9

The Recent Growth Boom in Developing Economies: A Structural-Change Perspective

Xinshen Diao, Margaret McMillan, and Dani Rodrik

1 Introduction

Developing countries have experienced an extraordinary period of economic development over the last couple of decades. Besides India and China, which registered record economic growth rates, countries in sub-Saharan Africa and Latin America have managed to match or exceed their performance of the 1960s and first half of the 1970s. The recent downturn in the global economy has cast a dark shadow on the future of this performance, and Latin America in particular has been badly hit by the decline in commodity prices. But growth in the low-income countries of Africa has been resilient and remains high in the non-resource-dependent countries.

X. Diao
Development Strategy and Governance, International Food Policy Research Institute (IFPRI), Washington, DC, USA
e-mail: x.diao@cgiar.org

M. McMillan
Tufts University and IFPRI, Medford, Somerville, MA, USA
e-mail: Margaret.McMillan@tufts.edu

D. Rodrik (✉)
John F. Kennedy School of Government, Harvard University, Cambridge, MA, USA
e-mail: dani_rodrik@harvard.edu

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Even a cursory look at the experience of the recent growth champions indicates that their experience differs greatly from the standard East Asian path. East Asian countries such as South Korea, Taiwan and China grew through rapid export-oriented industrialization. By contrast, none of the recent growth experiences outside East Asia show evidence of rapid industrialization. Instead, Latin American countries have experienced premature deindustrialization, while in Africa manufacturing industries are barely holding their own in most countries.

How do we understand this recent wave of economic growth in developing countries? What have been the main drivers and how sustainable are they? We offer a structuralist perspective on this recent experience, focusing on the role of structural change in driving economywide labor productivity growth. In East Asian countries, the movement of labor from low-productivity agriculture and informality to modern manufacturing industries and associated activities played a critical role. Was there a similar transformation in the recent crop of growth accelerations? Even if industrialization did not play a substantial role, did the expansion of other modern activities, such as services, substitute for it? And what has been the relationship between patterns of structural change and labor productivity growth within specific sectors or the "within" component of economywide labor productivity growth?

We begin by reviewing and updating some of the stylized facts in McMillan and Rodrik (2011) on structural dualism in developing nations and relating the structuralist perspective to the neoclassical growth model (Sect. 2). We then turn to recent episodes of growth acceleration in Latin America, Africa and India (Sect. 3). We decompose labor productivity growth during these episodes into two terms: within-sector productivity growth and inter-sectoral labor reallocation.

Our most interesting finding is that recent growth accelerations were based on either rapid within-sector labor productivity growth (Latin America) or growth-increasing structural change (Africa), but rarely both at the same time (Sect. 4). There is a strong negative correlation between the two components of growth across countries, with India as the sole exception. In Latin America, within-sector labor productivity growth has been impressive, but growth-promoting structural change has been very weak. In fact, structural change has made a negative contribution to overall growth excluding agriculture, meaning labor has moved from high-productivity sectors to low-productivity activities. In Africa, the situation is the mirror image of the Latin American case. Growth-promoting structural change has been significant, especially in Ethiopia, Malawi, Rwanda, Senegal and Tanzania. But this has been accompanied in these countries by mostly negative labor productivity growth within nonagricultural sectors.

We also show in Sect. 4 that this experience stands in sharp contrast with the classic East Asian growth experience (such as in South Korea and China), in which both components of labor productivity contributed strongly to overall growth. Moreover, the East Asian pattern seems to be replicated in more recent Asian cases of growth accelerations as well (in Bangladesh, Cambodia, Laos, Vietnam and India as mentioned earlier).

The Latin American pattern of weak or negative structural change was noted and discussed in McMillan and Rodrik (2011) and related to the region's commodity dependence, overvalued exchange rates, (relatively) low agricultural employment shares and deindustrialization. But the African pattern is puzzling. Rapid growth-promoting structural change has become a feature of the African economic landscape—something that was not evident in the data in McMillan and Rodrik (2011)—which is surely good news. It is also somewhat surprising, given that industrialization has not figured prominently in the region. But it now comes at the expense of declining labor productivity growth in the more modern sectors of the economy. How can we make sense of this anomaly?

We develop a simple two-sector general equilibrium model in Sect. 5 to shed light on regional patterns of structural change, especially the contrast between the African and Asian models. We make specific assumptions on preferences, namely, that demand is non-homothetic (with a declining budget share of the traditional sector) and the modern-sector good is price elastic. We show that the Asian pattern of strong "within" and "between" components is consistent with growth being driven mainly by positive productivity shocks to the modern sectors. The model generates a positive correlation between the two components of aggregate labor productivity growth: as the modern sector expands thanks to the positive productivity shock, it draws labor from the other, less productive sectors of the economy.

The African model, by contrast, is consistent with growth being driven not by the modern sector, but by positive aggregate demand shocks (e.g., due to foreign transfers) or by productivity growth in the traditional sector (agriculture). In this model, the modern sector expands and growth-promoting structural change takes place as increased demand spills over to the modern sector. (Our assumptions on preferences ensure that demand shifts are sufficiently biased toward the modern sector to ensure the modern sector expands in both cases, despite relative-price adjustments.) But labor productivity in the modern sector is driven down as a by-product, as diminishing returns to capital set in and less productive firms are drawn in. This is also consistent with the relatively poor performance of manufacturing in Africa.

These considerations suggest that positive structural change in African countries may be driven mainly from the demand side, whether due to external transfers or the induced demand effects from increased agricultural incomes. This in turn raises the question of the sustainability of recent growth, an issue we discuss in the concluding section (Sect. 6). The end of the commodity super-cycle has already thrown into question the continued rapid growth of resource-rich countries. Our analysis indicates that other fast-growing countries may face a slowdown as well, due to the self-extinguishing nature of the productive structural change that has so far fueled their growth.

2 Structuralism, Dualism and Labor Productivity Growth

The concept of structuralism in development economics dates back to the founding of the Economic Commission for Latin America and the Caribbean (ECLAC) in 1948. The central tenet of structuralism is that developing countries differ qualitatively from developed ones. Further, if these differences are not recognized, policies designed to stimulate growth and poverty reduction in the developing world are doomed to fail. The intellectual foundations of structuralism are attributed primarily to Raúl Prebisch, the founding director of ECLAC. A key insight of Prebisch which remains highly relevant today had to do with the important role of industrialization in the developing world. Prebisch (1950) along with Singer (1950) argued forcefully that the prices of primary commodities relative to those of manufactured goods were bound to decline over time, dooming poor countries to poverty unless they industrialized. This argument was behind the now famous period of import substituting industrialization (ISI) in Latin America. Although these policies have been widely criticized, growth in output per worker during the period of ISI—roughly 1950–1975—was higher than in any other period of Latin America's recent economic history (McMillan and Rodrik 2011).

A related but distinct concept is that of structural dualism. Structural dualism also has its roots in development economics and dates back to the work of Lewis (1954). This work draws a sharp distinction between the traditional and modern sectors of the economy; accumulation, innovation and productivity growth all take place in the modern sector while the traditional sector remains technologically backward and stagnant. Thus, economywide growth depends largely on the rate at which resources—principally labor—can migrate from the traditional to the modern sector. The reason that this concept is still so important in the context of developing countries is because the economies of today's poor countries are still very much characterized by structural dualism. The implication of this dualism is that there are potentially large payoffs to moving workers out of the traditional sector and into the modern sector.

These schools of thought both emphasize the idea that industrialization can lead to large gains in income per capita. For structuralists, manufacturing is considered key to the development process both because of its technical sophistication and because of the growth in output per worker associated with increasing returns to scale. For dualists, the combination of unlimited supplies of labor in the traditional sector and high marginal returns to activities in the modern sector implies that the expansion of the modern sector is the key to growth in output per worker. Because labor-intensive manufacturing was the modern sector that had the ability to absorb large numbers of unskilled workers, industrialization became synonymous with the modern sector in dual economy models of growth.

While it is well documented that industrialization played a key role in raising incomes in today's developed economies, it is unclear to what extent industrialization can play a role in rapid poverty reduction going forward. For example, Rodrik (2016) documents a pattern of premature deindustrialization whereby countries are running out of opportunities for industrialization at much lower levels of income compared to early industrializers. Labor shed through this process of deindustrialization has mainly ended up in low-productivity services in both Latin America and some developing countries including the United States. This process has also made the prospects for industrialization more bleak in Africa. China and Vietnam appear to be the exceptions, but even in Vietnam it seems hard to imagine that the share of employment in manufacturing will reach the peaks observed previously in the industrialized world. If deindustrialization has become the norm then we are faced with an important puzzle. What is driving the rapid growth we are seeing in many of today's very poor countries?

One way to begin to understand the growth booms we have observed over the past couple of decades in today's poor countries is to recognize the complementarity between structuralist models of growth and the neoclassical model of growth first introduced by Solow (1956). In this model growth depends on the incentives to save, accumulate physical and human capital and (in subsequent variants that endogenize technological change) innovate by developing new products and processes (Grossman and Helpman 1991;

Aghion and Howitt 1992). These models focus on the growth process *within* modern sectors. By contrast, structural models with an emphasis on industrialization focus on relationships and flows *among* sectors.

As Rodrik (2014) has argued, the two channels may have common determinants. For example, improved incentives to invest and adopt new technologies in the modern sector may enable the sector to expand and absorb labor from the traditional sector. But the two models emphasize different processes as being critical to growth. In what follows, we first present evidence which strongly suggests that dualism is alive and well in developing countries. We then lay out our conceptual framework for thinking about the sources of growth that incorporates both the dual economy and neoclassical models of growth. Of course, this approach abstracts from a number of important issues facing today's middle-income countries emphasized by structuralists.[1] But it seems to us a good place to start.

2.1 Structural Dualism: The Data

Our evidence on structural dualism is based on the 10-sector database produced by researchers at the Groningen Growth and Development Center (GGDC). We use the most recent version of the data which were last updated in January 2015 (Timmer et al. 2015). These data consist of sectoral and aggregate employment and real value-added statistics for 30 developing countries and 9 high-income countries covering the period up to 2010 and, for some countries, to 2011 or 2012. The countries and their geographical distribution are shown in Table 9.1, along with some summary statistics. We compute labor productivity by dividing each sector's real value added by the corresponding level of sectoral employment. The sectoral breakdown we use in the rest of the chapter is shown in Table 9.2.

Using the GGDC data to compute average labor productivity by sector raises some important measurement issues. The first has to do with the extent to which the GGDC data accounts for the informal sector. The data for value added come from national accounts, and as mentioned by Timmer and de Vries (2007, 2009), the coverage of such data varies from country to country. While all countries make an effort to track the informal sector, obviously the quality of the data can vary greatly. On employment, Timmer and de Vries (2007, 2009) relied on population censuses for total employment levels and

[1] Lance Taylor, probably the most prominent modern-day structuralist, along with Ocampo and Rada analyzed these issues at length in their book *Growth Policy in Developing Countries: A Structuralist Approach (2010).*

Table 9.1 Summary statistics

	Code	Economywide labor productivity	Coef. of variation of log of sectoral productivity	Sector with highest labor productivity		Sector with lowest labor productivity		Annual growth rate of economywide productivity (%)
				Sector	Labor productivity	Sector	Labor productivity	
High income								
United States	USA	83.2	0.065	Utilities	367.0	Personal services	52.3	1.68
Netherlands	NLD	53.1	0.108	Mining	1745.8	Personal services	28.5	1.41
United Kingdom	GBR	52.9	0.086	Mining	603.3	Agriculture	26.5	1.59
Japan	JPN	52.2	0.061	Utilities	197.9	Agriculture	16.1	1.17
France	FRA	49.2	0.047	Utilities	157.4	Business services	20.7	1.01
Sweden	SWE	47.2	0.060	Utilities	223.0	Business services	31.6	3.44
Italy	ITA	45.2	0.094	Utilities	220.0	Business services	5.2	−0.79
Denmark	DNK	44.8	0.118	Mining	1787.5	Business services	17.9	0.28
Spain	ESP	41.8	0.063	Utilities	222.4	Business services	16.7	0.30
Asia								
Singapore	SGP	81.3	0.090	Utilities	274.9	Agriculture	13.4	−0.35
Hong Kong	HKG	64.3	0.084	Utilities	465.6	Agriculture	20.2	3.57
Taiwan	TWN	52.0	0.092	Mining	473.6	Construction	17.0	1.29
South Korea	KOR	37.7	0.085	Utilities	304.0	Agriculture	18.0	2.38
Malaysia	MYS	29.2	0.125	Mining	1063.5	Construction	10.7	2.75
Thailand	THA	11.8	0.155	Mining	305.5	Agriculture	2.7	2.77

(*continued*)

Table 9.1 (continued)

	Code	Economywide labor productivity	Coef. of variation of log of sectoral productivity	Sector with highest labor productivity		Sector with lowest labor productivity		Annual growth rate of economywide productivity (%)
				Sector	Labor productivity	Sector	Labor productivity	
Philippines	PHL	7.8	0.115	Utilities	79.7	Personal services	2.5	2.51
China	CHN	7.4	0.127	Utilities	48.1	Personal services	1.4	10.38
Indonesia	IDN	7.0	0.118	Mining	102.6	Agriculture	2.3	2.66
India	IND	5.1	0.107	Utilities	40.7	Agriculture	1.7	6.38
Latin America								
Brazil	BRA	78.2	0.100	Utilities	774.6	Personal services	25.0	0.88
Chile	CHL	28.5	0.094	Mining	281.5	Agriculture	13.1	1.85
Venezuela	VEN	25.9	0.114	Mining	421.3	Agriculture	10.5	−0.34
Mexico	MEX	25.1	0.119	Mining	422.2	Agriculture	6.2	−0.51
Argentina	ARG	23.5	0.100	Mining	326.3	Personal services	9.3	1.75
Costa Rica	CRI	20.5	0.029	Transport services	31.2	Agriculture	12.5	1.77
Colombia	COL	14.1	0.111	Utilities	232.8	Agriculture	6.1	1.27
Peru	PER	13.7	0.107	Mining	110.7	Agriculture	3.8	3.73
Bolivia	BOL	7.5	0.126	Utilities	71.8	Construction	2.8	0.77
Africa								
Botswana	BWA	29.9	0.126	Mining	418.8	Agriculture	1.9	2.68
South Africa	ZAF	23.9	0.091	Utilities	96.8	Agriculture	4.3	2.57
Mauritius	MUS	22.1	0.061	Utilities	83.0	Personal services	12.3	2.87
Nigeria	NGA	5.0	0.243	Mining	1549.5	Personal services	0.8	3.81

(*continued*)

Table 9.1 (continued)

	Code	Economywide labor productivity	Coef. of variation of log of sectoral productivity	Sector with highest labor productivity		Sector with lowest labor productivity		Annual growth rate of economywide productivity (%)
				Sector	Labor productivity	Sector	Labor productivity	
Ghana	GHA	4.6	0.091	Utilities	23.6	Trade services	2.6	2.59
Senegal	SEN	4.0	0.161	Utilities	129.8	Agriculture	1.3	1.24
Kenya	KEN	3.1	0.114	Utilities	32.7	Agriculture	1.6	1.09
Zambia	ZMB	2.7	0.173	Utilities	36.3	Personal services	0.3	3.00
Tanzania	TZA	2.5	0.163	Business services	83.0	Personal services	0.5	4.37
Malawi	MWI	2.2	0.124	Mining	46.4	Agriculture	1.0	2.23
Ethiopia	ETH	1.4	0.148	Mining	31.2	Agriculture	0.8	5.07

Note: All data used in this table come from GGDC. All productivity numbers are for average 2000–2010 and are in 2005 purchasing power parity (PPP) $1000

Source: Diao et al. (2017)

Table 9.2 Sector coverage and labor productivity ('000 of 2000 PPP USD)

Sector	Average sector labor productivity	Maximum sector labor productivity		Minimum sector labor productivity	
		Country	Labor productivity	Country	Labor productivity
Agriculture	14.9	United States	53.7	Ethiopia	0.66
Mining	311.2	Denmark	1787.5	Ethiopia	2.27
Manufacturing	40.4	Brazil	121.9	Ethiopia	1.72
Utilities	155.5	Brazil	774.6	Nigeria	2.61
Construction	26.7	United States	69.5	Malawi	3.64
Trade services	25.7	Singapore	95.0	Ethiopia	2.59
Transport services	43.6	Brazil	138.9	Nigeria	2.54
Business services	42.8	United States	154.2	Nigeria	6.69
Government services	24.4	Brazil	126.0	Nigeria	1.32
Personal services	23.9	Hong Kong	114.5	Tanzania	0.33
Total economy	30.0	United States	83.2	Ethiopia	1.37

Note: All data used in this table come from GGDC. All numbers are an unweighted average over all countries for the period 2000–2010
Source: Diao et al. (2017)

their sectoral distribution; they used labor force surveys for the growth in employment between census years. Census data and other household surveys tend to have more complete coverage of informal employment. In short, a rough characterization of the data would be that the employment numbers in the GGDC dataset broadly coincide with actual employment levels, regardless of formality status, while the extent to which value-added data include or exclude the informal sector heavily depends on the quality of national sources. For a detailed explanation of the protocols followed to compile the GGDC 10-sector database, refer to Timmer, de Vries, and de Vries (2015) and "Sources and Methods" at the database's web page: http://www.ggdc.net/databases/10_sector.htm.

