11

The Middle-Income Trap and Premature Deindustrialization in South Africa

Antonio Andreoni and Fiona Tregenna

11.1 Introduction

The South African economy has been stagnant over an extended period of time, going back to the apartheid era. This is manifest in the lack of structural transformation and in weak economic growth. Even with the unique characteristics of the South African economy, it shares commonalities with some other middle-income countries and can be considered as an example of an economy stuck in the 'middle income trap'. It has remained in middle-income status over a long period of time, without approaching a transition towards high-income status. Growth has been stagnant, with little improvement in average living standards. At a structural level, the economy has not undergone the kind of structural transformation that could form the basis for a shift towards a superior growth path.

Premature deindustrialization (Palma, 2005 and 2008; Tregenna 2009, 2015, 2016a and 2016b; Rodrik, 2016) is among the key factors locking many middle-income countries in a trap of stagnant growth and thwarting their catching-up with advanced economies. When premature, deindustrialization is likely to have more severe consequences for growth than deindustrialization in advanced economies, as discussed further below. South Africa arguably started to deindustrialize in the early 1980s; by 2020 it was still at relatively low levels of income per capita and shares of manufacturing in gross domestic product (GDP) and total employment (see Chapter 2).

Beyond falling in the middle-income trap in general, with many of the features of premature deindustrialization, a further impediment to South Africa's economic progress has been that the country can also be understood to have been stuck in a 'middle income technology trap'. Andreoni and Tregenna (2020: 324) introduce this idea, conceptualized as 'specific structural and institutional configurations that are not conducive to increasing domestic value addition and

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to sustained industrial and technological upgrading'. This is reflected in the lack of crucial industrial and technological upgrading that could enable new development trajectories, with severe consequences for industrial development and economic growth. The middle-income technology trap is thus closely linked with the concept of premature deindustrialization.

The middle-income technology trap can contribute to premature deindustrialization, as the failure to upgrade manufacturing and move to more technology-intensive industries can exacerbate the poor performance of manufacturing. Premature deindustrialization, in turn, can contribute to countries being stuck in a middle-income trap. Linking the middle-income technology trap and premature deindustrialization presents the possibility of a vicious cycle of weak technological and broader industrial upgrading, deindustrialization, lack of structural transformation, and poor economic growth.

This diagnosis brings to the fore the importance of industrial policies in supporting industrial development and structural transformation, in particular in promoting technological upgrading throughout manufacturing and a shift towards more technology-intensive manufacturing activities. The effectiveness of industrial policy in addressing premature deindustrialization in middle-income countries critically depends on the specific features of the industrial system. Indeed, countries that are traditionally classified in the group of middle-income countries are highly heterogeneous with respect to their premature deindustrialization experiences.

This chapter analyses structural change, the middle-income trap, and premature deindustrialization in South Africa, in the context of the specific industrialization challenges faced by middle-income countries today. It provides global and regional evidence for the different premature deindustrialization trajectories that countries have followed. Throughout the chapter, reference is made to three selected middle-income countries as comparator cases: Brazil, China, and Malaysia. Whereas South Africa previously (up until 1972) had the highest income per capita of these countries, by 2020 it had the lowest. The four countries have followed very different policies, with diverse outcomes in structural transformation and growth. While there are some commonalities among them, these marked differences draw attention to the profound deficiencies in South Africa's policy choices and economic outcomes.

Section 11.2 discusses the issue of the 'middle-income trap' and the challenges that middle-income countries face in industrializing during the current period. Section 11.3 presents an empirical analysis of selected global evidence on the phenomenon of premature deindustrialization, situating South Africa in an international comparative perspective. Section 11.4 briefly discusses industrial policy implications for middle-income countries, and section 11.5 concludes.

11.2 The Middle-Income Trap, the Middle-Income Technology Trap, and Industrialization Challenges

11.2.1 The Middle-Income Trap

As a stylized fact, many middle-income economies have experienced stagnant economic growth and have struggled to transition to high-income status. In some cases, this manifests as a slowdown in growth after an earlier period of more rapid growth that took them from low- to middle-income status. The notion of a 'middle-income trap' has been used to refer broadly to the problem of a failure of middle-income countries catching up with advanced economies and transitioning to upper-income status.[1] Many middle-income countries have experienced stagnant growth (in both absolute and relative terms) over a long period of time, and being 'trapped' in an apparent low-growth equilibrium.

It is worth noting that the middle-income trap is not a confinement from which countries have no hope of escape. Between 1994 (the year of South Africa's democratization) and 2019, nine countries that had been classified as lower-middle-income transitioned to high-income status; seven of these nine countries were East European. In addition, over this period, a diverse group of twenty-two countries moved from upper-middle-income to high-income status, including Chile, Greece, Hungary, Uruguay, and Saudi Arabia. This indicates that there is a degree of mobility, and that some countries have moved ahead while South Africa has remained stuck in middle-income status. South Africa was one of nine countries classified as middle-income in both 1994 and 2019, with others including Brazil, Argentina, Malaysia, and Mexico. Of course, within these countries that remained in middle-income status during this period, some (such as Malaysia) followed a catching-up trajectory while others (including South Africa) fell further behind, as discussed further below. Eight low-income and thirty-five lower-middle income countries moved to upper-middle-income status between 1994 and 2019, a number of these overtaking South Africa in income per capita.

