Asia's Productivity Performance and Potential: The Contribution of Sectors and Structural Change

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Abstract

This paper aims to improve our understanding of economic growth performance in Asia during the past four decades by focusing on the role of resource reallocations between sectors and its contribution to aggregate productivity growth. We find that the traditional source of reallocating resources from agriculture to industry is still quite powerful for low income countries in the region (in particular South Asia and South East Asia), especially when account is taken of the existence of so-called "surplus labour" in the agricultural sector. For more advanced countries (in East Asia), the impact of structural change has not disappeared either. Within the manufacturing sector, shifts occurred from relatively labour intensive, low productive, manufacturing industries towards high-productivity industries in particular ICT. As a result, the manufacturing sector continues to drive much of the overall productivity growth in Asia. The traditional idea that services do not contribute to productivity growth is rejected for many countries. In advanced Asian countries productivity growth in trade contributes strongly to aggregate productivity growth, and in finance and business services the relatively high productivity level also contributes to the aggregate. However, in Japan service productivity growth has seriously slowed down during the 1990s. The potential for improvements in productivity growth in services through increased ICT use is still largely unrealized. Productivity level comparisons between countries suggest substantial productivity gaps for all countries relative to the United States both in manufacturing and services.

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1. Introduction and Summary

The recent growth slowdown in the Asian region, has renewed the urgency to understand the determinants of Asia's growth model during the final decades of the 20th century and its future prospects. No doubt part of the slowdown is related to the financial and economic crisis of 1997 and 1998, but the effects on Asia's growth potential in the long run go beyond such short term issues as unsustainable capital inflows and intransparent capital markets.[1] The recovery from the crisis has mostly been cautious, but with different implications for productivity growth - which is the main source of sustainable growth - across the region. In East and South East Asia, labour productivity growth has dropped well below the long term growth trend of the past three decades (see Table 1). In Japan, the slowdown in productivity growth had already set in much earlier, whereas labour productivity growth in South Asia (primarily India) also slowed somewhat but moved well beyond the growth rates for East and South East Asia during the second half of the 1990s.

Table 1: Growth rates of GDP per person engaged for Major Countries and Regions

	China	South Asia	Southeast Asia	East Asia	Japan	European Union	United States
	GDP per person engaged (annual compound growth rate)						
1960-1973	1.3	1.9	3.2	6.0	8.1	4.4	2.3
1973-1985	4.0	1.6	1.7	4.6	2.4	1.9	1.0
1985-1997	4.8	3.3	4.2	4.7	1.9	1.7	1.4
1997-2002	5.9*	2.7*	-1.3*	3.0*	0.9	0.9	2.2

Source: Groningen Growth and Development Centre Total Economy Database
*1997-2001

Much of the recent debate on the sources of growth in Asia has been strongly focused at the macro-level. Accumulation of physical capital has featured strongly as a source of growth in much of the literature on the East Asian "growth miracle" (World Bank 1993). In accordance with standard growth theory and the unconditional convergence hypothesis, growth rates are bound to slow as income rises depending on the degree at which diminishing returns to capital are setting in. The projections of future growth potential from capital therefore have ranged from very negative (Felipe 2000), to moderately negative (Young 1995; Krugman 1994) or moderately positive viewpoints (Crafts 1999). It is clear, however, that without technological change, capital accumulation on itself is a transitional source of growth.[2]

[1] See Stiglitz and Yusuf (2001) for a review of the impact of the crisis on the determinants of the East Asian growth model.
[2] See Timmer and van Ark (2002) for an overview of this debate and new estimates of capital accumulation and TFP in Korea and Taiwan.

Demographic trends are a second factor which has speeded up growth. When a relatively young population reaches working age, one can exploit the opportunities for growth. This demographic gift has been a major source of growth for East Asian countries during the 1960s and 1970s and is potentially still important for countries in the South Asian region (Bloom and Williamson 1999). But this source of growth also dries up once the relatively large working population hits retirement age as predicted by the demographic transition model.

The more permanent sources of growth arise from improvements in quality of inputs and from a rise in productivity, which are driven by continuous technological and organizational innovations and improvements in the social capability to catch up.[3] This typically requires the creation and maintenance of an extensive and high quality education system, the accumulation of other forms of intangible capital (including R&D, organizational capital, etc.) and the setup of an institutional environment that improves the functioning of markets, reduces intransparencies and helps to implement an effective macro and micro policy environment.

The recent debate on the sources of growth in Asia, however, has mostly neglected the underlying dynamics of changes in productivity growth within sectors (or industries) of the economy and, related to this, the shift of resources from low-productivity to high-productivity industries. This is in strong contrast to the earlier work on economic development, including that of Clark, Kaldor, Kuznets and Chenery and associates (Clark 1957, Kaldor 1966, Kuznets 1966 and 1979, Chenery et al 1986, Syrquin 1988). In this work changes in the sectoral composition of production and employment, and its interaction with the pattern of productivity growth, have featured prominently. [4]

There are several reasons to put sectoral productivity growth and the role of structural change back on the agenda. The first reason is that intersectoral shifts of factor resources can have a strong positive effect on aggregate productivity growth (Syrquin 1988). The size of this effect depends on the level of development. At low income levels a shift of resources from agriculture to more productive non-agricultural activities can boost growth. In this paper we show that this source of growth (which may be referred to as the "Lewis effect", see Lewis 1954) is still quite powerful for low income countries in South Asia but also in South East Asia, especially when taking into account the existence of so-called "surplus labour" in the agricultural sector.[5] At more advanced stages of development, resources become more concentrated in manufacturing and service industries. Manufacturing has undoubtly contributed much to aggregate productivity growth, and it appears that this source is still quite strong even in the most advanced Asian countries. It has been stated that growing service employment accounts for much of the overall slowdown in productivity growth (Baumol 1967). We show that even though the "Baumol effect" still exists in the more advanced countries in the (East) Asian region, services productivity growth is substantial in some industries (for example, trade and transport and communication) and in other service industries slow productivity growth is at least partly offset by the higher productivity *levels* relative to goods industries.

[3] For a discussion, see, for example, Stiglitz (1996) and Crafts (1999).
[4] See Chenery et al (1986) for a description of the much wider notion of "structural transformation", including changes in structure of demand, trade and intermediate inputs.
[5] This is most likely also true for some countries in Southeast Asia, not included in this paper, including Cambodia, Myanmar, and Vietnam.

Secondly, a timely reason to focus on sectoral productivity growth concerns the opportunities created by the recent rise in information and communication technology (ICT). This has created major opportunities both in the production of ICT as well as increased intensity of ICT use.[6] This issue is of particular importance for the most advanced countries in East and South East Asia, such as Japan, Korea, Taiwan, Singapore and Malaysia, which have output shares of ICT producing-industries which are among the largest in the world (IMF 2001). We find large contributions from ICT producing manufacturing to aggregate productivity growth in Japan, Korea and Taiwan during the 1990s, sustaining the leading role in this part of the manufacturing sector the manufacturing sector has played in the past decades. Hence manufacturing remains a major source of growth in many Asian countries. ICT-using services account for a smaller contribution to productivity growth, but its contribution is increasing especially in Taiwan. However, the Japanese economy has suffered from a productivity slowdown in ICT-using services.

A third reason to redirect our attention to sectoral productivity measures is that in a framework of catch-up and convergence, measures of comparative productivity levels by industry relative to the productivity frontier are a key ingredient (Prescott 1998). It has been argued that convergence through knowledge spillovers and technology transfers takes place product by product, not country by country (Harberger 1998). A fair amount of theoretical and empirical literature has also shown that innovation and in particular diffusion of technology has strong industry specific characteristics.[7] Most studies on catch-up and convergence, however, have refrained from quantifying the difference in productivity levels. In this study we find large and varying productivity gaps at sectoral level for all countries relative to the United States. Even in countries like Korea and Taiwan, manufacturing productivity is less than 50 per cent of the US level. The manufacturing productivity gap between Japan and the United States has increased since the mid 1990s. In services productivity gaps are also substantial

The remainder of the paper is organised as follows. In Section 2 we describe and discuss the data underlying this paper, which are derived from the Groningen Growth and Development Centre database. This database is designed to measure and compare growth rates and levels output and productivity for the aggregate economy, sectors and industries for a broad range of countries in the OECD area, Asia and Latin America for the period from 1963 to 2001.[8] In this section we also show the differences in levels and trends in market services relative to manufacturing in in the nine Asian countries which are included in this study. In Section 3 we discuss a variety of approaches to measure structural change. These methods, which are mostly based on variants of the traditional shift-share model originating from Fabricant (1942), can help us to identify the productivity effect of reallocations of resources between sectors. The traditional decomposition technique is modified in various ways. One issue is on how to deal with situations where marginal productivities differ from average productivities, as is the case for "surplus labour". We also introduce a method that reallocates all productivity effects that originate from shifts of resources between

[6] See van Ark, Inklaar and McGuckin (2002) for a detailed review of labour productivity growth in ICT-producing, ICT-using and non-ICT industries across OECD countries.

[7] See Verspagen (2001) for a useful discussion from an evolutionary growth perspective. Work on developing countries has also emphasized the industry specific nature of technological change, and the differences in potential to exploit new technological opportunities (Pack 1988).

sectors to only those sectors that are growing in importance. In Section 4 we focus on the traditional reallocation of labour resources from agriculture to industry which has been well documented. In Section 5 we look at the reallocation effects at the level of ten major sectors including five services sectors which have been much less studied. In Section 6 we introduce an alternative distinction between ICT-producing, intensive ICT-using industries and less intensive ICT-users to bring out the effects from ICT on sectoral contributions to productivity growth in Japan, Korean and Taiwan (relatively to the United States) during the 1990s. Finally, in Section 7 we assess the potential for labour productivity growth by comparing labour productivity levels in manufacturing for six Asian countries (China, India, Indonesia, Japan, Korea and Taiwan) with those in the US, and for trade and transport and communication for three countries (Japan, Korea and Taiwan). Section 8 concludes.

2. Data Sources and Some Trends by Major Sector

One of the main problems in studying sectoral performance in Asia is the lack of long-term sectoral output and employment trends in Asian economies. The published information from statistical offices is often incomplete. Various international organizations provide some series with sectoral detail, but these are often short series which contain many breaks due to shifts in a benchmark year, changes in industrial classifications or modifications dictated by changes in the System of National Accounts which are left unresolved.[9] In addition, GDP and employment series for a particular country often appear to be inconsistent with each other in terms of coverage which creates a serious shortcoming for productivity analysis.

To decompose aggregate labour productivity growth, a new sectoral database for nine Asian countries has been constructed at the Groningen Growth and Development Centre. This database provides series on GDP at current and constant national prices and employment for the period 1963-2001 covering the following nine countries: Hong Kong, India, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan and Thailand.[10] It is based on a variety of national and international sources and aims explicitly to provide long term and consistent series of output and labour input (see appendix for source descriptions).

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[8] These datasets include the GGDC Total Economy Dataset, the GGDC Sectoral Dataset and the ICOP Industry Database. They are available from the GGDC website at http://www.eco.rug.nl/ggdc/index-dseries.html.

[9] For example, sectoral GDP series can be found in the annual United Nations, *National Accounts Statistics*, and the International Labour Office provides sectoral detail on employment statistics in its *Yearbook of Labour Statistics*. Also, the Asian Development Bank collects data within its Statistical Database System (SDBS). See http://www.adb.org/Statistics/country.asp. See also the results of a project to provide long-run GDP figures at http://www.adb.org/Statistics/RLNAS/default.asp.

[10] Depending on data availability, the initial year for a country may differ. This database is available upon request from the authors and will be downloadable from the GGDC website (http://www.eco.rug.nl/GGDC/dseries/sectoral.shtml) in due time.

Industrial classification

In constructing our sectoral database, our aim is to distinguish over 50 industies at the most detailed level.[11] For the majority of Asian countries the level of industry detail is still much more limited. In Section 4 and 5 we distinguish ten sectors, 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.

For the purpose of Section 6, where study the effects of ICT, we reorganized the data into seven sectors but with some additional industry detail, namely (1) ICT-producing manufacturing, (2) ICT-producing services, (3) ICT-using manufacturing, (4) ICT-using services, (5) other manufacturing, (6) other services and (7) other industries (agriculture, mining, public utilities and construction). The precise shares of ICT-producing, ICT-using and other industries in total output and employment depend on the definitions of ICT-producing industries and on the empirical distinction between ICT-using industries and non-ICT industries. ICT-producing industries are defined by OECD, and include computer hardware and software producers, computer services and telecommunication equipment and services (OECD, 2000). For the definition of ICT-using industries, estimates of ICT capital in total capital for the United States were used, defining the "technological opportunity set" for ICT.[12] Finally, our manufacturing productivity level comparisons in Section 7 are at the level of 17 manufacturing industries.

Labour and Value Added

Labour input is defined as "all persons employed", i.e. the number of all paid employees and self-employed persons.[13] To provide standardised accounts of sectoral employment one can basically make use of two different primary sources, namely household surveys (for example population censuses and labour force surveys) or establishment surveys (such as production censuses or employment surveys). Unfortunately, only few countries in the world have reconciled the figures from the different sources, for example within the framework of their national accounts, so that generally large differences exist between these sources both in terms of levels and growth rates.[14] Our default option is to use annual or quarterly labour force surveys based on household data. The main reason for this is that countries at low levels of per capita income have large parts of the population employed in agriculture and small-scale, unregistered,

[11] See, for example, van Ark et al. (2002) for such a detailed industry study for OECD countries, including Japan.

[12] The distinction between intensive ICT using industries and "non-ICT" industries is discussed in van Ark (2001). This classification required a further breakdown of some sectors, in particular in electrical machinery and measurement equipment – which are partly ICT-producing and partly ICT-using industries –, and in some service industries, such as trade and business services – which are partly ICT-using and partly non-ICT industries –. As a result, data at this stage were only available for Japan, Korea and Taiwan. Even though ICT-producing industries are also ICT-using industries (as the producers themselves also invest heavily in ICT), ICT-producing industries are excluded from the ICT-using sector in the analysis below. Obviously the classification used here can be further tested for its sensitivity for other distributions, which is a topic for further research (see van Ark, Inklaar and McGuckin, 2002).