The second concern—and one that has gotten a lot of attention in recent literature[2]—is that the quality of the data collected by national statistical agencies in poor countries and Africa in particular is not very good. Like Diao, Harttgen and McMillan (2017), our confidence in the estimates of value added at the sectoral level is bolstered by the following facts. First, the African coun-

[2] See for example Klasen and Blades (2013).

tries included in the GGDC database are the countries in Africa with the strongest national statistical offices, and these countries have been collecting national accounts data for some time. Second, researchers at the GGDC specialize in providing consistent and harmonized measures of sectoral value added and our view is that this expertise lends credibility to these numbers. Finally, using Living Standard Measurement Study (LSMS) surveys, researchers have shown that sectoral measures of value added based on national accounts data are highly correlated with sectoral measures of consumption (Gollin et al. 2014).

The third concern stems from the measurement of labor inputs. Ideally, instead of using the measured number of workers employed in a sector, we would use the number of hours worked in a sector. This would correct for biases associated with the seasonality of agriculture that might lead to an underestimation of agricultural labor productivity. This is a serious issue and for the purposes of this chapter, we rely on work by Duarte and Restuccia (2010) who show that in a sample of 29 developed and developing countries the correlation between hours worked and employment shares is close to one, and Gollin et al. (2014) who show that correcting labor productivity measures for hours worked does not overturn the result that labor productivity in agriculture is significantly lower than labor productivity in the rest of the economy. Note that this does not mean that there are not off-farm activities in rural areas that bring in less income, for example than farming. In fact, this is highly likely in very poor economies where a large share of economic activity is of a subsistence nature.[3]

Finally, the productivity gaps we describe here are differences in *average* labor productivity. When markets work well and structural constraints do not bind, it is productivities *at the margin* that would be equalized. Under a Cobb-Douglas production function specification, the marginal productivity of labor is the average productivity multiplied by the labor share. Thus, if labor shares differ greatly across economic activities, then comparing average labor productivities can be misleading. The fact that average productivity in mining is so high, for example, simply indicates that the labor share in this capital-intensive sector is quite small. In the case of other sectors, however, there does not appear to be a clearly significant bias. Once the share of land is taken into account, for example, it is not obvious that the labor share in agriculture is significantly lower than in manufacturing (Mundlak et al. 2012). Therefore,

[3] Using LSMS-ISA data, McCullough (2015) finds that correcting for hours worked reduces the gap between labor productivity in agriculture and in other activities significantly, but she provides no explanation for the large difference between her results and the results of Gollin et al. (2014).

the large observed differences in average labor productivity between manufacturing, say, and agriculture do point to large gaps in marginal productivity.

2.2 Structural Dualism: The Evidence

Figure 9.1 shows that for the 11 African countries in the GGDC sample, the productivity gaps across sectors are indeed enormous.[4] Each bin in the figure corresponds to one of the nine sectors in the dataset,[5] with the width of the bin corresponding to the sector's share of total employment, and the height corresponding to the sector's labor productivity level as a fraction of average labor productivity in the economy. Agriculture, at 35 percent of average productivity, has the lowest productivity by far; manufacturing productivity is 1.7 times as high, and mining productivity is 16.8 times as high. Furthermore, the figure makes evident that the majority of employment in the African sample is in the most unproductive sectors, with roughly two-thirds of the labor force in the two sectors with below-average productivity (agriculture and personal services). Based on this figure, it appears that the potential for structural

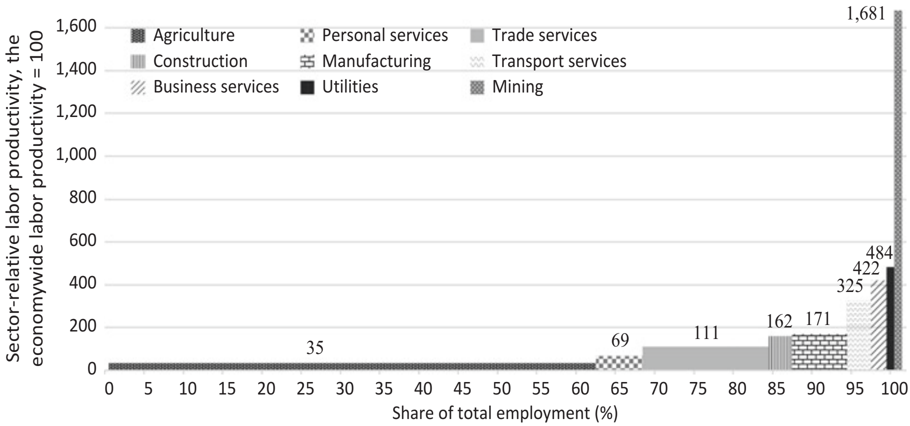

Fig. 9.1 Labor productivity gaps in Africa, 2010. (Note: The sector-relative labor productivity and sector share of employment are calculated using the weighted average for the region; the country data is in 2005 purchasing power parity dollars)
Source: Diao et al. (2017)

[4] We use Africa in this chapter to refer to the 11 sub-Saharan African countries included in the GGDC Database.

[5] Figure 9.1 excludes government services.

change to contribute to labor productivity growth is still quite large in most African countries.

That productivity gaps in Africa are large is not surprising. It is evident from Table 9.1 that the least productive countries in our sample are in Africa. In previous work (McMillan and Rodrik 2011), we showed that these productivity gaps tend to shrink as countries get richer. We provide updated evidence on this relationship in Fig. 9.2. The coefficient of variation is recorded on the vertical axis and the log of real value added per worker is recorded on the horizontal axis. Not surprisingly, extending the sample to 2010 does not alter our main insight; as countries get richer, the gaps in labor productivity across sectors shrink. The implication is that there is relatively more scope for achieving labor productivity gains in poor countries by moving labor out of agriculture and into other more productive sectors.

The way this process evolves tells us something important about the process of development. McMillan and Rodrik (2011) documented that the productivity gap between the agricultural and nonagricultural sectors of the economy follow a U-shaped relationship. The economic logic behind this relationship is intuitive. In very poor countries with few modern industries, the productiv-

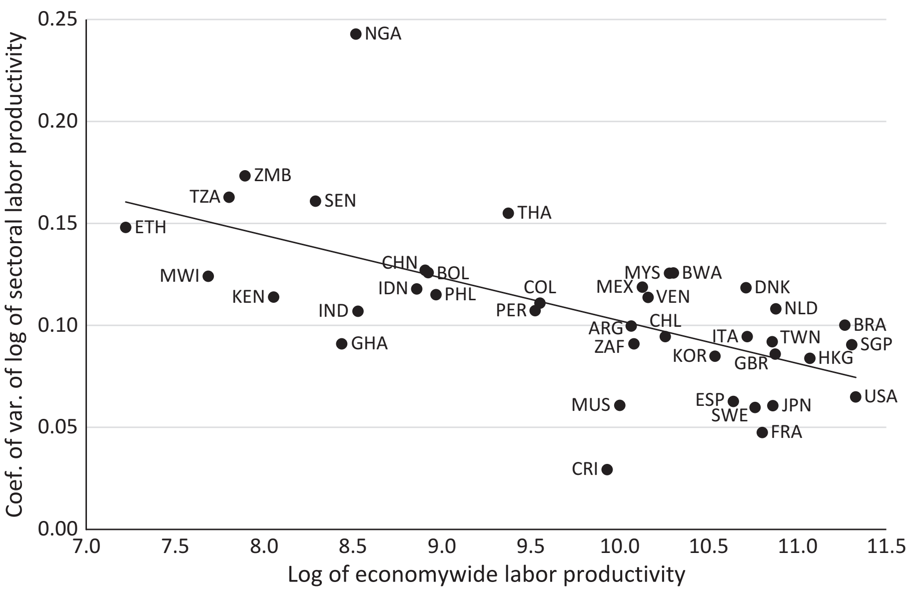

Fig. 9.2 Sectoral gaps in labor productivity shrink as income rises. (Note: Both economywide and sectoral labor productivities are value added at 2005 constant international PPP divided by total or sectoral employment and it is 2000–2010 average)
Source: Authors' calculations using GGDC data

ity gap between agriculture and the rest of the economy is low. As new activities start to take place in the modern sector, the gap starts to widen and the economy becomes more dual (Kuznets 1955). As labor starts to move from the traditional sector to the modern sector, productivity starts to converge between the two sectors. As noted by McMillan and Rodrik (2011), this story highlights two key dynamics of structural transformation: the rise of new industries (i.e., economic diversification) and the movement of resources from traditional industries to these new industries. Without the first, there is little that propels the economy forward. Without the second, productivity gains do not diffuse in the rest of the economy.

Of course these are broad patterns in the data and our story is about the way things should work if the process of development is on track. If we dig a little bit deeper, we can learn more about how the process of structural change is evolving across countries. To do this, we start with a little bit of algebra that clarifies the forces at work described in the previous paragraph. Let the relative productivity of the agricultural sector (RPA) be defined as follows:

$$RPA = \frac{Lprody_A}{Lprody_N} = \frac{VA_A}{L_A} \bigg/ \frac{VA_N}{L_N} = \frac{VAs_A}{VAs_N} \bigg/ \frac{Ls_A}{Ls_N} \tag{9.1}$$

where $VAs_i = \frac{VA_i}{GDP}$ and $Ls_i = \frac{l_i}{l}$ denote shares of value added and employment in sector i respectively.

What happens to the RPA over the course of development? To understand this, we focus on the last term in Eq. (9.1), which represents the relationship between the sectoral compositions of output and employment: the two interrelated aspects of structural change. The rise of new industries and the associated increase in the value-added share of nonagricultural sectors lowers the numerator, causing the RPA to fall. At the same time however, attracted by new opportunities in the nonagricultural sector, labor exits agriculture and the employment share in agriculture falls, which in turn causes the RPA to rise. Thus, the RPA only falls when the structural changes in the sectoral composition of output outpace the shifts in employment shares. We are more likely to observe this pattern in the early stages of development when productivity growth in the nonagricultural sector is faster than productivity growth in the agricultural sector.

Very few countries in our sample actually fit this pattern, but they are big countries. The first two charts in Fig. 9.3 show that this happened in China and India but for different reasons.[6] In China, very rapid productivity growth in manufacturing occurred alongside structural change. As Wei and Zhang

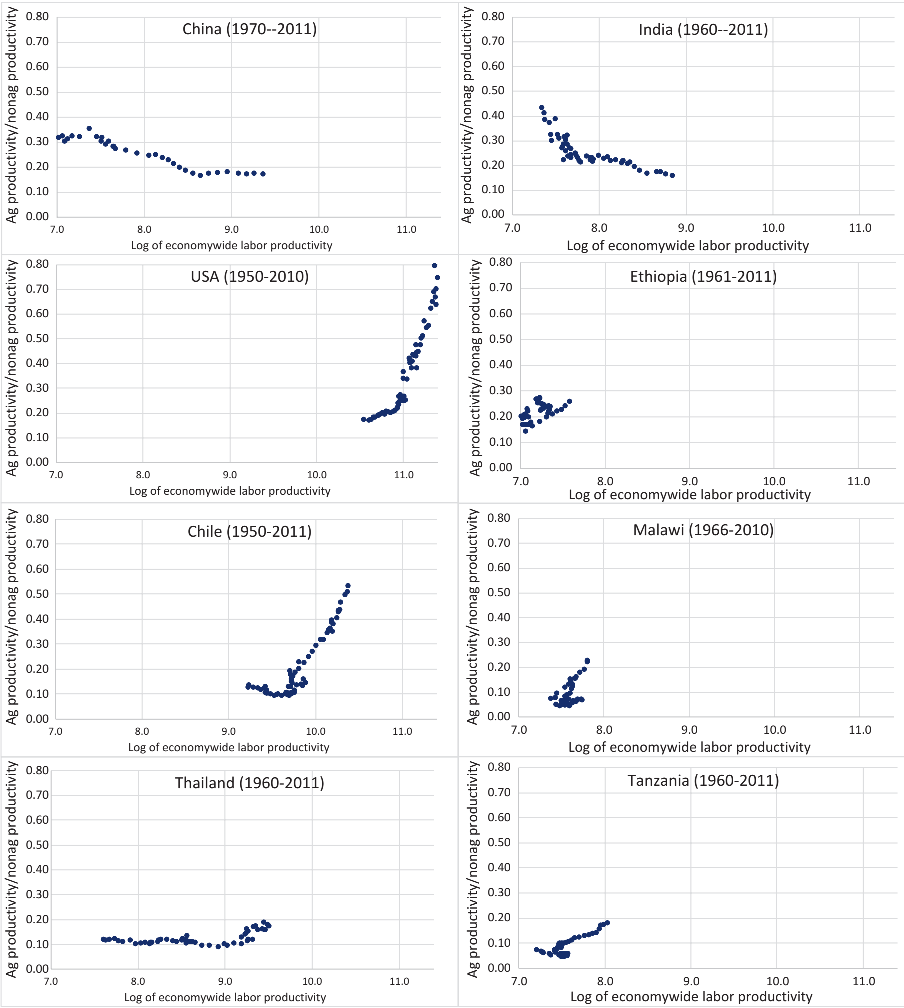

Fig. 9.3 Level of economywide labor productivity versus ratio of agricultural and non-agricultural productivity: China and India, United States, Chile and Thailand, and three African countries. (Note: Economywide labor productivity is total value added at 2005 constant international PPP divided by total employment. Agricultural and nonagricultural labor productivity is sectoral value added at 2005 constant PPP USD constant price divided by sector employment)
Source: Authors' calculations using GGDC data

[6] The RPA also fell in Nigeria, but this is driven solely by extremely high productivity in the oil sector without any meaningful structural changes.

