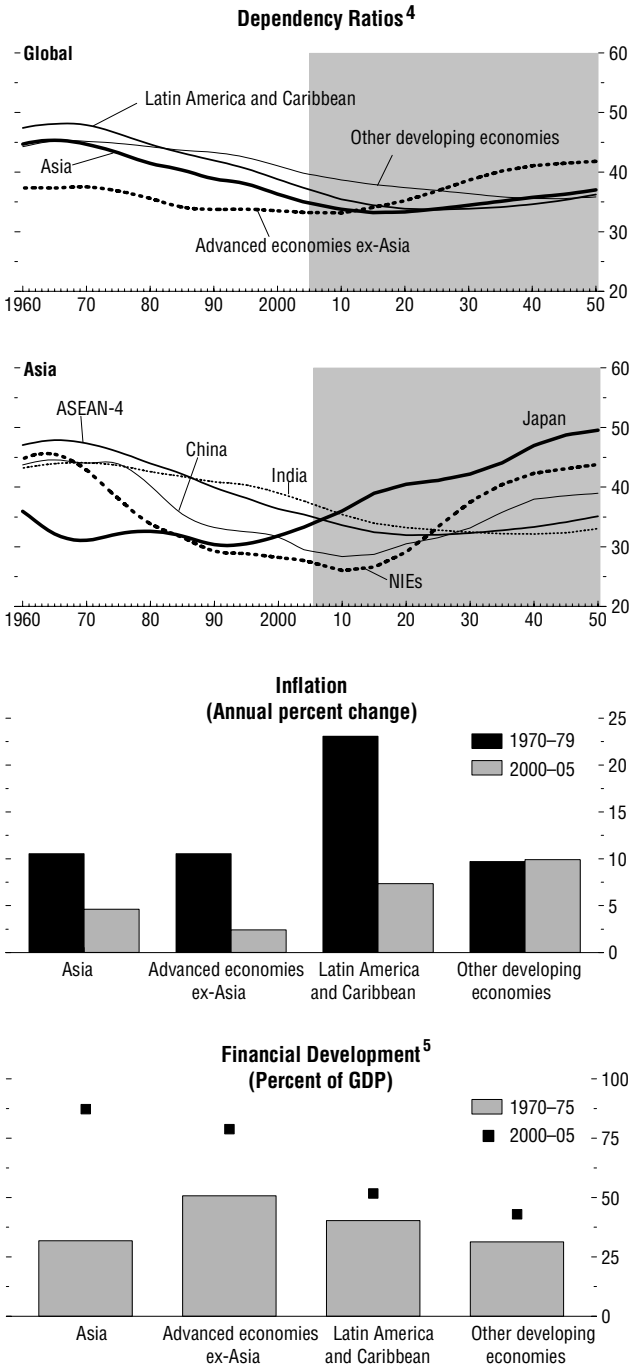
Sources: World Bank, *World Development Indicators* (2006); CEIC database; United Nations, *World Population Prospects: The 2002 Revision* (2003); Barro and Lee (2000); and *World Economic Outlook* (WEO) database.

[1] Defined as (total exports + total imports)/(world exports + world imports).

[2] The growth takeoff is defined as occurring in 1955 for Japan, 1967 for the newly industrialized economies (NIEs), 1973 for ASEAN-4 (Indonesia, Malaysia, the Philippines, and Thailand), 1979 for China, 1982 for India, and 1990 for other Asian economies. For this figure, for Japan, Period 5 = 100, reflecting data availability.

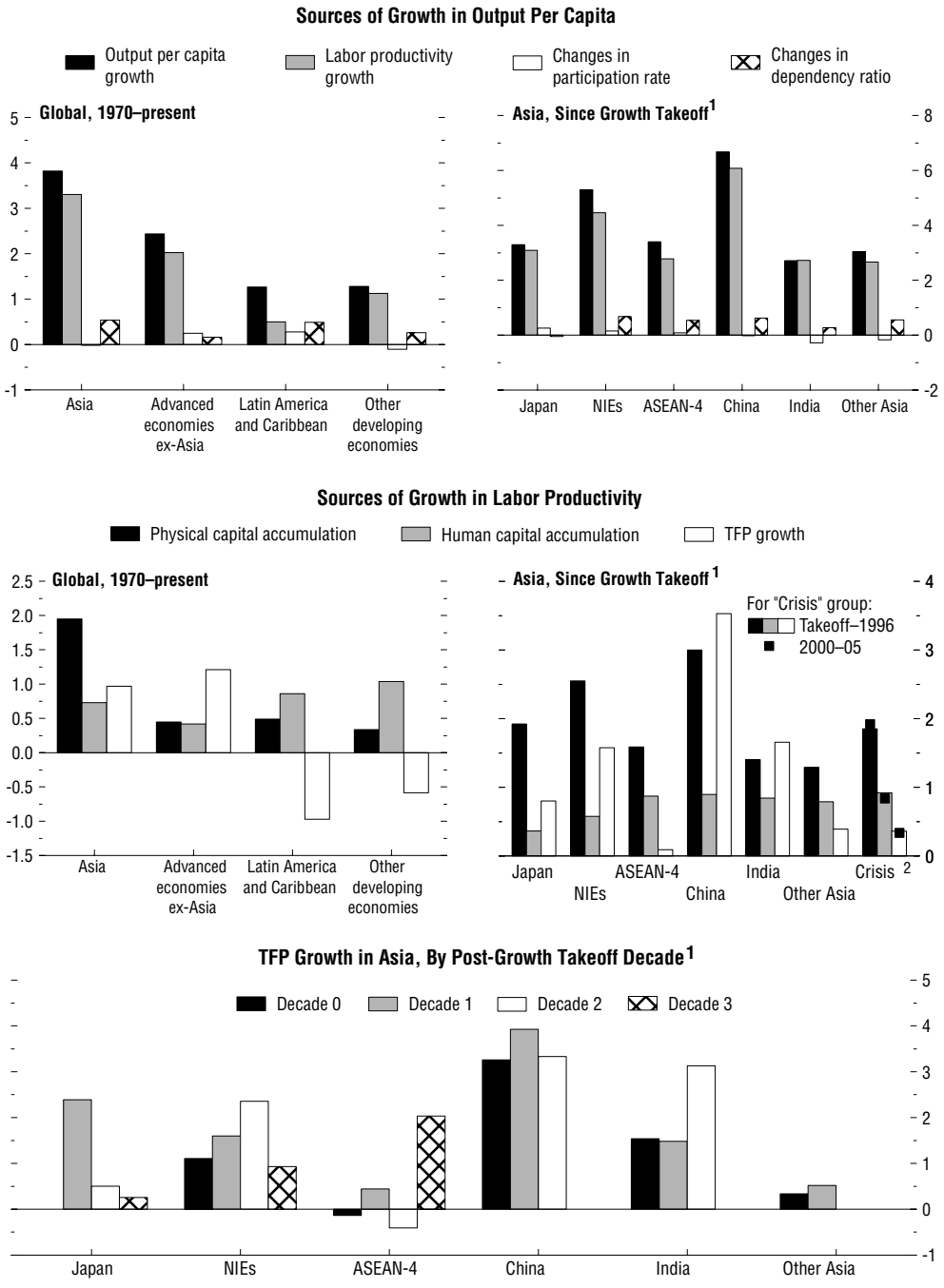
[3] For China, the bar represents the 1975 value, reflecting data availability.