[13] The manufacturing productivity level comparisons in Section 7 are also provided for manufacturing value added per hour worked.

[14] For a discussion, see OECD (2003).

industrial activities and services which are not covered in establishment surveys. Usually the latter source also only covers establishments of a given importance, that is, those fulfilling certain conditions, such as having more than a certain number of employees, having more than a certain value of output or capital etc. Therefore establishment data is subject to some bias and is likely to misrepresent the sectoral composition of the labour force, especially in developing countries. But these estimates are more useful to indicate trends than to indicate absolute levels.[15] Labour Force Surveys are available for all countries, except for Hong Kong (for which an establishment survey was used) and India and Indonesia. For the latter two countries we used data from population censuses held every 10 years. The years in between were interpolated by using the difference between the average annual growth rate of GDP and labour productivity for each sector. Sectoral trends in hours worked are unfortunately not available. At the aggregate there is a strong general tendency for hours worked to fall with increasing per capita income.[16]

For GDP series, the general approach is to start with GDP levels for the most recent available benchmark year expressed in that year's prices. Historical series were subsequently linked to this benchmark year. This ensures that the growth rates of the individual series are retained, but absolute levels are adjusted according to the most recent information and methods.[17] National accounts and labour statistics generally cover the same activities, with the notable exception of own-account production of housing services by owner occupiers. According to the System of National Accounts, an imputation of rent is made and added to GDP. This type of imputed production does not have an employment equivalent and was therefore excluded from output for the purpose of labour productivity comparisons. However, this adjustment proved to be impossible for Japan.[18]

It should be emphasized that the measurement of output and productivity in particular in services 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.[19] Although it can be argued that this might result in underestimating the

[15] A possible disadvantage of household surveys is that the respondents' statement concerning the industry in which he or she is employed may not be in accordance with the official classification. Also multiple job-holders are only counted once in the labour force survey according to their most important activity, while they may be active in more than one sector. However, the latter does not seem to be a disadvantage in the case when labour input is measured in persons employed rather than hours worked.

[16] See also Table 1

[17] For example, the National Accounts in India and Indonesia were recently revised which led to an upward adjustment of total GDP of about 9 per cent. These revisions were unrelated with the implementation of the new SNA 1993, but were prompted by discoveries of major undercoverage of certain economic activities in the past.

[18] To grasp the importance of this problem, we note that for example in 1988 the imputation for owner occupied housing amounted to more than 30 per cent of GDP in the FIRE (finance, insurance and real estate) sector in all countries for which data was available. Hence the labour productivity level of this sector in Japan is likely ot be substantially overstated and, as GDP in the FIRE sector grows much faster than the imputed GDP for dwellings, growth rates in this sector will be underestimated..

[19] See also Griliches (1992).

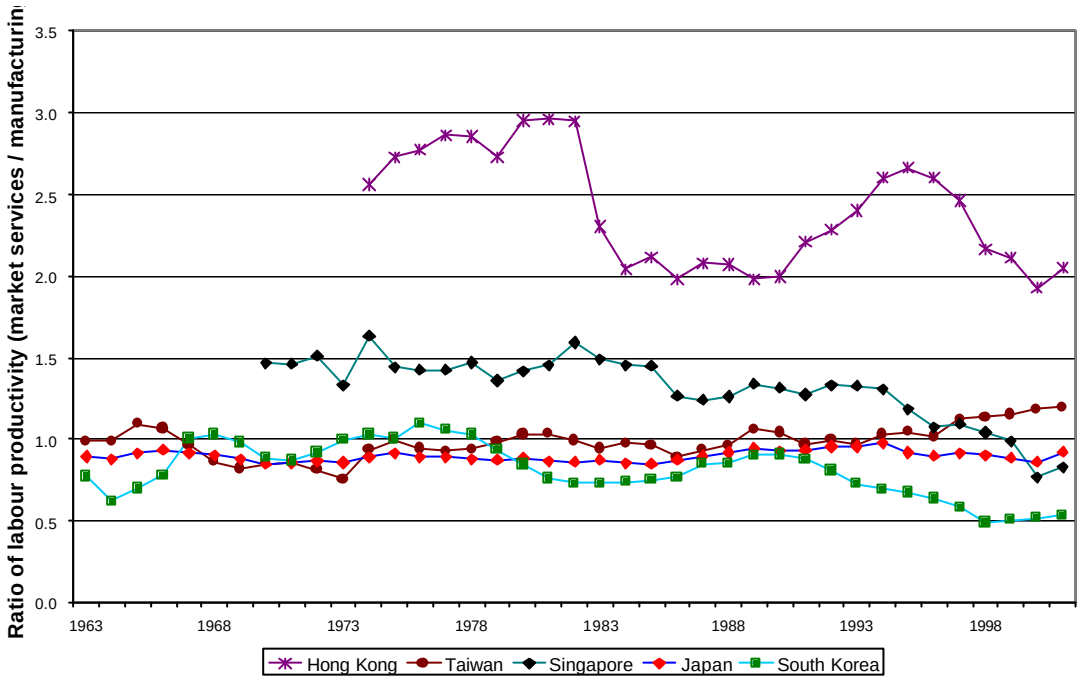
growth rate of services output relative to manufacturing and agriculture, the size of this bias is still unclear and there are equally good reasons to assume that part of services output is overstated.[20]

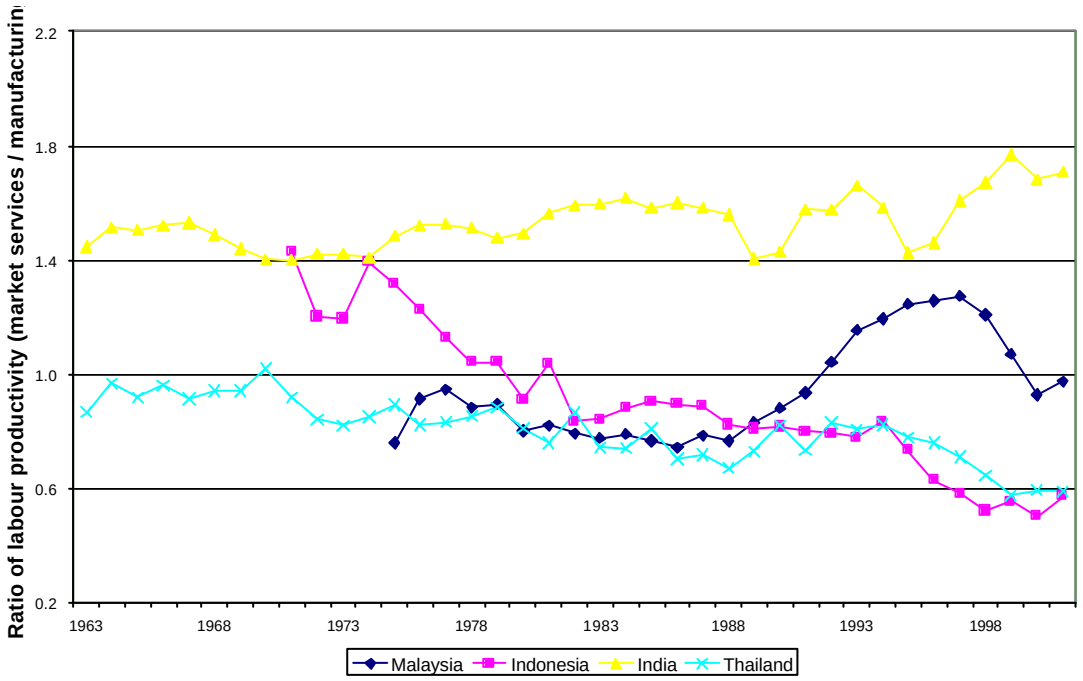
Productivity trends

There are several ways to give a summary presentation of the data series. Figure 1 shows some of the ratio of value added per person employed in terms of current prices and national currencies for all market services (transport and communication, trade and finance) relative to manufacturing. The top panel shows the results for the more advanced countries in the dataset. Hong Kong and Singapore being characterized by high levels of productivity in services. In Korea and Singapore productivity levels in market services relative to manufacturing fell considerably during the 1990s. The same downward trend in market services productivity levels relative to manufacturing can be observed for Indonesia and Thailand in the bottom panel, which includes the less advanced countries in the region. In contrast the relative productivity level in Taiwanese and Malaysian market services increased since the early 1990s, although it collapsed during the crisis in Malaysia. Relative productivity levels in market services relative to maufacturing were high in India due to the strong labour intensive nature of most of the unregistered manufacturing sector.

[20] See, for example, Triplett (1999).

Figure 1: Ratio of labour productivity levels in market services relative to manufacturing (in current prices)





Note: Labour Productivity is value added per person employed
Source: GGDC Sectoral Database (see appendix)

3. Modeling and Measuring Structural Change

One of the best documented patterns of structural change is the shift of labour and capital from production of primary goods to manufacturing and non-tradables. This shift is due to an interplay of effects, which importance vary across countries and over time. These effects include changes in domestic demand (Engel effects) and changes in the composition of trade which is the main driving force in small countries. Also the increase in intermediate use of manufacturing products has contributed to the rising share of manufacturing in most countries (Chenery and associates 1986). Another finding is that the level and growth rate of labour productivity in agriculture is considerably lower than in the rest of the economy (at least at low levels of income), reflecting differences in the nature of the production function and in the rate of technical change (Syrquin 1984, Crafts 1984). Together these findings suggest a potentially important, albeit temporary, role for resource allocation from lower to higher productive activities to boost aggregate productivity growth.

The traditional shift share analysis

This potential growth bonus was already identified in classical dual economy models such as Lewis (1954) and Fei and Ranis (1964).[21] These models presumed that in early stages of development, agricultural labourers shift to the industrial sector without any reduction in total agricultural output. In the remainder of the paper we refer to this as the "Lewis effect". The existence of this source of inefficiency can be explained by the immobility of agricultural labour vis-à-vis the industrial sector which is caused by the discrepancy between private costs, approximated by the average product in agriculture, and social costs.

To measure the importance of the Lewis-effect various measures have been proposed. The simplest way to model this effect is to assume a one-country, two-sector, two-period model and decompose the productivity change between period 0 and T into the contribution of two sectors i (with i=1 as the traditional sector, and i=2 as the modern sector). Let Y_i denote value added in sector i, L_i denote employment, and superscripts 0 and T the beginning and end of the period [0,T]. Then aggregate labour productivity (P) at time T can be written as:

$$P^T = \frac{Y^T}{L^T} = \frac{Y_1^T + Y_2^T}{L^T} = \frac{Y_1^T}{L_1^T}\frac{L_1^T}{L^T} + \frac{Y_2^T}{L_2^T}\frac{L_2^T}{L^T} = P_1^T S_1^T + P_2^T S_2^T \qquad (1)$$

with P_i denote the labour productivity level in sector i and S_i the share of in total employment.
Using (1), the difference in aggregate labour productivity levels at time 0 and T can be written as

$$P^T - P^0 = (P_2^T - P_2^0)\cdot S_2^T + (P_1^T - P_1^0)\cdot S_1^T + (S_2^T - S_2^0)\cdot P_2^0 + (S_1^T - S_1^0)\cdot P_1^0 \qquad (2)$$

[21] Lewis' dual economy was not based on a sharp distinction between agriculture and industry. Rather he emphasizes differences between traditional and modern activities which coexist in all sectors of the economy. Parts of agriculture such as plantations and other export oriented activities can have high labour productivity levels. On the other hand, family-based handicrafts in industry and petty trade in services are activities with relatively low levels of labour productivity.

or alternatively,

$$P^T - P^0 = (P_2^T - P_2^0) \cdot S_2^0 + (P_1^T - P_1^0) \cdot S_1^0 + (S_2^T - S_2^0) \cdot P_2^T + (S_1^T - S_1^0) \cdot P_1^T \qquad (3)$$

To make the decomposition invariant to a particular base, period averages can be used as weights.

$$P^T - P^0 = (P_2^T - P_2^0) \cdot \overline{S}_2 + (P_1^T - P_1^0) \cdot \overline{S}_1 + (S_2^T - S_2^0) \cdot \overline{P}_2 + (S_1^T - S_1^0) \cdot \overline{P}_1 \qquad (4)$$

with a bar indicating the arithmetic average over period [0,T].

In a multi-sector setting the decomposition becomes as follows

$$P^T - P^0 = \sum_{i=1}^{n} (P_i^T - P_i^0) \cdot \overline{S}_i + \sum_{i=1}^{n} (S_i^T - S_i^0) \cdot \overline{P}_i \qquad (5)$$

It follows that aggregate productivity growth can be decomposed into intra-sectoral productivity growth (the first term on the right-hand side, called "intra-effect") and the effects of changes in the sectoral allocation of labour (the second term, called "shift-effect"). The intra-effect is positive when labour productivity growth in sector *i* is higher than average labour productivity growth; it is negative when labour productivity growth in *i* is negative. The contribution of the shift effect can also be either positive or negative, depending on whether the labour productivity level in the expanding sector is higher or lower than the average labour productivity level in the sectors where the labour share is declining. This decomposition originates from Fabricant (1942) and is frequently used, for example in studies looking at the impact of labour reallocation from agriculture in developing countries (see Section 4).[22]

A number of criticisms can be raised against this type of decomposition (see Syrquin 1984, van Ark 1996, Timmer and Szirmai 2000, for an overview). Firstly, it is a labour productivity model and as such non-labour inputs are ignored. Ideally, sectoral productivity measures should treat all inputs symmetrically and take into the inputs of capital, materials and service inputs along with labour. Unfortunately, lack of capital data at industry level precludes this type of analysis for a wide range of countries. Secondly, the decomposition into shift effects and intra sectoral effects depends crucially on the selected price base year of the output series (Salter 1960, Gollop 1985). When price developments vary across sectors a decomposition based on, for example, 1985 prices will differ from a decomposition based on 1995 prices. Especially for developing countries, these differences can be large. During the process of industrial development, manufacturing prices generally decline rapidly relative to prices in the traditional part of the economy. Hence given an increasing labour share in manufacturing, the shift effect will be bigger with earlier base years than with later. This is akin to the Gerschenkron effect in measuring real aggregate growth over long periods (Gerschenkron 1951). This problem can be remedied by applying the decomposition presented in (5) to shorter time intervals and rebasing sectoral series each period (see van Ark 1996), or even annually, as in this paper. The third and fourth criticism, which deal with the issue of surplus labour and the distribution of shift effects across sectors respectively, are discussed in some more detail below.

