First Draft
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Asia's Productivity Performance and Potential at the Turn of the Century: An International Perspective

by Bart van Ark and Marcel Timmer
University of Groningen & Conference Board
The Netherlands
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Abstract

This paper aims to study the economic performance of Asian countries over the past four decades in an international comparative perspective. It quantifies the potential for growth and how much of it has been realized through increased factor inputs, resource reallocations and productivity improvements. The paper shows that the rise in labour input (brought about by demographic transition) and reallocation of resources from low-productivity to high-productivity sectors are gradually losing their force as a source of growth. Hence the emphasis lies on the rise on productivity within industry and services. The paper argues that the key challenges to increase productivity are to realise the catch-up potential in services, to stimulate the use of new technologies, in particular ICT, and to carry out structural reforms of labour-, product- and capital markets.

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1. Introduction and Summary

The financial and economic crisis in many Asian countries at the end of the 1990s and the rapid recovery of output growth since has raised new questions about the interpretation of Asia's rapid economic growth during the final decades of the 20th century and its future prospects. This paper places Asia's economic performance in an international comparative perspective. In doing this, we aim to make use of an internationally comparable dataset which is being constructed at the University of Groningen. We can therefore make comparisons with experiences elsewhere (in particular Europe and North and South America). This may help to uncover the specificities of growth performance in the Asian region, and to identify the key challenges to continue growth in the future.

In an earlier contribution on this issue by The Conference Board, which was put out in the midst of the crisis, we argued that the potential for continued rapid growth in Asia was large, and that, in order to realize this potential, facilitating resource allocations needed to be a high priority for Asian governments (McGuckin and Van Ark, 1998). Hence we argued that, in addition to continued access to foreign technology, Asian economies required structural reforms in labour, product and capital markets. The Conference Board study also argued that the diversity in economic performance is very large across countries, depending on their phase in the accumulation process, their openness to FDI and foreign technology, and the policies already in place to support structural reform.

Much of the empirical support for the Conference Board study on Asia came from a series of studies on international comparisons of output and productivity at the Groningen Growth and Development Centre (The Netherlands). The most comprehensive work in this area is that of Angus Maddison (1995), a study on sectoral performance in Japan and Korea vis-à-vis the United States by Pilat (1994), and one on manufacturing productivity performance in China, India, Indonesia, Korea and Taiwan also vis-à-vis the United States by Timmer (1999).

This paper is a follow-up on the earlier work described above. It aims to tie the issues of potential for growth, and its realization through increased investment in combination with resource reallocation, productivity improvement and structural reforms more strongly together. In Section 2 we introduce our framework of analysis. Following Abramovitz (1979) we define potential as the relative productivity gap compared to the productivity leader (for which we choose the United States). To identify ways by which the potential can be realised we partly use a typical growth accounting framework, which identifies the possibility to increase factor inputs, productivity or sectoral reallocation of resources. In addition we aim to uncover institutional and policy factors that influence the realization of the potential for growth. The following sections then deal in more detail with the main components set out in our analytical framework. Below we briefly summarise our main arguments.

Firstly we argue in Section 3 that, whereas the impact of labour input as a contributor to growth has been largely exhausted in the most advanced Asian countries, demographic trends in the lower-income economies still point at a substantial labour reservoir that can be used more effectively. With respect to capital, we show that even for advanced Asian countries, like Korea and Taiwan, the scope for further productive investment is still huge, which is reflected in the large gaps in capital-labour ratios and labour productivity relative to the United States.

Our second main point is dealt with in Section 4. During early stages of development the effects of shifts from low-productivity (in particular agriculture) to high-productivity sectors (in particular industry) on productivity have significantly contributed to productivity growth at the aggregate level of the economy. We argue that this type of structural change at the sectoral level is still an important source of growth for low-income countries. Even for higher-income countries, where shifts take place from industry to services, a positive contribution from these shifts to aggregate labour productivity growth is still found. However, the contribution of productivity growth within the service sectors is substantially slower than for the total economy. Hence, even while its importance in labour terms is shrinking, the manufacturing sector is still an important engine for productivity growth in Asia. We show that within manufacturing there is still potential for further productivity growth as the manufacturing productivity gap with the United States (the country that we identify as the manufacturing productivity leader) is still large. This productivity gap is still overwhelmingly explained by gaps in all manufacturing industries.

This brings us to our third main point (Section 5), which is that during a more advanced stage of economic development resource reallocations are of a different, more subtle, nature. It requires a greater orientation on the role of services in growth, and on the production and use of new technologies in manufacturing and services alike. To face these challenges, an institutional restructuring of labour and capital markets and a change in the approach to innovation and human capital creation are needed. We argue that despite the greater productivity gaps in Asia relative to the United States, such structural reforms which are also behind much of the policy discussion in Europe, are in their own ways as much needed in Asia.

In Sections 3 and 4 we make use of three databases developed by the Groningen Growth and Development Centre. The GGDC Total Economy Database is used in Section 3 to reconcile levels of labour productivity and per capita income relative to the United States. In Section 4 we use the GGDC Sectoral Database to demonstrate the effects of shifts of resources from low-productivity to high-productivity sectors on aggregate productivity growth. We also make of use the ICOP Industry Database to demonstrate that at the more detailed level of manufacturing industries shifts of resources between industries do not show much explanatory

power. The background of the data sources are discussed in some more detail in the Appendix to the paper.

2. The Analytical Framework

Following Abramovitz (1979) the potential for growth can be operationalized by way of the country's backwardness in productivity, that is its productivity gap relative to the productivity leader or the "catch up" potential. The realisation of that potential takes place through the accumulation of human and physical capital, resource reallocation and technological change, which is controlled by the speed at which institutional and policy changes allow these factor to play their role.[1] We argue in this paper that "catch-up" potential for many Asian countries is still large, but that its realisation requires different instruments in the process of growth.

Figure 1 provides a very stylistic sketch of the instruments through which the potential for growth can be realised. The top part of the figure basically identifies what may be called the "proximate causes" of growth (Maddison, 1988). These include the input of labour, investment in health and education, physical capital (augmented by technical progress) and efficiency of resource allocation.[2] In adopting a sectoral perspective, we extend Maddison's categorization of proximate causes of growth by the reallocation of factor inputs between sectors. If such reallocation takes from low-productivity activities in the direction of high-productivity activities, this process provides a growth bonus on top of that derived from investment and resource efficiency.

A simple decomposition of GDP per capita illustrates these facets of modern economic growth:[3]

$$\frac{Y}{P} = \frac{L}{P} \times \left(\frac{Yp}{Lp} \times \frac{Lp}{L} + \frac{Ynp}{Lnp} \times \frac{Lnp}{L} \right) \qquad (1)$$

with P representing the size of the population and L the size of the labour force. Taking time-derivatives in equation (1), the three key sources of per capita GDP growth appear: increases in the labour participation rate (L/P), increases in labour productivity (Y/L) and a structural change which entails a shift of labour towards productive sectors (increase in Lp/L). In early phases of development, increases in the labour force participation rate and a shift of labour out of agriculture provide important, but transitional, sources of growth. In later phases, per capita income growth must come mainly from labour productivity improvements.

[1] See Abramovitz (1979), p. 2, for a more detailed description of the potential for productivity growth and its realization. See also Ohkawa (1993).

[2] To this, Maddison (1988) adds degree of capacity use and some element of foreign aid or, conversely, plunder.

[3] See also Kuznets (1966).

The change in labour productivity (Y/L) ties into the tradition of growth accounting, as pioneered by scholars such as Solow, Abramovitz, Denison and Jorgenson, and (later) applied to a large range of countries across the world. Growth accounting decomposes the growth of (sectoral) output into the contributions of the growth of inputs (labour, capital, etc.) and a residual, which may be called efficiency of factor use or total factor productivity (TFP) growth (see Figure 1). Growth accounting has been at the heart of the economics profession since the 1950s. It has resulted in a multitude of detailed studies, trying to account for the role of different types of investment in growth, and treating the residual as "total factor productivity" (TFP) growth. It also led to a fierce discussion in the literature between two growth accounting traditions. The first may be called the "investment accounting" tradition and was pioneered by Jorgenson and Griliches (1967). It focuses on a meticulous accounting of the inputs in the production process, with a high level of disaggregation of inputs and of producing industries. Moreover the investment accounting tradition is strongly rooted in traditional neoclassical growth theory, using the marginal productivities of the inputs as factor weights. The "residual accounting" approach was pioneered by Denison (1967), and concentrates more strongly on the decomposition of the residual, into factors that include improved resource allocation, economies of scale, etc.. A fundamental difference between the two accounting approaches is the treatment of technological change. In the "investment accounting" tradition all technological change, as far as it is captured by the investors in their returns, is embodied in the inputs. The TFP residual then solely represents non-pecuniary spillovers (Jorgenson, 1995). In the "residual accounting" tradition, the final residual may represent advances in knowledge, as a form of disembodied technological change.

Both approaches in growth accounting have attracted the attention of Asian scholars. The "investment accounting" tradition is characteristic of the work on Japan by Nishimizu and Kuroda (often in joint cooperation with Jorgenson)[4], and, for Taiwan, by Liang and Jorgenson (1995). The residual accounting has been widely applied for Japan and Korea[5], and more recently also for Thailand.[6] The present paper does not aim to go beyond the meticulous growth accounting work of scholars for individual Asian countries.[7] Instead the key indicator in this paper is labour productivity itself, which we see as the only driving force behind improvement of living standards in the long run, and that does not get exhausted.

To fully comprehend the potential, we must also deal with the "ultimate" sources of growth, which can be found further down the scheme in Figure 1. Following Maddison these factors include the "basic social order", characterised by institutions, belief and ideology and

[4] See Jorgenson and Nishimizu (1978), Jorgenson and Kuroda (1987) and Kuroda **(xxx)**

[5] See Ohkawa and Rosovsky (1973), Denison and Chung (1976), Kim and Park (1985), Pilat (1994) and Kim and Hong (1997)

[6] Pranee Tinakorn and Chalongphob Sussangkarn (1996)

