SOUTH AFRICA ECONOMIC UPDATE

INNOVATION FOR PRODUCTIVITY AND INCLUSIVENESS

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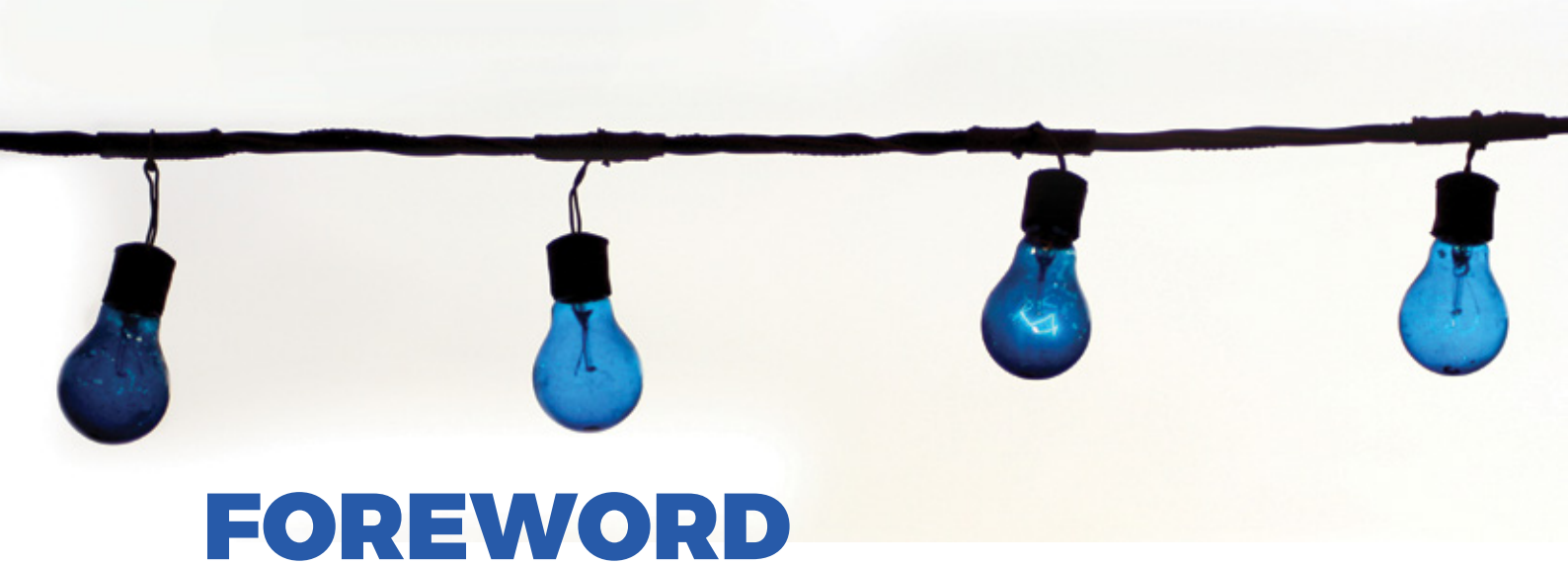


FOREWORD

I am pleased to launch this 10th South Africa Economic Update which offers a review of the country's recent economic and social developments and its outlook in the context of global economic prospects. It focuses on the role of innovation in fostering economic growth, creating jobs and reducing poverty in an environment in which more South Africans are getting poorer. Between 2008 and 2015, 4 out of 5 South Africans experienced poverty, some temporarily, some permanently.

In recent years, two important vehicles of South Africa's economic growth lost steam: high commodity prices and foreign direct investments, the latter being sanctioned in 2017 with the downgrade to sub-investment level. Meanwhile, South Africa diverged in productivity from main technological leaders, whereas private expenditure in research and development contracted. These developments highlight the pressing need to focus on innovation policy as an actionable tool for economic and social progress.

Reviewing South Africa's innovation strengths – academic excellence, entrepreneurial networks in large metros, a large array of operational public programs to support research and development, and weaknesses – a business environment insufficiently conducive to the emergence of innovative startups, a low skills base, a slow and expensive broad-band, high trading costs, the Update underlines the large untapped potential for innovation. Innovation can not only raise South Africa's competitiveness and allow breaking into new markets and creating jobs. It can also significantly improve the life of millions of poor South Africans and their chance for economic participation, through the provision of better and cheaper goods and services, in health, transports, and e-government notably. Fundamentally, innovation can help South Africa diversify from its traditional commodity-based economic model which did not lead to the reduction of inequalities in last decades.

The Update report builds on a solid research partnership between the Department of National Treasury, the Department of Science and Technology, the National Advisory Council on Innovation, Statistics South Africa, and the World Bank to better understand the drivers of innovation and how to maximize its social and economic impact. South African authorities are to be commended for making firms' tax and export transactions data available to the research community, enabling a deeper investigation of the complex issues at stake. The Update's findings also build on the ongoing cooperation between the national government, metros and the World Bank to improve the life of city dwellers, through better urban planning and management, and between Eskom and the World Bank to promote innovative energy solutions.

As the World Bank, we stand ready to work with all stakeholders and support South Africa to fulfill its development agenda and contribute towards ending extreme poverty and promoting shared prosperity. It is our hope that South Africa will continue using the World Bank's knowledge, global experience and convening power as a platform for peer-to-peer learning in the identification of evidenced based pragmatic solutions to reach the country's National Development Plan's goals.

Paul Noumba Um
World Bank Country Director for South Africa

ABBREVIATIONS

BRICS	Brazil, Russia, India, China, and South Africa
CO_2	Carbon dioxide
EMDEs	Emerging markets and developing economies
GDP	Gross domestic product
ICT	Information and communication technology
JSE	Johannesburg Stock Exchange
NT-SARS	National Treasury-South African Revenue Service
OECD	Organisation for Economic Co-operation and Development
PMI	Purchasing Managers' Index
R&D	Research and development
StatsSA	Statistics South Africa
SMME	Small, medium, and micro enterprise
TFP	Total factor productivity
R	South African rand

EXECUTIVE SUMMARY

Global growth picked up in the second quarter of 2017, reflecting improving conditions in advanced economies and emerging market and developing economies (EMDEs), from pronounced weakness in the first half of 2016. Global growth is expected to increase from 2.4 percent in 2016 to 2.7 percent in 2017 and 2.9 percent in 2018, as commodity prices and financial markets continue to stabilize.