(2011) have shown, the bulk of this productivity growth was a result of the entry of new private firms into the manufacturing sector. This rapid productivity growth in manufacturing outpaced labor exits from agriculture, thereby lowering the RPA. By contrast, in the case of India, recent rapid productivity growth in the modern services sector (e.g., IT) outpaced shifts in employment shares primarily because such modern services employ relatively few workers and so employment shares did not change all that much.

The more typical pattern in the data for a developing country is a long period (20–40 years) where the counterbalancing forces between changes in the sectoral composition of output and employment shares keep the RPA fairly constant. We show this pattern for Chile and Thailand in Fig. 9.3. In the case of Thailand, the RPA hovered around 0.10 for almost 40 years and it is only in the past ten years or so that it has started to inch upward at a level of economywide labor productivity over 10,000 purchasing power parity (PPP) USD. The pattern is not that different for Chile, although the data for Chile start at a much higher income level. In general, the RPA only starts to increase when shifts in employment from agriculture to nonagriculture become minimal and agricultural labor productivity growth starts to outpace productivity growth in the nonagricultural sector. This pattern can be seen for the United States in Fig. 9.3 and is typical of the developed countries in our sample. But it is also evident in a number of middle-income developing countries in Asia and Latin America.

A different pattern seems to be emerging in a number of poor African countries. We show this pattern for Ethiopia, Malawi and Tanzania in Fig. 9.3. In all three countries, the RPA seems to be trending upward but at very low levels of economywide labor productivity. Since we know that the employment share in agriculture has fallen over time in these three countries, the trend upward in the RPA implies that compositional changes in the structure of output have been slower than shifts in employment shares. In poor countries like Ethiopia, Malawi and Tanzania, we expect labor productivity in the modern sector to grow more rapidly than—or at least at the same rate as—labor productivity in agriculture, counterbalancing the labor reallocation effect. We return to the absence of this countervailing force later in the chapter.

2.3 A Formalization of the Two Growth Traditions

While structural dualism is clearly an important feature of developing countries, a complete accounting of labor productivity growth must take into account the fact that labor productivity growth can be achieved in one of two ways. First, productivity can grow within existing economic activities through capital accumulation or technological change. Second, labor can move from low-productivity to high-productivity activities, increasing overall labor productivity in the economy. Following McMillan and Rodrik (2011), we express these two components of labor productivity growth using the following decomposition:

$$\Delta y^t = \sum_i \theta_i^{t-k} \Delta y_i^t + \sum_i y_i^t \Delta \theta_i^t, \tag{9.2}$$

where y^t and y_i^t refer to economywide and sectoral labor productivity levels, respectively, and θ_i^t is the share of employment in sector *i*. The Δ operator denotes the change in productivity or employment shares between t-*k* and *t* and $t > k$. The first term in the decomposition is the weighted sum of productivity growth within individual sectors, where the weights are the employment share of each sector at the beginning of the period. As in McMillan and Rodrik (2011), we call this the "within" component of productivity growth. The second term captures the productivity effect of labor reallocations across different sectors. It is the inner product of productivity levels (at the end of the period), with the change in employment shares across sectors. We call this second term the "structural change" term.

The second term in Eq. (9.2) could be further decomposed into a static and dynamic component of structural change, as in de Vries et al. (2015). We choose not to go that route here because the dynamic component of the structural-change term is often negative and difficult to interpret. For example, when agricultural productivity growth is positive and the labor share in agriculture is falling, the term is negative, even though, on average, the movement of workers out of agriculture to other more productive sectors of the economy makes a positive contribution to structural change and economywide labor productivity growth. Moreover, structural change is, by its very nature, a dynamic phenomenon; thus, we find it counterintuitive to label a part of structural-change static.

The decomposition we use clarifies how partial analyses of productivity performance within individual sectors (for example, manufacturing) can be misleading when there are large differences in labor productivities (y_i^t) across economic activities. In particular, a high rate of productivity growth within a sector can have ambiguous implications for overall economic performance if the sector's share of employment shrinks rather than expands. If the displaced labor ends up in activities with lower productivity, economywide growth will suffer and may even turn negative. This has been an important reason for poor economywide productivity growth in Latin America, where modern sectors have performed very well, but without expanding their share of the economy's labor force (McMillan and Rodrik 2011).

This decomposition can be used to study broad patterns of structural change within a country and across countries. An example of this type of analysis can be found in McMillan and Rodrik (2011). We provide a brief discussion of growth decomposition methodologies and the method used in this chapter in the Appendix. Individual components of the decomposition such as labor shares and within-sector changes in productivity can also be used at the country level to dig deeper into where structural change is or is not taking place and to gain a deeper understanding of the country-specific factors that drive structural change. For example, if we know that the expansion of manufacturing is a characteristic of structural change in a particular country, we could use more detailed data on manufacturing to pinpoint which specific industries expanded, how many people were employed, and whether specific events or policies contributed to the expansion or contraction of a particular sector. For country-specific analyses of this type, refer to *Structural Change, Fundamentals, and Growth: A Framework and Country Studies* (forthcoming), edited by McMillan, Rodrik and Sepulveda.

3 Identification of Growth Accelerations

We use data from the Penn World Tables (PWT) 9.0 to compute annualized growth rates and to identify growth accelerations for the Latin American and African countries included in the GGDC's 10-sector database plus Rwanda. Our definition of a growth acceleration is based on a slightly modified version of the filter applied by Hausmann et al. (2005)—heretofore HPR. Instead of examining annualized growth in gross domestic product (GDP) per capita over an eight-year period, we limit ourselves to a seven-year period since our analysis is primarily focused on recent growth episodes. Thus, we will say that a country has experienced a period of growth acceleration if it satisfies the following three conditions:

$$g_{t,t+n} \geq 3.5\ ppa \text{ — } growth\ is\ rapid; \tag{9.3}$$

$$\Delta g_t = g_{t,t+n} - g_{t-n,t} \geq 2.0\ ppa \text{ — } growth\ accelerates; \tag{9.4}$$

$$y_{t+n} \geq \max\{y_i\}, i \leq t \text{ — } post-growth\ output\ exceeds\ pre-episode\ peak; \tag{9.5}$$

where the relevant time horizon is seven years (i.e., $n = 6$).

We summarize the timing and nature of these growth accelerations in Table 9.3. We include East Asian countries in this table, most of which had a much earlier growth acceleration, to provide a broad comparative context. Column (1) of Table 9.3 indicates the year in which the growth acceleration started for each country. Columns (2) and (3) show the average annual growth rates in the pre- and post-acceleration periods, respectively. In column (4) we report the difference between the pre- and post-acceleration growth rates. In column (5) we indicate whether post-growth output exceeds the pre-episode peak. In column (6), we report the growth rates following the initial seven years of growth episodes up to 2014.[7]

It is evident from Table 9.3 that most countries satisfy the three conditions in Eqs. (9.3)–(9.5), but there are some exceptions. Rather than dropping countries from the analysis, we modify the filter so as to include most Latin American and African countries in our analysis. For eight countries—four in Latin America and four in Africa—that do not satisfy the first condition in Eq. (9.3), we lower the cutoff to 2.0 ppa. Additionally, in 7 out of 21 countries the level of per capita GDP in the first year of growth acceleration has not yet exceeded the pre-episode peak. We keep these countries and indicate the year in which this happens in column (5) of Table 9.3. The last column of Table 9.3 displays the growth rate after the seven-year growth acceleration and up to 2014, the last year data for which are available in PWT (9.0).[8] Many African countries continue to exhibit rapid growth in this period (the exceptions are Malawi, Senegal and South Africa). This is also true for Latin America where Chile, Colombia, Peru, Bolivia and Costa Rica continued to grow. Finally, in the last row of Table 9.3 we report statistics for India because unlike the rest of Asia, India's growth take-off is relatively recent. It started to pick up speed in 1983 and it has become more rapid in the 1990s and 2000s.

To check the robustness of the results reported in Table 9.3, we use GDP per capita data from the World Development Indicators (WDI) and value added per worker data from the Groningen Growth and Development Center (GGDC). The results of this comparison for Latin American and African countries are reported in Table 9.4. In column (1) we repeat the initial year of the growth acceleration based on the data in Table 9.3. Although not reported

[7] Post-2014 data from WDI indicate that four of our African countries (MWI, NGA, ZAF and ZMB) have experienced either negative or almost zero growth rates on average during 2015–2016.

[8] Data for per capita GDP in 2015–2016 are available in the WDI. Including 2015–2016 does not change the patterns revealed in the last column of Table 9.3. However, it is true that between 2014 and 2016, the growth rate was lower in some countries and turned negative in Argentina, Brazil, Malawi, Nigeria and South Africa.

Table 9.3 Episodes of rapid growth and magnitude of accelerations (annual average growth rate)

Country	Initial year of growth acceleration	Growth in pre-acceleration period	Growth in post-acceleration period	Difference in pre- & post-acceleration periods	Whether GDP pc in post-acceleration period >= max in pre-acceleration period	Growth after 7-years' growth acceleration
	(t)	(t-6, t)	(t, t+6)			(t+6, 2014)
ARG	1992	−0.54	2.80	3.34	Yes	2.98
BRA	2002	0.50	3.00	2.50	Yes	2.90
CHL	1988	2.66	6.25	3.59	Yes	3.02
COL	2001	−0.79	3.66	4.45	Exceeded in 2003/04	3.19
MEX	1996	−0.12	2.28	2.40	Exceeded in 1997/98	0.92
PER	2002	0.76	5.47	4.71	Yes	4.17
VEN	2001	−1.11	4.20	5.31	Exceeded in 2005/06	−0.18
BOL	2003	0.34	2.93	2.59	Yes	3.77
CRI	2002	2.59	4.76	2.17	Yes	2.60
BWA	1967	3.33	13.35	10.03	Yes	4.74
ETH	2000	1.13	3.71	2.59	Yes	7.95
GHA	1984	−5.23	2.02	7.25	Exceeded in 1999	2.85
KEN	2003	−0.34	2.08	2.42	Exceeded in 2004	3.04
MWI	2002	−1.51	3.60	5.11	Exceeded in 2006	0.35
MUS	1973	1.14	6.31	5.17	Yes	4.10
NGA	2000	0.30	7.61	7.31	Yes	3.21
RWA	2002	3.07	5.73	2.66	Yes	4.46
SEN	1995	−1.65	2.23	3.88	Exceeded in 1999	0.98
ZAF	2001	0.98	3.10	2.12	Yes	0.83
TZA	1998	0.67	3.50	2.83	Yes	3.13
ZMB	2000	0.64	3.77	3.13	Yes	4.60
CHN	1978	1.82	5.59	3.77	Yes	6.61
IDN	1986	3.34	5.85	2.51	Yes	2.83
HKG	1968	4.78	7.20	2.42	Yes	3.86
KOR	1963	−0.04	6.13	6.17	Yes	3.27
MYS	1966	3.63	6.30	2.67	Yes	3.69
SGP	1966	3.00	11.24	8.24	Yes	4.48
THA	1964	5.13	8.51	3.38	Yes	4.55
TWN	1960	3.34	6.17	2.83	Yes	5.88
IND	1983	1.52	3.59	2.07	Yes	4.93

Note: Based on the method in Hausmann et al. (2005)
Source: Authors' calculations using data of PWT (9.0). http://www.rug.nl/ggdc/productivity/pwt/

Table 9.4 The annual growth rates for per capita GDP and labor productivity

	Initial year of growth acceleration	Seven years in pre-growth acceleration period (t-6, t)			Seven years in post-growth acceleration period (t, t+6)			Differences in pre- and post-growth acceleration periods		
	(t)	PWT	WDI	GGDC	PWT	WDI	GGDC	PWT	WDI	GGDC
Country	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ARG	1992	−0.54	−0.45	−1.33	2.80	2.76	3.40	3.34	3.22	4.73
BRA	2002	0.50	0.48	−0.12	3.00	3.04	1.18	2.50	2.56	1.30
CHL	1988	2.66	3.99	−0.74	6.25	6.25	4.12	3.59	2.25	4.87
COL	2001	−0.79	−0.53	−1.19	3.66	3.66	1.30	4.45	4.20	2.48
MEX	1996	−0.12	0.53	−0.77	2.28	1.57	−0.24	2.40	1.04	0.53
PER	2002	0.76	0.76	−0.97	5.47	5.47	4.47	4.71	4.71	5.44
VEN	2001	−1.11	−1.11	−1.19	4.20	4.20	0.48	5.31	5.31	1.67
BOL	2003	0.34	0.34	−0.14	2.93	2.93	1.55	2.59	2.59	1.69
CRI	2002	2.59	2.59	1.19	4.76	4.76	2.44	2.17	2.17	1.25
BWA	1967	3.33	3.41	0.00	13.35	16.11	11.62	10.03	12.71	11.62
ETH	2000	1.13	1.15	0.58	3.71	3.71	3.33	2.59	2.57	2.74
GHA	1984	−5.23	−5.23	−5.34	2.02	2.02	3.47	7.25	7.25	8.80
KEN	2003	−0.34	−0.43	−0.94	2.08	2.11	1.44	2.42	2.54	2.37
MWI	2002	−1.51	−1.43	0.39	3.60	2.93	2.52	5.11	4.36	2.14
MUS	1973	1.14	N.A.	N.A.	6.31	N.A.	7.84	5.17	N.A.	N.A.
NGA	2000	0.30	0.14	−0.27	7.61	8.71	6.06	7.31	8.57	6.33
SEN	1995	−1.65	−1.50	−0.68	2.23	1.89	1.77	3.88	3.39	2.45
ZAF	2001	0.98	0.22	1.83	3.10	3.23	2.56	2.12	3.01	0.73
TZA	1998	0.67	0.26	0.53	3.50	3.49	3.88	2.83	3.24	3.35
ZMB	2000	0.64	0.64	0.23	3.77	3.77	1.83	3.13	3.13	1.59
IND	1983	1.52	1.35	0.95	3.59	3.26	2.87	2.07	1.91	1.92

Sources: Authors' calculations using data of PWT (9.0), WDI (World Bank 2017) and GGDC (2014). Rwanda is not covered by GGDC. Accessed at http://www.rug.nl/research/ggdc/data/africa-sector-database in Table 9.4, we do find that the two data sources produce identical initial years for the start of the growth acceleration in almost all of the countries while it is off by only one or two years for a few countries. Thus our comparisons are based on the initial year of the acceleration identified using the PWT data. In columns (2)–(4) we report annualized growth rates in the seven years leading up to the growth acceleration based on PWT, WDI and GGDC, and in columns (5)–(7) we report growth rates during the period of the seven-year growth acceleration. In columns (8)–(10) we report the difference in growth rates between the pre- and post-acceleration periods based on the numbers in columns (2)–(7).

The PWT and WDI data show similar growth rates before and during the growth accelerations for all countries except Mexico. For Mexico, the WDI data show a much lower growth rate over the growth episode identified using the PWT (1.57 percent vs. 2.28 percent) and a smaller difference in growth rates between pre- and post-growth acceleration (1.04 percent vs. 2.40 percent). We nevertheless keep Mexico in our sample since in the growth decomposition analysis, the within versus between components may still be informative.