[22] Salter (1960) provides an alternative to this additive decomposition and proposes a multiplicative decomposition. However, the major disadvantage of the latter is that sectoral contributions to aggregate growth cannot be assessed which is an important use of the decomposition in this paper. Some applications of the Fabricant decomposition distinguish between a static and dynamic shift effect. However, the latter effect is the product of changes in shares and changes in labour productivity levels which becomes negligible when using annual data.

The issue of surplus labour

An important and more conceptual point of criticism is that the decomposition into intra- and shift effects does not take into account the existence of surplus labour or disguised employment in the agricultural sector. Due to a low mobility of resources, this disequilibrium phenomenon exists in many countries in early stages of development.[23] As long as marginal productivity is below average productivity, a decline in the number of agricultural workers will automatically raise the labour productivity level in agriculture. Using equation (5), the difference between average and marginal productivity in agriculture will end up in the intra-effect, whereas its effect actually arises from the shift of labour to the modern sector in response to the opening up of new employment opportunities elsewhere in the economy. This suggest that (part of) the intra-contribution of agriculture should be allocated to the shift-contribution of other sectors.[24]

To accommodate this important shortcoming, the standard decomposition can be modified as follows, inspired by the more informal approach of Denison (Denison 1967). As one cannot measure the wedge between marginal and average productivity of labour directly, certain assumptions are required. To generalize the case, let e_A be the ratio of the marginal and average labour productivity of labour in the base year, being in between 0 and 1. Also assume that there is a decline in the number of agricultural workers and there is no change in the labour productivity level of the remaining workers as we focus on the shift-effect only. Then the counterfactual labour productivity level in agriculture (P^{*T}_A) can be written as follows:

$$\begin{aligned} P*^{T}_{A} &= \frac{Y^{0}_{A} + e_A(L^{T}_{A} - L^{0}_{A}) \times P^{0}_{A}}{L^{T}_{A}} && \text{when} \quad L^{T}_{A} - L^{0}_{A} < 0 \\ P*^{T}_{A} &= P^{0}_{A} && \text{otherwise} \end{aligned} \qquad (6)$$

In the case that e_A=1, each worker leaving the sector will cause a cut in output equal to the average productivity of those who stay behind, which is the counterfactual assumed in the standard method. In that case, the labour productivity level in T is equal to the labour productivity level at 0. When e_A<1, we assume – in accordance with the Lewis hypothesis – that the productivity of those who leave the agricultural sector is lower than of those who stay behind. In the most extreme case, when the decline in the number of workers in agriculture has no effect on agricultural output, e_A=0 and the labour productivity level at T equals the output at 0 divided by the labour force at T. All workers who left the sector all had a productivity of zero and did not contribute to output. But it is probably more realistic to make assumptions on $0<e_A<1$. The contribution of agriculture to aggregate labour productivity growth is then defined as the labour productivity growth above the counterfactual level P*: $(P^{T}_{A} - P*^{T}_{A}) \cdot \bar{S}_A$. The remainder of the

[23] Combined models of household behaviour and rural labour markets have shown that this disequilibrium is independent of the assumptions of missing rural labour markets, but crucially depends on the response of other family workers to the removal of one worker (see Rosenzweig 1988 for an overview)

[24] Similarly, it might be the case that the agricultural sector acts as a buffer in hard times and absorbs labour which is put out of employment in other sectors of the economy. Crisis periods such the one following the Asian financial crisis in 1997 may cause such counter effects. But as the effects are short term rather than long term, this situation is not accounted for in this paper.

original intra-contribution of agriculture, $(P^{*T}_A - P^0_A)\cdot \overline{S}_A$, is distributed across those sectors which expand their labour shares according to their share in total expansion. The effects of this adjustment on the distribution of intra and shift effects are shown in Section 4, the shows the results of a two sector disaggregation (agriculture vs. non-agriculture).[25]

Others have suggested similar, but less general modifications to deal with the surplus labour issue. For example, Broadberry (1998) assumes zero marginal productivity (e_A=0) not only in agriculture but in all sectors which have a declining *share* in employment. However, this is not consistent with the surplus labour hypothesis which is not about *shares* of labour but about *absolute* amounts. Sectors for which employment shares are declining, but absolute number of workers are increasing are typical of rapidly expanding economies, such as in Asia. For example, the agricultural share in the total labour force in Thailand has already been declining since the beginning of the 1960s, but the absolute amount has only decreased since the end of the 1980s. Similar lags are found for other countries. Therefore the Broadberry-measure overstates the shift effect. Lastly, it is not clear why the surplus labour argument should hold for all sectors. For example, it is hard to defend that the labour outflow from manufacturing in the 1990s in Taiwan and South Korea represents shedding of surplus labour equivalent to the outflow of workers from agriculture earlier on.

McCombie and Thirlwall (1994, p.217 vv.) suggest another modification, in which the counterfactual labour productivity level (or "standardised level" as they call it) in agriculture at time T is calculated as the output in time T divided by the number of workers at time 0 multiplied by the aggregate growth rate of employment. In economies with stationary labour force growth, this amounts to setting e_A=0 (see equation 6). In the case of a shrinking labour force, e_A even becomes negative. This approach suffers from the same shortcomings as Broadberry's modification by not adequately defining the relevant counterfactual.[26]

In this paper we make no prior assumptions about the value of e_A. In fact we use a plausibility range for the ratio of the marginal to average labour productivity and measure its implications for the "Lewis" effect, as described above.

Reallocation of shift effects to sectors with expanding labour shares

A final problem of the shift-share methodology, as described above, becomes clear only once we look into individual contributions of sectors. Contributions of a particular sector i to aggregate labour productivity growth can be derived as follows. Let C_i the total contribution of sector i to aggregate labour productivity growth:

$$P^T - P^0 = \sum_{i=1}^{n} C_i = \sum_{i=1}^{n} (C_i^{intra} + C_i^{shift}) \qquad (7)$$

[25] Arguably, a similar adjustment as for agriculture should be made for other sectors where marginal and average productivity diverge, such as in the trade sectors. Unfortunately, data on the distribution of trade activities is not available.

[26] McCombie and Thirlwall (1994) suggest another modification, assuming increasing returns to scale within industry and constant returns in other sectors. This obviously increases the shift effect even more. However, the existence and importance of increasing returns is highly uncertain and therefore not assumed here.

The standard procedure allocates the shift effects rather mechanically without considering the cause of the shift. For example, in early stages of development the agricultural sector mostly creates a negative shift effect because its share in employment falls and it has a below-average productivity. It is not clear, however, how to interpret this negative shift effect from an analytical perspective. We therefore reallocated all shift effects (C^{shift}) from sectors that experienced shrinking labour shares to sectors that expanded their share in total labour. Let K be the set of sectors which expand their labour shares, and J the set of shrinking sectors. Then as the sum of the increasing labour shares of expanding sectors is equal to the sum of the declining labour shares in shrinking sectors, one can decompose aggregate labor productivity growth into sectoral contributions according to

$$\begin{aligned} C_i &= C_i^{intra} + C_i^{shift} = (P_i^T - P_i^0)\cdot\overline{S}_i + (S_i^T - S_i^0)(\overline{P}_i - \overline{P}_J) \qquad \forall i \in K \\ C_i &= C_i^{intra} = (P_i^T - P_i^0)\cdot\overline{S}_i \qquad \forall i \in J \end{aligned} \tag{8}$$

with P_J the labour productivity averaged over all shrinking sectors j e J:

$$\overline{P}_J = \frac{\sum_{i\in J}(S_i^T - S_i^0)\overline{P}_i}{\sum_{i\in J}(S_i^T - S_i^0)} \tag{9}$$

The implication of this reallocation of sectors is that the sectors that grow get credited for the shift effect. This shift effect is positive when an expanding sector's productivity (P_i with $\forall i \in K$) is higher than the average productivity of the shrinking sectors (P_j). But it can also be negative when the expanding sector's productivity is lower than the average productivity of the shrinking sectors.

The contributions of individual sectors to aggregate labour productivity growth can then be determined as follows:

$$C_i = C_i^{intra} + C_i^{shift}$$

$$\begin{aligned} C_i^{intra} &= (P_i^T - P_i^0)\cdot\overline{S}_i \qquad \forall i \neq A \\ C_A^{intra} &= (P_A^T - P*_A^T)\cdot\overline{S}_A \end{aligned}$$

$$\begin{aligned} C_i^{shift} &= 0 \qquad \forall i \in J \\ C_i^{shift} &= (S_i^T - S_i^0)(\overline{P}_i - \overline{P}_J) \qquad \forall i \in K \quad \text{when} \quad L_A^T - L_A^0 \geq 0 \\ C_i^{shift} &= (S_i^T - S_i^0)(\overline{P}_i - \overline{P}_J) + \frac{(S_i^T - S_i^0)}{\sum_{i\in K}(S_i^T - S_i^0)} * (P*_A^T - P_A^0)\cdot\overline{S}_A \qquad \forall i \in K \quad \text{when} \quad L_A^T - L_A^0 < 0 \end{aligned} \tag{10}$$

The effects of this adjustment on the distribution of intra and shift effects by individual sectors are shown in Sections 5 (10 sectors) and 6 (7 ICT and non-ICT sectors).

4. Measuring The "Lewis Effect"

To assess the importance of the Lewis-effect for aggregate productivity growth in the Asian countries, the modified decomposition which was introduced in the previous section (equation 6) has been used for the period from 1963 to 2001. Three subperiods are distinguished: 1963-1973, 1973-85 and 1985-2001.[27] The global economic slowdown following the oil crisis in 1973 provides a natural breakpoint. Similarly, during the mid-1980s many Asian countries encountered structural problems caused in part by an appreciation of their currencies due to the 1985 Plaza accord. In 1997, the effects of the devaluation of the Thai baht hit the region in what became known as the Asian financial crisis. The period from 1985-1996 might therefore also deserve separate treatment, but the appendix tables show that the impact on shift effects are generally quite small.

Using the sectoral database as described in Section 2, aggregate labour productivity is decomposed into the intra- and shift effects using two sectors only (agriculture and non-agriculture) to highlight the Lewis-effect.[28] The results are given in Table 2. Column (1) shows the average annual growth rate of aggregate labour productivity. The second and third column show the percentage contribution from the growth of labour productivity within sectors and the labour shift effect from agriculture to the rest of the economy.[29] In column (3) we assume that each labourer that leaves the agricultural sector reduces total agricultural output by the average labour productivity of the sector (e_A=1). In the final columns this assumption is changed to adjust for disguised employment (or surplus labour) in agriculture. Various values for the wedge between marginal and average labour productivity in agriculture (e_A) are used varying from 0 (i.e., the marginal productivity of each agricultural labourer that leaves the sector is the assumed to be zero) to 0.7.

Overall, it can be inferred that the intra-sector effect explains the biggest part of aggregate labor productivity growth in most countries during most periods. For example, during the period 1985-2001, productivity growth within both sectors explained 94 per cent of the aggregate growth in Taiwan. Structural change explained the remaining 6 per cent (without adjustment). However, the shift effect was much more important in many other cases. For example, it accounted for more than 30 per cent of aggregate labour productivity growth throughout all subperiods in Indonesia and Thailand, and was also important in Malaysia, South Korea and Taiwan the 1960s and 1970s and in India during the 1970s and early 1980s. These results indicate that there has indeed been a large productivity bonus to the Lewis effect.

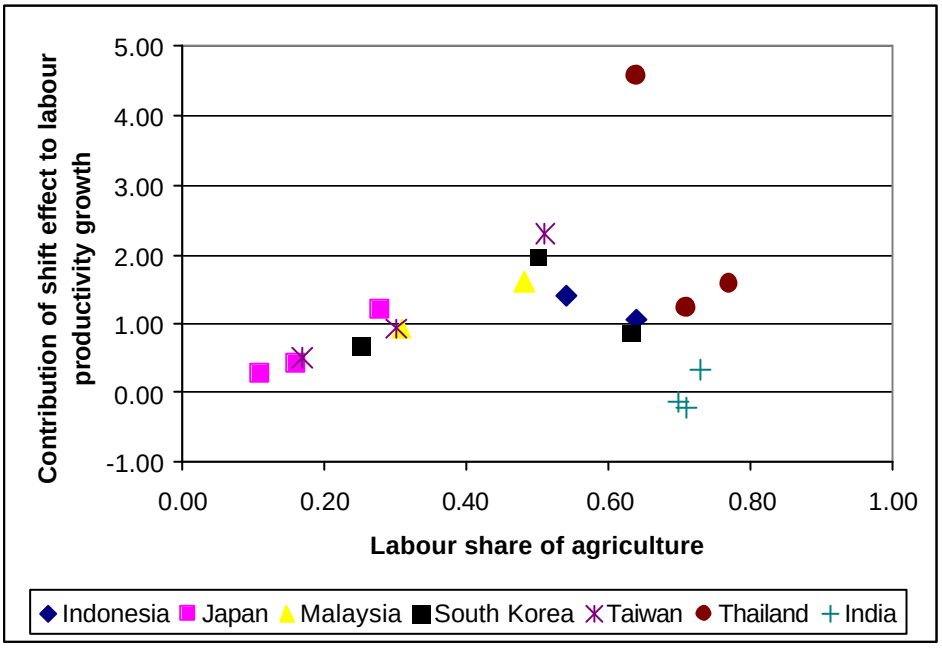
The finding of large effects from structural change becomes more pronounced when an adjustment for surplus labour is made. Assuming there is surplus labour, the last columns indicate that the shift effect is seriously underestimated in case of a rapidly declining agricultural labour force. Indeed for countries

[27] The periods differ by country depending on data availability. In the appendix the results for the latest period 1985-2001 are also shown separately for 1985-1996 to distinguish the effect from the crisis since 1996. The results for Hong Kong and Singapore are not shown here, as these city-states have very small agricultural sectors.
[28] See the next section for a more detailed breakdown.
[29] 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.

like South Korea and Thailand during the period 1973-85 and Malaysia during 1985-2001, the effects of surplus labour are important. Indeed these are the periods during which the share of agricultural labour declined rapidly. In case of South Korea the contribution of the shift effect increased from 31% without an adjustment for surplus labour to more than 47% under the assumption that all workers that left the agricultural sector between 1973 and 1985 had zero marginal productivity. In contrast, perhaps surprisingly, adjustment for surplus labour has no impact on the shift effect in India. But then it should be noted that the number of agricultural workers (in absolute terms!) continued to increase throughout the period. The same holds for Thailand during 1963-73 and to a large extent also for Indonesia from 1973 to 1985.