Figure 2. Selected Indicators *(concluded)*



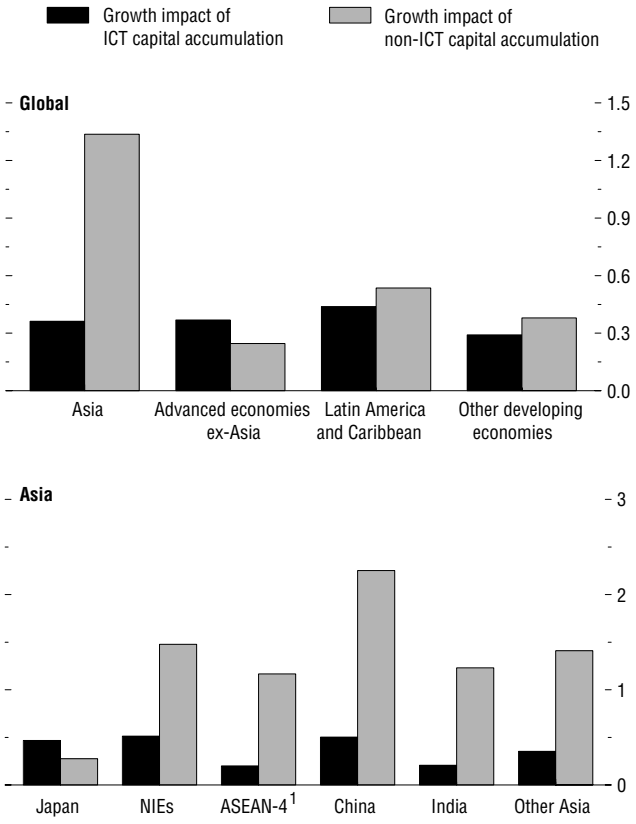
[4]Defined as 100 - (ratio of working-age (15-64) population to total population).
[5]As measured by stock of broad money (M2).

Figure 3. Growth Decompositions
(Percentage points, per year)



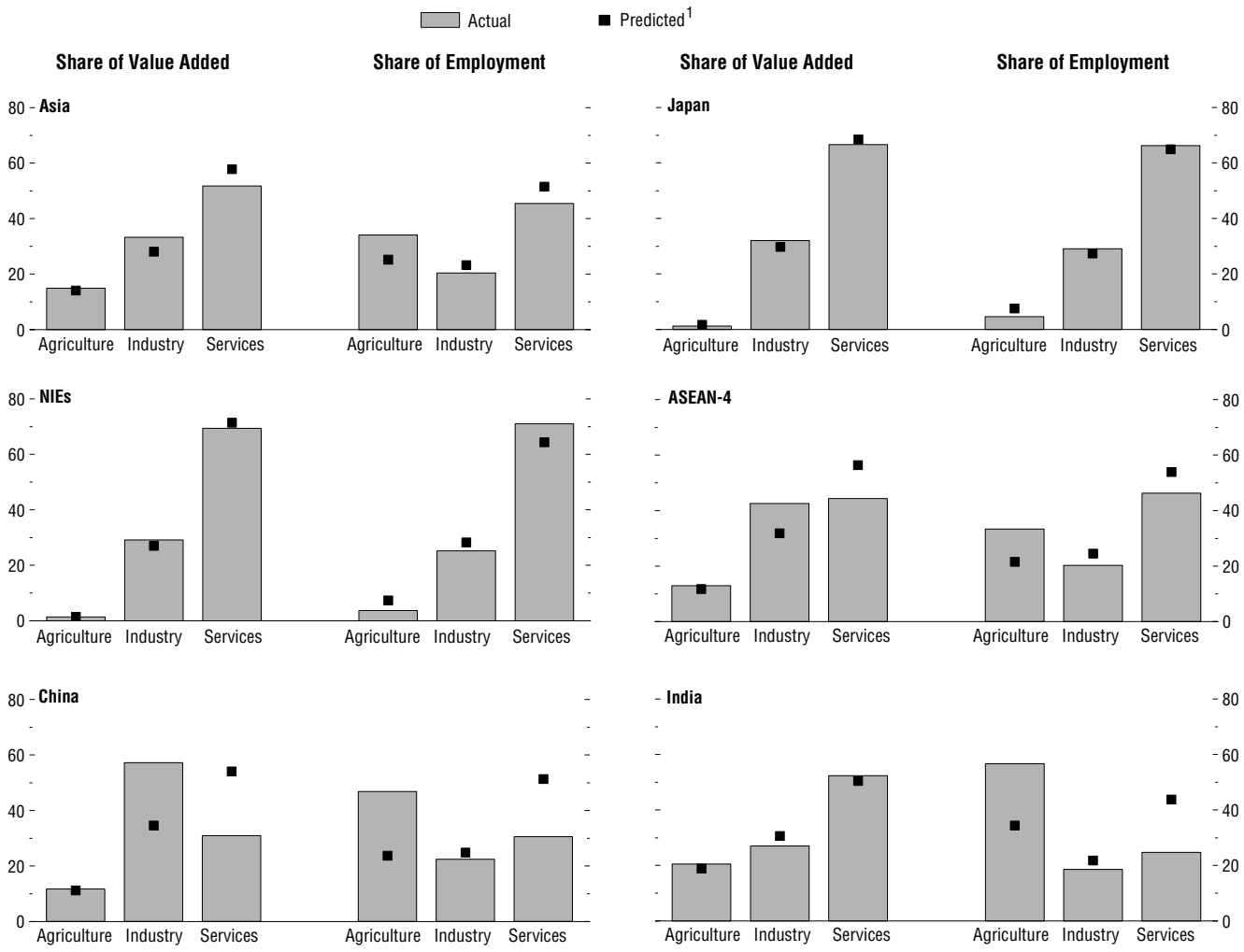
Source: Authors' calculations.
[1] The growth takeoff is defined as occurring in 1955 for Japan, 1967 for the newly industrialized economies (NIEs), 1973 for the ASEAN-4 (Indonesia, Malaysia, the Philippines, and Thailand), 1979 for China, 1982 for India, and 1990 for other Asian economies. Each decade corresponds to 10-year periods following the takeoff years stated above.
[2] The crisis countries group consists of Indonesia, Korea, Malaysia, the Philippines, and Thailand.