By contrast, a comparison between growth in GDP per capita and growth in value added per worker or labor productivity growth using the GGDC data reveals that labor productivity growth rates are comparable to GDP growth rates, albeit slightly lower. However, Mexico and Venezuela are exceptions. Labor productivity growth in Mexico is negative during the growth acceleration phase while per capita GDP growth rate using PWT and WDI data is positive. And labor productivity growth in Venezuela is much lower than growth in GDP per capita. Overall, however, the differences in labor productivity growth over the two periods are comparable to those of GDP per capita growth. This is important because when we decompose growth into its within and between components, we use the GGDC data.

4 Structural Change During Growth Accelerations

4.1 Comparing Patterns in Africa and Latin America

To better understand both the sources and sustainability of the growth accelerations we identified in Sect. 3, we decompose labor productivity growth into its within and between components. We use the GGDC data for this analysis and the methodology laid out in Sect. 2 for the growth decomposition. We examine both the pre- and post-acceleration periods as defined in Table 9.3. For the purpose of analyzing shifts in patterns of labor productivity growth, we extend the time horizon on either side of the break by three years so that in essence we study the growth decomposition in the ten years leading up to the growth acceleration and in the ten years following the initial year of growth acceleration.

We begin with broad patterns and then dig into country specifics. Figure 9.4 summarizes the growth decompositions by region. We include India as a separate "region" for purposes of comparison. Labor productivity growth is reported along the horizontal axis and ranges from around −1 percent to close to 5 percent when East Asia is included. The bars are coded according to how

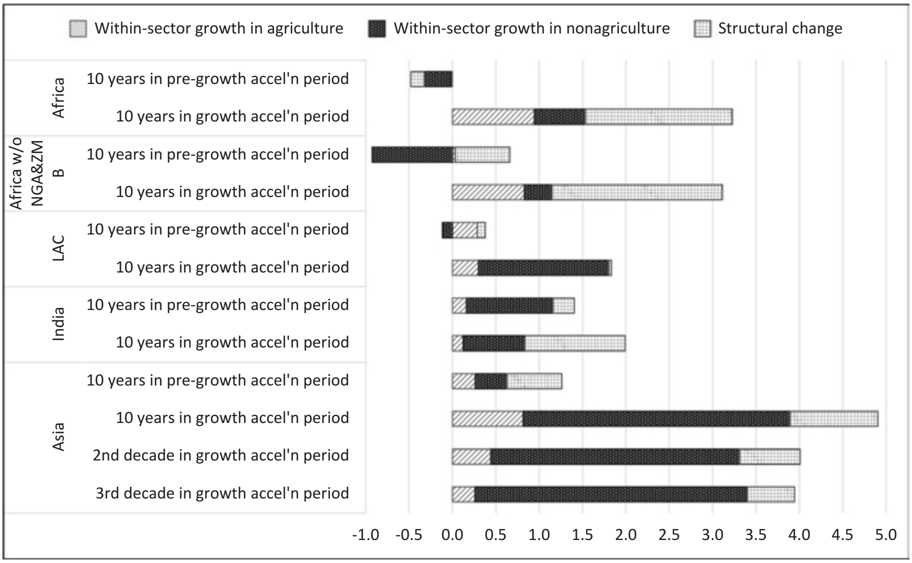

Fig. 9.4 Labor productivity growth within agricultural and nonagricultural sectors and due to structural change (annual average growth rates, percentages). (Note: The initial year of growth accelerations differs across countries. The economywide labor productivity growth equals the sum of growth from within agricultural and nonagricultural sectors and structural change. LAC includes ARG, BRA, CHL, COL, MEX, PER, VEN, BOL and CRI; Africa includes BWA, ETH, GHA, KEN, MWI, MUS, NGA, RWA, SEN, ZAF, TZA and ZMB; and Asia includes CHN, IDN, HKG, KOR, MYS, SGP, THA and TWN. Data for Rwanda are from national sources and only available for the growth acceleration period. Data for before growth acceleration period are not available for HKG, KOR, MYS, SGP and TWN in GGDC. A simple average method is used for each region. Asia average for pre-growth acceleration period is based on CHN, IDN and THA)
Source: Authors' calculations using GGDC data (except for RWA, for which country sources are used)

much of labor productivity growth comes from structural change (in Gantt chart) and how much comes from within-sector labor productivity growth in agriculture (in diagonal lines) and in nonagriculture (in black). We exclude Venezuela from this analysis because its growth was not sustained (see Table 9.3). We also exclude Botswana and Mauritius on the grounds that they do not belong in our group of countries with "late" growth accelerations (see Table 9.3, first column).

Figure 9.4 shows the much higher labor productivity growth during growth acceleration periods in all regions and the low or negative labor productivity growth rates prior to the growth acceleration. This is as expected and is by design. Turning to the growth decomposition, we can see that for Africa, both the within-sector and structural-change components of labor productivity growth are negative prior to the acceleration. In Latin America, prior to the growth acceleration labor productivity growth in the nonagricultural sector is negative and structural change contributes modestly to labor productivity growth.

After the growth acceleration, structural change contributes significantly to growth in Africa. This is not surprising since we expect the payoff to structural change to be greatest in poor countries. However, the contribution of within-sector labor productivity growth in the nonagricultural sector is smaller than labor productivity growth in agriculture in Africa during this period, a phenomenon we come back to later in this chapter. For Latin America, Fig. 9.4 shows that during the period of rapid growth, structural change contributes only minimally to growth for the region as a whole. In fact, this component is negative if we focus on nonagriculture only.[9] This finding implies that labor has moved from more productive subsectors to less productive subsectors within nonagriculture during the period of relatively high growth in Latin America. This pattern of deindustrialization accompanied by an expansion in low-productivity services which expand to absorb the workers displaced from the manufacturing sector is discussed at length in Ocampo et al. 2009. India differs from both regions in that the difference between the economywide labor productivity growth rates pre- and post-acceleration is more modest. However, during the relatively high-growth period, India is similar to Latin America in terms of showing strong productivity growth within the nonagricultural sector. But unlike Latin America and like Africa, structural change also contributed significantly to labor productivity growth in India.

Figure 9.5 is a scatter plot of the relationship between within-sector productivity growth (in the nonagricultural sector only, horizontal axis) and the

[9] The decomposition of structural change into agriculture and nonagriculture was not shown in Fig. 9.4.

labor productivity growth that arises as a result of structural change (vertical axis). Country details in growth decomposition are reported in Tables 9.9 and 9.10. The most important pattern revealed by Fig. 9.5 is the negative correlation between these two components of overall growth. The correlation implies that changes in the output structure are slower than changes in the

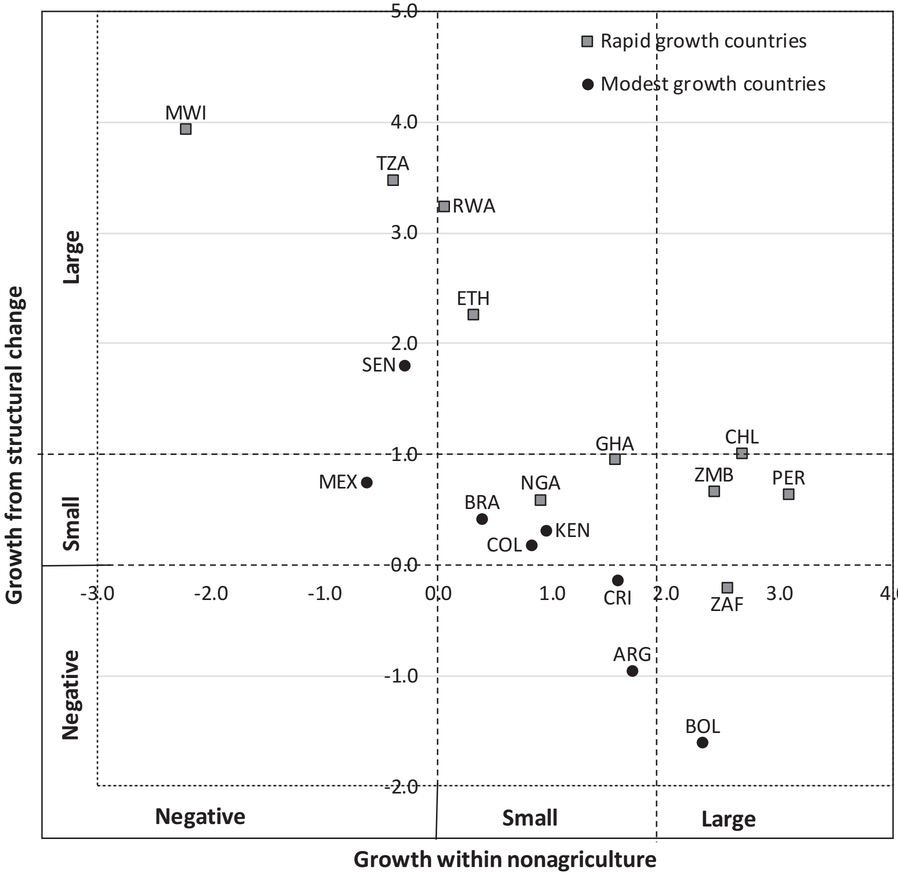

Fig. 9.5 Patterns of labor productivity growth within nonagricultural sector and from structural change in African and Latin American countries (measured in percentage points of economywide annual labor productivity growth). (Notes: Both x-axis and y-axis are percentages that measure the economywide annual labor productivity growth rate in the ten-year period of growth accelerations. The initial year of growth accelerations differs across countries. Squares are countries with rapid growth acceleration and dots are countries with modest growth, measured by economywide labor productivity growth. The correlation value is –0.891 among the rapid growth countries, –0.901 among the modest growth countries and –0.702 for all countries)
Source: Authors' calculations using GGDC data (except for RWA, for which country sources are used)

employment structure across most African countries during the period of growth accelerations. This pattern of growth is intriguing, as it contrasts with the Asian growth experience in which both within-sector labor productivity growth and structural change contributed positively—and strongly—to aggregate labor productivity growth (Fig. 9.6). In other words, the recent high-growth experiences in Africa and Latin America have been based on either high-productivity growth in the modern sectors or shifts in employment from traditional to modern sectors, but rarely both at the same time. We return to this anomaly and possible explanations later in the chapter.

Figure 9.4 hides some of the cross-country heterogeneity. In particular, Chile and Peru, the two Latin American countries with the most rapid economywide labor productivity growth during the period of relatively high growth

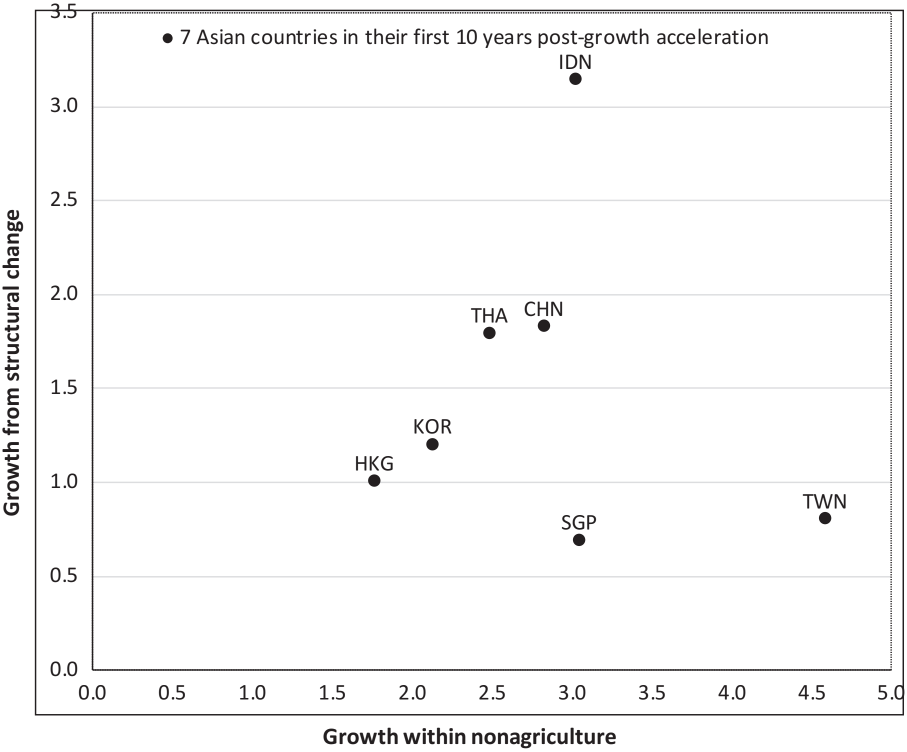

Fig. 9.6 Labor productivity growth within nonagricultural sector and from structural change in seven Asian countries (measured in percentage points of economywide annual labor productivity growth). (Notes: Both x-axis and y-axis are percentages that measure the economywide annual labor productivity growth in the ten-year period of growth accelerations. The initial year of growth accelerations differs across countries)
Source: Authors' calculations using GGDC data

(4.13 percent and 4.03 percent, respectively) are characterized by strong contributions from both the within-sector component of labor productivity growth and the structural-change component. However, for the rest of the countries in Latin America the pattern is similar to the regional average. There is a strong negative correlation between within-sector productivity growth and structural change (−0.892) across these countries; this negative correlation disappears when Chile and Peru are added.

For some African countries, the rapid economywide productivity growth is even higher than in Chile and Peru. For example, the economywide labor productivity growth rate is 4.65 percent for Ethiopia, 4.51 percent for Rwanda and 4.23 percent for Tanzania in the period of rapid growth. However, the negative correlation between labor productivity growth within the nonagricultural sector and the labor productivity growth as a result of structural change remains negative even when these three countries are included (correlation coefficient is −0.866 for all the ten African countries and is −0.920 when Ethiopia, Rwanda and Tanzania are excluded).

4.2 Digging Deeper: Strong Structural Change with Weak Nonagricultural Productivity Growth in Africa

We classify African countries according to the relative contributions of within and between terms (for the nonagricultural sectors only) to economywide labor productivity growth during the period of growth acceleration. We include the following six nonagricultural subsectors in the exercise: manufacturing, construction, trade services, transport services, business services and personal services. We exclude mining, utilities and government services since these are not sectors which can be expected to contribute in a meaningful way to economywide labor productivity growth.

Inspection of the data indicates that we can classify the countries into two groups:

Group 1: *Strong structural change with negative productivity growth in the non-agricultural sector*. The countries in this group are Ethiopia, Malawi, Rwanda, Senegal and Tanzania.

Group 2: *Weak structural change*. Four countries fall into this group and they are Ghana, Kenya, Nigeria and South Africa.

We observe a large negative correlation coefficient (−0.680) between productivity growth within these six nonagricultural sectors and their contributions to structural change for the countries in Group 1, indicating the sectors that positively contribute to structural change are often those that experienced declines in within-sector labor productivity. For the countries in Group 2, there exists a weak negative correlation between modest structural change and within-sector labor productivity growth (with coefficient of −0.246). Table 9.5 provides the details for the five Group 1 countries. While expansion of manufacturing does contribute overall to these countries' labor productivity growth (the structural-change term), labor productivity growth within manufacturing tends to be either negative or close to zero.

