Module 1

The structural transformation process: trends, theory, and empirical findings
1 Introduction

The quest for economic development is among the primary objectives of nations. Improving people’s well-being and socio-economic conditions is therefore one of the crucial challenges facing policymakers and social scientists today. Every year, aid is disbursed, investments are undertaken, policies are designed, and elaborate plans are devised to achieve this goal, or at least to get closer to it. What does it take to achieve development? What distinguishes high-achieving economies from economies struggling to converge towards high-income levels?

During their economic take-off, the economies that today are considered advanced were all able to diversify away from agriculture, natural resources, and the production of traditional manufactured goods (e.g. food and beverages, garments, and textiles). Thanks to productivity enhancements in agriculture, labour and capital progressively shifted into manufacturing and services, resulting in increases in overall productivity and incomes. By contrast, countries that today are considered less advanced have failed to achieve a similar transformation of their productive structures and have remained trapped at low and middle levels of income. For example, agriculture still plays a central role in sub-Saharan Africa, accounting for 63 per cent of the labour force, and thus is at the core of that region’s development challenge today. The gradual process of reallocation of labour and other productive resources across economic activities accompanies the process of modern economic growth and has been defined as structural transformation.

Sustained economic growth is therefore inextricably linked to productivity growth within sectors and to structural transformation. Economic growth, however, can only be sustainable – and therefore lead to socio-economic development – if these two mechanisms work simultaneously. Labour productivity growth in one sector frees labour, which can then move to other more productive sectors. This transformation in turn contributes to overall productivity growth. Considerable theoretical and empirical literature studies and tries to explain these phenomena.

This module aims to present the mechanics of the process of structural transformation and provide readers with the theoretical and empirical instruments to understand them. It first defines a conceptual framework for the analysis of structural transformation, based on the stylized facts that emerge from both historical and recent patterns of structural transformation. It then examines the evolution of development thinking with regard to structural transformation and offers an overview of some of its main schools of thought. The review of the theoretical literature is complemented by a review of the empirical literature on the critical components of structural transformation and on its impact on the overall process of economic growth and development. The last part of the module focuses on the role of structural transformation in social and human development. It discusses the empirical literature on the relationship between structural transformation, employment, poverty, and inequality. It also provides an original analysis on the relationship between structural transformation and human development, as reflected in the Millennium Development Goals (MDGs). The module concludes with exercises and discussion questions for students.

At the end of the module, students should be able to:

- Explain how patterns of structural transformation in developing countries and regions have evolved over time;
- Describe and compare main theories on the role of structural transformation in socio-economic development;
- Describe main indicators of structural transformation and use different empirical methods to calculate them;
- Identify main sources of labour productivity and employment growth;
- Analyse the relationship between structural transformation and socio-economic development.

2 Conceptual framework and trends of structural transformation

This section aims at developing a conceptual framework to analyse the pervasive processes of structural transformation that have accompanied modern economic growth. To this end, it defines structural transformation and discusses how it happens, what it entails, how to measure it, and what structural transformation trends countries have followed.

2.1 Definitions and key concepts

Also denoted as structural change, structural transformation refers to the movement of labour and other productive resources from low-productivity to high-productivity economic activities. Structural transformation can be particularly beneficial for developing countries because their structural heterogeneity – that is, the combina-
tion of significant inter-sectoral productivity gaps in which high-productivity activities are few and isolated from the rest of the economy—slows down their development.1

Structural heterogeneity in developing economies is well illustrated in Figure 1 which shows relative labour productivities in agriculture, industry (manufacturing and non-manufacturing industries), and services averaged over the period from 1991 to 2010 and measured against income levels in 2005. Relative labour productivity is computed as the output-labour ratio (labour productivity) of each sector and that of the whole economy. To get figures by income, average (weighted) labour productivity is computed for all countries in the same income group. As the figure shows, productivity gaps are highest at low-income levels. In particular, non-manufacturing industries (i.e. utilities, construction, and mining) are the most productive activities due to their high capital intensity, labour productivity tends to be very high. At higher-income levels, manufacturing becomes increasingly more productive, reaching the productivity levels of non-manufacturing industries. With development, productivity levels tend to converge.

Figure 1: Relative labour productivity by sector, 1991–2010

Source: UNIDO (2013: 26).
Note: Pooled data for 108 countries, excluding natural-resource-rich countries. PPP: purchasing power parity.

Economic activities also differ in terms of the strength of their linkages with the rest of the economy. In developing economies, the weak linkages between high- and low-productivity activities that make up the bulk of the economy reduce the chances of structural transformation and technological change. The existence of a negative relationship between differences in inter-sectoral productivity and average labour productivity has recently been demonstrated by McMillan and Rodrik (2011). Their evidence, reported in Figure 2, suggests that a decline in structural heterogeneity is usually associated with a rise in average productivity.
Structural transformation can generate both static and dynamic gains. The static gain is the rise in economy-wide labour productivity as workers are employed in more productive sectors. Dynamic gains, which follow over time, are due to skill upgrading and positive externalities that result from workers having access to better technologies and accumulating capabilities. Productive structural transformation can be defined as the structural transformation process that simultaneously generates productivity growth within sectors and shifts of labour from lower- to higher-productivity sectors, thereby creating more, better-remunerated, more formal, and higher-productivity jobs.

Economic activities also differ with respect to the capacity to absorb workers. Figure 3 depicts the shares of employment in agriculture, non-manufacturing industries, manufacturing, and tradable, non-tradable, and non-market services against relative labour productivity for 14 emerging economies. Several conclusions can be drawn from this figure. First, the industries with the highest labour productivity, namely tradable services and non-manufacturing industries, employ the smallest shares of the workforce (see Box 1 for a discussion of productivity measures with special reference to the services sector). Tradable services are becoming very important due to their tradable element and their use of modern technologies such as information and communications technology (ICT), but they are skill-intensive. Specializing in these services might therefore generate high-quality employment (with high salaries and learning opportunities), but many developing economies lack the high-skilled labour needed for these services. Moreover, because only a tiny fraction of the workforce can be employed in tradable services, structural transformation towards tradable services might not generate enough employment opportunities for the vast majority of the population. This explains why, even if successful, the ICT service industry in India has not become a driver of economic growth for the (very large) Indian population (Ray, 2015). For their part, non-manufacturing industries enjoy rapid productivity growth, but tend to be isolated from the rest of the economy. Moreover, they can generate unsustainable economic growth patterns due to the volatile international prices of commodities and the economic, social, and political inequalities that they tend to produce.

Non-tradable services and agriculture are the main sources of jobs in these emerging economies. Their low labour productivity, however, is reflected in low wages and limited opportunities for learning and accumulation of skills. Workers in these industries should be put in a position to move out of those jobs in order to stimulate the virtuous processes of structural change described in this module. In addition, non-tradable services are characterized by high informality rates and high job vulnerability. Hence, structural
transformation towards these services might fail to generate quality employment and widespread prosperity (Szirmai et al., 2013).

In terms of productivity and employment, manufacturing is situated between tradable and non-tradable services, as it is less productive but employs more workers than tradable services and is more productive but employs fewer workers than non-tradable services. Structural transformation towards manufacturing has been referred to as industrialization.

**Figure 3**

Share of employment and labour productivity by industry, 14 emerging economies, 2005

Source: UNIDO (2013: 27).

Note: Emerging economies included are Brazil, Bulgaria, People’s Republic of China, Cyprus, India, Indonesia, Latvia, Lithuania, Malta, Mexico, Romania, Russian Federation, Taiwan Province of China, and Turkey.

**Box 1**

**Measures of productivity and the meaning of productivity in the services sector**

Broadly defined, productivity is a ratio of a measure of output to a measure of input. Researchers use the concept of productivity to measure technical efficiency, benchmark production processes, and trace technical change. There are several productivity measures among which researchers can choose, based on the objectives of their research and often on the availability of data. Productivity measures can be single factor measures, relating a measure of output to one measure of input (e.g. labour productivity) or multifactor measures, relating a measure of output to multiple measures of input (e.g. total factor productivity – TFP). Labour productivity is the most frequently used productivity statistic. It is computed as the ratio between value added and total number of hours worked. It measures how productively labour can generate output. Given how it is measured, changes in labour productivity also reflect changes in capital: if an industry is characterized by high labour productivity, this might be due to low labour intensity and high capital intensity, which corresponds to high value added with limited use of labour (e.g. mining). TFP represents the amount of output not accounted for by changes in quantity of labour and capital. Formally, it can be defined as the difference between the growth of output and the growth of inputs (the latter weighted by their factor shares).

TFP is a more comprehensive indicator of productivity than labour productivity because it accounts for a larger number of inputs. However, it is entirely based on two very specific assumptions that characterize the standard neoclassical theoretical framework: (a) a production function with constant returns to scale, and (b) perfect competition, so that each factor of production is paid its marginal product (see Section 3.1.1). Together they imply that growth can be decomposed into a part contributed by factor accumulation and a part contributed by increased productivity (TFP). The contribution of a factor to growth is its rate of growth weighted by the share of the gross domestic product (GDP) accruing to that factor. TFP is measured as the residual between the observed growth and the fraction explained by factor accumulation. Given their specificity, these assumptions have been subject to several criticisms. In the real world, in fact, firms and industries often employ different production technologies, and markets are very often not in perfect competition (for more details on the critiques of the TFP concept, see Felipe and McCombie, 2003).

As a concept, productivity was conceived for industrial production. Therefore, for a number of reasons, it seems ill-suited to measure productivity in the services sector. First, as Baumol (1967) notes, services suffer from a “cost disease”: due to their nature, productivity enhancements in services are less likely than in manufacturing (see Section 3.1.2). For example, Baumol and Bowen (1966) look at the performing arts industry, noting that services such as orchestras experience little or no labour-saving technological change of the sort occurring in manufacturing, because a symphony that is meant to be performed by 30 musicians and to last
It should also be noted that structural transformation is a continuous process. Each level of economic development is a point along the continuum from a low-income agrarian economy, where most of the output and labour are concentrated in agriculture, to a high-income economy, where the lion’s share of production and labour accrues to manufacturing and services. The structure of the economy continuously changes as technological change leads it to upgrade to more and more sophisticated goods and production methods. This involves both a progressive diversification of the production base and an upgrade of the goods produced within each industry. Different industrial structures require different institutions and infrastructure that should therefore evolve accordingly. As we will see in Module 2 of this teaching material, this is not an automatic process, and institutional discordance can be a major obstacle to structural transformation, particularly in middle-income economies (Schneider, 2015).

Diversification is key to economic development. This challenges the well-known principle of specialization that is the basis of trade theory. Mature industrialized economies typically produce a vast spectrum of goods and services; developing countries, on the other hand, are engaged only in a limited number of economic activities. The critical importance of diversification, or horizontal evolution of production, has been recently underscored by the seminal findings of Imbs and Wacziarg (2003). Examining sectoral concentration in a large cross-section of countries, they documented an important empirical regularity: As poor countries get richer, sectoral production and employment become less concentrated, i.e. more diversified. Such diversification process goes on until relatively late in the process of development. Figure 4 displays the fitted curves and the 95% confidence bands graphically, showing that employment concentration (measured by the Gini index) decreases as income per capita rises up to middle-income levels.

Figure 4

Industrial concentration and income per capita

Another way in which structural transformation materializes is through the production of increasingly sophisticated goods. Industrial upgrading, which can take place at the firm and the country level, is the gradual process of moving towards higher value-added and more productive activities. Empirical evidence has demonstrated that countries that have managed to upgrade their productive structures and export more sophisticated goods have grown faster. Section 3.2.4 will delve deeper into this literature.

What determines whether and in which direction a country transforms its production structure is country-specific and often difficult to identify even ex-post. Among the many variables that influence the outcome of this process, factor endowments and public policies have received particular attention in academic and policy debates.

Factor endowments influence the direction of structural transformation by determining countries’ comparative advantages (see Box 2). As we will explain in Section 3, the literature has identified abundance of natural resources as one of the factors behind slow industrialization. Recent empirical evidence, however, demonstrates that after controlling for GDP per capita there is only a weak association between export sophistication and some key measures of countries’ endowments, such as human capital or institutional quality (Rodrik, 2006). While the evolution of a country’s productive structure does not entirely rely on its endowments, neither is it entirely random or the product of political decisions. Most of today’s developing economies are unlikely to engage in the production of highly sophisticated products like airplanes, given their skill and capital endowments, the size and sophistication of their enterprises, and their wider institutional structures.

Structural transformation involves large-scale changes, as new and leading sectors emerge as drivers of employment creation and technological upgrading. It also involves constant improvement of tangible and intangible infrastructure that should fit the needs of the emerging industries. Such a constantly evolving scenario requires inherent coordination, with large externalities to firms’ transaction costs and returns to capital investment. In this context, the market alone cannot be expected to allocate resources efficiently. As a matter of fact, successful economies of the past have always made use of some forms of industrial policy to push the limits of their static comparative advantage and diversify into new and more sophisticated activities. This topic is the focus of Module 2 of this teaching material.

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**Box 2**

### The concept of comparative advantage

Is international trade beneficial to all economies, or only to some? Ever since Adam Smith, economists have debated this question. The point of entry in this debate has been the source of advantage on global markets. The principle of “absolute advantage”, introduced by Adam Smith in *The Wealth of Nations* in 1776, states that an economy holds an advantage over its competitors in producing a particular good if it can produce it with less resources (primarily labour) per unit of output. In other words, the principle of absolute advantage is based on a comparison of productivity between economies. Based on absolute advantage, it is possible to justify a situation in which one country produces all goods in the economy, while another (e.g. a developing economy) would be in absolute disadvantage in any good, thereby eliminating every possibility of trade.

In his 1817 book *On the Principles of Political Economy and Taxation*, David Ricardo outlined his theory of “comparative advantage”, according to which a country’s welfare is maximized under free trade as long as the economy specializes in goods it can produce at a lower opportunity cost compared to its trade partners. Opportunity cost refers to the unit of a good that a country has to give up to produce a unit of another good. Therefore, the principle of comparative advantage is based on a comparison of relative productivity. When one brings opportunity cost into the picture, international trade becomes beneficial because an economy can trade goods in which it has a comparative advantage for goods that would be relatively more costly to produce, given its resource endowment and technology. This holds regardless of the labour productivity of the other country, meaning that even if a country is absolutely better at producing every good, it would still be better off specializing in the production of the good in which it has a comparative advantage and importing the others.

If we think again about the situation of developing countries, the theory of comparative advantage justifies trade between a developed and a developing economy, on the basis of lower opportunity costs. Building on Ricardo’s theory of comparative advantage, Eli Heckscher and Bertil Ohlin developed a model of international trade, the Heckscher-Ohlin model. In this model, international trade is driven by the differences in countries’ resource endowments and, more precisely, by the interplay between the proportions in which different factors of production are available in a country and the proportions in which factors are used in producing different
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exports in GDP. GDP and inflate the share of towards domestic consumption, decrease the value of intermediaries and not directed consequence of global value imports, so higher imports, a spending, and export minus investment, government is the sum of consumption, complishing their task. GDP that they re-export after accomplishing their task. GDP is the sum of consumption, investment, government spending, and export minus imports, so higher imports, a consequence of global value chains and not directed towards domestic consumption, decrease the value of GDP and inflate the share of exports in GDP.

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**Box 2**

**The concept of comparative advantage**

goods. This interplay defines a country’ specialization in international trade, as countries would export goods whose production is intensive in the factors with which they are abundantly endowed (Krugman et al., 2012).

Many authors (e.g. Lin and Chang, 2009) have expressed dissatisfaction with the theory of comparative advantage on the grounds that it does not capture important dynamics (such as those related to the process of structural transformation) that are crucial to understanding the process of development. Moreover, a number of authors have argued that a country’s comparative advantage is not static (or given), but that it evolves over time, i.e. is endogenous (Amsden, 1989; Grossman and Helpman, 1991; Krugman, 1987; Redding, 1999). This has resulted in the concept of “dynamic comparative advantage”. Although there is no agreed-upon definition, dynamic comparative advantage refers to advantages that an economy can potentially achieve (and, arguably, should seek) in the long run. Dynamic comparative advantage might arise from learning by doing, adoption of technologies, or, more generally, technological change. Based on dynamic comparative advantage, if an economy produces a good for which it does not have a static comparative advantage, with time it might eventually gain a dynamic comparative advantage because domestic firms would be able to reduce production costs and become more competitive on global markets, thanks to technological change. This concept has critical policy implications. By opening to international trade, developing economies might be led to shift their resources from industries with a potential dynamic comparative advantage back to industries with a static comparative advantage (e.g. due to stronger international competition). If these economies are to produce goods in which they are not yet internationally competitive, they would need industrial policy to help the economy achieve and exploit dynamic comparative advantages (see Module 2 of this teaching material).