South Africa also emerged from recession in the second quarter of 2017. This is good news, but this growth is unlikely to restore positive per capita GDP growth in 2017, following negative per capita growth in 2015 and 2016. Between 2011 and 2016, per capita incomes barely increased and more than 3 million people have joined the 30.4 million poor South Africans now living on less than R1,131 per month (about US$2.9 a day). Between 2008 and 2015, almost 80 percent of South Africa's population experienced poverty, about half permanently and the other half intermittently.

Insufficient economic growth is pushing South Africa into a vicious circle: insufficient tax revenue raises the risk of public debt distress, which plays an important role in the downgrade of South Africa's sovereign credit rating in early 2017. The credit rating downgrade in turn reduces investors' appetite for South Africa, where their investments would support much-needed growth. Insufficient revenue and more complicated borrowing terms also limit the government's capacity to support the economy and its citizens.

Apart from a drop in global commodity prices, domestic factors such as drought, electricity shortages, logistical constraints, and difficult labor relations have contributed to South Africa's poor growth performance in recent years. Although authorities are working to address some of these factors, South Africa is today much less productive than it was before the financial crisis. With the same amount of economic resources – natural resources, capital, and labor – South Africa produced 6 percent less in 2016 than in 2007. A critical contributing factor to this deterioration is the insufficient innovation efforts of private firms, in absolute terms and in comparison with peers in the last decade. Innovation is defined as the introduction of new-to-the-world and new-to-the-firm goods, services, business practices, and organizational methods. While not a perfect metric, the drop in private research and development (R&D) expenditures, which by some estimates is about 40 percent lower than in 2009, suggests a growing innovation gap relative to many peers. From a productivity standpoint, South Africa is falling behind leaders in technology.

Building on the examination of big data from tax forms, export transactions, and professional networks, this 10th South Africa Economic Update underscores the large untapped potential of innovation that could be mobilized to advance South Africa's economic and social development goals. Given the country's medium level of economic sophistication and diversification, there is wide scope for adapting foreign technologies, and turning private R&D into a more powerful driver of corporate profitability and economic growth. Despite widespread fears that automation will result in a loss of jobs, our estimates suggest that greater R&D efforts are actually likely to create more jobs rather than shed jobs in net terms. The resilience of the South African high-tech manufacturing sector, at a time when lower-tech manufacturing sectors are shedding jobs, illustrates this point. Moreover, innovation can improve the lives of millions of people, particularly poor people, by improving goods and services. Introducing disruptive technologies can lower barriers for competition and expand economic opportunities.

To realize this potential, South Africa's innovation strengths – academic excellence, and the concentration and connectedness of centers of innovation in large metros – need to be integrated more effectively with the rest of the economy. Innovation can only have a strong economic and social impact if commercialized and brought to a large number of beneficiaries. This can be done in several ways, detailed below.

Insufficient economic growth is pushing South Africa into a ***vicious circle***

Foster a business climate conducive to innovation

Nurturing South Africa's entrepreneurs and innovative companies requires a business climate that is more conducive to the entry and growth of new firms, and to risk-taking and experimentation. This requires reviewing product market regulations that favor incumbents and cutting red tape, which tends to disproportionately affect small and young firms where large innovation potential lies. Legal reforms and peer learning among local governments could go a long way in improving the business climate. By combining the nine largest metros' best practices in obtaining construction permits, getting electricity connections, and enforcing contracts, it would be possible to boost South Africa's relative performance to a level above the average in high-income Organisation for Economic Co-operation and Development (OECD) countries. Innovation itself can play a major part in reducing costs and cutting red tape, because e-government solutions can simultaneously improve services and stimulate growth in the information and communication technology (ICT) industry. One-stop shops and electronic platforms for public service delivery introduced in various emerging economies have reduced the time and cost of complying with government regulation and mitigate the risk of corruption.

Policy uncertainty needs to be limited. In the case of innovation, delays and uncertainties surrounding the reform of the intellectual property rights regime have been a longstanding concern, and limit the usefulness of patents granted in the country. Persistent uncertainty regarding the future of power purchase agreements, the copyright amendment bill, and the ICT regulatory framework may also deter investment in innovation.

Access to finance is a major challenge for small businesses. Their access to credit is constrained by two factors – lack of suitable financial products offered by banks and inadequate capacity of small business founders to present their funding needs to financial institutions. The government is working with banks to remove the risks of lending to small businesses and to provide these enterprises with direct loans. It is important to scale up these programs. Relative to the size of the financial system, the venture capital raised by South Africa's start-ups remains small, particularly in funding for new-to-the-world technology intended for global markets. To identify the growth drivers, further research is needed into the types of early-stage companies that are obtaining funding. Then policy options need to be reviewed for growing equity investments into young high-growth firms.

High and uneven ports tariffs discourage innovation. A large share of innovation efforts are focused on goods, and innovative companies are more likely to export their products by sea than companies that do not innovate. Although port costs have declined significantly since 2012, they remained 88 percent higher than the global average in 2016/17. Bringing down cargo and inland handling costs, and improving port efficiency, can support innovation. Furthermore, South Africa's port tariffs continue to favor the transport of minerals over manufactured goods. This increases the cost of technology absorption that occurs via the import of capital goods in the form of advanced technology. It also makes the country a less competitive destination for export-oriented industries.

Nurture innovation ecosystems in cities

Innovation happens in cities. In addition to striving to match the best business practices of international metros, South African metros could build on their existing network of innovation programs and cluster them further around innovation districts. Fostering partnerships with the private sector, particularly between academic institutions and private companies of different sizes, would leverage existing research capacity. Programs could range from open data initiatives that use information collected by cities to develop commercial applications and improve service delivery, to projects providing start-ups and small, medium, and micro enterprises (SMMEs) with better access to equipment and experts in the public research and education system, to creating centers of excellence and encouraging collaborative research programs between companies and research institutions. Some of these partnerships can be started at city level, but many would also require support and funding from national departments. From a national perspective, consideration needs to be given to building on existing resources, networks, and partnerships in the largest metros when allocating resources to spur innovation. Although this prioritization could run counter to balanced development objectives, it will raise the impact of public programs for innovation.

Build the skills base

Labor shortages in high-skilled sectors, such as ICT, severely limit innovation. Increasing the supply of the highly skilled will take time, requiring strengthened primary and secondary education, and adult education, vocational training, and entrepreneurship programs that build skills and create employment. A complementary way to improve the skills supply is to encourage highly skilled professionals to work in South Africa. Recommendations in the government's current migration white paper could have significant implications for filling high-skills gaps in the labor market.