Of course, these income categories are based only on income levels (specifically, gross national income (GNI) per capita in US$), and do not reflect the deeper structural features that are associated with the concept of a middle-income trap. Nonetheless, these observations do point on the one hand to the stagnation of some countries (including South Africa) in middle-income status, while on

[1] For recent literature on the middle-income trap, see for instance Gill and Kharas, 2007; Arias and Wen (2015); Wade (2016); Felipe et al. (2017); Kang and Paus (2020); Klingler-Vidra and Wade (2020); Lebdioui et al. (2020); and Paus (2020).

the other hand others have been able to attain sustained high growth rates and transition to high-income status, some of these overtaking South Africa in the process.[2]

Various explanations have been advanced for the apparent prevalence and persistence of the middle-income trap (see Wade, 2016). One focuses on productivity, and specifically the failure of middle-income countries to sustain rates of labour productivity growth above those of advanced economies (see, for example, Lin, 2017). Other authors such as Lee (2013) draws attention to middle-income countries being squeezed between, on the one hand, countries with lower wages and that have been successful as large-scale exporters, and on the other hand, more technologically advanced economies.

If the idea is embraced that manufacturing industries play a critical role in boosting productivity, value addition, and technological change, premature deindustrialization could be another factor responsible for the phenomenon of the middle-income trap. Countries can be considered to experience premature deindustrialization when the level of GDP per capita and/or the shares of manufacturing in total employment and GDP at which deindustrialization sets in are lower than is typically the case internationally.

11.2.2 South Africa: Stuck in the Middle

According to various indicators of industrial competitiveness, South Africa is stuck in the middle-income countries segment, and has shown signs of an ongoing process of premature deindustrialization. Over several decades, the annual growth rate of the manufacturing sector has slowed down dramatically, thereby affecting the absolute manufacturing value addition produced in the country. As a result of this premature deindustrialization process, if South Africa's export performances are benchmarked against those of other middle-income countries, gross export value is shown to increase after 2000, but at a much slower pace than major comparator countries.[3]

Figure 11.1 compares the evolution of South Africa's GDP per capita with that of the three comparator middle-income countries that are referenced throughout this chapter: Brazil, China, and Malaysia. Each of the four countries' GDP per capita is shown relative to that of the USA over the period 1960–2019, showing the extent to which they are catching up or falling behind.

[2] See Felipe et al. (2017) for a systematic analysis of countries' historical transitions between income categories; they argue that the evidence suggests that there is no generalized phenomenon of a middle-income trap.

[3] Chapter 2 provides a comprehensive overview of relevant empirical trends in the South African manufacturing sector, demonstrating the lack of structural transformation and deindustrialization.

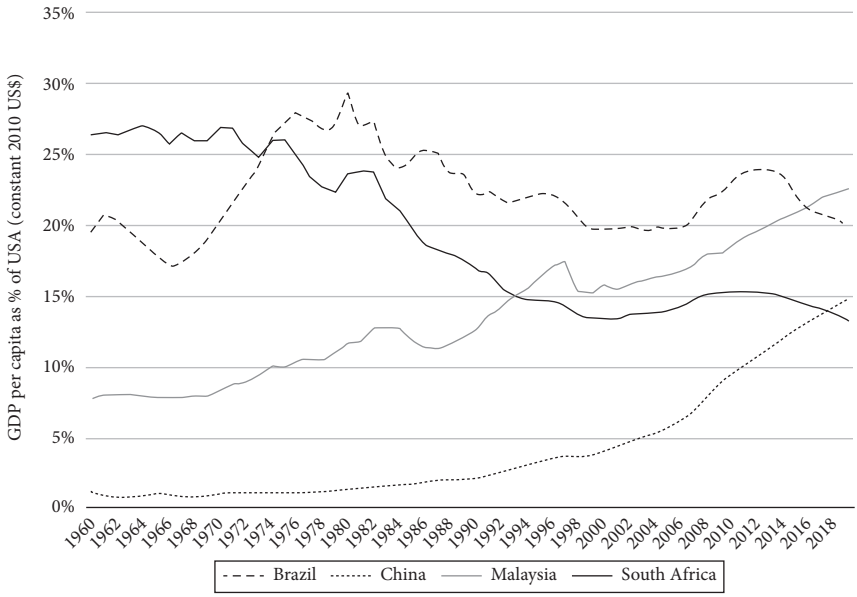

Figure 11.1 South Africa and comparator countries: % of US GDP per capita 1960–2019
Source: World Bank World Development Indicators (WB WDI).

Until 1972, South Africa had the highest level of GDP per capita in the group, after which it was overtaken by Brazil. South Africa was then overtaken by Malaysia in 1993 and China in 2018, leaving it with the lowest income level among these four countries. South Africa's income per capita remained at a little over a quarter of that of the USA until the mid-1970s, but this ratio fell dramatically during the 1990s and 2000s. There was modest growth in South Africa during the 2000s, which saw some catching-up with the US benchmark. However, this ratio has fallen again from 2011 onwards. Thus, over an extended period of time, instead of catching up, South Africa fell further behind, with a GDP per capita just 13 per cent of that of the US in 2019.

Figure 11.1 also illustrates the contrasting fortunes of the three comparator countries, all of which are currently classified as middle-income economies. Brazil experienced rapid catching-up from 1966 to 1980, reaching almost 30 per cent of US income per capita; it then experienced a short period of catching-up during the Lula presidency and the early years of the Dilma presidency, before again falling behind the USA as well as being overtaken by Malaysia in 2016. Malaysia and China are pre-eminent examples of sustained catching-up. China's GDP per capita rose from just 1 per cent of that of the USA to 15 per cent over the period shown. While these are both classified as middle-income countries at the time of writing, neither has been stuck in a middle-income trap.

It is true that virtually all countries would show up poorly when benchmarked against China's long-run growth miracle. Yet South Africa performed poorly when compared not just against the three comparator countries and the benchmark of the US as shown here, but against all relevant country groupings and aggregates.

This underscores the long-term structural deficiencies of South Africa's economy and growth trajectory, and the extent to which it is has remained stuck in its middle-income position and in fact has fallen down the global rankings in GDP per capita. Even during the period of relatively rapid economic growth in the 2000s, there was a failure of structural transformation in the South African economy.

