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PART II, Chapter 3

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Technological Progress, Structural Change and Trade Integration

Chapter 3

A. Introduction

Productive capacities do not only develop through capital accumulation, but also through technological progress and structural change. Technological progress usually requires investment because much technology is embodied in machinery and other kinds of capital equipment. However, it also requires knowledge and know-how which people and organizations acquire through learning, and which are embodied in procedures and institutional arrangements. In particular, technological progress will not take place without technological capabilities — the skills, information and experience to build and reconfigure core production competences through new investment, incremental and radical product and process innovation and the development of new markets and linkages.

Within development policy analysis there is quite a sharp divide between those who emphasize the importance of capital accumulation as the key to development and those who emphasize knowledge accumulation, technological capabilities and learning. Nelson and Pack (1999), for example, distinguish two explanations of the growth of the Asian Newly Industrializing Economies (NIEs) – accumulation theories, which emphasize the role of physical and human capital accumulation, and assimilation theories, which emphasize the importance of learning in identifying, adapting and operating imported technologies. But this divide is artificial. In reality both processes are important and interrelated. Within LDCs, the development of productive capacities requires both capital accumulation and knowledge accumulation.

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Technological progress occurs through innovation which, following Schumpeter (1942), can best be defined as: (i) the introduction of new goods and services, or of new qualities of goods and services; (ii) the development of new production methods, or new marketing strategies; (iii) the opening-up of new markets; (iv) the discovery of new sources of raw materials or exploitation of previously known resources; and (v) the establishment of new industrial structures in a given sector. Whenever firms undertake activities which are new to them, even if it is not new to their competitors, to their countries or to the world, it is a risky process. But if it is successful, a technology may become more and more widely adopted. Various incremental innovations normally occur in the innovation diffusion process. These involve minor increases in technical efficiency, productivity and precision in production processes, or changes in products to achieve better quality, reduce costs or widen their range of uses. But the end-result of this process is intra-sectoral productivity growth and economy-wide structural change, as well as changes in the form of trade integration of a country as enterprises acquire international competitiveness in the production of more skill- and technology-intensive goods and services.

In the most successful developing economies which have achieved fast rates of catch-up growth, economic growth has been associated with a structural transformation. This has occurred as successive waves of economic activity which are new to the country have been introduced and diffused. Agricultural

productivity growth has usually occurred at the initial stages of the growth process. However, agriculture has become progressively less important and manufacturing and services have become relatively more important as a share of GDP and source of employment. There has also been a shift from less to more technology-, skill- and capital-intensive activities both within and across sectors. Moreover, there has been a progressive shift in the export structure as enterprises located within the country acquire the technological capabilities necessary to compete internationally.

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This chapter provides an overview of patterns of structural change, trade integration and the development of technological capabilities in the LDCs. Section B provides an overview of trends in production structure, labour productivity and trade integration in the LDCs. The evidence shows that for LDCs as a whole there has been very little structural change since 1980, the productivity gap between the LDCs and other developing countries is widening and most LDCs remain focused on primary commodity exports. However, there are significant differences amongst the LDCs. Section C examines whether differences in growth performance are related to patterns of structural change and trade integration. Section D thus completes the analysis by examining the level and trends in technological learning in LDCs. The general lack of structural change, productivity growth and international competitiveness is a manifestation of weak technological capabilities. But this section deepens the analysis by examining indicators of technological effort. Data are very patchy and the section therefore draws on evidence from Investment Climate Surveys conducted in the LDCs. The conclusion summarizes the main points of the chapter.

B. Trends in production structure, labour productivity and trade integration

The economies of most of the LDCs continue to be dominated by agriculture and petty service activities.

The present section identifies trends in production structure using data from various sources, including World Bank, the UN Statistical Division (UNSD), UNIDO and FAO, and trends in trade structure using UN COMTRADE data. The data are far from ideal. Indeed, it is striking how difficult it is to get dtailed internationally comparable data on what LDCs produce and how people within LDCs earn a living. The analysis which follows is based on a careful assessment of differences in data sources and comparative analysis to ensure that the arguments presented in this chapter are robust with regard to the particular selection of data sources (see box 11). It is also limited to the relatively broad level of sectoral disaggregation which the data allow.

1. Trends in production structure

There has been little structural change in the LDCs as a group over the past twenty-five years. The economies of most of the LDCs continue to be dominated by agriculture and petty service activities. Both industrial activities and services are becoming slowly more important for the LDC group as a whole. The types of industrial activities which are expanding are mining, the exploitation of crude oil and, in the same cases, the generation of hydropower; and the types of services which are expanding are petty trade and commercial services. However, within this overall pattern of structural stasis there are considerable differences amongst the trends in different LDCs.

Box 11. Data on production and labour in least developed countries

Internationally comparable data on value added in least developed countries is provided by two principle sources, namely the United Nations Statistical Division (UNSD) and the World Bank's *World Development Indicators* (WDI). Both databases provide value-added data for the three principal economic sectors, namely agriculture, industry and services, and both databases also provide value-added data for the manufacturing sector. The two datasets have their advantages and disadvantages. The UNSD database, unlike WDI data, provides value-added data for sub-sectors of the industrial sector, and provides value-added data for the main sub-sectors of the services sector. But a major shortcoming of the UNSD database, compared with the WDI data, is that it does not provide value-added data in constant dollars for one of the main economic sectors, namely the industrial sector. As one of the objectives of this report was to conduct a trend analysis of structural change, value added data in constant dollars was indispensable, especially for the principal sectors of the economies. As the available data for the LDCs has not allowed for the estimation of reliable deflators for the industrial sector, this report has based its analysis on value-added data provided by WDI rather then UNSD, even though this choice implies accepting a smaller country coverage.

But the differences between the two datasets are not only limited to the disaggregation of data, the availability of deflators and the coverage of countries. There are also marked differences between the two datasets as regards the actual level of value added. The two datasets show considerable differences in the level of value added for the group of LDCs, but also for a good number of individual LDCs. But the differences in value added cannot be systematically linked to individual countries. Furthermore, the differences in value added cannot systematically be linked to the use of deflators. In some cases, conversion of the data into constant dollars exacerbates the differences, but in others the conversion into constant dollars actually minimizes these differences.

The United Nations Industrial Development Organization (UNIDO) publishes value added data for sub-sectors of the manufacturing sector. This data shows: the technology intensity of manufacturing activities; employment by manufacturing activities; and gross fixed capital formation by manufacturing activities. The data therefore does not only make it possible to estimate the level of manufacturing value-added, but also to evaluate the nature of manufacturing activities. The basic problem as far as the LDCs are concerned is that the country coverage is very weak, and that the available data are not very reliable. Data on employment and gross fixed capital formation associated with individual manufacturing activities was only available for seven LDCs out of a sample of 50 LDCs for the period between the early 1980s to the late 1990s. Furthermore, there are large discrepancies between total manufacturing value-added, as presented by UNIDO, and total manufacturing value-added as presented by either UNSD or WDI. Due to these data issues, this report focuses on value added in two categories, namely the category of resource-intensive and low-technology manufacturing activities and the category of medium- and high-technology manufacturing activities. Value-added data for these categories is presented only as a share of total manufacturing value-added.

In addition to the difficulties with production data, there are considerable difficulties with employment data. While UNIDO collects employment data for the manufacturing sector, the International Labour Organization (ILO) collects employment data for all principal economic sectors. The ILO database, however, has a very weak coverage of the LDCs. Long-term employment trends by economic activities can be observed for only 7 LDCs out of a sample of 50 LDCs. Some of the LDCs for which the ILO provides employment data are the same as the LDCs for which UNIDO has collected employment data. Where employment in the manufacturing sector is concerned, these two data sources show considerable differences. The weak coverage of countries and the discrepancies between available employment data make it difficult to conduct a trend analysis of employment or labour productivity by economic sectors. This report therefore estimates employment changes on the basis of changes in the size of the economically active population.

Data on the economically active population may be used as a proxy for employment as they include both people that are formally employed, but also persons who are informally employed. It includes everybody who works to make a living and formally or informally contributes to output. According to ILO's definition (ILO LABORSTA online, January 2006) it includes all those "who furnish the supply of labour for the production of goods and services during a specified time-reference period", namely employers; self-employed workers; salaried employees; wage earners; unpaid workers, people assisting in a family, farm or business operation; members of producers' cooperatives; and members of the armed forces (see ILO LABORSTA online, January 2006). The same definition is also used by FAO (FAOSTAT online January 2006). Those that are economically active at a given point in time are also referred to as the labour force. In this analysis, the term economically active population is therefore used interchangeably with the term labour force.

Data on the economically active population in the LDCs is provided in three principal sources, namely the ILO, the WDI and the Food and Agriculture Organization (FAO). All three data sources have a good coverage of the LDCs, but there are also some discrepancies between them. The largest discrepancies are apparent between FAO and WDI data on the one hand, and ILO data on the other; the discrepancies are small between FAO data and WDI data. Another important difference between the datasets is that unlike ILO and the WDI database, which provide data on the economi-

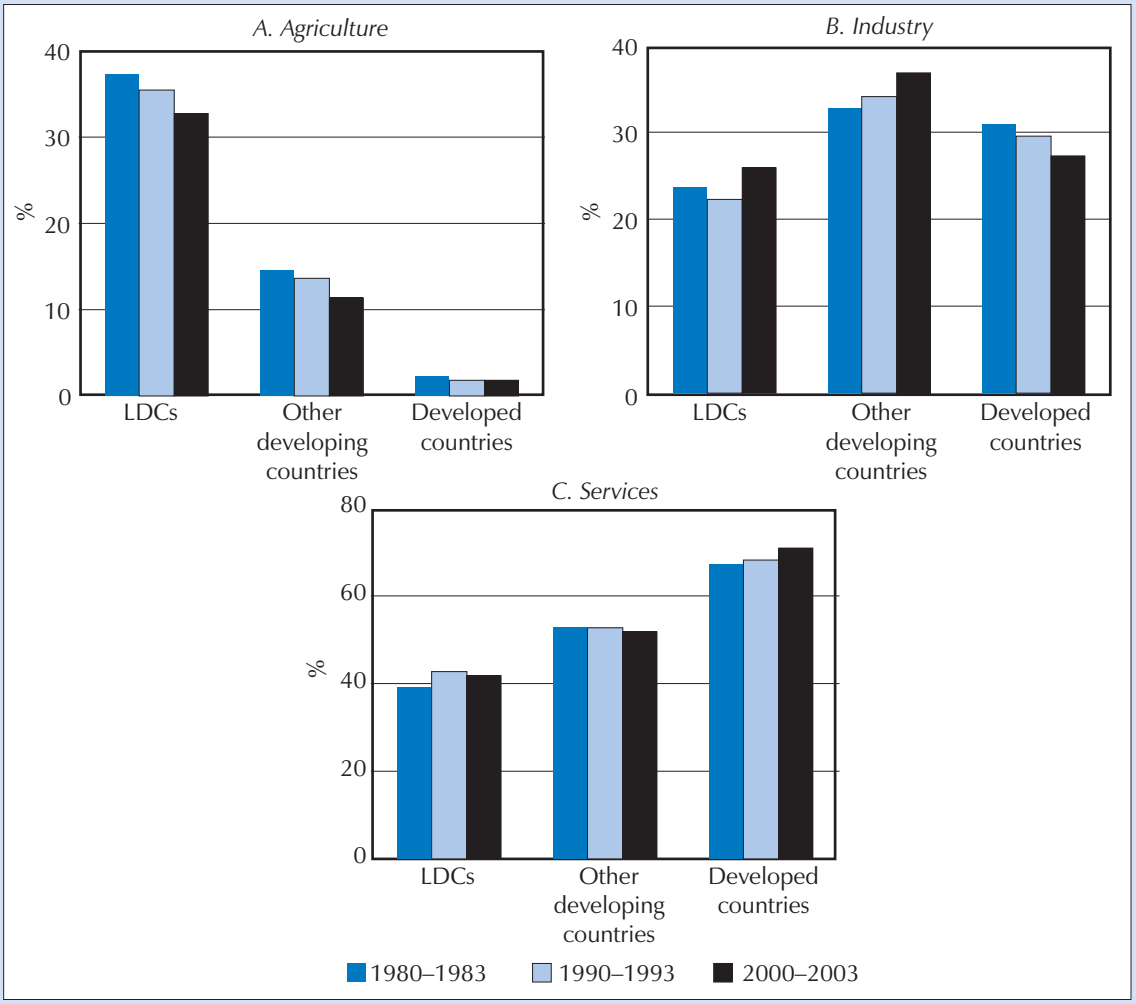
Box 11 (contd.)

cally active population only for the economy as a whole, the FAO provides a breakdown of the data for the agricultural and the non-agricultural sectors. This report uses the FAO database. It is only by using the FAO database that it is possible to show changes in the structure of employment between the agricultural and the non-agricultural sector and changes in labour productivity in the agricultural and non-agricultural sectors. While the WDI database does not provide the data to estimate labour productivity in the agricultural or non-agricultural sectors, the WDI database does provide an estimate of labor productivity in the agricultural sector. The estimated level of agricultural labour productivity provided by WDI is lower than our estimate of agricultural labour productivity based on FAO data. A comparison between estimates of the level of economy-wide labour productivity using FAO data and estimates using ILO data indicated that the latter were 10 per cent higher on average. However, the labour productivity trends were the same for both data sources.

Source: Herrmann (2006).

CHART 19. DISTRIBUTION OF VALUE ADDED AMONG PRINCIPAL ECONOMIC SECTORS OF LDCs, OTHER DEVELOPING COUNTRIES AND DEVELOPED COUNTRIES, 1980–1983, 1990–1993 AND 2000–2003

(Percentage of total value-added, average)



Source: UNCTAD secretariat estimates based on World Bank, *World Development Indicators 2005*, CD-ROM.

Note: Shares are calculated based on constant 2000 dollars. Averages are weighted. Group values are based on a sample of 64 other developing countries and 22 developed countries.

Chart 19 shows the share of agriculture, industry and services in total value-added in LDCs, other developing countries and developed countries in 1980–1983, 1990–1993 and 2000–2003. In 2000–2003:

- Agriculture contributed 33 per cent of total value-added of the LDCs compared with 11 per cent in other developing countries, and 2 per cent in developed countries;

- Industry contributed 26 per cent of total value-added of the LDCs compared with 37 per cent in other developing countries and 27 per cent in developed countries;
- Services contributed 42 per cent of total value-added of the LDCs compared with 52 per cent in other developing countries, and 71 per cent in developed countries.

The share of agriculture in GDP[1] is declining slowly in the LDCs — down four percentage points in 2000–2003 from 37 per cent in 1980–1983; whilst the share in industry and services in GDP is rising slowly — with industrial share rising (in rounded numbers) by three percentage points from 23 per cent in 1980–1983 and the services share rising by three percentage points from 39 per cent in 1980–1983.

Although the share of industrial value-added within GDP has increased for the group of LDCs as a whole, this is mainly attributable to the increase of mining, oil extraction and hydroelectric power.

At this broad level of aggregation, the extent of structural change (measured as percentage point changes) is not that much different from that which has occurred within other developing countries. However, more disaggregated analysis which examines differences amongst the LDCs (see table 31), and also breaks down the industrial sector (which includes manufacturing activities and also non-manufacturing activities, namely construction, utilities and mining) and the services sector, gives a more nuanced picture.

(a) Agriculture

The overall slow decline in the relative share of agriculture disguises a complex pattern in which agriculture is rising as a share of GDP in some LDCs, whilst falling in others, sometimes quickly. The share of agriculture in GDP rose between 1980–1983 and 2000–2003 in more than one-third of the LDCs for which there are data (13 out of 35 countries). Within the 22 LDCs in which the contribution of agriculture decreased, there are 5 LDCs in which the agricultural sector as a share of total value added contracted by more than one third of its 1980–1983 level. In four of these LDCs (Angola, Bhutan, Equatorial Guinea and Lesotho), the relatively large contraction of the agricultural sector is attributable to a relatively large expansion of the industrial sector, mainly oil exploitation, hydroelectric power and, in the case of Lesotho, some manufacturing industries; in one of these LDCs (Kiribati), it is attributable to a relatively large expansion of the services sector, especially in tourist activities.

(b) Industry

The share of industrial value-added within GDP has fallen in more than one-third of the LDCs between 1980–1983 and 2000–2003.

Although the share of industrial value-added within GDP has increased for the group of LDCs as a whole, this is mainly attributable to the increase of mining, oil extraction and hydroelectric power. The share of manufacturing activities in GDP is much lower in LDCs than in other developing countries, and is also increasing much more slowly than within other developing countries. It increased from 9 to 11 per cent of GDP in the LDCs as compared with an increase from 17 to 23 per cent in the other developing countries between 1980–1983 and 2000–2003. Within manufacturing activities, the share of medium- and high-technology manufactures is also lower and growing more slowly in LDCs than in other developing countries. The share of medium- and high-technology manufactures increased from 13 to 16 per cent in the LDCs between 1980–1983 and 2000–2003, whilst it increased from 24 to 28 per cent in other developing countries and from 46 to 51 per cent in developed countries over the same period (chart 20).