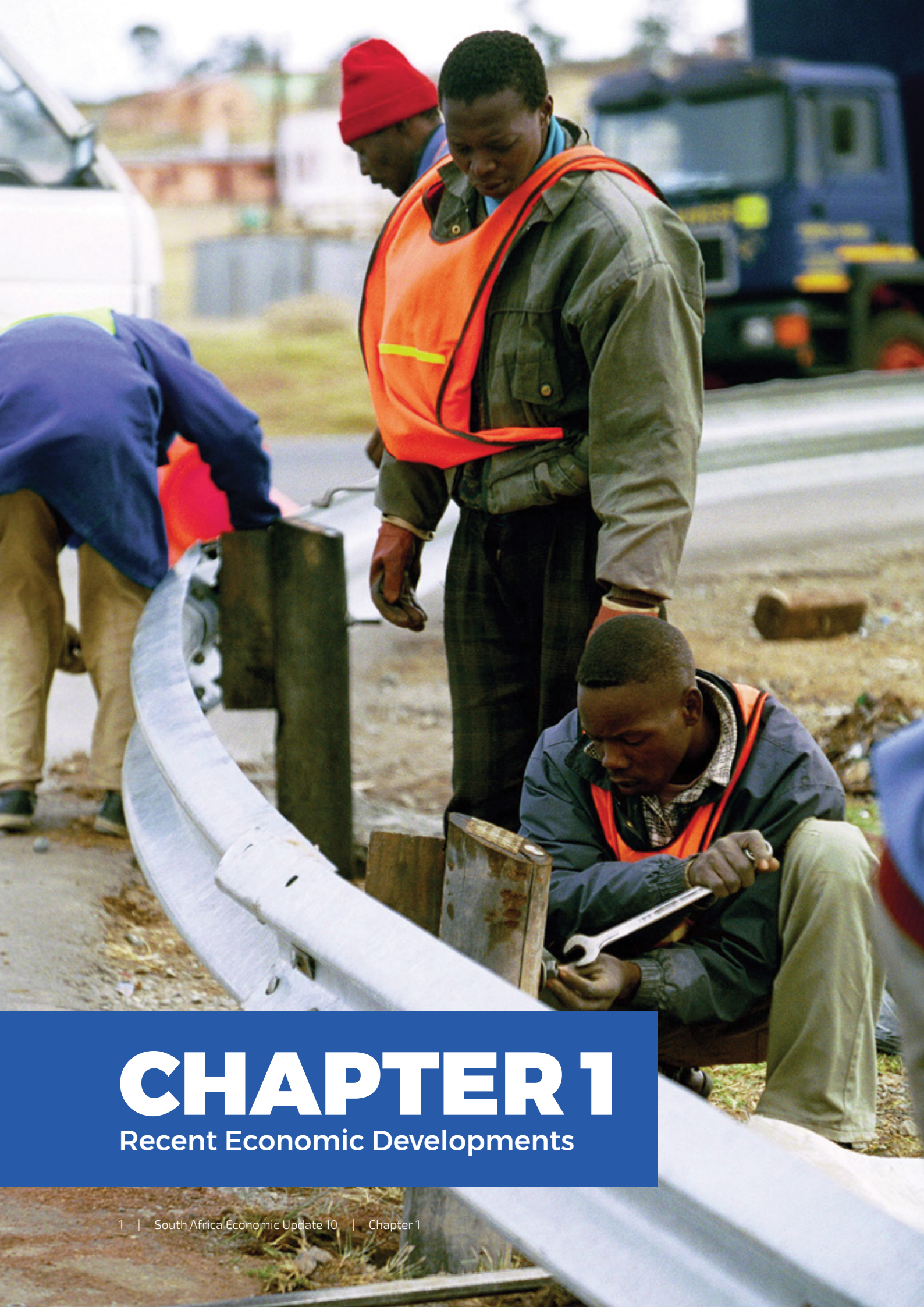
Improve ICT infrastructure

A knowledge economy requires fast and cheap broadband to connect businesses with domestic and international consumers, and to enable the efficient delivery of public services. But South African consumers are paying more for broadband services of lower speeds than many other emerging economies. Urgent reforms are needed to increase investment in mobile and fixed broadband infrastructure, strengthen competition, and improve the quality and reduce the price of ICT services. It should be a priority to ensure the policy independence of the regulator and confirm its field of action, so that stalled processes such as 4G licensing can be expedited. Ultimately, the importance of ICT lies in its role in facilitating innovation in the economy as a whole.

Enhance the effectiveness of public programs and incentives for innovation

Government support programs are a formidable strength of South Africa's innovation ecosystem. But there is scope to improve their effectiveness by consolidating program objectives, budgets, and management arrangements. The multiplicity of programs, along with limited budgets, may be fragmenting and reducing the impact of public funding for private sector development. It is important to evaluate the effectiveness of these initiatives (including their targeting, cost-effectiveness, and economic impact), set standards (for incubators in particular), and consolidate and scale up the best performing programs. It is also important to ensure predictable funding and adequate staffing of the agencies implementing innovation and entrepreneurship support programs.

R&D tax incentives prioritize new products and services. Extending the eligibility criteria to include absorbing technology from elsewhere will make incentives much more relevant for the large number of domestic firms that are not working at the technological frontier. In addition, simplifying the R&D tax incentive process and allowing firms that are not yet profitable to benefit from it can help boost the growth of young firms in South Africa.