An alternative way of looking at these patterns is to focus on correlations across countries for individual nonagricultural subsectors. This is done in Table 9.6, which shows the correlation between the structural-change term and within-sector productivity growth across different countries, sector by

Table 9.5 Number of nonagricultural sectors contributing to structural change with and without labor productivity growth within sector (Group 1 countries only)

	Total SC-led growth, (percentage points)	# of sectors with positive SC but negative within sector	# of sectors with positive SC & positive within sector	Manufacturing is in SC-1 & its growth contribution (within sector vs. SC, percentage point)	Manufacturing is in SC-2 & its growth contribution (within sector vs. SC, percentage point)
		SC-1	SC-2		
MWI	3.93	5	1	(−0.23, 0.77)	
TZA	3.47	4	2		(0.02, 0.44)
RWA	3.23	4	5	(−0.12, 0.39)	
ETH	2.25	4	1	(−0.17, 0.36)	
SEN	1.80	4	2	(−0.39, 0.54)	

Source: Authors' calculations using GGDC data (except for RWA, for which country sources are used)

Table 9.6 Correlation across African countries by nonagricultural sector

	All countries	Group 1 countries	Group 2 countries
Manufacturing	−0.878	−0.427	−0.726
Construction	−0.327	−0.531	0.589
Trade services	−0.877	−0.673	−0.759
Business services	−0.568	−0.966	0.695
Transport services	−0.808	−0.727	0.176

Source: Authors' calculations using GGDC data (except for RWA, for which country sources are used)

sector. Figure 9.7 displays the relationship in a scatter plot. The preponderance of negative correlations is striking, especially for Group 1 countries. Once again, sectors that contribute strongly to structural change-led growth tend to be the ones that do worse in terms of within-sector productivity growth.

4.3 African Versus Asian Patterns of Structural Transformation

For purposes of comparison, we present similar information for seven Asian countries during their first ten years after their initial growth accelerations in

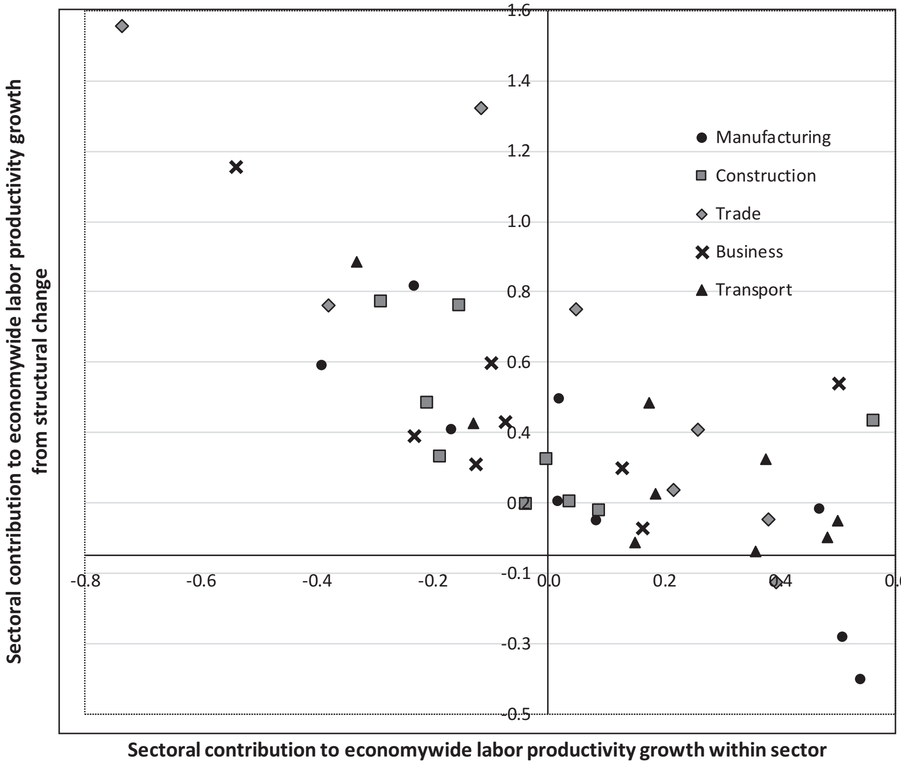

Fig. 9.7 Labor productivity growth within sector and from structural change across African countries for specific nonagricultural sectors (measured in percentage points of economywide annual labor productivity growth). (Notes: Both x-axis and y-axis are percentages that measure the economywide annual labor productivity growth in the ten-year period of growth accelerations)
Source: Authors' calculations using GGDC data

Fig. 9.8. The countries covered are those included in the GGDC dataset. In contrast to the African countries, Fig. 9.8 shows that the Asian countries exhibit a positive correlation between the within and structural-change components of labor productivity growth for each specific nonagricultural sector. In other words, in Asia well-performing nonagricultural sectors have contributed to economywide productivity growth both by drawing labor from lower productivity sectors and by experiencing rapid productivity improvements.

Could these patterns be due to differences in the timing of growth accelerations? Using the same HPR filter and data from the PWT 9.0, we identify four low-income Asian countries which experienced growth accelerations starting in the 1990s or early 2000s; these are Bangladesh, Cambodia, Lao

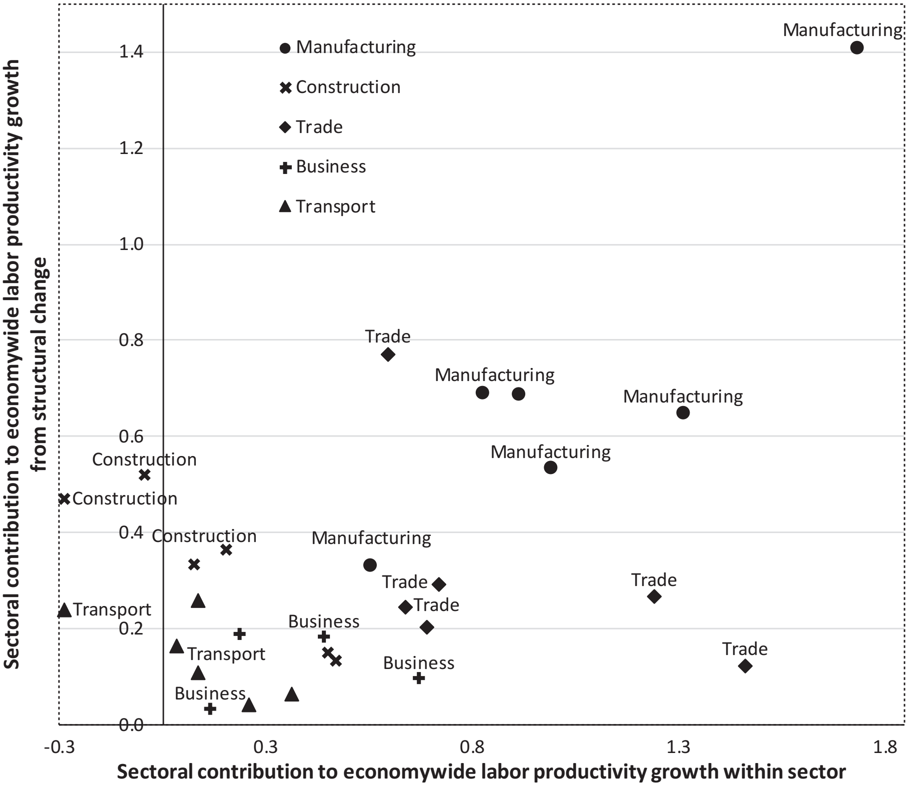

Fig. 9.8 Labor productivity growth within sector and from structural change across seven Asian countries for specific nonagricultural sectors (measured in percentage points of economywide annual labor productivity growth). (Notes: Both x-axis and y-axis are percentages that measure the economywide annual labor productivity growth in the first ten years of growth accelerations)
Source: Authors' calculations using GGDC data

and Vietnam. Since these countries are not included in the GGDC dataset, we instead use value-added data from the United Nations Statistics Division (UNSD) website and employment data from the International Labor Organization (ILO). These data allow us to decompose output and employment among three broad sectors only: agriculture, industry and services. We note that manufacturing tends to dominate employment and value added in these countries so that industry primarily reflects manufacturing and not mining. A second limitation is that the ILO provides sectoral employment data only for the 2003–2014 period. Apart from Bangladesh, all of these countries experienced their growth accelerations during the 1990s. Nevertheless, since growth accelerated and the industrial share of employment continued to increase in the 2000s for all four countries, we rely on 2003–2014 data to examine the patterns during the period of growth acceleration.

The results are shown in Fig. 9.9. In all four countries, the within-sector component of productivity growth in the nonagricultural sector was the largest contributor to overall labor productivity growth, but the structural-change component was also positive and made a substantial contribution in at least three of the four cases. Looking at the role of the specific nonagricultural sectors as we did earlier, we find that with almost no exception, industry and

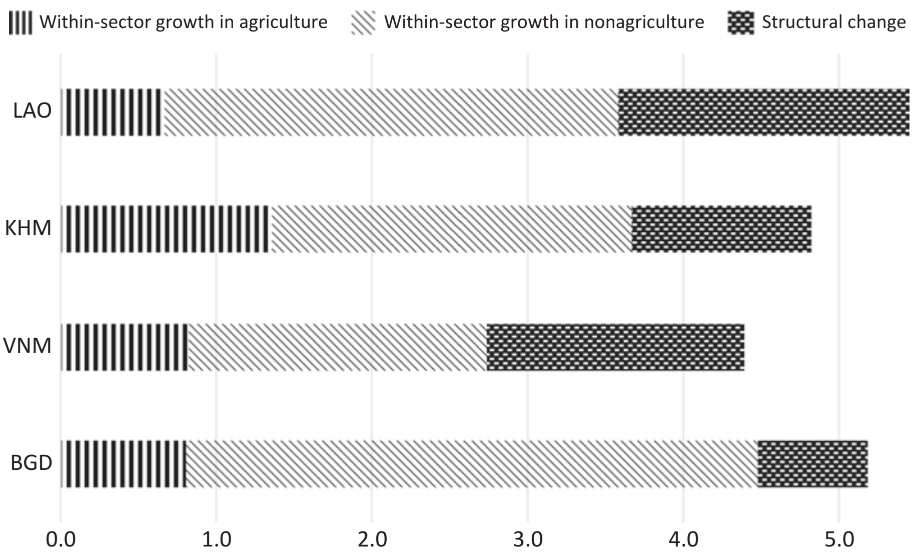

Fig. 9.9 Labor productivity growth within agricultural and nonagricultural sectors and due to structural change, four low-income Asian countries (annual percentages). (Note: The period covered is 2003–2014. See text for sources)

services contributed significantly to both the within and structural-change components of labor productivity growth (Fig. 9.10).

The main conclusion we can draw from these numbers is that when structural change contributed significantly to overall growth as it did in all four low-income Asian countries, it was not at the expense of poor productivity performance in the expanding sectors as in Africa. As previously noted, within-sector productivity growth and structural change also went hand in hand in China, Korea and Thailand in Asia, but also in Botswana and Mauritius in Africa.

In the next section, we develop a model that attempts to further explain the intriguing differences between African and Asian countries in the aftermath of growth accelerations. Here we simply note that the Asian comparison does raise concerns about the sustainability of the recent African growth experience. While structural change is strong and has led to rapid productivity

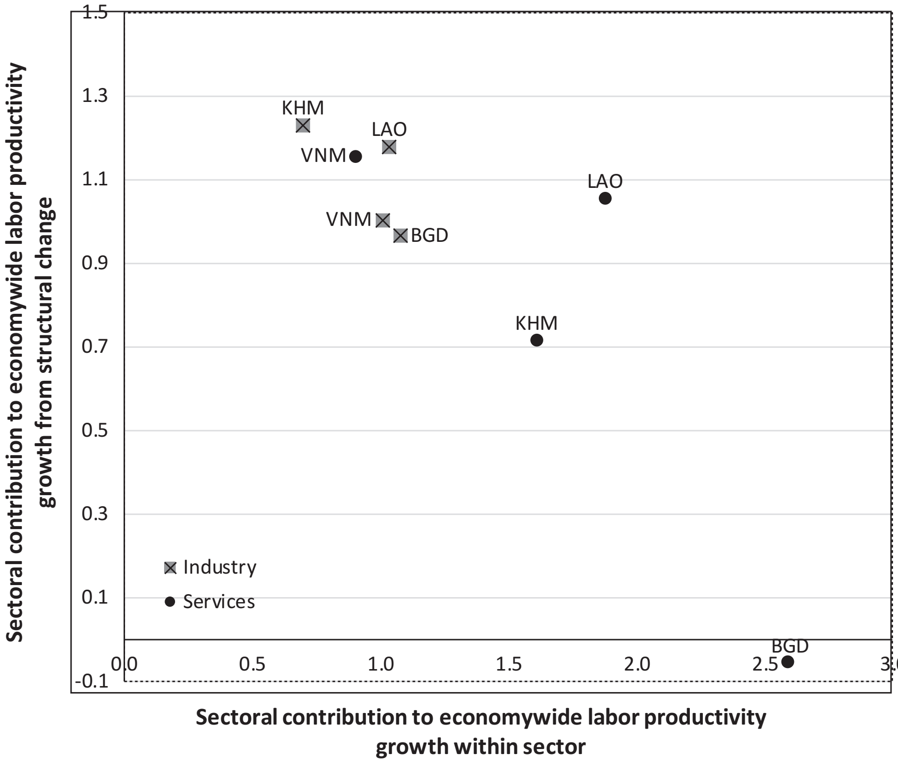

Fig. 9.10 Nonagricultural sectors' contribution to growth accelerations, four low-income Asian countries (annual percentage). (Note: The period covered is 2003–2014. See text for sources)

growth in African countries, it has been accompanied by weak to negative performance in within-sector productivity growth in the nonagricultural sectors of the economy.[10] If this trend were to continue, the gap in labor productivity between high-productivity nonagricultural sectors and the agricultural sector would shrink prematurely, that is, while these countries still remain relatively poor. This would in turn lead to a decline in overall growth potential and limit the role of growth-inducing structural change in the future.

5 A Simple Economic Framework

In this section we develop a simple economic model to help us interpret the pattern of correlations we discussed previously. Our focus is on understanding the relationship between various types of demand and supply side shocks, on the one hand, and patterns of structural change and within-sector labor productivity performance, on the other. In particular, what might explain the difference between the Asian pattern and the more recent African pattern? In the former, high-productivity sectors that expanded also experienced high rates of productivity growth, whereas in the latter expanding high-productivity sectors have experienced poor productivity growth.

We will stress that this and other related asymmetries are likely the result of differences in the nature of the shocks driving growth in the two regions. In Asia, it was the expansion of modern sectors (especially manufacturing) that acted as the engine of growth. In the more recent growth accelerations in Africa, the impetus came not from manufacturing or the modern parts of the economy but from positive demand shocks or productivity growth in agriculture.

We divide the economy into traditional and modern sectors, identified by subscripts t and m. In terms of the classification we used earlier, agriculture is the main traditional sector, while urban services and manufacturing comprise the modern sector.