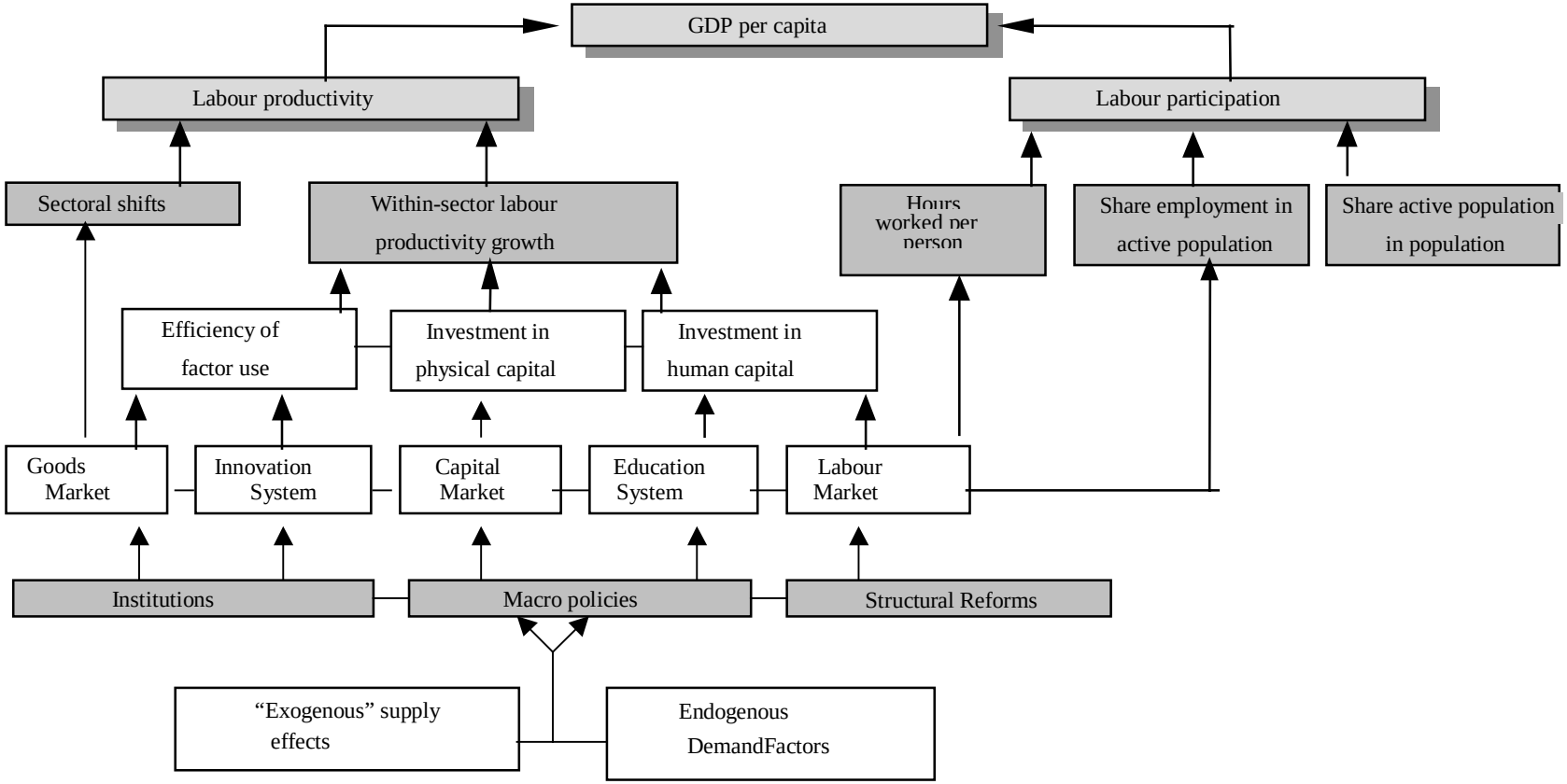
[7] However, we do refer to a companion paper on long term capital stock and TFP growth in Korea and Taiwan (Timmer and Van Ark, 2000).

macroeconomic policies for growth and stability.[8] From the sectoral viewpoint, adopted in this paper, the ultimate causes can be extended by micro-economic policies that affect the organization of markets and the way the technology and education systems are organized, which we will address in some more detail in Section 5.

Before proceeding, it should be emphasized that Figure 1 is only meant to be illustrative of what we view as the key components affecting growth. The arrows do not suggest that the causality is one-way. On the contrary, at the bottom of the graph we show that in particular demand factors can be endogenously determined by the growth process itself, providing new stimuli to alter institutions, modify the functioning of markets for factor inputs and improve innovation and education systems. Nor should this framework be seen as an "engineering device" where opening one tap can do the trick. This would deny the interaction between the various growth factors, which has been strongly emphasized by, among others, Ohkawa (1993).

[8] Maddison also adds the degree of sociopolitical conflict to his set of ultimate variables.

Figure 1 – Analytical Scheme of the Study



3. The Factor Input Potential

Labour Input

Even when two countries have similar labour productivity levels (output per hour worked), more use of labour—more hours of work, less unemployment, and higher labour participation rates—can cause one country to have higher per capita income than the other. The greater use of labour in many Asian countries compared to Europe and North America is an important characteristic of its past growth performance. The relationship between labour productivity and per capita income can be conveniently expressed with the aid of a decomposition that links differences in per capita income and productivity. First, the relative difference in per capita income, *O/P*, between two countries (*X* and *US*) is expressed as the relative difference in labour productivity, *O/L*, times the relative difference in labour input per person, *H*/*P*:

$$O/P^{x\text{-}us} = (O/H)^{x\text{-}us} * (H/P)^{x\text{-}us} \quad (1)$$

This expression is reflected in the estimates which are shown in Tables 1 and 2. Table 1 shows regional averages of GDP per capita and GDP per hour worked relative to the United States, with China and Japan separated out as individual countries. Output is converted to US dollars on the basis of purchasing power parities (PPPs) for 1990 or any other latest benchmark for which a PPP could be obtained. The end column shows the US level of per capita income and GDP per hour at the 1990 US$ price level. The table shows that on a regional basis the United States clearly is the leader in terms of per capita income and productivity, but otherwise some important differences in comparative performance occur. For example, whereas Japan's catching-up in terms of per capita income has been much faster than that in the European Union, and overtook Europe's average per capita income level by 1980, the European Union still has a much higher labour productivity level than Japan. A similar difference can be observed for the "East Asian" countries (Hong Kong, Korea, Singapore and Taiwan). Whereas GDP per hour for that group of countries had increased to 43 per cent of the U.S. level by 1996, GDP per capita was as much as 58 per cent of the U.S. level. The same is true of China and Southeast Asia. For Latin America, the picture is the opposite of that in the advanced Asian countries. GDP per capita relative to the United States was 24 per cent in 1996, whereas labour productivity was at 29 per cent.

Table 1 – GDP per Capita, GDP per Hour Worked and Employment/Population Ratios, Major Regions, as a % of the United States, 1960-1998

	China	South Asia	Southeast Asia	East Asia	Latin America	Japan	European Union	United States	United States
				GDP per head of the population (as % of the United States)					*1990 US$*
1960	6.0	6.5	10.7	13.2	29.5	34.7	61.4	100.0	11,193
1973	5.1	5.1	10.4	21.0	28.6	66.3	69.4	100.0	16,607
1980	5.8	5.2	12.1	28.3	31.0	71.8	72.3	100.0	18,270
1987	8.2	5.6	11.9	40.1	25.9	77.1	70.9	100.0	20,880
1996	11.9	6.8	17.5	57.9	24.3	86.0	72.3	100.0	23,634
1998	12.4	6.9	15.0	53.9	23.8	78.9	71.5	100.0	25,159
				GDP per hour worked (as % of the United States)					*1990 US$*
1960	4.6	5.4	9.4	13.0	32.1	21.3	45.7	100.0	16.78
1973	3.9	4.9	9.7	17.4	34.7	47.2	65.2	100.0	23.60
1980	4.4	5.0	10.5	21.3	34.7	54.0	73.7	100.0	25.61
1987	5.8	5.5	9.7	29.2	31.8	59.7	80.3	100.0	27.74
1996	8.1	7.0	13.8	42.7	29.2	70.3	88.2	100.0	30.35
1998	8.6	7.2	12.0	42.7	n.a.	65.6	87.4	100.0	31.69
				Labour Input/Population Ratio (as % of the United States)(a)					
1960	130.1	120.2	113.6	101.9	91.9	162.3	134.2	100.0	
1973	129.6	102.8	107.4	120.4	82.4	140.5	106.5	100.0	
1980	132.0	103.4	114.8	132.8	89.3	132.9	98.1	100.0	
1987	141.1	101.8	122.6	137.7	81.5	129.3	88.3	100.0	
1996	146.6	97.2	126.8	135.7	83.1	122.4	82.0	100.0	
1998	144.6	95.5	124.5	126.1	n.a.	120.2	81.8	100.0	

(a) Represents total hours worked divided by the total population in each region relative to total hours worked divided by the population in the United States.
Note: South Asia includes Bangladesh, India, Pakistan and Sri Lanka. Southeast Asia includes Indonesia, Malaysia, Philippines and Thailand. East Asia includes Hong Kong, Korea, Singapore and Taiwan. Latin America includes Argentina, Brazil, Chile, Colombia, Mexico and Venezuela.
Source: GGDC Total Economy Database (see Appendix)

The bottom panel shows the ratio of the share of total hours worked divided by the total population between each region and the United States. This ratio accounts for the difference between comparative GDP per capita and labour productivity performance.[9] This panel shows that China, Southeast Asia, East Asia and Japan all higher shares of labour input to total population than in the United States. For East Asia and Japan some decline has occurred since 1987, but it has risen further in China and Southeast Asia. The labour input-population ratios for the European Union relative to the United States have been continuously on the decline since 1960.

[9] We show this number as a ratio between each region and the US, because in an absolute sense the ratio of hours worked relative to the population is not a meaningful measure. Employment/population ratios, which do not take account of differences in working hours per person between countries, show a more moderate picture. For example, the ratio of employment to total population in 1996 amounted to 52 per cent in China, 34 per cent in South Asia, 45 per cent in Southeast Asia, 43 percent in East Asia, 33 per cent in Latin America, 52 per cent in Japan, 41 per cent in the European Union and 48 per cent in the United States. See below for a more detailed decomposition.

The variation between the countries is quite substantial. Table 2 shows the same estimates as those from Table 1 for individual countries in the Asian region, with countries ranked according to their GDP per capita level in 1996. The gap between relative GDP per capita and labour productivity levels in largest for the most advanced countries in the region, and for some of the South Asian countries at the lower end of the scale it is even the opposite. In these countries employment-population ratios are still relatively low because of their fairly young population.

To fully assess the difference between relative per capita income and productivity levels, a more detailed decomposition can be made by decomposing the labour input to population differential into hours worked per person employed (*H*/*E*), numbers of persons employed relative to the total labor force, i.e. employed persons plus registered unemployed persons (*E*/*L*), the ratio of the labor force to all persons aged 15 to 64, i.e. the "active" population (*L*/*P*15–64), and the share of the active population in the total population (*P*15–64/*P*). Algebraically this can be expressed as:

$$H/P^{x\text{-}us} = (H/E)^{x\text{-}us} * (E/L)^{x\text{-}us} * (L/P15\text{–}64)^{x\text{-}us} * (P15\text{–}64/P)^{x\text{-}us} \quad (2)$$

This simple decomposition highlights major sources of labor supply and determines the fraction of the population employed. For example, equation 2 attributes lower labor force participation in country *X*, relative to country *US*, to fewer working hours per employee, higher official unemployment, lower labour force participation (that is, underemployment), or a too-young or too-aged population.

Table 3 shows the results of this decomposition on a country-by-country basis and for regional average. The large gap between GDP per hour and GDP per capita relative to the USA for the East Asian economies is largely due to the much larger number of hours worked per person in those countries. On average the number of working hours per person in the four East Asian countries amounted to 2,435 hours per person in 1996, compared to 1,848 hours in Japan, 1,615 in the United States and 1,560 in the European Union. Strikingly, we find that the labour force participation rates in the East Asian countries are relatively low compared to the United States, which compensates for part of the gap between the per capita income and productivity measures. The lower labour force participation rates are due to the smaller share of women in the labour force compared to the United States (except for Singapore). In Japan higher hours account for part of the gap between the two performance measures, but the share of the active population (15-64 years) appears relatively high in Japan as well.