11.2.3 Structural Challenges: The Middle-Income Technology Trap

Andreoni and Tregenna (2020) identify three specific structural factors associated with the middle-income trap: breaking into globally concentrated industrial production; linking up with global value chains (GVCs) while also linking back with local production systems; and keeping pace with technological change. The combined impact of these three structural challenges is what they call the 'middle-income technology trap'. Indeed, capturing this set of factors and observing how they unfold in different countries along different structural trajectories constitutes a key step in designing appropriate industrial policy for middle-income countries.

11.2.3.1 The Challenges of Breaking into Globally Concentrated Manufacturing Production

First, global industrial production generally remains highly concentrated, with world manufacturing value added shares being captured by a few mature and emerging economies. This is despite a small number of countries (especially in East Asia) having managed to meaningfully expand and upgrade their industrial production. In this context of the global industrial landscape, South Africa has faced a fundamental challenge in increasing its domestic value added (DVA) in manufacturing industries and exported products. Simply put, manufacturing DVA indicates the extent to which a country adds value in manufacturing, excluding the value of imported intermediate inputs. In South Africa, the net DVA declined among all major manufacturing subsectors between 1995 and 2008 (Figure 11.2). Some recovery was registered after 2008, for example in the machinery and equipment industries (see Chapter 13).

11.2.3.2 The Challenge of Linking Up with GVCs While Linking Back with Local Production Systems

A second challenge identified by Andreoni and Tregenna (2020) is that of 'linking up' through productive integration in GVCs, while also 'linking back' with the

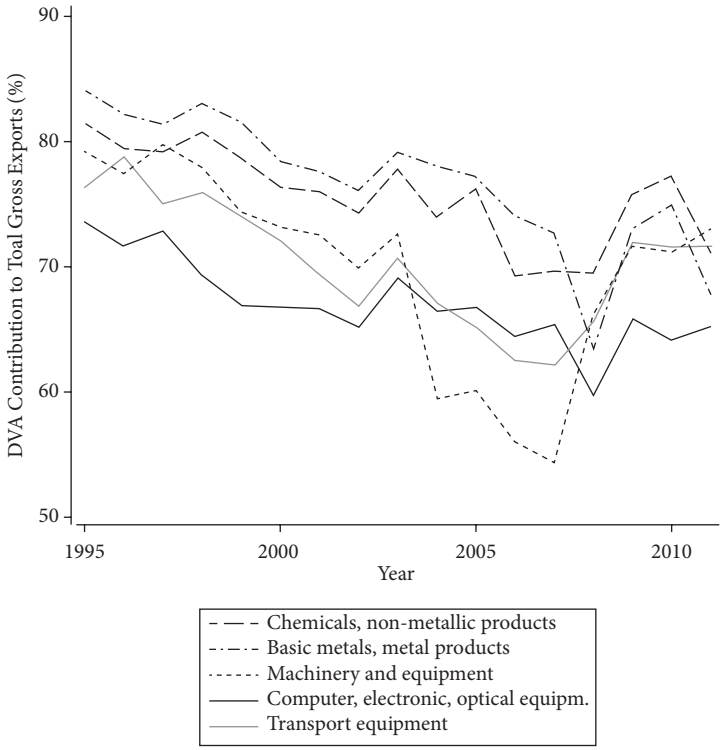

Figure 11.2 Domestic value-added content of South African exports by major manufacturing sub-sectors
Source: Authors, based on TIVA.

local production system. It is important that countries develop their industrial capabilities and maximize the potential benefits of forward integration into GVCs.[4] Between 1990 and 2010, African countries experienced limited gains from GVC integration and declining forward integration (and DVA) in international trade. Much of Africa's participation in GVCs has developed in upstream production (backward integration), with declining downstream integration. South Africa has seen an increase in backward integration, measured in this context as the share of foreign value added in exports, from 17 per cent in 1995 to 30 per cent in 2011 (Figure 11.3).

Middle-income countries like South Africa typically struggle to move into the more complex, technologically sophisticated, and profitable segments of GVCs, which can contribute to their often remaining stuck in a middle-income technology trap, and a middle-income trap more broadly. Where middle-income countries' engagement with RVCs or GVCs is predominantly in low value-added production, this brings the risk of disarticulation with the domestic manufacturing

[4] See Chapter 13 for more discussion on GVCs, in particular around upgrading and integration.

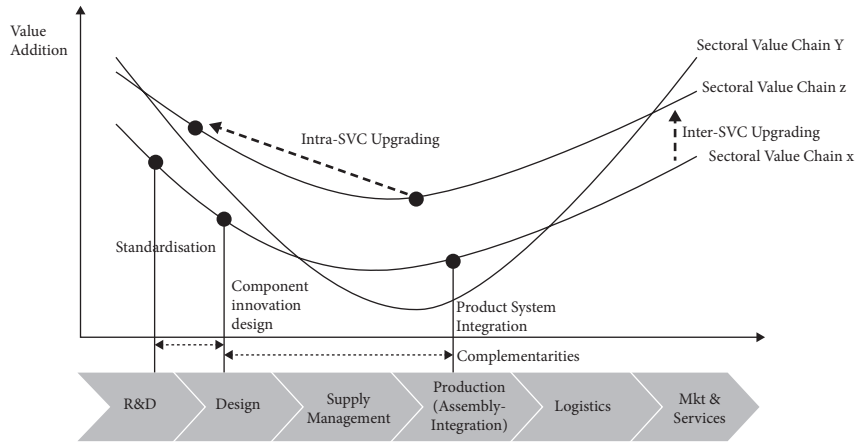

Figure 11.3 Capturing high-value niches and the need for multiple sets of complementary capabilities
Source: Andreoni (2019).

sector and a hollowing out of domestic industrial capabilities. This points to the importance of 'linking back' with domestic production systems, in a way that fosters structural transformation. GVC upgrading involves transitioning to more profitable and/or technologically advanced economic niches within GVCs. To do so, firms require multiple sets of capabilities that are relevant to various stages of value chains (Figure 11.3).