Table 2 also suggests that the Lewis effects peter out over time. This is, for example, seen in the case of Taiwan where the contribution of the shift effect steadily declines over time. Figure 1 illustrates this point by comparing the aggregate labour productivity growth that is due to the shift of labour from agriculture to the rest of the economy with the share of agriculture in the total labour force. Here the quantitative impact of the Lewis effect is calculated by multiplying the shift effect (using the moderate assumption of e = 0.3) by the actual aggregate labour productivity growth, as given in column (1) of Table 2.

Figure 2: Contribution of Lewis-effect to aggregate labor productivity growth



Source: GGDC Sectoral Database (see Appendix)

Figure 2 shows that, on average, the Lewis effect contributed more than 1 percentage point to annual aggregate labour productivity growth in early stages of development, except for India where it is almost negligible or even negative. However, when the share of agricultural labour drops below 30 per cent, the Lewis effect quickly diminishes. Hence the potential for Malaysia to grow on basis of the Lewis effect is low, as is the case for South Korea and Taiwan. Indeed the shift of labour from agriculture to manufacturing and services in an early stage of development provides a only a

Table 2: Decomposition of aggregate labour productivity growth in Asian Economies

	Labour produc-tivity growth (annual)	Percentage of labour productivity growth explained by:				
		No Adjustment for surplus labour in agriculture (e= 1.0)		Shift effect with adjustment for surplus labour in agriculture		
		Intra- effect	Shift effect	e= 0.7	e= 0.3	e= 0
India						
1963-73	1.9	111	-11	-11	-11	-11
1973-85	1.4	75	25	25	25	25
1985-96	4.0	103	-3	-3	-3	-3
Indonesia						
1973-85	3.1	67	33	34	34	35
1985-96	2.6	59	41	46	53	58
Japan						
1963-73	7.1	86	14	15	17	18
1973-85	2.8	88	12	13	15	16
1985-96	1.9	88	12	14	15	16
Malaysia						
1976-85	3.7	59	41	42	44	45
1985-96	3.7	85	15	19	25	29
South Korea						
1963-73	4.7	83	17	18	18	18
1973-85	4.6	69	31	36	42	47
1985-96	4.6	89	11	12	15	16
Taiwan						
1963-73	5.7	80	20	21	22	22
1973-85	4.1	91	10	11	12	13
1985-96	4.5	94	6	6	7	7
Thailand						
1963-73	4.9	68	32	32	32	32
1973-85	2.8	63	37	40	44	47
1985-96	6.5	35	65	67	71	73

Note: Decomposition of labor productivity growth into part due to labor productivity growth in sectors (intra-sector effect) and shift of labor between branches (shift effect) using equation (10) on two sectors, shifting the base annually.
Source: Data on employment and GDP for 10 sectors from GGDC Sectoral Database (see Appendix).

temporary bonus to aggregate productivity growth. After that period, growth must come from intra-sectoral productivity growth. Even so, countries such as Thailand and Indonesia can still benefit from the Lewis effect as agriculture still accounted for more than 35 % of the labour force in 1996. Especially for India the potential bonus can be large. In India, the share of agriculture has only slightly declined over the last decades and was still at a high 68 percent in 1996.

5. Measuring Reallocation between Industry and Services

While the Lewis effect is a dominant source of structural change for countries at low income levels, a second well-established change in the production structure of a country is the decline in the share of manufacturing in GDP and employment when per capita income rises beyond a certain level. From the demand side, Clark (1957) argued there is a well-defined sequence in the composition of demand as a country develops. Analogous to the shift from agricultural and basic goods to manufactures, described by Engel's Law, demand shifts increasingly towards services as per capita income grows. In particular for small export-oriented countries this tendency can be temporarily offset by a continued growth of manufacturing exports. But as wages increase, labour-intensive manufacturing imports from lower-wage countries cause an acceleration in the decline in manufacturing employment, especially in the low-skilled labour segment (see Wood 1994). In addition it has been argued that deindustrialisation in advanced countries is a natural consequence of different trends in productivity growth across sectors. Labour productivity typically grows much faster in manufacturing than in services, which is the result of rapidly rising cost and prices of service production relative to the manufacturing of goods (Baumol 1967). Consequently, lagging productivity growth in services results in this sector absorbing a rising share of total employment when real output growth in services is equal or even lower than in manufacturing (Baumol, Blackman and Wolff 1989).

Even though the service sectors of most advanced Asian countries are still smaller in terms of their employment share than those in, for example, Western Europe and North America, the growth of service sector employment has been quite rapid. In some sectors, in particular in finance, insurance and real estate, employment doubled in ten years time, and even distribution and transport and communication industries (which showed slow employment growth in Europe) expanded rapidly in most Asian countries. By 1995, South Korea and Taiwan already had service sector employment shares of over 50 per cent. The increased importance of especially market services such as finance, insurance and real estate, transport and communication and trade is reflected in Figure 3, which plots employment shares of market services minus the share in manufacturing for various countries and years against the level of per capita GDP. Japan's service employment sector share 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 the Japanese service sector.

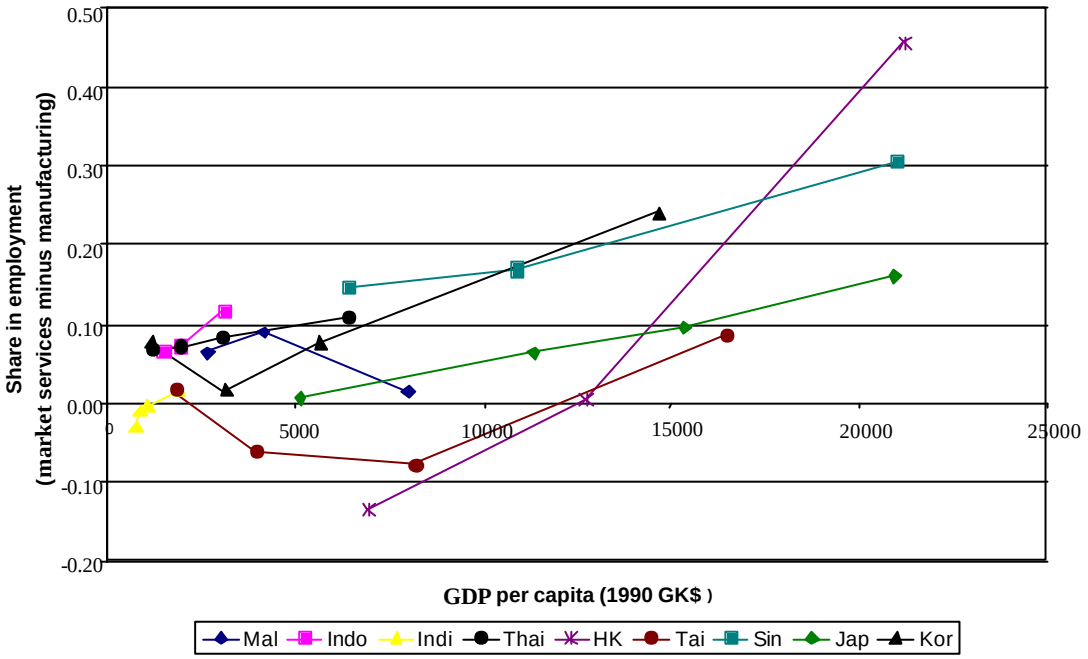
It has often been hypothesised that the labour shift to services should have negative effects on aggregate labour productivity growth, but using our shift-share decompositions as described in Section 3, we show that this is not necessarily the case. To investigate the impact of the shift towards services on aggregate productivity growth, the productivity contributions of each sector is obtained using equation (10) from Section 3, and the detailed 10-sector disaggregation described in Section 2 and the Appendix. As explained in Section 3, we reallocated shift effects from sectors with a declining share in the labour force to those with a rising share. The results are based on the assumption that the marginal labour productivity in agriculture is 30% of the average labour productivity ($e_A = 0.3$).[30] The results for the period

[30] These results can be different from those in Section 4, because we now use a 10-sector disaggregation.

1985-2001 are given in Table 3, which represents the period during which the effects from shifts to services are likely to be biggest.[31]

The first column in Table 3 shows the total contribution of each sector, and the following columns show the contribution of intra-sectoral productivity growth and shift effects. For example, in Thailand manufacturing contributed 47 per cent to aggregate labour productivity growth, partly due to intra-growth in this sector (22 per cent), but also due to the fact that manufacturing increases its share of labourers and had higher labour productivity levels than the shrinking sectors (contributing another 26 percent to overall labour productivity growth).

Figure 3: Employment Shares of Manufacturing and Market Services



Note: Market services include trade; transport and communication; finance, insurance, real estate and business services. The Asian countries included are Hong Kong, India, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan and Thailand for the years 1963, 1975, 1987 and 2001
Source: GGDC total Economy and Sectoral Database (see Appendix).

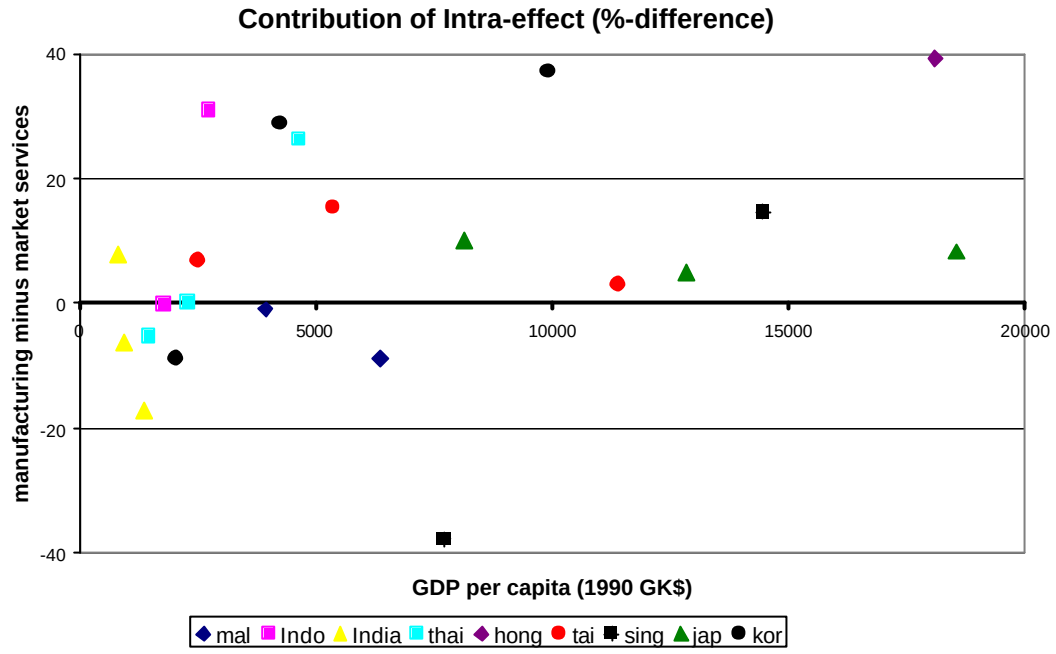
Some common patterns can be distinguished in Table 3. In the least developed countries (India, Indonesia, Thailand and Malaysia) manufacturing is by far the largest contributor, mainly through within-sector productivity growth, but also by employing more labour at a higher productivity level than the labour shrinking sectors.[32] For the more developed East Asian countries a striking duality can be observed.

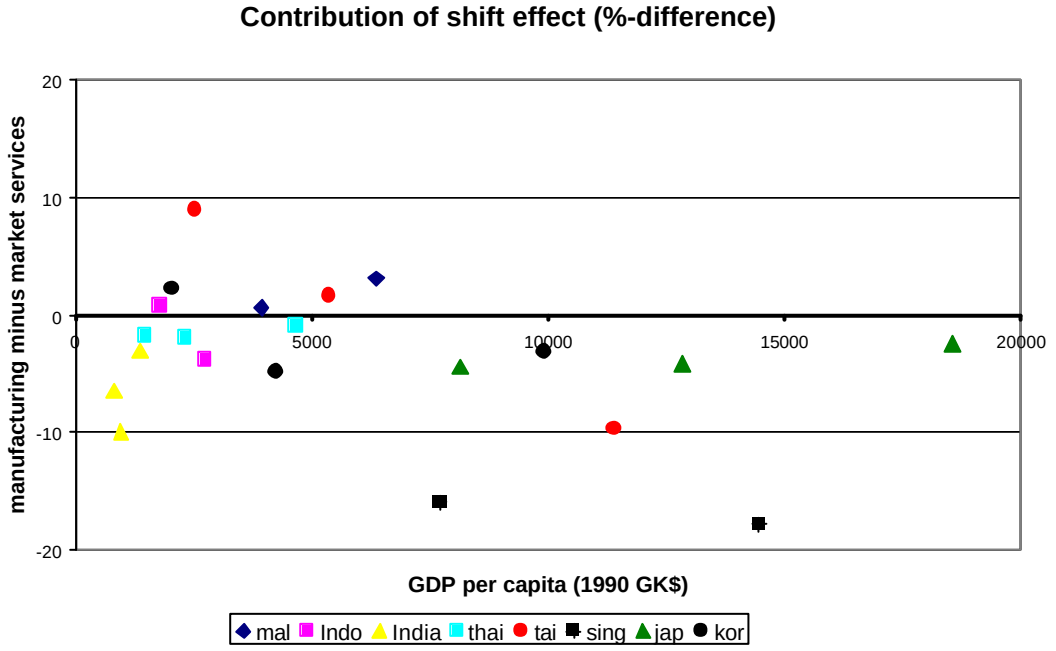
[31] For the other periods, appendix tables are added.
[32] In India there was no shift effect from manufacturing because its labour share stagnated around 10 percent in this period.