The overall increase in the share of industrial value-added within GDP also disguises significant differences between the LDCs. The share has fallen in more

TABLE 31. SHARE OF VALUE ADDED IN PRINCIPAL ECONOMIC SECTORS IN LDCs AND LDC SUBGROUPS, 1980–1983 AND 2000–2003

(percentage of total value added, average)

	Agriculture		Industry		Manufacturing		Services	
	1980–1983	*2000–2003*	*1980–1983*	*2000–2003*	*1980–1983*	*2000–2003*	*1980–1983*	*2000–2003*
Afghanistan	..	56	..	21	..	..	..	24
Angola	10	6	57	74	8	3	33	20
Bangladesh	33	24	17	26	11	16	50	50
Benin	25	36	13	14	6	9	62	49
Bhutan	57	34	19	38	5	8	24	27
Burkina Faso	32	32	19	16	16	11	49	52
Burundi	52	49	22	21	..	..	26	30
Cambodia	..	37	..	26	..	19	..	36
Cape Verde	16	12	17	18	10	9	66	71
Central African Republic	43	59	21	21	9	10	36	20
Chad	40	38	12	16	..	..	48	46
Comoros	27	46	8	13	2	5	65	41
Dem. Rep. of the Congo	29	62	37	21	..	..	34	17
Djibouti	..	4	..	14	..	3	..	82
Equatorial Guinea	55	6	25	89	..	..	20	5
Eritrea	..	15	..	24	..	12	..	61
Ethiopia	59	47	11	10	..	..	29	43
Gambia	39	32	13	14	5	5	48	54
Guinea	23	24	35	36	..	4	42	40
Guinea-Bissau	48	57	19	14	15	11	33	29
Haiti	34	28	26	17	18	8	40	55
Kiribati	30	17	8	10	2	1	62	73
Lao PDR	62	51	12	25	7	18	26	25
Lesotho	27	17	29	42	10	18	43	40
Madagascar	27	30	14	14	13	12	58	56
Malawi	30	37	20	16	16	11	50	47
Mali	44	41	14	23	4	3	42	36
Mauritania	24	20	29	30	18	9	47	50
Mozambique	32	27	24	28	..	15	44	45
Nepal	54	42	13	22	4	9	34	37
Niger	32	39	20	17	7	7	48	44
Rwanda	35	43	30	21	22	11	35	37
Samoa	..	14	..	26	..	16	..	60
Sao Tome and Principe	..	20	..	17	..	4	..	63
Senegal	23	18	17	21	11	13	60	61
Sierra Leone	54	47	29	34	..	..	17	19
Sudan	36	41	20	20	11	8	44	39
Togo	23	35	21	19	7	9	57	46
Uganda	51	36	11	21	5	10	37	43
United Rep. of Tanzania	..	45	..	16	..	8	..	39
Vanuatu	19	15	12	10	3	4	69	75
Yemen	..	14	..	46	..	5	..	39
Zambia	15	21	36	27	8	12	49	52
LDCs	37	33	23	26	9	11	39	42

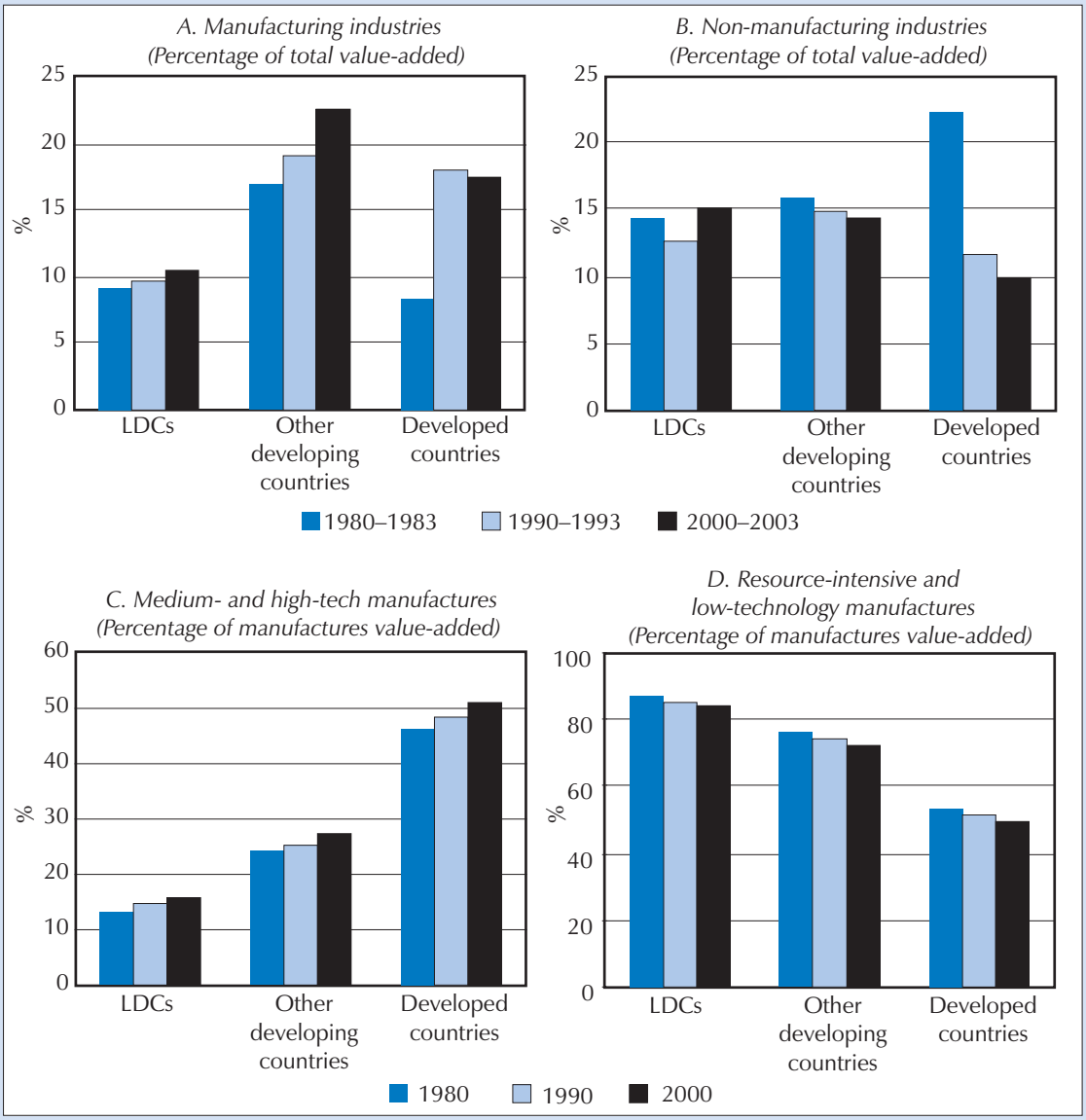
Source: UNCTAD secretariat estimates based on World Bank, *World Development Indicators 2005*, CD-ROM.

Note: Shares are calculated based on constant 2000 dollars.
Other LDCs were not included due to lack of data.

than one-third of the LDCs for which there are data (14 out of 35 countries) between 1980–1983 and 2000–2003. Much of the increase in industrial value-added, both manufacturing and non-manufacturing, is concentrated in a few LDCs. Sixty per cent of the increase in industrial value-added of the LDCs as a group is concentrated in four countries — Angola, Bangladesh, Equatorial Guinea and Yemen. If these four LDCs are omitted from the sample, the share of industrial activities in GDP hardly changed within LDCs between 1980–1983 and 2000–2003, increasing by just one percentage point. Three of these

CHART 20. DISTRIBUTION OF VALUE ADDED WITHIN THE INDUSTRIAL SECTOR OF LDCs, OTHER DEVELOPING COUNTRIES AND DEVELOPED COUNTRIES, 1980–1983, 1990–1993 AND 2000–2003[a]

(Percentage)



Source: UNCTAD secretariat estimates based on World Bank, *World Development Indicators 2005*, CD-ROM; UNIDO (2005).

Note: For classification of medium- and high-technology manufactures, and resource-intensive and low-technology manufactures see UNIDO (2005).

For charts A and B, group values are based on a sample of 64 other developing countries and 22 developed countries. For charts C and D, group values are based on a sample of 27 LDCs, 72 other developing countries and 33 developed countries.

Between 1990 and 2000 medium- and high-tech manufactures of LDCs increased by 1.2 percentage points if Senegal is included, and increased by only 0.6 percentage points if Senegal is not included in the sample.

a Data on medium- and high-tech mamufactures and resource-intensive and low-tech manufactures are available only for 1980, 1990 and 2000.

countries — Angola, Equatorial Guinea and Yemen — are oil exporters and extractive industrial activities have been the largest economic sector in terms of value-added since 1990–1993. In contrast, the major industrial activity in Bangladesh is manufacturing.

Whilst the LDC group as a whole has seen a relatively modest increase of manufacturing value-added, there is considerable unevenness in this process. Bangladesh accounted for 38 per cent of the manufacturing value-added in the LDC group in 2000–2003. Between 1990–1993 and 2000–2003, half of the

total increase in manufacturing value-added in the LDC group as a whole was attributable to the growth of manufacturing in Bangladesh. Many of the LDCs individually have seen a considerable contraction of manufacturing value-added. Between 1990–1993 and 2000–2003 manufacturing value added as a share of total value-added declined in 19 out of 36 LDCs for which data are available and stagnated in two LDCs (chart 21). Many of the countries that have seen a decline of manufacturing value-added, have seen a relatively large decline, measured as a share of their total value added. Out of the 19 LDCs there are 15 LDCs where manufacturing value added declined by more than 10 per cent of total value added vis-à-vis the 1990–1993 level; out of these 15 LDCs, there are 10 LDCs in which manufacturing value-added declined by more than 20 per cent of total value added vis-à-vis the same base period of 1990–1993. Measured in constant dollar terms manufacturing value-added declined in absolute terms in seven out of the 19 LDCs and it remained unchanged in one of these LDCs.

Between 1990–1993 and 2000–2003 manufacturing value added as a share of total value-added declined in 19 out of 36 LDCs and stagnated in two LDCs.

Many LDCs have, moreover, not only experienced a decline in the relative size of the manufacturing sector, but also a decline in the relative importance of medium- and high-technology manufactures. On the basis of UNIDO data it is apparent that between 1990 and 2000, a total of 14 out of 25 LDCs saw a decline of their share of medium- and high-technology manufactures in total manufactures. The slight increase of the share of medium- and high-technology manufactures in total manufacturing value-added for the LDC group noted above is largely attributable to a single country, Senegal.

(c) Services

Within most LDCs, services make the largest contribution to GDP. But the services sector in LDCs has two major characteristics. Firstly, most of the LDCs have a very weak specialization in advanced commerce-support services, including financial intermediation and business promotion and support. Secondly, many of the LDCs have experienced a large relative and absolute decline of state administrative services, including public administration, defense and compulsory social security.

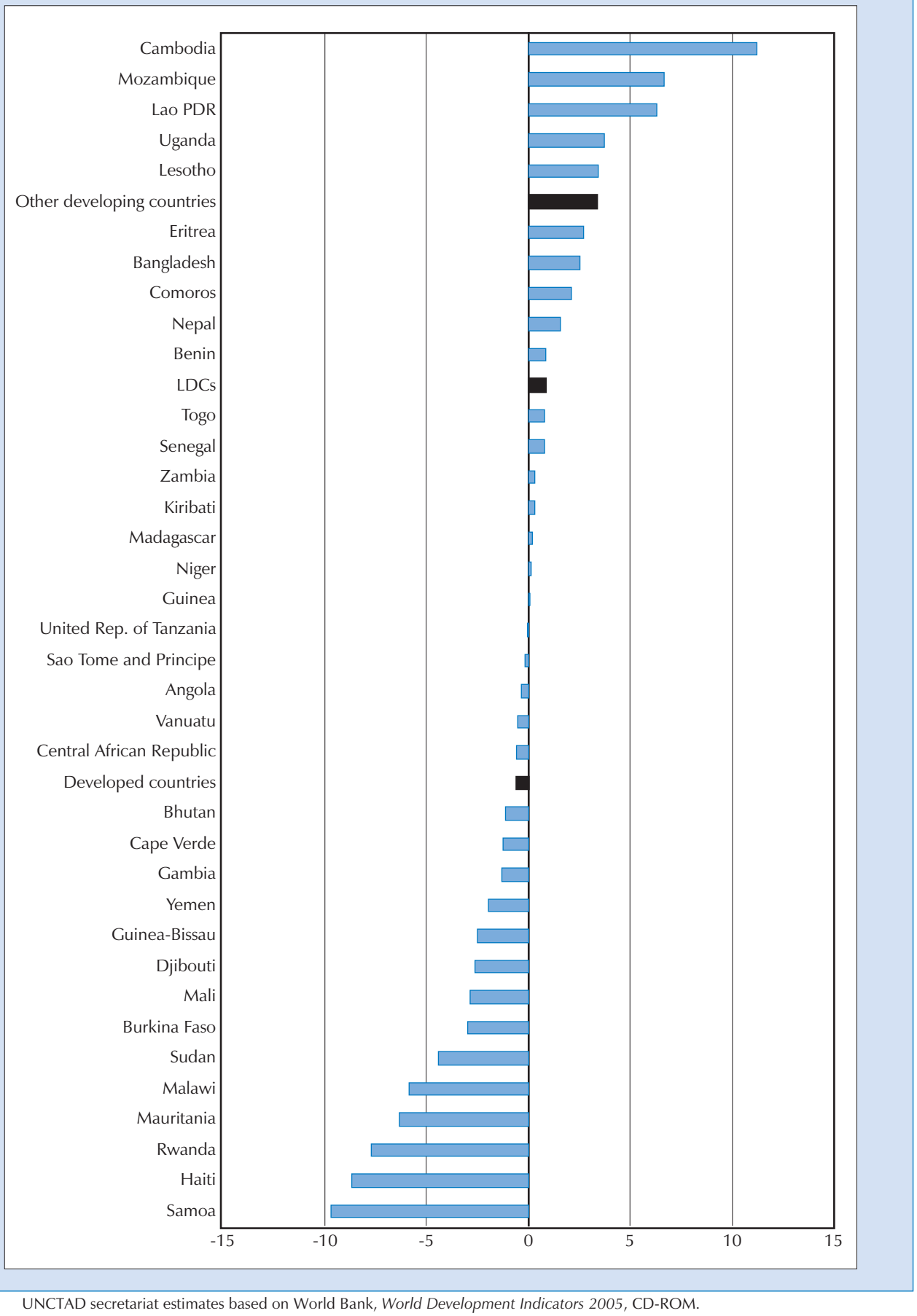
Within most LDCs, services make the largest contribution to GDP. But most of the LDCs have a very weak specialization in advanced commerce-support services, and have experienced a large decline of state administrative services.

Chart 22, which draws on UNSD data, shows the share of different types of services within total services value-added in LDCs, other developing countries and developed countries in 1980–1983, 1990–1993 and 2000–2002. From the chart, it is apparent that basic commercial services have become relatively more important within the LDCs between 1980–1983 and 2000–2002, whilst they declined in importance in both other developing countries and developed countries. In the latter period they contributed almost 20 percentage points more of services value-added in the LDCs than in other developing countries. Human development services also increased as a share of services value-added in the LDCs over the same period, and they were around the same share as other developing countries in 2000–2002. Advanced commerce-oriented services are relatively less important than in other developing countries and they contracted between 1980–1983 and 2000–2002. Finally, state administrative services declined from 17 to 9 per cent of services value-added in the LDCs, which was the opposite trend to other developing countries where there was a slight increase from 13 to 14 per cent of services value-added.

Although state administrative services absorbed a much larger share of GDP in the LDCs than in other developing countries and developed countries at the start of the 1980s, this situation was completely reversed 20 years later. In 2000–2002, only 3.5 per cent of GDP was devoted to state administrative services in

CHART 21. CHANGE IN SHARE OF MANUFACTURING VALUE ADDED IN TOTAL VALUE-ADDED BETWEEN 1990–1993 AND 2000–2003

(Percentage point change)

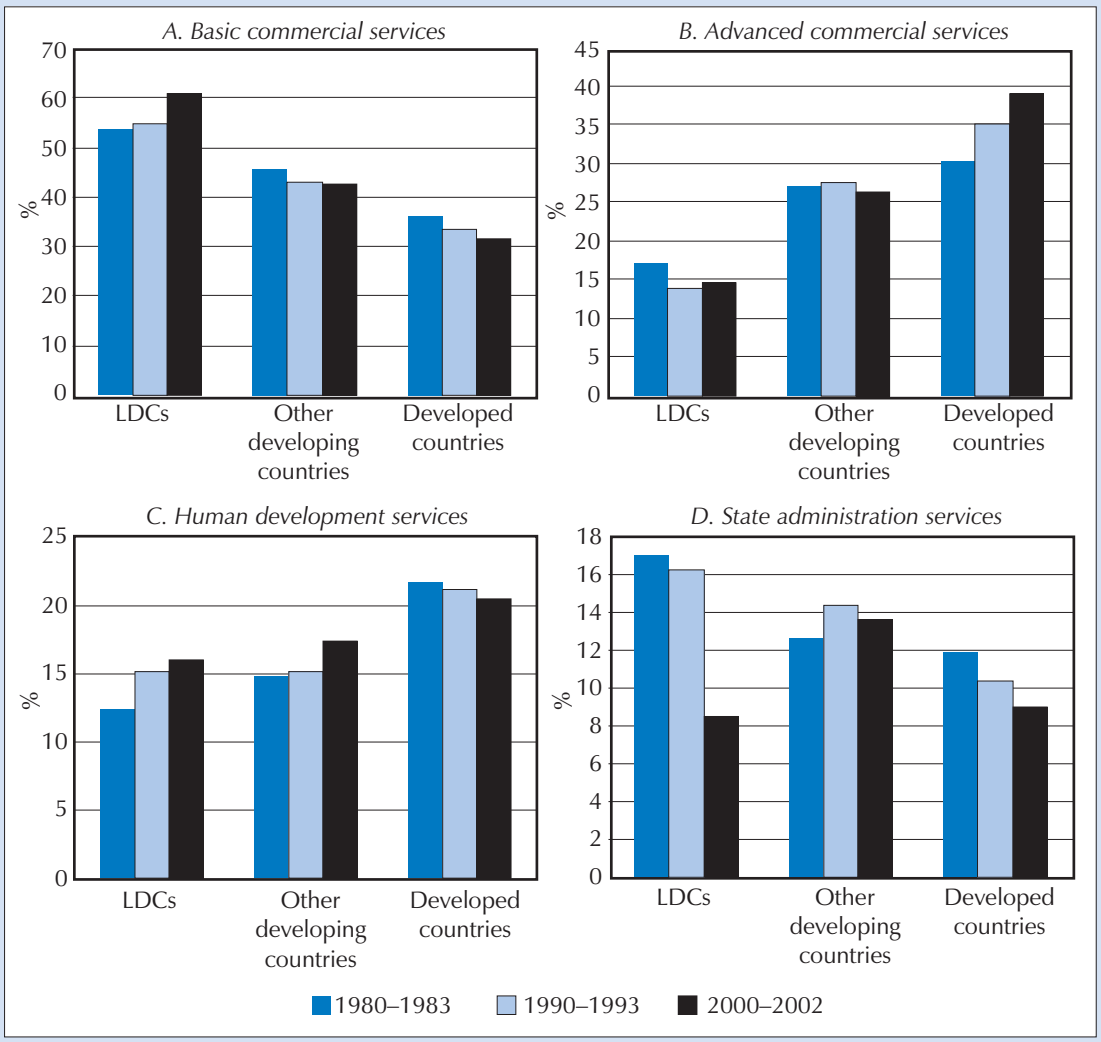


Source: UNCTAD secretariat estimates based on World Bank, *World Development Indicators 2005*, CD-ROM.