Figure 4. Information and Communications Technologies (ICT) Investment and Labor Productivity Growth, 1989–2005
(Annual percent change)



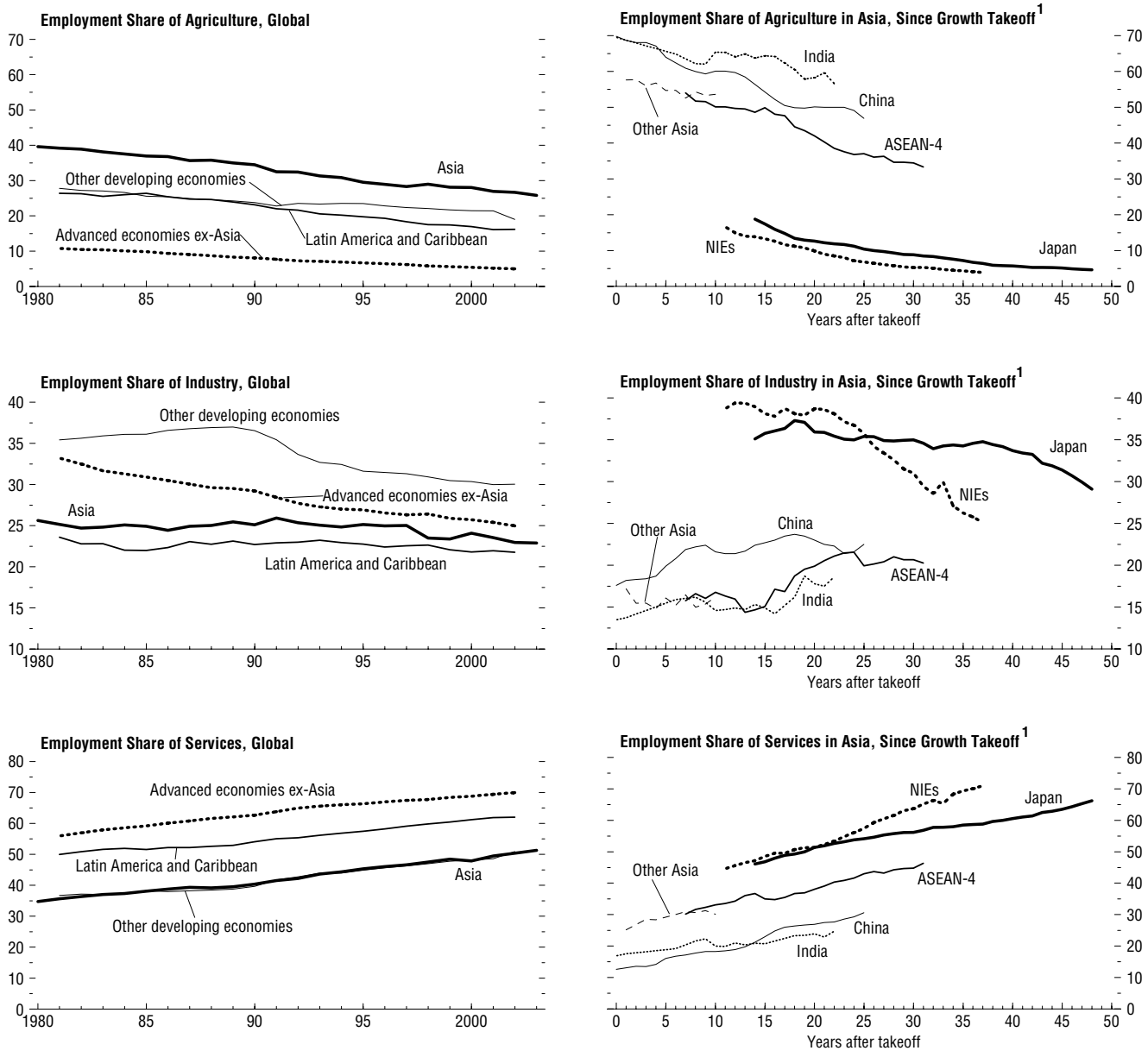
Source: Authors' calculations.
[1] ASEAN-4 includes Indonesia, Malaysia, the Philippines, and Thailand.

Figure 5. Sectoral Shares of Value Added and Employment for Asia
(Percent, latest available year)



Sources: World Bank, *World Development Indicators* (2006); CEIC database; and national statistical offices.
[1]Based on a regression including initial income per capita, country size, and population. The predicted value is calculated as the difference between the actual share and the value of the dummy variable for the region/country.