Production functions in the two sectors are written as

$$y_t = \theta_t g\left(1 - l_m\right)$$

$$y_m = \theta_m f\left(l_m\right)$$

[10] Timmer et al. (2015) have pointed earlier that sectors that expanded their employment shares tended to have productivity growth rates below those of shrinking sectors over the 1990–2010 period. The same point is also made in starker form in the African context in de Vries et al. (2015).

where y_t and y_m are the outputs of the two sectors, l_m is the share of the economy's employment in the modern sectors, and $f(.)$ and $g(.)$ are neo-classical production functions with $f', g' > 0$ and $f'', g'' < 0$. The parameters θ_m and θ_t are shifters that will allow us to do comparative statics for supply side shocks in different parts of the economy. Denoting the relative price of modern goods by p, aggregate output (GDP) is

$$y = y_t + py_m.$$

We allow total expenditures in the economy to differ from GDP so that we can perform comparative statics also around demand-side shifts. We express total expenditures, z, as the sum of GDP and an external transfer, b.

$$z = y + b.$$

On the side of consumer preferences, we posit a Stone-Geary-type utility function so that demand patterns will be non-homothetic between traditional and modern goods. In addition, we assume demand for the modern good is price elastic. If σ_t is the "subsistence" level of the traditional good, expenditure on the modern good is expressed as:

$$pc_m = \gamma(p)(z - \sigma_t),$$

where c_m is the physical consumption level of the modern good and $\gamma'(p) < 0$. Note that the budget share of the modern good increases with total expenditures z, since $\frac{pc_m}{z} = \gamma(p)\left(1 - \frac{\sigma_t}{z}\right)$. In the limit, when z becomes very large relative to the subsistence consumption σ_t, the budget share of the modern good converges from below to $\gamma(p)$. And since $\gamma'(p) < 0$, this budget share is also decreasing in the relative price of the modern sector. Demand for the goods produced by the traditional sector is correspondingly written as

$$c_t = \sigma_t + (1 - \gamma(p))(z - \sigma_t).$$

Note that the budget constraint $c_t + pc_m = z$ is satisfied.

We need to express market-clearing for at least one of the sectors, which we do for the modern one:

$$c_m = y_m + \rho(b)$$

where $\rho(b)$ is the component of the external transfer that comes in the form of the modern good.

Labor is mobile between the two sectors, but we state labor market equilibrium in a manner that allows for structural misallocation in the economy. In particular, we assume there is a wedge of magnitude $\varphi > 0$ that prevents the equalization of the value of marginal products of labor in the two sectors. So:

$$p\theta_m f'(l_m) = \theta_t g'(1 - l_m) + \varphi.$$

Since the value of the marginal product of labor is higher in the modern sector than in the traditional sector in equilibrium, the economy has too few workers in the modern sector. Structural change in the direction of the modern sector—a movement of workers from the traditional to modern sector—would increase economywide labor productivity.

This completes the description of the formal model. We have a system of eight independent equations that determines the following eight endogenous variables: $p, l_m, c_m, c_t, y_m, y_t, y$ and z. We will use this system to perform comparative statics on both demand-side (b) and supply side shocks (θ_m, θ_t).

The equilibrium of the model can be pictured with the help of Fig. 9.11. The horizontal axis represents the size of the labor force, with the two vertices as the origins of the modern and traditional sectors, respectively. The vertical axes measure the value marginal product of labor in the modern (left axis) and traditional (right axis) sectors ($VMPL_m$ and $VMPL_t$). The downward sloping schedules, from the perspective of each origin, capture the declining physical marginal product of labor as employment increases, holding all else constant. The equilibrium allocation of labor is determined such that $VMPL_m$ exceeds $VMPL_t$ exactly by φ, the wedge between productivity in the two sectors. Note that the $VMPL_m$ schedule is drawn for the equilibrium value of the relative price p, which is determined with the addition of the demand side of the system.

We begin by analyzing supply side shocks, setting $b = 0$. Consider first a positive supply shock to the modern sector that leads the sector to expand on impact. In terms of the model, this corresponds to an increase in θ_m. This shifts the $VMPL_m$ schedule up, as shown in Fig. 9.12. However, this cannot be the end of the story, since the increase in income that is generated in the modern sector has implications for relative prices. On impact, the supply shock raises the supply of modern goods, while leaving the supply of traditional goods unchanged. The resulting income gains will show up as increases in demand for both goods. Consequently, the impact effect of the shock is to create an excess supply of the modern good (and an excess demand for the

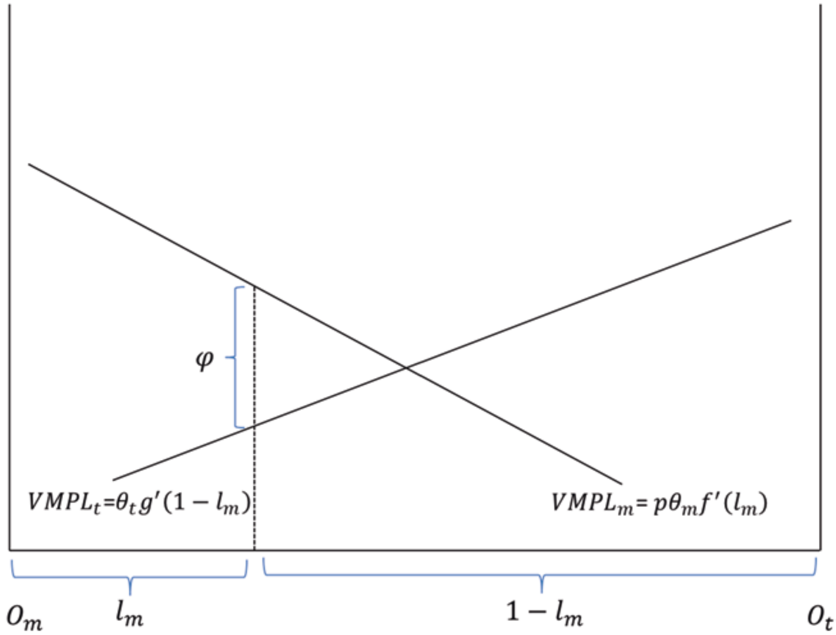

Fig. 9.11 Equilibrium allocation of labor

traditional good). The relative price of the modern good (p) will therefore have to decline.

The magnitude of the decline depends on preferences. Given our assumption of price elastic demand for the modern good, the decline in p has to be smaller in proportional terms than the increase in θ_m. To see why, assume, counterfactually, that the decline was proportionally identical, so that the $VMPL_m$ schedule returned to its original, pre-shock position (i.e., that $\frac{dp}{p} = -\frac{d\theta_m}{\theta_m}$). Since the fall in p exactly offsets the rise in y_m, there would be no income effect on the composition of expenditures (recall that $z = y = y_t + py_m$). However, there would still be an excess demand for the modern good, because price elastic demand implies that the quantity demanded would have risen more than the supply. Hence to reinstate goods-market equilibrium p must fall by less (so that $\left|\frac{dp}{p}\right| < \left|\frac{d\theta_m}{\theta_m}\right|$). Consequently, the $VMPL_m$ schedule shifts only partway back in the final equilibrium (see Fig. 9.15).[11]

[11] The general case, but with homothetic preferences, is derived in a similar model in Dani Rodrik (2016). For the case of non-homothetic preferences, see Kiminori Matsuyama (1992). However, Matsuyama

The result is that the positive supply shock to the modern sector ends up increasing both labor productivity ($\theta_m f'(l_m)$) and employment (l_m) in the modern sector (Fig. 9.12). Note further that any increase in total expenditures z due to the positive productivity shock would reinforce this outcome, as it would lead to greater demand at the margin for the modern sector, and hence expanded employment there. As we discussed in the previous section, this is the canonical East Asian pattern of structural change during the process of economic development.

Next, consider a positive productivity shock in the traditional sector ($d\theta_t > 0$). This shifts the $VMPL_t$ schedule up (Fig. 9.13). Once again, there will be a relative-price adjustment. The excess supply of the traditional good will drive up the relative price of the modern sector, *p*. As regards the direction of change in the equilibrium allocation of labor, what matters is whether the rise in p is proportionally larger or smaller than the increase in θ_t. Our assumptions on preferences pull in conflicting directions in this case. The income effect produces a desired increase in the budget share of the modern

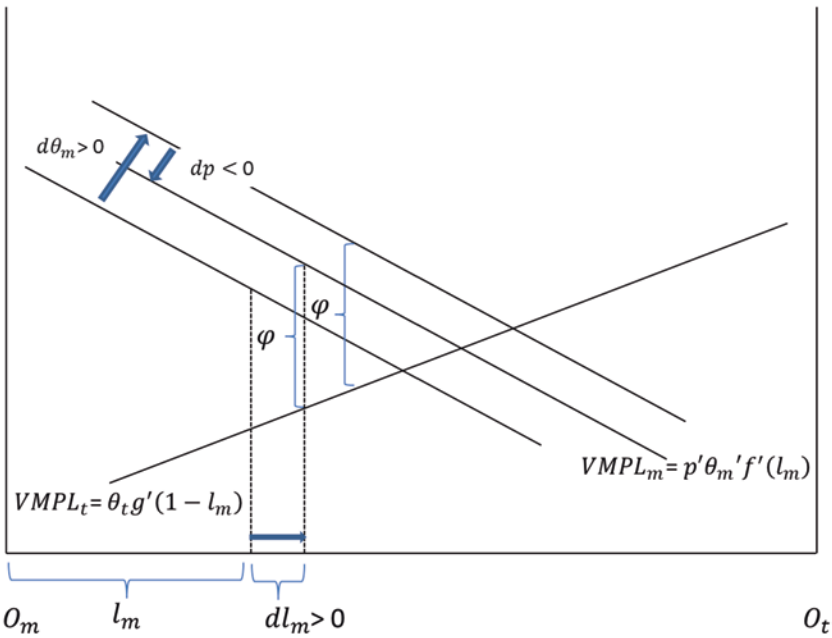

Fig. 9.12 A positive supply shock to modern sector

assumes the price elasticity of demand for manufacturing is unity, which implies that an increase in manufacturing productivity leaves manufacturing employment unchanged. Our assumption of price elastic demand for the modern good produces a different result, as explained in the text.

good, which requires a proportionately larger increase in p. But the fact that the budget share of the modern good is decreasing in p pushes it in the opposite direction. We assume here that the income effect dominates (as in Matsuyama 1992), so that $\frac{dp}{p} > \frac{d\theta_t}{\theta_t}$.

In terms of our figure, this means there will be a commensurately greater upward shift in the $VMPL_m$ schedule relative to the $VMPL_t$ schedule. The result, as shown in Fig. 9.13, is once again an increase in employment in the modern sector, l_m. However, in this case expansion of the modern sector is accompanied by a *decline* in labor productivity in the modern sector ($\theta_m f'(l_m)$) because of the declining marginal productivity of labor (and the absence of any increase in θ_m). This outcome is reminiscent of the African model of structural change we discussed previously.

There is reason to believe that developments in African agriculture in particular have been important in driving economic growth there. A large part of total employment (60–80 percent) in low-income African counties remains in the agricultural sector. Even modest growth in agriculture can have a significant demand effect in domestic markets for nonagricultural goods and services. Among the low-income African countries in the GGDC dataset, total within-sector labor productivity growth is mainly explained by agricultural productivity growth in six of the eight countries, and agricultural productivity

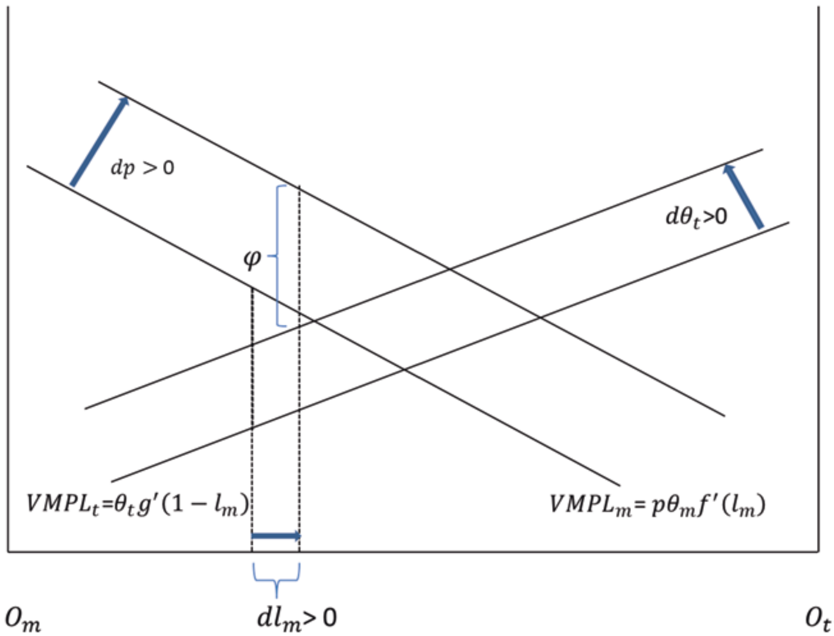

Fig. 9.13 A positive productivity shock in the traditional sector

growth is important in three of the four countries in Group 1 (ETH, TZA and MWI). When income increases among the rural population and it is spent disproportionally on nonagricultural products, this creates a market for small businesses in the informal economy, including micro and small manufacturing firms that can provide import substitutes but at much lower prices (and often with lower quality). Such informal manufacturing operations often have low labor productivity. This explains why modern-sector labor productivity (including in manufacturing) falls with structural change.

Finally, we consider a positive demand-side shock to the economy, in the form an external transfer *b*. The relative-price implications of this would depend on the specific composition of the transfer in terms of the modern and traditional goods. We consider a neutral "aggregate demand" shock such that the transfer expands the supply of the two goods available to domestic consumers in equal proportions. Therefore, at the initial relative prices, the expenditure shares of the two goods remain unchanged.

However, since consumers are now richer, their desired budget share of the modern good increases. This implies that the relative price of the modern sector p must rise. This shifts the $VMPL_m$ schedule up and induces an increase in modern-sector employment. The equilibrium is as shown in Fig. 9.14. In the new equilibrium, labor productivity in the modern sector falls as employ-

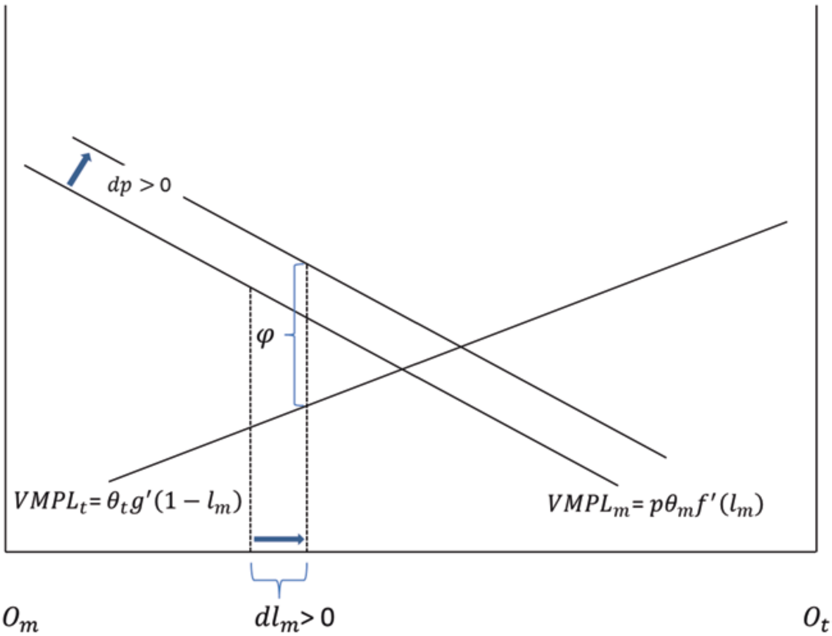

Fig. 9.14 An increase in aggregate "demand"

Table 9.7 Correlation between changes in relative sector prices and shares of sectoral value added

	Group 1	Group 2	All countries
With manufacturing	0.325	0.080	0.185
Without manufacturing	0.294	0.084	0.168

Source: Authors' calculations using GGDC data

ment expands. This demand-driven pattern of structural change is also in line with the African model.