Somewhat related to this concept is the concept of “latent comparative advantage” introduced by Justin Lin in various publications (Lin and Monga, 2010; Lin, 2011). This refers to the comparative advantage that an economy has in a certain good, but fails to realize due to high transaction costs related to logistics, transportations, infrastructure, institutional obstacles, and, in general, difficulty in doing business. To identify latent comparative advantage, Lin and Monga (2010) propose to look at the goods produced for 20 years in growing economies with similar endowments and a per capita income that is 100 per cent higher than in the economy that is being analysed. Among these goods, one may give priority to those with existing domestic production. Government should support structural transformation by identifying and removing the constraints limiting competitiveness in these industries. If there are no firms producing these goods in the economy, a range of interventions, such as attracting foreign direct investment and cluster development, can help trigger structural transformation.

Source: Authors.

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2.2 **Measures of structural transformation**

The two most evident (and used) measures of structural transformation are employment shares and value-added shares of sectors in total employment and total value added (where the degree of data disaggregation depends on the research question and data availability). Employment shares are calculated using the number of workers or hours worked by sector. Value-added shares are commonly expressed in current prices (“nominal shares”), but they may also be expressed in constant prices (“real shares”). Export shares by sector as percentages of GDP can also be used to measure structural transformation. Box 3 offers additional information on how these measures are computed. The details presented therein are of particular importance because, when doing quantitative work, one needs to be well aware of the distinctions between the different measures of structural transformation.
Box 3

Sectoral composition of employment and output

The structure of an economy consists of many components and is therefore described by many variables. To get an initial idea of the structural characteristics of a particular economy, researchers begin by examining the distribution of employment and output, or value added, across sectors. To this end, they compute the share of employment and value added for each sector of the economy. The level of disaggregation (i.e. the number of sectors included in the analysis) depends on the research question being asked as well as on the availability of data.

Assume that the researcher is interested in a level of disaggregation that divides the economy into n sectors. Total employment and output can then be calculated by summing up the number of workers in each sector. Similarly, total nominal value added is calculated by summing up the nominal value added created in each sector. Formally we write total employment, $\lambda$, and total value added, $\theta$, as:

$$\lambda = \sum_{i=1}^{n} \lambda_i, \quad \theta = \sum_{i=1}^{n} \theta_i$$

where $\lambda_i$ stands for employment or number of workers in sector $i$, and $\theta_i$ stands for nominal value added in sector $i$.

The distribution of employment and value added by sector is obtained by dividing these expressions by total employment and output, respectively:

$$\lambda_i = \frac{\lambda_i}{\lambda}, \quad \theta_i = \frac{\theta_i}{\theta}$$

where $\lambda_i$ and $\theta_i$ are the shares of sector $i$ in total employment and value added. Note that the sum of the shares must add up to unity. This is what we expect, of course, since total employment, for example, is nothing else than the sum of its components.

The data needed to calculate the distribution of output and employment by sector and other structural indicators can be found at:

- The United Nations National Accounts website (http://unstats.un.org/unsd/snaama/Introduction.asp) which offers access to comprehensive datasets on GDP, also disaggregated by economic activities; and

Source: Authors.

Employment and value-added shares also have limitations as singular measures. Employment shares may not adequately reflect changes in “true” labour input, for example because there might be differences in hours worked or in human capital per worker across sectors that vary with the level of development. Value-added shares do not distinguish between changes in quantities and prices. Finally, note that the sectoral composition of employment and output, and economy-wide and sectoral labour productivity, are closely interconnected. Labour productivity in a sector with a share of employment larger than its share of total output is below the average labour productivity in the economy and vice versa.

2.3 Global trends in structural transformation

This section presents some stylized facts on structural transformation. Ideally, since structural transformation is a continuous process, we should examine changes for individual countries over long periods of time, making use of long-time data series. However, the scarcity of data restricts the set of countries that can be studied over the long term to those that are currently fully developed. This, in turn, leaves open an essential question: why should we expect economies that are currently less advanced to present the same regularities that developed economies displayed at a lower level of development a century or two ago? Limiting attention to long-time data series has the additional disadvantage that these data typically are not of the same quality as the standard datasets for recent years. In this teaching material, we will therefore document the regularities of structural transformation employing both historical data for developed economies and more recent data that cover a much larger group of countries.
2.3.1 Historical evidence for today’s advanced economies

The pattern of economic development in the current advanced economies has been characterized by a shift away from agriculture towards manufacturing and services. Both labour and capital have constantly moved from agriculture into more dynamic activities. In the process, informal self-occupation declined in favour of formal wage employment. In order to illustrate this pattern of transformation we use data on sectoral employment and value-added shares over the 19th and 20th centuries for ten developed economies constructed by Herrendorf et al. (2013). These time series are reported in Figure 5. The vertical axes represent the share of employment (left panel) and the share of value added in current prices (right panel) in agriculture, manufacturing, and services. On the horizontal axes, there is the log of GDP per capita in 1990 international dollars, as reported in Maddison (2010).

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In the Maddison database, international dollars are computed using the Geary-Khamis method. This is a method to convert values in international PPP values. The international dollar is a hypothetical unit of currency that has the same purchasing parity power of the US dollar in the United States in 1990.
Over the last two centuries, economic growth has been associated with declining employment and nominal value-added shares of agriculture offset by the rise of services. Employment and valued-added shares of manufacturing followed a hump shape, that is, they increased at lower levels of GDP per capita, reached a peak at medium levels of GDP per capita, and decreased thereafter. Figure 5 reveals two additional empirical regularities. First, at low income levels, the employment share of agriculture remains considerably above the value-added share of the sector. This means that poor countries tend to display an employment structure biased towards agriculture despite its low productivity. Second, both employment and nominal value-added shares of the services sector remain significantly far from zero all along the development process. There is, however, an acceleration in the rate of increase of the value-added share of services at a GDP per capita of approximately $8,100. Interestingly, the value-added share for manufacturing peaks at around the same income level, suggesting that the services sector progressively replaces manufacturing as the main engine of growth at middle-income levels.

2.3.2 Recent evidence for developed and developing economies

As mentioned earlier, using historical data limits the analysis to industrialized economies. We therefore need to verify whether the structural transformation regularities described above can be extended to developing countries. Herrendorf et al. (2013) use the World Bank’s World Development Indicators (WDI) for employment by sector, and the national accounts of the United Nations Statistics Division for value added by sector. The coverage of these two datasets is large: they both include most of today’s developed and developing economies. Figure 6 plots the sectoral employment shares from the WDI against the log of income per capita. The plots confirm the regularities discussed above: first, agricultural employment shares decrease with income, while employment in services monotonically increases; and second, manufacturing shares of employment follow an inverse U-shaped pattern. The decline in agricultural employment has many implications for an economy, two of which are relevant to this discussion. First, as labour moves from low-productivity agriculture to higher-productivity activities, average productivity in the economy increases. Second, the higher incomes that are a by-product of this structural transformation create additional demand for both manufactured goods and services. This demand provides scope for the expansion of manufacturing and services.

Figure 6 also confirms that the employment share of manufacturing increases until it reaches a certain threshold of about 30 per cent of total employment. From there it flattens out and then begins to decrease. While this is consistent with the pattern described previously, the downward sloping part is less pronounced in Figure 6 than in Figure 5. The relatively lower peak of 30 per cent, compared to the previous 40 per cent for industrialized countries (see Figure 5), indicates a shift in recent patterns of industrialization for both developed and developing countries towards lower peaks of manufacturing employment in total employment. This observation has led some to question the role of manufacturing as a modern engine of economic growth in developing countries (see Section 3.3). Indeed, Figure 6 also shows the existence of a strong positive relationship between the share of employment in services and per capita income.

Rodrik (2009) also finds an inverted-U relation between the share of the manufacturing sector in overall output and employment and income per capita (see Section 3.2.1).
Figure 7 shows value-added shares in agriculture, manufacturing, and services against GDP per capita. It confirms the same patterns documented above and adds a few interesting insights. First, the hump shape for manufacturing emerges more clearly when value added is used as a measure of structural transformation. Second, the line representing the trend of the services share becomes steeper and the share of manufacturing value added peaks at the same time, when the log of GDP per capita reaches a threshold value around 9, i.e. at a GDP per capita of approximately $8,100. Beyond this level of income per capita, the relative contribution of manufacturing to output and employment becomes smaller and services turn out to be increasingly important. This matches the historical experience of industrialized countries shown in Figure 5.
2.3.3 Trends of deindustrialization and premature deindustrialization

Following what we have explained so far, we would expect countries to deindustrialize (i.e. to see their shares of manufacturing in employment and value added decrease) after they reach a certain level of income per capita. This section provides further empirical evidence on the deindustrialization trends described in Section 2.3. Figure 8 shows the evolution of the share of manufacturing value added in GDP from 1962 to 2012 as the world average, the average for advanced countries, and the average for developing countries. Data show that as a whole, the world deindustrialized over these five decades. This was driven not only by the advanced nations but by developing countries that also deindustrialized, especially since the 1990s.
Table 1 presents data on value-added shares of agriculture, industry, manufacturing (which is also included in industry), and services in GDP for 29 developing economies. From there, we can take a few illustrative examples to characterize the industrialization trends in the last six decades. In 1950, Argentina, Brazil, and other Latin American economies, together with some African countries such as South Africa and Morocco, were among the most industrialized economies in the developing world. Their shares of manufacturing in GDP were higher than in economies such as the Republic of Korea. By 1980, most of these economies had further expanded their manufacturing industries, and were joined by other economies such as the United Republic of Tanzania and Zambia. By 2005, however, the situation had changed dramatically: most of these economies that had become more industrialized between 1950 and 1980 had gone back to the industrialization levels of the 1950s. In other words, these economies had deindustrialized. The services sector benefited from this process, with its share in value added growing from 45 to 67 per cent in South Africa, and from 45 to 64 per cent in Brazil. These trends do not only apply to all the 29 selected economies. At the bottom of Table 1, we report averages for Africa, Asia, Latin America, developing economies, and 16 advanced economies. These averages show that while in Asian countries shares of manufacturing in value added consistently increased over recent decades, Latin American and African countries embarked on a deindustrialization process similar to those experienced by advanced economies.

For the African case, see also UNCTAD (2011a).
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To conclude, while deindustrialization historically happened after countries had fully developed, today economies deindustrialize at lower income levels. Various studies (Felipe et al., 2014; Palma, 2005; Rodrik, 2016; UNCTAD, 2003a) show that in recent decades the shares of manufacturing employment and value added peaked and began to decrease at lower levels of GDP per capita than in the past. In the literature, this phenomenon has been referred to as “premature deindustrialization”, an expression originally coined by UNCTAD (2003a). Section 3.3 will delve deeper into the literature on premature deindustrialization in relation to the rise of services as a new, or additional, engine of economic growth.

2.4 Structural transformation and economic growth

As labour shifts from lower- to higher-productivity sectors, value added increases (static gains) and rapid technological change further boosts economic growth (dynamic gains). This explains why structural transformation is associated with faster economic growth. This section explores the relationship between GDP growth and changes in employment shares of agriculture, industry, and services. Figures 9–11 present scatter plots of annual growth rates of value added per capita against changes in employment in agriculture, industry, and services, respectively.

First, larger reductions in agricultural employment are associated with faster economic growth. Confirming the empirical evidence presented in Section 2.3.3, employment in industry increased the most in Asian countries, ranging between 14 and 26 percentage points were associated with rates of output growth of around 6 per cent. By contrast, sub-Saharan and Northern African countries reduced their agricultural employment by less than five percentage points and their incomes grew at rates between 3.6 and 4.4 per cent.

Second, growing shares of industrial employment are associated with faster economic growth. Confirming the empirical evidence presented in Section 2.3.3, employment in industry increased the most in Asian countries, ranging between 8.5 and 6.3 percentage points. Economies in Latin America and Northern and sub-Saharan Africa, on the other hand, experienced little structural transformation towards industry. Advanced economies and former Soviet Union countries deindustrialized, with modest rates of GDP growth. This possibly reflects the tendency of high-income economies to deindustrialize (see Section 2.3.1) and country-specific as well as glob-
al issues, ranging from the global financial crisis to the rise of modern knowledge services.

Finally, as shown in Figure 11, there does not seem to be a strong relationship between changes in service employment and GDP growth. This result might be related to the heterogeneous nature of the services sector, composed of low-productivity services (non-tradable services) and high-productivity services (tradable services), as depicted in Figure 3. Structural change in favour of low-productivity rather than high-productivity services – as has occurred in many developing economies since the 1990s – is likely to be weakly associated with economic growth.

Source: Authors’ elaboration based on the International Labour Organization’s Global Employment Trends dataset (see Box 3) and World Bank’s World Development Indicators.

Note: ADV: Advanced economies; CEA: Central and Southeastern Europe (non-EU) and Commonwealth of Independent States; EA: East Asia; SEA: Southeast Asia and the Pacific; SA: South Asia; LAC: Latin America and the Caribbean; ME: Middle East; NA: North Africa; SSA: sub-Saharan Africa.

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Structural changes in the composition of employment in agriculture and annual growth rates of GDP per capita, 1991–2012 (per cent and percentage points)

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Structural changes in the composition of employment in industry and annual growth rates of GDP per capita, 1991–2012 (per cent and percentage points)
Because industry includes manufacturing, mining, utilities, and construction, which are very different in terms of their labour productivity and capacity to absorb labour (see Figure 3), we analyse more disaggregated data in order to look at the relationship between economic growth and manufacturing. Data on manufacturing shares in employment, however, are less widely available than data on manufacturing value-added shares; we therefore use shares of manufacturing value added in GDP. Figure 12 depicts the correlation between GDP per capita growth and growth of the share of manufacturing in value added. The figure clearly shows that increasing shares of manufacturing value added in GDP are associated with faster rates of GDP per capita growth, with South Asia and Southeast Asia leading in terms of manufacturing value-added growth. Surprisingly, the correlation between the share of manufacturing in GDP and economic growth is lower than the correlation between the share of employment in industry and economic growth (0.59 versus 0.95). The literature has found that manufacturing employment is a much better predictor of economic growth than manufacturing output (Felipe et al., 2014; Rodrik, 2016). This is because it is through employment creation that manufacturing can spur economic growth (see Sections 3.3 and 4.1 for a discussion). Following this insight, we could expect a higher correlation between manufacturing employment and economic growth than the one observed between manufacturing output and economic growth.

Source: Authors’ elaboration based on the International Labour Organization’s Global Employment Trends data (see Box 3) and World Bank’s World Development Indicators.
Note: ADV: Advanced economies; CEA: Central and Southeastern Europe (non-EU) and Commonwealth of Independent States; EA: East Asia; SEA: Southeast Asia and the Pacific; SA: South Asia; LAC: Latin America and the Caribbean; ME: Middle East; NA: North Africa; SSA: sub-Saharan Africa.
The characteristics of manufacturing discussed in the previous section explain why, ever since the Industrial Revolution, rapid economic growth has been associated with growth of manufacturing. After the United Kingdom, Germany and other European countries, the United States, and Japan caught up by industrializing. Since the Second World War, there have been two waves of catch-up, both based on manufacturing growth: in the peripheral European countries (namely, Austria, Finland, Greece, Ireland, Portugal, and Spain) during the 1950s and 1960s; and in East Asia during the 1970s and 1980s. Today, the People’s Republic of China, Malaysia, Thailand, and Viet Nam seem to be on a similar path. These phenomena, and more specifically the structural transformation process that is behind them, have attracted the attention of many scholars from early development economists until today. This section reviews the theoretical and empirical literature on structural transformation.

3.1 Structural transformation in development theories

Sustained economic growth underpinned by continuous technological progress is a phenomenon linked to the Industrial Revolution. Most economists in the classical tradition, from Adam Smith up to the early 20th century, believed that laissez-faire economics should be pursued to achieve sustained economic growth. Markets would be able to allocate resources efficiently and maximize an economy’s growth potential. In this framework, the price system would determine what is produced and how, and structural transformation would take place automatically as the economy expands and markets reallocate factors of production to more productive sectors that offer better returns. This approach represented the dominant intellectual framework in the 18th and 19th centuries. Among other things, however, it did not take into account the key role of technological change and industrial upgrading in sustaining economic growth. It is precisely the continuous process of technological change that distinguishes modern (fast) economic growth from pre-modern (slow) dynamics.

More recent approaches to the study of economic development recognize this important shortcoming and propose different theoretical perspectives to deal with it. They proceed on two related but separate tracks: growth theories mostly related to the neoclassical tradition, and development theories related to the structuralist tradition. A third track, known as “new structuralist economics”, emerged in the late decade and aimed at reconciling the two schools of thought (see Section 3.1.3.1).

3.1.1 The neoclassical growth models

Some of the key elements of the first track can be found in the work of classical economists (Ramsey, 1928; Schumpeter, 1934), but systematic modelling only started in the second half of the 20th century, when the first growth models based on aggregate...
production functions were developed. Building on the seminal work of Harrod (1939) and Domar (1946), Robert Solow’s influential one-sector growth model gave rise to the first wave of growth analysis in the neoclassical tradition (Solow, 1956).

These models rest on a number of critical assumptions:

- Production technologies are represented by aggregate production functions (see Box 1). Because production functions are aggregate, the implicit assumption of these models is that all firms and industries use the same technology.
- Production exhibits constant returns to scale, i.e. economies of scale are considered negligible.
- Markets are assumed to be perfectly competitive.
- Technological change is assumed to be “neutral”, meaning that technological change improves the productivity of labour and capital equally.