Intersectoral upgrading is becoming increasingly important, given that modern, high-value manufacturing activities require cross-cutting capabilities and technology systems. Technology systems such as biotechnologies, advanced materials, microelectronics, and automation are required in a range of manufacturing activities (Chapter 12). These complementary sets of capabilities are thus important for innovation and technological upgrading—both intra- and inter-sectoral upgrading—and hence to enable new development trajectories.

11.2.3.3 The Challenge of Keeping Pace with Technological Change

A third challenge is that of 'keeping pace' with technological change and innovation (Andreoni and Tregenna, 2020). Technological change at the innovation frontier—the so-called fourth industrial revolution—has increasingly been recognized by lower- and middle-income countries as a critical competitive factor for GVC upgrading and a leapfrogging opportunity.

'Key technology systems' are particularly important in keeping pace with technological change, especially in the current global industrial landscape. The European Commission (2009), for example, identified the following list of technology systems as key enablers of innovation and structural change in the global economy: micro- and nano-electronics and nanotechnology, photonics,

Table 11.1 South Africa and comparator countries: R&D and technology indicators

	Brazil	China	Malaysia	South Africa
Total R&D personnel per million inhabitants	2,917	3,824	3,835	1,327
Total R&D personnel per thousand total employment	6.3	7.0	8.3	4.6
Gross domestic expenditure on R&D as a percentage of GDP	1.3	2.1	1.4	0.8
Gross domestic expenditure on R&D per capita (current PPP$)	194	320	405	108
Scientific and technical journal articles	60,148	528,263	23,661	13,009
Patent applications, residents	4,980	1,393,815	1,116	657
High-technology exports (% of manufactured exports)	13.0	31.4	52.8	5.3

Note: Each variable is shown for the most recent year for which data are available for all four countries; years and data sources as follows: both R&D personnel measures are for 2014 and from UNESCO; both R&D expenditure measures are for 2014 and from UNESCO; all other measures are for 2018 and from the World Bank World Development Indicators (WB WDI).

industrial biotechnology, advanced materials, and advanced manufacturing systems. These key enabling technologies (KETs) are transversal, in that they are utilized across multiple sectors and supply chains. They are also embedded, playing an important function in integrated technology systems. Key technology systems have the potential to be quality-enhancing, productivity-enhancing, and strategic. All of these characteristics render key technology systems important in technological upgrading and for avoiding a middle-income technology trap.

Regarding the challenge of keeping pace with these technologies, Table 11.1 compares South Africa with Brazil, China, and Malaysia for some key research and development (R&D) and technology indicators. The comparisons show South Africa ranked as the worst in all seven of these measures. For instance, South Africa had approximately one-third of the R&D personnel per million inhabitants as did both China and Malaysia, and also spent far less on R&D (both as a percentage of GDP and per capita) than the three comparator countries. As an indication of technological intensity, South Africa had by far the lowest share of high-technology exports in total manufactured exports. South Africa is clearly a laggard in both the 'inputs' to technological upgrading and the 'outcomes' in technological intensity and, as seen earlier, economic growth. Insofar as 'keeping pace' is important in avoiding a middle-income trap, these comparisons do not bode well for South Africa's prospects of catching up.

Furthermore, recognizing the role of 'key technology systems' draws attention to the fact that there are important functions and activities relating to these technological capabilities which are not necessarily located in individual manufacturing firms. For instance, these activities could be in separate engineering, design, and research institutions and businesses, which may be classified within

the services sector. While sector categories remain relevant, the blurring between sectoral divisions and the growing integration between sectors needs to be recognized (Andreoni and Chang, 2017; Cramer and Tregenna, 2020). This also affects apparent trends in manufacturing employment and output shares. While manufacturing employment share may have remained steady or even fallen in countries that have successfully developed these capabilities, the manufacturing share is nevertheless higher than predicted, as in the cases of China and Malaysia for instance.

Apparent deindustrialization, based on aggregate trends in manufacturing output or employment, can obscure different dynamics in the composition of manufacturing, in productivity (Tregenna, 2009 and 2013), the extent of outsourcing to the services sector (Tregenna, 2010), and, of particular relevance here, the role of 'key technology systems'. Structural transformation involves not just change in the overall sectoral composition of the economy, but also a shift towards activities with the scope for higher cumulative productivity increases. Key technology systems have important roles to play in this, irrespective of the sectors within which these activities may be formally classified.

Middle-income countries such as South Africa run the risk of undermining the 'technological preconditions' that have to be met in order to capture value opportunities from technological change. For example, to make investments in ICT and digital solutions valuable, investments in the production capacity and hardware and organizational capabilities must be in place. In particular, the integration of digital technologies and networks with robotics and autonomous systems requires investments in key technology sub-systems and components, including automation and m2m (machine-to-machine) technologies, embedded software, sensors and human interfaces, and augmented reality. These emerging technologies are expected to reshape the industrial plant of the future, making processes faster and more responsive, while reshaping the nature of jobs and skills (see Chapter 12).

11.3 Premature Deindustrialization: South Africa from an International Comparative Perspective

This triple set of structural challenges faced by middle-income countries, as synthesized in the idea of a 'middle-income technology trap', highlights the existence of potential reinforcing mechanisms and cumulative vicious cycles undermining structural transformation.[5] Specifically, breaking into the global

[5] The literature on circular and cumulative causation initiated by Allyin Young and later developed by several structuralist and development scholars, including Gunnar Myrdal and Nicholas Kaldor, has emphasized the risks of cumulativeness and circularity in structural dynamics. While these properties can be responsible for virtuous expansionary cycles of increasing returns, they can also turn into negative cycles and a low-level equilibrium trap. For a review, see Toner, 1999.

economy, linking up while linking back, and keeping pace with technological change are in themselves interlinked challenges. But they are also intertwined and reinforced by the cumulative structural dynamics of industrialization or deindustrialization. If a country falls behind in its industrialization pathway, and it shows signs of premature deindustrialization, the triple set of structural challenges discussed above becomes progressively more constraining. With a reduction in a country's industrial base, its opportunities for DVA shrinks, and its companies will find it increasingly difficult to 'link back'. Furthermore, investments in technological upgrading and innovation will be limited by reduced expansionary dynamics and scale across manufacturing industries. These domestic dynamics of manufacturing and technological contraction will also be reflected in a reduced international competitiveness and potential growth in import penetration. It is then unsurprising that many countries that are stuck in a middle-income technology trap have also undergone a process of deindustrialization, in particular premature deindustrialization.