CHAPTER 1

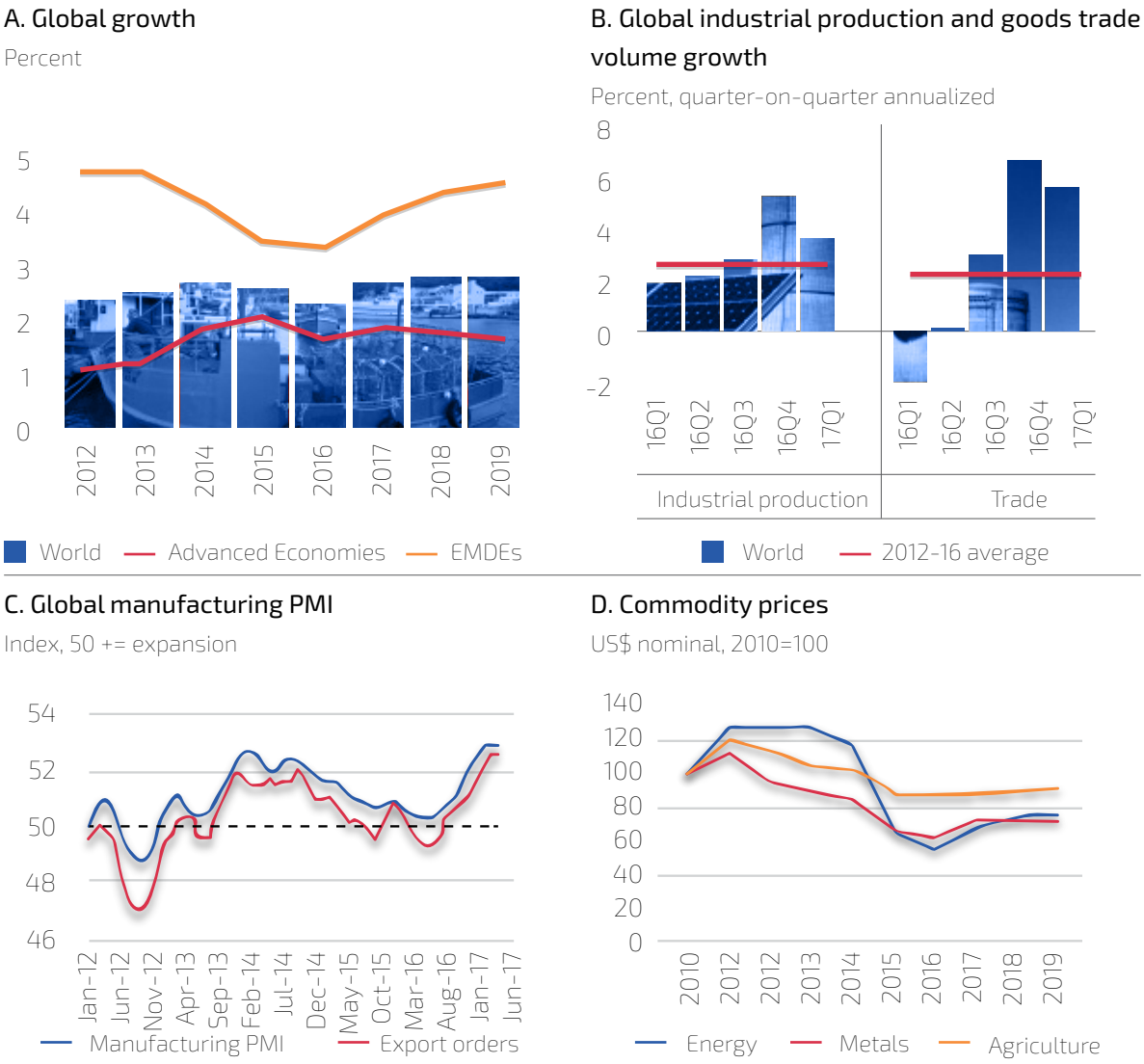
Recent Economic Developments

Global Economic Developments

The global economy is recovering

Global growth picked up in the second quarter of 2017, reflecting improving conditions in advanced economies and EMDEs following pronounced weakness in the first half of 2016. The global manufacturing purchasing managers' index (PMI)[1] and export orders remained expansionary in July and August, suggesting continued robust production and trade momentum in the third quarter (Figure 1.1).

Figure 1.1: Global activity indicators



Sources: Haver Analytics, World Bank, CPB Netherland Bureau for Economic Policy Analysis. Notes: A. Aggregate growth rates calculated using constant 2010 U.S. dollars GDP weights. Shaded areas indicate forecasts. B. Last observation is 2017Q1. C. 3-month moving averages. Last observation is August 2017. D. Shaded areas indicate forecasts

Activity is picking up in advanced economies, with investment and exports regaining momentum after subdued growth in 2016. Following a slowdown in the first quarter of 2017, growth in the United States recovered in the second quarter, to 3 percent (quarter-on-quarter seasonally adjusted annualized rate), supported

[1] PMI is an indicator of the economic health of the manufacturing sector. A rating above 50 indicates expansion in the sector. A reading below 50 signals contraction. A reading of 50 indicates no change.

by renewed strength in consumer spending. High-frequency indicators point to robust third quarter growth in personal consumption, equipment investment, and export growth. The growth outlook for countries in the euro area has strengthened. Growth has also picked up in Japan, supported by a recovery in external demand.

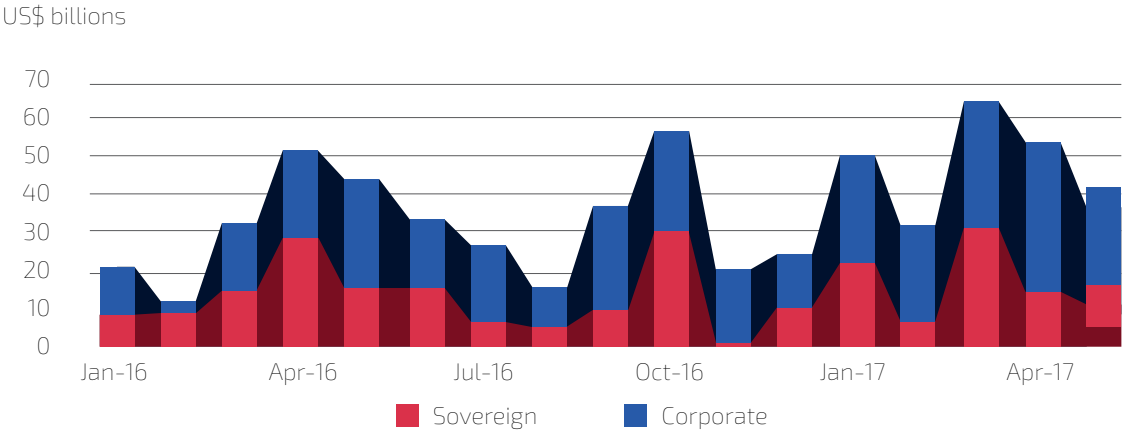
Among EMDEs, growth remained steady in China at 6.9 percent (year-on-year) in both the first and second quarters of 2017. EMDE commodity exporters are recovering from deep recessions in 2016. Nigeria recorded positive growth of 0.6 percent (year-on-year) in the second quarter. Growth in Russia accelerated from 0.5 percent (year-on-year) in the first quarter of the year to 2.5 percent in the second quarter. In Brazil, gross domestic product (GDP) expanded further in the second quarter. In commodity-importing EMDEs, accommodative policies are supporting domestic demand and a recovery in global trade is fueling export growth.