Because of its minimalist structure, the Solow-type, one-sector model necessarily abstracts from several features of the process of economic growth. One of these is the process of structural transformation. Another is that technological progress is kept exogenous and outside of the model. The more recent endogenous growth models propose extensions of the one-sector framework that are consistent with the stylized facts of structural transformation and try to understand why technological diffusion takes place in some countries but not in others, and how it generates changes in the shares of output and employment. In these models, the technological process is treated as a lottery in which the prize is a successful innovation. More tickets of the lottery can be acquired by investing more in research and development (R&D). Technology is considered a public good, which creates opportunities for technological spillovers and ultimately leads to increasing returns to scale at the aggregate level (Acemoglu et al. 2001; Aghion and Howitt, 1992; Glaeser and Shleifer, 2002; Jones, 1998; Romer, 1987; 1990). Despite the advances that these models introduce in terms of considering the complex processes of technological change, some scholars have criticized them for not being realistic enough and not properly reflecting the complexity of the issues at stake (Dosi, 1982; Freeman and Louça, 2001; Malerba et al., 1999; Nelson and Winter, 1982; Silverberg, 2001; Silverberg and Verspagen, 1994; see also Section 3.1.3.3 in this module).

With regard to development theories that focused directly on the specific economic challenges facing poorer and more vulnerable economies, structuralist economics was the first school of thought to propose a detailed analytical investigation of the relationship between changes in the production structure and economic growth. The next section delves deeper into this strand of the literature.

3.1.2 The structuralist approach

The contribution of the structuralist school to development economics started in the 1940s and 1950s. It builds on the idea that the virtuous circle of economic development depends on structural transformation. As Kuznets (1979: 130) wrote: “It is impossible to attain high rates of growth of per capita or per worker product without commensurate substantial shifts in the shares of various sectors.” The seminal work of Rosenstein-Rodan (1943) paved the way to a rich strand of research from Chang (1949) to Nurkse (1953), Lewis (1954), Myrdal (1957), and Hirschman (1958) that came to be known as the structuralist approach to economic development. This approach is based on the following key assumptions:

Economic growth is a path-dependent process:
The knowledge accumulated during the production process gives rise to dynamic economies of scale and externalities that lead to further economic growth and development. In this sense, initial production experiences have cumulative effects on the economy, as firms learn how to produce better quality goods or how to produce goods at lower average costs.

Developing economies are characterized by structural heterogeneity:
This means that in these economies, modern economic activities that are highly productive and use state-of-the-art technologies coexist with traditional economic activities with low productivity and high informality. Models of dual economies illustrated this situation, with the best examples being those of Lewis (1954) and Ranis and Fei (1961). In these models, it is the reallocation of labour from traditional to modern activities that drives economic growth.

Modern economic activities are generally urban manufacturing activities: A long tradition in the literature has seen manufacturing as an engine of economic growth. In his seminal works, Nicholas Kaldor (1957, 1966) identifies some empirical regularities, later known as Kaldor’s laws, about economic development and structural transformation.

10 Emerging economies in East Asia are telling examples in this regard. Their success originates in a set of economic policies (see Module 2 of this teaching material) that in the long run have allowed firms to accumulate experience in producing manufactures and engage in a circular process of learning and rising competitiveness. The opposite dynamics can also occur. According to Easterly (2000), adverse shocks that affect economic activity in the short run, such as the debt crises of 1980s in Africa and Latin America, can have long-term negative effects on the growth of an economy.

11 For a review of these models, see Temple (2005) and Ranis (2012).
The structural transformation process: trends, theory, and empirical findings

The faster the growth rate of manufacturing output, the faster the growth rate of GDP;
• The faster the growth rate of manufacturing output, the faster the growth rate of labour productivity in manufacturing; and
• The faster the growth rate of manufacturing output, the faster the growth rate of aggregate labour productivity.

What is so special about manufacturing? The literature has provided several (complementary) answers to this question.

First, manufacturing generates static and dynamic increasing returns to scale. Large production scales reduce firms’ costs, specialization allows for a finer division of labour, and with accumulated production firms learn to produce more efficiently (Kaldor, 1966; Verdoorn, 1949).

The role of increasing returns was formalized in the Verdoorn law that postulates that growth of output is positively related with productivity growth (Verdoorn, 1949). This relies on the interaction between economies of scale at the firm level and the size of the market: only a large enough market would allow higher productivity to compensate for higher wages and therefore generate the conditions for modern methods of production to replace traditional ones (Rosenstein-Rodan, 1943). The market dimension itself, however, depends on the extent to which these modern techniques are adopted (Young, 1928).

The process of development will therefore be sustainable if modernization starts on a large scale from the outset. The market dimension is important in the structuralist literature, which maintained that production growth cannot be sustained without buoyant aggregate demand. When demand is insufficient, existing resources will be underutilized, which will hinder structural transformation. Strong growth of demand therefore becomes a necessary condition for overall economic growth (Kaldor, 1957, 1966; Taylor, 1991).

Second, manufacturing provides opportunities for capital accumulation. Manufacturing is more capital-intensive than agriculture and services (Chenery et al., 1986; Hoffman, 1958). Szirmai (2012) collects data on capital intensity in agriculture and manufacturing from 1970 to 2000. He shows that manufacturing was the most R&D-intensive sector, as well as in some branches of modern agriculture that have become more capital-intensive and knowledge-based (see, for example, the application of biotechnology and bioengineering in agriculture or the application of ICT in services). Lavopa and Szirmai (2012) collect data on R&D expenditures in 2008 by 36 advanced economies, distinguishing between the major sectors in the economy (agriculture, manufacturing, mining, construction and utilities, and services). The data show that manufacturing was the most R&D-intensive industry in these economies, spending up to 6.5 percentage points more of its value added on R&D than services or agriculture.

Fourth, manufacturing has stronger linkages to the rest of the economy. Manufactured goods are not only sold to final consumers but also widely used in the other sectors, creating complementarities, or linkages, between various industries (Cornwall, 1977; Hirschman, 1958; Nurkse, 1953; Rosenstein-Rodan, 1943). Hirschman (1958) identifies two types of linkages: backward linkages, which occur when an industry needs inputs that can be sourced within the economy (e.g. production of cars might induce investment in the production of steel); and forward linkages, which occur when investment in an industry induces investment in downstream industries that use the output of the upstream industry (using the previous example, production of steel can stimulate the emergence of an automobile industry). Thanks to these linkages, knowledge and technological advances that occur in manufacturing can spill over to other sectors, benefiting the whole economy. This however depends on the strength and importance of the linkages. For example, an industry might be very connected to another, constituting a strong linkage, but this other industry might add little value to the economy. The notions and indicators of forward and backward linkages have been used to identify key sectors in the economy and to inspire industrial policy.

Fifth, manufacturing has both price and income elasticity advantages. According to Engel’s law of demand, as the economy grows, individuals demand more of a good, or a service, as its price changes (price elasticity), or as the average income in the society changes (income elasticity).
(Engel, 1857), the lower the per capita income of a country, the larger the proportion of income spent on agricultural products. As income increases, demand shifts from agricultural to manufactured goods, stimulating manufacturing production. In addition, the price and income elasticity of demand is relatively higher in manufacturing than in other sectors, giving manufacturing an additional advantage. Higher demand for manufactured goods also creates demand for the intermediate inputs and capital goods necessary to produce consumer goods, thus further spurring output in manufacturing. If a country successfully industrializes, the higher demand for manufactured goods can be satisfied domestically. However, if an economy does not industrialize, it will need to import manufactured goods. Given the high price and income elasticity of manufacturing, imports of manufactured goods can lead to shortages of foreign exchange and balance of payment problems (Chenery et al., 1985; see also the insights about Latin American structuralism presented later in this section).

What about the services sector? It was clear dating back to Kaldor (1968) that the services sector is composed of two types of services: traditional services and services related to industrial activities. The latter complement manufacturing activities and are therefore expected to grow as a result of the expansion of these activities. It was also noted that the development process is generally accompanied by a shift of labour towards services, where there are lower productivity gains than in industry. This referred to as cost disease or the structural burden hypothesis (Baumol, 1967; Baumol et al., 1985; see also Box 1).

Observing these empirical regularities and taking stock of this literature, Cornwall (1977) described the role of manufacturing in economic growth through a simple model. The Cornwall model, also known as the engine of growth hypothesis model, assumes that the growth rate of manufacturing and that of the overall economy are mutually reinforcing. This is expressed through the following equations:

\[ Q_m = g_m + g_q + g_q + g_q + g_q, \]  
\[ Q = e + e Q_m. \]

The first equation explains the growth rate of output in manufacturing \((Q_m)\) and the second the growth rate of output in the economy \((Q)\). Economic growth (i.e. the growth rate of output in the economy) depends on the growth rate of output in the manufacturing industry \((Q_m)\), hence \(e\) measures the power of manufacturing as an engine of economic growth. The growth rate of manufacturing output, in turn, depends on the growth rate of total output in the economy \((Q)\) and income levels \((g_q)\). A measure of backwardness, income relative to the most developed economy \((g_q)\), is also introduced to account for convergence. In order to account for countries’ efforts to import or develop technologies, the original Cornwall model also included investments \((I/Q)\). This model became the basis for a prolific empirical literature that tested the hypothesis that manufacturing is the engine of economic growth in an economy (see Section 3.2.1).

Within the structuralist tradition, it is important to distinguish the Latin American structuralist school, whose genesis can be found in the work of Raúl Prebisch (1950). Prebisch suggested that by specializing in commodities and resource-intensive industries where many of them have a comparative advantage, developing countries could lose their chances of industrializing. This direction of structural transformation would in fact make their terms of trade decline, thereby exacerbating the balance-of-payments constraint on economic growth. Such dependence would also lead their exchange rates to cyclically appreciate due to commodity prices booms. This situation would create debt crises and erode industrial competitiveness, ultimately destroying domestic manufacturing industries.

While these theories were inspired by the structural change dynamics of Latin American countries, the issues related to the abundance of natural resources are relevant for countries in other regions as well (see Section 3.1.3.5). Even if many developing countries would tend to specialize in resource-intensive industries because that is where their comparative advantage lies, comparative advantage is also partly the result of policy decisions and strategies, as discussed in Box 2. For example, Brazil experienced significant growth-promoting structural change throughout the 1970s, diversifying away from natural resources. As defended in the structuralist and Latin American structuralist literature, exchange rate, industrial, and trade policies play an important role in promoting productive structural transformation. These policies are the subject of Module 2 of this teaching material.

Today, due to the increased participation of developing countries in manufactured exports, the debate over the terms of trade has shifted from the comparison between developed and developing countries’ terms of trade to the comparison between prices of manufacturing exports from developing countries and prices of manu-
facturing exports from developed countries. In particular, the debate focuses on the types of manufacturing goods produced by developed and developing countries. The types of goods depend on countries’ capabilities, labour market institutions, and the presence or absence of surplus labour. In this debate, it is noted that the types of manufacturing goods exported today by developing economies share some of the disadvantages of the commodities that were the object of the Prebisch hypothesis (UNCTAD, 2002, 2005). Empirical research showed that since the mid-1970s, there has been a downward trend in the terms of trade of manufactures produced by developing countries compared to those produced by developed economies (Maizels, 2000; Minford et al., 1997; Rowthorn, 1997; Sarkar and Singer, 1991; Zheng and Zhao, 2002). More precisely, developing economies that specialized in low-tech, low-skill-intensive manufactures faced declining terms of trade, while those that managed to upgrade their exports into high-tech, high-skill-intensive manufactures could improve their terms of trade. This result implies that an export-oriented diversification strategy towards manufacturing does not necessarily solve the terms-of-trade issue noted by Prebisch, which in turn emphasizes the increasing role of upgrading and technological change.

3.1.3 The revival of the debate on structural transformation since the mid-2000s

The interest in structural transformation progressively diminished in the 1980s and 1990s, mainly due to the prevalence in both academic and policy circles of views and prescriptions related to the Washington Consensus (see Module 2 of this teaching material for a more detailed treatment of this issue). However, since the early 2000s, the topic has come back into the spotlight, thanks to the mixed results of the policies inspired by the Washington Consensus in terms of economic and social performance (Priewe, 2015). Five new strands of literature contributed most to the revival of this debate: (a) the new structural economics literature; (b) the new Latin American structuralism; (c) Schumpeterian, or evolutionary, economics; (d) the global value chain literature; and (e) the literature on resource-based industrialization.

3.1.3.1 New structural economics literature

Ideas rooted in both neoclassical and structuralist traditions have been revived by the new structural economics. Along the lines of the structuralist perspective, this strand of literature recognizes the importance of changes in the productive structure for economic development. More in line with the tradition of neoclassical trade models, it also postulates that these structural changes should rely on firms specializing in industries consistent with comparative advantages determined by factor endowments (Lin, 2011; Lin and Treichel, 2014). According to this approach, firms would move up the industrial ladder and become progressively more competitive in more capital- and skill-intensive products. This in turn would lead to an upgrade of the overall economy’s factor endowment and industrial structure (Ju et al., 2009). This comparative-advantage approach can however be excessively slow in countries with serious poverty problems. According to the critics of the new structural economics literature, conforming too much to the current factor endowments may not actually lead to structural change and industrial upgrading, but rather actually limit a country’s development potential (Lin and Chang, 2009). These critics, mostly from the structuralist tradition, argue that structural transformation can be achieved by acquiring new types of capacity, i.e. by undertaking new productive activities in strategic industries even before the “right” factor endowments are in place.

3.1.3.2 The new Latin American structuralism

Latin American structuralism has also seen a revival in recent decades, with two strands emerging. One focuses on a key development variable in the Latin American structuralist literature, the exchange rate (Bresser-Pereira, 2012; Ocampo, 2014; Ocampo et al., 2009). The other combines the structuralist and Schumpeterian approaches and focuses on the role of structural transformation and technological progress. It shows how productive heterogeneity and the direction of structural transformation that prevailed in recent decades hampered technological change and development. More specifically, according to this strand of literature, Latin American economies are characterized by strong heterogeneity, resource-based industries are highly productive and technologically advanced, whereas manufacturing industries are less productive and advanced. Structural transformation favoring resource-based industries at the expense of manufacturing industries halted industrialization and slowed technological change, learning, and accumulation of capabilities. This could have made manufacturing firms more competitive, thereby spurring shared economic growth and lifting people out of poverty (Cimoli, 2005; Katz, 2000). These strands do not contradict each other, as shown, for example, in the work of Ocampo (2005) and Astorga et al. (2014).
3.1.3.3 Schumpeterian, or evolutionary, economics

Another strand of literature that contributed to the analysis of structural change is the Schumpeterian or evolutionary economics school. Authors in this tradition include Nelson and Winter (1982) and Dosi et al. (2000) (see also Lal, 1992). These authors focus on the role of innovation and analyse how capabilities affect learning and development. The evolutionary approach to structural change relies on the idea that the scope for technological change varies substantially across industries, and that the speed of technological progress thus crucially depends on the dynamics of structural transformation in an economy (Dosi et al., 1990). In contrast to the new structural economics, the evolutionary school of thought argues that comparative advantages are not endowed but rather created. Production and endowment structures (and hence a country’s comparative advantage) are shaped by learning and innovation. In the same vein as old structuralists, evolutionary economists emphasize that successful economies that have relied on government interventions have managed to move production structures towards more dynamic activities, characterized by economies of scale, steep learning curves, rapid technological progress, high productivity growth, and high wages (Salazar-Xirinachs et al., 2014).

3.1.3.4 The value-chain literature

The debate on structural transformation has also been revived by the observation that production today is globally fragmented, giving rise to global value chains (GVCs). The concept of value chains describes the full range of activities that firms and workers perform to bring a product from its conception to final use (Gereffi and Fernandez-Stark, 2011). The GVC of a final product can be defined as “the value added of all activities that are directly and indirectly needed to produce it” (Timmer et al., 2014a: 100). The emergence of GVCs means that production is increasingly taking place within global production networks and consequently is fragmented across countries, rather than occurring in a single country or a single firm as was previously the case. Countries increasingly participate in international trade by specializing in one or a few tasks of a value chain, rather than specializing in producing one good. This means that instead of mastering a whole production process, countries need to master one or a few stages of production of a certain product to be part of global trade (Baldwin, 2012). While some countries specialize in the design and prototype of the product, others produce inputs and components, while yet others specialize in assembling the final product. These activities are not all alike: for example, design is more skill- and R&D-intensive, while assembling is more labour-intensive. Because prices of various types of labour and capital vary, tasks in which countries specialize define the share of value that countries add, and consequently the income and employment generated through those tasks. Hence, whether a country supplies critical high-tech components or is responsible for assembly makes a huge difference for structural transformation and development (Milberg et al., 2014; UNCTAD, 1996, 1999, 2002, 2006a, 2006b, 2013a, 2015a).