Having explored the structural challenges facing middle-income countries, the discussion turns to a closer exploration of deindustrialization. Deindustrialization trends across countries are empirically analysed, the patterns and dynamics of deindustrialization internationally—in particular premature deindustrialization—are explored, and South Africa is located in the context of these trends.

The first step is an estimation of the relationship between countries' GDP per capita and their shares of manufacturing in total employment. This simple regression analysis enables the identification of the level of GDP per capita and share of manufacturing in total employment associated with the 'turning point' at which the share of manufacturing levels off and begins to decline. Second, is the characterization of country experiences based on countries' changes in share of manufacturing in total employment, and on whether their actual share of manufacturing in total employment is higher or lower than the regression analysis would predict. Countries are categorized based on these two dimensions. Finally, combining this with data on countries' 2015 level of GDP per capita and manufacturing employment share makes it possible to identify potential premature deindustrializers among middle-income economies. Throughout, particular attention is drawn to the case of South Africa, while also making reference to the three comparator countries.

11.3.1 The 'Inverted-U' Pattern of Industrialization and Deindustrialization

This part of the study begins with an analysis of the relationship between GDP per capita and the share of manufacturing in total employment. This step of the method follows Rowthorn (1994), Palma (2005 and 2008), Tregenna (2015), and

Tregenna and Andreoni (2020). Rowthorn (1994) identifies an inverted-U relationship between countries. That is, at higher levels of GDP per capita, the share of manufacturing in total employment typically rises, up to a turning point associated with a particular level of GDP per capita and share of manufacturing employment, after which manufacturing accounts for a declining share of total employment. Naturally, this is a stylized pattern based on data for many countries, and countries will inevitably have either a higher or lower actual employment share than would be predicted, based on the regression analysis.

The share of manufacturing employment in total employment is estimated as a function of GDP per capita and GDP per capita squared (all in natural logs). The inclusion of the squared term takes account of the expected non-linear relationship between the explanatory and independent variables.[6] The final sample comprises 148 countries, with excellent coverage across regions and across levels of development.[7]

The results confirm the expected inverted-U relationship between GDP per capita and manufacturing share of employment. This simple regression yields an estimated turning point for 2015 of approximately $17 000 (2015 current US$). This level of GDP per capita corresponds (in this regression) to a 12 per cent share of manufacturing in total employment. The curve is shown in Figure 11.4, which also shows the turning point of the regression—the level of GDP per capita and associated share of manufacturing in total employment at which the latter levels off and subsequently begins to decline.

11.3.2 Characterizing Country Patterns

Next, countries are categorized based on two dimensions. First, whether their actual share of manufacturing in total employment in 2015 was higher or lower than would be 'predicted' based on their level of GDP per capita in 2015 and the estimated coefficients from the regression (that is, the sign of the residual term for each country). This dimension gives a sense of which countries may be 'under-industrialized' given their level of GDP per capita. Where this is positive, a country falls above the curve in Figure 11.4, and conversely where this is negative. Second, whether they experienced an increase or decrease in the share of

[6] Data on GDP per capita and population are from the United Nations (UN) Main National Accounts database (UNMNA), available at https://unstats.un.org/unsd/snaama/Introduction.asp (UNMNA). GDP data are in current US$. Data on manufacturing share of employment are taken from the International Labour Organisation (ILO) ILOSTAT database, available at http://www.ilo.org/ilostat/faces/ilostat-home/home?_adf.ctrl-state=97dmq1had_4%26_afrLoop=410,550,119,330,777#.

[7] The initial sample includes 181 countries for which data are available on all variables for both 2005 and 2015. All countries with a population below one million people are excluded from the sample. This excludes from the analysis small island nations and other small countries, which may follow atypical development paths that can distort the analysis. A further three countries identified as outliers are also excluded.

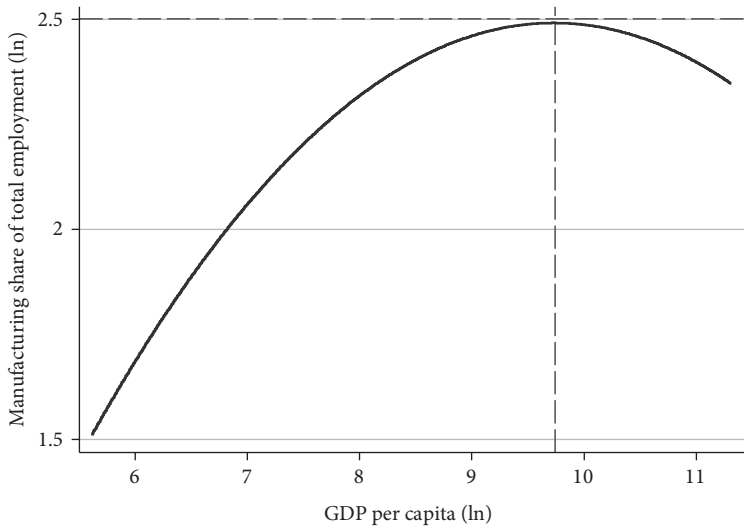

Figure 11.4 Estimated relationship between GDP per capita and manufacturing share of employment, 2015

Note: Dashed lines indicate the turning point of the relationship.

manufacturing in their total employment between 2005 and 2015. This second dimension indicates which countries can be considered (simply on the basis of sectoral employment shares) to have deindustrialized during this period. Taken together, these two dimensions allow for the tentative classification of countries into four broad categories, depicted schematically in the four quadrants of Figure 11.5.