Table 2. GDP per Capita, GDP per Hour Worked and Employment/Population Ratios, Asia, as a % of the United States, 1960-1998

	Bangla-desh	India	Pakistan	Philip-pines	China	Sri Lanka	Indo-nesia	Thai-Land	Malaysia	South Korea	Taiwan	Singapore	Hong Kong
GDP per head of the population (as % of the United States)													
1960	4.8	6.6	5.9	13.3	6.0	14.8	10.1	9.2	14.0	11.6	12.5	18.5	25.7
1973	2.9	5.1	5.9	11.8	5.1	10.1	9.3	10.5	17.6	17.1	22.1	32.3	42.1
1980	3.0	5.1	6.3	13.7	5.8	11.6	10.2	13.1	22.3	22.5	30.8	44.6	56.2
1987	3.2	5.5	7.0	10.3	8.2	12.5	10.4	14.8	22.5	34.0	42.2	50.5	73.1
1996	3.4	7.0	7.8	10.3	11.9	14.5	15.6	26.1	34.8	52.6	57.2	80.6	88.2
1998	3.5	7.0	7.5	9.8	12.4	14.8	13.0	21.7	31.5	47.0	57.5	80.3	78.6
GDP per hour worked (as % of the United States)													
1960	4.6	5.3	5.8	11.6	4.6	13.4	9.9	5.8	14.0	12.7	10.0	13.2	31.4
1973	3.2	4.9	6.3	11.1	3.9	9.9	9.4	7.6	17.6	15.4	16.5	25.8	29.5
1980	4.6	4.7	6.9	13.1	4.4	12.8	9.5	8.8	20.6	17.6	22.4	30.0	38.4
1987	4.0	5.2	8.4	9.7	5.8	13.8	8.6	9.9	21.0	25.0	30.7	36.3	49.5
1996	4.0	6.9	10.2	9.1	8.1	17.2	12.5	17.2	30.3	37.5	46.7	52.6	63.6
1998	4.0	7.1	10.0	8.8	8.6	17.9	10.3	15.5	27.6	37.2	48.8	51.6	57.3
Labour Input/Population Ratio (as % of the United States)													
1960	103.7	124.4	102.5	114.9	130.1	110.9	101.9	158.9	100.1	91.5	125.2	140.6	81.7
1973	90.0	105.4	94.2	106.0	129.6	102.2	98.7	138.9	99.7	111.3	133.9	124.9	142.5
1980	66.4	109.7	92.3	104.9	132.0	90.4	107.8	148.8	108.3	127.9	137.4	148.3	146.2
1987	79.7	107.2	83.2	106.0	141.1	90.1	121.1	150.0	107.1	136.3	137.8	139.1	147.7
1996	86.4	101.6	76.8	113.2	146.6	84.0	125.1	151.8	115.0	140.4	122.4	153.1	138.6
1998	85.5	99.7	75.6	111.0	144.6	82.9	125.6	140.1	114.1	126.5	117.9	155.6	137.2

Source: GGDC Total Economy Database (see Appendix)

Table 3. Decomposition of gross domestic product (GDP) per hour relative to the United States into effects of working hours, labor force participation and GDP per capita, 28 countries and areas, 1996

Country or area	GDP per hour worked as a percent of the U.S.	Effect of working hours[1]	GDP per person employed as a percent of U.S[2]	Effect of unemploy-ment[3]	Effect of labor force as a percent of the active population (aged 15 to 64)[4]	Effect of active population (aged 15 to 64) as a percent of total population[5]	Total effect of labor force partici-pation[6]	GDP per person employed as a percent of the U.S.[7]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bangladesh	4	1	6	0	–2	0	–2	3
China	8	3	11	1	0	0	1	12
Hong Kong	66	26	93	3	–10	6	–1	92
India	7	3	9	0	–1	–1	–2	7
Indonesia	13	5	18	0	–2	–1	–3	15
Japan	72	9	82	2	–1	5	6	87
Malaysia	31	11	42	1	–5	–4	–8	33
Pakistan	10	4	14	0	–5	–2	–6	7
Philippines	9	3	13	0	–1	–1	–2	10
Singapore	54	23	77	2	8	6	16	93
South Korea	37	20	57	3	–8	4	–2	56
Sri Lanka	18	6	24	–2	–8	0	–10	14
Taiwan	47	22	70	2	–13	3	–8	61
Thailand	19	7	26	0	0	1	1	26
United States	100	0	100	0	0	0	0	100
GDP-weighted average:								
Latin America	29	5	34	–4	–3	–2	–9	25
Asia	12	4	17	0	–1	0	–1	15
Asia excl. Japan	10	4	13	0	–1	0	–1	12
Newly Industrializing Economies[8]	43	22	65	2	–9	4	–3	62
Southeast Asia[9]	15	5	20	0	–2	–1	–3	17
South Asia[10]	7	3	10	0	–2	–1	–3	7
European Union[11]	86	-3	83	-5	-8	2	-12	71

1 Calculated on the basis of actual hours worked per person per year.
2 Sum of columns 1 and 2.
3 Calculated on the basis of the ratio of employment to the labor force.
4 Calculated on the basis of employment force as a percent of the population aged 15 to 64. This column also includes rounding differences.
5 Calculated on the basis of population aged 15 to 64 as a percent of total population
6 Sum of columns 4, 5, and 6, plus rounding differences.
7 Sum of columns 3 and 7.
8 Includes Hong Kong, Singapore, South Korea, and Taiwan.
9 Includes Indonesia, Malaysia, Philippines, and Thailand.
10 Includes Bangladesh, India, Pakistan, and Sri Lanka.
11 ExcludesLuxembourg. Rounding differences, and so forth, are included with the estimates of the labor force/active population effect in column 5.
Sourse: Sources for GDP, hours, employment, and labour productivity from GGDC Total Economy Database

All these figures point at the important role of changes in the rate of labour input relation to the population rate and the underlying process of demographic transition as a source of growth. During this transition, the ratio will first decline, because of declining mortality, than rise, followed by a decline when fertility rates have dropped as well and the population starts ageing. Bloom and Williamson (1997) argue that population dynamics can explain a

significant part of growth in per capita income in East and Southeast Asia. Other regions in the world did not enjoy a similar demographic gift.

Table 4 shows the percentage of growth in per capita GDP that can be explained by a rise in the labour input/population share. It shows that this force played a big role for the East Asian countries during the 1960s and 1970s. The rapid growth of population in the 1950s and 1960s, which initially burdened these economies because of the rise in the proportion of young people in the population, was an important source of growth once the youngsters entered the labour force. But since the late 1980s it has been loosing much of its force. Even though there is still scope for greater labour participation within the 15–64 age group, the projections for population growth suggest a decrease in the share of the working-age population in the total population. It is also unlikely that working hours per employee can be increased much beyond about 2,500 hours per year. In Southeast Asia the contribution of labour input to growth still plays a substantive role. In contrast, South Asia still suffers from a substantial under-utilization of labour. In fact, labour input rose at an even slower rate than population during the 1960s and again during the early 1990s. But most of this negative effect on living standards should be offset in the future by an expected decline in the fertility rate. This should increase the proportion of South Asia's working-age population, so that expanded labour input can enhance output growth for this part of the region as well. However, this requires a substantial expansion of economic activity.

Table 4 – Percentage contribution to GDP per capita growth of rise in ratio of total hours worked to total population

	China	South Asia	Southeast Asia	East Asia	Japan
1960-73	4.8	-10.8	-0.3	19.7	-9.6
1973-85	11.7	4.2	13.6	12.7	-2.6
1985-96	9.7	0.2	12.1	7.7	-0.1

Source: GGDC Total Economy Database

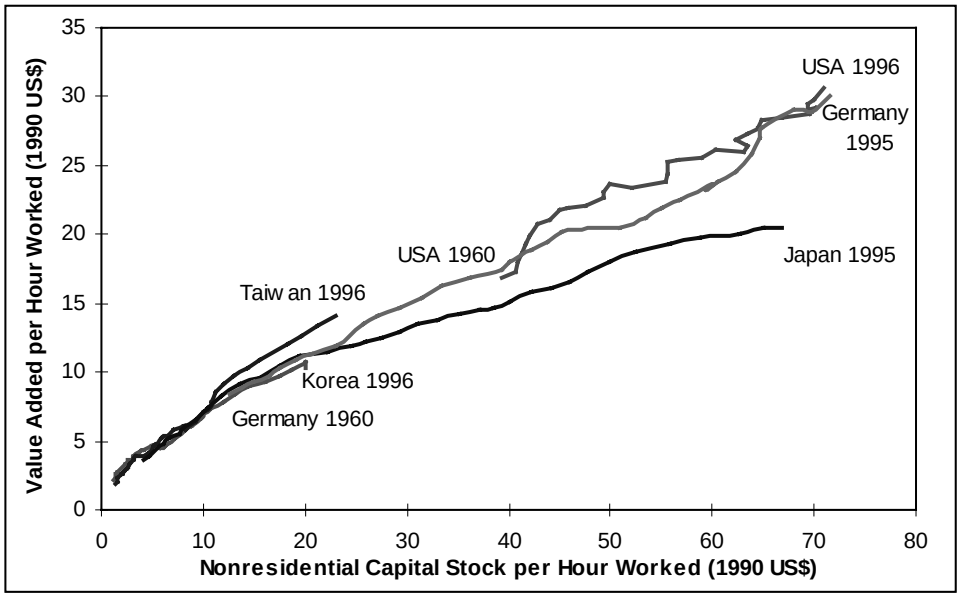
In conclusion, in countries were the demographic transition has taken place, increases in labour participation cease to be a further source of per capita GDP growth. Labour productivity growth will be the primary vehicle to increase living standards. But even in countries in the middle of the transition have to rely on this important source of growth. Potential for improvements are abundant as all countries still face a large productivity gap with the United States and other advanced countries in the Western Hemisphere.

Capital Input

In an accompanying paper we look at the contribution of another input source, which has featured much more prominently in the growth literature, namely that of physical capital. Timmer and Van Ark (2000) reconstruct the long term nonresidential capital stock for Korea and Taiwan since the 1950s on the basis of the perpetual inventory method. Apart from

calculations in national currency, the capital stock is also converted to US dollars (prices of 1990) on the basis of purchasing power parities for capital formation. Figure 2 shows the relation between the non-residential capital stock per hour worked and GDP per hour worked in 1990$ for the total economy in a graphical format. We have also added estimates compiled on the basis of a similar method for Japan and Germany. The figures clearly show the progress all countries made in catching up with the USA both in terms of labour productivity and capital intensity. However, there are large differences in the degree of catch-up between countries. Whereas Germany has caught up with the United States on both variables, Japan still shows a 30 per cent productivity gap despite a capital-intensity which is only 4 per cent lower than that in the United States.

Figure 2 - Labour Productivity and Capital Intensity, Total Economy, 1990 US$



Source: Timmer and van Ark (2000)

The other two East Asian countries started to grow from even lower relative levels of productivity and capital intensity, They showed a substantial catch up, but still showed large gaps with the USA on both counts by 1996. These findings suggest that, for Korea and Taiwan, despite the rise in capital intensity continued growth on the basis of expansion of inputs is not 'inevitably subject to diminishing returns' (Krugman, 1994, p.63). There remains substantial scope for further investment in these countries, but it must be accompanied with measures that help to realise the potential of productivity improvements through disembodied technical change. Unfortunately at this moment we lack sufficient data to assess the potential for further investment along these lines for other Asian countries in this perspective.

4. The Reallocation of Resources to Industry and Services

An important aspect of development are the changes in the relative output and employment share of sectors (agriculture, industry, services) in the economy. Kuznets stated that "it is

impossible to attain high rates of growth of per capita or per worker product without commensurate substantial shifts in the shares of various sectors" (Kuznets, 1979, p.130). The hypothesis that reallocation of capital and labour from low-productivity to high-productivity sectors is an important source of output and productivity growth is essentially derived from classical models of a dual economy (Lewis, 1954), and has become a central tenet of the growth-accounting literature. Assuming the existence of surplus labour in some parts of the economy, a shift of labour towards modern industry will be beneficial at the aggregate level as workers with low productivity will be put to more productive uses.

The hypothesis that structural change is an important source of aggregate productivity growth involves two important basic assumptions. Firstly, productivity levels and growth rates must differ considerably across sectors. Secondly, there have to be major shifts in the distribution of factor inputs from low-productivity to high-productivity sectors during the period considered. The basic pattern of development involves a shift from the agricultural sector to industry and, in a later stage, to services (Chenery, Robinson and Syrquin, 1986). Although the agricultural sector has generally much lower productivity levels than industry, productivity in services is not always higher than in industry. This means that only in a first stage of development structural change will be an important, but temporary, source of aggregate labour productivity growth. We call this the structural bonus hypothesis.