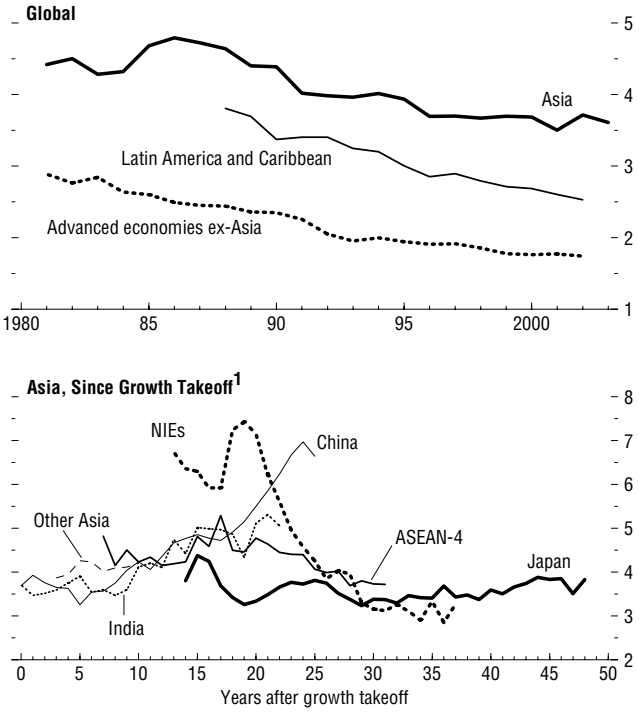
Figure 6. Sectoral Shares of Employment Over Time
(Percent of total employment)



Sources: World Bank, *World Development Indicators* (2006); CEIC database; and national statistical offices.
[1]The growth takeoff is defined as occurring in 1955 for Japan, 1967 for the newly industrialized economies (NIEs), 1973 for the ASEAN-4 (Indonesia, Malaysia, the Philippines, and Thailand), 1979 for China, 1982 for India, and 1990 for other Asian economies.

Figure 7. Relative Labor Productivity of Non-Agricultural Sectors Over Time

(Ratio of non-agricultural labor productivity to agricultural labor productivity)

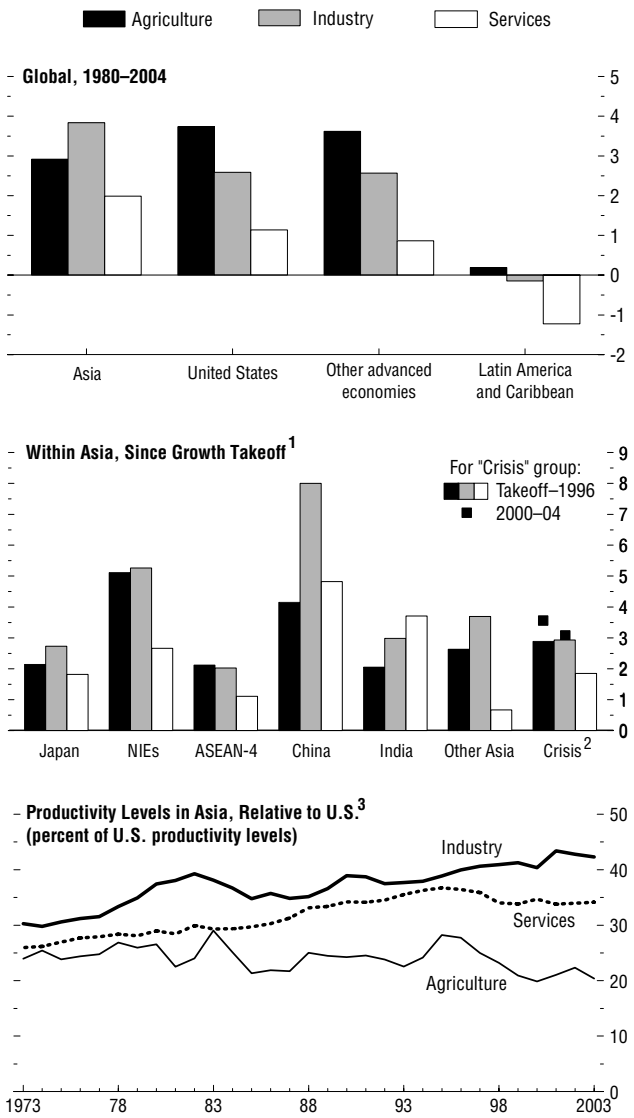


Sources: World Bank, *World Development Indicators* (2006); CEIC database; and national statistical offices.

[1]The growth takeoff is defined as occurring in 1955 for Japan, 1967 for the newly industrialized economies (NIEs), 1973 for the ASEAN-4 (Indonesia, Malaysia, the Philippines, and Thailand), 1979 for China, 1982 for India, and 1990 for other Asian economies.

Figure 8. Productivity Growth by Sector

(Annual percent change unless otherwise noted)



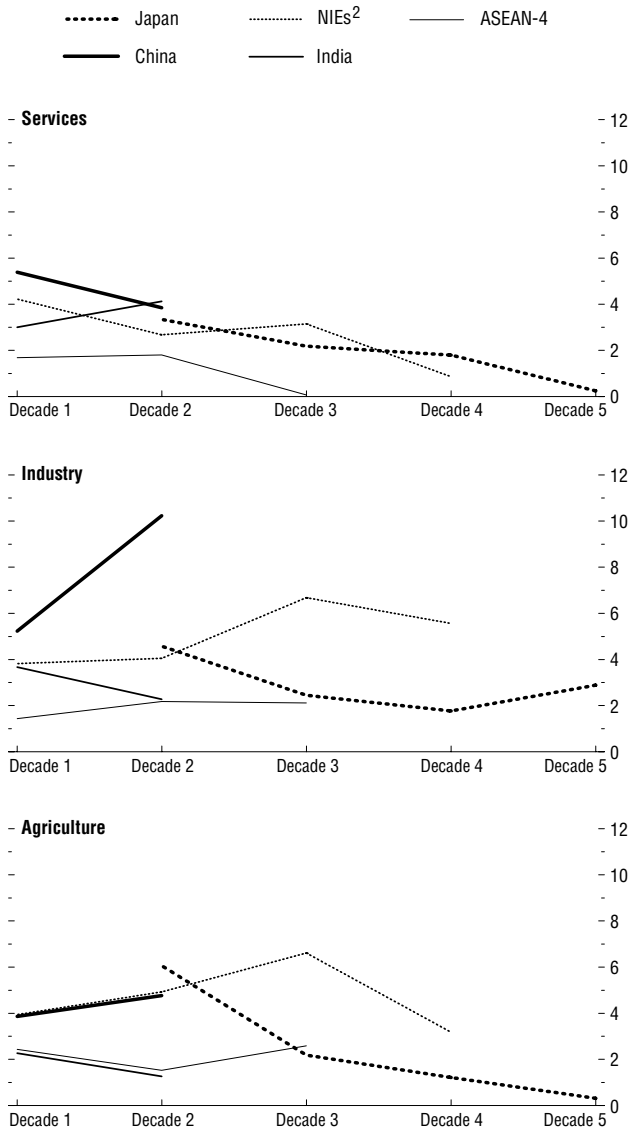
Sources: World Bank, *World Development Indicators* (2006); CEIC database; and national statistical offices.