Given the pervasiveness of global value chains, it is worthwhile to look at structural transformation and development in light of this new phenomenon and reflect on the implications such production fragmentation has for the process of transformation and development. Table 2 highlights the implications of GVCs for five impact areas relevant for developing countries: (a) local value capture; (b) upgrading and building long-term productive capabilities; (c) technology dissemination and skill-building; (d) social and environmental impact; and (e) job creation, income generation, and quality of employment (see Module 2 of this teaching material for the policy implications of this discussion).
Local value capture

- Participation in a GVC can generate value added in domestic economies and contribute to faster GDP growth if developing countries manage to gradually move up the value chain (e.g. from raw coffee to roasted coffee to processed coffee). Such opportunities exist because firms previously located in a single country now outsource certain activities to developing countries with relatively lower labour costs.
- Concerns exist that the value-added contribution of GVCs is often limited where imported contents of exports are high and where GVC participation is limited to a small or lower value part of the overall GVC or end-product.
- Transnational corporations and their affiliates can provide opportunities for local firms to participate in GVCs, generating additional value added through local sourcing, which often takes place through non-equity relationships.
- A large part of GVC value added in developing economies is generated by affiliates of transnational corporations. This raises concerns that value can be leaked, e.g. via transfer price manipulation. Also, part of the earnings of affiliates will be repatriated, with possible effects on the balance of payments, although evidence shows that these effects are limited in most cases. More broadly, the leakage of value is a critical issue for developing countries, as such value cannot be channeled into other sectors or used for a country’s general development.

Upgrading and building long-term productive capabilities

- GVCs can offer longer-term development opportunities if local firms manage to upgrade to activities with higher value added in those chains.
- Some forms of GVC participation can cause long-term dependency on a narrow technology base and on access to GVCs governed by transnational corporations and involving activities with limited value added.
- The capacity of local firms to avoid such dependency and the potential for them to upgrade depends on the value chain in which they are engaged, the nature of inter-firm relationships, absorptive capacity, and the local business environment. That is, firms that operate in value chains that have limited scope for upgrading will have to move to other value chains that have such scope.
- At the country level, successful GVC upgrading paths involve not only growing participation in GVCs but also the creation of higher domestic value added and the gradual expansion of participation in GVCs with increasing technological sophistication.

Technology dissemination and skill-building

- Knowledge transfer from transnational corporations to local firms operating in GVCs depends on the complexity and codifiability of the knowledge involved, the nature of inter-firm relationships and value chain governance, and absorptive capacity of the firms in developing countries. Thus, if the knowledge that the domestic firm wants to retrieve from the transnational corporation is complex and not codified (e.g. written down), it may be difficult to acquire and adapt such knowledge in the domestic context. Whether the transnational corporation is willing to share knowledge or skills also affects the potential for technology dissemination. Lastly, the firm in the developing country should have the capabilities in house to use such knowledge (e.g. sufficient engineers who can adapt technology to the firm’s context).
- GVCs can also act as barriers to learning for local firms, or limit learning opportunities to a few firms. Local firms can also remain locked into low-technology (and low-value-added) activities, without being able to upgrade.

Social and environmental impact

- GVCs can serve as a mechanism to transfer international best practices in social and environmental efforts, e.g. through the use of corporate social responsibility standards and other standards with which firms need to comply when participating in GVCs. Firms can learn from such standards, improving the quality of their products and processes.
- Working conditions and compliance with applicable standards in firms supplying GVCs have been a source of concern when GVCs are based on low-cost labour in countries with relatively weak regulatory environments. Effects on working conditions can be positive within transnational corporations or their key contractors when they apply harmonized human resource practices, use regular workers, comply with applicable corporate social responsibility standards, and mitigate risks associated with cyclical changes in demand.

Job creation, income generation, and employment quality

- GVC participation tends to lead to job creation in developing countries and higher employment growth, even if that participation depends on imported contents in exports (e.g. assembly of imported goods for export).
- GVC participation can lead to increases in both skilled and unskilled employment. The skill levels generated vary with the value added of activities in which foreign firms are involved.
- Stability of employment in GVCs can be relatively low because oscillations in demand are reinforced along value chains, although firm relationships in GVCs can also enhance continuity of demand and employment.

Table 2

<table>
<thead>
<tr>
<th>Impact areas</th>
<th>Highlights of findings</th>
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<tbody>
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</tr>
<tr>
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<td>GVC participation tends to lead to job creation in developing countries and higher employment growth, even if that participation depends on imported contents in exports (e.g. assembly of imported goods for export). GVC participation can lead to increases in both skilled and unskilled employment. The skill levels generated vary with the value added of activities in which foreign firms are involved. Stability of employment in GVCs can be relatively low because oscillations in demand are reinforced along value chains, although firm relationships in GVCs can also enhance continuity of demand and employment.</td>
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Source: Adapted from UNCTAD (2013a: 149).
As shown in Table 2, GVCs are typically led by transnational corporations and established through equity holdings (foreign direct investment) and non-equity modes. Through non-equity modes, transnational corporations can require firms in developing countries to adopt new procedures and new managerial and production processes, working standards, and so on. In addition, transnational corporations might provide firms with concrete specifications related to the design and quality of the product or service to be delivered, contributing to the learning process of the local firm. The use of non-equity modes has increased rapidly over the last decade or so due to their relatively lower capital requirements, reduced risks, and greater flexibility. As we saw in Table 2, the development implications of non-equity modes vary according to the industry, the specific activity performed, the contractual arrangements, and the conditions and policies in the developing country (UNCTAD, 2011b).

Empirical research has also shown that there are only a handful of major lead firms in GVCs and that they are mainly concentrated in the developed world, and with few exceptions in the People’s Republic of China (Gereffi, 2014; Starrs, 2014). This concentration of power in the hands of a few leading firms influences how these networks are managed, with clear developmental implications for developing countries. Concentration of power might lead these firms to somehow limit the upgrading opportunities available to firms in the host developing countries. As a consequence, firms in developing countries might be locked into low-value-added activities and face pressures to keep labour costs low. As a matter of fact, structural transformation within GVCs is achieved through upgrading, which can only be achieved through accumulation of productive and technological capabilities (UNCTAD, 2006a, 2006c, 2014a; see also Section 5.2.1 of Module 2 of this teaching material).

Firms can upgrade their standing in GVCs through four main channels (Humphrey, 2004; Humphrey and Schmitz, 2002; UNCTAD, 2013a):

- **Product upgrading.** Firms move into more sophisticated product lines characterized by higher value added.
- **Process upgrading.** Firms can introduce new technologies or organizational innovations to produce more efficiently.
- **Functional upgrading.** Firms can move into more sophisticated (and skill-intensive) tasks in the chain (e.g. from assembly and production of standardized inputs to production of high-tech components and design).
- **Chain upgrading.** Firms use the capabilities acquired in a chain to enter another chain.

The potential for different forms of upgrading differs across countries. According to Milberg et al. (2014), low-income and smaller countries usually seek to increase the domestic value added of their exports by functional upgrading. Middle-income countries, on the other hand, aim to avoid the middle-income trap through product and process upgrading, trying to establish their brands.

Some authors such as Banga (2013) have pointed out that global value chains emerged from regional value chains, with a case in point being the role of Japanese firms moving production and assembly of their branded products to other Asian countries. Regional value chains can be a vehicle for firms to become competitive in the global market, as they can enable them to accumulate capabilities and boost their competitiveness. This issue is particularly relevant for the least developed and most-marginal economies like many sub-Saharan African countries (Banga et al., 2015).

### 3.1.3.5 The literature on resource-based industrialization

It has long been argued that resource-rich economies suffer from a resource curse, known as Dutch disease, that penalizes the manufacturing industry and ultimately leads to unsatisfactory outcomes for industrial development and long-run economic growth (Auyé, 1993; Collier, 2007; Frankel, 2012; Sachs and Werner, 1995; van der Ploeg, 2011). As the Dutch disease argument goes, the discovery of natural resources, as well as commodity price booms, may cause the manufacturing industry to shrink because:

- Incentives to reallocate productive resources such as capital and labour to primary sectors lead to a rise in the production of commodities and divert resources away from manufacturing; and
- An inflow of revenue leads to an exchange rate appreciation, making other economic activities, including manufacturing, less competitive.

Commodities are known to experience large swings in prices and long-run deterioration in their terms of trade (Prebisch, 1950; Singer, 1950; for more recent evidence, see Erten and Ocampo, 2012; Ocampo and Parra, 2003; and UNCTAD, 1993, 2003a, 2008, 2013b, 2015b). Resource-rich developing countries that rely excessively on commodities suffer the most from commodity price swings. In these contexts, commod-
20 Especially in African countries, taxes levied on export revenues represent a significant share of government revenues (UNCTAD, 2003b). Due to the recent commodity price boom, total collected tax revenue in Africa increased by 12.8 per cent from 2000 to 2012, with the category “other taxes” (largely composed of natural-resource-related tax revenues) representing 46 per cent of total tax revenues (AfDB et al., 2014).

21 On financial aspects of the recent commodity price boom, see UNCTAD (2008, box 21), UNCTAD (2009, Chapter 2), UNCTAD (2011c, Chapter 5), and UNCTAD (2015b, Chapter 1 and its annex).

### Box 4

**Types and examples of production linkages**

Following Hirschman’s theory of linkages, Kaplinsky (2011) discusses three types of production linkages that are relevant in the context of commodities – backward, forward, and horizontal – as described below:

- **Backward linkages** capture the flow of intermediate goods or inputs from supplying industries to the commodity industry. Backward linkages are strong when the growth of the commodity industry leads to strong growth of the industries that supply the commodity industry. For example, backward linkages can arise from logging to logging equipment and from logging equipment to engineering.

- **Forward linkages** capture the effect of the commodity industry on industries that process commodities. Forward linkages are strong when the growth of the commodity industry leads to strong growth of industries that process commodities. An example of forward linkages is found between timber industries and sawmilling and furniture production.

- **Horizontal linkages** refer to the process in which an industry creates backward and forward linkages (as a supplier of inputs or a user of outputs of the commodity industry), develops capabilities because of that, and subsequently uses such capabilities in other industries. For example, horizontal linkages can arise from the adaptation of logging equipment to cane growing, i.e., the use of equipment for similar tasks in different production processes.

Source: Kaplinsky (2011).

From 2002 until recently, the world experienced a commodity price boom, driven by the relatively strong and stable performance of the global economy and fast economic growth and industrialization in a number of large developing economies, primarily the People’s Republic of China, that guaranteed stable demand (Kaplinsky and Farooki, 2011; see also UNCTAD, 2005). Growing attention to the challenges of climate change and shrinking oil reserves also contributed to this price boom (UNCTAD, 2008). Finally, increased financial speculation, driven by an upsurge in investment in commodities futures and options, amplified this upward trend (Tang and Zhu, 2015; UNCTAD, 2008, 2009, 2011c, 2013b, 2015b; Zhang and Balding, 2015). Several developing countries have recently discovered reserves of minerals and fuel, and others have allocated significant resources to commodity production in order to take advantage of favourable terms of trade.

In light of these developments, it is no surprise that the debate about commodity-based development and industrialization strategies has been re-opened. Some authors have argued in favour of resource-based industrialization (AfDB et al., 2013; Andersen et al., 2015; Kaplinsky and Farooki, 2012; Perez, 2008; UNECA, 2013; Wright and Czelusta, 2004, 2007). According to these authors, natural resources can form the basis for an industrial development strategy and lead to industrialization. In this strand of literature, it is noted that resource-based manufacturing activities are becoming increasingly dynamic and R&D-intensive, as shown in the cases of salmon farming in Chile (UNCTAD, 2006d) or production of mining equipment in South Africa (Kaplan, 2012). This literature has argued that, contrary to what is commonly believed, strong production linkages exist between commodity industries and the rest of the economy, reducing the enclave nature of commodity production and making commodities a potential engine of industrialization. Box 4 describes the nature of production linkages in the context of commodities.
Apart from production linkages, commodities generate two additional types of linkages: fiscal linkages and consumption linkages. With respect to the former, governments can channel revenues from natural resources into other industries or into broader development programmes, thus exploiting the fiscal linkages of commodities. In this regard, UNCTAD (2008) cautions that whether these fiscal linkages can be realized largely depends on the distribution of commodity export earnings between domestic and foreign stakeholders. Countries where state-owned enterprises are in charge of the extraction and production of natural resources can appropriate most or all of the gains from favourable terms of trade. Otherwise, well-designed taxation and royalty systems can help improve the distribution of rents between domestic actors and foreign investors (see also Section 5.1.2 of Module 2 of this teaching material). Consumption linkages can also spur industrialization, as higher incomes earned in the commodity industry can spur demand in other sectors (Andersen et al., 2015; Kaplinsky, 2011; Kaplinsky and Farooki, 2012).

In spite of this optimistic view of the possibilities for industrialization opened up by the recent commodity price boom, it has also been noted that it is misleading to think of developing countries only as commodity exporters, as they also import commodities. The actual effect of commodity price booms on the terms of trade depends on trade structures and price trends of the commodities imported and exported. The evolution of prices also affects the distribution of income within countries, as the social and economic groups that benefit from higher prices of exported commodities are not necessarily the same as those bearing the costs of higher import prices (UNCTAD, 2005, 2008). Moreover, developing countries that have benefited the most from the recent commodity price boom have often become net capital exporters, and capital has generally moved towards richer economies. Empirical research shows that these current account reversals are associated with terms-of-trade shocks and characteristics of the exchange rate regimes. In particular, countries that experience a current account reversal also experience a positive shock in their terms of trade, and countries with a fixed exchange rate are more likely to improve their current accounts compared to countries with a floating exchange rate (UNCTAD, 2008).

3.2 Empirical literature on structural transformation

The descriptive analysis presented in Section 2.4 offered some insights on the relationship between changes in productive structures and economic growth. The simple existence of a strong correlation between these two processes, however, does not prove that structural change fosters economic growth. Several econometric studies examined the impact of economic structures and structural change on economic or productivity growth. We can identify four strands of literature in this field of research: (a) studies on manufacturing as an engine of economic growth; (b) studies that disentangle the role of structural change in labour productivity growth; (c) studies that look at structural change within manufacturing; and (d) studies on industrial upgrading.

### 3.2.1 Is manufacturing the engine of economic growth?

According to structuralist economists, there is something special about manufacturing that makes it the engine of economic growth in the economy. Early econometric studies tested this idea and confirmed its validity (Cornwall, 1977; Cripps and Tarling, 1973; Kaldor, 1967). More recently, using a large sample of countries between 1960 and 2004, Rodrik (2009) shows that the shares of industry in GDP and employment are associated with higher economic growth, with the results holding when the sample is split between advanced and developing economies. Other studies in this strand of literature focus on world regions or states in federal countries and confirmed that manufacturing is the engine of growth in the economy – i.e. that higher rates of growth of manufacturing output are associated with faster economic growth (see Felipe, 1998, for Southeast Asia, and Tregenna, 2007, for South Africa). Even for countries like India, where the share of services in GDP and employment is on the increase and where many observers talk of services as the engine of economic growth, Kathuria and Raj (2009) show that manufacturing is the engine of growth in Indian states. These results are supported by other studies showing that, even though the Indian experience suggests that specialization in services with high value added and based on skilled labour can spur economic growth, manufacturing remains extremely important (Chandrasekhar, 2007; Kathuria and Raj, 2009; Ray, 2015).

Fagerberg and Verspagen (2002) and Szirmai and Verspagen (2015) propose a Schumpeterian view on this topic by investigating the role of technological change in manufacturing growth. Fagerberg and Verspagen (2002) use data for 29 (mostly advanced) economies for the period 1966–1995. In their econometric model, they include variables typical of empirical studies related to the evolutionary economics school (e.g. number of patents) and structural variables, namely the shares in GDP of output.
value added by manufacturing and services. They find that manufacturing had a much more pronounced role before 1973 than after that year, while higher shares of value added in GDP from services were positively associated with GDP growth in all time periods. While interesting, this finding might be a byproduct of the specific sample of economies used for the analysis: as Section 2.3 showed, as economies develop, their manufacturing industries shrink in favour of the services sector.

Szirmai and Verspagen (2015) test the engine of growth hypothesis using data for a large sample of developed and developing countries for the period from 1950 to 2005. The authors find that manufacturing is an engine of economic growth, while services do not have the same impact. The authors also analyse the role of the accumulation of capabilities in industrialization and economic growth by adding to the estimations of the Cornwall model interaction effects between an indicator of accumulation of capabilities (average years of schooling for the population above 15 years of age) and the share of manufacturing in GDP. They find a positive and significant relationship between this interaction term and economic growth, indicating that economic growth is positively associated with manufacturing growth, especially in countries with a more educated workforce. This result is particularly revealing: modern industrialization requires more skills in industrializing countries. Due to this, industrialization today is a more difficult route to economic growth than in the past, as investment in human capital becomes paramount.