In these countries manufacturing has remained a main contributor to growth, in particular in Korea, Singapore and Japan. But manufacturing productivity growth in these countries is almost exclusively based on intra-productivity growth as its share in aggregate employment is decreasing. There are also high positive productivity growth contributions from finance, insurance, real estate and business services in advanced East Asian countries but, with the exception of Japan, these contributions are almost exclusively based on the shift effect.[33] This implies that the labour productivity level is relatively high in this sector, causing a positive shift effect, but intra-sectoral productivity growth is slow. The trade sector on the other hand appears to be a service industry in which share in employment has not increased, but for which intra-productivity growth is high, contributing 18% in Singapore, 19% in Hong Kong and 17% in Taiwan. Productivity growth in this sector is probably due to a rapid shake-out of disguised employment in the form of small family-owned enterprises. In Korea and Japan, however, productivity growth in the trade sector is much less.

[33] Note that imputed GDP for owner occupied housing was excluded from the productivity measures, except for Japan.

Figure 4: Contribution of manufacturing minus contribution of market services to aggregate labour productivity growth in Asia, various periods.





Note: The Asian countries included are Hong Kong, India, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan and Thailand (for the years 1963, 1973, 1985 and 1996; the year mentioned with the labels indicates the beginning year of the subperiod). Negative intra-effect for market services for Hong Kong 1975 not included (-25%)
Source: Table 3

Table 3: Sector Contribution to Aggregate Labour Productivity Growth (as percentage of aggregate growth), 1985-2001

	Hong Kong			India			Indonesia		
	Total contri-bution	Due to intra effect	Due to shift effect	Total contri-bution	Due to intra effect	Due to shift effect	Total contri-bution	Due to intra effect	Due to shift effect
Agriculture	-1	-1	0	4	11	-7	-29	4	-33
Mining	0	0	0	3	2	0	15	-5	20
Manufacturing	32	32	0	21	21	0	57	18	39
Public Utilities	12	10	1	4	3	0	8	4	4
Construction	1	0	0	8	7	1	5	-6	11
Wholesale and Retail trade	19	13	6	17	15	1	17	7	11
Transport and communications	12	9	3	12	12	0	6	0	6
Finance, Insurance and Real Estate	7	-29	36	13	11	2	7	-19	26
Community, Social and Personal services	19	15	4	19	19	0	14	10	3
Government services									
Total	100	50	50	100	102	-2	100	13	87
Annual Labour Productivity Growth	3.6	1.8	1.8	4.0	4.1	-0.1	2.6	0.4	2.3

	Japan			Malaysia			Singapore		
	Total contri-bution	Due to intra effect	Due to shift effect	Total contri-bution	Due to intra effect	Due to shift effect	Total contri-bution	Due to intra effect	Due to shift effect
Agriculture	0	0	0	-1	2	-4	-1	0	0
Mining	0	0	0	15	9	6	0	0	0
Manufacturing	44	43	1	27	18	9	44	43	1
Public Utilities	4	3	1	5	3	2	4	3	1
Construction	2	0	2	-4	-1	-3	7	7	0
Wholesale and Retail trade	9	10	-1	7	11	-4	18	19	-1
Transport and communications	7	6	1	8	5	2	16	15	2
Finance, Insurance and Real Estate	22	19	4	18	10	8	13	-5	18
Community, Social and Personal services	7	3	4	9	10	-1	-2	6	-9
Government services	5	5	0	17	18	-1			
Total	100	88	12	100	85	15	100	88	12
Annual Labour Productivity Growth	1.9	1.7	0.2	4.5	3.8	0.7	3.8	3.3	0.4

Table 3 (continued)

	South Korea			Taiwan			Thailand		
	Total contri-bution	Due to intra effect	Due to shift effect	Total contri-bution	Due to intra effect	Due to shift effect	Total contri-bution	Due to intra effect	Due to shift effect
Agriculture	1	4	-2	1	1	0	1	8	-7
Mining	2	2	0	1	1	0	8	6	2
Manufacturing	60	57	3	35	33	2	47	22	26
Public Utilities	6	5	1	4	4	0	14	9	5
Construction	7	3	3	0	1	-2	-3	-12	8
Wholesale and Retail trade	4	8	-4	17	16	1	5	-11	16
Transport and communications	10	9	1	11	10	0	17	11	6
Finance, Insurance and Real Estate	12	3	9	14	3	11	0	-5	5
Community, Social and Personal services	-3	-3	0	7	8	-1	8	2	6
Government services				11	9	2	4	1	3
Total	100	87	13	100	86	14	100	32	68
Annual Labour Productivity Growth	4.6	4.0	0.6	4.8	4.1	0.7	4.2	1.3	2.8

Note: Contribution of sectors to aggregate labor productivity growth due to intra sector effect and, in case of expanding sectors, shift effects using equation (10), using e =0.3.
Source: GGDC Sectoral Database (see Appendix). Figures may not add due to rounding.

To obtain a more comprehensive view of the differences between the contribution to aggregate labour productivity of manufacturing minus market services (i.e., all services, excluding community, personal and government services) are shown. Figure 4a looks at differences in the contribution of the two major sectors in terms of the intra effect and Figure 4b looks at the differences in terms of the shift effect.

These figures confirm the impressions based on Table 3 (and the appendix tables), namely that at higher income levels shift effects to services have become important contributors to aggregate productivity growth (given the fact that shift effects in Figure 4b drop below the zero-line). But Figure 4a reveals that at higher income levels the intra-sectoral contributions of the manufacturing sector still remain higher than those in services. This is more strongly so than in other advanced countries outside Asia, including, for example, Germany and the United States.[34] Hence even when, in terms of labour shares, market services have since long overtaken the manufacturing sector, productivity growth within manufacturing remains at least as important.

6. The Role of ICT as a Source of Structural Change

Technology shocks are an important source of structural change which can significantly raise productivity of particular industries, alter their contribution to overall labour productivity growth, and increase the opportunities to exploit the potential for catch-up as outlined in the previous sections. The rise of information and communication technology (ICT) during the 1990s typically represents an important technology shock, in particular in some of the more advanced (East) Asian economies. For example, the share of ICT-producing manufacturing (active components, IT hardware and telecom equipment) has risen rapidly in Singapore, Korea, Japan, Taiwan, Malaysia, but also Thailand and the Philippines (IMF 2001, Figure 3.3). As ICT is a typical general purpose technology, characterized through its broad scope of applications across the economy and its ability to generate a continuous stream of cost-reducing innovation, it also creates new opportunities for intensive ICT using industries to invest in ICT goods and services. These investments may – at least partly – lead to substitution of ICT capital for obsolete capital equipment or (unskilled) labour, but in many cases an important capital deepening effect has been observed as well (IMF 2001, Box 3.3).

One way to assess the impact of ICT on productivity growth and its relation to structural change is to look at the contributions to overall labour productivity growth from three groups of industries, i.e. ICT producing industries, intensive ICT using industries, and industries that use

[34] Based on calculations from van Ark et al. (2002).

ICT less intensively, hereafter referred to as "non-ICT" industries.[35] This approach can shed light on the role of ICT in growth. Indeed a strong presence of ICT-producing industries (i.e. hardware and software producers), as is the case in several Asian countries, may be an important reason for a greater contribution of manufacturing to growth in these countries than is the case elsewhere. Table 4 shows that, compared to Japan and the United States, Korea and Taiwan rapidly increased their GDP shares in ICT-producing manufacturing industries, although only Taiwan showed a slight rise in the employment shares as well. Output and employment shares of ICT-producing services increased in Japan, Korea and Taiwan, but not as rapidly as in the United States.

A large ICT-producing sector may also facilitate the process of diffusion of ICT to industries that are major users. Some industries, such trade, finance and knowledge intensive business services, are much more intensive ICT users than other industries. Table 4 shows that in Japan big users of ICT are also found in the manufacturing industry, even though the GDP and employment shares in ICT-using manufacturing have declined during the 1990s. In all countries GDP and employment shares in ICT-using services are on the rise, but the U.S. is clearly ahead of the advanced Asian countries.[36]

[35] As discussed in Section 2 we in fact distinguish here between seven groups: (1) ICT-producing manufacturing, (2) ICT-producing services, (3) ICT-using manufacturing, (4) ICT-using services, (5) other manufacturing, (6) other services, (7) other industries (agriculture, mining, public utilities and construction). The distinction between ICT-goods and other goods is important because the price changes for these goods, for which the real growth rates of ICT-producing and ICT-using industries need to be corrected, are quite different.

[36] The average GDP share of ICT using services in the European Union was 21.1% in 2000 (van Ark et al. 2002)

Table 4: Value Added and Employment Shares of ICT-producing, ICT-using and other industries

Value added share	Korea		Taiwan		Japan		United States	
	1990	1999	1990	1998	1990	2000	1990	2000
	Gross Value Added (current prices) as % of total Gross Value Added							
ICT Producing manufacturing	3.6	5.9	4.3	6.0	3.5	3.3	2.8	2.6
ICT Producing services	2.4	3.1	2.0	2.6	2.5	3.1	3.3	4.5
ICT Using manufacturing	4.3	4.1	4.5	3.5	8.6	6.7	5.7	4.3
ICT Using services	13.3	14.5	17.1	21.3	21.8	20.0	22.9	26.9
Non-ICT manufacturing	19.6	20.1	26.3	19.5	13.5	11.1	10.3	8.9
Non-ICT services	33.4	35.2	33.0	36.8	35.0	42.7	43.9	43.1
Non-ICT other	23.5	17.2	12.8	10.2	15.0	13.1	11.1	9.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Employment share								
	Employment as % of Total Employment							
ICT Producing manufacturing	3.2	2.6	4.8	5.4	2.8	2.5	1.9	1.6
ICT Producing services	1.6	2.5	0.9	1.1	1.7	1.9	2.5	3.3
ICT Using manufacturing	3.0	2.6	3.6	3.3	8.9	7.5	5.5	4.2
ICT Using services	7.8	11.5	11.6	15.0	23.5	23.2	25.1	24.6
Non-ICT manufacturing	20.1	14.2	24.1	19.9	12.4	10.9	7.8	6.8
Non-ICT services	37.2	47.0	33.9	37.0	31.6	35.9	47.9	50.4
Non-ICT other	27.1	19.6	21.2	18.2	19.2	18.1	9.2	9.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(a) ICT-producing manufacturing consists of IT hardware, radio, television and communication equipment, medical appliances and instruments and appliances for measurement

(b) ICT-producing services consists of telecommunication and computer services

(c) ICT-using manufacturing includes publishing and printing, the chemical industry, electrical and electronic machinery and equipment, medical and measurement appliances

(d) ICT-using services includes wholesale trade, post and telecommunication, the financial sector, the renting of machinery, computer services, research and development and part of business services (accountants, architectural firms, legal offices, consultants and marketing agencies)

(e) Other industries include agriculture, mining, construction and utilities

Source: Groningen Growth and Development Centre Sectoral Database and The Conference Board

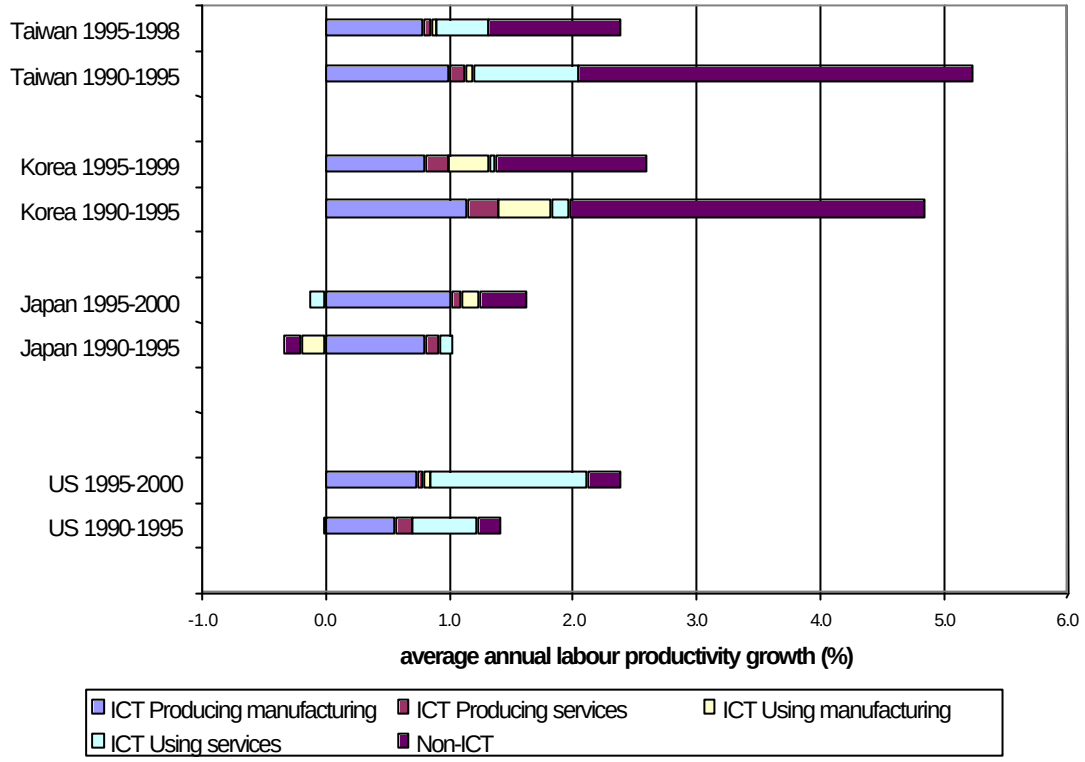
Using the shift-share methodology as outlined in Section 3, we computed the contributions of the ICT-producing, ICT-using and non-ICT industries to productivity growth during the 1990s (Table 5 and Figure 5). A number of important observations can be made. Firstly, the table shows that ICT-producing manufacturing industries are very important contributors to overall productivity growth in particular in Japan, Korea and Taiwan with contributions at least as big as in the United States. Secondly, the contributions of ICT-using manufacturing was largest for Korea, whereas ICT-using services contributed most to labour productivity growth in the United States. Strikingly, the contribution of ICT-using services to labour productivity growth in Japan was negative, which is in particular due to the bad productivity performance of the trade sector during the second half of the 1990s.