[1] Not all years since takeoff have available data. The takeoff is defined as occurring in 1955 for Japan, 1967 for the newly industrialized economies (NIEs), 1973 for the ASEAN-4 (Indonesia, Malaysia, the Philippines, and Thailand), 1979 for China, 1982 for India, and 1990 for other Asian economies.

[2] Crisis countries consist of Indonesia, Korea, Malaysia, the Philippines, and Thailand.

[3] Sample includes China, India, Japan, Korea, Pakistan, the Philippines, Singapore (except for agriculture, which has a marginal role in this country), and Thailand. Productivity levels are adjusted based on economy-wide PPP factors; this may overstate productivity in industry, while understating productivity in services.

Figure 9. Sectoral Productivity Growth Since Takeoff[1]
(Annual percent change)

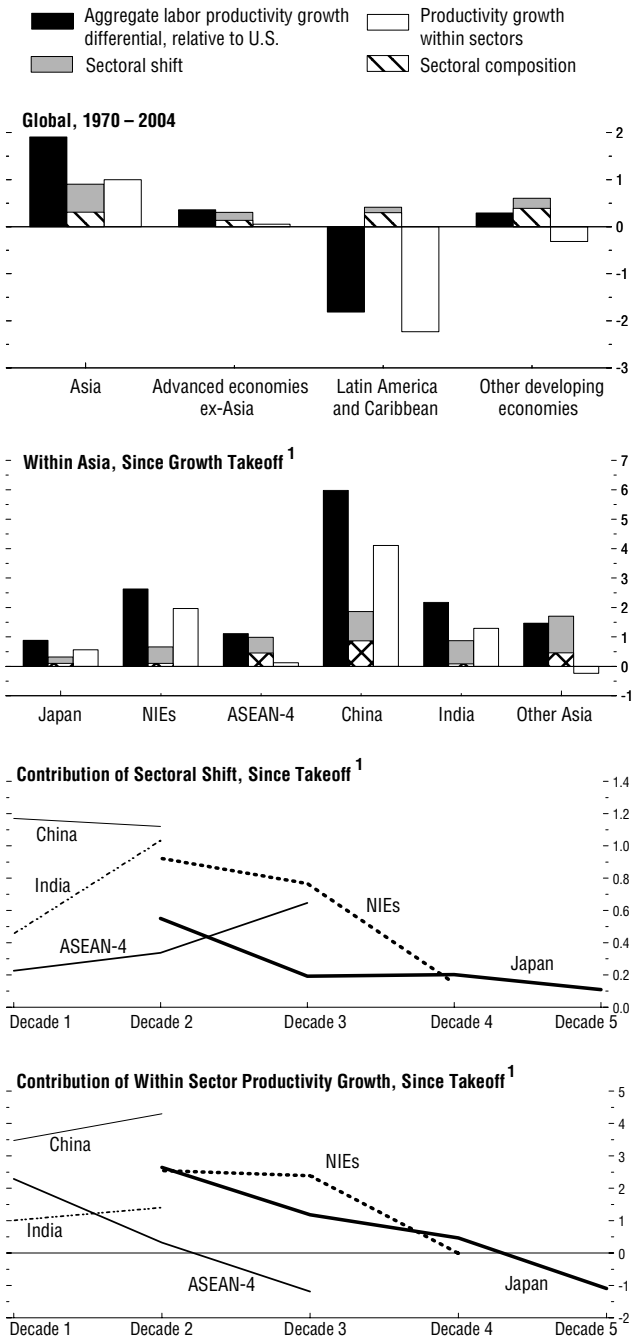


Sources: World Bank, *World Development Indicators* (2006); CEIC database; and national statistical offices.

[1]Not all years since takeoff have available data. The takeoff is defined as occurring in 1955 for Japan, 1967 for the newly industrialized economies (NIEs), 1973 for the ASEAN-4 (Indonesia, Malaysia, the Philippines, and Thailand), 1979 for China, and 1982 for India.

[2]Taiwan Province of China and Hong Kong SAR are excluded because data are only available from Decade 2 onwards. The broad patterns are robust to including these two latter economies in the group. Singapore is also excluded from the panel on agriculture, owing to the sector's marginal role in that country.

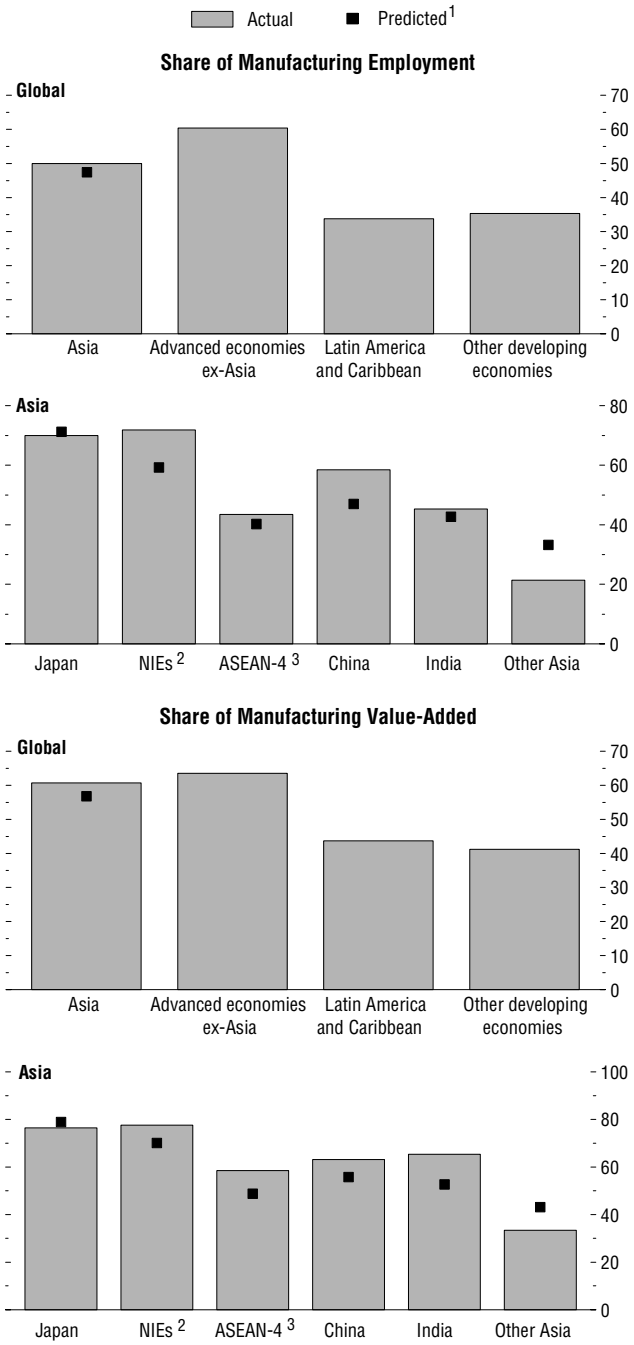
Figure 10. Contributions to Average Labor Productivity Growth Differential with the United States
(Percentage points, per year)