Note: Shares are calculated based on data in constant 2000 dollars.
Group of other developing countries includes 67 countries; group of developed countries includes 22 countries.

CHART 22. DISTRIBUTION OF VALUE ADDED WITHIN THE SERVICE SECTOR OF LDCs, OTHER DEVELOPING COUNTRIES AND DEVELOPED COUNTRIES, 1980–1983, 1990–1993 AND 2000–2002

(Percentage of services value-added)



Source: UNCTAD secretariat estimates based on UN Statistics Division national accounts data.

Note: Shares are calculated based on data in constant 2000 dollars. Averages are weighted.

The group of other developing countries includes 67 countries; the group of developed countries includes 22 countries.

Services include State administrative (public administration, defence and compulsory social security), human development services (education, health, social work, other community, social and personal services), advanced commercial services (financial intermediation, real estate, renting and business activities) and basic commercial services (transport, storage, communication, wholesale, retail, gastronomy, and personal household services). For this clasification see Herrmann (2006).

the LDCs, compared with 7.1 per cent in other developing countries and 6.5 per cent in developed countries. The relatively large contraction of the state administrative service sector in the LDCs is associated with policies adopted in stabilization and structural adjustment programmes in the 1980s and 1990s.

The relative expansion of human development services in the LDCs is a positive development to the extent that the quality of those services is good. This development will contribute to improving the weak human resources of the LDCs. However, the scale of the contraction of the state administrative sectors can have negative consequences in LDCs, particularly as they had already weak state capacities to begin with.

This evidence highlights the fact that the pattern of structural change in most LDCs has been relatively weak compared with the changes in other developing countries. Moreover they show that for most LDCs, the type of structural transformation which has occurred in the most successful developing countries is not occurring. De-industrialization, in the sense that manufacturing value-added is declining as a share of GDP, is occurring in many LDCs. The share of medium- and high-technology manufacturing activities is only increasing very slowly, and instead of an increasing specialization in high value-added service sector activities, what is actually occurring is a shift away from specialization in these sectors.

Productivity growth has been slow for the LDCs as a group.

2. Trends in labour productivity

Not only has the pattern of structural change been weak within the LDCs but the available data also indicate that productivity growth has been slow for the LDCs as a group, and that the productivity gap between the LDCs and other developing countries is widening.

The available international data do not allow a detailed sectoral analysis. However, FAO provides estimates of the number of people working in agriculture and non-agriculture, and on the basis of these estimates it is possible to identify labour productivity in these two broad sectors and trends over time. According to this data, value-added per worker in 2000–2003 was just 20 per cent of the level in other developing countries and 1 per cent of the level in developed countries (table 32).

In 2000–2003, agricultural labour productivity in the LDCs was just 46 per cent of the level in other developing countries and non-agricultural labour productivity was just 23 per cent.

One reason for the low level of labour productivity is the fact that a large share of the working population is engaged in agriculture in the LDCs. In 2000–2003, 70 per cent of the economically active population was engaged in agriculture in the LDCs, as against 52 per cent in other developing countries, and 3 per cent in the developed countries. In all countries, labour productivity in the agricultural sector tends to be below the national average, and thus, other things being equal, the larger the share of the labour force in agriculture the lower the overall labour productivity. However, a much more important reason for the productivity gap between the LDCs and other country groups is that labour productivity is lower in the LDCs within both agriculture and non-agricultural activities. As table 32 shows that in 2000–2003:

- Agricultural labour productivity in LDCs was just 46 per cent of the level in other developing countries, and less than 1 per cent of the level in developed countries;
- For non-agriculture, productivity in the LDCs was just 23 per cent of the level in other developing countries, and 2 per cent compared with that in developed countries.

The productivity gap between LDCs, other developing countries and developed countries widened in both agriculture and non-agriculture sectors.

Not only is the productivity gap between LDCs and other developing countries and developed countries very wide, it is also widening over time. Chart 23 shows that labour productivity in the LDCs as a group remained almost unchanged in the 1980s and early 1990s. Despite a subsequent increase, it was only 18 per cent higher in 2003 than in 1983. In contrast, over the same period, labour productivity increased by 41 per cent in other developing countries and by 62 per cent in developed countries.

The lackluster performance in productivity growth in the LDCs is apparent in both agriculture and non-agriculture. The productivity gap between LDCs, other

TABLE 32. SECTORAL DISTRIBUTION OF LABOUR FORCE AND INTER-SECTORAL LABOUR PRODUCTIVITY IN LDCs, 1980–1983 AND 2000–2003

	Labour force[a] in agriculture % total labour force		Labour productivity[b] in agriculture		in non-agriculture		economy-wide	
	1980–1983	*2000–2003*	*1980–1983*	*2000–2003*	*1980–1983*	*2000–2003*	*1980–1983*	*2000–2003*
Afghanistan	72	66	239	251	556	398	327	300
Angola	76	71	..	148	..	..	..	..
Bangladesh	71	54	223	307	1 147	1 125	487	682
Benin	67	53	264	572	..	..	..	..
Bhutan	94	94	127	185	1 634	5 242	212	504
Burkina Faso	92	92	128	165	2 871	3 919	341	457
Burundi	93	90	118	104	1 316	958	205	188
Cambodia	75	70	..	294	..	1 117	..	545
Cape Verde	36	22	..	1 630	..	..	..	..
Central African Republic	84	71	281	400	1 933	691	545	483
Chad	87	74	151	214	1 532	1 000	327	421
Comoros	80	73	305	367	..	1 025	..	545
Dem. Rep. of the Congo	71	62	221	198	1 256	195	520	197
Djibouti	84	78	..	69	..	6 298	..	1 441
Equatorial Guinea	78	70	..	712	..	24 086	..	7 789
Eritrea	..	77	..	63	..	1 211	..	326
Ethiopia	..	82	..	123	..	622	..	214
Gambia	84	79	290	233	2 349	1 784	618	566
Guinea	90	83	..	221	..	3 499	..	769
Guinea-Bissau	87	82	185	249	..	873	..	358
Haiti	70	62	803	473	3 696	1 919	1 658	1 029
Kiribati	35	27	1 125	727	1 338	1 332	1 264	1 169
Lao PDR	79	76	..	457	..	1 414	..	684
Lesotho	41	39	452	509	875	1 533	699	1 135
Liberia	76	67	..	..	..	..	..	..
Madagascar	81	74	181	177	2 043	1 156	534	436
Malawi	87	82	89	122	1 435	965	262	271
Maldives	48	21	..	..	..	..	..	..
Mali	88	80	172	223	1 664	1 274	344	432
Mauritania	69	53	207	283	1 465	1 219	597	727
Mozambique	84	81	..	133	..	1 542	278	401
Myanmar	75	70	..	..	..	..	..	..
Nepal	94	93	163	207	2 097	3 817	284	462
Niger	91	87	189	168	3 863	1 727	518	365
Rwanda	93	91	220	220	4 250	2 439	518	429
Samoa	48	34	..	1 729	..	5 338	..	4 125
Sao Tome and Principe	74	63	..	223	..	1 639	..	752
Senegal	80	73	275	264	3 122	2 885	840	965
Sierra Leone	69	61	532	282	910	507	648	369
Solomon Islands	79	73	..	..	..	..	..	..
Somalia	78	70	..	..	..	..	..	..
Sudan	72	60	378	680	1 633	1 434	732	984
Timor-Leste	85	81	..	263	..	..	..	..
Togo	68	59	275	402	1 583	937	690	622
Uganda	87	79	202	228	1 307	1 547	349	500
United Rep. of Tanzania	86	80	..	278	..	1 371	..	499
Vanuatu	48	36	1 000	1 096	4 530	3 373	2 833	2 559
Yemen	69	49	..	495	..	2 695	..	1 620
Zambia	76	68	185	207	3 362	1 743	958	692
LDCs	79	70	239	273	1 319	1 204	495	554
Other developing countries	64	52	408	599	4 248	5 145	1 789	2 765
Developed countries	7	3	11 608	28 013	38 766	52 887	36 761	52 067

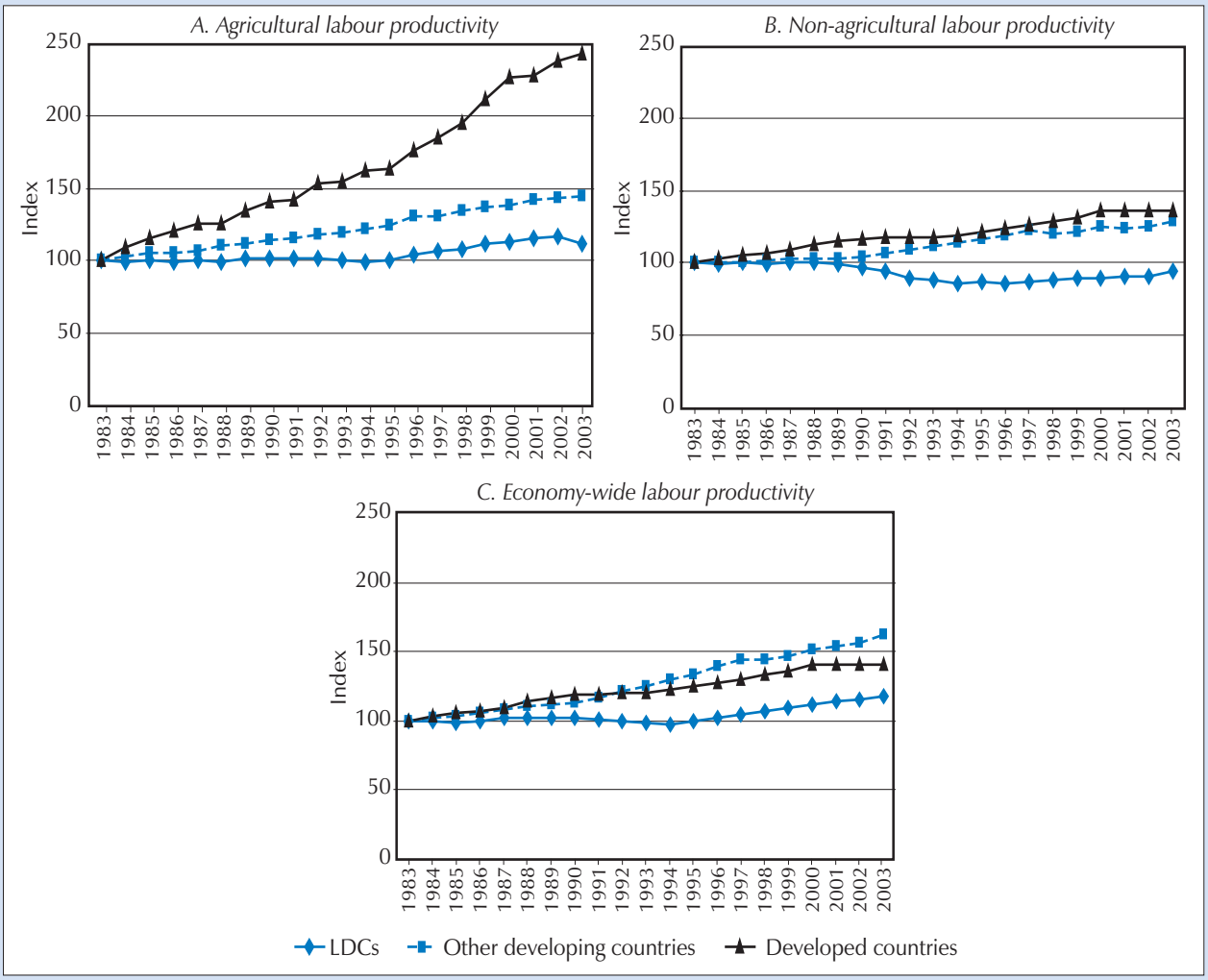
Source: UNCTAD secretariat estimates based on World Bank, *World Development Indicators 2005*, CD-ROM; and FAO, FAOSTAT online, December 2005.

Note: Labour productivity was calculated using value-added data are in constant 2000 dollars.

a The labour force is the economically active population.

b Labour productivity in agriculture, non-agriculture and economy-wide is the ratio between value added and the economically active population in respective sectors.

CHART 23. CHANGE OF AGRICULTURAL, NON-AGRICULTURAL AND ECONOMY-WIDE LABOUR PRODUCTIVITY IN LDCS, OTHER DEVELOPING COUNTRIES AND DEVELOPED COUNTRIES, 1983–2003



Source: UNCTAD secretariat estimates based on World Bank, *World Development Indicators* 2005, CD-ROM; and FAO, FAOSTAT online, December 2005.

Note: Group of other developing countries includes 67 countries; group of developed countries includes 22 countries; averages are weighted.
Indices are calculated based on data in constant 2000 dollars.
Labour productivity is ratio of value-added and economically-active population in respective sectors.

developing countries and developed countries widened in both sectors. But whereas agricultural labour productivity increased slightly within the LDCs during the period 1983–2003, non-agricultural labour productivity actually decreased. Chart 23 shows that between 1983 and 2003:

- Value-added per worker in agriculture within the LDCs increased by only 11 per cent;
- Value-added per worker in non-agriculture actually declined by 6 per cent.

Both these trends are widespread amongst LDCs (table 32). Between 1980–1983 and 2000–2003:

- Agricultural labour productivity rose, albeit slightly in most cases, in over two-thirds of the LDCs for which data are available (19 out of 29 countries)
- Non-agricultural labour productivity declined in four-fifths of the LDCs for which data are available (21 out of 26 countries).

Although agricultural labour productivity rose, albeit slightly in most cases, in over two-thirds of the LDCs, non-agricultural labour productivity declined in four-fifths of the LDCs.

The finding that non-agricultural value-added per worker is actually declining in the LDCs as a group and also within four-fifths of those for which data are available is highly significant. Although there is no data to disaggregate the non-agricultural sector, this decline is related to the nature of structural change taking place in most LDCs noted above in which the increasing share of industry in GDP is mainly based on mining industries and oil extraction, manufacturing value-added is declining as a share of GDP in many LDCs and there has been an expansion of petty services. Population is growing rapidly and the share of the economically active population seeking work outside agriculture has risen from 21 per cent in 1980-1983 to 30 per cent in 2000–2003. But most LDCs have found it difficult to generate the jobs to employ them productively. This issue will be explored further in the next chapter.

The goods and services which the LDCs can supply competitively to world markets are ultimately limited by the goods and services which they can produce and how efficient they are in producing them.

3. Trends in trade integration

The goods and services which the LDCs can supply competitively to world markets are ultimately limited by the goods and services which they can produce and how efficient they are in producing them. Given the scale of the productivity gap identified above, it is not surprising to find that the participation of LDCs in world trade is marginal, despite improvements since the early 1990s (see UNCTAD 2002; 2004). In 2000–2003, when their share of the world population was 10.6 per cent, the LDC share in world exports of goods and services was 0.5 per cent, and their share in world imports of goods and services was 0.7.

Even if LDCs exported all their output, their share of world exports of goods and services would only be 2.4 per cent.

However, the marginal position of the LDCs in world trade cannot be attributed to a low level of integration of the national economies of these countries in the world economy, or to a lack of "openness".[2] In 2000–2003, exports and imports of goods and services constituted 52 per cent of the GDP of the LDC group as whole (table 33). If the trade/GDP ratio is taken as an indicator of the "openness" of an economy, then the LDCs as a group are as "open" as high-income OECD countries (which had a trade/GDP ratio of 49 per cent in 2000–2003), and more "open" than low-income countries as a group (43 per cent).

The LDCs have a low share of world trade because they have a low share of world output. Although comparable to the world average and the level in high-income OECD countries, the export/GDP of the LDCs (22 per cent in 2000–2003) is slightly lower than in low- and middle-income countries (30 per cent). But even if the export orientation of the LDCs increased to the same level as low- and middle-income countries in 2000–2003, their share of world exports of goods and services would only increase to 0.8 per cent. Indeed, even if they exported all their output, their share of world exports of goods and services would only be 2.4 per cent. The development of export supply capacities cannot be divorced from the improvement of productive capacities in general.