Table 5: ICT-Sectors contributions to aggregate labour productivity growth (as percentage of aggregate growth)

	Korea (1990-1999)			Taiwan (1990-1998)			Japan (1990-2000)			U.S. (1990-2000)		
	Total Contri-bution	Due to Intra effect	Shift effect	Total Contri-bution	Due to Intra effect	Shift effect	Total Contri-bution	Due to Intra effect	Shift effect	Total Contri-bution	Due to Intra effect	Shift effect
ICT Producing manufacturing	22	22	0	12	11	1	51	52	-1	60	81	-21
ICT Producing services	9	6	2	3	2	1	5	4	1	42	34	7
ICT Using manufacturing	7	7	0	5	5	0	27	37	-10	-37	-9	-27
ICT Using services	12	7	5	25	16	8	40	48	-8	61	91	-31
Non-ICT manufacturing	32	32	0	16	16	0	1	10	-9	50	73	-23
Non-ICT services	-6	3	-9	28	31	-3	8	-19	27	-64	-135	71
Non-ICT other	24	24	0	11	12	0	-32	-37	5	-11	-15	3
Total	100	101	-2	100	94	7	100	96	4	100	120	-20
Annual labour productivity	4.3	4.4	-0.1	4.8	4.4	0.3	0.7	0.7	0.0	1.8	2.1	-0.4

Note: see Table 6 for definition of sectors; contribution of sectors to aggregate labor productivity growth due to intra sector effect and, in case of expanding sectors, shift effects using equation (8).
Source: GGDC ICT database and The Conference Board. Figures may not add due to rounding.

Figure 5: Sector Contribution to average annual labour productivity growth



In conclusion, the analysis in this Section suggests that ICT, as a general purpose technology, has contributed to the growth of productivity during the 1990s and that it has been an important source of within-sector growth. ICT-producing manufacturing industries have continued to contribute significantly to aggregate productivity growth in Korea, Taiwan and Japan. The potential for more a productive use of ICT remains very large in these countries, but is still largely unrealized, in particular in Japan.

7. Comparative Levels of Productivity

So far we have mainly dealt with the intra-sectoral and shift effects by sectors contributing to overall productivity growth of Asian countries, without considering the productivity gap these countries face compared to the productivity leader, i.e., the United States. However, in particular when the growth experience of Asia is analyzed in a framework of catch-up growth, comparative productivity levels become a crucial ingredient of the analysis. Following Abramovitz (1979) the size of this gap can be interpreted as the potential for further catch-up to the production frontier.

In Table 5 we provide comparisons of value added per worker and value added per hour worked in manufacturing for five Asian countries relative to the USA. Labour productivity levels have been put on comparable levels using so-called unit value ratios rather than exchange rates or

GDP PPPs. 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. The output and employment figures for the benchmark years are based on detailed information on individual industries derived from manufacturing censuses.[37]

Table 4 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 some catch-up with the USA has taken place, albeit from a very low level (in 1987 labour productivity levels in medium and large scale manufacturing in these countries were still at less than 9 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 45 per cent in Taiwan and 37 percent in Korea in 2001 (in per hour terms).[38] But even for those countries the remaining productivity gap is still big which indicates that there is ample room for further catch up growth. In Japan the catch-up in manufacturing productivity on the U.S. stalled by the mid 1990s, and since then the gap widened substantially.

[37] The benchmark years are 1983/84 for India, 1985 for China, 1987 for Japan, and 1997 for Taiwan, Korea and Indonesia. The extension to cover small scale firms is mostly done on the basis of data from specific statistical surveys or national accounts. The extrapolation from the benchmark years is also done on the basis of national accounts series on output and labour statistics series on employment. For methodological details see, for example, van Ark (1993), – specifically on Asia - Timmer (2000, 2002) and OECD (2003).

[38] Compared to our earlier estimates for Korea and Taiwan, which were benchmarked on the manufacturing censuses for 1986 and 1987 respectively instead of national accounts, showed a productivity advantage for Korea relatively to Taiwan.

Table 6: ICOP Estimates of Comparative Levels of Labour Productivity in Manufacturing, 1973-2001, USA=100

	Value Added per person engaged				Value Added per hour worked			
	1973	1987	1997	2001	1973	1987	1997	2001
India								
all firms	2.3	2.2	2.7	2.6 (d)				
Registered firms only (a)	7.7	8.8	11.7	12.0 (e)	6.2	6.8	9.3	9.4 (e)
China								
all firms	5.8	4.5	7.6	9.2 (f)				
large firms only (b)		5.7	8.0	9.7 (f)				
Indonesia								
medium & large only (c)		8.2	13.3	10.4	2.6	6.4	11.3	8.6
all firms	3.1	5.8	6.2	5.1	6.2	5.0	5.3	4.3
Taiwan	32.4	42.6	52.9	51.3	23.2	32.5	43.2	44.5
Korea	16.3	24.5	38.8	47.9	11.9	16.8	31.0	36.8
Japan	69.4	78.8	80.8	73.2	61.2	70.8	81.3	72.6
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) enterprises above township level; (c) establishments with 20 or more employees except those in oil and gas refineries; (d) 2000; (e) 1998; (f) 1999

Source: Estimates for benchmark years are based on manufacturing censuses for India (1984), China (1985) and Indonesia (1997). Other countries on national accounts basis for Korea and Taiwan (1997) and Japan (1987). Extrapolation over time on the basis of national accounts series and labour statistics. See Stuivenwold and Timmer (2003, forthcoming) for Korea, Taiwan and Indonesia, and ILO (2003, forthcoming) for Japan-US.

For estimates of other countries, see Groningen Growth and Development Centre, ICOP Industry Database (http://www.eco.rug.nl/GGDC/icop.shtml).

It might be hypothesized that a major explanation for the gap in labour productivity between Asian countries and the world productivity leader 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. Structural differences between the Asian countries and the USA would then play an important role in explaining the large labour productivity gaps. Timmer (2000) using the shift-share method discussed above by taking an interspatial, instead of an intertemporal, perspective has shown that intra-branch productivity differentials explain the lion's share of the labour productivity gaps.

As was shown in the previous section, at more advanced stages of growth, shifts towards the services sectors become an increasingly important a source of productivity growth, either through high contributions from intra-sector growth (such as in trade) or from shift effects (as for the shifts towards finance, insurance and real estate). Again it is also important to determine the potential for further productivity improvements in services by looking at the productivity gaps relative to manufacturing.

Table 7: Labour Productivity in Trade and Transport and Communication, as % of the United States

	1980	1990	2000
Japan:			
Transport and Communication	49.4	56.7	44.6
Wholesale and Retail Trade	38.6	47.9	37.5
Korea:			
Transport and Communication	36.7	42.9	54.2
Wholesale and Retail Trade	17.9	26.1	20.9
Taiwan:			
Transport and Communication	33.8	45.3	70.8
Wholesale and Retail Trade	31.2	41.5	46.9

Source: ICOP estimates; see ILO KILM 2003

Table 6 reports sectoral labour productivity gaps in Korea, Taiwan and Japan relative to the United States for retail trade and transport and communication. As in Table 5, output is converted to US dollars on the basis of industry-specific purchasing power parities (or unit value

ratios).[39] The table suggests that whereas Japan still had higher services productivity levels than Korea and Taiwan in 1990, the latter two countries had overtaken Japanese productivity in trade by 2000 and Taiwan was also substantially ahead of Japan in transport and communication. It should be stressed that service productivity is much more difficult to measure than manufacturing productivity, and the measures in Table 6 may fail to adequately pick up differences in quality of the services provided. But even when accepting large margins of undertainty, the main message from Table 6 is that the potential for catch up is not restricted to manufacturing, but is at least as large for service industries. In Japan productivity levels in services are even considerably lower than in manufacturing.

8. Concluding Remarks

In this paper we focused on the role of sectoral productivity growth and structural change as an explanation of growth in the Asian region. We find that the traditional source of reallocating resources from agriculture to industry is still quite powerful for low income countries in the region (in particular South Asia and South East Asia), especially when account is taken of the existence of so-called "surplus labour" in the agricultural sector. For more advanced countries (in East Asia), the impact of structural change has not disappeared either. Within the manufacturing sector, shifts occurred from relatively labour intensive, low productive, manufacturing industries towards high-productivity industries in particular ICT. As a result, the manufacturing sector continues to drive much of the overall productivity growth in Asia. The traditional idea that services do not contribute to productivity growth is rejected for many countries. In advanced Asian countries productivity growth in trade contributes strongly to aggregate productivity growth, and in finance and business services the relatively high productivity level also contributes to the aggregate. However, in Japan service productivity growth has seriously slowed down during the 1990s. The potential for improvements in productivity growth in services through increased ICT use is still largely unrealized. Productivity level comparisons between countries suggest substantial productivity gaps for all countries relative to the United States both in manufacturing and services.

Even though ICT is an important source of growth in many Asian countries, the economies are also characterized by important imbalances. Firstly, even in the most ICT-intensive sectors of the economies in East and South East Asia (such as electrical engineering), many activities are still very labour intensive – often supported by a strong export advantage – which will become increasingly under threat from competition of lower-wage economies, such as China. Also, the shift towards the service sector is hampered by the continued existence of

[39] See van Ark, Monnikhof and Mulder (1999) for a discussion of the methodology to compute PPPs for trade and transport and communication. The figures published in this table will also be published as part of the ILO KILM (Key Indicators of the Labour Market) Database 2003.

traditional low-productivity services. Structural reforms that allocate resources to its most productive uses are needed to support intra-sectoral productivity growth.

Structural change is not a process that comes by automatically, but requires well-balanced policies that facilitate the economies to raise productivity through applying new technologies, and improve the functioning of markets and institutions. It should be emphasized that such a call for reforms is no new phenomenon and it is 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 in East and South East Asia during earlier decades. 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 (Gerschenkron 1951).

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 a more complex economic environment, with 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.[40] 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, 2000, p. 10).

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[40] 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: DETAILED SOURCE DESCRIPTION of GGDC Sectoral Database for Asia

Hong Kong

Gross Domestic Product in Constant Prices

Sources:
- Figures on GDP for the period 1961-2000 for the total economy from Census and Statistics Department, "Estimates of GDP", various issues. Supplemented with production indices from ADB, SDBS and price indices from Census and Statistics Department, "Hong Kong Annual Digest of Statistics", various issues, linked in 2000
- 2000-2002 from Hong Kong Census and Statistics department

Notes:
- figures are at 2000 factor prices
- Only GDP at constant Market Prices calculated from the expenditure side for the total economy is available (upto 1999). In order to derive sectoral GDP in constant 1990 prices we used a 3-step procedure. First we applied the real growth rate of GDP at market prices from the expenditure side to 1990 sectoral sum in current prices. Second, we estimated constant price series for each sector separately. For Agriculture (1979-96), an index of agricultural production was used. Other years were derived by applying a growth rate derived by deflating current series by the CPI (for middle incomes) for foodstuffs. For manufacturing and mining, the manufacturing production index for 1982-1996 was applied to 1990 current GDP. Other years were derived by applying a growth rate derived by deflatin g current series by the average CPI (for middle incomes) for foodstuffs and clothing and footwear. For other sectors, current series were deflated by various appropriate components of the CPI. Lastly, we controlled for total by scaling the sectoral series for each year by the difference between sectoral sums derived in step 2 and total GDP derived in step 1.

Gross Domestic Product by Industry in Current Prices

Sources:
- 1970-1979 From Census and Statistics Department, "Estimates of GDP, 1966 to 1980", Hong Kong, linked in 1979 to
- 1979 ADB, SDBS
- 1980-2001 from Census and Statistics Department, "Estimates of GDP", april 2003.

Notes:
- Figures given are at factor cost
- Figures before 1980 are not strictly comparable with those of 1980 onwards. The former are income-based estimates whereas the latter are production-based estimates.
- Ownership of dwellings is included in finance, insurance and real estate.
- Government services is included in Community, Social and Personal Services
- For 1979 ownership of dwellings and financial intermediation splitted using 1980 shares.

Number of Persons Employed by Industry

Sources:
- 1974-76 trend from Census and Statistics Department, "Hong Kong Annual Digest of Statistics",

1981, Hong Kong, applied to 1976

- 1976 from by-census of 1976 as published in Census and Statistics Department, "Hong Kong Annual Digest of Statistics", 1981.
- 1981 from Census and Statistics Department, Hong Kong 1981 Census Basic Tables.
- 1985-2001 from ILO, Laborstat, April 2003.

Notes:
- Periods between 1976, 1981 and 1985 are based upon exponential trend.
- Figure for Construction for 1974 and 1975 was estimated using trend in Manufacturing.
- Agricultural employment for 1974 and 1975 based on annual trend for 1976-81.