The shocks that generate Asian versus African patterns of structural change have differing implications for relative prices as well, as sketched out earlier. A positive supply side shock in the modern sector reduces the relative price of the modern sector, while a positive aggregate demand shock or a productivity shock in the traditional sector raises it. When structural change is driven from the demand-side or by productivity increase in the traditional sector, expanding modern sectors will also experience a rise in their relative prices. As Table 9.7 shows, this is broadly consistent with the African experience for countries in Group 1—those that experienced strong structural change with declining within-sector labor productivity in modern sectors.

We also compare the domestic relative prices of manufacturing (the archetypal modern sector) in the Asian and African countries during their high-growth periods. As Fig. 9.15 shows, manufacturing prices in Asia exhibit a very sharp drop relative to economywide prices, especially during the high-growth years of the 1960s and 1970s. The decline is by a factor of 2–4 over a period of three decades. In Africa, by contrast, there is either a much smaller decline or no downward trend at all (Fig. 9.16). During the growth acceleration years, African countries exhibit no fall in manufacturing relative prices. This is consistent with the expansion in African manufacturing (such as it is) being driven mostly by the demand effects of developments originating elsewhere in the economy.

6 Concluding Remarks: The Sustainability of Recent Growth Accelerations

A large number of countries in Latin America and sub-Saharan Africa have experienced growth accelerations beginning in the early 1990s, making the most recent couple of decades a rare period of economic convergence with advanced economies. Yet we know from the history of growth spurts in the developing world that many growth accelerations eventually peter out

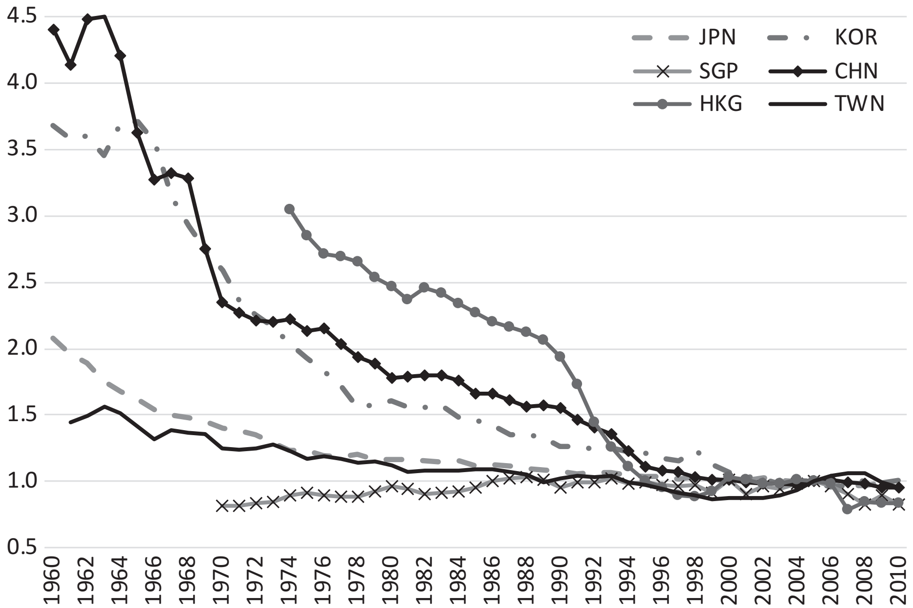

Fig. 9.15 Domestic real prices for manufacturing in Asia. (Note: Implicit price indices are derived by taking the ratio of nominal and constant price value-added series. The manufacturing price is then normalized by the economywide price index)
Source: Authors' calculations using GGDC data

(Hausmann et al. 2005; Jones and Olken 2008). The present sample includes four countries where, after the initial acceleration, annual labor productivity growth fell below 1 percent (Mexico, Malawi, Senegal and South Africa) and one country where it turned negative (Venezuela). By contrast, growth accelerated early and lasted for three to four decades in Botswana, Ghana, India and Mauritius (see Table 9.3). The latter countries' longer term growth patterns could help us better understand the potential paths of other countries in Africa and Latin America.

We present in Fig. 9.17 the long-term growth patterns in each decade following these four countries' growth take-offs. Their growth accelerations were triggered by different mechanisms: diamond discoveries in Botswana in the mid-1960s; the creation of an export processing zone and the emergence of a labor-intensive manufacturing sector in Mauritius during the early 1970s; and business- and market-friendly reforms that unleashed private sector investment in Ghana and India during the 1980s. Because of these different initial triggers, we are likely to find different patterns of growth across these four countries.

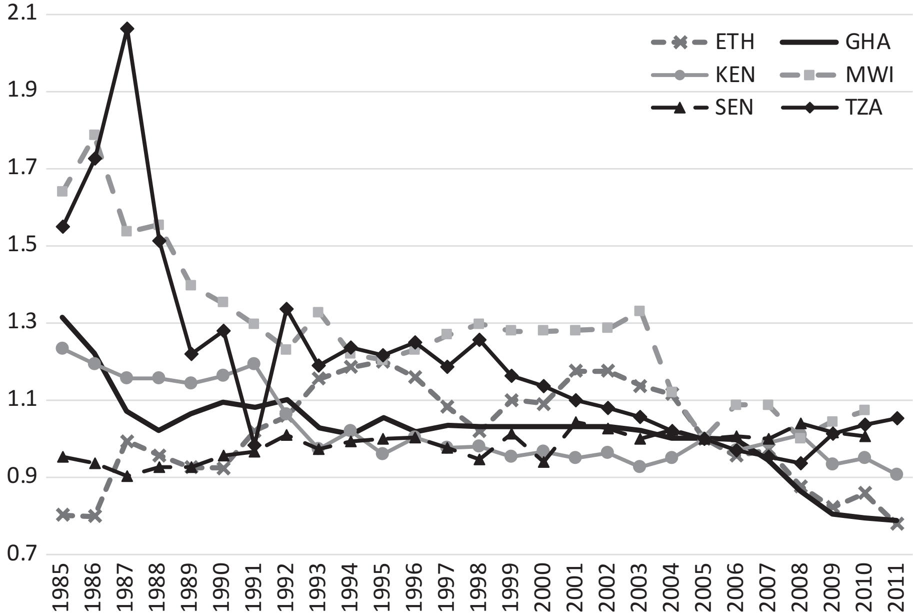

Fig. 9.16 Domestic real prices for manufacturing in Africa
Source: Same as the previous figure

We summarize the salient features of each country's experience in Table 9.8, paying particular attention to the roles of within-sector labor productivity growth and structural change. One thing that Table 9.8 makes clear is the importance of robust within-sector productivity growth. In all four countries, within-sector labor productivity growth makes a positive contribution to labor productivity growth in the early years and becomes increasingly important as time goes on. By contrast, structural change plays an important role in the early years and becomes less important over time. This is as expected: we pointed out in Sect. 2 the diminishing importance of inter-sectoral labor reallocation over the course of development, as structural productivity gaps diminish.

In addition, we can see from Table 9.8 that the manufacturing sector has not always contributed a significant growth impetus. Mauritius followed the East Asian path and industrialization figured prominently in economywide labor productivity growth, especially during the first two decades when structural change also played an important role. The share of manufacturing employment peaked at more than 30 percent of total employment in the late 1980s. Botswana, on the other hand, never established a sizable manufacturing sector. In Ghana, manufacturing contributed to within-sector

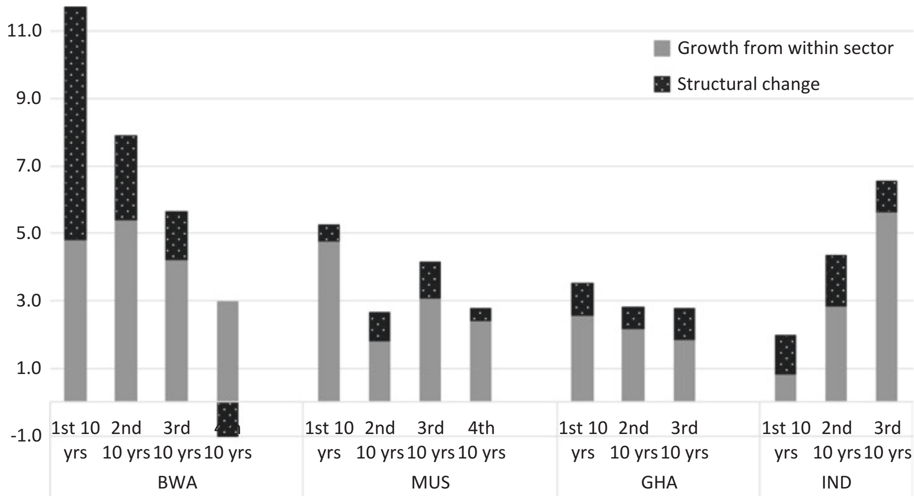

Fig. 9.17 Sustained growth in four countries in each post-growth acceleration decade (annual percentage)
Source: Authors' calculations using GGDC data

labor productivity growth and exhibited modest increases in employment in the early years of the country's growth acceleration. But in subsequent periods manufacturing's employment share has remained stagnant. Ghana's labor productivity growth has been balanced across sectors, making it difficult to identify a leading sector.

As in Ghana, the share of manufacturing employment in India has stagnated at around 12 percent. Manufacturing did contribute to labor productivity growth through structural change, although within-sector labor productivity growth has been the main driver of growth in India. Over a period of nearly 30 years, India's manufacturing employment share increased by a mere 2 percentage points. Overall labor productivity growth in India was modest during the first decade of the growth acceleration, but it accelerated in the following decades. Meanwhile, agriculture's share of employment fell by 16 percentage points, as employment in service sectors grew. In terms of broad patterns of structural change, Ghana and India are quite similar, although India has experienced much higher within-sector labor productivity growth in recent years.

The growth experiences that raise the greatest concern with respect to sustainability are those that exhibit stagnant or declining within-sector labor productivity in the modern sectors, as in many of our African cases. As the experience with sustained growth we have just summarized indicates, productivity growth in the modern sectors is the sine qua non of longer term development.

Table 9.8 Summary of three early growth African countries plus India

	Botswana	Mauritius	Ghana	India
Per capita GDP growth rate in 7 years prior to growth acceleration	3.33	1.14	−5.23	1.52
Triggers of growth accelerations	Discovery of diamonds	Development of labor-intensive manufacturing	Reforms associated with crisis	Reforms out of stagnant growth
The most important sectors contributing to growth accelerations in the early years	Mining, construction, private and public services	Manufacturing and public services	Hard to identify	Hard to identify
Impact of structural change in the early years post-growth accelerations	+ and strong	+	+	+
Impact of structural change in the later years post-growth accelerations	–	+ but smaller than the early years	+ and similar to the early years	+ but smaller than the early years
Impact of labor productivity growth within sector in the early years after growth accelerations	+ and strong	+ and strong	+ and strong	+ and similar to structural change
Impact of labor productivity growth within sector in later years	+ and strong	+ and strong	+ and strong	+ and strong

Source: Based on authors' calculations/assessment using GGDC data

This is not to belittle the significance of rapid productivity growth in agriculture, the archetypal traditional sector. Our model suggests agriculture has played a key role in Africa not only on its own account but also as a driver of growth-increasing structural change. Diversification into non-traditional products and adoption of new production techniques can transform agriculture into a modern activity in part. But there are limits to how far this process can carry the economy. In part because of the low-income elasticity of demand for agricultural products, a movement of labor out of agriculture is an inevitable outcome during the process of development. The labor that is released has to be absorbed in modern activities. And if productivity is not growing in these modern sectors, economywide growth ultimately will stall. This is so on account of both the within and structural-change components. The contribution that the structural-change component can make is necessarily self-limiting if the modern sector does not experience rapid productivity growth on its own.

It is possible of course that the increase in demand for modern-sector goods would lead to capital accumulation and technology adoption in modern services, setting off a process of productivity growth. Perhaps this will eventually happen in Africa. But it does not show up in the data so far.

None of this is to suggest that low-income African countries cannot sustain moderate rates of productivity growth, on the back of steady improvements in human capital and governance. In view of the prospects for advanced economies, continued convergence seems quite achievable. But the recent exceptional growth rates engineered with the help of rapid growth-promoting structural change may well be out of reach.

Acknowledgments We acknowledge Peixun Fang for excellent research assistance. Diao and McMillan gratefully acknowledge the support of the CGIAR's research program Policies, Institutions and Markets (PIM) led by the International Food Policy Research Institute. We also thank Jose Antonio Ocampo for helpful comments.

Appendix: Methodological Notes on Growth Decompositions

Equation (9.2) in Sect. 2 indicates that the growth decomposition is an accounting exercise which can have various economic interpretations. Besides Eq. (9.2), there are a few different ways to decompose economywide labor productivity. In general, we are facing three sets of choices: (1) which weights to use, (2) whether to use annual data or simply period end points and (3) how to annualize the growth rates. While aggregate labor productivity growth rates are little affected by these choices, they could influence the magnitude of labor productivity growth rates within sector and from structural change. The difference in results among the three choices disappears only in the limit where the length of a period is infinitely short.

The following discussion explains how different choices could possibly affect the magnitude of growth in both the within and between components of the growth decomposition. A few examples based on the GGDC data are also provided. We then explain our preferred methodology for decomposing labor productivity growth into its within and between components.

Equation (9.6) is a starting point that describes a change in economywide labor productivity in a given period of (*t*-*k*, *t*) with *k* years:

$$y^t - y^{t-k} = \Delta y^t = \sum_i y_i^t \theta_i^t - \sum_i y_i^{t-k} \theta_i^{t-k} \quad (9.6)$$

where y^t and y^{t-k} are economywide labor productivity at time *t* and *t*-*k* respectively, y_i^t and y_i^{t-k} are sector *i*'s labor productivity at *t* and *t*-*k*, $\theta_i^t = \frac{L_i^t}{L^t}$ and $\theta_i^{t-k} = \frac{L_i^{t-k}}{L^{t-k}}$ are share of labor (*L*) employed in sector *i* at *t* and *t*-*k*, and $t > k$.

By rearranging (9.6), we can express the growth decomposition as

$$\Delta y^t = \sum_i \theta_i^{t-k} \Delta y_i^t + \sum_i y_i^t \Delta \theta_i^t \quad (9.7)$$

or

$$\Delta y^t = \sum_i \theta_i^t \Delta y_i^t + \sum_i y_i^{t-k} \Delta \theta_i^t \quad (9.8)$$

where $\Delta y_i^t = y_i^t - y_i^{t-k}$ and $\Delta \theta_i^t = \theta_i^t - \theta_i^{t-k}$. Equation (9.7) is identical to Eq. (9.2) in Sect. 2 and is the version of the decomposition most commonly used in the literature (as in McMillan and Rodrik 2011, and de Vries et al. 2015).

In (9.7), weights in the "within term" are sectors' labor shares at the beginning of the period (start-point weight) and weights in the "between term" are sectors' labor productivity at the end of the period (end-point weight). In (9.8), weights are the opposite of those in (9.8), that is, the within term uses end-point weights and the between term uses start-point weights. Both Δy_i^t and $\Delta \theta_i^t$ can be positive or negative for a given sector, while $\sum \Delta \theta_i^t = 0$.

Assuming $\Delta y_i^t \neq 0$ and $\Delta \theta_i^t \neq 0$, for a given sector *i*, there are four possibilities for combined Δy_i^t and $\Delta \theta_i^t$ with different signs, that is, (a) $\Delta y_i^t > 0$ & $\Delta \theta_i^t < 0$, (b) $\Delta y_i^t > 0$ & $\Delta \theta_i^t > 0$, (c) $\Delta y_i^t < 0$ & $\Delta \theta_i^t > 0$, and (d) $\Delta y_i^t < 0$ & $\Delta \theta_i^t < 0$. Under different situations, the choice of the weights affects the magnitudes of the two components at the sector level. We consider each case below.