The development of export supply capacities cannot be divorced from the improvement of productive capacities in general.

The importance of productive capacities for the development of export supply capacities applies as much to the composition of exports as it does to the volume of exports. In this regard, just as the production structure of the LDCs is strongly oriented to the exploitation of natural resources, so the export structure is strongly oriented to exploitation of natural resources.

Focusing on merchandise exports, chart 24 shows that in 2000–2003, primary commodities constituted 70 per cent of the total merchandise exports.[3] Oil exports from Angola, Chad (since 2003), Equatorial Guinea, Sudan (since

TABLE 33. LEVEL OF TRADE INTEGRATION OF LDCs AND OTHER COUNTRY GROUPS, 1980–1983, 1990–1993 AND 2000–2003

(Percentage of GDP)

	1980–1983	1990–1993	2000–2003
LDCs			
A. Total trade (B+C)	35.7	37.0	52.3
B. Exports of goods and services	11.9	13.5	22.1
C. Imports of goods and services	23.8	23.5	30.2
D. Trade balance (B-C)	-11.9	-10.0	-8.1
Low-income countries			
A. Total trade (B+C)	24.6	31.7	43.4
B. Exports of goods and services	9.7	14.3	20.7
C. Imports of goods and services	14.9	17.3	22.7
D. Trade balance (B-C)	-5.1	-3.0	-2.0
Low and middle income countries			
A. Total trade (B+C)	33.4	43.7	58.4
B. Exports of goods and services	16.4	21.6	30.1
C. Imports of goods and services	17.0	22.1	28.3
D. Trade balance (B-C)	-0.5	-0.5	1.8
High-income OECD countries			
A. Total trade (B+C)	36.0	34.2	43.5
B. Exports of goods and services	17.6	17.1	21.4
C. Imports of goods and services	18.4	17.1	22.0
D. Trade balance (B-C)	-0.8	0.0	-0.6
World			
A. Total trade (B+C)	37.8	38.4	48.5
B. Exports of goods and services	18.6	19.2	24.2
C. Imports of goods and services	19.2	19.2	24.3
D. Trade balance (B-C)	-0.6	-0.1	-0.1

Source: UNCTAD secreteriat estimates based on World Bank, *World Development Indicators 2005*, CD-ROM.

2000) and Yemen constitute more than half the primary commodity exports, with the remainder divided more or less equally between minerals and agricultural products. Exports of manufactured goods constituted thirty per cent of total merchandise exports in 2000–2003.

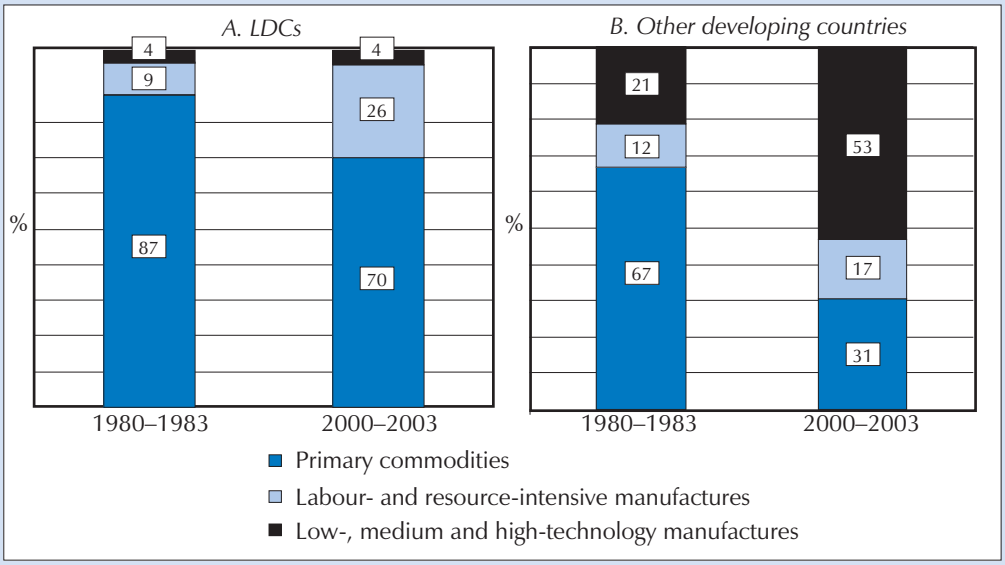
An important feature of the trends in the merchandise export composition of the LDCs is that manufactures exports have been increasing. In 1980–1983, manufactured exports constituted only 13 per cent of total merchandise exports for the LDCs as a group. However, the shift away from primary commodities into manufactures is occurring much more slowly than in other developing countries and has not gone as far. Between 1980–1983 and 2000–2003, the share of manufactures in total merchandise exports of other developing countries increased from 33 to 70 per cent (chart 24).

The shift away from primary commodities into manufactures is occurring much more slowly than in other developing countries and has not gone as far... and has been driven by low-skill labour-intensive products, particularly garments.

On top of this, the increase in manufactures exports in the LDCs has been driven by low-skill labour-intensive products, particularly garments. This is a major difference between the LDCs and other developing countries. As chart 25 shows, the greatest increase in the latter group of countries has been in medium- and high-technology exports whilst the greatest increase in the LDCs has been in labour- and resource-intensive exports. In 2000–2003, clothing exports constituted 21 per cent of the merchandise exports of the LDCs. Most of these have developed through various trade preference regimes, mainly associated with the now-defunct Agreement on Clothing and Textiles or special preferences geared towards LDCs. Medium- and high-technology manufactured goods

CHART 24. COMPOSITION OF MERCHANDISE EXPORTS IN LDCS AND OTHER DEVELOPING COUNTRIES, 1980–1983 AND 2000–2003

(Percentage of total merchandise exports)[a]



Source: UNCTAD secretariat estimates based on UN COMTRADE.

Note: Other manufactures includes low-, medium and high-technology manufactures. For classification, see note 3 to text.

a The charts exclude other manufactures and products not classified elsewhere. These constitute an insignificant share.

exports were less than 3 per cent of total merchandise trade of LDCs in 2000–2003, whilst they constituted 40 per cent of those of other developing countries.

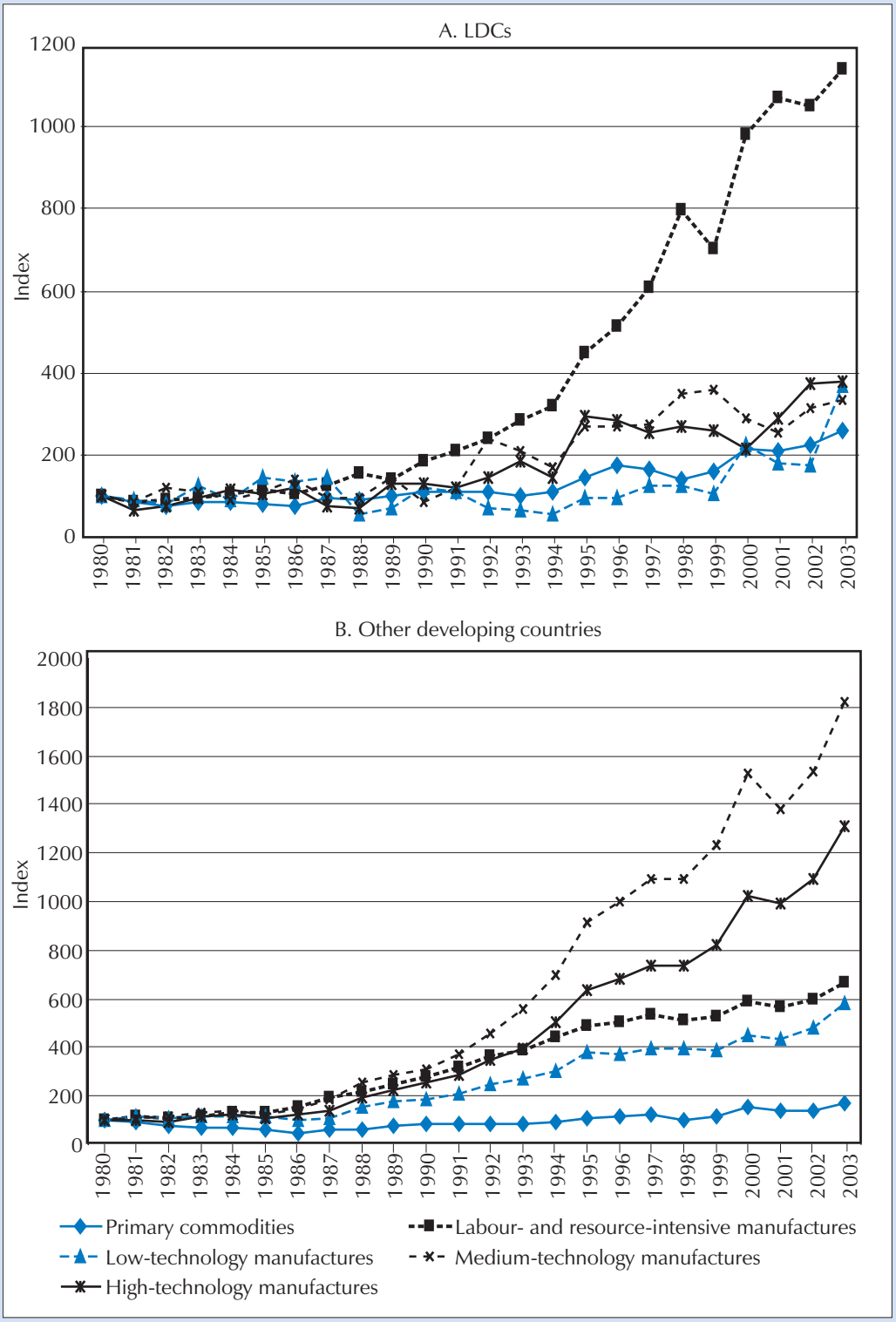
The expansion of manufactured exports has also been concentrated within a few LDCs (chart 26). This is apparent if the LDCs are classified according to their major export specialization.[4] For the agricultural exporters, exports of manufactured goods only increased from 6 to 10 per cent of total merchandise exports between 1980–1983 and 2000–2003, whilst in mineral exporters exports of manufactured goods only increased from 6 to 14 per cent of total merchandise exports. In contrast, the group of LDCs classified as manufactures exporters started with a much higher share of manufactures in total exports (37 per cent in 1980–1983). But by 2000–2003 this had increased to 76 per cent. However, within this group of LDCs medium- and high-technology manufactures exports have not expanded. For this group, 62 per cent of total merchandise exports is composed of clothing and accessories.

The only positive sign of upgrading in the composition of commodity exports has been a shift, within unprocessed agricultural products, from static to more dynamic products.

These data show that there has been little diversification out of primary commodity exports in most LDCs. But a further significant trend is that there has been very mixed pattern with regard to upgrading *within* primary commodity exports. For the LDCs as a group, the share of processed minerals and metals within total mineral and metal exports fell from 35 to 28 per cent between 1980–1983 and 2000–2003 (chart 27). Within agricultural exports, there has been a fall in processing before export for agricultural goods. The share of processed agricultural goods within total agricultural exports decreased from 23 per cent in 1980–1983 to 18 per cent in 2000–2003. The only positive sign of upgrading in the composition of commodity exports has been a shift, within unprocessed agricultural products, from static to more dynamic products.[5] The share of dynamic agricultural products within total agricultural exports increased from 19 per cent in 1980–1983 to 39 per cent in 2000–2003. The most

CHART 25. TRENDS IN MERCHANDISE EXPORTS[a] CLASSIFIED ACCORDING TO TECHNOLOGY INTENSITY FOR LDCs AND OTHER DEVELOPING COUNTRIES, 1980–2003

(Index 1980 = 100)

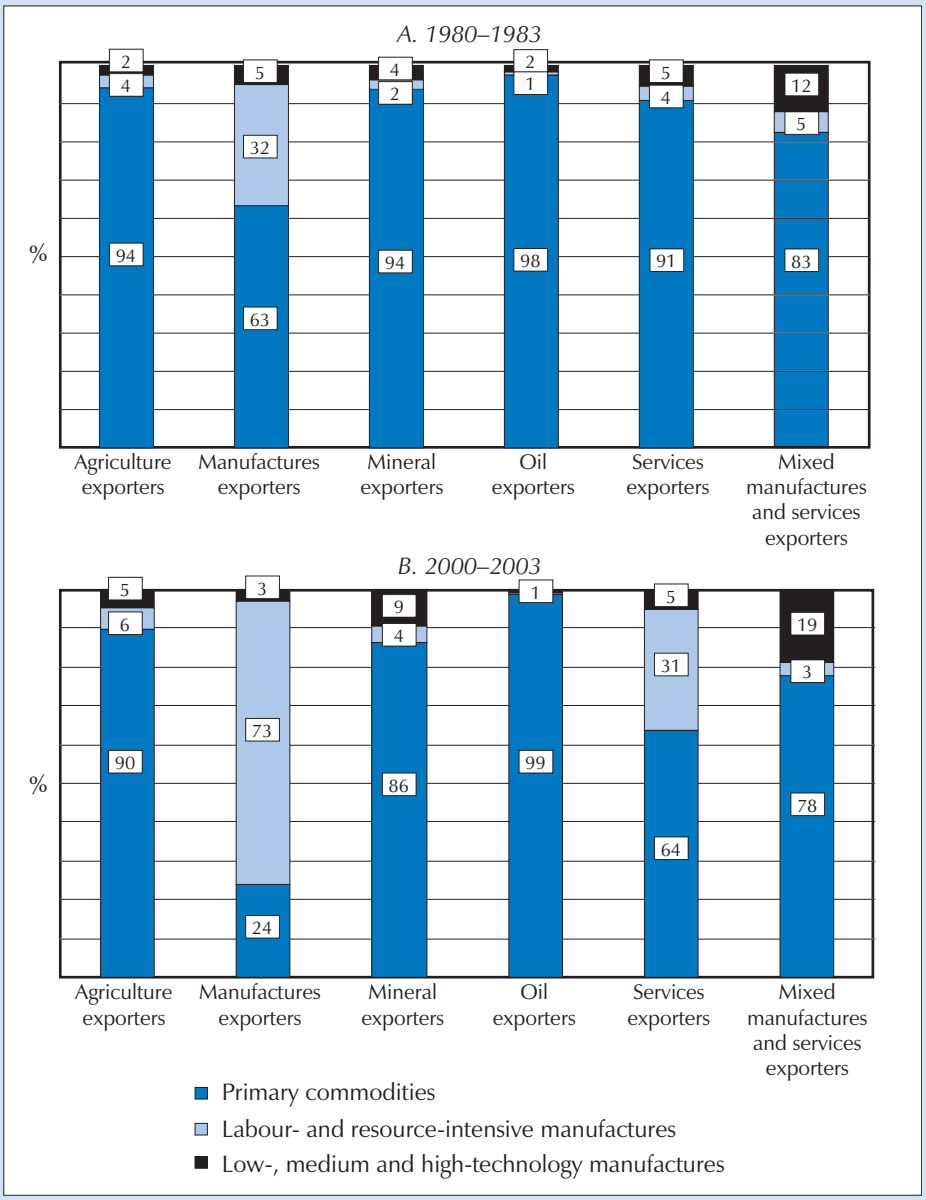


Source: UNCTAD secretariat estimates based on UN COMTRADE.

a Trends are based on value of exports in current dollars.

CHART 26. COMPOSITION OF MERCHANDISE EXPORTS IN LDC SUBGROUPS CLASSIFIED BY EXPORT SPECIALIZATION, 1980–1983 AND 2000–2003

(Percentage of total merchandise exports)[a]



Source: UNCTAD secretariat estimates based on UN COMTRADE.

Note: Other manufactures includes low technology, medium technology and high technology manufactures. For classification of LDC subgroups by export specialization, see note 4 to the text.

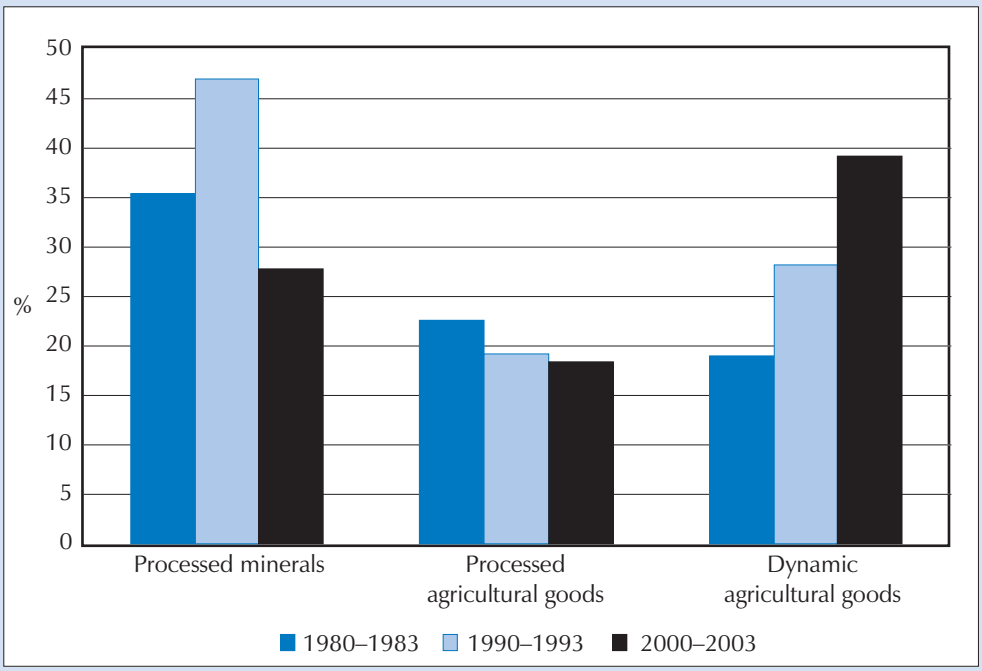
a The charts exclude other manufactures and products not classified elsewhere. These constitute an insignificant share.

important dynamic agricultural products are fresh or frozen fish and fishery products and spices. But exports of the former have been unstable in a number of LDCs (see box 12).