As sectors not only differ in terms of productivity levels, but also in terms of productivity growth rates, factor input reallocation has both static and dynamic effects. These effects are naturally modelled in the decomposition of aggregate labour productivity growth pioneered by Fabricant (1942). His method is known as the shift-share analysis and is frequently used to assess the importance of structural change for productivity growth.[10] Let LP denote the labour productivity level, subscript i denote sectors (i=1,..n with n the number of sectors in this case 10), S_i the share of sector i in total employment and superscripts 0 and T the beginning and end of the period [0,T]. Then aggregate labour productivity at time T can be written as:

$$LP^T = \frac{Y^T}{L^T} = \sum_{i=1}^{n} \frac{Y_i^T}{L_i^T} \frac{L_i^T}{L^T} = \sum_{i=1}^{n} LP_i^T S_i^T \qquad (4)$$

Using (1), the difference in aggregate labour productivity levels at time 0 and T can be written as:

$$LP^T - LP^0 = \sum_{i=1}^{n} (LP_i^T - LP_i^0)\, S_i^0 + \sum_{i=1}^{n} (S_i^T - S_i^0)\, LP_i^0 + \sum_{i=1}^{n} (S_i^T - S_i^0)(LP_i^T - LP_i^0) \qquad (5)$$

[10] See, for example, Syrquin (1984).

Dividing both sides of equation (5) by LP^0, it follows that aggregate productivity growth can be decomposed into intra-sector productivity growth (the first term on the right-hand side) and the effects of structural change which consist of a static shift effect (the second term) and a dynamic shift effect (the third term). Whereas the static shift effect measures productivity growth caused by a shift of labour towards sectors with a higher labour productivity level at the beginning of the period, the dynamic shift effect captures shifts towards more dynamic sectors, *i.e.* sectors with higher labour productivity growth rates.

Aggregate Shift Effects

The results of the decomposition of aggregate labour productivity growth is reported in Table 5. We looked at the period 1963-96 and the sub-periods 1963-73, 1973-85 and 1985-96.[11] For each country and each of the four periods, the annual growth rates of aggregate labour productivity are given in the first column. The other columns show the percentage contribution to this growth rate from growth of labour productivity within sectors and by shifts in labour shares across sectors.[12] We distinguish ten sectors in the economy, largely following the International Standard Industrial Classification (ISIC), i.e. (1) agriculture, hunting, forestry and fishing, (2) mining and quarrying, (3) manufacturing, (4) electricity, gas and water, (5) construction, (6) wholesale and retail trade, (7) transport, storage and communication, (8) finance, insurance, real estate and business services, (9) community, social and personal services, including hotels and restaurants, and (10) government services, including other producers.

As can be inferred from the second column in Table 5, the intra-sector effect explains the biggest part of aggregate labour productivity growth in most countries during most periods. For example, during the period 1963-1996, productivity growth within the 10 sectors explained 83 per cent of the aggregate growth in Taiwan. Structural change explained the remaining 17 per cent: 19 per cent was due to a shift of labour from lower to higher productivity sectors, and minus 2 per cent was due to a shift to sectors with lower labour productivity growth rates. In general the total shift effect accounted for between 5 and 35 per cent of labour productivity growth in Asia. Only in the most recent periods in Thailand and the earliest period in Indonesia, shift effects accounted for more than 50 per cent of aggregate labour productivity growth. In contrast, during the most recent period all aggregate labour productivity growth in Japan was explained by intra-sectoral growth. This is also confirmed by results from a similar exercise using data for European countries for the period 1950-1990 shown in Table 6. The average contribution from the shift effect was less than 20 per cent in Europe (see van Ark, 1996). These results are suggestive evidence in favour of the structural

[11] Shorter periods were taken when data was not available.

[12] Note that a change in labour shares does not necessarily involve a physical transfer of employees from one sector to another. This depends on the overall growth of the labour force. In an economy with high population growth rates, some shares may decline while employment is increasing in all sectors.

bonus hypothesis which predicts that the importance of the shift-effect for aggregate labour productivity growth will diminish during economic development.

This is further investigated in Figure 3, which plots the contribution of the shift effect (combining both the static and the dynamic shift effect) to aggregate labour productivity growth against the level of economic development as measured by the average level of per capita GDP (in 1990 US $) in a given period for all Asian countries. The graph shows a clear decreasing trend in the contribution of labour shifts as per capita income grows (except for Hong Kong), confirming the structural bonus hypothesis.

Table 5. Decomposition of aggregate labour productivity growth in Asian Economies

	Labour productivity growth (annual)	Percentage of labour productivity growth explained by:			
		Intra-sector effect	Static shift effect	Dynamic shift effect	Total Effect
Hong Kong					
1975-85	3.6	66	39	-5	100
1985-95	4.6	58	47	-6	100
1975-95	4.1	60	46	-6	100
India					
1960-70	2.8	85	23	-8	100
1970-80	0.1	240	-106	-34	100
1980-90	2.4	65	47	-13	100
1960-90	1.8	74	37	-11	100
Indonesia					
1976-85	1.5	29	291	-220	100
1985-96	4.0	67	44	-11	100
1976-96	2.9	56	54	-11	100
Japan					
1963-73	7.4	87	12	0	100
1973-85	3.0	90	11	0	100
1985-96	1.9	101	1	-2	100
1963-96	4.2	93	7	-1	100
Malaysia					
1975-85	3.4	113	-3	-10	100
1985-96	4.5	90	12	-2	100
1975-96	4.0	95	9	-4	100
Singapore					
1969-73	5.0	102	5	-7	100
1973-85	4.3	90	19	-9	100
1985-96	5.2	90	18	-8	100
1969-96	4.8	91	18	-8	100
South Korea					
1963-73	4.7	88	19	-6	100
1973-85	4.9	71	34	-5	100
1985-96	4.3	79	27	-5	100
1963-96	4.6	77	28	-5	100
Taiwan					
1963-73	7.0	74	29	-3	100
1973-85	4.9	82	19	-1	100
1985-96	5.3	84	18	-2	100
1963-96	5.7	83	19	-2	100
Thailand					
1963-73	4.8	60	40	0	100
1973-85	3.7	37	64	0	100
1985-96	7.2	26	81	-6	100
1963-96	5.2	48	56	-4	100

Note: Percentages may not add to 100 due to rounding. Decomposition of labour productivity growth into part due to labour productivity growth in sectors (intra-sector effect) and shift of labour between branches (shift effects) shifting the base annually.
Source: GGDC Sectoral Database (see Appendix).

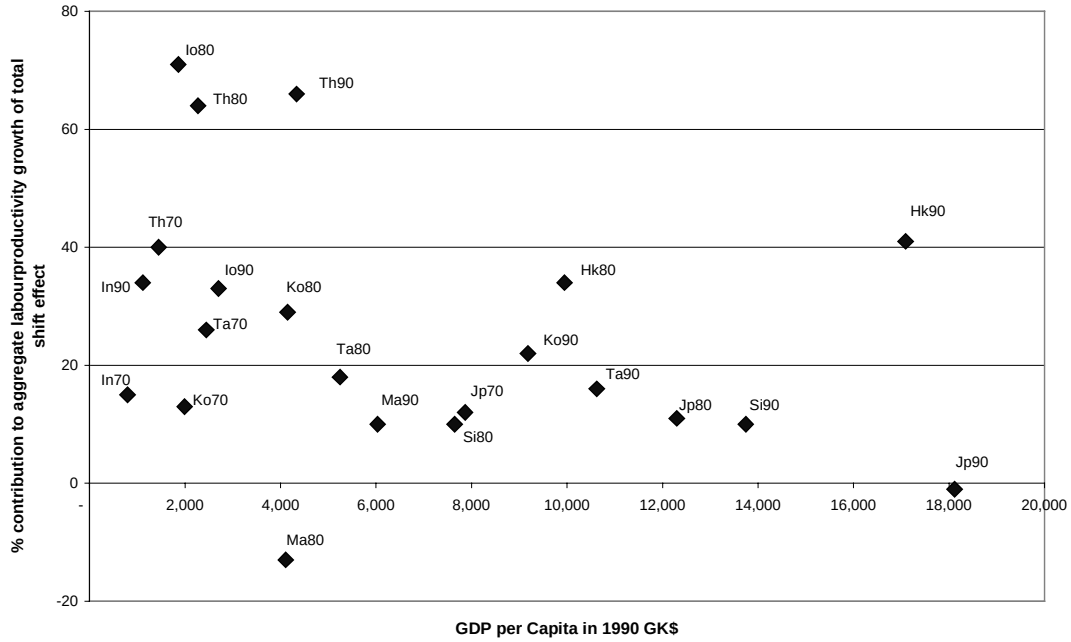
Table 6. Decomposition of aggregate labour productivity growth in European countries and the United States

	Labour productivity growth (annual)	Percentage of labour productivity growth explained by:			
		Intra-sector effect	Static shift effect	Dynamic shift effect	Total Effect[a]
Denmark					
1950-1973	3.45	89	16	-6	100
1973-1990	1.72	84	27	-11	100
1950-1990	2.97	87	20	-7	100
France					
1950-1973	4.35	91	8	2	100
1973-1990	2.31	86	26	-12	100
1950-1990	3.83	89	14	-3	100
Germany					
1950-1973	4.84	81	13	6	100
1973-1990	1.98	86	14	0	100
1950-1990	3.92	83	13	4	100
Italy					
1950-1973	5.31	73	19	8	100
1973-1990	1.97	73	45	-18	100
1950-1990	4.18	73	26	1	100
Netherlands					
1950-1973	3.83	115	10	-25	100
1973-1990	0.97	102	33	-35	100
1950-1990	2.75	112	14	-27	100
Spain					
1950-1973	5.37	77	13	10	100
1973-1990	3.64	86	20	-6	100
1950-1990	5.19	81	16	3	100
Sweden					
1950-1973	2.99	88	19	-7	100
1973-1990	1.27	104	11	-15	100
1950-1990	2.45	93	17	-10	100
U.K.					
1950-1973	2.08	97	22	-19	100
1973-1990	1.34	113	29	-43	100
1950-1990	1.97	104	25	-28	100
U.S.					
1950-1973	1.91	109	6	-15	100
1973-1990	0.48	142	17	-58	100
1950-1990	1.37	116	8	-24	100

Note: Percentages may not add to 100 due to rounding. Decomposition of labour productivity growth into part due to labour productivity growth in sectors (intra-sector effect) and shift of labour between branches (shift effects) shifting the base for each subperiod.

Source: GGDC Sectoral Database (see Appendix). See Van Ark (1996).

Figure 3 - Contribution of shift-effect to aggregate labour productivity growth for Asian countries, various periods.



Note: In=India, Io=Indonesia, Ko=Korea, Ta=Taiwan, Jp=Japan, Si=Singapore, Hk=Hong Kong, Th=Thailand. The number behind each abbreviation represents an approximate middle year in the subperiod. See Appendix Tables 2 to 4 for exact sub-period. India 1970-80 is not included as labour productivity growth was near zero.
Source: GGDC Sectoral Database (see Appendix)

Sectoral Contributions to Shift Effects

One can take a more detailed look at the contribution of the various sectors using the decomposition formula (4). In Table 7 we show for each country (for the longest period possible), the individual effects of the separate branches on aggregate labour productivity growth.[13] This table should be read as follows. Taking the example of South Korea, Table 5 shows that aggregate labour productivity grew at 4.6 per cent annually during the period 1963-96. Of this, 77 per cent is explained by intra-sectoral productivity growth, 28 per cent by static shift effects and minus 5 per cent by dynamic shift effects. The latter figures appear again in the last row for the Korea-panel in Table 7. In the rows above the percentage contribution of each sector to aggregate labour productivity growth is given. The columns report the separate effects: intra, static- and dynamic-shift effects and the total effect. For example, the agricultural sector contributed in total minus 3 per cent to aggregate labour productivity growth. In fact, it contributed positively (13 per cent) through productivity growth in the agricultural sector itself. However, the shift effect was strongly negative over the whole period, because the labour share of agriculture declined sharply over this period. On the other hand, the finance, insurance and real estate sector contributed positively to labour productivity growth (20 per cent in total). This is not due to faster labour productivity within

[13] Similar tables for subperiod are presented in the appendix (Appendix Tables 2 to 4)

the sector, but because of a shift of resources to this sector in combination with a relatively high productivity level in finance, insurance and real estate (explaining the high static effect).