Figure 1.2: Global financial conditions

A. Corporate bond spreads

B. Commodity-exporting EMDE bond spreads and exchange rates

C. EMDE international bond issuance



Sources: Bloomberg, Dealogic, International Energy Agency, World Bank, Haver Analytics. A. Spread between yields on non-sovereign debt with at least 18 months to final maturity and U.S. Treasury yields of equivalent maturity. Individual bonds are weighted by market capitalization. Dotted lines indicate the median values since 2005. Last observation is May 24, 2017. B. Medians of a nine-country group of EMDE commodity exporters are shown. Exchange rates are bilateral against the U.S. dollar, with upward movement showing an appreciation. Last observation is May 24, 2017. C. Last observation is September 5, 2017.

Commodity prices continue to stabilize

After averaging US$53 per barrel in the first quarter of 2017, oil prices fell below US$50 per barrel in early May. Oil production declined in early 2017 as a result of agreed cuts by members of the Organization of the Petroleum Exporting Countries and some non-member oil producers. However, these cuts were partly offset by stronger-than-expected shale oil production in the United States. Oil prices are expected to average US$53 per barrel in 2017, up 24 percent from 2016 but US$2 per barrel less than January forecasts, and to stabilize around US$54 per barrel in 2018. Metal prices have surged from their late-2015 lows due to strong demand and tightening supply as China imposed environmental restrictions on aluminum and zinc mines and processing plants. Agricultural prices have weakened, reflecting well-supplied key grain and oilseed markets after a better-than-expected harvest.

Financial market volatility remains generally low

Global financial conditions have been benign since the start of 2017 (Figure 1.2). Shortly after the U.S. elections of November 2016, the country's long-term yields rose sharply, similar to their surge during the mid-2013 taper tantrum.[2] But, unlike the taper tantrum, the late-2016 increase reflected market expectations of strengthening growth and higher inflation in the United States, and was not accompanied by a sudden and sustained re-pricing of risk. In an environment of low market volatility and robust risk appetite, emerging market bond spreads[3] have narrowed and equity prices have recovered. Bond spreads have narrowed most notably among commodity exporters, while their currencies have generally strengthened. Overall, capital inflows to EMDEs have been strong in the first half of 2017, with EMDE bond issuance activity increasing at a record pace.

The global outlook is favorable

From a post-crisis low of 2.4 percent in 2016, global growth is expected to increase to 2.7 percent in 2017 and 2.9 percent in 2018, mainly driven by stronger growth in EMDEs. As the cyclical impulse wanes and monetary policy becomes less accommodative, placing upward pressure on interest rates, growth in advanced economies is expected to gradually moderate.

EMDE growth is expected to increase to 4.2 percent in 2017, from 3.7 percent in 2016, reaching 4.6 percent in 2018/19. Growth in EMDE commodity exporters is expected to increase from 0.9 percent in 2016 to 1.8 percent in 2017, while growth in commodity importers is projected to remain broadly stable at about 5.7 percent. Growth should rebound in Sub-Saharan Africa, but the recovery is expected to be slow, as some commodity exporters – South Africa in particular – struggle to adjust to low commodity prices. In contrast, robust growth is expected to continue in EMDE regions with substantial numbers of commodity-importing economies, such as East Asia and Pacific, and South Asia.

Real Sector Developments in South Africa

South Africa emerged from recession

South Africa's GDP growth slowed from 2013 to 2017. Between the first quarters of 2013 and 2017, finance, real estate, and business services made the largest contribution to growth, followed by general government services and trade, catering, and accommodation. The largest drag on growth in the last three years came from agriculture, especially during 2015 and 2016 as a result of drought; electricity, particularly in 2015 due to supply bottlenecks; and gas and water. Mining production

[2] Taper tantrum refers to the 2013 surge in U.S. Treasury yields, which resulted from the Federal Reserve's gradual reduction (or tapering) in the amount of money it was feeding into the economy. In response, investors drew their money out of the bond market rapidly, which sharply increased bond yields.

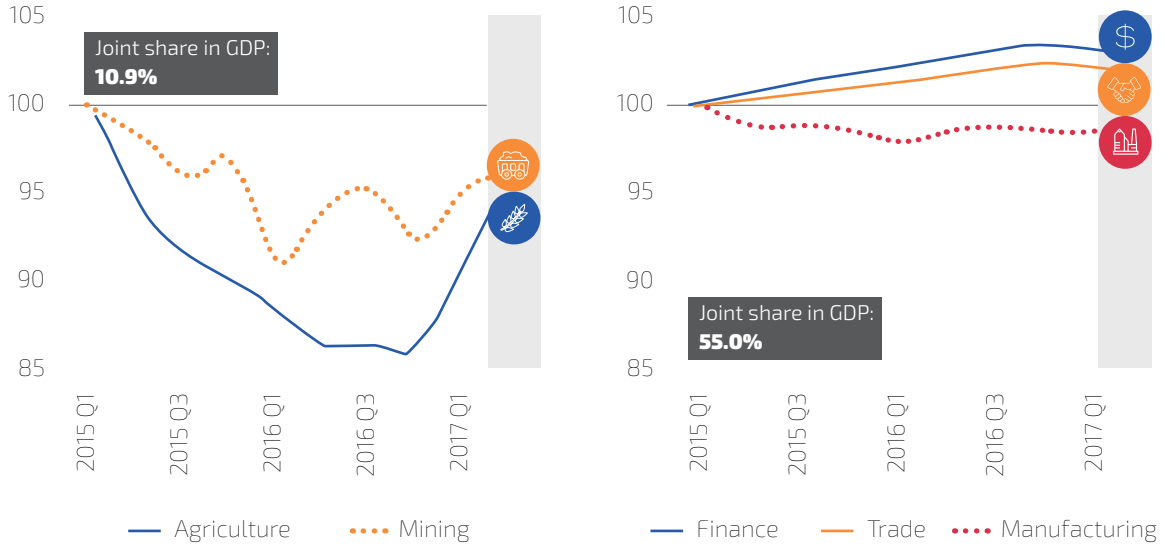
[3] The cost of raising funds outside the domestic market reflects two factors: the risk-free rate, which is accepted as the interest rate on a U.S. Treasury security with the same maturity; and a spread to reflect the greater risks that investors perceive as being associated with the issue or issuer.

also fell as commodity prices declined, production was disrupted by strikes and infrastructure constraints, and policy uncertainty and lower commodity prices limited expansionary investment. Manufacturing showed little movement, with production stagnating. The slowdown in GDP growth is even more pronounced when measured in per capita terms: since 2015, the country's GDP grew more slowly than its population, leaving South Africans worse off on average.