A country-by-country analysis shows that over the past twenty years, the number of commodities exported has increased over time for the majority of LDCs (28 out of 44). There are two noteworthy examples of large increase in the number of products exported, classified at the SITC 3 digit level: Myanmar has seen its number of commodities increase from 59 in the early 1980s to 104 in 2000–2003, while in the case of the United Republic of Tanzania the increase

CHART 27. LDC EXPORTS OF AGRICULTURAL GOODS AND PROCESSED MINERALS, 1980–1983, 1990–1993 AND 2000–2003

(Percentage)



Source: UNCTAD secretariat estimates based on UN COMTRADE.

Note: Exports of processed minerals have been calculated as a share of total exports of minerals and metals, while exports of processed and of dynamic agricultural goods have been calculated as a share of total agricultural goods. Exports of minerals do not include oil and oil-related exports.
For definition of dynamism, see text.

has been from 56 to 104 (see table 34). Four conflict-affected countries have experienced the greatest fall in the number of commodities exported, namely Afghanistan, the Democratic Republic of the Congo, Sierra Leone and Sudan. In spite of the increase, the number of commodities exported by the LDCs (43) remains low when compared with the average of 123 commodities exported by the other developing countries in 2003.[6]

Focusing on the top five export products, it is apparent that the major exports of many LDCs (32 out of the 44 countries for which data are available) included more dynamic products in 2000–2003 than in 1980–1983 (table 34). However, for most LDCs, with the exception of those who have diversified into manufactures, the most important export products still rank low in terms of their market dynamism. Also, the export structure of the LDCs is not only composed of few commodities, but its dynamic components, excluding manufactures, are concentrated on products that seem to be the same for all LDCs, namely spices, fish and fishery products.

The export structure of the LDCs is not only composed of few commodities, but its dynamic components are concentrated on products that seem to be the same for all LDCs, namely spices, fish and fishery products.

Box 12. Fish Exports from LDCs

Fisheries play a significant socio-economic role in a third of all LDCs (16 out of 50) — see box table 5. In three of these countries (Mauritania, Senegal and the United Republic of Tanzania), the sector accounted for at least (or nearly) 20 per cent of total exports of goods and services, while six LDCs relied on fish exports for about 10 per cent of their total foreign exchange earnings (Samoa, Uganda, Mozambique, Kiribati, Maldives and the Solomon Islands). If one disregards service exports and considers the structure of merchandise exports only, fisheries have been the first or second most significant source of export earnings in 10 LDCs, among which are four countries where fish dominates the structure of merchandise exports: Tanzania, Senegal, Samoa and Maldives. In addition, licence fees/royalties from fisheries agreements with foreign operators have been the main source of foreign exchange earnings in Kiribati, a country which has one of the largest exclusive economic zones of all LDCs.

At least six of the 16 fish-exporting LDCs represented in the table have undergone much instability in their fish exports. These countries are Cape Verde, The Gambia, Madagascar, Mauritania, Uganda and Yemen. Meanwhile, more stable, long-term growth has been observed in Eritrea (from very low levels in the mid-1990s), Mozambique and the United Republic of Tanzania. In the latter country, growth in fish exports was particularly rapid after 2000. Other countries, such as Guinea, Senegal, Bangladesh, Maldives, Samoa and the Solomon Islands, have had a relatively stable fish export performance in the long run.

A variety of factors, ranging from domestic issues to external influences beyond domestic control, explain the instability that has been observed in fish exports in some LDCs. Among the main external factors that have also had an impact on the export performance of LDCs are the changes observed in fish stocks. The global concern about overexploitation and depletion of marine fishery resources has implications for a number of LDCs. In the *State of World Fisheries and Aquaculture 2004*, the FAO noted that "the status of skipjack tuna stocks is highly uncertain, although there are indications of some potential for increases in catches in the Pacific and Indian oceans…". It stated that in three out of four regions observed, "at least 70 per cent of fish stocks are already fully exploited or overexploited", and concluded that more cautious and restrictive management measures are needed. In two thirds of the main marine subregions from which data are available, fish production has been declining slightly, while the decline was sharp in a third of the same observed zones, including areas of interest to LDC fishing enterprises. In short, according to the FAO, "overfishing has been a main contributory factor in some cases, [while] … adverse or highly variable environmental conditions" have also played a negative role.

Box table 5. LDCs in which fisheries are an important socio-economic sector

	Export value in 2003 *($ million)*	Broad evolution in relevant exports over the last two decades	Percentage of total exports of goods and services in 2003	Ranking of fisheries among all merchandise exports	Ranking of fisheries among all export sectors
Bangladesh	338.9	Peaks in 1995 and 2000, stability after 2000	4.3	2	2
Cape Verde	0.7	Large fluctuations since 1985	0.3	3	7
Eritrea	1.5	Higher export performance since 2000 than in the 1990s	1.3	4	7
Gambia	2.9	Large fluctuations since 1985	2.0	3	6
Guinea	24.4	Relatively stable export performance	3.3	5	6
Kiribati	2.6	Stability since 1995	9.8	2	3[a]
Madagascar	82.1	Large fluctuations since 1985	7.3	4	4
Maldives	53.7	Peak in 1998, stability at lower levels after 2000	9.8	1	2[b]
Mauritania	143.4	Sharp decline in the 1990s, recovery since 2000	39.4	2	2
Mozambique	117.9	Long-term growth since 1985	10.0	2	2[c]
Samoa	9.7	Peak in 1999, relative stability in subsequent years	12.8	1	2
Senegal	295.9	Peak in 1996, decrease since 2000	19.6	1	1
Solomon Islands	12.4	Peak in 1997, substantial decline then stability afterwards	9.5	2	4
Uganda	90.5	Large fluctuations since 1995	10.9	2	3
U. R. of Tanzania	350.2	Growth in the 1990s, rapid increase after 2000	22.3	1	2
Yemen	66.5	Sharp fluctuations since 1980	1.6	3	4

Source: UNCTAD secretariat estimates based on UN COMTRADE.

a Besides the domestic fishing sector, the first source of foreign exchange earnings in Kiribati, in 2003, were licence fees/royalties from fisheries agreements with foreign operators.

b Licence fees/royalties from fisheries agreements were the fifth largest source of foreign exchange earnings in Maldives in 2003.

c Licence fees/royalties from fisheries agreements were the seventh largest source of foreign exchange earnings in Mozambique in 2003.

Table 34. Exported goods by type and dynamism in the LDCs, 1980–1983 and 2000–2003

	Type of export product[a]		Average rank of first 5 products[b]		Number of commodities exported		Dynamic agricultural goods as % of total primary exports		Processed goods as % of total primary exports[c]	
	1980–1983	*2000–2003*	*1980–1983*	*2000–2003*	*1980–1983*	*2000–2003*	*1980–1983*	*2000–2003*	*1980–1983*	*2000–2003*
Afghanistan	MAN	SAG	164	175	58	29	30.3	34.4	34.9	30.7
Angola	MIN	MIN	149	85	34	51	0.3	0.5	0.2	0.1
Bangladesh	MAN	MAN	110	33	49	95	25.2	73.3	2.9	0.7
Benin	SAG	SAG	191	146	21	41	25.8	25.7	31.9	8.3
Bhutan	DAG	MAN	95	106	17	35	43.9	15.0	22.3	22.9
Burkina Faso	SAG	SAG	171	159	29	58	6.0	4.5	8.3	5.8
Burundi	MIN	SAG	163	196	18	11	0.4	0.7	2.8	13.0
Cambodia	SAG	MAN	149	59	29	66	3.8	14.3	2.7	23.2
Cape Verde	DAG	MIN	118	52	13	15	25.4	35.2	5.0	32.7
Central African Republic	SAG	MIN	164	173	18	12	0.1	0.1	8.4	3.0
Chad	SAG	SAG	155	124	11	26	1.3	0.3	6.3	1.7
Comoros	DAG	DAG	106	108	10	5	88.9	99.7	0.8	0.0
Dem. Rep. of the Congo	MIN	MIN	166	140	61	37	3.4	0.1	8.5	1.4
Djibouti	MIN	MIN	130	143	36	56	10.0	23.7	27.2	26.4
Equatorial Guinea	SAG	MIN	195	142	11	18	0.4	0.8	0.7	0.1
Eritrea	..	SAG	..	135	..	27	..	23.3	..	48.7
Ethiopia	..	SAG	..	136	..	33	..	9.3	..	6.8
Gambia	SAG	DAG	148	121	17	24	32.6	55.4	34.7	31.1
Guinea	MIN	MIN	166	152	41	35	1.9	0.9	1.6	1.2
Guinea-Bissau	SAG	MIN	167	134	16	11	32.5	63.2	6.5	0.3
Haiti	SAG	MAN	108	33	60	49	15.4	48.4	19.2	12.6
Kiribati	SAG	DAG	161	117	11	8	19.6	53.7	7.9	0.2
Lao People's Dem. Rep.	SAG	SAG	159	100	24	48	1.7	1.8	9.6	37.8
Lesotho	..	MAN	..	53	..	34	..	5.2	..	78.8
Liberia	..	..	..	..	24	10	0.9	0.1	1.7	1.8
Madagascar	SAG	DAG	143	76	48	86	38.8	80.7	3.6	10.4
Malawi	SAG	SAG	197	165	55	56	3.0	3.2	21.0	17.0
Maldives	DAG	DAG	118	80	15	10	66.8	93.3	16.7	21.8
Mali	SAG	SAG	172	145	29	..	9.7	2.4	12.1	2.9
Mauritania	MIN	DAG	131	139	20	40	35.2	52.9	17.4	2.5
Mozambique	SAG	MIN	161	122	61	79	20.8	21.4	18.8	5.5
Myanmar	SAG	MIN	150	97	59	104	14.6	28.1	42.8	12.0
Nepal	MAN	MAN	142	84	37	63	27.6	61.2	38.3	63.8
Niger	MIN	MIN	189	113	44	42	4.4	13.5	8.3	6.7
Rwanda	SAG	SAG	176	192	14	10	0.9	0.1	6.4	1.6
Samoa	SAG	MAN	144	74	16	20	38.9	85.2	30.9	22.9
Sao Tome and Principe	SAG	SAG	131	152	9	8	0.2	5.8	0.1	1.6
Senegal	MIN	DAG	151	114	88	123	35.3	44.4	28.5	22.4
Sierra Leone	MIN	SAG	154	100	29	13	14.8	0.0	4.9	0.1
Solomon Islands	SAG	SAG	141	154	18	25	43.8	24.9	31.9	10.1
Somalia	SAG	SAG	163	132	21	46	24.5	17.9	11.6	10.6
Sudan	SAG	MIN	175	188	61	43	10.4	2.9	18.6	1.8
Timor-Leste	MAN	..	83	..	14	..	19.3	..	13.5	..
Togo	MIN	MAN	195	178	35	71	0.5	12.3	1.5	17.4
Tuvalu	MAN	MAN	111	67	5	31	0.1	1.0	0.0	1.7
Uganda	SAG	SAG	145	166	35	78	0.4	20.7	2.4	7.6
United Rep. of Tanzania	SAG	MIN	193	126	56	102	18.0	38.0	6.8	6.9
Vanuatu	SAG	SAG	177	129	10	15	3.6	22.2	0.9	9.7
Yemen	..	MIN	..	143	..	83	..	2.9	..	1.2
Zambia	MIN	MIN	146	125	69	103	0.4	2.3	3.8	7.0
LDC	..	..	152	122	32	43	17.4	25.0	12.7	13.4

Source: UNCTAD secretariat estimates based on UN COMTRADE and UNCTAD (2005).

a The types of export product are classified into mineral products (MIN), manufacture products (MAN), static agricultural goods (SAG), and dynamic agricultural goods (DAG), based on the first five most exported merchandise goods.

b The product ranking, according to export dynamism, was taken from UNCTAD (2002). It was estimated by taking the products at the 3-digits level, SITC Rev. 2, whose export growth, calculated from 1980 to 1998, has led to products being ranked in decreasing order (from the highest to the lowest). There is a maximum of 225 products.

c Exports of processed goods do not include oil or oil-related exports.

C. Economic growth, structural change and trade integration

Given the diversity in growth performance and in patterns of structural change and of trade integration amongst the LDCs, an important question which arises is whether or not there is a relationship between economic growth and structural change, and between economic growth and trade integration. This section explores this relationship by examining the differences between LDCs which have been classified (see chapter 2) as : (1) converging economies — those in which real GDP per capita grew at more than 2.15 per cent per annum from 1980–2003; (2) weak growth economies — those in which annual average growth of real GDP per capita was positive, but below this level over the same period; and (3) regressing economies — those in which annual average growth of real GDP per capita was negative during the period 1980–2003. Oil-exporting LDCs (Angola, Equatorial Guinea, Sudan and Yemen) and island LDCs were taken out of the sample as they have rather specific patterns of change. This left the following countries:

- Converging economies: Bangladesh, Bhutan, Lao People's Democratic Republic, Lesotho, Nepal, Mozambique and Uganda;
- Weak-growth economies: Benin, Burkina Faso, Chad, Ethiopia, Guinea, Malawi, Mali, Mauritania and Senegal;
- Regressing economies: Burundi, Central African Republic, Democratic Republic of Congo, Gambia, Guinea-Bissau, Haiti, Madagascar, Niger, Rwanda, Sierra Leone, Togo and Zambia.

The analysis in the following sections is based on this list of countries, although the precise sample for the analysis of structural change differs slightly from that for trade integration owing to data availability.

A country specializing in increasing returns activities will naturally have a higher growth of output than countries specializing in diminishing returns activities, and in this sense structure and structural change will matter for economic growth.

1. Economic growth and structural change

The orthodox neo-classical growth model is an aggregate one-sector model, with constant returns to scale, and diminishing returns to the factors of production. Capital, labour and GDP rises as a result of increases in the labour force, capital accumulation and technical progress. The structure of the economy does not matter. There is no distinction between the different production characteristics of sectors, so that no one sector is regarded as more important than another. The effect of resource shifts between sectors is included as part of technical progress or total factor productivity growth; and in the long run, in a competitive environment, productivity is assumed to equalise across sectors.

In practice, however, different activities have different production characteristics, and by aggregating them into a single production function, important insights into the dynamics of growth are lost. An important distinction needs to be made between diminishing returns activities, on the one hand, and increasing returns activities, on the other. A country specializing in increasing returns activities will naturally have a higher growth of output than countries specializing in diminishing returns activities, and in this sense structure and structural change will matter for economic growth.

In general, land-based activities such as agricultural products and minerals are subject to diminishing returns and also have a low income elasticity of

demand, while manufacturing activities are generally produced under conditions of increasing returns and have a higher income elasticity of demand. Service activities vary according to whether they are petty service activities to be found in the urban sector of poor countries, or sophisticated producer services that support the industrial sector of rich countries. Historically, income per capita started to rise rapidly in the now-prosperous countries as resources switched from agriculture to industry; nowadays, there is a close association across countries between the level of per capita income and the share of resources devoted to manufacturing industries and the services associated with them. There is also a close association across countries between the growth of per capita income and the growth of manufacturing industry, or more accurately the growth of living standards and the excess of manufacturing output growth over non-manufacturing output growth. In other words, living standards are growing fast where the share of manufacturing output in total output is rising, i.e. in the so-called newly-industrializing economies.

The association between the growth of GDP and the growth of the manufacturing sector is known in the literature as Kaldor's growth laws, after Kaldor put forward the hypothesis of manufacturing as the engine of growth in two lectures in the 1960s (Kaldor, 1966 and 1967). The basis of the argument is two-fold. First, a fast growth of manufacturing output induces a fast rate of growth of labour productivity *within* manufacturing industries because of static and dynamic increasing returns. Static returns relate mainly to the economies of large-scale production, while dynamic returns relate to induced capital accumulation embodied technical progress and learning by doing. All these efforts are captured by Verdoorn's Law named after the economist who discovered a relationship across countries of eastern Europe between manufacturing output growth and labour productivity growth (Verdoorn, 1949). Second, a fast growth of manufacturing output induces a fast rate of growth of labour productivity *outside* of industry because in agriculture and petty services there are diminishing returns to labour, so that as labour is absorbed from those sectors into industry, the average product of labour rises. A fast rate of growth of manufacturing output thus has two important productivity effects, both of which contribute to a fast rate of growth of GDP.[7]

The share of agricultural value-added in GDP has fallen on average by ten percentage points in the converging economies. Within the regressing economies it rose by six percentage points.