It must be emphasized that this analysis is exploratory and indicative, rather than definitive.[8] It is thus only suggestive of which countries might be considered as deindustrializers, and especially as premature deindustrializers.

Quadrant I includes countries in which the share of manufacturing employment is higher than expected in 2015, and in which this share grew between 2005 and 2015. Based on this analysis, these countries do not raise a concern in terms of deindustrialization. Countries in Quadrant 4 are also growing their share of manufacturing in total employment, which in 2015 remained below their 'expected' values. Thus, even though these countries might be regarded as

[8] Reasons for circumspection include: that this is just one approach to conceptualizing and measuring premature deindustrialization; the inclusion of estimated values in the ILOSTAT database; limitations of the econometric methodology and specification (including the non-inclusion of explanatory variables other than GDP per capita and its squared term); the narrow range of the predicted values of manufacturing share of total employment; measurement of deindustrialization only in terms of employment shares and not also shares in GDP; and sensitivity to the specific years used in the analysis. Furthermore, to reach more definitive conclusions, individual country-level analysis would be needed, taking into account country-specific dynamics.

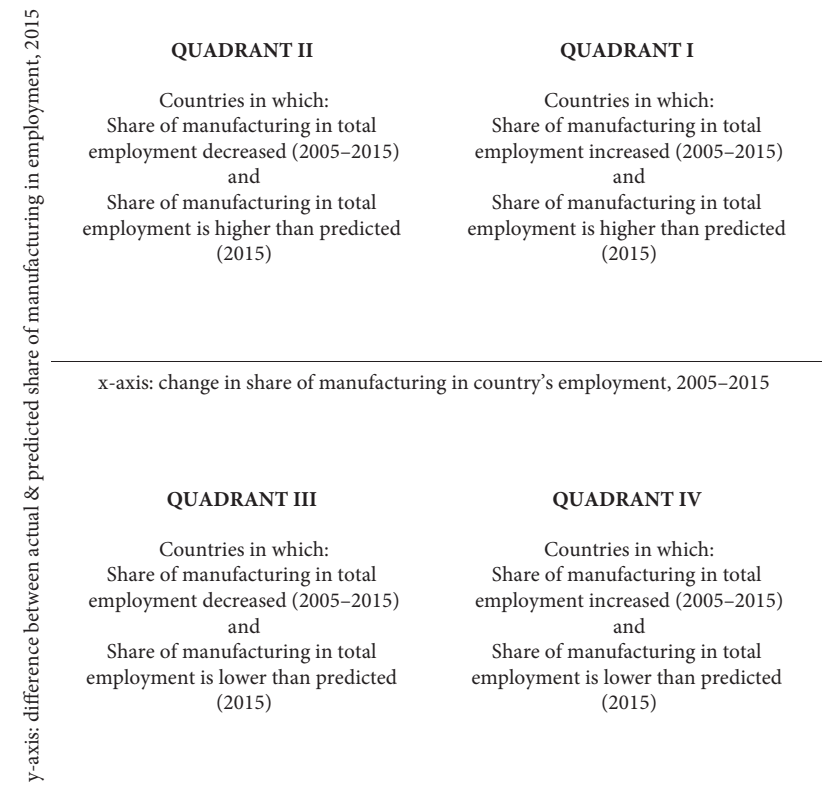

Figure 11.5 Characterization of international trends in deindustrialization

'under-industrialized', they show evidence of industrializing during this decade (2005–15).

Countries falling in Quadrants II and III can be characterized as possible deindustrializers, in that their share of manufacturing in total employment fell between 2005 and 2015. Yet, in the case of Quadrant II countries, their manufacturing employment share in 2015 still remained above their 'expected' level.

From the standpoint of structural change and concerns around the impact of deindustrialization on growth, it is the countries falling in Quadrant III that potentially raise more significant concerns. In these countries, the share of manufacturing in employment fell over the period 2005–15 as well as being lower than expected (based on cross-country regressions) in 2015. Rather than catching up to their 'expected' level of industrialization, this group of countries fell further behind. Furthermore, some of these countries had a higher than expected level of industrialization in 2005, but fell below the curve by 2015.

South Africa falls in Quadrant III—the category of greatest potential concern in terms of deindustrialization. Between 2005 and 2015, the share of manufacturing in South Africa's total employment fell from 13.9 per cent to 11.2 per cent (based on the ILOSTAT data). Worth noting is that this is in fact only slightly below the expected value for 2015 based on South Africa's GDP per capita and international patterns of widespread deindustrialization; that is, South Africa's share is actually close to its predicted value.

In contrast with South Africa, the three comparator countries—Brazil, China, and Malaysia—all fall in Quadrant II. Like South Africa, their share of manufacturing in total employment declined between 2005 and 2015. Yet, unlike the case of South Africa, their share of manufacturing in total employment remained higher than predicted in 2015. A key factor in this difference is that these three comparator countries began the period of analysis at relatively higher shares of manufacturing in total employment, for their levels of income per capita, than in the case of South Africa.

Key statistics for South Africa, Brazil, China, and Malaysia are shown in Table 11.2. South Africa had the lowest share of manufacturing in total employment in both 2005 and 2015. Moreover, as discussed, it is the only one among this cohort of countries to have a lower than predicted share of manufacturing in total employment in 2015 (albeit only very slightly lower than predicted). Brazil's actual share is only slightly higher than its predicted share, while in China and Malaysia the actual shares were well above predicted shares, indicating the high levels of industrialization in the latter two countries.