When looking at the total contribution of the ten sectors in each country, it is clear that the manufacturing sector has contributed most to aggregate productivity growth.[14] Only in the city-states Hong Kong and Singapore the service sector, and in particular the finance, insurance and real estate sector, was more important. In early phases of industrialization, domestic demand is mainly geared towards manufactures, complemented by strong import demand from foreign markets. In this phase the manufacturing sector expands and contributes to aggregate labour productivity growth both through its increasing share in the labour force, and through increases in manufacturing labour productivity levels. However, as income rises domestic demand shifts to service goods and the labour share of the manufacturing sector declines. This, for example, most clearly happened in in South Korea and Taiwan at the end of the 1980s, even though the manufacturing employment share in these countries is still bigger than in most other Asian countries. Hence manufacturing's contribution to aggregate productivity growth can then only be made through productivity improvements within the sector. We will turn to an analysis of manufacturing productivity growth trends further on in this section.

During the second stage of development where the labour share in manufacturing is declining, labour shifts towards the service sector. Hence whereas in early phases of development the shift towards manufacturing was the main determinant of the aggregate shift effect, at a later stage the shift towards services is dominating. This is clear from Figure 4 in which the percentage contribution of the shifts of labour towards manufacturing and services to aggregate labour productivity growth is plotted against per capita GDP level.[15] The figure shows that whereas in early stages of development the shift effects of manufacturing dominate, in later phases of growth the shift to market services is clearly most important.[16] The shift-effect for manufacturing even becomes negative as labour shares in this sector decline. South Korea and Taiwan are two countries which clearly show this reversal during their development path. It should be emphasized, however that even during early stages of development, labour is shifted not only to manufacturing but also to market services, first mainly to the trade sector and later on also to finance, insurance and real estate. Moreover this shift effect to services is strikingly positive because of the high productivity level in some service sectors, in particular finance, insurance and real estate. Hence, it should be emphasized that the shift to services does not necessarily cause slower aggregate productivity growth because of lower productivity levels in that sector.

[14] This is also true for Japan for which results are given in Appendix Table 1.
[15] We only look at the shift to market services (which include trade; transport and communication; finance, insurance and real estate) and excluded the community, social and personal service and government service sector (which are combined in the statistics for many countries).
[16] See also Appendix Tables 2 to 4 in the Appendix.

However, not only is there a difference between manufacturing and market services in the timing of their shift-contribution to growth, but also in their intra-sectoral contribution to productivity. The latter has more pervasive consequences for continuing growth. Whereas in early stages expansion of manufacturing output was coupled with strong labour productivity improvements, the same is not true for the market services sector. In Figure 5, the contribution to aggregate labour productivity growth from the intra-sectoral labour productivity growth in manufacturing and market services is plotted. In early phases of development productivity growth in the manufacturing sector contributes in almost all cases more to aggregate growth than intra-growth in market services. This pattern persists at higher levels of per capita income. Even when, in terms of labour shares, market services have since long overtaken the manufacturing sector, productivity growth within manufacturing remains more important. Hence while the total contribution (intra plus shift-effect) of market services to aggregate labour productivity growth is positive, this is mainly due to a temporary shift-effect and not because of impressive productivity growth. In conclusion, unless the shift of resources towards services is coupled with clear labour productivity improvements, aggregate productivity growth is bound to slow down when countries begin to deindustrialise and the temporary bonus of the shift-effect has vanished.

As outlined in section 2, when both the labour input bonus and the structural bonus have been exhausted as sources of growth, intra-sectoral productivity growth will be the sole determinant of further per capita income growth. Also for Europe, a period of rapid labour productivity growth before 1973 was followed by much slower growth afterwards in part because the structural bonus had been exhausted, and labour shifted towards services where productivity growth was generally lower than in industry. And although recently labour productivity growth has been rapidly increasing in the USA, this is appears mainly due to productivity improvements within manufacturing, and much less so within services.

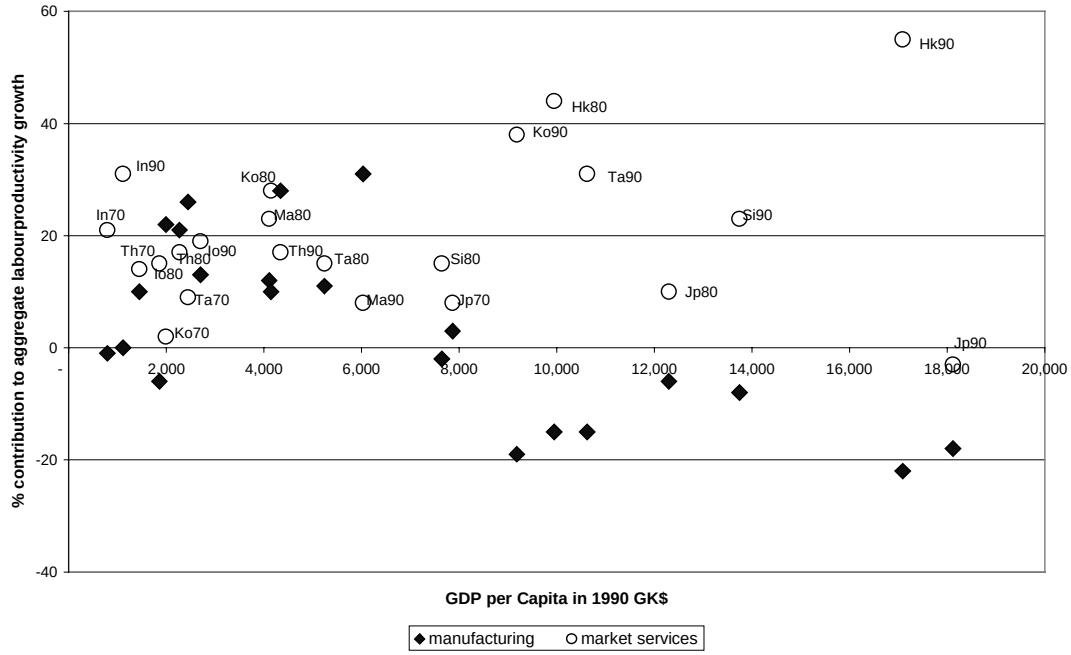
Table 7. Sector contribution to aggregate labour productivity growth (as percentage of aggregate growth), 1963-1996.

	Hong Kong, 1975-95				India, 1960-90				Indonesia, 1976-96				Singapore 1969-96			
	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect
Agriculture	0	0	0	-1	15	-9	-2	3	12	-8	3	7	1	-1	0	-1
Mining	0	0	0	0	5	-1	-1	3	-11	21	-9	1	0	0	0	0
Manufacturing	35	-21	-2	11	35	-1	0	34	21	12	-1	32	30	-4	-1	24
Utilities	4	0	0	4	5	1	0	6	2	0	-1	2	4	-2	-1	2
Construction	3	0	0	2	3	3	-1	6	5	6	-1	11	7	0	-1	6
Trade	5	4	0	9	8	10	1	19	10	8	1	19	27	-3	-1	24
Transport and communication	6	17	-1	22	2	10	0	12	1	6	0	7	11	0	0	11
Finance, insurance and real estate	-7	35	-2	26	-5	11	-6	0	3	6	-2	7	4	27	-3	28
Com., social and personal services	14	11	0	25	7	12	-3	17	13	4	-1	15	6	0	0	6
Government services	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Total	60	46	-6	100	74	37	-11	100	56	54	-11	100	91	18	-8	100

	Malaysia, 1975-96				South Korea, 1963-96				Taiwan, 1963-96				Thailand, 1963-95			
	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect
Agriculture	22	-21	-2	-1	13	-15	-1	-3	5	-5	0	-1	10	-6	0	4
Mining	17	-11	-2	4	1	-1	-1	-1	1	-1	0	0	4	-1	-1	2
Manufacturing	21	26	0	48	48	-9	-1	38	36	-5	0	31	16	21	0	37
Utilities	2	1	0	3	3	2	0	5	4	-1	0	3	0	3	0	3
Construction	2	3	0	5	0	10	0	10	2	3	0	4	1	8	-1	7
Trade	11	2	0	12	11	9	0	20	13	5	0	18	6	9	-1	14
Transport and communication	6	3	0	9	3	3	0	6	7	0	0	8	5	4	0	9
Finance, insurance and real estate	5	7	0	12	-4	24	-1	20	2	20	0	21	6	17	0	23
Com., social and personal services	0	2	0	2	0	5	0	6	5	3	0	8	(b)	(b)	(b)	(b)
Government services	9	-3	0	6	(a)	(a)	(a)	(a)	8	0	0	8	(b)	(b)	(b)	(b)
Total	95	9	-4	100	77	28	-5	100	83	19	-2	100	48	56	-4	100

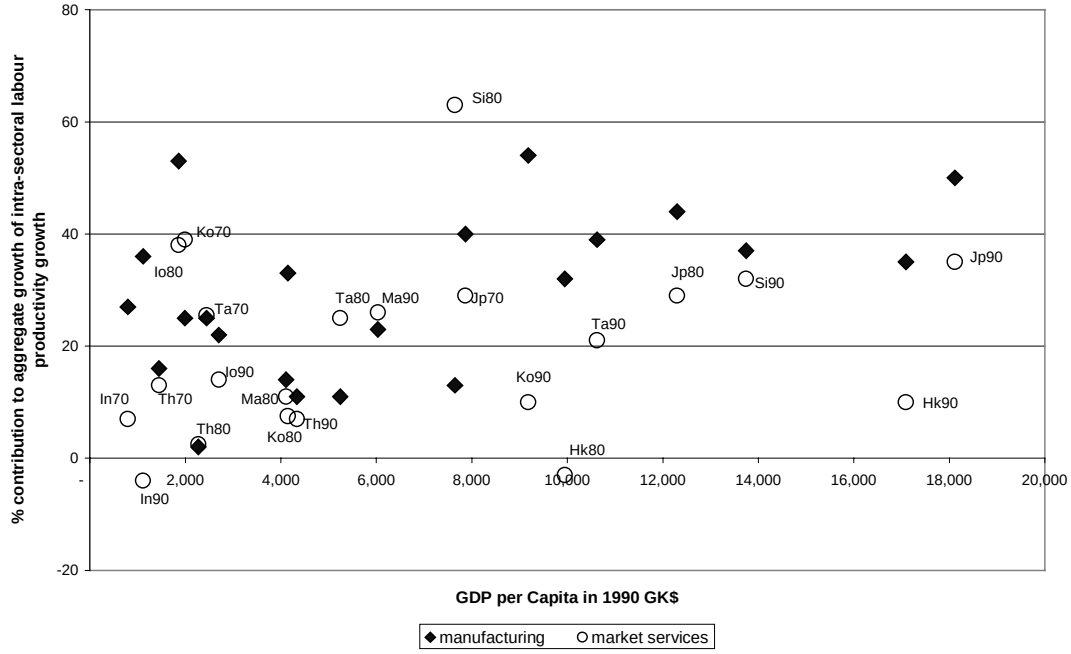
(a) included in community, social and personal services; (b) included in finance, insurance and real estate.
Note: Decomposition of aggregate labour productivity growth into intra sector effect and structure effect using equation (4). The total effect is the sum of the intra and structure effects. The total row is similar to the rows for each country for the whole period in Table 6.
Source: GGDC Sectoral Database (see Appendix)

Figure 4 - Contribution of shift effect to manufacturing sector and market services to aggregate labour productivity growth for Asian countries, various periods.



Note: Market services includes: trade; transport and communication; finance, insurance and real estate. For Thailand, the finance, insurance and real estate sector is excluded as no separate data for this sector is available. India 1970-80 is not included as labour productivity growth was near zero. For abbreviations, etc., see Figure 3
Source: GGDC Sectoral Database

Figure 5 - Contribution of intra-sectoral labour productivity growth in manufacturing and market services to aggregate labour productivity growth in Asian countries, various periods.