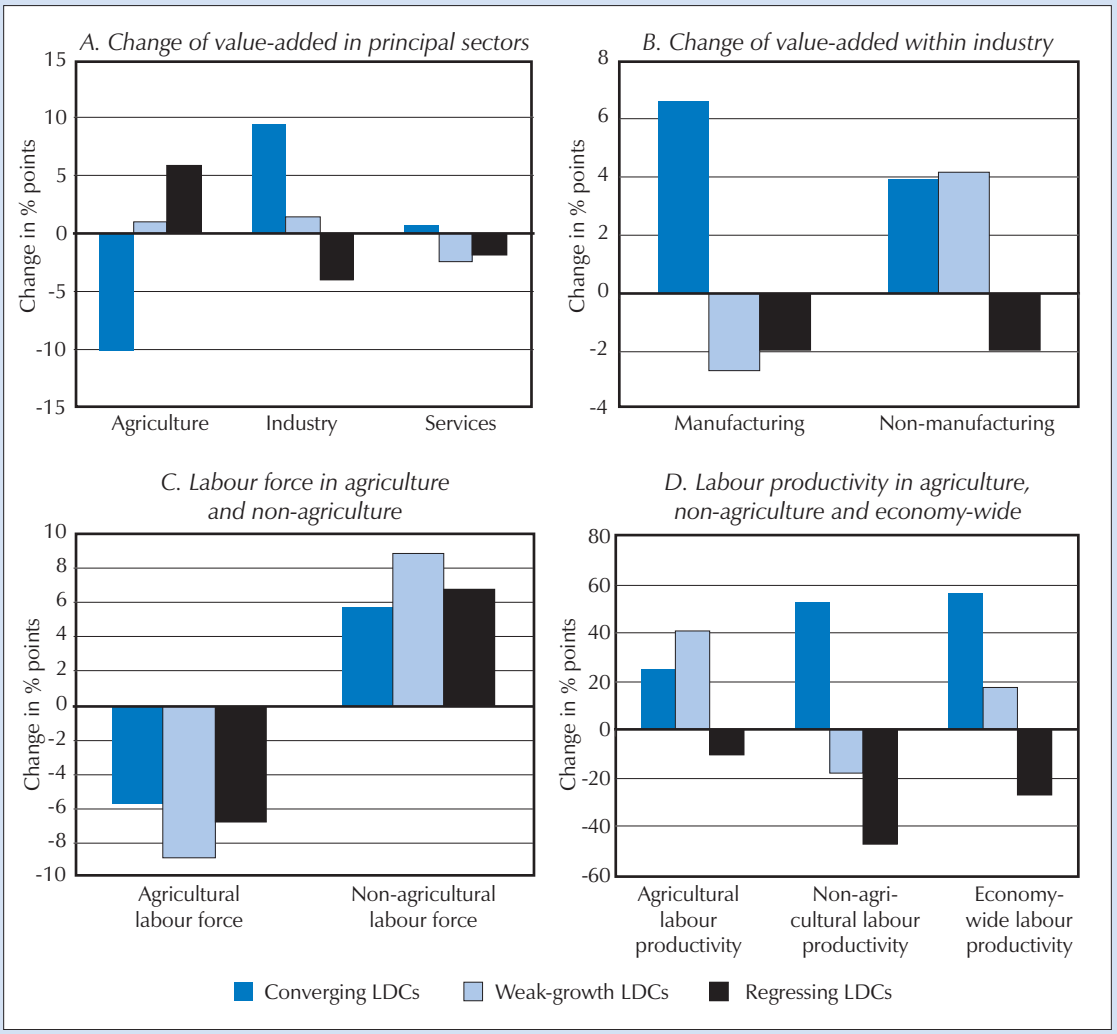
In order to clarify the relationship between economic growth and structural change among the LDCs, chart 28 shows the differences in the pattern of structural change and productivity growth within converging economies, weak-growth economies and regressing economies between 1980–1983 and 2000–2003. From the chart, it is clear that there are significant differences between the pattern of structural change and growth performance in the LDCs.

Firstly, the share of agricultural value-added in GDP has fallen on average by ten percentage points in the converging economies. In contrast, within the regressing economies it rose by six percentage points. The agricultural value-added share declined in each of the converging economies and rose in 8 out of the 11 regressing economies. The weak-growth economies fall between these two extremes. The share of agricultural value-added in GDP increased by one percentage point on average, but it declined — but not by as much as in the converging economies — in 5 out of the 8 weak-growth economies.

The share of industrial value-added in GDP increased on average by nine percentage points in the converging economies and declined by four percentage points on average in regressing economies.

Secondly, the share of industrial value-added in GDP increased on average by nine percentage points in the converging economies and declined by four percentage points on average in regressing economies. Once again, the weak-growth economies are between these two extremes. Industrial value-added increased by one percentage point over the same period.

CHART 28. CHANGE OF VALUE-ADDED TO LABOUR FORCE AND LABOUR PRODUCTIVITY IN LDCS CLASSIFIED ACCORDING TO LONG-TERM GROWTH PERFORMANCE, BETWEEN 1980–1983 AND 2000–2003



Source: UNCTAD secretariat estimates based on World Bank, *World Development Indicators 2005*, CD-ROM; and FAO, FAOSTAT online, December 2005.

Note: Converging LDCs: Bangladesh,Lao PDR, Lestho,Mozambique, Nepal and Uganda; Weak-growth LDCs: Benin, Burkina Faso, Chad, Guinea, Malawi, Mali, Mauritania, Senegal; Regressing LDCs: Burundi, Cetral African Republic, Democratic Republic of the Congo, Gambia, Guinea-Bissau, Haiti, Madagascar, Niger, Rwanda, Sierra leone, Togo and Zambia). The samples with data on manufactures and non-manufactures are smaller. They do not include Mozambique, Chad, Guinea, Burundi, Democratic Republic of the Congo or Sierra Leone.
Calculations were based on data in constant 2000 dollars.

The share of manufacturing value-added increased in the converging economies.

Thirdly, the share of manufacturing value-added increased by seven percentage points on average in the converging economies. Moreover, the manufacturing value-added share increased in each of the converging economies. In contrast, the manufacturing value-added share decreased by three percentage points in the weak growth economies and two percentage points in the regressing economies. During the 1990s, the manufacturing value-added share declined, or was stagnant, in 13 out of 16 weak-growth or regressing economies for which there is data.

Fourthly, there was little difference between the country groups in terms of the change in the share of services in GDP. It grew slightly in the converging economies and fell slightly in the weak-growth and regressing economies.

A further difference amongst the three groups is that the share of the economically active population in agriculture tended to decline more slowly in the converging economies than in the other economies. On average, this share fell by 6 percentage points in the converging economies, and by nine and seven percentage points in the weak-growth and regressing economies, respectively.

Finally, turning to the trends in labour productivity, there are again clear differences amongst the three groups. As chart 28d shows:

- Between 1980–1983 and 2000–2003, labour productivity increased by 56 per cent on average in the converging economies. It also increased in the weak-growth economies, but more slowly — by 18 per cent. However, it fell by 27 per cent on average in the regressing economies.
- Within the converging economies, labour productivity increased within both agriculture and non-agriculture, more strongly in the latter than the former.
- Within the weak-growth economies, labour productivity increased within agriculture but declined in non-agriculture. The increase in agricultural productivity was actually greater than in converging economies (by 41 per cent as against 25 per cent).
- Within the regressing economies, labour productivity fell in agriculture and non-agriculture. The decline in non-agricultural labour productivity was stronger than in the weak-growth economies (48 per cent as against 18 per cent).

From these patterns it seems clear that the dynamics of production structure matter for economic growth in the LDCs.

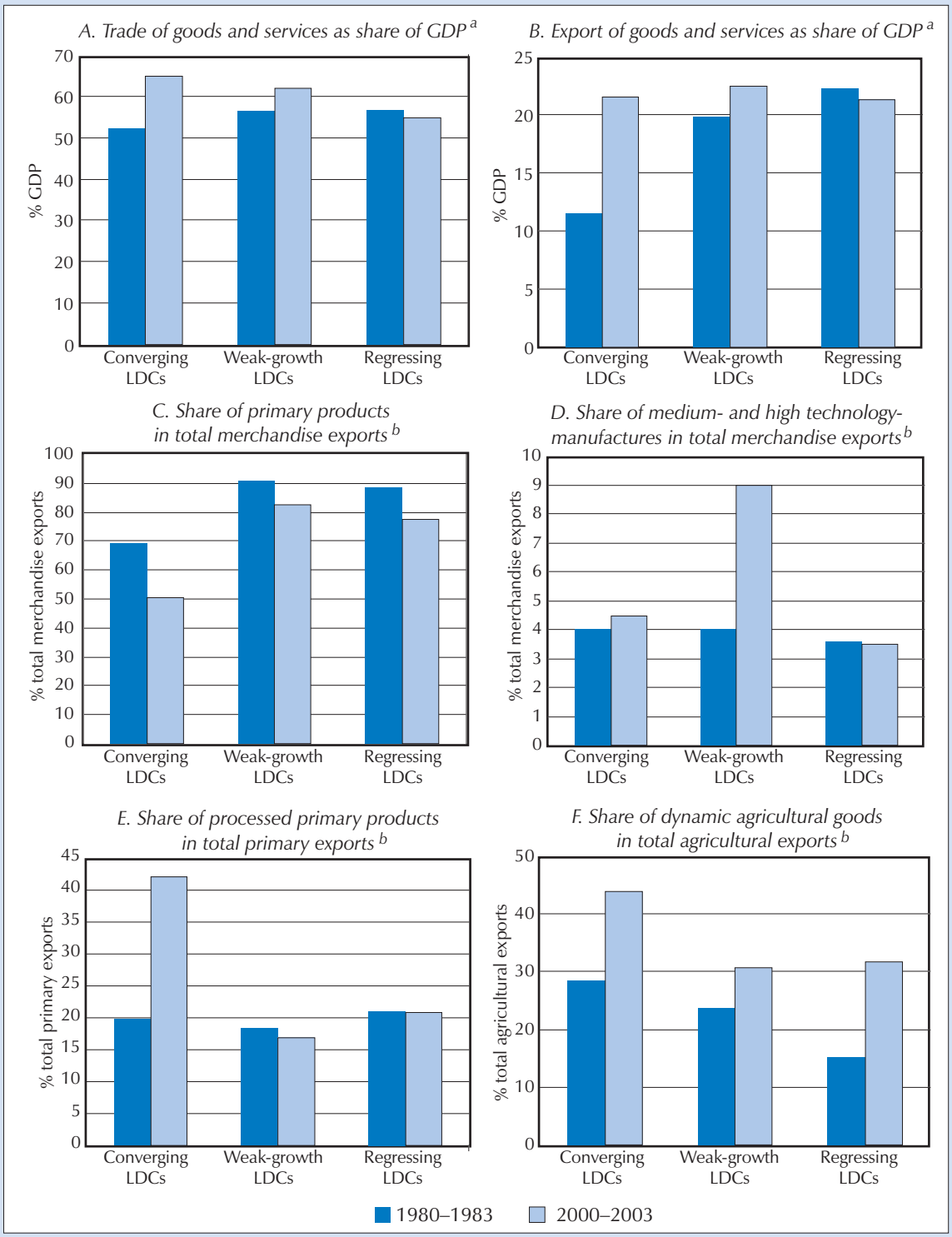
From these patterns it seems clear that the dynamics of production structure matter for economic growth in the LDCs. Just as within other developing countries, industrialization, and in particular the expansion of manufacturing activities, is characteristic of the LDCs which have experienced the highest and most sustained economic growth. Moreover, de-industrialization, understood here as a decline in the share of manufacturing activities in GDP, and also an increase in the share of agriculture in GDP, are characteristic features of economic regression.

2. Economic growth and trade integration

It is possible to deepen the analysis of the comparative growth performance of the LDCs by considering how this is related to the level and form of trade integration. Chart 29 summarizes the differences amongst the three groups of countries — converging, weak-growth and regressing economies — in terms of key trade indicators. At a theoretical level, it is expected that the relation between trade and economic growth will depend on the nature of the goods exported. Different goods have different income elasticities of demand, which will affect how fast the demand for them grows in the world market as world income and trade grows. Primary commodities typically have an income elasticity lower than unity (Engel's Law), while manufactured goods and traded services have an income elasticity of demand greater than unity. But within each sector, income elasticities will also differ according to the type of goods: whether they are low value-added or high value-added; whether they are niche products in the case of agricultural commodities, and where they lie on the ladder of technical sophistication in the case of manufactures. Countries which export traditional commodities are likely to have a slow growth of exports and output than countries which have acquired dynamic comparative advantage and shifted their trade structure in the direction of niche markets and higher value-

It is expected that the relation between trade and economic growth will depend on the nature of the goods exported.

CHART 29. TRADE INDICATORS FOR LDC SUBGROUPS CLASSIFIED ACCORDING TO LONG-TERM GROWTH PERFORMANCE, 1980–1983 AND 2000–2003



Source: UNCTAD secretariat estimates based on UN COMTRADE and World Bank, *World Development Indicators 2005*, CD-ROM.

a Converging LDCs include: Bangladesh, Bhutan, Lesotho, Mozambique, Nepal and Uganda. Weak-growth LDCs include: Benin,Burkina Faso, Chad, Ethiopia, Malawi, Mali, Mauritania, Senegal. Regressing LDCs include: Burundi, Central African Republic, Democratic Republic of the Congo, Gambia, Guinea-Bissau, Haiti, Madagascar, Niger, Rwanda, Sierra Leone, Togo and Zambia.

b Converging LDCs include: Bangladesh, Bhutan, Lao PDR, Mozambique, Nepal and Uganda. Weak-growth LDCs include: Benin,Burkina Faso, Chad, Guinea, Ethiopia, Malawi, Mali, Mauritania and Senegal. Regressing LDCs include: Burundi, Central African Republic, Democratic Republic of the Congo, Gambia, Guinea-Bissau, Haiti, Madagascar, Niger, Rwanda,Togo and Zambia.

added manufactures. The evidence below for the LDCs supports these predictions.

The results show that between 1980–1983 and 2000–2003, the share of trade in GDP increased by 13 percentage points in converging economies, by six percentage points in the weak-growth economies and declined in regressing economies (see chart 29A). This picture fits well with the conventional wisdom that increasing trade orientation is good for growth. However, it is necessary to point out that there is also an important difference between the three groups of countries in terms of the initial level of trade integration. Both the weak-growth and regressing LDCs had higher trade/GDP ratios in 1980–1983 than the converging LDCs. If the trade/GDP ratio is used as an index of the openness of the economy, it is the economies which were initially more "open" (in the sense of trade integration with the global economy), which subsequently did worse in terms of growth performance. But it is the economies which increased their "openness" (in the same sense) most over the 20-year period which did best. This is not a paradox because the more open countries were initially more dependent on primary commodities (see below).

Since 1980 the share of trade in GDP increased by 13 percentage points in converging economies, by six percentage points in the weak-growth economies and declined in regressing economies.

The trends in the export/GDP ratio underlie and mirror changes in the trade/GDP ratio. But to underline the importance of the initial degree of trade integration, it is worth noting that the export/GDP share in 1980–1983 in the converging economies was 12 per cent compared with 20 per cent in weak-growth economies and 22 per cent in the regressing economies. In the latter group, the export/GDP was slightly lower in 2000–2003 than in 1980–1983. In weak-growth economies it increased by only 2 percentage points, whilst in the converging economies it doubled to 22 per cent of GDP.

With regard to the share of manufactures in total merchandise exports, the converging economies start with a much higher share in 1980–1983 than the other two groups of countries — 31 per cent of total merchandise exports as against 9 per cent in the weak growth economies and 11 per cent in regressing economies. By 2000–2003 primary products had become less important in all groups. But the shift to manufactures went furthest fastest in the converging LDCs. By that period, manufactures constituted 49 per cent of total merchandise exports in the converging economies, compared with 17 per cent on average in the weak-growth economies and 22 per cent in the regressing economies. Interestingly the regressing economies include two countries – Haiti and Madagascar — which have successfully developed clothing manufactures exports through Export Processing Zones (EPZs). This reflects the fact that it is possible to expand manufacturing exports without much expansion of domestic value-added, as export production involves assembly or limited processing of imported inputs (see UNCTAD 2002). It is therefore clear that although the converging economies have tended to shift their composition of exports out of primary commodities towards manufactures, this is not a magic solution and will not, in itself, ensure sustained economic growth.

Although the converging economies have tended to shift their composition of exports out of primary commodities towards manufactures, this is not a magic solution and will not, in itself, ensure sustained economic growth.

Turning to the composition of primary commodity exports, there are two clear trends which indicate that the converging LDCs have not simply been diversifying into manufactures but also upgrading the composition of their primary commodity exports.

Firstly, the share of processed products in total primary exports of the converging economies increased from 20 per cent in 1980–1983 to 42 per cent in 2000–2003. Over the same period, the share remained constant at 21 per

cent in the regressing economies and decreased by 1 percentage point in the weak growth economies.

Secondly and in contrast, there is little difference between the performance of the country groups in terms of the shift from static to dynamic agricultural exports. The share of dynamic agricultural products in total agricultural exports increased on average in all country groups, including in the regressing LDCs. In 2000–2003, these products constituted 44 per cent in the converging economies, compared with 31 per cent in weak-growth LDCs and 32 per cent in the regressing economies.

Diversification away from primary commodity exports towards manufactured exports, as well as upgrading within primary commodity exports has proceeded further and faster, in the converging economies.

To summarize, the converging economies have switched towards more processed and more dynamic agricultural goods, while the regressing economies have switched towards more dynamic agricultural products but the processing of primary products before export has not changed. These patterns show that the converging economies have not only been characterized by greater structural change than the other countries and rising labour productivity in both agriculture and non-agriculture, but they are also characterized by a greater increase in trade orientation and export orientation than the other groups. In addition, diversification away from primary commodity exports towards manufactured exports, as well as upgrading within primary commodity exports has proceeded further and faster in this group of countries. Thus, within the converging economies, the pattern of trade integration has reinforced the pattern of structural change.