11.3.3 Identifying Possible Premature Deindustrializers

Next, Quadrant III countries are further divided into those that might be regarded as possible premature deindustrializers. Possible premature deindustrializers for 2015 are identified as those countries in which: (1) the share of manufacturing in

Table 11.2 South Africa and comparator countries

	Actual share of manuf. in total employment 2005 (%)	**Actual share of manuf. in total employment 2015 (%)**	**Difference btw actual & predicted share of manuf. in total employment 2015 (%)**
South Africa	13.9	11.2	−0.1
Brazil	14.2	12.5	0.7
China	23.6	17.6	5.9
Malaysia	19.8	16.5	4.6

total employment fell between 2005 and 2015; (2) the share of manufacturing in total employment in 2015 was less than would be expected based on their GDP per capita (i.e. they fell below the curve shown in Figure 11.4; and (3) their GDP per capita in 2015 was below the level of GDP per capita associated with the turning point in the relationship based on the pattern found across countries (i.e. they fell to the left of the turning point shown in Figure 11.4). As such, this set of countries excludes those in Quadrant III with levels of GDP per capita above the income turning point (i.e. advanced economies that are deindustrializing). This part of the analysis thus introduces a third dimension (to the left or right of the income turning point), to identify the (potential) premature aspect of the deindustrialization experiences internationally.

From this, middle-income countries that emerge as possible premature deindustrializers are listed in Table 11.3. This excludes low-income (e.g. Zimbabwe) and high-income (e.g. Chile) countries that also fit the criteria of possible premature deindustrializers.

11.4 The Role of Industrial Policy in Avoiding the Middle-Income Trap

This section is a brief reflection on some industrial policy implications (industrial policy for structural transformation is more fully discussed in Chapter 15). Industrial policy is crucial for avoiding a middle-income technology trap in general and a middle-income technology trap in particular, for avoiding or reversing premature deindustrialization, and of course more broadly for structural transformation. Table 11.4 provides a list of industrial policy instruments, organized around five key policy areas, namely: building production, technological, and organizational capabilities; innovation and technological change; linking up while linking back into GVC and industrial restructuring; demand and trade; and industrial finance.

These areas have been selected as they match the critical challenges that countries in the middle-income status present, which might also relate to their premature deindustrialization. A number of policy instruments are effective tools in addressing more than one policy area. The table also shows the extent to which the selected comparator countries—Brazil, China, and Malaysia—have adopted these instruments (for a discussion of the historical trajectories in industrial policymaking across these countries, see Andreoni and Tregenna, 2018; and Andreoni and Tregenna, 2020).

As discussed in Andreoni (2016), the identification of a mix of policy instruments is only the first step. Indeed, these instruments must be aligned, coordinated, and synchronized over time. Andreoni (2016) conceptualizes an

Table 11.3 Possible middle-income premature deindustrializers, 2005–15

Country	Income group	Region
Albania	Upper-middle	Europe and Central Asia
Angola	Upper-middle	Sub-Saharan Africa
Armenia	Lower-middle	Europe and Central Asia
Botswana	Upper-middle	Sub-Saharan Africa
Cameroon	Lower-middle	Sub-Saharan Africa
Costa Rica	Upper-middle	Latin America and the Caribbean
Cuba	Upper-middle	Latin America and the Caribbean
Dominican Republic	Upper-middle	Latin America and the Caribbean
Ecuador	Upper-middle	Latin America and the Caribbean
Georgia	Upper-middle	Europe and Central Asia
Ghana	Lower-middle	Sub-Saharan Africa
Iraq	Upper-middle	Middle East and North Africa
Jamaica	Upper-middle	Latin America and the Caribbean
Kazakhstan	Upper-middle	Europe and Central Asia
Kyrgyzstan	Lower-middle	Europe and Central Asia
Mauritania	Lower-middle	Sub-Saharan Africa
Namibia	Upper-middle	Sub-Saharan Africa
Panama	Upper-middle	Latin America and the Caribbean
Peru	Upper-middle	Latin America and the Caribbean
Philippines	Lower-middle	East Asia and Pacific
South Africa	**Upper-middle**	**Sub-Saharan Africa**
Tajikistan	Lower-middle	Europe and Central Asia

Note: Countries listed in alphabetical order. Income and regional group classifications based on World Bank classification; income groups use 2015 classification (see https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups).

Source: The authors.

industry policy matrix with three main axes. First, the 'industrial policy governance model', referring to the level at which policies are implemented (regional/state, national/federal, or in some cases supranational). Second, 'industrial policy targets and areas', in terms of the cluster of objectives addressed by each industrial policy instrument (for example, instruments aimed at the 'innovation and technology infrastructure' policy area). Third, 'industrial policy levels of intervention', in respect of how selective each industrial policy instrument is. While some policy instruments are sector-specific or even firm-specific, others are applicable to manufacturing as a whole and others are macroeconomic in nature (although even these economy-wide measures will typically have uneven effects across sectors).

Combinations of industrial policy measures can be directed at a common objective, or they can be used to manage trade-offs between competing objectives. The success of any individual industrial policy measure will be conditional on how it is coordinated with other measures affecting the same firm, sector, or value chain. This underscores the importance of coordination between industrial policy

Table 11.4 An industrial policy toolbox for middle-income countries

Areas	Critical challenges for middle-income countries		Policy instruments	Brazil	China	Malaysia	South Africa
1	Building capabilities	1.1	Skills policy	X	XXX	XX	X
		1.2	Technology and extension services via intermediate institutions	XXX	XXX	XX	X
		1.3 & 2.1	Matching grants and targeted subsidies for investment	XX	XXX	XX	XXX
2	Innovation and technological change	2.2	Public-private partnerships and consortia with universities	XX	XXX	XX	XXX
		2.3	Joint ventures with multinational corporations	XX	XXX	XX	XX
3	Linking up while linking back into GVCs and industrial restructuring	3.1	Strategic mergers and acquisitions, and recession cartels	X	XXX	X	X
		3.2	Competition policy	X	XX	X	XX
		3.3	FDI incentives	X	XXX	XX	X
		3.4	Local content policy	XXX	XXX	XX	XX
		3.5	SMEs targeted investments	X	XX	X	X
		3.6	Cluster policy	X	XX	X	X
		3.7	Special economic zones	X	XXX	XX	X
4	Demand and trade	4.1	Export promotion zones	X	XXX	XXX	X
		4.2	Export cartels	X	XXX	X	X
		4.3	Selective trade policy	XX	XXX	XX	X
		4.4	Public procurement	XX	XXX	X	X