In the first quarter of 2017, South Africa entered a technical recession, defined as two consecutive quarters of negative economic performance: GDP fell by 0.7 percent in the first quarter of 2017 (quarter-on-quarter seasonally adjusted annualized rate), following a contraction of 0.3 percent in the fourth quarter of 2016. It was the country's first recession since the global financial crisis and the associated economic downturn in 2008 and 2009. And, for the first time since 1994, all sectors except mining and agriculture contracted in the first quarter of 2017.

Figure 1.3: Growth in mining and agriculture, and major industry and services

(Sectoral value added, seasonally adjusted annualized rate, 2015 Q1=100)



Source: Statistics South Africa (StatsSA) and World Bank staff calculations

In the second quarter of 2017, South Africa emerged from recession, led by agriculture and mining. Jointly, these sectors account for 10.9 percent of GDP. World Bank staff calculations suggest that multiplier effects from higher growth in the agriculture and mining sectors are low compared to other South African sectors.[4] But, given the magnitude of their growth performance (agriculture alone grew by 21.1 percent in the first quarter and 33.6 percent in the second quarter), the two sectors have been the main drivers of growth in the first half of the year.

Drought continues to affect some parts of South Africa, notably the Western Cape, but it has lifted in other parts, boosting agriculture. Accordingly, the agriculture, forestry, and fisheries sector has rebounded in the first half of 2017 (Figure 1.3), with bumper harvests in summer crops and maize in particular. Maize production is estimated to more than double from 7.8 million tons in 2016 to 16.4 million tons in 2017, with the largest production increases in the Free State, Mpumalanga, Limpopo, and North West Province.[5] Higher production supports falling food prices, one of the main reasons for the drop in inflation in 2017. This has left more disposable income in the pockets of consumers and thus also supported sales in the retail sector in the second quarter of 2017, especially in relation to food and clothing.

The mining sector also strengthened in the first half of 2017 as a result of rising commodity prices and fewer supply disruptions, such as at the Richards Bay coal terminal. But production remains depressed by historical standards and, given weak investment

[4] Multiplier effects measure the impact of higher growth in a given sector on the demand for goods and services from other sectors.
[5] Source: http://www.sagis.org.za/CEC-Aug2017.pdf. Note: summer crops are harvested between May and August.

in the sector, it is unlikely to become an engine of growth in South Africa in the near term. The new Mining Charter remains a point of contention between the South African Chamber of Mines and the Department of Mineral Resources. Uncertainty around the details of the charter keeps investment in the sector at bay. According to the Fraser Institute's 2016 survey of mining companies, South Africa ranked 91st in the category of "Uncertainty Concerning the Administration, Interpretation, and Enforcement of Existing Regulations" among the 104 countries and jurisdictions surveyed. Less than a fifth of participating mining houses felt satisfied regarding policy certainty and political stability.

Performance in industry and services was mixed in the first half of the year. Following a contraction across the board in the first quarter, moderate growth returned – except for in government services and construction. Manufacturing grew by 1.5 percent. Electricity, gas, and water grew by 8.8 percent, supported by energy demand from factories and mines, and easing water constraints. Manufacturing has been particularly driven by food and beverages, cars and automotive parts, and accessories and transport equipment. Retail and wholesale supported growth of 0.6 percent in the trading sectors. Finance, real estate, and business services grew by 2.5 percent, largely due to greater financial intermediation, insurance, and trading in global financial markets. Improved private consumption has supported activity in these sectors in the second quarter.

Table 1.1: Contributions to GDP

(Percentage point contributions to quarter-on-quarter seasonally adjusted annualized rate growth, expenditure approach)

	Gross Domestic Product	Private Consum. Expend.	Public Consum. Expend.	Private Gross Fixed Capital Formation	Public Gross Fixed Capital Formation	Change in Business Inventories	Exports of Goods & Non-Factor Services	Imports of Goods & Non-Factor Services
2013 Q1	1.9	0.9	0.6	1.3	0.5	0.0	1.0	-2.6
2013 Q2	5.0	1.4	1.3	2.1	0.2	2.9	1.6	-4.4
2013 Q3	0.9	0.2	-0.1	1.7	0.5	-3.2	1.8	0.0
2013 Q4	5.6	-0.3	0.4	0.5	0.5	-3.4	1.4	6.5
2014 Q1	-2.5	0.0	0.4	-1.9	0.1	-2.3	4.4	-3.2
2014 Q2	1.0	0.4	0.1	-0.4	0.3	5.6	-7.9	2.8
2014 Q3	2.0	1.5	-0.3	1.4	-0.1	-1.4	3.3	-2.5
2014 Q4	4.5	1.4	0.0	0.9	0.0	0.0	4.6	-2.5
2015 Q1	1.8	1.2	-0.1	-0.7	1.4	6.1	-0.4	-5.6
2015 Q2	-2.7	0.0	0.3	-1.0	0.6	-8.5	2.7	3.2
2015 Q3	0.4	1.4	0.5	0.2	0.9	-0.7	-0.8	-1.1
2015 Q4	1.6	0.9	0.6	-0.7	-0.3	2.3	0.2	-1.3
2016 Q1	-1.7	-0.9	0.3	-1.9	-0.4	-1.1	-1.4	3.6
2016 Q2	3.6	0.7	0.6	-0.3	-0.3	-4.6	4.8	2.7
2016 Q3	0.4	1.3	0.4	-0.7	0.0	6.2	-7.1	0.3
2016 Q4	-0.1	1.3	0.1	-0.2	0.5	-3.5	3.4	-1.8
2017 Q1	-0.7	-1.7	-0.4	0.1	0.1	3.0	-1.0	-0.9
2017 Q2	2.4	2.8	0.2	-0.5		-0.2	4.1	-3.9

Source: StatsSA and South African Reserve Bank.