Case (a): $y_i^t > y_i^{t-k}$ and $\theta_i^t < \theta_i^{t-k}$. This is commonly seen for i = agriculture among developing countries.

In this case, sector i positively contributes to within-sector growth and negatively contributes to growth from structural change. Moreover, since $\theta_i^{t-k}\Delta y_i^t > \theta_i^t \Delta y_i^t$ and $\left|y_i^t \Delta\theta_i^t\right| > \left|y_i^{t-k}\Delta\theta_i^t\right|$, compared to Eq. (9.8), Eq. (9.7) could overstate the contribution of sector *i*'s (agricultural) within-sector productivity growth and hence also overstate the negative contribution of this sector to structural change.

Case (b): $y_i^t > y_i^{t-k}$ and $\theta_i^t > \theta_i^{t-k}$. This is commonly seen among East Asian countries for i = manufacturing.

In this case, $\theta_i^{t-k}\Delta y_i^t < \theta_i^t \Delta y_i^t$ and $y_i^t \Delta\theta_i^t > y_i^{t-k}\Delta\theta_i^t$. Compared to Eq. (9.8), Eq. (9.7) could understate the contribution of sector *i*'s (manufacturing) within-sector productivity growth and overstate the contribution of this sector to structural change.

Case (c): $y_i^t < y_i^{t-k}$ and $\theta_i^t > \theta_i^{t-k}$. We have seen this in this chapter in the case of African countries for many nonagricultural sectors.

In this case, $\Delta y_i^t < 0$, $\left|\theta_i^{t-k}\Delta y_i^t\right| < \left|\theta_i^t \Delta y_i^t\right|$, but $y_i^t \Delta\theta_i^t < y_i^{t-k}\Delta\theta_i^t$, which implies that Eq. (9.7) could understate both the negative contribution of sector i to within-sector productivity changes and its positive contribution from structural change in comparison with Eq. (9.8).

Case (d): $y_i^t < y_i^{t-k}$ and $\theta_i^t < \theta_i^{t-k}$, which is a rare case, but we do see it in Hong Kong for the construction sector for the period 1990–2010 in the GGDC data.

Because both $\Delta y_i^t < 0$ and $\Delta\theta_i^t < 0$, $\left|\theta_i^{t-k}\Delta y_i^t\right| > \left|\theta_i^t \Delta y_i^t\right|$ and $\left|y_i^t \Delta\theta_i^t\right| < \left|y_i^{t-k}\Delta\theta_i^t\right|$, Eq. (9.7) could overstate sector *i*'s negative contribution within sector and understate the negative contribution to structural change in comparison with Eq. (9.8).

The discussion of these four cases is for individual sectors. There is never a situation where all sectors of a country follow a single case, and thus, combined

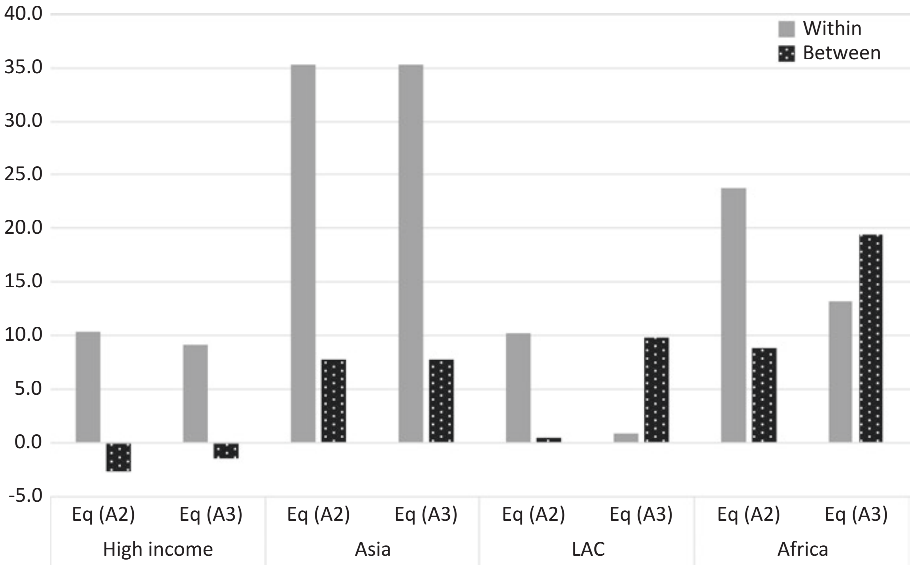

Fig. 9.18 Comparison of two methods in Eqs. (9.7) and (9.8) for labor productivity growth in 2000–2010 (percentages)
Source: Authors' calculations using GGDC data

effects across sectors often produce ambiguity. In general, there is less concern for which equation should be used when productivity gaps across sectors are small or changes in employment structure over time are modest. In the examples shown in Fig. 9.18, however, it is clear that the choice between these two equations affects the decomposition in the African and Latin American country groups significantly, while there is little effect for the high-income country group or for Asian countries.

We have checked the robustness of the main findings discussed in the body of the chapter by comparing them with the results when we use Eq. (9.8) instead of Eq. (9.7). As expected, we get a somewhat different quantitative decomposition into the between and within terms. But we still have a negative correlation between the magnitudes of the within and between terms. In addition, Latin America's growth acceleration is due overwhelmingly to the improvement in the within terms, while Africa's is due to the between terms, as discussed.

The second and third choices related to the growth decomposition exercise are whether we just calculate changes in labor productivity growth within sector and from structural change in a given period (e.g., over ten years) as shown in Eq. (9.7) or (9.8), or whether we compute their annual growth rates. Reporting annual growth rates in labor productivity growth

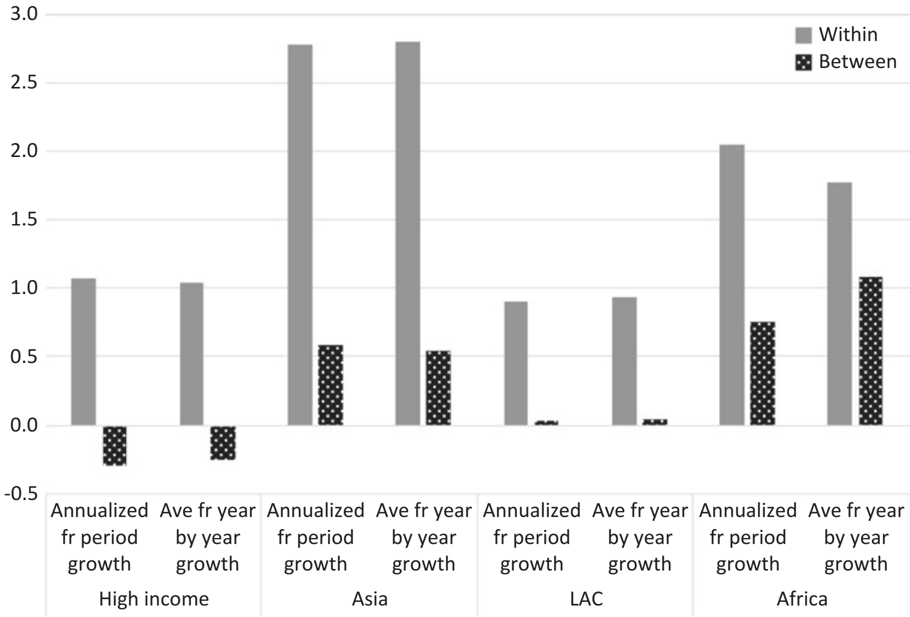

Fig. 9.19 Comparison of different approaches to annualize labor productivity growth rate in 2000–2010 (percentages). (Note: Equation (9.2) is used in both approaches)
Source: Authors' calculations using GGDC data

within sector and from structural change has the advantage that we can relate these to annual growth rates in GDP as we do in Table 9.4 of this chapter. A commonly used method is to first get the changes in within and between terms across sectors over an entire period, and then annualize them to get an average annual growth rate. This method is used by McMillan and Rodrik (2011) and de Vries et al. (2015). One advantage of this method is that we only need value added and employment data across sectors at two data points (two years). The disadvantage is that when time series data are available, this method simply ignores all the data between the initial and end points in a growth decomposition analysis. Again, when sectoral labor productivity and shares of employment do not fluctuate over time and follow a monotonic trend in growth (a trend either up or down) during the period in question, different methods of annualizing matter little. Indeed, we do not see much difference for the two different methods of annualizing the data for the high-income and Asian country groups, but there are some differences for African countries (Fig. 9.19).

In this chapter, we focus on recent growth accelerations in African and Latin American countries. Therefore, we decided to use a year-by-year calculation using the weights defined in Eq. (9.7) but to calculate each year's growth rate for the within and between components at sector level across countries as follows:

$$g_y^t = \sum_i \theta_i^{t-1} \pi_i^{t-1} g_{y_i}^t + \sum_i \Delta\theta_i^t \pi_i^{t-1} \left(1 + g_{y_i}^t\right). \tag{9.9}$$

where $g_y^t = \frac{\Delta y^t}{y^{t-1}}$, $g_{y_i}^t = \frac{\Delta y_i^t}{y_i^{t-1}}$, and $\neq_i^t$ is relative labor productivity for sector i defined as $\pi_i^t = \frac{y_i^t}{y^t}$. We then calculate the average annual growth rates for the within and between terms in a given period (e.g., over ten years) for each sector by taking a simple average as follows:

$$\overline{g}_i^{within} = \frac{1}{10} \sum_{10}^{t=1} \theta_i^{t-1} \pi_i^{t-1} g_{y_i}^t$$

and

$$\overline{g}_i^{between} = \frac{1}{10} \sum_{10}^{t=1} \Delta\theta_i^t \pi_i^{t-1} \left(1 + g_{y_i}^t\right)$$

where $\overline{g}_i^{within}$ and $\overline{g}_i^{between}$ are the average labor productivity growth rates of sector i within sector and from structural change in a given ten-year period, and where both $\overline{g}_i^{within}$ and $\overline{g}_i^{between}$ are measured as fractions of the average annual growth rate of economywide labor productivity in this period. Thus, the annual economywide labor productivity growth rate and its two components in this given period are defined as follows:

$$\overline{g} = \sum_i \overline{g}_i^{within} + \sum_i \overline{g}_i^{between} \tag{9.10}$$

Tables 9.9 and 9.10 present $\overline{g}$, $\sum_i \overline{g}_i^{within}$, and $\sum_i \overline{g}_i^{between}$ at the country level, while the details for $\overline{g}_i^{within}$ and $\overline{g}_i^{between}$ at the sector level across countries can be obtained from the authors upon request.

Table 9.9 Labor productivity growth within sector and due to structural change, before and during growth accelerations—LAC, Africa and India (ten years in each period, annual average)

	Labor productivity growth		Within sector		Structural change	
	Before growth acceleration	Growth acceleration period	Before growth acceleration	Growth acceleration period	Before growth acceleration	Growth acceleration period
	(t-9, t)	(t, t+9)	(t-9, t)	(t, t+9)	(t-9, t)	(t, t+9)
ARG	−0.66	1.19	−0.46	2.15	−0.21	−0.96
BOL	0.81	1.04	0.81	2.65	0.00	−1.61
BRA	0.94	1.06	0.71	0.65	0.23	0.41
CHL	0.05	4.15	−0.52	3.15	0.57	1.00
COL	−0.19	1.21	0.06	1.04	−0.25	0.17
CRI	0.73	1.78	0.47	1.92	0.26	−0.14
MEX	−0.43	0.20	−1.04	−0.54	0.60	0.74
PER	0.84	4.03	1.32	3.40	−0.48	0.64
ETH	1.22	4.65	−0.44	2.40	1.66	2.25
GHA	−4.13	3.51	−3.15	2.56	−0.98	0.95
KEN	−1.17	1.48	−2.38	1.18	1.21	0.30
MWI	0.88	2.52	−0.62	−1.41	1.49	3.93
NGA	−0.27	4.34	3.49	3.76	−3.75	0.58
RWA		4.51		1.28		3.23
SEN	−1.30	1.56	−1.98	−0.24	0.69	1.80
ZAF	1.75	2.44	1.87	2.65	−0.12	−0.21
TZA	0.89	4.23	0.43	0.76	0.46	3.47
ZMB	−2.18	3.04	−0.17	2.38	−2.01	0.66
LAC average	0.26	1.83	0.17	1.80	0.09	0.03
Africa average	−0.48	3.23	−0.33	1.53	−0.15	1.70
Africa average w/o NGA & ZMB	−0.27	3.11	−0.89	1.15	0.63	1.96
India	1.77	1.99	1.41	0.84	0.36	1.16

Notes: The initial year (*t*) of growth accelerations differs across countries. The numbers are in percentage points, measured in terms of economywide annual labor productivity growth, that is, the economywide labor productivity growth in the first two columns equals the sum of growth from within-sector versus structural-change terms in columns 3–4 and columns 5–6. Data for Rwanda are from national sources and are only available for the growth acceleration period. A simple average method is used for the regional average

Source: Authors' calculations using GGDC data

Table 9.10 Labor productivity growth within sector and due to structural change, before and during growth accelerations—Asia (ten years in each period, annual average)

	Labor productivity growth				Within sector				Structural change			
	Before growth acceleration	Post-growth acceleration 1st decade	Post-growth acceleration 2nd decade	Post-growth acceleration 3rd decade	Before growth acceleration	Post-growth acceleration 1st decade	Post-growth acceleration 2nd decade	Post-growth acceleration 3rd decade	Before growth acceleration	Post-growth acceleration 1st decade	Post-growth acceleration 2nd decade	Post-growth acceleration 3rd decade
	(t-9, t)	(t, t+9)	(t+19, t+19)	(t+19, t+29)	(t-9, t)	(t, t+9)	(t+19, t+19)	(t+19, t+29)	(t-9, t)	(t, t+9)	(t+19, t+19)	(t+19, t+29)
CHN	4.19	6.70	6.82	9.17	2.57	4.87	6.12	8.21	1.63	1.83	0.70	0.95
HKG		5.07	4.18	3.07		1.93	3.38	2.48		3.15	0.80	0.59
IDN	1.43	4.51	2.14		−0.59	3.31	1.85		2.03	1.20	0.28	
KOR		3.81	2.77	5.16		2.81	2.33	3.36		1.00	0.44	1.80
MYS		3.51	3.76	2.52		5.87	4.17	2.84		−2.36	−0.40	−0.32
SGP		3.76	3.53	2.06		3.07	3.24	2.16		0.69	0.29	−0.10
THA	4.46	5.10	4.17	4.59	3.03	3.31	1.58	3.37	1.43	1.79	2.58	1.22
TWN		6.78	4.71	5.00		5.97	3.82	4.80		0.81	0.89	0.20
Asia average	1.26	4.91	4.01	3.94	0.63	3.89	3.31	3.40	0.64	1.01	0.70	0.54

Notes: The initial year (*t*) of growth accelerations differs across countries. The numbers are in percentage points, measured in terms of economywide annual labor productivity growth, that is, the economywide labor productivity growth in the first four columns equals the sum of growth from within sector in columns 5–8 versus structural-change terms in columns 9–12. Data for before growth acceleration period are not available for HKG, KOR, MYS, SGP and TWN in GGDC. The initial year of growth acceleration for IDN is 1986, and data are available only for the first two decades post-growth acceleration in this case. Asia average for before growth acceleration period is based on CHN, IDN and THA

Source: Authors' calculations using GGDC data

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