According to some authors, manufacturing is even more powerful than accounted for by early development economics. Rodrik (2013a) shows that over time productivity levels in manufacturing tend to converge to the technological frontier (intended here as the most productive manufacturing activities). More precisely, manufacturing exhibits unconditional convergence, meaning that convergence in manufacturing productivity does not depend on other variables, such as the quality of policies or institutions, or geography and infrastructure. This essentially happens because activities with initially lower productivity levels enjoy faster labour productivity growth. Using disaggregated data from the United Nations Industrial Development Organization (UNIDO) covering formal activities, Rodrik (2013a) shows that productivity levels in manufacturing activities converge at a rate of 2 to 3 per cent per year. Figure 13 shows this dynamic at work for 21 sub-Saharan economies by presenting estimated partial correlations between initial levels of labour productivity (on the horizontal axis) and their growth rates over the subsequent decade (on the vertical axis). Each observation represents a manufacturing branch for the last ten years for which data are available. Period and industry dummies (and interaction terms between the two) are included as control variables. Even when they are not included the negative relationship holds, confirming the unconditional convergence of manufacturing productivity. This is valid for sub-Saharan African economies, but holds as well for other world regions.

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Data are disaggregated at two-digit levels of the ISIC Revision 3 (e.g. food and beverages, chemicals and chemical products, motor vehicles, etc.).
Finally, recent empirical evidence has demonstrated that not only is structural transformation towards manufacturing positively associated with economic growth, but that this economic growth is also more sustained over time. Foster-McGregor et al. (2015) econometrically investigate this relationship using a panel dataset comprised of 108 countries between 1960 and 2010. Results confirm that a larger manufacturing industry, measured by the share of manufacturing value added in GDP, is significantly associated with longer periods of economic growth. Hence, a strong manufacturing industry is key both to trigger and to sustain economic growth.

3.2.2 Quantifying the effect of structural change on labour productivity

Labour productivity can be fostered in three different ways. Within each sector, productivity can grow through capital accumulation, technological change, exploitation of economies of scale, or learning (the within or direct, productivity effect). During processes of structural transformation, labour moves across sectors: movements from low- to high-productivity sectors increase aggregate labour productivity by making the higher-productivity sector larger (the structural change, or reallocation, effect). Finally, changes in productivity can occur as a result of changes in relative output prices between different sectors (the terms of trade-effect). Because the latter is relatively marginal, we will focus on direct and structural productivity changes. Following this, aggregate labour productivity can be decomposed into:

\[ \Delta Y_t = \sum_{i=1}^{n} \theta_i \Delta y_{i,t} + \sum_{i=1}^{n} y_{i,t} \Delta \theta_i, \]

where \( Y_t \) and \( y_{i,t} \) refer to economy-wide and sectoral labour productivity and \( \theta_i \) captures the share of employment in sector \( i \) at time \( t \). \( \Delta \) denotes changes in productivity (\( \Delta y_{i,t} \)) or employment shares (\( \Delta \theta_i \)) between times \( t-k \) and \( t \). The first component of labour productivity is the sum of productivity growth within each sector weighted by the employment share of each sector at the beginning of the time period. This is the within-component of labour productivity growth. Intuitively, this component captures the idea that the larger the sector with higher-than-average productivity growth in the economy, the larger the aggregate labour productivity growth of that economy. As discussed in Section 2.1, production structures in developing economies are highly heterogeneous, meaning that the economy is composed of a few high-productivity activities and many low-productivity activities. This element captures this heterogeneity by taking into account differences in sectoral productivity and differences in sizes of sectors. The second part of the formula, on the other hand, captures the impact of labour movements across sectors along the time period. Hence, this is the structural change, or reallocation, component of labour productivity growth. It accounts for the fact that when labour moves from a lower-productivity sector to a higher-productivity sector, the employment share of the former decreases and the employment share of the latter increases, thus increasing aggregate labour productivity.

Imagine that an economy is composed of two industries: shoes and computers. Labour productivity of the computer industry is higher than labour productivity of the shoe industry, and the shoe industry employs more workers than the computer industry. From time \( t-k \) to time \( t \), the shoe industry becomes more productive (e.g. due to learning), and so does the computer industry (e.g. because firms invest in modern technologies). Let us also assume that the labour productivity increase in computers is higher than the labour productivity increase in shoes. If workers remain in their respective industries (i.e. no structural change occurs), the structural change component is zero. So, labour productivity growth is exclusively due to the first component, the within-productivity effect. Because labour productivity has increased in both industries, aggregate labour productivity growth would increase. Still, because the size of the two industries remained unchanged, aggregate labour productivity increases less than it would have had the computer industry been larger. If the economy undergoes a process of structural change, and workers move from shoes to the computer industry, the structural change component is not zero anymore; rather, it is positive.

Using this decomposition formula and similar variations of it like the one presented in Box A1 in the annex of this module, various studies have analysed how structural change contributed to labour productivity growth (de Vries et al., 2015; McMillan and Rodrik, 2011; Timmer and de Vries, 2009; Timmer et al., 2014b). Figure 14 presents averages of within and structural change productivity effects for Latin America and the Caribbean, sub-Saharan Africa, Asia, and high-income countries for the 1990–2005 period. Consistent with the empirical regularities discussed in Section 2.1, structural change made the smallest contribution to overall labour productivity growth in high-income economies. By contrast, structural change played a key role in developing regions, albeit in different ways. In Latin America and Africa, the structural change component was negative, meaning that labour moved from higher- to lower-productivity activities. In Asia, it was positive. These findings contribute to explaining the differences in growth rates between these three regions.24

24 This exercise does not account for unemployment, which would worsen the picture for Latin America and the Caribbean and possibly for Africa, given the rise of unemployment in the period under analysis.
3.2.3 Looking inside the manufacturing industry

Some authors noted that manufacturing cannot be considered a homogenous category, as manufacturing branches differ considerably. As a consequence, structural transformation cannot be simply intended (and analysed) as the shift of labour from agriculture to manufacturing, because structural change also occurs within manufacturing, i.e. from less productive to more productive manufacturing branches. In particular, structural change within manufacturing can be qualified as a movement from light to heavy manufacturing, where light manufacturing is less capital-intensive than heavy manufacturing (Chenery et al., 1986; Hoffman, 1958). Timmer and Szirmai (2000) called this the structural bonus hypothesis. Timmer and Szirmai (2000), Fagerberg and Verspagen (1999), Fagerberg (2000), and Peneder (2003) apply the shift-share decomposition method to look inside manufacturing and identify the contribution of different branches within manufacturing. Box 5 provides more details on the shift-share decomposition method.

Box 5

Shift-share decomposition method

The shift-share decomposition method is an example of the accounting-based approach designed to analyse the impact of structural change on productivity growth. As described by Fagerberg (2000: 400), the shift-share decomposition “is a purely descriptive technique that attempts to decompose the change of an aggregate into a structural component, reflecting changes in the composition of the aggregate, and changes within the individual units that make up the aggregate.”

The method is derived as follows. Let \( P = \) labour productivity, \( Q = \) value added, \( N = \) labour input in terms of worker-years, and \( i = \) industry \((i = 1, \ldots, m)\). Then, similarly to the Divisia decomposition method described in Box A1 in the annex of this module, we can write labour productivity as:

\[
P = \frac{Q}{N} = \frac{\sum Q_i}{\sum N_i} = \sum \left( \frac{N_i}{\sum N_i} \right) P_i = \sum [P_i S_i]
\]  

(5.1)

where \( P_i = \frac{Q_i}{N_i} \) is labour productivity in industry \( i \), and \( S_i \) is the share of industry \( i \) in total employment.

After a straightforward algebraic manipulation and using \( \Delta \) as a notation for the difference in a variable between two points in time (as in \( \Delta P = P_1 - P_0 \)), we can write equation (5.1) in the growth-rate form:

\[
\frac{\Delta P}{P} = \sum \left( \frac{P_i \Delta S_i}{P_i} + \frac{\Delta P_i S_i}{P} + \frac{S_i \Delta P_i}{P} \right)
\]  

(5.2)

The first term captures the contribution to productivity growth of changes in the reallocation of labour between industries. This is positive if the share of high-productivity industries in total employment increases. The second term is the interaction between changes in productivity in each industry and changes in labour shares. This component is positive if the high-productivity-growth industries increase their shares of employment as well. The third term measures the contribution of productivity growth within industries (weighted by the share of these industries in total employment).

Source: Authors.
Timmer and Szirmai (2000) study four Asian economies (India, Indonesia, Republic of Korea, and Taiwan Province of China) over the period 1963–1993. Their data allow for distinguishing between 13 manufacturing branches. Their dependent variable is total factor productivity (TFP) growth, expressed as a linear function of output growth. The authors modify the standard shift-share decomposition method to account for the Verdoorn law (see Section 3.1.2). The idea behind the paper is that if returns to scale differ across industries, then the contribution of structural change to productivity growth is larger than measured by the standard shift-share analysis. The authors find that the structural change component does not explain TFP growth, contrary to what the literature suggests. Following their modification of the shift-share analysis, the component of structural change is positive when inputs move to higher-productivity branches, branches whose productivity grows faster, or branches with higher Verdoorn elasticity, intended as the elasticity of TFP growth to output growth. This change of the methodology, however, does not change the main results, so the shift-share method does not systematically underestimate the contribution of structural change.

Peneder (2003) examines the contributions to economic growth of services and two categories of the manufacturing industry, namely technology-driven and human-capital-intensive manufacturing. The study examines 28 economies from the Organisation for Economic Co-operation and Development (OECD) over the period 1990–1998. Results show that a rise in the employment share of services has a (lagged) negative effect on GDP growth, confirming the structural bonus hypothesis put forth by Baumol (see Section 3.1.2). By contrast, increases in the shares of technology-driven and human-capital-intensive manufacturing exports have a significant and positive effect on the level and growth rate of GDP. The author attributes these results to producer- and user-related spillovers, positive externalities, and other supply-side factors that enhance productive capacity that is associated with the industrial sector. He also points out that when both the effects of services and manufacturing industries are taken into account, the net effect of structural transformation appears to be weak because the positive and negative effects from changes in the structure of the economy cancel each other out.

Fagerberg and Verspagen (1999) focus on the role of specific manufacturing industries deemed to be particularly strong engines of economic growth. Using the UNIDO Industrial Statistics Database, they find that from 1973 to 1990, the electrical machinery industry became one of the most dynamic industries in developed economies, with extraordinarily high labour productivity growth rates. Inspired by this finding, they develop an econometric model to estimate the impact on manufacturing productivity growth of the size of the electrical machinery industry, captured by its employment share. They find that the share of employment in electrical machinery is a significant determinant of productivity growth in manufacturing, while the share of employment in other high-growth industries is not a significant determinant. This supports the idea that the electrical machinery industry is special because it can drive productivity growth in manufacturing. This result also illustrates the concept of linkages discussed in Section 3.1.2—that is, thanks to the widespread application of ICT in a large range of economic activities, fostering the electrical machinery industry indirectly induces investments in other industries, and spurs productivity in other industries and at the aggregate level, also fostering innovation through knowledge spillovers and new products. At the same time, today’s new technologies generate different patterns of structural transformation compared to those observed during the first half of the 20th century (e.g. electricity and synthetic materials). As stated by Fagerberg (2000: 409): “New technology, in this case the electronics revolution, has expanded productivity at a very rapid rate, particularly in the electrical machinery industry, but without a similarly large increase in the share of that industry in total employment.” The weak effect on employment may call into question the poverty-reducing impact of this new type of structural change, as well as its role as an engine of economic growth, especially in developing economies with large and growing populations.

3.2.4 Industrial upgrading through export sophistication and within value chains

Structural transformation is a continuous process spurred by industrial upgrading through diversification and sophistication of production and exports. Two strands of literature have recently analysed these processes: the product space literature, and the GVC literature. The product space literature (Hausmann and Kliger, 2007; Hausmann et al., 2007, 2011; Hidalgo et al., 2007) builds on a very structuralist idea: what economies produce and export matters for their economic growth and development. This literature also contains a strong evolutionary element: countries cannot produce a good for which they have no knowledge or expertise. This puts learning, capabilities, and technological change at the centre of struc-
The structural transformation process: trends, theory, and empirical findings

27 EXPY is calculated in two steps. First, using the six-digit Harmonized Commodity Description and Coding System (HS), which covers more than 5,000 different commodities, the authors compute the weighted average of the incomes of the countries exporting each traded commodity, where the weights are the shares of each country, where the average of the PRODY for each commodity (normalized so that the weights sum up to 1). This gives the income level of that commodity (the variable generally referred to as PKODY). Next they calculate EXPY as the weighted average of the PRODY for each country, where the weights are the shares of each commodity in that country’s total exports.


Various studies applied the methodologies outlined in the product space literature to map product spaces and identify possible paths of productive diversification, especially for developing economies (see Hausmann and Klinger, 2008, for Colombia; Felipe et al., 2013, for China; Jankowska et al., 2012, for Asia and Latin America; and Fortunato et al., 2015, for Ethiopia).

A similarly prolific literature is analyzing the implications of the rise of GVCs for structural transformation by using input-output matrices recently made available by a number of new databases (e.g. the World Input Output Database and the Trade in Value Added Database) 28 These studies have provided empirical evidence on the pervasiveness of GVCs and discussed their implications for firms and governments in developing countries. They generally recognize that despite being global, production is concentrated in a small number of countries, predominantly in East Asia. Lead firms are generally from advanced economies and globalization of production is more pronounced in some industries than oth...
ers, with clothing and textiles, electronics, and automotive industries being the most fragment-
ed (De Backer and Miroudot, 2013; Timmer et al., 2014a; UNCTAD, 2014a). Another common find-
ing in this literature is that while participation of developing countries in GVCs has increased
tremendously over recent decades, developed economies tend to benefit more from insertion
in GVCs than developing countries. The latter are sometimes locked into low-value-added activi-
ties and face difficulties in upgrading (Milberg et al., 2014; UNCTAD, 2002, 2014a).

In this strand of literature, Banga (2013) uses the World Input Output Database to compare various
indicators measuring the participation of coun-
tries in GVCs and the distribution of gains from
that participation. The author shows that while
developing countries are increasingly participat-
ing in GVCs, developed countries contribute the
most to value addition. The paper distinguishes
between two mechanisms through which coun-
tries can participate in GVCs: through forward
linkages, whereby the country provides inputs into
exports of other countries, or through backward
linkages, whereby the country imports intermedi-
ate goods to be used in its own exports. This dis-
tinction captures how much countries gain from
participation in GVCs, as stronger forward link-
ages, more so than backward linkages, are a sign
of higher domestic value creation. Findings show
that the United States, Japan, the United King-
dom, and Italy are the countries with the highest
ratio between forward and backward linkages,
meaning that their net gains from participation
in GVCs are the highest. Moreover, the study dem-
strates that even when developing economies
manage to enter high-tech industries through
GVCs, their participation might not ensure net
gains in terms of value added into exports.

Timmer et al. (2014a) use the World Input Out-
put Database to illustrate how value chains have
sliced up global production. An example from
their paper illustrates this. In the German car
manufacturing industry, defined in this frame-
work as the industry that sells cars in Germany’s
domestic market, the value-added contribution
by firms outside Germany increased from 21 per
cent in 1995 to 34 per cent in 2008, pointing to
increased fragmentation of production (Table 3).
Moreover, the value added by capital and high-
skilled labour (no matter the origin) increased,
while the value added by low-skilled labour de-
creased or remained constant. This suggests that
in the car industry, countries that specialized in
capital-intensive stages of production gained
more than countries that specialized in labour-
intensive stages of production. Consistent with
this trend, empirical research has shown that
since the 1980s, a shift has occurred in the func-
tional distribution of income – which shows how
income is distributed among the owners of the
main factors of production, i.e. labour and capital
– that has moved income away from wages and

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Decomposing value in global value chains: the case of German cars, 1995 and 2008 (per cent)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1995</td>
</tr>
<tr>
<td>German value added</td>
<td>79</td>
</tr>
<tr>
<td>High-skilled labour</td>
<td>51</td>
</tr>
<tr>
<td>Medium-skilled labour</td>
<td>55</td>
</tr>
<tr>
<td>Low-skilled labour</td>
<td>58</td>
</tr>
<tr>
<td>Capital</td>
<td>40</td>
</tr>
<tr>
<td>Foreign value added</td>
<td>61</td>
</tr>
<tr>
<td>High-skilled labour</td>
<td>42</td>
</tr>
<tr>
<td>Medium-skilled labour</td>
<td>47</td>
</tr>
<tr>
<td>Low-skilled labour</td>
<td>46</td>
</tr>
<tr>
<td>Capital</td>
<td>34</td>
</tr>
<tr>
<td>Total final output</td>
<td>48</td>
</tr>
</tbody>
</table>

Source: Timmer et al. (2014a, 104).
Taking a different unit of analysis and applying a different methodology, Dedrick et al. (2010) use the examples of the Apple Ipod and notebook personal computers to illustrate how profits are distributed between the participants of these two GVCs. The intuition behind this exercise is relatively straightforward: an ipod and a computer are made of lots of components produced by different firms in different countries. Each of these firms charges a price for its component or activity and in turn pays other firms for the intermediate goods needed to complete its stage of production. Table 4 presents different indicators of profit margins of the main participants in the ipod global value chain. Without going into the technicalities of the exercise, the table clearly depicts the gap between the profits enjoyed by firms that specialize in product design (or the production of critical components, such as the controller chip or the video chip) and firms that specialize in assembly or production of low-tech standardized components like memory chips.