Sources: World Bank, *World Development Indicators* (2006); CEIC database; and national statistical offices.

[1] The growth takeoff is defined as occurring in 1955 for Japan, 1967 for the Newly Industrialized Economies (NIEs), 1973 for the ASEAN-4 (Indonesia, Malaysia, the Philippines, Thailand), 1979 for China, 1982 for India, and 1990 for other Asian economies.

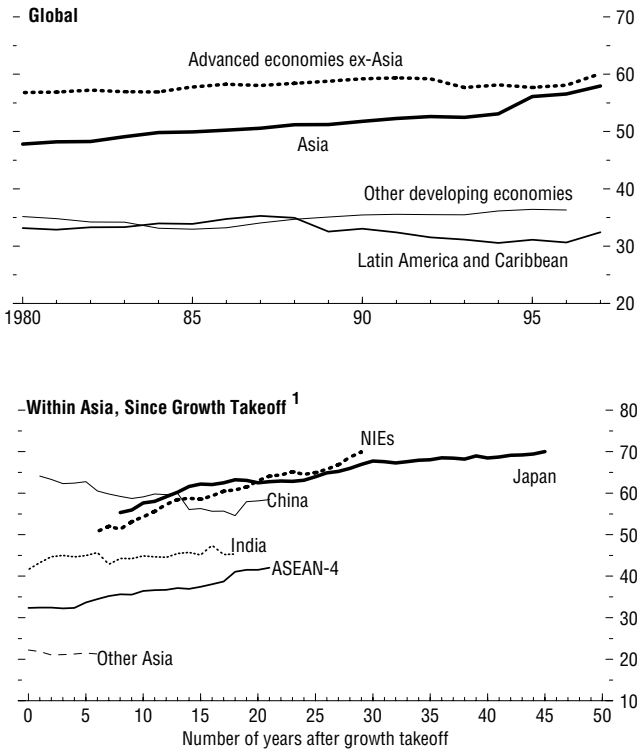
Figure 11. Skill-Intensive Manufacturing Sectors: Employment and Value-Added Shares
(Percent, latest available year)



Source: UNIDO Industrial Statistics databases.
[1] Based on a regression including initial income per capita, country size, and population.
[2] Newly industrialized economies.
[3] Indonesia, Malaysia, the Philippines, and Thailand.

Figure 12. Employment Share of Skill Intensive Sectors Over Time

(Percent of total employment in industry)

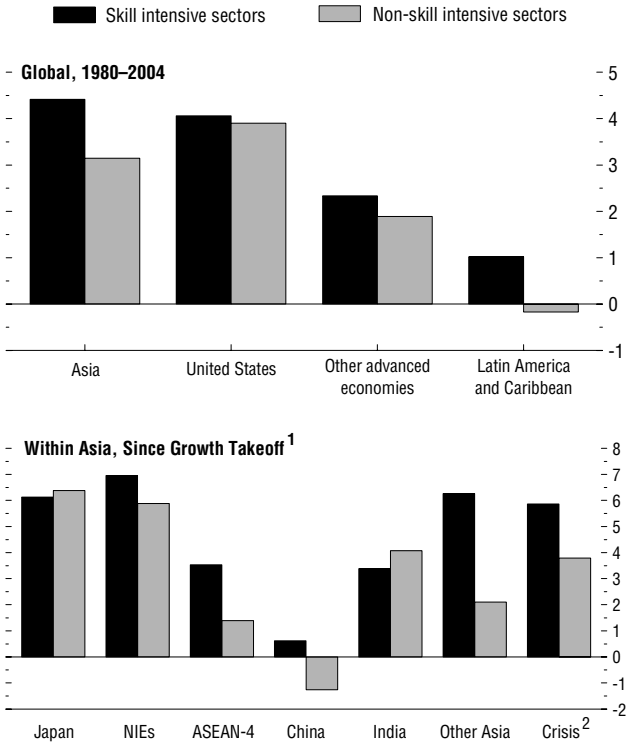


Source: UNIDO Industrial Statistics databases.

[1]The growth takeoff is defined as occurring in 1955 for Japan, 1967 for the newly industrialized economies (NIEs), 1973 for the ASEAN-4 (Indonesia, Malaysia, the Philippines, and Thailand), 1979 for China, 1982 for India, and 1990 for other Asian economies.

Figure 13. Productivity Growth by Sector

(Annual percent change unless otherwise noted)