Household expenditure contracted in the first quarter of 2017, but increased to 2.8 percent growth in the second quarter. While lower inflation has undoubtedly supported household budgets, South African consumers continue to face considerable challenges. The Bureau of Economic Research consumer confidence indicator remains negative, falling from -5 in the first quarter of 2017 to -9 in the second quarter. Household spending power is also constrained by low real wage growth and slowing credit extension. Total compensation of employees grew by only 1.1 percent in the first half of 2017 (year-on-year in real terms), with wage growth below inflation since 2012. Private consumption grew at the same rate in that period. While private consumption was the strongest expenditure category (other than imports) in early 2017, it is barely enough to keep up with population growth.

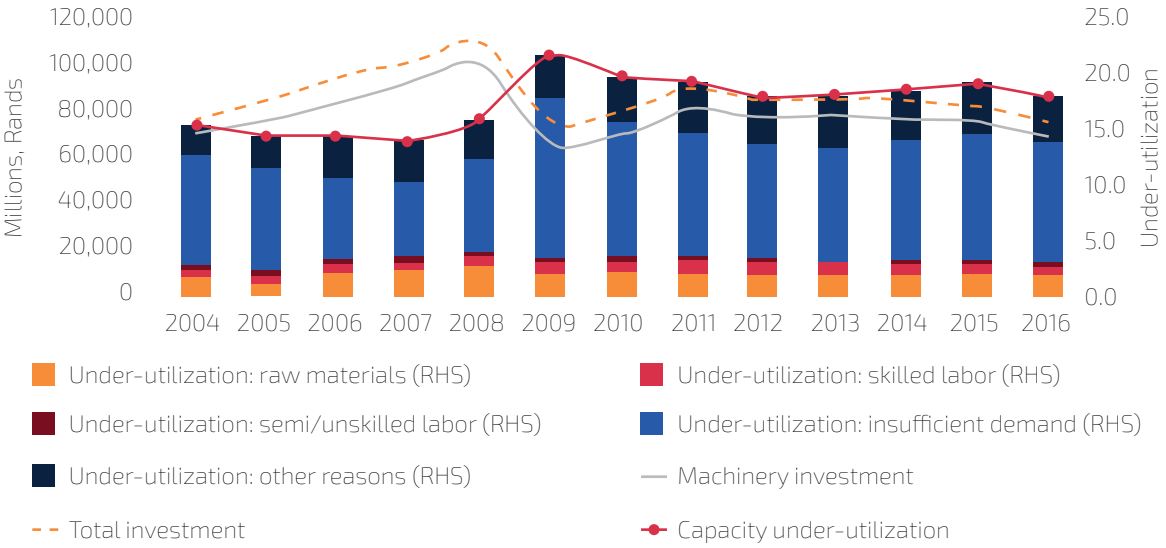
Credit conditions remain tight, lending little support to household consumption. In real terms, credit extension to households remains negative. Slowing credit helps reduce household dissavings – that is, spending exceeding income – with dissaving dropping from 2.3 percent of disposable income in the second quarter of 2013 to 0.3 percent in the first quarter of 2017. This lowers the financial vulnerability of households and brings down their indebtedness. However, unsecured credit and overdrafts have been among the fastest-growing categories of household credit. Mortgage advances – that is, credit to build household assets and more permanently strengthen households' wealth – have grown more slowly, both in May and June 2017. Corporate credit continued to grow above the inflation rate, at 9.0 percent in May and 10.1 percent in June in nominal terms.

Exports had a weak start to the year, contracting by 3.2 percent in the first quarter of 2017, led by mineral products, vehicles, and transport equipment. The second quarter saw a rebound of 14.4 percent growth in exports, reflecting the good performance of the mining and automotive manufacturing sectors. Mining exports drew on both strong production in the second quarter and inventories built up in the first quarter. The automotive sector accumulated inventories. Yet, in spite of such temporary improvements, comparing the first halves of 2016 and 2017, export growth was zero, suggesting that overall the manufacturing response to opportunities in global markets remains timid. The PMIs of 42.9 and 44.0 in July and August respectively do not point to any significant increase in activity (values below 50 indicate pessimism in the manufacturing sector). South Africa may be missing opportunities from strengthening global demand and a depreciated rand, which is still about 16 percent below its peak in December 2010 in real, trade-weighted terms. Imports, on the other hand – supported by improvements in private consumption and the import of capital goods – outgrew exports in the first half of 2017 in real terms.

Weak overall demand results in low capacity utilization rates (Figure 1.4). This means South Africa's installed industrial capacity and resources are not being used and its potential economic output is not being realized. Capacity under-utilization in manufacturing is significantly higher than before the global financial crisis (increasing from 14.5 percent in 2006 to 18.1 percent in 2016, and climbing even further at the beginning of 2017), largely due to insufficient demand.

Figure 1.4: Capacity under-utilization and investment in the manufacturing sector

(Capacity under-utilization in percent and investment in million rand, constant 2010 prices)



Source: World Bank staff calculations based on StatsSA, Quantec (2017)

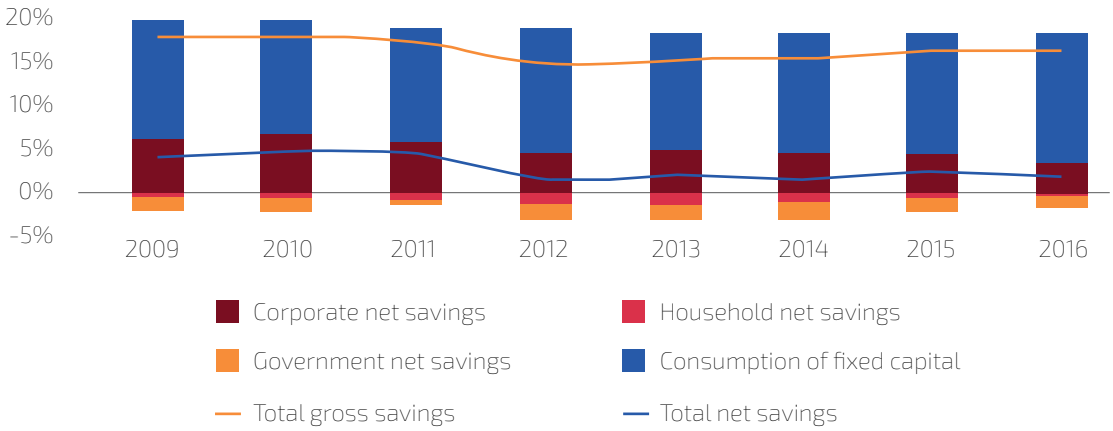
Excess capacity and low demand mean that there is limited need to expand existing production lines. This is one reason for weak private investment. Year-on-year, fixed investment fell for a seventh consecutive quarter in the second quarter of 2017; it contracted by 1.1 percent in the first half of 2017.