Note and source: See Figure 4

Industrial Development and Manufacturing Productivity

Before looking in more detail at productivity growth potential in services, a closer look should also be taken at the potential for further productivity growth in the manufacturing sector in Asian countries. The size of this potential can be inferred from the gap relative to the country that we identify as the manufacturing productivity leader, the United States. In Table 8 we provide comparisons of value added per worker and per hour worked for a number of countries with the USA. Labour productivity levels have been put on comparable levels using so-called unit value ratios rather than exchange rates or GDP PPPs which have been used in section 2. These unit value ratios are relative producer price levels for manufacturing products based upon a large number of detailed product matches, using the industry-of-origin approach as carried out for the International Comparisons of Output and Productivity (ICOP) project at the University of Groningen.[17] Table 8 shows that for China, India and Indonesia large gaps exist with labour productivity levels in US manufacturing. Labour productivity growth in the manufacturing sector in these countries in the past decades has been moderate and only recently catch-up with the USA is taking place, albeit from a very low level (in 1996 labour productivity levels in these countries were stilll at less than 7 per cent of the US level). On the other hand South Korea and Taiwan have shown rapid catch up with the US starting from very low levels in the 1960s up to around 40 per cent in 1996, which is close to the level of Spain. However, even for those countries the productivity gap is still big which indicates that there is room for further growth.

It might be hypothesised that a major explanation for the gap in labour productivity between the world productivity leader and the Asian countries is because factor inputs in countries with lower levels of per capita income are mainly concentrated in branches with relatively low levels of labour productivity. In contrast, in advanced countries labour is concentrated more in capital-intensive industries with higher labour productivity levels. If this is true, structural differences between the Asian countries and the USA would play an important role in explaining the large labour productivity gaps. To test this hypothesis, we modify the shift-share method discussed above by taking an interspatial, instead of an intertemporal, perspective. Let superscripts A and B denote countries, with B the base country, in this case the USA. The differences in labour productivity levels at the aggregate manufacturing level (LP^B-LP^A) are decomposed into two parts instead of three as in equation (2). In an interspatial context, the dynamic shift effect has no straightforward interpretation and therefore we take the two shift effects together as follows:

$$LP^B - LP^A = \sum_{i=1}^{n} (LP_i^B - LP_i^A)\frac{1}{2}(S_i^A + S_i^B) + \sum_{i=1}^{n} (S_i^B - S_i^A)\frac{1}{2}(LP_i^A + LP_i^B) \qquad (6)$$

[17] See, for example, Maddison and van Ark (1988), van Ark (1993) or Timmer (1999).

If the two countries do not differ in their employment structure, the second term of the right hand side of equation (6) is zero and the total productivity differential is solely due to intra-branch productivity differences. If branch productivities are equal, the first term equals zero. Differences in employment structures then explain the entire gap in labour productivity.

We applied this decomposition using data on 13 manufacturing branches as described in Timmer (1999). Table 9 shows the results of the decomposition of gaps in labour productivity levels in aggregate manufacturing between the Asian countries and the USA for the earliest and latest year in our data set, using equation (3). It follows that intra-branch productivity differentials explain the lion's share of the labour productivity gaps. Clearly the hypothesis that the Asian countries have concentrated their labour in branches with a below-average level of labour productivity is rejected. In 1993, structural differences explain 17 per cent of the gap between Indonesia and the USA and 10 per cent of the gap between South Korea and the USA. In all other years and countries, the contribution of structural differences is modest or even negative as in the case of China, India and Taiwan in 1993. Gaps in aggregate manufacturing labour productivity are overridingly due to gaps in labour productivity within each manufacturing branch and not due to differences in branch composition in output, whether now or in the past. This also indicates that by far the most important source of productivity improvements in Asian manufacturing stemmed from the closing of the productivity gap within industries, rather than a shift towards more productive branches. Similarly, it indicates that there is no structural bonus within manufacturing and that further improvements in labour productivity levels must come from intra-industry growth.

Labour productivity growth within branches can be realised by increasing the capital intensity of production. Similar to Figure 2, we present the relation between the non-residential capital stock per hour worked and GDP per hour worked in 1990$ for the manufacturing sector in Figure 6. The Figure clearly shows the rapid catching up with the USA but also indicate the remaining potential for further growth in East Asia through narrowing two gaps: one through increased capital intensity and another one through a rise in productivity. The gap in capital intensity indicates that there is still ample scope for further investment-driven growth. In fact, the pattern of low relative capital intensity levels has been found in all major manufacturing branches except textiles (see Timmer, 1999). The gap in labour productivity seems to be worrysome. With the same amount of capital per hour worked, the United States generated much more manufacturing output in the 1960s than the East-Asian countries in the 1990s. The concave nature of the growth paths indicates an increasing capital-output ratio with diminishing returns as in the traditional growth model of Solow (1956). Like for the total economy (see Figure 2) there remains substantial scope for further investment, but it must be accompanied with measures that help to realise the potential of productivity improvements through disembodied technical change if manufacturing is to remain an important source of futher growth in per capita income (see Timmer and Van Ark, 2000).

Table 8. ICOP Estimates of Comparative Levels of Labour Productivity in Manufacturing, 1950-1996, USA=100

	1960		1973		1987		1996	
	Value Added per Person Employed	Value Added per Hour	Value Added per Person Employed	Value Added per Hour	Value Added per Person Employed	Value Added per Hour	Value Added per Person Employed	Value Added per Hour
India								
all firms	2.1		2.6 g		**2.2**		2.5 k	
Registered firms only (a)	6.7		7.0 g		**8.4**	6.8	10.8 i	
China								
all firms					**4.5**		6.4 j	
large firms only (b)					**5.7**	4.9		
Indonesia								
all firms	4.0 e		3.0 h		**4.6**		5.0 k	
Medium & large only (c)					**8.0**	6.3	11.2 k	
Hungary	17.6		16.7		**20.1**		25.2	
Poland	23.9		24.9		**21.2**		18.5	
East Germany	24.3		22.5		**22.5**	23.5	57.6	
Czechoslovakia	27.7		23.9		**24.0**	18.9		
Portugal	15.0		24.2		**24.5**		23.2 k	
USSR								
all industry (d)	27.2	27.3	25.5	26.8	**26.1**	27.7		
manufacturing only					**24.8**	26.3		
Mexico	36.8		35.3		**25.5**		25.4	
Korea	9.8 f	6.9 f	15.0	10.9	**26.5**	18.4	40.6	31.7
Taiwan	11.8 f	8.1 f	19.5	14.0	**26.6**	20.4	34.7	28.3
Brazil	41.8		46.3		**32.7**		21.9	
Spain	15.1		28.5		**46.5**		39.6	
Australia	40.7	39.6	43.1	43.8	**48.4**	49.9	80.8	47.3
United Kingdom	49.9	45.9	51.1	52.5	**53.6**	58.0	53.1	61.1
Finland	47.9	45.5	53.2	56.1	**65.9**	74.3	86.4	103.5
Sweden	53.6	55.3	73.0	88.3	**68.4**	87.4	83.1	99.3
West Germany	63.0	57.9	75.6	79.0	**70.2**	82.2	66.2	84.6
France	51.8	49.8	67.6	71.4	**71.2**	84.0	75.4	91.2
Japan	24.9	19.9	55.0	47.5	**76.4**	67.5	82.7	83.2
Canada	80.4	80.2	83.9	86.0	**77.5**	79.4	73.0	77.4
Belgium	42.1	42.2	57.6	67.0	**78.5**	99.8	80.8	104.0
Netherlands	54.4	50.2	79.3	87.0	**83.3**	105.4	82.5	111.7
United States	100.0	100.0	100.0	100.0	**100.0**	100.0	100.0	100.0

(a) establishments with 20 or more employees and establishment with between 10-20 employees using power; (b) enterpises above township level; (c) establishments with 20 or more employees except those in oil and gas refineries; (d) including mining and public utilities; (e) 1961; (f) 1963; (g) 1970; (h) 1971; (i) 1993; (j) 1994; (k) 1995

Notes: Countries are ranked according to their level of value added per person employed in 1987. Portugal/UK, Spain/UK, Hungary/W-Germany, Poland/W-Germany and East Germany/W-Germant have been converted to the USA as the base country for the benchmark year.

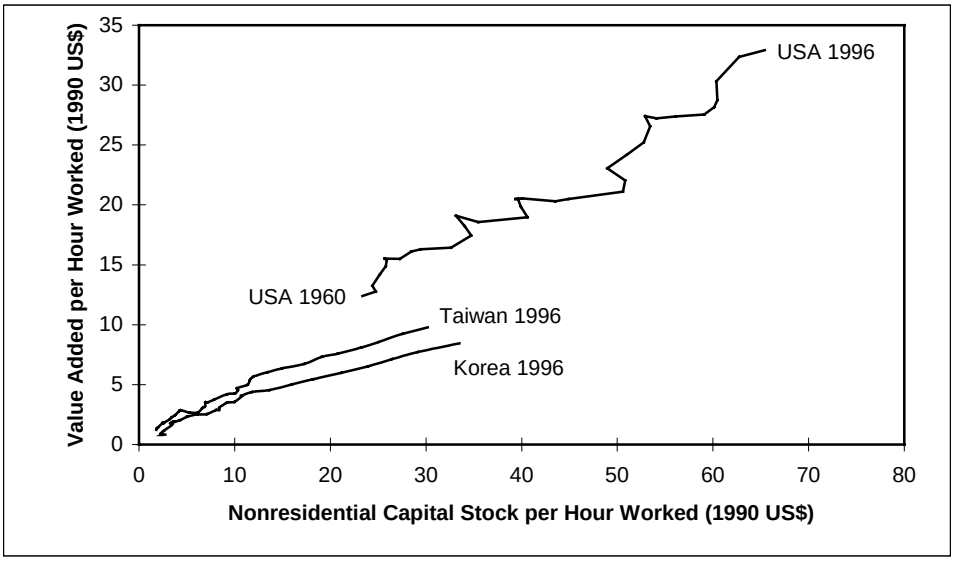
Sources: ICOP Industry Database (see Appendix)

Table 9. Decomposition of manufacturing labour productivity differences with USA (percentage explained)

	China, IAE at township level and above		India, registered sector		Indonesia, medium and large scale sector		South Korea, Full		Taiwan, full	
	1980	1992	1973	1990	1975	1993	1963	1993	1963	1993
Intra branch effect	101	102	97	97	95	83	95	90	96	102
Structure effect	-1	-2	3	3	5	17	5	10	4	-2
Total effect	100	100	100	100	100	100	100	100	100	100

Note: Decomposition of difference in labour productivity levels between Asian country and the USA into part due to differences in branch levels (intra-branch effect) and differences in branch shares in employment (structure effect) using equation (6).
Source: Timmer (1999, Table 7.6).

Figure 6 - Labour Productivity and Capital Intensity, Manufacturing, 1990 US$



Source: Timmer and van Ark (2000)

5. The Challenges in Continuing to Realising the Growth Potential

As argued above the only long run source of growth for any country is productivity improvement. Given the heavy reliance of many countries in East and Southeast Asia on accumulation of labour and capital and reallocations of resources from low to high productivity sectors during the process of industrialization, the emphasis should shift more strongly to within-sector productivity growth. In this section we discuss three related sources of growth which may need to be further exploited to realise further growth potential, namely higher productivity growth in services, more efficient use of new technologies (in particular ICT) and structural reforms in labour, product and capital markets. Even though the urgency of the matter may be stronger in Asia than in Europe or North America, given the lower productivity levels and the stagnating productivity growth in recent years in many Asian countries, these factors also get considerable attention outside Asia. Hence we can partly benefit from evidence derived from other regions to assess the importance of addressing these issues in more detail

Services

Even though the service sectors of most Asian countries is still smaller in terms of their employment share than those in Western Europe and North America, the growth of service sector employment has been very rapid in all countries (Table 10). In some sectors, in particular in finance, insurance and real estate, employment doubled in ten years time, and even in distribution and transport and communication (which showed slow employment growth in Europe and the USA) expanded rapidly in most Asian countries. By 1995, South Korea and Taiwan had service sector employment shares of over 50 per cent. Only Japan's service employment sector appears relatively small compared to other advanced countries. Indeed, lack of structural reforms in product markets have often been blamed for the sluggish employment growth of service sectors, such as distribution and transport and communication.