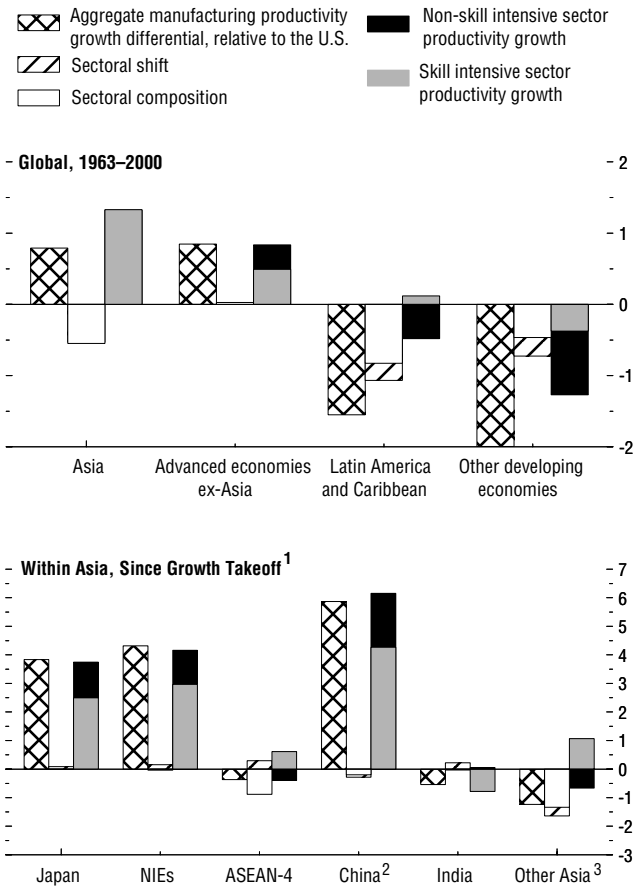


Source: UNIDO Industrial Statistics databases.

[1]Not all years since takeoff have available data. The takeoff is defined as occurring in 1955 for Japan, 1967 for the newly industrialized economies (NIEs), 1973 for the ASEAN-4 (Indonesia, Malaysia, the Philippines, and Thailand), 1979 for China, 1982 for India, and 1990 for other Asian economies. The crisis group data is from takeoff to 1996.

[2]Crisis countries consist of Indonesia, Korea, Malaysia, the Philippines, and Thailand.

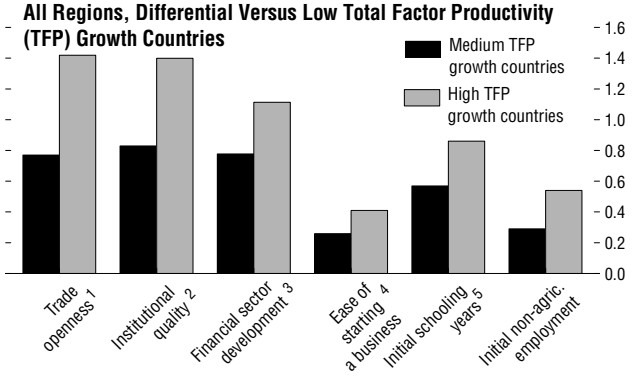
Figure 14. Contributions to Average Manufacturing Productivity Growth Differential with the United States
(Annual percent change)



Sources: UNIDO Industrial Statistics databases; and authors' calculations.
[1]The growth takeoff is defined as occurring in 1955 for Japan, 1967 for the newly industrialized economies (NIEs), 1973 for the ASEAN-4 (Indonesia, Malaysia, the Philippines, and Thailand), 1979 for China, 1982 for India, and 1990 for other Asian economies.
[2]Data for China start in 1990.
[3]Other Asia includes only Bangladesh, Pakistan, and Sri Lanka.

Figure 15. Global Determinants of Productivity Growth, 1965–2005

(Level expressed as multiple of sample standard deviations)



Sources: Barro and Lee (2000); Wacziarg and Welch (2003); Kaufmann, Kraay, and Mastruzzi (2005); World Bank, *Doing Business* database (2006); Beck, Demirgüç-Kunt, and Levine (2000); World Bank, *World Development Indicators* (2006); CEIC database; national statistical offices; and authors' calculations.

[1] Fraction of the sample period in which a country is considered open, according to the Wacziarg and Welch (2003) indicator.

[2] Kaufmann and Kraay government effectiveness measure for 1996.

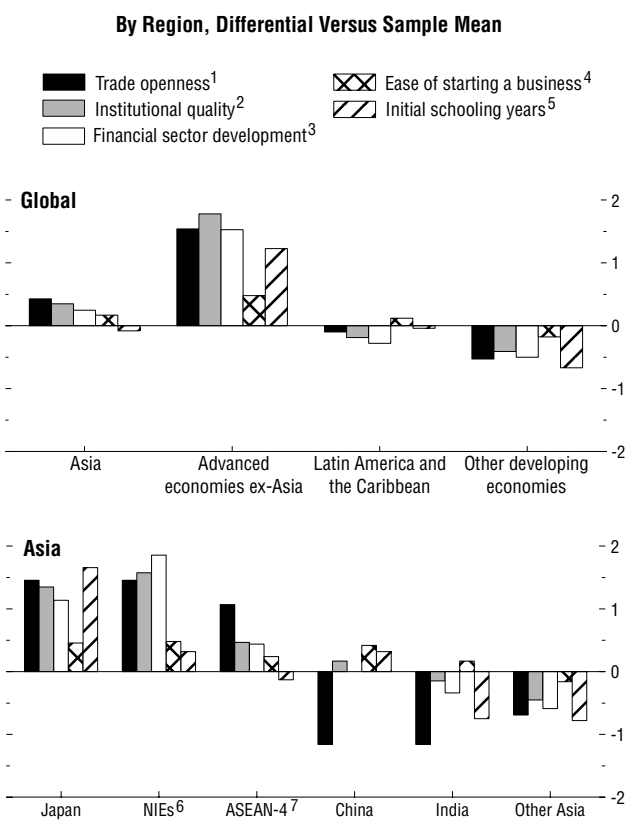
[3] Private credit extended by deposit money banks and other financial institutions as a percent of GDP for 2004, from Beck, Demirgüç-Kunt, and Levine. No data for China or Taiwan Province of China.

[4] Defined as the negative of the cost of starting a business, from the World Bank, *Doing Business* database.

[5] Initial average schooling years in 1960 (for China, 1975), from Barro and Lee.

Figure 16. Regional Determinants of Productivity Growth, 1965–2005

(Level expressed as multiple of sample standard deviations)



Sources: Barro and Lee (2000); Wacziarg and Welch (2003); Kaufmann, Kraay, and Mastruzzi (2005); World Bank, *Doing Business* database (2006); Beck, Demirgüç-Kunt, and Levine (2000); World Bank, *World Development Indicators* (2006); CEIC database; national statistical offices; and authors' calculations.

1 Fraction of the sample period in which a country is considered open, according to the Wacziarg and Welch (2003) indicator.

2 Kaufmann and Kraay government effectiveness measure for 1996.

3 Private credit extended by deposit money banks and other financial institutions as a percent of GDP for 2004, from Beck, Demirgüç-Kunt, and Levine. No data for China or Taiwan Province of China.