<table>
<thead>
<tr>
<th>Function</th>
<th>Supplier</th>
<th>Gross margin</th>
<th>Operating margin</th>
<th>Return on assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller chip</td>
<td>PortalPlayer</td>
<td>44.8</td>
<td>20.4</td>
<td>19.1</td>
</tr>
<tr>
<td>Lead firm</td>
<td>Apple</td>
<td>29.0</td>
<td>11.8</td>
<td>16.6</td>
</tr>
<tr>
<td>Video chip</td>
<td>Broadcom</td>
<td>52.2</td>
<td>10.9</td>
<td>9.8</td>
</tr>
<tr>
<td>Primary memory</td>
<td>Samsung</td>
<td>31.5</td>
<td>9.4</td>
<td>10.3</td>
</tr>
<tr>
<td>Battery</td>
<td>TDK</td>
<td>26.3</td>
<td>7.6</td>
<td>4.8</td>
</tr>
<tr>
<td>Retailer</td>
<td>Best Buy</td>
<td>25.0</td>
<td>5.3</td>
<td>9.6</td>
</tr>
<tr>
<td>Display</td>
<td>Toshiba-Matsushita Display</td>
<td>28.2</td>
<td>3.9</td>
<td>1.8</td>
</tr>
<tr>
<td>Hard drive</td>
<td>Toshiba</td>
<td>26.5</td>
<td>3.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Assembly</td>
<td>Inventec Appliances</td>
<td>8.5</td>
<td>3.1</td>
<td>6.1</td>
</tr>
<tr>
<td>Distribution</td>
<td>Ingram Micro</td>
<td>5.5</td>
<td>1.3</td>
<td>3.1</td>
</tr>
<tr>
<td>Minor memory</td>
<td>Elpida</td>
<td>17.6</td>
<td>0.1</td>
<td>-1.0</td>
</tr>
<tr>
<td>Minor memory</td>
<td>Spansion</td>
<td>9.6</td>
<td>-14.2</td>
<td>-9.2</td>
</tr>
</tbody>
</table>

Source: Dedrick et al. (2010: 92).
Note: Bold values evidence the gaps in profit margins between different participants in the ipod global value chain.

Despite the fact that some activities like assembly do not generate high profits for local firms, they do create employment. Hence, while countries should try to move up the value chain, lower-value-added activities create employment and allow countries to insert themselves into global trade and learn through production and interactions with other GVC participants. Section 5.2.1 of Module 2 of this teaching material will delve deeper into the challenges that GVCs pose to structural transformation and how industrial policies can facilitate industrial upgrading in value chains.

Some authors have related industrial upgrading through export sophistication and value chain upgrading to income traps, and in particular to the middle-income trap. Felipe et al. (2012) analyse the dynamics of 124 countries between 1950 and 2010, classifying economies by income groups and computing how many years they took to graduate to higher-income groups. They find that structural transformation, export sophistication, and diversification help countries avoid the middle-income trap. Lee (2013) propose an evolutionary perspective on middle-income traps, associating them with the development of technological capabilities. According to his analysis, in order to avoid middle-income traps, countries should upgrade and diversify their economies by moving into industries characterized by rapid technological change. Rapid innovation quickly makes existing products obsolete and incumbents less competitive, creating opportunities for new firms to enter the industry.

Combining the structuralist and evolutionary views, Lavopa and Szirmai (2014) develop an index of structural modernization that builds on the idea that in order to successfully develop, countries must undertake processes of structural and technological change simultaneously. For this purpose, the index is composed of a structural change and a technological change component. The structural transformation component of the index is captured by employment shares in the modern sector made up of industry (i.e. mining, manufacturing, utilities, and construction) and tradable services (transport and telecommunications, and financial and professional services). These industries generally present above-average productivity levels and higher potential for productivity growth. The technological change component is measured by the labour
The structural transformation process: trends, theory, and empirical findings

productivity of the modern sector, as defined above, compared to that of the United States (considered the world technological frontier). The structural modernization index is computed for 100 countries over the period 1950–2009. The trends followed by this index in recent decades confirm that only the economies that managed both transformations at the same time (e.g. the Republic of Korea, Taiwan Province of China, Hong Kong (China) and Singapore) caught up with the advanced world. By contrast, those that did not embark on sustained processes of structural and technological transformation got caught in low- and middle-income traps.

3.3 Premature deindustrialization and the (possible) role of services as the new engine of economic growth

Some observers have recently suggested that services are taking over the role of manufacturing and becoming the new engine of economic growth. This position draws on several observations. First, as already discussed in Section 2.3, one of the empirical regularities about structural transformation is that as economies develop beyond a certain (relatively high) level of income, they tend to deindustrialize. Studying the relationship between manufacturing employment and income per capita in 70 countries in 1990, Rowthorn (1994) shows the existence of a stable inverted-U relationship between these two variables. This empirical regularity is supported by econometric evidence showing that in the advanced world, manufacturing is not the engine of economic growth that it was some decades ago (see Section 3.2.1).

The phenomenon of deindustrialization, however, is a bit more complex than that. Rowthorn and Wells (1987) distinguish between two types of deindustrialization: positive deindustrialization, which occurs in developed economies as a natural result of sustained economic growth, and negative deindustrialization, which occurs at all income levels. In the case of positive deindustrialization, fast productivity growth in manufacturing allows firms to satisfy demand using less labour (in other words, productivity growth reduces employment) while output expands. Displaced workers find employment in the services sector because, as incomes rise, demand patterns shift towards services, also due to Engel’s law. Therefore, the share of employment in services is expected to rise at the expense of employment in manufacturing (Baumol, 1967; Baumol et al., 1985; see also Section 3.1.2). By being the result of industrial dynamism (i.e. productivity growth), positive deindustrialization is a sign of economic success. Negative deindustrialization, on the other hand, is a product of economic failure. It occurs when a country has a poor economic performance or when its manufacturing industry faces challenges. In these cases, falling manufacturing output, or higher productivity in manufacturing, creates unemployment, thereby depressing incomes (Rowthorn, 1994; Rowthorn and Wells, 1987; UNCTAD, 1995).

In addition, Palma (2005) documents that the relationship between manufacturing employment and income per capita is not a stable one. Rather, a declining level of manufacturing employment is associated with each level of income per capita, suggesting that today developing countries tend to deindustrialize before they reach high enough incomes. Figure 16 depicts the log of income per capita (at constant 1985 prices) on the horizontal axis and the share of manufacturing employment in total employment on the vertical axis. Each curve represents data for a certain year. The figure illustrates the decline in the share of manufacturing employment with each level of per capita income and a dramatic reduction in the level of income per capita from which the downturn in manufacturing employment begins. In particular, the level of income per capita at which the manufacturing employment began to decline dropped from $20,645 in 1980, to $9,805 in 1990 and $8,691 in 1998.
The structural transformation process: trends, theory, and empirical findings

Figure 16
The changing relationship between manufacturing employment and income

According to Palma (2005), several factors may explain this phenomenon. They include labour-displacing technological progress that has increased the capital intensity of production at the expense of labour, and the rise of globalization and GVCs that have facilitated the relocation of labour-intensive stages of production to low-wage labour-abundant economies, especially in Asia. As we will see later on in this section, relocation of labour-intensive production activities has predominantly benefited Asian economies, leading to the expansion of manufacturing employment and output (i.e. industrialization). Firms from Latin American and African countries have been less capable of inserting themselves into these GVCs, which has contributed to the trend towards “premature deindustrialization”. Dutch disease – the phenomenon by which the discovery of natural resources makes economies specialize in primary commodities at the expense of manufacturing activities (see also Section 3.1.3.5) – is another determinant of premature deindustrialization. As Palma (2005) argues, some developing countries, especially in Latin America, have experienced policy-driven Dutch disease since the 1980s. Policies that sought to generate a trade surplus in manufacturing have been substituted by policies that promote specialization based on comparative advantages and, hence, in accordance with countries’ resource endowments. This has led to fast premature deindustrialization.

In discussing the possible determinants of premature deindustrialization, Tregenna (2009) analyse the trends of 48 deindustrializing economies, including high-income as well as middle- and low-income economies. She shows that in almost all the economies studied, manufacturing has become less labour-intensive, essentially due to rapid labour productivity growth. This would not be a problem if the share of manufacturing in GDP had not decreased. However, this seems not to have been the case: in the majority of the economies analysed, the fall in manufacturing employment was associated with a fall in manufacturing shares in GDP. As Tregenna (2009: 459) argues, this reduced the long-term growth prospects of these economies as they lost out on the “growth-pulling effects of manufacturing”.

Felipe et al. (2014) delve deeper into the detrimental effects of premature deindustrialization. They analyse 52 economies, mostly high- and upper-middle-income ones, but a few lower-middle-income economies as well. They identify a statistically significant relationship between the historical peak of manufacturing employment and subsequent levels of income per capita, meaning that countries that achieved a high share of manufacturing employment in the past enjoy higher incomes today. Figure 17 illustrates this by depicting the historical peak of the manufacturing employment share between 1970 and 2010 on the horizontal axis and the logarithm of average income per capita between 2005 and 2010 on the vertical axis. According to the estimations by Felipe et al. (2014), a one percentage point difference in the peak of manufacturing employment shares is associated with a per capita GDP in 2005–2010 that is 13 percentage points higher. This relationship holds for employment shares, but not for output shares. Hence, as the authors

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Note: The 1960 curve is built using data for 81 countries. The other curves are built using data for 105 countries.

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30 Middle-income economies included in the analysis are Poland, Chile, Colombia, Argentina, Latvia, Romania, Uruguay, Jamaica, Suriname, the Russian Federation, St. Lucia, and the Bolivarian Republic of Venezuela. Low-income economies are Pakistan and Mongolia.
put it, “the industrialization process predicts future prosperity only insofar as it generates manufacturing jobs” (Felipe et al., 2014: 5). The paper further shows that industrialization is a predictor of future wealth: achieving a manufacturing share in employment of 18 to 20 per cent in the period from 1970 to 2010 has been an absolutely necessary condition for becoming a high-income economy. Finally, results confirm that manufacturing employment peaks at increasingly lower levels of per capita income, confirming the above-described trends of premature deindustrialization.

Rodrik (2016) looks further into these processes and uncovers interesting regional dynamics: consistent with the descriptive statistics discussed in Section 2.3.3, Asia is the only developing region that maintained a strong manufacturing industry over recent decades. By contrast, Latin America and sub-Saharan Africa present the most dramatic deindustrialization processes (see also UNCTAD, 2003a). According to Rodrik (2016), these regional trends can be explained by the trends in globalization: jobs in manufacturing have been destroyed mostly in countries without a strong comparative advantage in manufacturing. Labour-displacing technological change, intended as technological change that increases capital intensity and saves unskilled labour, is also among the causes of (premature) deindustrialization. Indeed, Rodrik (2016) shows that the reduction of manufacturing employment predominantly affected low-skilled workers.

In an attempt to explain the changing relation between industrialization and per capita income, some have noted that certain statistics may underestimate the extent to which manufacturing is a source of employment and overestimate instead the importance of services. UNIDO (2013), for example, points out that (a) while informality is considered typical of services, there has recently been a rise in informal jobs in manufacturing; and (b) the distinction between manufacturing and services is becoming blurred as manufacturing firms outsource many of their service activities to firms in the tertiary sector and thus create manufacturing-related services (see also Manyika et al., 2012). Manufacturing-related services, and especially business services such as design, research, engineering, branding, advertising, and marketing, are an important source of employment in industrialized countries where they often compensate for the decline in manufacturing jobs. The rise in manufacturing-related services has not been limited to the industrialized countries, however. Increased regional integration and participation in international production has led to significant employment gains in manufacturing-related services (e.g. business services and transport) in fast-growing developing countries and regions, and particularly in East Asia and the Pacific (UNIDO, 2013).

It has also been argued that opportunities can be found in potential linkages between services and high-productivity industrial activities. For example, manufacturing firms are increasingly outsourcing activities such as business services

31 UNIDO (2013) defines manufacturing-related services as services required for producing and delivering manufacturing products. The report identifies business services as most closely linked to manufacturing production, followed by trade, financial intermediation, and inland transportation services. Hotels and restaurants, and air and water transportation show the weakest link to manufacturing, and activities such as real estate, post and telecommunications, and auxiliary transportation show a low linkage.
This discussion shows that manufacturing has lost some of its importance in modern economic growth. This has led some authors to argue that the services sector or parts of it have replaced manufacturing as the engine of economic growth (Ghani and O’Connell, 2014), or has become an additional engine (Acevedo et al., 2009; Felipe et al., 2009). Several of these studies are based on the experience of India, where services, especially ICT-enabled ones, grew tremendously over the last two decades (Chakravarty and Mitra, 2009; Dasgupta and Singh, 2005, 2006; Ghani and Kharas, 2010; Joshi, 2011).

A skeptical view is offered by Rodrik (2014). Following his argument, tradable services such as banking, finance, insurance, and other business services enjoy higher productivity levels than many manufacturing activities, thanks in part to their usage of modern technologies like ICT. They also pay higher salaries and provide workers with more learning opportunities. However, tradable services require skilled labour, a scarce resource in developing countries and one that is difficult to attain because workers leaving the agricultural sector are difficult to train and reallocate in the tradable services sector. Training a farmer to use a machine to produce textiles or steel is easier than training him or her to work in a bank, so manufacturing provides a more readily available employment solution for agricultural workers displaced from their farms due to enhancements in agricultural productivity. Nevertheless, in today’s developing countries, existing excess labour, which can further expand when productivity growth in agriculture frees labour (thereby fostering structural transformation), is employed in non-tradable services, and especially in activities such as retail trade, restaurants, or hotels. Non-tradable services are very good at absorbing labour, but their opportunities for productivity enhancements are limited. Moreover, while these services could also benefit from technological progress, they are naturally constrained by the size of the domestic market. In manufacturing, by contrast, even small developing countries can devise export-led industrial strategies that can sustainably spur manufacturing and economic growth.

To conclude, as Rodrik (2013a: 171) has stated in another of his studies: “Economic activities that are good at absorbing advanced technologies are not necessarily good at absorbing labor.” This is exactly the trade-off that we observe in the services sector, where services that can absorb technologies (tradable services) are not good at absorbing employment, and services that are good at absorbing employment (non-tradable services) cannot absorb technology in the same fashion. This explains why, according to Rodrik (2014) it is difficult to imagine that a services-led model can deliver rapid growth and good jobs in the way that manufacturing did in the past.

4 Structural transformation and development

This section looks at how the composition of production affects various aspects of social and human development. As Kuznets (1966) noted almost 50 years ago, structural change brings pervasive social transformations such as higher urbanization and secularization, as well as demographic transitions towards low fertility rates. Today, improved life expectancy in both developed and developing countries has created the phenomenon of the aging population (UNCTAD, 2013c). While these are all great achievements and create important opportunities for any developing country, they also pose a great deal of challenges such as those related to rural migration, urban planning, and social spending. Box 6 provides a short review of some of the modern social issues related to the processes of structural transformation discussed in this module. In this section, we will briefly review the existing literature on the role of structural transformation in employment generation and reduction of poverty and inequality. We will then move to the analysis of the relationship between structural transformation and human development, defined in terms of progress towards the Millennium Development Goals.
4.1 Structural transformation, employment and poverty

Structural transformation has clear implications for employment growth and poverty reduction. Lavopa and Szirmai (2012) distinguish three ways in which economic growth affects employment and poverty: a direct impact, an indirect impact, and an induced impact. A direct impact can result from the creation of new jobs or the reallocation of workers. In the case of new jobs, previously unemployed people are employed, therefore the effect on employment and income is straightforward. In the case of reallocation of workers, provided that workers move from lower- to higher-productivity sectors and that wages reflect productivity levels, economic growth will reduce poverty. The indirect impact of economic growth on employment and poverty depends on the strength of the linkages between the growing sector and the rest of the economy: the stronger the linkages, the larger the impact. Growth in the rest of the economic activities in turn further creates employment, productivity, and income growth, thereby creating multiplying effects. This is the induced impact, as defined by Lavopa and Szirmai (2012).

Moving to the empirical literature on the relationship between structural transformation, employment, and poverty, some studies used the decomposition analysis discussed in Section 3.2.2 to investigate the relationship between structural change and employment generation. These studies are concerned with the social dimension of economic growth and with the idea that economic growth alone is not enough to deliver development because it needs to be accompanied by employment generation. Following these ideas, Pieper (2000) defines the "socially necessary rate of growth" as that which delivers both productivity and employment growth. In particular, growth patterns are defined as socially sustainable if labour productivity growth and employment growth rates are equal or above 3 per cent. The author notes that economies that have followed socially sustainable patterns (Indonesia, the Republic of Korea, Malaysia, and Thailand) have also enjoyed high output growth, led by growth in manufacturing.