5	Industrial finance	5.1	Export finance services	X	XXX	X	X
		5.2	Development banks	XXX	XXX	XX	X
		5.3	Sector-specific development banks	X	XXX	X	X
		5.4	Hybrid finance solutions combining grants, loans, subsidies	XX	XXX	XX	X
		5.5	Direct investment policy and SOEs	XXX	XXX	XX	XX

Source: Authors, based on Andreoni, 2016; Andreoni and Tregenna, 2018; Andreoni and Tregenna, 2020; UNIDO, 2020.

and other domains—such as macroeconomic policy, innovation and technology policy, labour market policies, trade policy, infrastructure policy, and so on—in setting countries on a path of avoiding or escaping a middle-income trap and avoiding or reversing premature deindustrialization.

Andreoni and Tregenna (2020) point to three important policy issues with regard to a middle-income technology trap and a middle-income trap in general. First, while there are substantial opportunities for upgrading in value chains, this requires significant industrial policy support, including in key technological and product services. Second, it is important that firms and countries deepen their productive and technological capabilities to support innovation and upgrading. Third, countries need to both 'link up' and 'link back' through the development and integration of their local production systems, including through technological upgrading.

While industrial policies must inevitably have a particular focus on the manufacturing sector, they also need to apply to other sectors and to the ways in which sectors are interconnected. As shown here, South Africa lags behind comparator countries in R&D and technological intensity, which are especially important for avoiding a middle-income technology trap and for structural transformation more broadly. This points to the critical importance of policies specifically designed to support R&D, innovation, and technological upgrading as integral aspects of industrial development.

There is a great deal of heterogeneity among middle-income economies, including between South Africa and the three comparator countries referenced here—Brazil, China, and Malaysia. This includes differences in their industrial policies and in their innovation and technology performance. While all four countries show evidence of having deindustrialized, the analysis presented here draws attention to the difference between the trajectories in South Africa and the other three countries. South Africa presents as a failure of structural transformation, while Malaysia and China represent exemplars of structural transformation in middle-income countries. Unsurprisingly, these four middle-income countries had dramatically differing fortunes in economic growth.

11.5 Concluding Remarks

This chapter assesses the development and industrialization challenges facing South Africa as a middle-income country—and moreover, as a country that is arguably caught in a middle-income trap. South Africa can also be understood as being in a middle-income technology trap, failing in the technological upgrading necessary for structural transformation and catching-up. 'Stuck in the middle', South Africa—alongside a number of middle-income countries—has been unable

to break out of its middle-income status. On the contrary, South Africa has been falling behind frontier economies and falling down global GDP rankings over a long period of time. Far from catching up with advanced economies, other countries are catching up with and overtaking South Africa, including some countries that were previously in the low-income group.

South Africa's poor growth performance has been concomitant with its failure to take forward its industrialization and to upgrade the structure of its economy. It has not successfully come to terms with the challenges of breaking into the global concentration of industrial production, linking up and back, and keeping pace with technological change. Unsurprisingly, the long-term deindustrialization trend has not been halted or reversed. This analysis of the global evidence on premature deindustrialization benchmarks South Africa's structural position and trajectory in the global context. The share of manufacturing in total employment in South Africa in 2015 is shown to have fallen over the preceding decade as well as being (slightly) below the share that would be predicted based on international patterns.

Adding to the concern about the quantitative share is the composition of South Africa's manufacturing sector and exports. With some exceptions, the profile of South African manufacturing production and exports does not show the desirable patterns of structural transformation, which would include growth in domestic value added, movement up the value chain, and increasing focus on products that show potential for cumulative productivity increases and are demand-dynamic. South Africa is also lagging in terms of innovation and in the development and application of KETs that would enable the country to become competitive in the manufacture of complex products and to gain from the opportunities associated with the fourth industrial revolution.

Reversing premature deindustrialization in South Africa will depend on the coordination of a feasible set of integrated interventions that reinforce each other. In particular, strategic forward integration and upgrading in GVCs is a complex process, as it entails both linking domestic players to foreign companies and markets, while at the same time building local supply chains of producers.

As discussed above, a variety of industrial policy tools are available. Different combinations of tools are relevant to particular country contexts. The heterogeneity among the four comparator countries and among middle-income countries overall also highlights the need for dynamic and flexible industrial policies that are well suited to individual countries' particular political economies and other relevant characteristics. At the same time, clear lessons are apparent from the diversity of industrialization and growth experiences and outcomes over a period of time.

Industrialization remains important for technological change, structural transformation, and avoiding or escaping a middle-income trap. These goals also

require upgrading and compositional changes within manufacturing. Furthermore, there are significant opportunities for value addition within other sectors and at the interfaces between manufacturing and other sectors, and at the intersection of different technology systems. Certain services activities are closely linked with manufacturing and are critical to the competitiveness of manufacturing, technological upgrading within manufacturing, (re)industrialization, and structural transformation. In addition to their importance to manufacturing, some services activities (as well as some activities in other non-manufacturing sectors) provide opportunities for cumulative productivity increases and growth-pulling, and thus require industrial policy-type support. Bold industrial policy, and coordination between industrial policy and other policy areas, are crucial for shaping a new industrial ecosystem in South Africa and in helping the country escape the middle-income trap.

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