4 Defined as the negative of the cost of starting a business, from the World Bank, *Doing Business* database.

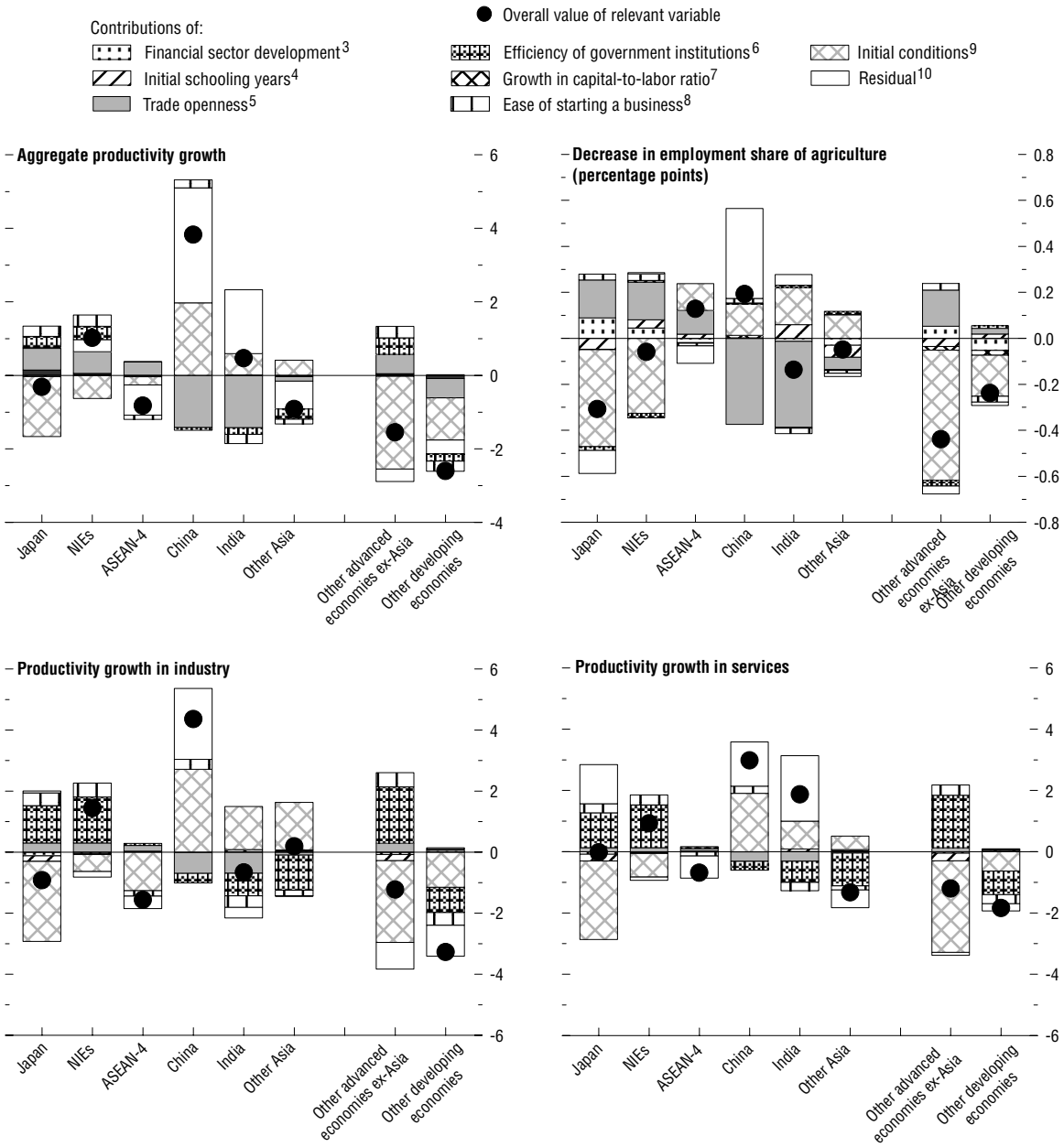
5 Initial average schooling years in 1960 (for China, 1975), from Barro and Lee.

6 Newly industrialized economies.

7 Indonesia, Malaysia, the Philippines, and Thailand.

Figure 17. Detailed Contributions to Productivity Growth[1, 2]

(Difference from Asia average; annual average; percent unless otherwise noted)



Sources: Barro and Lee (2000); Wacziarg and Welch (2003); Kaufmann, Kraay, and Mastruzzi (2005); World Bank, *Doing Business* database; Beck, Demirgüç-Kunt, and Levine (2000); World Bank, *World Development Indicators* (2006); Nehru and Dhareshwar, 1993, updated as in Fajnzylber and Lederman, 1999, using data from the *World Economic Outlook* (WEO) database; CEIC database; national statistical offices; and authors' calculations.

[1] Contributions are calculated based on regression analysis (see Table 2). For Asian subgroups, productivity growth is examined for the period following the growth takeoff. The takeoff is defined as occurring in 1955 for Japan, 1967 for the newly industrialized economies (NIEs), 1973 for the ASEAN-4 (Indonesia, Malaysia, the Philippines, and Thailand), 1979 for China, 1982 for India, and 1990 for other Asian economies. For other advanced economies and other developing economies, productivity growth is examined over the full sample period, 1970–2004.

[2] Due to sectoral data availability, the sample period in the panels for changes in the agriculture employment share and productivity growth in industry and services is shorter than for aggregate productivity growth.

[3] Private credit extended by deposit money banks and other financial institutions as a percent of GDP in initial year (not available for China), form Beck, Demirgüç-Kunt, and Levine.

[4] Initial average years of schooling, from Barro and Lee; for the change in employment share of agriculture, growth in average schooling years.

[5] Fraction of the sample period in which a country is considered open, according to the Wacziarg and Welch (2003) indicator.

[6] Kaufmann and Kraay government effectiveness measure for 1996.

[7] Only included in determinants of the change in employment share of agriculture.

[8] Defined as the negative of the cost of starting a business, from the World Bank, *Doing Business* database.

[9] Initial conditions include the initial productivity gap and/or the initial sectoral employment shares (see Table 2 for precise specification).

[10] The residual for China includes any effect of financial sector development.