India

Gross Domestic Product in Constant Prices

Sources:

- 1950-79 trend in 1980/81 prices from CSO, *National Accounts Statistics (NAS), Disaggregated Statements*, 1950/51-1979/80;
- 1980-93 trend in 1980/81 prices from CSO, *NAS*, various issues., linked in 1993
- 1993-95 in 1993/94 prices from ADB, Statistical Database System (SDBS) and CSO, *NAS*, 2000.
- 1996-1997 in 1993/94 prices from ADB, Key indicators of developing Asian and Pacific countries.
- 1998-2002 in 1993/94 prices from ministry of statistics and programme implementation, CSO.

Notes:

- Figures given are at 1993/94 factor cost
- 1950 refers to fiscal year 1950/51 etc.

CSO has revised its national accounts in 1999. These revisions include: 1. Better estimation of unregistered activities, 2. Inclusion of new products, 3. Improvement in coverage of existing products, and 4. Methodological improvements. In practice GDP in 1993 was revised upwards by about 9 per cent. However, growth rates generally remained unchanged. (see Economic and Political Weekly, *New Series of National Accounts Statistics*, April 3-9, 1999).

Gross Domestic Product by Industry in Current Prices

Sources:

- 1950-1993 trend from National accounts statistics, CSO, National Accounts Statistics (NAS), various issues, linked in 1993.
- 1993-1997 ADB, Key indicators of developing Asian and Pacific countries
- 1998-2002 from ministry of statistics and programme implementation, CSO.

Notes:

- at factor costs
- 1950 refers to fiscal year 1950/51 etc.
- CSO has revised its national accounts in 1999. These revisions include: 1. Better estimation of unregistered activities, 2. Inclusion of new products, 3. Improvement in coverage of existing products, and 4. Methodological improvements.

The data for 1992 and backwards have been upscaled, using the ratio between 1993 (unrevised) and 1993 (revised). In practice GDP in 1993 was revised upwards by about 9 per cent (note that this differs considerably between sectors). However, growth rates generally remained unchanged. (see Economic and Political Weekly, *New Series of National Accounts Statistics*, April 3-9, 1999).

Number of Persons Employed by Industry

Sources:

- 1960, 1970 and 1980 from Van Ark, "Long Term Economic Stagnancy in 20th Century India", University of Groningen, 1987, mimeographed.
- 1991 on basis of CSO, Census of India 1991
- 1991-2001 trends for all sectors except agriculture from CSO, Labour-related establishment survey, various issues as, given in ILO, Labour statistics database, January 2003, applied to 1991.
- 2001 agricultural sector on basis of CSO, Census of India 2001

Notes:

- For 1991 public utilities seperated from manufacturing, and FIRE from other services, using data for organised sector from Ministry of Finance, Economic survey 1994/95, assuming these sectors consist only of organised sector.
- Figures for years between 1960-1970, 1970-1980 and 1980-1991 are estimated by using sectoral average labour productivity growth rates for these periods. For agriculture the average growth rate of employment was taken.
- Agriculture 1992-2000 using average growth rate of period 1991-2001.
- Total economy from GGDC, Total economy database, Third quarter 2000.

Indonesia

Gross Domestic Product in Constant Prices
Sources:
- 1960-71 trend in 1960 prices from BPS, National Income, various issues linked in 1971
- 1971-83 trend in 1973 prices from BPS, National Income, various issues, linked in 1983
- 1983-88 trend in 1983 prices trend from BPS, National Income, various issues, linked in 1988
- 1988-1995 in 1993 prices from ADB SDBS dataset, March 1999 (new series).
- 1996-2001 in 1993 prices from ADB, Key indicators 2002: Population and Human Resource Trends and Challenges.

Notes:
- Figures given are at 1993 market prices
- For 1960-71 Government services included Community etc. services
- Trend for 1988 and earlier in Community etc. services includes business services.
- BPS has revised national accounts in 1993. The new series have some methodological refinements and a sectoral reclassification. Total GDP in 1993 was increased by about 9%. Revisions back to 1988 have been published. Most important reclassification involved the transfer of ownership of dwellings into finance, insurance and real estate services. Also in the new series business services, which were included in other private services in the old series, were moved to FIRE.

Gross Domestic Product by Industry in Current Prices
Sources:
- 1966-1988 trend from BPS, National Income, various issues linked in 1988
- 1988-1996 from CBS, Official Communication, 9 April 1999
- 1997-2001 from ADB, Key indicators 2002: Population and Human Resource Trends and Challenges.

Notes:
- Figures given at market prices
- Trend for 1988 and earlier in Community, Social and Personal Services includes business services.
- BPS has revised national accounts in 1993. The new series have some methodological refinements and a sectoral reclassification. Total GDP in 1993 was increased by about 9%. Revisions back to 1988 have been published. Most important reclassification involved the transfer of ownership of dwellings into finance, insurance and real estate services. Also in the new series business services, which were included in other private services in the old series, were moved to FIRE.

Number of Persons Employed by Industry
Sources:
- 1961, 1971 and 1980 from Hugo et all, The Demographic Dimension in Indonesian Development (1987), Table 8.7, based on Population Censuses
- 1990 from Hill 1996, Table 2.2, based on 1990 Population Census.
- Trends for 1989-98 from ILO, Yearbook of Labour statistics, various issues, applied to 1990.
- Trends for 1998-2001 from BPS, National Labour Force Survey, various issues, applied to 1998.

Notes:
There are a number of sources on labour force statistics but they lack consistency due to differences in concepts, procedures, seasonal timing etc (see Hugo et all, 1987). This especially effects the nuber of workers reported in agriculture and trade. Therefore we choose to rely solely on population censuses to maximise intertemporal consistency, and apply trends from the labour force survey to these benchmarks. Population census have been held in 1961, 1971, 1980 and 1990.
- 1989 and 1991-94, 1996-97 by applying growth rates from ILO, Yearbook of Labour statistics, various issues (which uses figures based on labour force surveys) to 1990 population census benchmark.
- in 1995 no labour force survey was held. An average of 1994 and 1996 is taken instead.
- 1980 split for manufacturing and public utilities, and for finance and community etc. services based on shares for 1980 from ILO, Yearbook of Labour Statistics.

- 1990 split for mining and public utilities, and for finance and community etc. services based on shares for 1990 from ILO, Yearbook of Labour Statistics.
- Figures for years between 1971-1980 and 1980-1989 are estimated by using sectoral average labour productivity growth rates for these periods.

Japan

Gross Domestic Product in Constant Prices

Sources:
- 1953-1981 trend in 1985 prices for all sectors, except Community, Social and Personal Services and Government Services, from Pilat (1994) linked in 1981
- 1981-2000 from STAN database May 2003.

Notes:
- Figures given are at 1990 market prices
- Figures for 1953 and 1954 are based upon the old 1953 SNA and therefore not completely comparable
- 1953-1960 trend for Community, Social and Personal Services and Government Services combined from Pilat (1994) was used for both individual series
- Business services are included in Community, Social and Personal Services and not in FIRE.

Gross Domestic Product by Industry in Current Prices

Sources:
- 1953-1981 for all sectors, except Community, Social and Personal Services and Government Services, from Pilat (1994)
- 1981-2000 from STAN database May 2003.

Notes:
- Figures given are at Market Prices
- Figures for 1953 and 1954 are based upon the old 1953 SNA and therefore not completely comparable
- 1953-1960 trends for Community, Social and Personal Services and Government Services combined from Pilat (1994) was used for both individual series
- Business services are included in Community, Social and Personal Services and not in FIRE.

Number of Persons Employed by Industry

Sources:
- 1953-1954 from Ohkawa, Shinohara & Meisner (1979)
- 1955-1970 from Economic Planning Agency, Report on National Accounts from 1955-1989, Tokyo, October 1991;
- 1971-1981, EPA, Annual Report on National Accounts, 1997.
- 1981-2000 from STAN database May 2003.

Notes:
- Business services are included in Community, Social and Personal Services and not in FIRE.

Malaysia

Gross Domestic Product in Constant Prices

Sources:
- 1970-78 at 1970 prices from United Nations, National Accounts Statistics, various issues, linked in 1978
- 1978-87 at 1978 prices from United Nations, National Accounts Statistics, various issues, linked in 1987
- 1987-2001 at 1987 prices from ADB, SDBS, February 2003.

Notes:
- Figures in 1987 market prices
- For 1987-2001, owner-occupied dwellings was included in community etc. services in the original source. This has been reallocated to FIRE using ADB, SDBS, March 1999 and UN, National Accounts Statistics.

Gross Domestic Product by Industry in Current Prices

Sources:
- 1970, 1973 and 1978 from United Nations, National Accounts Statistics, various issues.
- 1987-2001 from ADB, SDBS, February 2003.

Notes:
- Figures are given at market prices
- Figures inbetween 1970, 73, 78, 87 were intrapolated.
- For 1987-2001, owner-occupied dwellings was included in community etc. services in the original source. This has been reallocated to FIRE using ADB, SDBS, March 1999 and UN, National Accounts Statistics.

Number of Persons Employed by Industry

Sources:
- 1975-79 and 1981-84 figures for agriculture, mining, manufacturing and other sectors aggregated from Asian Development Bank, "Key Indicators of developing Asian and Pacific countries", 1996.
- 1980 all sectors from Department of Statistics, “Monthly Statistical Bulletin of Malaysia”, 1994.
- 1985-95 from United Nations 'Statistical Yearbook for Asia and the Far East', various issues.
- 1996 from Department of statis tice, “Monthly Statistical Bulletin of Malaysia”, 1997.
- 1996-2000 trends from ILO, Labour statistics database, February 2003.
- 2000-2001 trend from ADB, “Key Indicators of developing Asian and Pacific countries”, 2002

Notes:
- For 1975-1979 only total of all sectors, excluding agriculture, mining and manufacturing, is given in source. Controlling for this total, we distributed across the various sectors assuming identical sectoral labour productivity growth rates.
- For 1981-1984 only total of all sectors, excluding agriculture, mining and manufacturing, is given in source. Controlling for this total, we distributed across the various sectors using average productivity growth in each sector for the period 1980-85.
- The ILO and ADB databases figures are based on figures from one survey month only, rather than two or more rounds as the other sources. Hence only trends from these sources can be used.
- For 1996-2000 total of community, social and personal services and government services is given in source. Controlling for this total, we distributed across the various sectors using average productivity growth in each sector for the period 1995-2000.
- For 2001 Sectoral weights from 2000 have been used in order to calculate the employment data for 2001 for Public Utilities, Construction, Trade, T&C, FIRE, CSPS and Government Services

Singapore

Gross Domestic Product in Constant Prices

Sources:
- 1960-1970 trend in 1968 prices from Department of Statistics, "Singapore National Accounts", Singapore, 1975, linked in 1970
- 1970-1990 trend in 1985 prices from Department of Statistics, "Singapore National Accounts", Singapore, 1987 and Department of Statistics, "Yearbook of Statistics Singapore', 1991, linked in 1990
- 1990-1998 trend in 1990 prices from ADB, ESDB March 1999, linked in 1998.
- 1998-1999 trend in 1990 prices from ADB, Key Indicators 2002, March 2003, linked in 1999.
- 1999-2002 in 1995 prices from Singapore Statistics, economic survey of Singapore 2002.

Notes:
- Figures given are at 1995 basic prices
- Government services is included in community and other services
- The use of trends leads to a minor inconsistency between the current and constant price series for the benchmark year 1995.

Gross Domestic Product by Industry in Current Prices

Sources:
- 1960 from Department of Statistics, "Singapore National Accounts", Singapore, 1975,
- 1970-1990 trend from Department of Statistics, "Singapore National Accounts", Singapore, 1987 and Department of Statistics, "Yearbook of Statistics Singapore', 1991, linked in 1990
- 1990-1998 trend from ADB, ESDB March 1999, linked in 1998.
- 1998-1999 trend from ADB, Key Indicators 2002, March 2003, linked in 1999.
- 1999-2002 from Singapore Statistics, economic survey of Singapore 2002.

Notes:
- Figures given are at basic prices
- Government services is included in community and other services

Number of Persons Employed by Industry

Sources:
- 1971 and 1972 from Yearbook of Statistics, Singapore 1972/73, Department of Statistics, linked in 1970 to
- 1970 and 1973-1981 from Department of Statistics, "Economic and Social Statistics Singapore, 1960-1982" Singapore, linked in 1981 to
- 1981-1989 from Department of Statistics, "Yearbook of Statistics Singapore", various issues.
- 1990-2001 from ILO, Labourstatistics.
- 2002 from Singapore Ministry of Manpower, department Manpower Research.

Notes:
- Community etc. services includes government services and employment not allocated by industry.
- Employment figures for 2000 (and the construction sector in 1990) are calculated using the average of 1999 and 2001.

South Korea

Gross Domestic Product in Constant Prices

Sources:
- 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
- 1970-2001 in 1995 prices from Bank of Korea, "National Accounts" published on Internet March 2003.

Notes:
- Figures given are at 1995 Market Prices.
- Figures for 1953-70 based upon the old 1953 SNA and therefore not completely comparable
- Government services is included in community and other services

Gross Domestic Product by Industry in Current Prices

Sources:
- 1953-1970 trend from D. Pilat, "The Economics of Catch Up: the Experience of Japan and Korea, Groningen Growth and Development Centre, 1993". linked in 1970
- 1970-2001 from Bank of Korea, "National Accounts" published on Internet March 2003.
- imputation for owner occupied dwellings based on shares in current prices

Notes:
- Figures are at market prices.
- Figures for 1953-70 based upon the old 1953 SNA and therefore not completely comparable
- Government services is included in community and other services
- **imputation for owner occupied dwellings based on shares derived from benchmark input-output tables 1970-1995, Bank of Korea. Intermediate years intrapolated.**

Number of Persons Employed by Industry

Sources:
- 1963-86 from Pilat 1994, "The Economics of Rapid Growth: the Experience of Japan and Korea", originally from EPB, Annual Report on the Economically Active Population Survey, Seoul, various issues.
- 1987-1999 EPB, "Annual Report on the Economically Active Population Survey", Seoul, various issues.
- 2000 From ILO, Labour statistics
- 2001-2002 From National Statistics Office, Korea.