However, the development of manufactured exports is not a magic bullet for development success. Even in the converging economies it is apparent that there is still a mismatch between the production structure and the trade structure, suggesting that whereas the growth of manufacturing exports has occurred, this process may be, as discussed more generally in UNCTAD (2004), weakly linked to the rest of the economy. Some of the regressing economies have actually successfully developed manufactured exports but this has not been associated with structural change and economic growth, and assembly activities with few local technological capabilities can easily collapse. Moreover, it is clear that in 1980 many of the weak-growth and regressing LDCs started with a much higher level of integration with the global economy and also greater export orientation than the converging economies. Thus, whilst changes in the level of trade integration are related to growth performance, the actual level is not.

The overall lack of structural change, the very slow rate of productivity growth and the limited range of goods in which LDCs are internationally competitive are all symptomatic of a lack of technological learning and innovation within LDCs.

D. Processes of technological learning

The overall lack of structural change, the very slow rate of productivity growth and the limited range of goods in which LDCs are internationally competitive are all symptomatic of a lack of technological learning and innovation within LDCs. The patterns of production and trade not only indicate that the level of accumulation of knowledge-based assets is generally low, but there is also regression rather than accumulation in these assets in many LDCs.

The rest of this section focuses more closely on the processes of technological learning which underlie innovation. It is these processes which, together with capital accumulation, are at the heart of structural change and international competitiveness. Developing productive capacities in the LDCs will entail addressing the constraints on technological learning as much as the constraints on capital accumulation.

1. Technological learning trajectories in LDCs

Technological learning is the process of acquiring and mastering the information and skills that enable enterprises to operate physical plant and equipment efficiently and competitively, as well as the information and skills to raise quality and to introduce new products and production processes. This is not a simple process. As Lall (2005a: 11) has put it:

"Whilst technological hardware (equipment, designs, patents and so on) *is* available to all countries, just importing hardware does not ensure that it is used efficiently. This is because the disembodied elements of technology ("tacit" knowledge) cannot be transferred like physical products. Technical knowledge is difficult to locate, price and evaluate. Its transfer cannot be embodied in equipment or instructions, designs or blueprints. Unlike the sale of a good, where the transaction is complete when physical delivery has taken place, the successful transfer of technology is a prolonged process, involving local learning to complete the transaction. The embodied elements can be used at best operative levels only if they are complemented by a number of *tacit* elements that must be developed locally. The need for learning exists in all cases, even when the seller provides assistance, though the costs vary by technology, firm and country".

There are important differences between the technological learning trajectories of countries at different levels of development and this implies that the necessary technological capabilities change as countries develop.

Lall (2004) summarizes the ten general features of technological learning as follows: (1) it is real and significant process which is primarily conscious and purposive rather than automatic and passive; (2) there is limited information on technical alternatives and learning involves risk, uncertainty and costs; (3) enterprises may not even know how to learn; (4) learning is path-dependent and cumulative; (5) different technologies differ in their learning requirements and so the learning process is highly technology specific; (6) learning occurs through external sources as well as internal activities; (7) it involves effort at all levels of the enterprise and is not limited to R&D; (8) it becomes increasingly costly as enterprises acquire a deeper understanding of technology; (9) it requires inter-linkages between suppliers and customers; and (10) it takes place through interactions both within and between countries.

However, there are also important differences between the technological learning trajectories of countries at different levels of development and this implies that the necessary technological capabilities change as countries develop. Within OECD countries, high levels of R&D investment are at the heart of technological learning. However, technological learning and technical change in the LDCs takes place primarily by using and improving technologies that already exist in advanced industrial countries or other developing countries. Key technological capabilities are related to: the acquisition of mature technologies, including simple assembly, product specification, production know-how, technical personnel and components and parts; the ability to undertake incremental innovations to adapt technologies to local conditions; the ability to develop new markets through close links with customers and strategic management of marketing functions; and to develop linkages with other enterprises, public research organizations and technology transfer agencies. For most LDCs, the three most important sources of building their endogenous knowledge-base are likely to be education and strengthening of the skills base; foreign technology transfer; and the mobility of experienced technical personnel. Importation of foreign technology, reverse engineering of existing mature foreign products, and the mobility of experienced technical and managerial engineering personnel can be harnessed to bring about effective adoption and diffusion of imported technologies to their economies.

For most LDCs, the three most important sources of building their endogenous knowledge-base are likely to be education and strengthening of the skills base; foreign technology transfer; and the mobility of experienced technical personnel.

The relative importance of different channels through which firms acquire and improve technology in LDCs and in other developing countries is shown in table 35. This evidence is based on the World Bank's Investment Climate Assessments (ICA) and includes data for 12 LDCs and 21 other developing countries. From this data, it is clear that capital investment in new machinery and equipment is the most important source of technological acquisition in both LDCs and other developing countries. In the LDCs, 45 per cent of the firms report the investment in new machinery and equipment as the most important source of technological acquisition. Overall, almost two-thirds of the firms report new machinery and equipment as either the first-most, second-most or third-most important source. This result has an important corollary that there is a close association between capital investment and technological learning. The low levels of capital investment described in the previous chapter are directly related to low levels of technological learning.

In the LDCs, 45 per cent of the firms report that investment in new machinery and equipment is the most important source of technological acquisition.

Key personnel is the second most important channel of technology acquisition within the LDCs, whereas in other developing countries internal R&D is reported as the second most important channel. Compared with capital investment, fewer firms report these two sources as their most important source of technology acquisition. Only 14 per cent of LDC firms report key personnel as the most important source of technology acquisition, and only 11 per cent report R&D. The differences between LDCs and other developing countries in the proportion of firms reporting these as their most important source of technology acquisition are not great. However, if one adds up the firms reporting key personnel as their first-most, second-most and third-most important source of technology acquisition, it is apparent that 55 per cent regard key personnel as important in the LDCs, as against only 43 per cent in other developing countries.

These trends reflect expectations. However, table 35 also suggests significant weaknesses in the process of technology acquisition and diffusion within the LDCs.

Firstly, licensing from domestic or international sources and transfers from a parent company in LDCs are both negligible sources of technology acquisition.

TABLE 35. RELATIVE IMPORTANCE OF DIFFERENT CHANNELS OF TECHNOLOGY ACQUISTIONS IN LDCS AND OTHER DEVELOPING COUNTRIES, VARIOUS YEARS

	Share of companies in LDCs that considered it…			**Share of companies in other developing countries that considered it…**		
	Most important channel	*Second most important channel*	*Third most important channel*	*Most important channel*	*Second most important channel*	*Third most important channel*
New machinery or equipment	45.0	11.5	9.5	44.3	13.0	9.9
Key personnel	13.7	26.6	14.1	12.2	19.6	10.7
Collaboration with customers	11.3	13.3	15.9	7.6	12.2	12.7
Internal R&D	11.3	15.8	14.9	13.6	19.0	15.1
Trade Fairs	5.8	10.0	12.7	6.9	11.4	15.0
Collaboration with suppliers	3.8	5.4	7.7	4.3	9.3	11.9
Transferred from parent company	2.3	2.2	2.7	3.2	2.9	2.9
Consultants	2.1	4.9	7.9	2.5	4.1	8.2
Licensing from international sources	1.6	2.7	3.8	1.9	2.5	2.8
Licensing from domestic sources	1.6	3.5	3.4	1.5	2.2	2.3
Business or industry associations	1.3	3.1	5.5	1.7	2.8	6.2
Universities, public institutions	0.4	1.0	2.0	0.5	1.2	2.4

Source: Knell (2006) based on World Bank, Investment Climate Surveys, online, December 2005.

Only 1.6 per cent of firms in LDCs report licensing from international sources as the most important source of technology acquisition. Only 2.3 per cent report transfer from a parent company as the most important source of technology acquisition. The latter figure may partly reflect sampling design of the ICA surveys. However, it suggests that although foreign firms do, as we shall later see, undertake more internal R&D and use more foreign-licenced technology than domestic firms in the LDCs, the direct transfer of technology to LDCs through transnational corporations is of relatively minor importance in this sample of countries.[8]

Secondly, universities and public institutions are currently under-utilized in the process of technology acquisition in LDCs. They are reported as the first-most, second-most and third-most important sources of technology acquisition by only 3.4 per cent of the firms. This same disconnect between public technology institutions and private sector enterprise is also apparent in other developing countries.

The institutional context for technological learning and innovation is weak in the LDCs.

Thirdly, one would expect that collaboration amongst firms would be a very important source of technology acquisition in a low-income setting. For LDCs, it is apparent that collaboration with customers is indeed important, and if we take collaboration with customers and suppliers together, 15 per cent of the firms report that they are the most important source of technology acquisition. But this too seems low because in the LDC context, knowledge acquired from external sources is likely to be a critical component of technological learning.

Fourthly, consultants are a very minor channel of technology acquisition by private firms in LDCs. Given the important role of consultants in technical cooperation, this suggests that there is a major disconnect between aid in the form of technical cooperation and the development of private sector technological capabilities.

What these data suggest is that both firm-level learning capabilities and the institutional context for technological learning and innovation is weak in the LDCs. The development of technological capabilities depends in part on the extent of linkages amongst economic agents, as well as with specialized organizations such as public research bodies which are generating knowledge. The nature of the domestic knowledge systems in the LDCs will be addressed in chapter 6.

Gross expenditure on R&D in 2003 was 0.2 per cent of GDP in the LDCs.

2. Indicators of technological effort

There is now an expanding literature on the measurement of technological capabilities and the knowledge assets of countries (Archibugi and Coco 2004; 2005). Widely-used indicators include R&D expenditure, number of scientists and engineers, licensing fees and number of publications in scientific journals. Care must be taken in interpreting these data as they do not capture the full range of innovative activities in LDCs, in particular incremental innovation. However, they provide the only internationally comparable data to measure the extent of the knowledge divide in terms of technological capabilities.

Table 36 summarizes where LDCs stand in relation to other developing countries and developed countries with regard to some traditional indicators of technological effort. From the table, it is clear that:

- R&D expenditure in both LDCs and other developing countries is very low when compared with OECD countries. Gross expenditure on R&D

TABLE 36. INDICATORS OF TECHNOLOGICAL EFFORTS IN LDCs, OTHER DEVELOPING COUNTRIES AND DEVELOPED COUNTRIES

	LDCs	Other developing countries	Developed countries
Total R&D expenditures as share of GDP in 2003[a]	0.2	0.3	2.2
Researchers & scientists per million population in 2003[a]	176	662	7144
Scientific & technical publications, sum 1990–1999			
Number	7 788	479 837	4 841 762
Share in world total (%)[b]	0.1	8.5	86.0
Utility patents[c], sum 1991–2004			
Number	20	14 824	1 823 019
Share in world total (%)[b]	0.0	0.8	99.0

Source: Knell (2006).

Note: Gross expenditures on research and development as share of GDP is based on 11 LDCs; reseachers and scientists per million population is based on 16 LDCs.

a Or latest available year.

b Shares in world total do not add up to 100 per cent because transition economies are not shown in the table.

c Utility patents include patents for inventions, but do not include design patents, plant patents, re-issue patents, etc.

in 2003 (or the latest available year) was 0.2 per cent of GDP in the LDCs and 0.3 per cent of GDP in other developing countries, compared with 2.2 per cent of GDP in OECD countries.

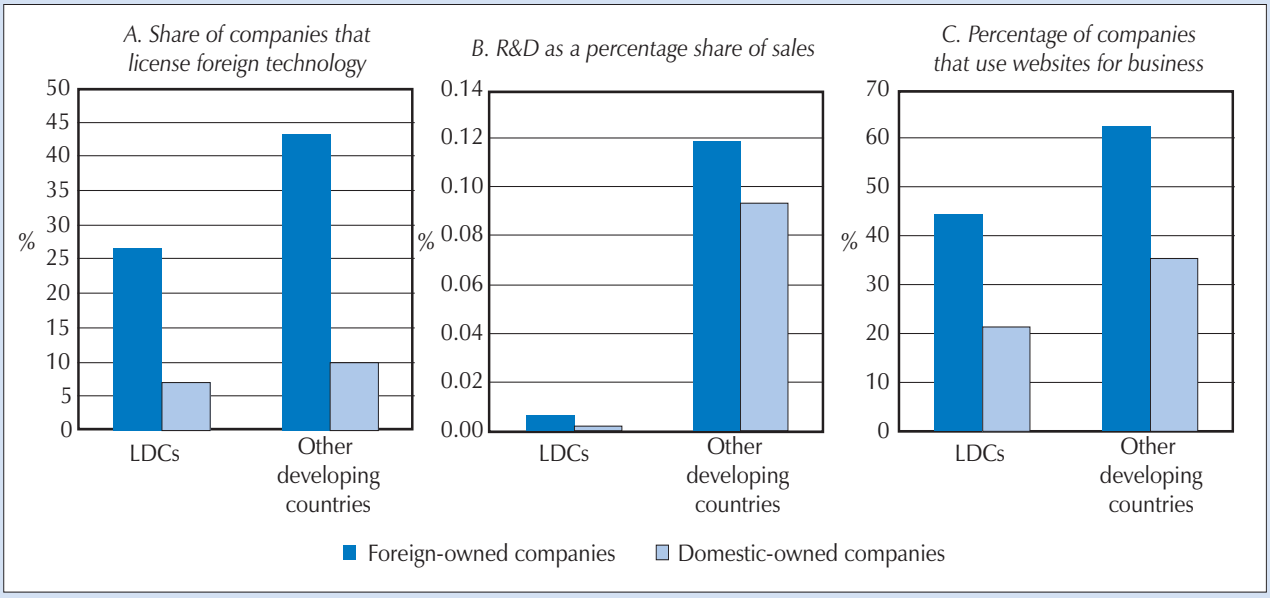
- The number of researchers and scientists engaged in R&D activities per million population in the LDCs in 2003 (or the nearest year) are just 27 per cent the level in other developing countries and 2 per cent the level in OECD countries
- During the period 1990-1999, only 0.1 per cent of the scientific and technical journal articles in physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology and earth and space sciences originated in LDCs
- Between 1991 and 2004, only 20 US patents were granted to citizens from LDCs compared with 14,824 to citizens from other developing countries and 1.8 million to citizens from OECD countries.

Only 7 per cent of the domestic firms in LDCs license foreign technology and only 21 per cent of domestic firms in LDCs use a website for business.

These statistics show there is a major knowledge divide within the global economy. However, it would be wrong to infer that innovation and problem-solving is not occurring in the LDCs. There are many incremental innovations with significance for domestic needs that are not being captured by these traditional indicators. This is especially the case for "invisible" process innovations. These can only be measured through field research and also indicators of sales, productivity and profitability.

Chart 30 includes some firm-level data from the Investment Climate Surveys. These differentiate between the technological effort of domestic firms and foreign firms in both LDCs and other developing countries. In all cases, the indicators of technological effort are lower in the LDCs than in other developing countries, and they are lower in domestic firms than in foreign firms. It is striking that average expenditure by domestic firms in the LDCs on R&D as a percentage of sales is almost zero. More worrying still is the fact that only 7 per cent of the domestic firms in LDCs license foreign technology. Only 21 per cent of domestic firms in LDCs also use a website for business. This is less than half the proportion of foreign-owned firms who use a website for business; domestic firms in LDCs also lag behind domestic firms in other developing countries.

Chart 30. Differences in technological effort in LDCs and other developing countries by foreign and domestic companies, various years[a]



Source: Knell (2006) based on World Bank, *Investment Climate Surveys*, online, December 2005.

Note: Investment Climate Surveys were conducted between 2000 and 2005.

a The group of other developing countries includes 21 countries; the group of LDCs includes 12 countries for which data are available, namely Bangladesh (2002), Bhutan (2001), Cambodia (2003), Eritrea (2002), Ethiopia (2002), Madagascar (2005), Mali (2003), Nepal (2000), Senegal (2003), Uganda (2003), United Republic of Tanzania (2003) and Zambia (2002).

Given the importance of capital investment for technology acquisition, imports of machinery and equipment are a good indicator of technological effort in the LDCs. Chart 31 shows machinery and equipment imports into LDCs and other developing countries between 1980 and 2003 using two indicators of technological effort: machinery and equipment imports as share of GDP and machinery and equipment imports per capita.