The definition of a "socially necessary rate of growth" as proposed by Pieper (2000) uses employment growth as a measure of employment generation and does not take into account the trends of higher participation rates in many developing countries (e.g. due to stronger participation of women in the labour force). As a consequence, if an economy generates jobs at a rate of 3 per cent, but the labour force increases faster than the rate of employment growth, the number...
of jobs created might not be enough to guarantee social inclusion. This is likely to occur in developing countries where labour forces grow rapidly (also due to demographic trends), requiring constant creation of new job opportunities. Finally, looking at employment trends might not be enough to capture the employment problem of many developing economies where individuals cannot afford the "luxury" of being unemployed, preferring underemployment and low-quality employment (UNCTAD, 2013c). In these cases, underemployment growth would contribute to employment growth, inflating the employment figure without guaranteeing adequate income to workers. It has been noted that the greater participation of developing economies in global manufacturing trade has increased the supply of labour-intensive manufactures, thus lowering market prices and consequently wages (UNCTAD, 2002, 2005, 2010). By lowering the purchasing power of workers, low wages do not allow domestic demand to sustain manufacturing growth, which also limits further employment growth. Even technological change (which can allow for expansion of production) might have negative effects on employment, owing to its labour-saving nature. Due to these dynamics, the link between GDP growth and employment growth is weaker in developing than in developed economies (UNCTAD, 2010).

Kucera and Roncolato (2012) also note the existence of a trade-off between labour productivity growth and employment generation, which would imply that achieving social sustainability as defined by Pieper (2000) is very difficult. The authors compare employment growth with growth of the workforce and show that some developing regions, especially in Asia, experienced “jobless growth”, meaning that economic growth was not accompanied by employment expansion. In line with the idea that labour productivity growth and employment creation are difficult to achieve at the same time, the paper finds that wholesale and retail trade and restaurants and hotels contribute the most to employment growth in developing countries. They are however also those with the lowest contributions to aggregate labour productivity growth. This research confirms what we discussed already in Section 3.3, which is easily summarized by Rodrik’s (2013a) conclusion that economic activities good at absorbing technologies are often poor in absorbing labour, thereby creating a trade-off between productivity enhancements and employment generation.

Using the Divisia index presented in Box A1 in the annex of this module, UNCTAD (2014b) offers a detailed analysis of the structural transformation patterns of least developed countries (LDCs) from 1990 to 2012 (for more details, refer to the annex at the end of this module). UNCTAD (2014b) investigates the contributions of direct productivity and reallocation effects to aggregate labour productivity, also distinguishing their sectoral contributions. One of the crucial findings of this analysis is that in LDCs, the agricultural sector greatly contributes to aggregate productivity growth. Productivity gains in agriculture are especially important for developing countries because of the large numbers of workers employed and because their output (food and food-related items) represents the highest share of the average consumption basket. Rapid productivity growth in agriculture activates structural transformation by freeing labour that becomes redundant in the presence of modern machinery, and allows it to move to activities with higher levels of productivity. This has led some authors to argue that increasing productivity in the agricultural sector by moving from subsistence to commercial agriculture and higher-value-added crops should be a prominent element in economic policymaking (Szirmai et al., 2013; UNCTAD, 2013c, 2015c).

Clearly, socially sustainable economic growth is also important for poverty reduction: poverty can only be alleviated if benefits of economic growth are shared among a large portion of the population through employment. Some studies have explicitly investigated the role of different growth patterns for poverty. Cross-country studies find that in poorer economies, growth in agriculture has the most sizable effect on poverty reduction. At higher income levels, the role of agriculture in poverty reduction becomes less pronounced, while secondary sectors gain importance (Christiansen and Demery, 2007; Hasan and Quibria, 2004). Other studies have focused on specific countries. For example, Ravallion and Datt (1996) analyse the role of structural change in poverty in India from 1951 to 1991. The authors split output into three sectors: the primary sector (agriculture and mining), the secondary sector (manufacturing, construction, and utilities), and the tertiary sector (services). They empirically test if poverty reduction is associated with output growth in any of these sectors. They find that poverty reduction, both rural and urban, is associated more with output growth in the primary and tertiary sector than in the secondary sector. Ravallion and Chen (2007) apply this methodology to study the People’s Republic of China from 1980 to 2001. They find that the primary sector reduces poverty the most. In the case of Indonesia from 1984 and 2002, urban services growth had the largest impact on reducing rural poverty, while growth of the industrial sector had only a limited impact on rural and urban poverty reduction (Suryahadi et al., 2009).
Despite this empirical evidence against an important role of the secondary sector in poverty reduction, UNIDO (2015) shows that structural transformation towards manufacturing is positively associated with a number of indicators of social inclusiveness. For example, Figure 18 shows the relationship between the share of employment in manufacturing and the non-poor ratio, computed as one minus the poverty headcount ratio. As the share of manufacturing employment in total employment increases, poverty decreases (the ratio of non-poor increases). Lavopa (2015) provides more solid econometric evidence in support of these findings.

4.2 Structural transformation and human development

This section presents original empirical work on the relationship between structural transformation and human development. This analysis builds on UNCTAD (2014b) by expanding the initial country coverage and using up-to-date data. The report and this analysis build on the idea that a virtuous process of structural transformation can transform an economy and a society beyond its effects on GDP growth, as higher wages for a larger share of the population allow economies to reduce overall poverty and hunger, and enable families to send their children to school and spend more on their health. Higher wages and rising incomes also allow governments to collect more taxes, which can be used to strengthen institutions, widen social protection measures, and increase expenditure on public services such as education and health. All these measures have evident effects on social and human development.

One way to examine the link between structural transformation and human development is by using the structural transformation component of the Divisia index (see Box A1 in the annex of this module) in relation to progress towards the MDG targets. The analysis is conducted on a sample of 92 countries, including low-, lower-middle, and upper-middle-income countries, from 1991 and 2012. The sample varies by indicator, reflecting data availability and the relevance of a certain development goal for the country. The analysis examines whether progress in these areas of human development is correlated with the processes of structural transformation. It focuses on several aspects of human development as captured by progress on the following MDGs:

- Eradication of extreme poverty and hunger (MDG 1), measured by progress on the proportion of the population living below US$1.25 (2005 PPP) per day;
• Achievement of universal primary education (MDG 2), measured by progress on the net enrolment ratio in primary education;
• Reduction of child mortality (MDG 4), measured by progress on under-five mortality rates;
• Reduction of maternal mortality (MDG 5), measured by progress on maternal mortality ratios;
• Environmental sustainability (MDG 7), measured by progress on the proportion of the population with access to a safe drinking water source.

In order to illustrate how decomposition methods work, we now show the results of the decomposition exercise based on the Divisia index decomposition method. Figure 19 presents aggregate labour productivity growth decomposed into two of its main components: direct productivity effects and reallocation effects (terms-of-trade effects are not included due to their small values). In line with the results obtained by McMillan and Rodrik (2011) and presented in Section 3.2.2, we find that Asian countries had the highest productivity growth rate. The reallocation component in these countries is also the highest. The other regions experienced positive but modest productivity growth, mainly driven by direct productivity effects rather than reallocation effects.

We will now move to the analysis of the link between structural transformation, as measured by the reallocation component of labour productivity growth, and achievement of the MDGs targets. Figure 20 depicts the relationship between the structural transformation and performance on target 1A of MDG 1, i.e. halving the proportion of people whose income is less than US$1.25 a day. It suggests a strong and positive relationship between structural change and poverty reduction, whereby countries that achieved faster transformation (e.g. People’s Republic of China, Bhutan, Cambodia, and Viet Nam) performed better in terms of poverty reduction than those where transformation was slower (e.g. the Democratic Republic of the Congo, Togo, Haiti, and Côte d’Ivoire).

The annex at the end of this module illustrates how students can replicate this sort of analysis.
A positive albeit less strong relationship is found between structural transformation and achievements in enrolment in primary education as per target 2A of MDG 2. As Figure 21 illustrates, rapidly transforming economies also perform well on this goal, even if progress on schooling seems more difficult to achieve than progress on reducing poverty. Among the best performers are countries such as Cambodia and Lao PDR, but also Ethiopia and Burkina Faso. While in 1997 Cambodia had 83 per cent of its children enrolled in primary education and Lao PDR had 71 per cent, the corresponding figures for Ethiopia were 30 per cent and for Burkina Faso 33 per cent. These numbers indicate how difficult it was for certain developing countries to achieve MDG targets and how structural change can be a powerful driver of improvements in social and human development.

Similar patterns are found for the other MDG targets, suggesting a positive relationship between structural transformation and achievement of those targets. Figure 22 confirms this by showing the reallocation effect component of labour productivity growth on the horizontal axis and the average achievement of MDGs target, computed as the average achievement in the five indicators mentioned above, on the vertical axis.
The impact of structural transformation on human development can be further investigated by dividing the sample of countries into dynamic and lagging economies, defined as those with a value of the reallocation component of labour productivity growth above and below the average, respectively, and by comparing the relationship between economic growth and performance on the MDGs in the two groups of countries. With the exception of MDG 4 and 5 (reducing under-five mortality rates and reducing maternal mortality ratios), correlations between economic growth and performance on the MDGs are stronger in dynamic economies than in lagging economies. The largest differences concern poverty reduction (MDG 1) and primary education enrolment (MDG 2). Figure 23 presents the relationship between economic growth and achievement of MDG 1 for dynamic and lagging economies. Countries that benefit from a faster-than-average structural transformation process display a much stronger correlation between GDP growth and poverty reduction than those where transformation has been slower than average. More specifically, the impact of economic growth on poverty reduction has been almost zero in countries where the component of structural transformation in productivity growth has been small. This ultimately means that if countries grow but do not transform their productive structures, their economic growth will not be enough to achieve poverty reduction.

Source: Authors’ elaboration based on the same data as in Figure 19 for the reallocation effect, and on data from the United Nations website for the Millennium Development Goals indicators (http://mdgs.un.org/unsd/mdg).
Figure 24 shows the differential impact of GDP growth on the achievement of MDG 2, i.e. making primary education universal. While there is a difference between dynamic and lagging economies, this seems to be less strong than in the case of poverty reduction. Nevertheless, in the case of dynamic economies, the association between economic growth and improvements in education is positive. In the case of lagging economies, on the other hand, it is negative. These results indicate that structural transformation can help growing economies by creating conditions for people to access education and benefit from education through better job opportunities. This might happen because in more industrialized economies, productive activities agglomerate in urban areas where governments find it easier to provide basic education, or because through structural transformation more skills become necessary, giving parents and children more incentives to attain basic education.

To conclude, this simple analysis suggests that economic growth by itself is not enough to achieve the MDGs and improve human development indicators. Many developing countries have achieved high or modest rates of economic growth in recent decades without making improvements in poverty reduction, inequality, or other social indicators. Angola and Cambodia are two illustrative examples. Angola’s GDP grew by 3.2 per cent annually in the period from 1991 to 2012 and its labour productivity growth was 0.69 per cent. Based on our decomposition of labour productivity growth, this increase in labour productivity was due to direct productivity effects, while reallocation effects were negative. Angola had a rather low performance in MDG targets: its best result was achieved in primary education enrolment, on which it almost reached the MDG target of 100 per cent. During recent decades, Angola did not manage to diversify away from oil production, which still represents more than 90 per cent of Angolan exports. While oil guaranteed rapid economic growth, economic growth alone could not translate into more and better jobs and prosperity for all. By contrast, in a highly transformative economy such as the Cambodian one, economic and productivity growth have been accompanied by processes of structural change that led to impressive improvements along all the dimensions of human development investigated here. These findings support the idea that economic growth can improve the living conditions of the most vulnerable segment of society if accompanied by fast structural transformation processes.

5 Conclusions

This module has examined the process of structural transformation that accompanies and fosters socio-economic development. We presented the main ideas on which our approach is based and the most widely accepted stylized facts using historical evidence for today’s industrialized economies and more recent data for a larger sample of both developed and developing countries. We also showed that structural transformation is associated with economic growth, especially when directed towards industry and manufacturing.
The module stressed that productive structural transformation relies on both horizontal and vertical evolution, and that both diversification and technological upgrading are therefore essential to sustain economic growth. While undoubtedly affected by endowments, the potential for diversification and upgrade is critically influenced (and shaped) by policy decisions. These decisions are the subject of Module 2 of this teaching material.

The module also reviewed some of the key insights from different strands of the theoretical and empirical literature on structural transformation. The literature review included a discussion on how empirical studies have decomposed labour productivity growth in order to disentangle the effect of structural transformation. Applying this methodology to a large number of countries over the last 25 years, we empirically examined the relationship between structural transformation and human development.

The key messages of this module include:

- Sustained economic growth is associated with higher output and employment shares of secondary and tertiary sectors, and especially with an expanding manufacturing industry;
- Sustained economic growth requires both efficiency gains and changes in the economic structure;
- Manufacturing is the engine of productivity growth, while the services sector is the main source of employment;
- Productivity gains in agriculture are necessary to sustain economic growth, structural transformation, and poverty reduction;
- Structural transformation processes have pervasive effects on the economy and the society as a whole, affecting economic growth, poverty reduction, and social and human development;
- Instead of pursuing economic growth, countries should aim at economic growth with structural and productive transformation, meaning that productivity enhancements within sectors cannot come at the expense of job creation. This maximizes the impact of structural transformation on poverty reduction; and
- Economies that experienced faster structural transformation processes could also achieve more progress in attaining the MDGs.

**Exercises and questions for discussion**

**Exercise No. 1: Structural transformation trends and economic growth**

(a) Choose an economy to study and get the following data for this economy: real value added by economic sector and GDP per capita from the UN National Accounts, and employment by economic sector from the ILO’s Key Indicators of Labour Markets (see Box 3). Aggregate the data for this economy into three main sectors: agriculture, industry, and services.

(b) Using the formulas presented in Box 3 and a spreadsheet software such as MS Excel, compute the shares of output and employment for each of the three sectors for the period for which data are available.

(c) Analyse the evolution of the employment and output structure of this particular economy.

(d) Analyse the statistical association between income per capita and measures of economic structure using UNCTAD (2014b) as a guide. To this end, students may construct simple graphs called scatterplots between annual GDP per capita (on the horizontal axis) and annual sectoral shares of employment and output (on the vertical axis). They may also compute correlation coefficients between annual GDP per capita and annual shares of employment or output for each sector. Can students identify any significant associations between GDP per capita and indicators of economic structure? Discuss.

**Question 1 for discussion: Theoretical perspectives on structural transformation**

This activity is based on Ocampo (2005) and Lin (2011).

(a) After reading these two articles, students should:

- Identify three main ideas that characterize each of these perspectives;
- Discuss how each of these perspectives views and uses the concept of comparative advantage in its analysis of structural transformation;
Exercises and questions for discussion

- Discuss the methodological issues researchers face when they try to analyse causal linkages between economic growth and variables such as productivity growth, physical and human accumulation, institutions, and economic policies;
- Discuss the concept of complementarities that appears in Ocampo (2005) and provide examples;
- Discuss the types of structural transformation processes identified by Ocampo (2005) based on the interaction between the learning process and complementarities.

(b) Two groups of students (3-4 students each) should debate similarities and differences between old structuralist and more recent perspectives.

Question 2 for discussion: Empirical studies on structural transformation

(a) This activity is based on Lavopa and Szirmai (2012), who provide a comprehensive review of the literature on the contributions of manufacturing to economic growth, employment creation, and poverty reduction. Students should read the paper and address the following issues:

- Define the three channels through which growth in manufacturing output affects economic growth, employment, and poverty according to the analytical framework proposed by Lavopa and Szirmai (2012). Discuss the main factors and mechanisms of each of these three channels.
- The paper reviews several studies that econometrically test Kaldor’s laws. Discuss the main findings of the literature and present in detail the findings of one of the papers reviewed by Lavopa and Szirmai (2012) to the class.
- Summarize the findings of the empirical literature on direct, indirect, and induced effects of manufacturing on employment generation. Discuss why employment multipliers (for expansion of manufacturing activities) found by micro-based studies are so much higher than those found by macro-based studies.
- Discuss the methodology used in the literature to estimate sectoral poverty elasticity of growth. What are the main findings on the relationship between structural change and poverty reduction?

(b) Several recent papers (Ghani and Kharas, 2010; Ghani and O’Connell, 2014) challenge the view that manufacturing is the main engine of economic growth (see Section 3.3). Two small groups of students should first present the findings of this literature. This would be followed by a debate of its main arguments.

(c) This activity is based on Palma (2005). Students should read the article and answer the following questions:

- What are the main sources of deindustrialization and what is the method that the author uses to quantify them?
- What are the factors that may cause the Dutch disease in an economy?
- What does the author mean by “policy-induced Dutch disease”?
- How has the process of industrialization differed between Southeast Asian economies such as the Republic of Korea, Singapore, or Taiwan Province of China, and countries in Latin America and the Caribbean such as the Dominican Republic, El Salvador, Honduras, and Mexico?