Notes:
- Government services included Community etc. services
- For 2001-2002 only the data for agriculture, mining and manufacturing were available. The other sectors are calculated from aggregate data, using their 2000 sectoral weights.

Taiwan

Gross Domestic Product in Constant Prices

Sources:
- 1961-2000 from Directorate-General of Budget, Accounting and Statistics, "Statistical Abstract of National Income in Taiwan Area of the Republic of China, March 2000", complemented with DGBAS, "National Income in Taiwan Area," 1994 and 1999.

Notes:
- Figures given are at 1996 Market Prices.
- Community, social and personal services include other private producer of services
- Total GDP includes all industries plus GDP less imputed bank service charges plus import duties plus value added tax (existing since 1986).
- For 1961-88, community, social and personal services estimated by applying growth rates in 1991 prices from DGBAS , "National Income in Taiwan Area, 1994".
- For 1989-98, community, social and personal services from DGBAS, "National Income in Taiwan Area, 1999".
- For 1999-2000, community, social and personal services estimated by applying growth rates in 1996 prices for total GDP minus GDP from all other industries

Gross Domestic Product by Industry in Current Prices

Sources:
- 1961-2000 from Directorate-General of Budget, Accounting and Statistics, "Statistical Abstract of National Income in Taiwan Area of the Republic of China, March 2000", complemented with DGBAS, "National Income in Taiwan Area," 1994 and 1999.

Notes:
- Figures are given at Market Prices.
- Community, social and personal services include other private producer of services. Taken from DGBAS, "National Income in Taiwan Area," 1994 and 1999.
- Total GDP includes all industries plus GDP less imputed bank service charges plus import duties plus value added tax (existing since 1986).
- For 1999-2000, community, social and personal services estimated by applying growth rates for total GDP minus GDP from all other industries

Number of Persons Employed by Industry

Sources:
- 1963-1965 trends from Directorate-General of Budget, Accounting and Statistics, "Statistical Yearbook of the Republic of China, 1982" applied to 1965
- 1965-1977 from Directorate-General of Budget, Accounting and Statistics, Statistical Yearbook of the Republic of China, 1993 and 1999
- 1978-2000 from Directorate-General of Budget, Accounting and Statistics, "Monthly Bulletin of Manpower Statistics, Taiwan Area", various issues.

Notes:
- For the years 1963-1977 separate figures for Community services and Government services are not given. We assumed identical labour productivity growth rates in both sectors and controlled for combined employment.

Thailand

Gross Domestic Product in Constant Prices

Sources:

- 1946-1951 trend in 1972 prices from Vanderveen, 1987, 'Postwar Economic Growth and Structural Change in Thailand', linked in 1951

- 1951-1960 trend in 1956 prices from NESDB, National Income of Thailand, 1951-63, linked in 1960
- 1960-1970 trend in 1962 prices from NESDB, National Income of Thailand, 1960-75, linked in 1970
- 1970-1980 trend in 1972 prices from NESDB, National Income of Thailand, 1970-90, linked in 1980
- 1980-1993 in 1988 prices from NESDB, National Income of Thailand, 1980-96
- 1994-2001 in 1988 prices from NESDB, National Income of Thailand, may 2003.

Notes:

- Figures at 1988 Market Prices.
- The figures after 1970 were based on a different industrial classification in which simple agricultural processing products had been taken away from the manufacturing sector and put under the agricultural sector. We retain the industrial classification used for the post-1970 figures. (NB This is in contrast with Office of the National Economic and Social Development Board, *National Income of Thailand, 1951-1996*, 1999, in which this break is not resolved).
- Ownership of dwellings is included in FIRE.
- In the National accounts, hotels and restaurants are included in services. This industry is reallocated to trade.

Gross Domestic Product by Industry in Current Prices

Sources:

- 1951-1960 trend from NESDB, National Income of Thailand, 1951-63, applied to 1960
- 1960-1970 trend from NESDB, National Income of Thailand, 1960-75, applied to 1970
- 1970-1980 trend from NESDB, National Income of Thailand, 1970-90, applied to 1980
- 1980-1993 from NESDB, National Income of Thailand, 1980-96
- 1994-2001 from NESDB, National Income of Thailand, may 2003.

Notes:

- Figures at current prices differ between the various issues in overlapping years. Therefore we applied growth rates to the earliest year of the most recent publication.
- The figures after 1970 were based on a different industrial classification in which simple agricultural processing products had been taken away from the manufacturing sector and put under the agricultural sector. We retain the industrial classification used for the post-1970 figures. (NB This is in contrast with Office of the National Economic and Social Development Board, *National Income of Thailand, 1951-1996*, 1999, in which this break is not resolved).
- Ownership of dwellings is included in FIRE.
- In the National accounts, hotels and restaurants are included in services. This industry is reallocated to trade.

Number of Persons Employed by Industry

Sources:

- 1960-77 trend from N. Vanderveen, 1987, 'Postwar Economic Growth and Structural Change in Thailand', mimeo University of Groningen, linked in 1977 to
- 1977-1997 trend from NSO, Labour Force Survey, various issues, linked in 1997 to
- 1997-2002 from NSO, Labour Force Survey, may 2003

Notes:

- The labour force survey is held more than once in most years. We take the average of the Februari (first round) and the August survey (third round) to take account for the seasonal inactive labour force. For years for which only August round results are available (1980, 1982 and 1990) we estimated the Februari round by applying the February/August proportions from the year before.

- For Finance, insurance and real estate, the trend (1960-1997)f rom wholesale and retail trade has been applied. This is because this sector is included in trade in the data before 1998.
- For Government services, the trend (1960-1997) from Community, social and personal services has been applied. This is because this sector is included in services in the data before 1998.

Appendix Tables

Table A1 Sector contribution to aggregate labour productivity growth (as percentage of aggregate growth), Japan

	1963-73			1973-85			1985-96			1985-2001		
	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift
Agriculture	1	1	0	1	1	0	1	1	0	0	0	0
Mining	1	1	0	0	0	0	0	0	0	0	0	0
Manufacturing	43	40	3	40	38	2	41	40	1	44	43	1
Public Utilities	3	2	0	3	3	0	3	2	1	4	3	1
Construction	6	5	2	0	0	0	7	5	2	2	0	2
Wholesale and	19	18	1	18	17	0	15	15	0	9	10	-1
Transport and	6	5	1	6	5	0	6	5	1	7	6	1
Finance. Insurance	12	7	5	16	10	6	16	13	3	22	19	4
Community, Social	6	3	3	10	4	6	8	2	5	7	3	4
Government	2	2	1	6	6	0	3	3	0	5	5	0
Total	100	85	15	100	85	15	100	86	14	100	88	12

Appendix Tables

Table A2 Sector contribution to aggregate labour productivity growth (as percentage of aggregate growth), Taiwan

	1963-73			1973-85			1985-96			1985-2001		
	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift
Agriculture	11	11	0	3	3	0	1	1	0	1	1	0
Mining	1	1	0	1	1	0	1	1	0	1	1	0
Manufacturing	42	26	16	45	36	9	39	38	1	35	33	2
Public Utilities	4	4	0	5	4	1	4	4	0	4	4	0
Construction	3	2	1	3	2	1	0	2	-2	0	1	-2
Wholesale and	11	7	4	10	9	1	17	17	0	17	16	1
Transport and	10	8	2	11	10	1	6	6	0	11	10	0
Finance. Insurance	6	5	1	7	1	5	16	5	10	14	3	11
Community, Social	3	3	0	5	6	-1	6	8	-2	7	8	-1
Government	9	9	0	9	7	3	10	9	1	11	9	2
Total	100	76	24	100	79	21	100	91	9	100	86	14

Appendix Tables

Table A3 **Sector contribution to aggregate labour productivity growth (as percentage of aggregate growth), Korea**

	1963-73			1973-85			1985-96			1985-2001		
	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift
Agriculture	3	9	-6	11	11	-1	5	5	0	1	4	-2
Mining	5	4	1	0	-2	2	3	3	0	2	2	0
Manufacturing	35	26	9	45	34	11	49	46	3	60	57	3
Public Utilities	5	2	2	9	6	3	5	3	2	6	5	1
Construction	7	6	2	10	6	4	8	3	5	7	3	3
Wholesale and	23	21	2	5	3	2	4	8	-4	4	8	-4
Transport and	13	12	2	9	5	4	8	7	1	10	9	1
Finance, Insurance	5	3	3	7	-3	10	13	2	11	12	3	9
Community, Social	5	4	1	4	-1	6	5	3	1	-3	-3	0
Government												
Total	100	85	15	100	59	41	100	80	20	100	87	13

Appendix Tables

Table A4 **Sector contribution to aggregate labour productivity growth (as percentage of aggregate growth), Malaysia**

	1975-85			1985-96			1985-2001		
	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift
Agriculture	27	18	9	5	6	-1	-1	2	-4
Mining	21	19	2	7	7	0	15	9	6
Manufacturing	19	11	8	31	19	11	27	18	9
Public Utilities	2	1	1	4	3	1	5	3	2
Construction	0	1	-1	5	4	0	-4	-1	-3
Wholesale and	8	5	3	18	20	-2	7	11	-4
Transport and	6	3	3	7	5	1	8	5	2
Finance, Insurance	5	3	2	16	11	5	18	10	8
Community, Social	0	1	0	2	3	-1	9	10	-1
Government	12	8	4	5	5	0	17	18	-1
Total	100	70	30	100	84	16	100	85	15

Appendix Tables

Table A5 Sector contribution to aggregate labour productivity growth (as percentage of aggregate growth), Indonesia

	1973-85			1985-96			1985-2001		
	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift
Agriculture	23	25	-2	9	11	-2	-29	4	-33
Mining	-19	-68	50	5	-6	11	15	-5	20
Manufacturing	38	34	4	40	25	15	57	18	39
Public Utilities	1	0	1	3	2	0	8	4	4
Construction	8	6	2	11	4	7	5	-6	11
Wholesale and	14	16	-2	16	8	7	17	7	11
Transport and	9	6	3	5	-1	6	6	0	6
Finance. Insurance	14	12	2	11	6	4	7	-19	26
Community. Social Government	11	10	2	0	0	0	14	10	3
Total	100	41	59	100	50	50	100	13	87

Appendix Tables

Table A6 Sector contribution to aggregate labour productivity growth (as percentage of aggregate growth), India

	1963-73			1973-85			1985-96			1985-2001		
	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift
Agriculture	7	23	-17	1	8	-7	16	19	-3	4	11	-7
Mining	2	2	0	5	3	2	3	2	1	3	2	0
Manufacturing	28	27	1	29	23	6	26	25	0	21	21	0
Public Utilities	3	2	1	5	4	1	4	3	0	4	3	0
Construction	11	10	1	6	-2	7	4	2	2	8	7	1
Wholesale and	14	13	1	14	1	13	14	11	3	17	15	1
Transport and	6	5	1	10	8	2	7	7	0	12	12	0
Finance. Insurance	7	2	6	21	19	2	16	12	3	13	11	2
Community. Social Government	22	22	-1	9	10	0	12	11	1	19	19	0
Total	100	107	-7	100	74	26	100	92	8	100	102	-2

Appendix Tables

Table A7 **Sector contribution to aggregate labour productivity growth (as percentage of aggregate growth), Hong Kong**

	1974-85			1985-96			1985-2001		
	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift
Agriculture	1	1	0	-1	-1	0	-1	-1	0
Mining	1	1	0	0	0	0	0	0	0
Manufacturing	48	50	-2	39	39	0	32	32	0
Public Utilities	9	8	1	7	5	2	12	10	1
Construction	2	1	2	2	2	1	1	0	0
Wholesale and	31	25	6	19	12	7	19	13	6
Transport and	3	1	1	8	5	3	12	9	3
Finance, Insurance	-7	-41	34	20	-14	34	7	-29	36
Community, Social Government	12	11	1	7	4	3	19	15	4
Total	100	57	43	100	51	49	100	50	50

Appendix Tables

Table A8 **Sector contribution to aggregate labour productivity growth (as percentage of aggregate growth), Singapore**

	1973-85			1985-96			1985-2001		
	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift
Agriculture	0	0	0	-1	0	0	-1	0	0
Mining	1	0	0	0	0	0	0	0	0
Manufacturing	12	12	0	35	35	1	44	43	1
Public Utilities	5	4	1	4	3	1	4	3	1
Construction	7	3	5	9	9	0	7	7	0
Wholesale and	8	9	0	16	17	-2	18	19	-1
Transport and	29	29	1	14	12	2	16	15	2
Finance, Insurance	29	13	16	17	2	15	13	-5	18
Community, Social Government	9	10	-1	5	8	-3	-2	6	-9
Total	100	80	20	100	86	14	100	88	12

Appendix Tables

Table A9 Sector contribution to aggregate labour productivity growth (as percentage of aggregate growth), Thailand

	1963-73			1973-85			1985-96			1985-2001		
	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift	Total contri-	Due to intra	Due to shift
Agriculture	18	18	0	-40	6	-45	1	5	-4	1	8	-7
Mining	2	1	1	15	9	6	4	3	1	8	6	2
Manufacturing	28	19	9	45	14	31	37	21	16	47	22	26
Public Utilities	4	3	1	3	0	3	5	3	2	14	9	5
Construction	1	-4	5	10	4	6	3	-4	7	-3	-12	8
Wholesale and	27	20	7	27	4	22	18	6	12	5	-11	16
Transport and	4	1	3	14	6	8	11	7	5	17	11	6
Finance, Insurance	4	3	1	6	3	3	12	9	4	0	-5	5
Community, Social	8	3	5	13	6	7	6	3	3	8	2	6
Government	4	2	3	7	4	3	2	0	2	4	1	3
Total	100	66	34	100	57	43	100	53	47	100	32	68