Table 10. Development of Service Sector Employment (1985-1995) and Share in Total Employment (1995)

	Growth of Service Sector Employment (1985-1995), 1985=100						Share of Service Sector Employment in Total Employment
	Wholesale and Retail Trade	Transport and Communi-cation	Finance, Insurance and Real Estate	Community, Social and Personal Services	Government Services	Total Employment	
India (1980-90)	167	205	238	210	(a)	130	26
Indonesia	147	178	273	150	(a)	130	38
Thailand	167	177	174	(b)	(b)	125	32
South Korea	161	151	276	151	(a)	136	54
Taiwan	145	122	266	157	118	122	51
Singapore	119	147	235	142	(a)	137	69
Hong Kong	147	164	237	161	113	117	71
Japan	112	117	115	139	126	115	60
France	103	103	133	127	116	103	70
Germany (West)	113	104	119	151	110	107	62
United Kingdom	108	97	144	168	96	106	73
United States	119	121	114	144	109	118	77

(a) included in Community, Social and Personal services
(b) included in Finance, Insurance and Real Estate
Source: GGDC Sectoral Database (see Appendix)

Table 11. GDP per Person Employed or per Hour Worked as a % of the United States (USA=100)

	Mexico (1993)	Brazil (1993)	Korea (1996)		Japan (1995)		France (1995)		Germany (1995)	
	Per person	Per person	Per person	Per hour	Per person	Per hour	Per person	Per hour	Per person	Per hour
Agriculture	7.3	4.4	7.5	6.2	6.8	8.0	71.6	90.9	31.3	39.7
Mining	74.5	44.9	14.7	13.1	19.1	19.8				
Manufacturing	17.5	25.2	39.8	29.8	88.7	84.4	71.5	87.0	65.7	80.0
Construction	42.3	51.8	58.1	50.6	54.4	58.0				
Public Utilities	21.5	30.0	40.4	28.6	51.0	48.4				
Wholesale and Retail trade	22.4	19.9	34.5	21.9	67.2	53.9	94.1	93.4	70.6	70.1
Transport and Communications	23.1	30.7	41.5	28.3	48.1	45.0	67.2	78.7	54.7	64.0
Finance and real Estate	89.6	24.6	36.5	27.9	99.2	95.8				
Other Services	32.6	34.2	99.0	66.1	108.9	92.7				
Total (aggregate from sectors)	26.7	17.0	46.9	32.2	70.9	62.6				
Total (total economy)	32.3	27.8	57.9	37.5	80.4	70.3	98.0	103.5	93.3	96.8

Source: Brazil and Mexico from Hofman and Mulder (1997). Korea and Japan for 1985 from Pilat (1994), France and Germany from Van Ark, Monnikhof and Mulder (1999). All series updated to current year with time series on real value added and employment from GGDC Sectoral Database (see Appendix).

Given the rapid rise in service sector employment, productivity growth in service industries is an essential tool for further growth. It should be emphasized that the measurement of services output and productivity is fraught with measurement problems. According to Griliches (1994) data-collection efforts in measuring real output and productivity have not kept pace with changes in the functioning of the economy. National accounts estimates of real output (that is, the nominal value of output corrected for price changes) are valid provided a clear separation is possible between the quantity and price component of output, as was the case with most agricultural and industrial products in the past. However, new products and, in particular, new services have appeared which make it increasingly difficult to adjust the measures of real output for changes in quality.[18]

Taking these words of caution into account, it is possible to establish the potential for service productivity growth by looking at the service productivity gap for a limited number of countries relative to the United States. Table 11 reports sectoral productivity gaps for some countries in the ICOP database. Most ICOP comparisons of productivity deal with the manufacturing sector only (see Table 8), but for some countries service sector productivity has also been measured. The table shows that the catch-up potential for Korea and Japan is still relatively large. With the exception of finance and insurance in Japan, other service sectors in both countries show relatively low productivity levels not only compared to the United States, but also compared to France and Germany.

New Technologies

Invention and innovation are the key forces behind disembodied technological change. Countries with a large catch-up potential, which are characterised by openness through trade or capital flows, can benefit from the international technology diffusion. In particular when domestic institutions are such that they provide a seedbed for adapting new technologies to the local situation, technology diffusion can a very effective tool to raise productivity. There is a large literature which provides evidence that many East Asian countries have been very successful in benefitting from technology diffusion.[19]

The key technology that has attracted most attention in the past few years is Information and Communication technology (ICT). Indeed use of ICT has rapidly increased everywhere. However, there are still large differences across regions. Table 12 shows that, compared to Europe, Japan, and the USA, Asian countries (except Japan) still show low penetration in terms of PCs and internet hosts.[20]

[18] See also Griliches (1992). Estimates by Van Ark (2000), applying a method proposed by Sichel (1997) for the USA to five advanced economies (France, Germany, Netherlands, UK and USA), suggest that due to the shift of economic activity from manufacturing to service sectors the measurement bias of real output increased by between 0.238 percentage points (for the UK) and 0.406 percentage points (for France) each year between 1985 and 1996 compared to the period 1960-1973.

[19] For a review of the literature, see Timmer (1999), Chapter 8.

[20] For an overview of ICT in Asia, see UN/ESCAP, *Economic and Social Survey of Asia and the Pacific, 1999*, Bangkok.

Table 12. Personal Computers and Internet Hosts per 10,000 people, 1997

	Personal Computers per 10,000 people	Internet Hosts per 10,000 people
NAFTA	307.4	320.1
Japan	202.4	82.9
European Monetary Union	186.1	75.8
World	64.2	34.8
Latin America& Carribean	32.8	6.2
Europe & Central Asia	17.7	3.5
Middle East & North Africa	15.4	2
East Asia & Pacific	7.4	0.5
South Asia	2.1	0.2
Sub-Saharan Africa	..	0.1

Source: World Bank, *World Development Indicators*

For the purpose of productivity analysis, however, a number of questions need to be explicitly addressed. Firstly, how large in the investment part of expenditure on ICT? Expenditure on ICT as a percentage of GDP in Asian countries was between 2 per cent (for the lowest income countries) and 6 per cent of GDP, and ICT investment as a share of total investment rates between 3 and 10 per cent. On the latter count, the non-Asian show decisively higher rates of ICT investment Hence the European economies, and in particular the US is more ICT intensive than the average Asian economy.

To really get a good handle on the importance of ICT one needs estimates of the stock of accumulated ICT capital. These are difficult to obtain as it requires careful measurement of ICT investment, ICT deflators and evidence on the asset-life functions of ICT capital. Reasonably good stock estimates of information technology (IT) capital (i.e., excluding communication equipment) are available for the United States, which again show surprisingly low shares in the total capital stock. For example, Oliner and Sichel (1994) and Sichel (1999) suggest that computer capital accounts for no more than 2 per cent of the nonresidential capital stock in the private business sector in the USA. Such small numbers can at least in part be explained by the very rapid depreciation of computer capital. Hence much of the new investment in IT replaces outdated IT capital without adding much value to the stock. A second observation from the American data is that the distribution of computer capital is very unequal across sectors. The service sector is by far the most intensive user of computers. For example, in 1996 more than three quarters of all computer capital in the US was concentrated in wholesale and retail trade (24.7 per cent), finance, insurance and real estate (29.1 per cent), and other private services, including business services, hotels and heatlh and education services (24.4 per cent) (McGuckin and Stiroh, 1999).[21]

[21] Note that IT capital here does not include CNC equipment, which is of course most intensively used in manufacturing.

Table 13 – ICT Shares in Output and Investment, 1996 (%)

	ICT expenditure as % of GDP	ICT investment as % of gross fixed capital formation
India	1.9	2.9
Indonesia	1.9	11.3
Thailand	2.4	2.9
Malaysia	4.7	5.1
Korea	6.1	7.7
Taiwan	3.3	6.5
Singapore	6.1	6.7
Hong Kong	6.1	7.6
Japan	6.4	6.5
Belgium	5.6	12.1
Denmark	6.3	15.3 (a)
France	5.9	10.9
Germany	5.2	11.2
Netherlands	6.6	13.5
Sweden	7.6	17.4
United Kingdom	7.6	18.3
European Union	5.6	n.a.
United States	7.7	20.6

(a) 1995;

Note: ICT output is value added in office and computing technologies and radio, TV and communication. ICT expenditure concerns IT hardware, IT services and software and telecommunication. ICT investment is defined as expenditure of IT hardware (assuming that IT expenditure on hardware by households, which is included, is offset by IT expenditure by unincorporated enterprises, which are excluded) and 30 per cent of expenditure on telecommunications (assuming to represent the part of expenditure on communications by enterprises)

Source: ICT expenditure as % of GDP for OECD countries (incl. Japan and Korea) from OECD (1999); ICT expenditure for other countries and calculations of ICT investment from WITSA, International Data Corporation; gross fixed capital formation from OECD, *National Accounts, Main Aggregates 1960-1997* and ADB, *Key Indicators of Developing Countries 1998*.

For empirical evidence on the contribution of IT capital to output growth, estimates from recent studies by Jorgenson and Stiroh (1999) and Sichel (1999) show that even though the contribution of IT capital to output growth in the US has strongly risen during the 1990s, it is still no more than between 4 and 8 per cent of output growth. Sichel stresses the acceleration of the contribution of computer capital to growth during the 1990s. In particular the faster

growth of real output since 1996 is traced to a doubling of the growth rate of IT capital. Hence investment in ICT capital may be a promising route for productivity gains, but the experience of the United States shows that the gains are not immediate and unequally distributed across the economy. In particular the services sector in the United States has only since very recently seen some acceleration of productivity growth which may be linked to ICT investment.[22]

Institutions and Structural Reforms

To face the challenges of the rise in service sector production in many Asian countries, and to facilitate the economies to raise productivity through applying new technologies, the functioning of markets and institutions needs to be reconsidered. It should be emphasized that such a call for reforms is no new phenomenon and it not unique to Asian countries. It essentially calls for responding adequately to new circumstances in the same way as the successful institutional responses that helped to create the catch-up phase of the earlier decades in, for example, East Asia. Hence, in a modified sense, Gerschenkron's "backwardness hypothesis" still has full swing, that is, institutions need to adapt to the particular phase of development a country is in relative to its competitors.

The modification is, however, that the role of the government may be different from the earlier catch-up phases. Gerschenkron's "developmental state" model called for an active government intervention in stimulating vertically integrated enterprises, the development of investment banking, enforce investment decisions, resolve problems of asymmetric information by finance for industrialization, and mobilize savings and develop infant industries. But in an environment of more economic activity in an absolute sense, more diversification of economic activities in different sectors, more sophistication in consumer demand, technologies that make it more difficult to control the channeling of information, and greater integration in the world economy, such an intensive government role may be more difficult to accomplish, even in (what Gerschenkron called) a strong developmental state.[23] institutional arrangements may need to be reconsidered. Indeed "as development progresses a shift towards more orthodox market-based arrangements and financial liberalization will be attractive in particular to improve productivity performance and allocative efficiency" (Crafts, 1999, p. 10)

[22] See Van Ark (2000) for a more detailed overview for European countries.

[23] A strong developmental state enjoys a relatively strong autonomy and insulation from pressure of distributional coalitions. Weak developmental states are strongly dependent on distributional coalitions and short-term interests of political leaders. See also Hayami (1997), Chapter 8.

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Appendix: The Groningen Growth and Development Centre Data Base (http://www.eco.rug.nl/ggdc/Dseries/dataseries.html)

A. Source description of GGDC Total Economy Data Base for Asia

Population series
Bangladesh, India, Indonesia, Japan, Pakistan, Philippines, South Korea, Sri Lanka, Taiwan and Thailand: series up to the year 1992 were taken from Maddison, A, (1995), *Monitoring the World Economy, 1820-1992*, OECD Development Centre. China from A. Maddison (1998), The Chinese Economy in the Long Run, OECD Development Centre, Paris. Hong Kong, Malaysia, Singapore and Sri Lanka: series from the United States, Bureau of the Census International Database internet site (http://www.census.gov/ipc/www/). The latter series were also used to update all countries to 1998.