Exercise No. 2: Structural transformation trends and economic growth

This activity is based on Chapter 4 of UNCTAD (2014b), which presents a methodology that allows researchers to identify the contribution of each economic sector to aggregate productivity growth and to the employment-to-population ratio. Students should read this chapter and continue the case study started in Exercise No. 1:

- Discuss the meaning of the following concepts: direct productivity growth effect, reallocation effect, and terms-of-trade effect;
- Analyse the sectoral contributions of agriculture, industry, and services to aggregate labour productivity growth and to employment generation using the Divisia index decomposition method presented in Box A1 in the annex of this module;
- What are the main observations with respect to sectoral contributions to aggregate labour productivity growth?
- Which economic sector appears to be the main direct contributor to aggregate labour productivity growth?
- Which economic sector appears to be the main contributor to the employment-to-population ratio?
ANNEX 1

An illustration of how to decompose labour productivity growth and discuss empirical results

This annex is based on Chapter 4 of UNCTAD (2014b) and aims to guide students in using the Divisia decomposition method presented in Box A1 to conduct original research on the role of structural transformation. Towards this end, it identifies and discusses the various steps that students need to follow in order to replicate the analysis in Chapter 4 of UNCTAD (2014b). The chapter focuses on LDCs and analyses their structural transformation, output, and employment growth between 1991 and 2012. The analysis is conducted on a comparative basis dividing countries into three main country groups: the group of LDCs, the group of other developing countries (ODCs), and the group of developed countries. As is the case for any analysis of indicators aggregated across economies, the results here are sometimes biased towards economies with significant shares in overall output and employment. Please note that while the methodology applied here is the same as in Section 4.2, the sample of countries differs. Moreover, while UNCTAD (2014b) conducts the analysis using data for agriculture, industry, and services, students can use more disaggregated data, provided that they are available for the country and period that they intend to study. Following UNCTAD (2014b), LDCs are classified here by their export specialization into:

- Exporters and producers of food and agricultural goods: Guinea-Bissau, Malawi, Solomon Islands, and Somalia;
- Exporters of fuel: Angola, Chad, Equatorial Guinea, South Sudan, Sudan, and Yemen;
- Exporters of mineral products: Democratic Republic of the Congo, Eritrea, Guinea, Mali, Mauritania, Mozambique, and Zambia;
- Exporters of manufactures: Bangladesh, Bhutan, Cambodia, Haiti, and Lesotho;

The analysis is composed of three steps: (1) analyzing the economic situation of the economies under scrutiny; (2) decomposing labour productivity growth; and (3) analysing sectoral contributions to labour productivity growth.

**STEP 1 Analysing the economic situation of the selected countries**

In the first step of our empirical analysis, we want to know how the selected economies are performing and what their structural characteristics are, i.e. what is their composition of employment and value added by sector and which sectors benefited from structural transformation. Let us start by looking at the annual growth rates of real value added per capita, which is equivalent to real per capita GDP, by groups of countries at constant 2005 prices in US dollars over the 1991–2012 period (Figure A1). LDCs grew more slowly than the other developing countries. Consistent with the evidence shown in Section 2.1 and 2.4, among LDCs, diversified exporters and economies that specialize in manufactured goods performed better than mineral and fuel exporters and, as expected, considerably better than agriculture exporters.
We now turn to the description of structural change dynamics in employment and value added. Changes in employment depend on the rate of employment growth, but also on initial conditions and the rate of population growth. Most developing countries are characterized by large shares of the workforce employed in subsistence agriculture and rapid growth in the working-age population. The former characteristic is reflected in the high shares of employment in agriculture in both LDCs and ODCs (Table A1): in LDCs, 74 per cent of the working population was employed in agriculture in 1991, and while that number declined over time, by 2012 agriculture still employed 65 per cent of the working population. A reduction in agricultural employment was more sizable in the ODCs. These figures are especially striking when compared to developed countries, where only 4 per cent of the workforce is employed in agriculture. Moreover, it is worth noting that country groups whose GDP grew the fastest – namely manufacturing exporters and mixed exporters (see Figure A1) – also recorded the fastest (absolute) changes in employment shares. In particular, manufacturing exporters saw a reduction of the agricultural share in total employment of 16 percentage points. Most of these workers went to services, whose share in total employment grew by 15 percentage points, with the other percentage point that left agriculture going into industry. By contrast, sectoral employment compositions of mineral exporters and agriculture exporters changed the least. Finally, in all country groups, workers moving out of agriculture mostly entered the services sector.

**Table A1**

<p>| Sectoral composition of employment, 1991–2012 (per cent and percentage points) |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|</p>
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<th>Industry</th>
<th>Services</th>
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<td>Mineral exporters</td>
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<td>Manufactures exporters</td>
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<tr>
<td>Service exporters</td>
<td>82</td>
<td>78</td>
<td>72</td>
</tr>
<tr>
<td>Mixed exporters</td>
<td>72</td>
<td>68</td>
<td>63</td>
</tr>
</tbody>
</table>

Source: UNCTAD (2014b: 64).

Note: Figures are expressed in per cent, except for the columns titled “change”, which are expressed in percentage points. Differences between the figures shown and the last column are due to rounding. ODCs: other developing countries, LDCs: least developed countries.
In contrast to employment, the largest output expansion occurred in industry rather than services (Table A2). This should not be a surprise because the services sector is more labour-intensive but less productive than the industrial sector (see Figure 3). This can explain the discrepancy between structural change dynamics when measured in terms of employment and output. Clearly, the combination of a growing share of services employment and a stable share of services output indicates a modest, or even negative, increase in labour productivity in the services sector.

### Table A2

| Sectoral composition of output, 1991–2012 (per cent and percentage points) |
|---------------------------------|------------------|------------------|-----------------|------------------|------------------|------------------|
|                                  | Agriculture      | Industry         | Services        | Agriculture      | Industry         | Services        |
| Developed economies              | 1     | 1     | 2     | 0      | 28    | 26    | 24    | -4     | 71    | 72    | 75    | 4      |
| ODCs                             | 11    | 10    | 8     | -4     | 38    | 40    | 40    | 2      | 51    | 51    | 52    | 2      |
| LDCs                             | 33    | 30    | 25    | -8     | 23    | 27    | 31    | 9      | 45    | 43    | 44    | -1     |
| Agriculture exporters            | 48    | 45    | 37    | -10    | 12    | 12    | 20    | 8      | 40    | 43    | 43    | 3      |
| Fuel exporters                   | 21    | 22    | 19    | -2     | 36    | 45    | 48    | 11     | 43    | 33    | 34    | -9     |
| Mineral exporters                | 39    | 36    | 31    | -8     | 20    | 22    | 25    | 5      | 41    | 42    | 44    | 3      |
| Manufactures exporters           | 28    | 23    | 18    | -10    | 20    | 24    | 29    | 9      | 53    | 53    | 53    | 0      |
| Service exporters                | 44    | 40    | 30    | -14    | 16    | 18    | 22    | 5      | 40    | 43    | 48    | 9      |
| Mixed exporters                  | 38    | 38    | 33    | -5     | 17    | 17    | 22    | 5      | 45    | 44    | 45    | 0      |

Note: Figures are expressed in per cent, except for the columns titled “change”, which are expressed in percentage points. Differences between the figures shown and the last column are due to rounding. ODCs: other developing countries; LDCs: least developed countries.

### STEP 2 Decomposing labour productivity growth

We will now try to understand how these structural transformation patterns affected labour productivity growth. In order to do so, we decompose labour productivity growth along its main components applying the Divisia index decomposition method presented in Box A1. Figure A2 reports the results of this exercise. It shows that in all country groups, the reallocation (or structural change) effect is always smaller than the direct productivity (or within) effect. The reallocation effect is the smallest in developed economies, which already underwent their major structural transformation processes. The reallocation effect, however, is smaller in LDCs than in ODCs, pointing to a certain difficulty for LDCs to change their production structures.
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Decomposition of aggregate labour productivity growth by country groups, 1991–2012 (percentage points and per cent)

Source: Adapted from Chart 27 in UNCTAD (2014b: 73).
Note: The direct productivity effect and the reallocation effect are expressed in percentage points, labour productivity growth rate in per cent. ODCs: other developing countries; LDCs: least developed countries.

Figure A3 zooms in on the group of LDCs, following the categorization according to export specializations proposed at the beginning of the annex. Interestingly, exporters of manufactured goods experienced the fastest growth rates of labour productivity, as well as the highest reallocation effects. By contrast, in economies specialized in fuel and extractives, aggregate labour productivity growth was primarily due to direct productivity increases, and in mineral exporting economies, the structural change effect was even negative.

Decomposition of aggregate labour productivity growth in least developed countries, 1991–2012 (percentage points and per cent)

Source: Adapted from Chart 27 in UNCTAD (2014b: 73).
Note: The direct productivity effect and the reallocation effect are expressed in percentage points, labour productivity growth rate in per cent.
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The Divisia index decomposition of labour productivity and employment growth

This box presents a method of decomposing aggregate labour productivity and the economy-wide employment-to-population ratio into sectoral contribution effects based on the Divisia index (Sato, 1976). The Divisia index is a “weighted sum of logarithmic growth rates where the weights are the components’ shares in total value” (Ang, 2004: 1133). The first step of the decomposition analysis is to define the aggregate indicator to decompose as a function of factors of interest. We begin with aggregate labour productivity, computed as the ratio of total real value added to total employment. Aggregate labour productivity is a reflection of dynamics within and between sectors.

Let there be \( n \) sectors in the economy. Each sector \( i \) produces real value added \( X_i \) (i.e. value of production at constant prices) and employs \( L_i \) workers. As in Box 3, we define total employment in the economy as the sum of sectoral employment \( L = \sum_i L_i \). Because prices across sectors differ, we cannot calculate total real value added, \( X \), as the sum of sectoral real value added. Instead, total real value added is computed as the sum of nominal value added in each sector (i.e. at current sectoral prices, \( P \)) divided by the overall price index \( P \). Hence, aggregate labour productivity can be expressed as follows:

\[
\varepsilon = \frac{X}{L} = \sum_i \frac{P_i X_i}{P_L} \tag{A1}
\]

Multiplying equation (A1) by \( L_i/L \) allows us to define aggregate labour productivity as the product of three factors:

\[
\varepsilon = \sum_i \frac{P_i X_i}{P_L} = \sum_i \lambda_i \rho_i \lambda_i \tag{A2}
\]

where \( \varepsilon = \frac{X}{L} \) stands for sectoral labour productivity, \( \lambda = \frac{L_i}{L} \) for employment shares and \( \rho = \frac{P_i}{P} \) for terms of trade. Aggregate labour productivity growth can now be decomposed into several contributing factors. Changes in sectoral labour productivity amount to within-productivity effects; changes in the structure of the economy as measured by the labour shares lead to structural change effects; and changes in the terms of trade reflect market structure effects. Assuming that all variables are continuous, differentiating equation (A2) with respect to time, \( t \), and dividing both sides by aggregate labour productivity \( \varepsilon \) yields:

\[
\ln(\varepsilon)/dt = \sum_i \rho_i \frac{\ln(\varepsilon_i)/dt + \ln(\lambda_i)/dt + \ln(\lambda_i)/dt}{P_i/P} \tag{A3}
\]

The weight \( \rho_i \) is the share of sector \( i \) in total nominal value added. Integrating equation (A3) over a time interval \([\omega, T]\) gives the Divisia decomposition of aggregate labour productivity growth:

\[
\int_\omega^T \frac{\ln(\varepsilon)}{\rho_i} dt = \int_\omega^T \left[ \frac{\ln(\varepsilon_i)/dt}{P_i/P} \right] + \int_\omega^T \left[ \frac{\ln(\lambda_i)/dt}{P_i/P} \right] + \int_\omega^T \left[ \frac{\ln(\lambda_i)/dt}{P_i/P} \right] \tag{A4}
\]

Applying the exponential to equation (A4) we get:

\[
D_{agg} = D_{intr} D_{str} D_{price} \tag{A5}
\]

where the components are given by:

\[
D_{intr} = \exp\left[ \int_\omega^T \sum_i \rho_i \frac{\ln(\varepsilon_i)/dt}{P_i/P} \right] \tag{A5.1}
\]

\[
D_{str} = \exp\left[ \int_\omega^T \sum_i \rho_i \frac{\ln(\lambda_i)/dt}{P_i/P} \right] \tag{A5.2}
\]

\[
D_{price} = \exp\left[ \int_\omega^T \sum_i \rho_i \frac{\ln(\lambda_i)/dt}{P_i/P} \right] \tag{A5.3}
\]

To match the discrete format of the data we can write the decomposition in discrete terms:

\[
D_{intr} = \exp\left( \sum_i \ln(\varepsilon_i)/\rho_i + \ln(\lambda_i)/\lambda_i \right) \tag{A6.1}
\]

\[
D_{str} = \exp\left( \sum_i \ln(\lambda_i)/\rho_i + \ln(\lambda_i)/\lambda_i \right) \tag{A6.2}
\]

\[
D_{price} = \exp\left( \sum_i \ln(\varepsilon_i)/\rho_i + \ln(\lambda_i)/\lambda_i \right) \tag{A6.3}
\]

Turning to employment generation, a fundamental insight is that a sector creates enough jobs (i.e. creates jobs in excess of its population growth) if its output per capita grows faster than its labour productivity (Ocampo et al., 2009). To see the details we can start with the identity \( \rho = L/P \) where \( P \) is the population. Labour productivity in sector \( i \) is \( \varepsilon_i = X_i/L_i \) and sectoral output level per capita is defined by \( \xi = X_i/P_i \). After simple alge-
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The Divisia Index decomposition of labour productivity and employment growth

By algebraic manipulation, the employment-to-population ratio can be expressed as $a = \sum_i (\xi_i) \lambda_i$.

Following a similar approach as for aggregate labour productivity, the growth rate of $a$ can be decomposed according to:

$$ln \frac{a_T}{a_S} = \sum_i (n_i(T) - n_i(S)) (\lambda_i + \lambda_i)$

where $\lambda_i$ are the sectoral employment shares. In a multiplicative form, the Divisia Index decomposition of the employment-to-population-ratio growth rate is:

$$\Delta a_{div} = \frac{D_{prod}}{D_{inc}}$$

where $D_{inc}$ is the income per capita index, and $D_{prod}$ is the productivity index.

Source: Authors.

STEP 3 Analysing sectoral contributions to labour productivity growth

We now know that productivity growth is mainly due to direct productivity effects rather than reallocation effects. But which sectors contribute the most to this productivity growth? The third and last step of this analysis answers this empirical question. Before delving into the analysis, it is important to clarify two aspects of the decomposition method used here. First, the index assigns a negative reallocation effect to a sector whenever there is a decline in its share of employment. If workers transfer from a low- to a high-productivity sector, the (positive) reallocation effect observed for the high-productivity sector is, in absolute terms, above the (negative) reallocation effect observed for the low-productivity sector. Hence, the reallocation effect at the aggregate level will be positive. In this case, we can say that the process of structural change has benefitted the economy. Second, reallocation and direct productivity effects by sectors must be analysed concomitantly, since employment and labour productivity are closely related to each other. For example, a rise in employment in a sector can cause a decline in its labour productivity if output does not sufficiently expand. Similarly, a rise in a sector’s labour productivity caused by more capital-intensive modes of production can lead to a decline in employment. These examples suggest that the ideal structural transformation process is the one where high-productivity sectors create many jobs, while also generating strong productivity gains. In Section 2.1, we defined this as productive structural transformation. We are now ready to interpret the results of the analysis.

Direct productivity and reallocation effects by sector are presented in Table A3, while Table A4 shows correlations between aggregate labour productivity growth and its productivity and reallocation components by sector. Several conclusions can be drawn from these two tables. We limit our attention to the most visible ones. Table A4 indicates that labour productivity growth is mostly associated with direct productivity increases and with structural transformation in favour of the industrial sector occurring simultaneously, as suggested by the correlation between direct and aggregate and reallocation and aggregate which are higher in industry than in agriculture and services. This finding corroborates the insights from the literature reviewed in Section 3. In ODCs, the fastest-growing group of countries (see Figure A1), labour productivity in industry added 33.4 percentage points through direct productivity effects and 13.5 percentage points as a result of absorption of labour, leading to the highest aggregate productivity growth (114.2 per cent). The group with the second-highest aggregate productivity growth is the group of LDC manufacturing exporters, followed closely by LDC mixed exporters.

Another group of countries that registered high aggregate productivity growth, namely the group of LDC fuel exporters, achieved labour productivity enhancements mainly through direct effects within industry, with lower reallocation effects. A similar pattern characterizes the LDC mineral exporters, with even lower reallocation effects. This result can be explained by three factors. First, extractive industries are very capital-intensive. A more advanced machine, for example, can therefore increase labour productivity by facilitating the production of more output with the same amount of labour. This would explain the generally high direct productivity effects in industry. Second, due to their high capital intensity, resource-intensive industries are characterized by above-average labour productivity, meaning that a movement away from these industries is likely to reduce, rather than enhance, aggregate labour productivity. Finally, as mentioned in Section 2.1, structural transformation is more difficult in resource-abundant economies, reducing the chances of productive structural transformation.
Correlation analysis of aggregate labour productivity growth and its components

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Source: Adapted from Table 15 in UNCTAD (2014b: 74).

Note: Direct productivity effects and reallocation effects are expressed in percentage points, aggregate productivity growth in per cent. ODCs: other developing countries; LDCs: least developed countries.

Correlation analysis of aggregate labour productivity growth and its components

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REFERENCES


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