From this chart it is clear that:

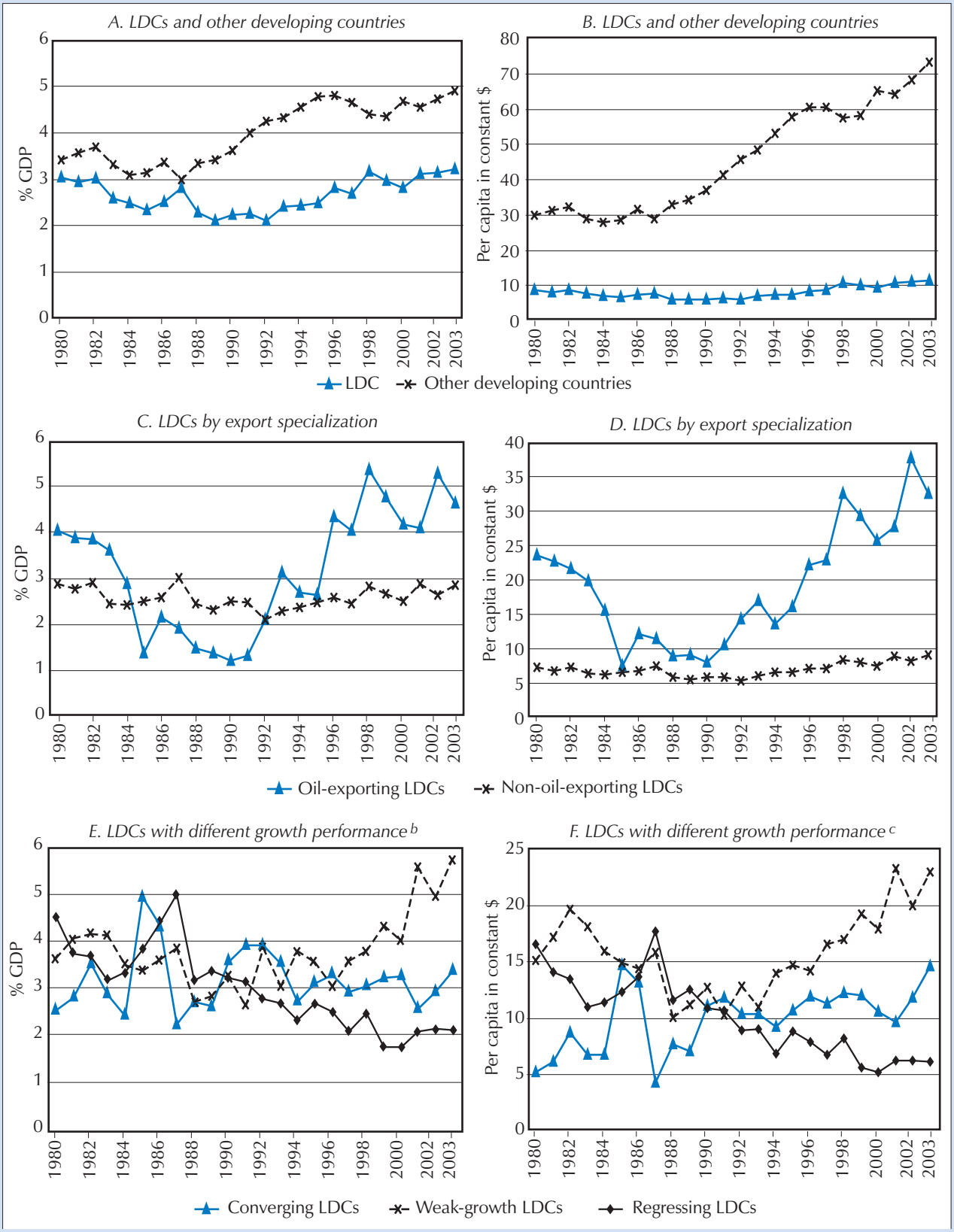
- As a share of GDP, machinery and equipment imports into LDCs in the period 2000–2003 were lower than those into other developing countries (3 per cent versus 4.8 per cent of GDP) and the gap between the two groups of countries has widened since the early 1980s (when machinery and equipment imports to LDCs were 2.9 per cent of GDP, while those to other developing countries was 3.3 per cent).
- In real per capita terms, machinery and equipment imports into LDCs during 2000–2003 were at almost the same level as 1980. Real capital goods imports per capita were about $10 per capita (in 1990 US$), which was seven times lower than real capital goods imports of other developing countries.

In real per capita terms, machinery and equipment imports into LDCs during 2000–2003 were at almost the same level as 1980.

Disaggregating the trends between converging economies, weak growth economies and regressing economies, it is apparent that there is a sharp fall in machinery and equipment imports into regressing LDCs, both as a share of GDP and per capita (chart 31 E and 31F). But significantly, no strong upward trend can be discerned in such imports in the converging economies. In real terms machinery and equipment imports per capita stood at the same level in the converging economies in 2003 as they were in 1985. This suggests weaknesses in the development of technological capabilities in the converging economies, and that these LDCs may be vulnerable to setbacks as a result of intensifying competition with other developing countries. Case studies of garment exports in

CHART 31. MACHINERY IMPORTS PER CAPITA[a] AND AS A SHARE OF GDP IN LDCs, LDC SUBGROUPS AND OTHER DEVELOPING COUNTRIES, 1980–2003

(Constant $ and percentage of GDP)



Source: UNCTAD secretariat estimates based on UN COMTRADE; and World Bank, *World Development Indicators 2005*, CD-ROM.

a Machinery imports per capita are in constant 2000 dollars. The GDP deflator, in dollars, was used to convert the series into real terms.

b Converging LDCs include: Bangladesh, Bhutan, Mozambique, Nepal and Uganda. Weak-growth LDCs include: Benin, Burkina Faso, Chad, Malawi, Mali, Mauritania and Senegal. Regressing LDCs include: Burundi, Central African Republic, Democratic Republic of the Congo, Gambia, Guinea-Bissau, Haiti, Madagascar, Niger, Rwanda, Sierra Leone, Togo and Zambia.

c Converging LDCs include: Bangladesh, Bhutan, Lao PDR, Mozambique, Nepal, Uganda. Weak growth LDCs include: Benin, Burkina Faso, Chad, Guinea, Malawi, Mali, Mauritania, Senegal. Regressing LDCs include: Burundi, Central African Republic, Democratic Republic of the Congo, Gambia, Guinea-Bissau, Haiti, Madagascar, Niger, Rwanda, Togo and Zambia.

Lesotho and also Cambodia indeed confirm these weaknesses and the vulnerability to competition (Lall 2005; Rasiah 2006). The strongest upward trend in terms of machinery and equipment imports is apparent in the weak-growth economies. This probably reflects the fact that it is in these economies that increasing investment has been most strongly driven by FDI (see previous chapter).

It is impossible to differentiate the relative importance of domestic and foreign firms in capital goods imports. However, it is apparent that there is a close association between countries which have received the highest levels of FDI inflows and countries in which capital goods imports have risen as a share of GDP and in per capita terms. An important feature of the trends in capital goods imports to LDCs, and a reflection of the role of FDI, is that the oil-exporting LDCs experienced significant increases in the 1990s. Thus, whilst the capital goods imports to oil-exporting LDCs rose from $7 per capita to $33 per capita (in 1990 US $) from 1990 to 2003, those into non-oil exporting LDCs only increased from $6 to $10. Amongst non-oil exporting African LDCs, capital goods imports were not only smaller in per capita terms but accounted for a smaller share of GDP in 2000–2003 than they were in 1980–1983.

Amongst non-oil exporting African LDCs, capital goods imports were not only smaller in per capita terms but accounted for a smaller share of GDP in 2000–2003 than they were in 1980–1983.

Most of the data above refer to firms engaged in industrial activities and services. However, given the importance of agriculture in many LDC economies, agricultural research and development, and also extension activities to link research findings with farmers, are particularly important aspects of technological effort. Data on this is also patchy. However, table 37 gathers

TABLE 37. PUBLIC AGRICULTURAL RESEARCH EXPENDITURES IN SELECTED LDCs, 1980–1989, 1990–1999 AND 2000–2001

	Public research expenditures							
	1993, $ million				*Percentage of agricultural GDP*			
	Average			Change	Average			Change
	1980–1989 (a)	*1990–1999 (b)*	*2000–2001*	*(b-a)*	*1980–1989 (a)*	*1990–1999 (b)*	*2000–2001*	*(b-a)*
Burkina Faso	4.0	7.9	..	3.9	0.6	0.9	..	0.4
Burundi	..	3.3	1.5	..	..	0.7	0.4	..
Cape Verde	1.7	1.9	..	0.2	3.5	4.1	..	0.7
Ethiopia	6.6	9.9	13.6	3.3	0.3	0.3	0.4	0.0
Guinea	..	4.4	3.5	..	..	0.6	0.3	..
Lesotho	0.8	0.8	..	-0.1	0.7	0.6	..	-0.1
Madagascar	5.8	5.3	2.6	-0.5	0.6	0.6	0.3	0.0
Malawi	10.4	11.0	..	0.6	1.6	1.4	..	-0.2
Mali	12.1	11.3	..	-0.8	1.3	1.0	..	-0.3
Mauritania	..	1.9	2.4	..	..	0.8	1.0	..
Niger	5.7	5.6	..	-0.1	0.7	0.7	..	0.0
Rwanda	4.3	3.9	..	-0.5	0.5	0.6	..	0.0
Senegal	23.6	15.2	..	-8.4	2.6	1.4	..	-1.1
Sudan	8.7	9.0	7.9	0.3	0.5	0.1	0.2	-0.4
Togo	5.8	4.3	4.2	-1.5	1.4	0.8	0.6	-0.6
Uganda	..	7.8	10.2	..	..	0.4	0.5	..
United Rep. of Tanzania	..	6.5	8.5	..	..	0.3	0.4	..
Yemen	..	16.2	..	..	..	0.5	..	..
Zambia	11.7	11.6	..	-0.2	2.8	2.2	..	-0.6

Source: UNCTAD secretariat estimates based on CGIAR, ASTI database online, February 2006; and World Bank, *World Development Indicators 2005*, CD-ROM.

available data on public expenditure on agricultural research and development in African LDCs for which data is available.

From this table it is clear that for this sample of countries public expenditure on agricultural R&D declined in real terms in the 1980s and also in the 1990s in many countries. This reflects the fact that in Africa rapid growth of spending on agricultural R&D in the 1960s — a post-independence period of institution-building underwritten with development aid — gradually gave way to the debt crisis in the 1980s and curbs on government spending and waning donor support in the 1990s (Pardey and Beintema 2001: 3). Today, despite relatively high returns on investments in agricultural research, investment in agricultural research and development remains very low.

Despite relatively high returns on investments in agricultural research, investment in agricultural research and development remains very low.

E. Conclusions

This chapter has described and analysed the trends in production structure, labour productivity and trade integration in the LDCs, and examined the processes of technological learning which, together with capital accumulation, underlie structural transformation, productivity growth and international competitiveness.

The chapter has shown that for the LDCs as a group there has been little structural change and the productivity gap between the LDCs and other developing countries and developed countries is increasing. The share of agriculture in GDP in the LDCs is declining slowly (from 37 per cent in 1980–1983 to 33 per cent in 2000–2003). Both industrial and service activities are expanding. But much of the increase in industrial value-added is concentrated in a few LDCs and the type of industrial activities which are expanding most in the LDCs are mining industries, the exploitation of crude oil and, in come cases, the generation of hydroelectric power, rather than manufacturing. Moreover, the type of services which are expanding most are low value-added petty trade and commercial services.

The data show that, on average, it requires 5 workers in the LDCs to produce what one worker produces in other developing countries, and 94 LDC workers to produce what one worker produces in developed countries in 2000–2003. Worse still, the productivity gap is widening. Labour productivity in the LDCs as a group in 2000–2003 was just 12 per cent higher than in 1980–1983, whilst it increased by 55 per cent on average in other developing countries. Significantly, although agricultural value-added per agricultural worker rose slightly in the LDCs, non-agricultural value-added per non-agricultural worker actually declined by 9 per cent between 1980–1983 and 2000–2003. Non-agricultural labour productivity declined in four fifths of the LDCs for which data are available over this period, indicating that there is a widespread and major problem in productively absorbing labour outside agriculture.

Labour productivity in the LDCs as a group in 2000–2003 was just 12 per cent higher than in 1980–1983.

The goods and services which the LDCs can supply competitively to world markets are ultimately limited by the goods and services which they can produce and how efficiently they are in producing them. This is the basic source of the marginalization of the LDCs in world trade. Even if they exported all their output, the LDCs' share of world exports of goods and services would be only 2.4 per cent, even though their share of world population is 10.6 per cent. Moreover, just as the production structure of the LDCs is strongly oriented to exploit natural resources, so their export structure is also strongly oriented in that way. The capacity to export manufactures is increasing in the LDCs. But this is

occurring much more slowly than in other developing countries, it is also concentrated in only a few countries, and has thus far limited mainly to low-skill, labour-intensive products, particularly garments, with low learning potential and weak domestic linkages, rather than in the medium- and high-technology exports.

Structural change, productivity growth and trade integration cannot be divorced from patterns of economic growth. With this in view, the chapter has analysed whether there are differences between LDCs according to their growth performance. Using the classification of the LDCs as converging, weak-growth and regressing economies introduced in the previous chapter, important patterns emerge. In short, the converging economies are characterized by: (i) a decline in the share of agriculture in GDP; (ii) an increase in manufacturing value-added; (iii) rising labour productivity in both agriculture and non-agricultural sectors; (iv) an increase in the share of trade in GDP; and (v) an increase in the share of manufactures exports in merchandise exports. In the regressing economies: (i) the share of agriculture in GDP is rising; (ii) de-industrialization, in the sense of a declining share of manufactures in GDP, is occurring; (iii) labour productivity is declining in both agricultural and non-agriculture; (iv) trade is declining as a share of GDP; and (v) although manufactures exports are increasing as a share of total merchandise exports, this is occurring much more slowly than in the converging economies.

The patterns of production and trade indicate that the level of accumulation of knowledge-based assets is generally low. But there is also regression rather than accumulation in these assets in many LDCs.

This analysis shows that the LDC experience does not diverge from the classic long-term patterns of structural transformation which has been found when sustained economic growth occurs (see Clark 1957, Kuznets 1966; Syrquin and Chenery1989). The dynamics of production structure are closely associated with economic growth performance. In the previous chapter, it was shown that the converging economies did significantly better than the weak-growth economies and regressing economies in terms of their domestic savings mobilization and investment effort. It is also now clear that structural transformation has been greater in these countries.

The overall lack of structural change, the very slow rate of productivity growth and the limited range of goods in which LDCs are internationally competitive are all symptomatic of a lack of technological learning and innovation within LDCs. The patterns of production and trade indicate that the level of accumulation of knowledge-based assets is generally low. But there is also regression rather than accumulation in these assets in many LDCs. Using traditional indicators of technological effort (such as R&D, patenting, numbers of scientists and researchers and publications), it is apparent that there is a major knowledge divide between the LDCs, other developing countries and developed countries. These statistics do not represent the full picture as they do not capture types of innovation and dimensions of innovativeness which are relevant for very poor countries. But firm-level data also identifies deficiencies in technological capabilities. Significantly, this appears to be an area of weakness even in converging economies.

Within rich countries, an increasing proportion of production is now within what is called the knowledge economy, i.e. they are based on the manipulation of ideas and knowledge rather than material objects. But the knowledge intensity of production within the global economy is high not only in high-technology sectors, creative industries and producer services. It is also increasing within primary production and low-skill manufactures. For this reason, knowledge accumulation and the development of technological capabilities is as important for the LDCs as it is for rich countries. International competitiveness in

For the LDCs, the weak development of technological capabilities together with weaknesses of capital accumulation reinforce each other and threaten the marginalization of the LDCs within the global economy.

the global economy is increasingly based on knowledge and innovation rather than on price and cost. As this occurs the divide between rich and poor countries in terms of their stock of knowledge assets and learning capabilities is becoming increasingly important as an obstacle to development and poverty reduction. For the LDCs, the weak development of technological capabilities together with weaknesses of capital accumulation reinforce each other and threaten the marginalization of the LDCs within the global economy. Yet, as discussed in the growth model at the start of the previous chapter, the availability of technologies already in use in other countries offers a major opportunity for catch-up growth.

This chapter completes the discussion of the core processes through which productive capacities develop — capital accumulation, technological progress and structural change. The next chapter extends the analysis by considering the implications of the slow rate of capital accumulation and technological progress, as well as the weak pattern of structural change for poverty. It does so by focusing more closely on the labour productivity trends identified in this chapter, as well as the ability of the LDCs to absorb their growing labour force productively both within and outside agriculture.

Notes

1. For semantic simplicity the text throughout this chapter refers to sectoral shares in GDP. The estimates are based on shares in total value-added.
2. The term "openness" within trade and development analysis refers both to a type of trade policy regime or the degree of trade orientation (see UNCTAD 2002: Box 9). It is used in the latter sense here. However, as shown in the LDC Report 2004, most LDCs have also undertaken extensive trade liberalization.
3. For this estimate, primary products correspond to categories 0-4 plus items 524 (radioactive and associated materials), 667 (precious stones), 68 (non-ferrous metals), 941 (live and zoo animals) and 971 (gold). This classification of primary products differs slightly from that used in Part I of this Report (and also earlier LDC Reports). The inclusion of items 524, 667, 941 and 971 means that the share of primary commodities in total merchandise exports is slightly higher than the estimate in Part I. The commodity classification is based on Wood and Mayer (1998) and UNCTAD (1998), and is used throughout this section.
4. This classification is based on the LDC export structure of the late 1990s: (i) Agricultural exporters: Afghanistan, Benin, Bhutan, Burkina Faso, Burundi, Chad, Eritrea, Ethiopia, Guinea-Bissau, Kiribati, Malawi, Mali, Mauritania, Rwanda, Sao Tome and Principe, Solomon Islands, Somalia, Togo, Uganda and the United Republic of Tanzania; (ii) Mineral exporters: Central African Republic, Democratic Republic of Congo, Guinea, Liberia, Niger, Sierra Leone and Zambia; (iii) Oil exporters: Angola, Equatorial Guinea, Sudan and Yemen; (iv) manufactures exporters: Bangladesh, Cambodia, Haiti, Lao People's Democratic Republic, Lesotho, Madagascar, Myanmar and Nepal; (v) Service exporters: Cape Verde, Comoros, Djibouti, Gambia, Maldives, Samoa, Tuvalu and Vanuatu; and (vi) Mixed manufactures and services exporters: Mozambique and Senegal (UNCTAD, 2004, p. 24).
5. The distinction between static and dynamic agricultural goods is drawn from Wood and Mayer (1998). Dynamic agricultural goods are those with an income elasticity of demand greater than one.
6. The number of commodities exported include only those products that are greater than $100,000 or more than 0.3 per cent of the country's total exports. (UNCTAD, *Handbook of Statistics*, 2005)
7. Since Kaldor first enunciated his growth laws in the mid-1960s there has been a mass of empirical evidence supporting them (see, for example, surveys by Thirlwall, 1983; McCombie, Pugno and Soro, 2003). A recent study has tested these laws across 45 countries including 27 LDCs in Africa (Wells and Thirlwall, 2003).
8. It is of course important in those LDCs in which FDI inflows are concentrated, particularly oil-exporting LDCs.

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