GDP series
The 1990 US$ level (converted at Geary Khamis PPPs) was obtained from Maddison (1995). The time series were derived as follows: Bangladesh, India, Indonesia, Japan, Pakistan, Philippines, South Korea, Taiwan and Thailand up to 1990 from Maddison (1990). Updated to 1997 on the basis of Asian Development Bank, *Key Indicators of Developing Countries* 1998, except for Japan and South Korea which were updated on the basis on OECD, . Updated to 1998 on the basis of IMF, World Economic Outlook Database (September 1999; www.ilo.org). China from Maddison (1998). Hong Kong, Malaysia, Singapore and Sri Lanka from combination of ADB, Key Indicators …, and Asian Productivity Organisation, *Comparative Information on Productivity Levels,* and World Bank, *World Tables*. Updated to 1998 on the basis of IMF, World Economic Outlook Database (September 1999; www.ilo.org).

Employment and hours series
Based on a combination of Asian Development Bank, Asian Productivity Organisation as described above. For some countries national statistics were used to fill gaps in the data. China from Maddison (1998). India was derived from decennial population census. Japan from OECD, *Labour Force Statistics*. These series were updated to 1998 using data from the OECD, *Economic Outlook.* Updates for Korea also on the basis of OECD, *Economic Outlook*. Hours benchmarked on Maddison (1995) and for Korea, Taiwan, Hong Kong and Singapore on N.F.R. Crafts (1997), "Economic Growth in East Asia and Western Europe since 1950: Implications for Living Standards", *National Institute Economic Review*

B. Source description of GGDC Sectoral Database for Asia

Gross Value Added in Constant Prices

Taiwan: 1961-1995 from Directorate-General of Budget, Accounting and Statistics, "National Income in Taiwan Area of the Republic of China, 1996". 1996 from ADB, “Key Indicators of Developing Asian and Pacific Countries”, 1997.

Singapore: 1960-1973 in 1968 prices from Department of Statistics,”Singapore National Accounts”, Singapore, 1975, linked in 1973 with 1973-1979 in 1968 prices from Department of Statistics, “Economic and Social Statistics Singapore, 1960-1982” Singapore, linked in 1979 to 1979-1990 in 1985 prices from ADB, Internet site. 1990-1995 in 1990 prices from Department of Statistics, ”Yearbook of Statistics Singapore’, various issues. 1996 in 1990 prices from ADB, Internet site

Korea: 1953-1970 in 1985 prices from D. Pilat, "The Economics of Catch Up: the Experience of Japan and Korea, Groningen Growth and Development Centre, 1993". linked in 1970. 1970-1997 in 1990 prices from OECD, “National Accounts”, 1999.

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India: CSO, “National Accounts Statistics”, various issues.

Indonesia: 1960-1995 from Pierre van der Eng.

Thailand: 1946-79 in 1972 prices from N.Vanderveen, 1987, ‘Postwar Economic Growth and Structural Change in Thailand’ linked in 1980 1980-96 from Asian Development Bank, Internet site

Number of Persons Employed by Industry

Taiwan: 1963-1978 trends from Directorate-General of Budget, Accounting and Statistics, "Statistical Yearbook of the Republic of China, 1982" applied to 1978. 1978-1995 from Directorate-General of Budget, Accounting and Statistics, "Monthly Bulletin of Manpower Statistics, Taiwan Area”, various issues. 1996 from ADB, “Key Indicators of Developing Asian and Pacific Countries”, 1997.

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APPENDIX 1 Detailed results of shift-share analysis for Asian countries

Appendix Table 1 Sector contribution to aggregate labour productivity growth (as percentage of aggregate growth), Japan, 1963-1996

	Japan, 1963-73				Japan, 1973-85				Japan, 1985-96				Japan, 1963-96			
	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect
Agriculture	4	-5	0	-1	3	-4	0	-1	0	-3	0	-3	2	-4	0	-2
Mining	2	-1	0	0	0	-1	0	0	1	-1	0	0	1	-1	0	0
Manufacturing	40	3	0	43	44	-6	0	38	50	-18	-1	31	45	-7	0	37
Utilities	2	0	0	2	3	0	0	3	4	0	0	4	3	0	0	3
Construction	5	2	0	7	0	-1	0	-1	4	6	0	10	3	2	0	5
Trade	17	2	0	19	15	2	0	17	12	-1	0	11	14	1	0	15
Transport and communication	5	0	0	6	6	-1	0	5	4	1	0	5	5	0	0	5
Finance, insurance and real estate	7	6	0	13	8	9	0	17	29	-3	0	26	15	4	0	19
Com., social and personal services	4	4	0	9	4	10	0	14	3	14	0	16	4	10	0	13
Government services	1	1	0	2	6	2	0	8	-6	6	0	0	1	3	0	4
Total	88	12	0	100	90	11	0	100	101	1	-2	100	93	7	-1	100

Appendix Table 2 Sector contribution to aggregate labour productivity growth (as percentage of aggregate growth), 1963-1973

	India, 1960-70				South Korea, 1963-73				Taiwan, 1963-73				Thailand, 1963-73			
	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect
Agriculture	10	0	0	11	8	-7	0	1	13	-12	-1	0	26	-5	0	20
Mining	2	0	0	2	4	-2	-2	1	0	0	0	0	1	1	0	1
Manufacturing	27	-1	0	26	25	21	1	47	25	25	1	51	16	10	0	26
Utilities	1	4	1	7	3	2	-1	3	5	-1	-1	3	3	1	0	4
Construction	13	-1	-1	11	6	1	-1	6	1	4	0	5	-4	5	0	1
Trade	11	2	1	15	24	2	0	26	9	5	-1	13	4	2	0	6
Transport and communication	2	7	1	9	11	0	0	11	8	2	0	9	9	12	0	22
Finance, insurance and real estate	-6	17	-7	4	4	2	-2	4	8	3	0	11	6	14	0	20
Com., social and personal services	24	-4	-3	17	3	0	0	2	2	1	0	3	(b)	(b)	(b)	(b)
Government services	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	1	3	-1	4	(b)	(b)	(b)	(b)
Total	85	23	-8	100	88	19	-6	100	74	29	-3	100	60	39	0	100

Note: (a) included in community, social and personal services; (b) included in finance, insurance and real estate.

Appendix Table 3 Sector contribution to aggregate labour productivity growth (as percentage of aggregate growth), 1973-1985

	Hong Kong, 1975-85				India, 1970-80				Indonesia, 1976-85				Singapore,1973-85			
	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect
Agriculture	-3	0	0	-3	-504	22	-3	-485	40	-14	-5	21	3	-3	-1	-1
Mining	0	0	0	0	42	-22	-11	9	-115	216	-156	-56	0	1	-1	0
Manufacturing	32	-15	-2	15	166	-44	-6	116	53	4	-10	46	13	-1	-1	12
Utilities	4	0	0	5	33	1	1	35	2	4	-4	2	5	-2	-1	2
Construction	8	-3	-1	4	34	-62	-5	-33	-3	15	-7	5	4	8	-2	11
Trade	3	4	0	6	100	18	2	120	24	11	-3	32	38	0	-1	36
Transport and communication	8	16	0	24	141	8	2	151	6	6	-1	12	10	-4	0	6
Finance, insurance and real estate	-14	26	-2	10	93	-42	-17	34	8	34	-32	10	15	22	-2	35
Com., social and personal services	28	9	0	38	134	16	3	153	13	15	-1	27	1	-2	0	-1
Government services	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Total	66	39	-5	100	240	-106	-34	100	29	291	-220	100	90	19	-9	100

	Malaysia, 1975-85				South Korea, 1973-85				Taiwan, 1973-85				Thailand, 1973-85			
	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect
Agriculture	34	-29	-3	2	19	-17	-1	1	6	-8	-1	-2	16	-8	0	8
Mining	46	-30	-6	11	-1	2	0	0	2	-2	0	0	10	0	0	9
Manufacturing	14	13	-1	26	33	10	0	43	31	11	1	43	2	21	0	23
Utilities	1	2	0	3	6	1	-1	6	5	0	0	5	1	2	0	3
Construction	0	7	0	7	7	2	-1	9	2	1	0	2	4	5	0	9
Trade	5	9	0	14	8	9	0	17	8	6	0	14	-3	15	0	12
Transport and communication	6	4	0	10	4	3	0	7	9	1	0	9	5	2	0	7
Finance, insurance and real estate	0	10	0	10	-3	17	-1	13	8	8	0	16	2	27	0	29
Com., social and personal services	0	2	0	2	0	6	0	6	6	1	0	7	(b)	(b)	(b)	(b)
Government services	7	9	0	15	(a)	(a)	(a)	(a)	5	2	0	6	(b)	(b)	(b)	(b)
Total	113	-3	-10	100	71	34	-5	100	82	19	-1	100	37	64	0	100

Note: (a) included in community, social and personal services; (b) included in finance, insurance and real estate.

Appendix Table 4 Sector contribution to aggregate labour productivity growth (as percentage of aggregate growth), 1985-96

	Hong Kong, 1985-95				India, 1980-90				Indonesia, 1985-96				Singapore, 1985-96			
	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect
Agriculture	1	-1	0	0	28	-15	-3	10	11	-9	-1	1	0	0	0	0
Mining	0	0	0	0	6	-1	-1	4	-5	9	-2	3	0	0	0	0
Manufacturing	35	-22	-3	10	36	0	0	36	22	15	-2	34	37	-7	-1	29
Utilities	4	0	0	4	6	0	0	5	2	0	-1	2	4	-2	-1	1
Construction	2	0	0	2	-2	7	-1	5	6	6	-1	12	8	-3	-1	4
Trade	6	4	0	10	4	14	1	19	11	8	-1	18	23	-5	-1	17
Transport and communication	5	17	-1	22	-1	12	-1	10	0	7	0	7	11	2	0	14
Finance, insurance and real estate	-6	37	-2	29	-7	10	-5	-2	3	5	0	8	-2	31	-4	26
Com., social and personal services	11	12	0	23	-4	21	-3	14	15	3	-4	15	8	2	0	10
Government services	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Total	58	47	-6	100	65	47	-13	100	67	44	-11	100	90	18	-8	100

	Malaysia, 1985-96				South Korea, 1985-96				Taiwan, 1985-96				Thailand, 1985-95			
	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect	Intra sector effect	Static shift effect	Dyna-mic shift effect	Total effect
Agriculture	19	-19	-1	-2	11	-15	-1	-5	3	-4	0	-1	6	-4	0	2
Mining	8	-6	-1	2	2	-2	-1	-1	1	-1	0	0	2	0	-1	1
Manufacturing	23	30	1	54	54	-17	-2	35	39	-14	-1	24	11	29	-1	39
Utilities	2	1	0	3	2	2	0	4	4	-1	0	3	-1	4	0	3
Construction	2	2	0	4	-2	13	0	11	2	3	0	5	0	9	-1	8
Trade	13	-1	0	12	11	9	0	20	15	5	0	20	4	13	-1	16
Transport and communication	6	3	0	9	3	3	0	6	7	0	0	7	3	6	-1	9
Finance, insurance and real estate	7	6	0	13	-4	27	-1	22	-1	26	0	24	1	23	-1	22
Com., social and personal services	0	2	0	1	1	5	0	6	5	4	0	10	(b)	(b)	(b)	(b)
Government services	9	-6	0	3	(a)	(a)	(a)	(a)	10	-1	0	8	(b)	(b)	(b)	(b)
Total	90	12	-2	100	79	27	-5	100	84	18	-2	100	26	81	-6	100

Note: (a) included in community, social and personal services; (b) included in finance, insurance and real estate.