While there is little appetite to expand existing production facilities, new opportunities could be sought both domestically – in new technologies (see Chapter 2) – and by expanding into global markets. But domestic savings are too low to finance additional investment. South African gross savings were equivalent to 16 percent of GDP in 2016. Given the high capital intensity of the economy, 14 percent of GDP are savings simply required to maintain existing capital stock. This leaves 2 percent of GDP for new investments.

As both households and government spend more than their income, corporate and foreign savings have been financing South African investment (equivalent to 19.6 percent in 2016). South Africa's National Development Plan targets investment of 30 percent of GDP to accelerate growth to the national target of an average of 5.4 percent. But, given low savings levels and investor concerns about policy uncertainty and growth prospects, this target is far from being realized.

Figure 1.5: Corporate, government, and household savings/dissavings

(Savings in percent of GDP)



Source: South African Reserve Bank

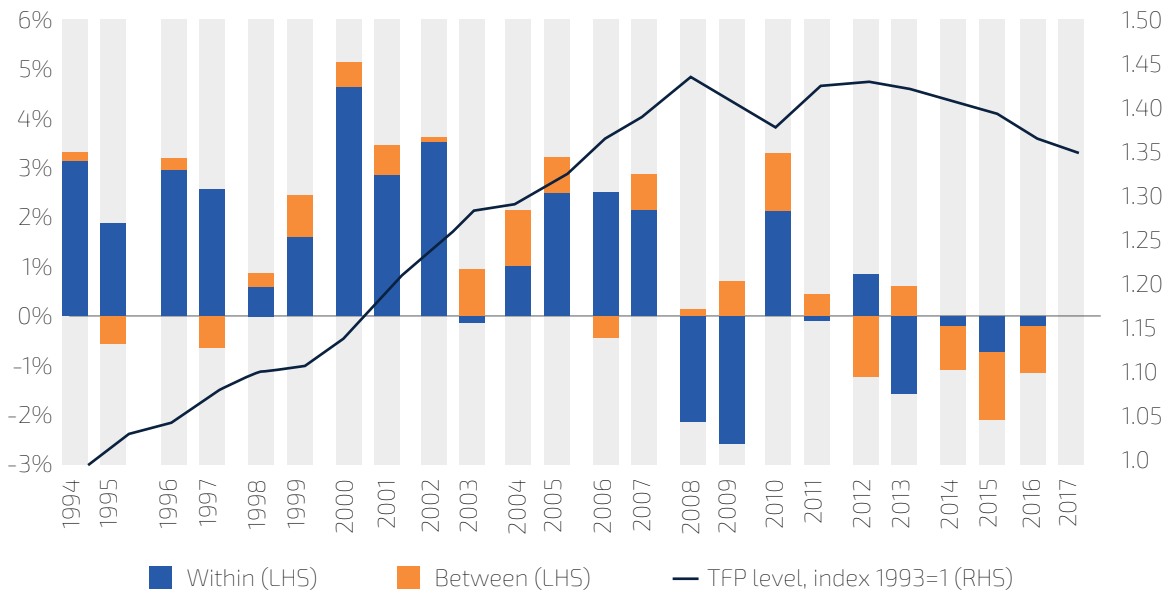
Growth has been dragged down by protracted productivity losses since 2008

South Africa's protracted growth deceleration has been underpinned by negative growth in total factor productivity (TFP). TFP measures how efficiently labor and capital are used in the production process. Negative growth indicates that South Africa has produced less over time with the same amount of labor and capital. TFP reflects the market mechanisms in place and the effectiveness of public institutions, but, in its broadest sense, productivity growth is about innovation, as discussed further in Chapter 2.

TFP in South Africa has declined since the financial crisis, costing the equivalent of 0.7 percentage points of foregone GDP growth every year on average between 2008 and 2016 (Figure 1.6). The decline can largely be attributed to productivity losses within rather than between sectors. Between-sector losses reflect the change in aggregate TFP resulting from the reallocation of labor and capital to sectors with lower productivity levels. Poor allocative efficiency of capital was highlighted in the 9th South Africa Economic Update,[6] and labor seems to exhibit the same pattern of not necessarily moving to sectors where it can be most productive.

[6] World Bank (2017d).

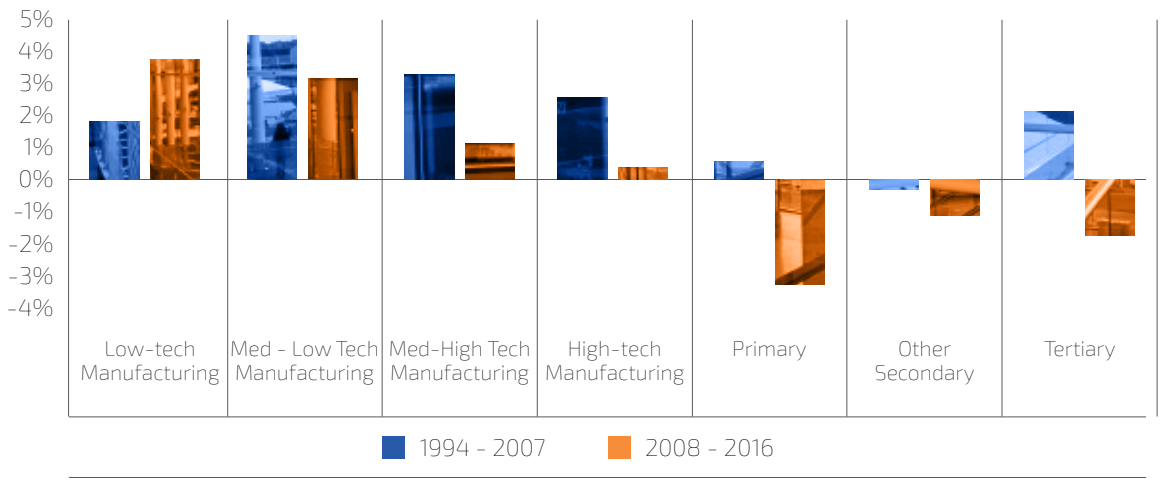
Figure 1.6: South Africa TFP gains and losses, within and between sectors



Source: World Bank staff calculations based on Quantec (2017)

Figure 1.7 shows TFP trends by sector. Growth in manufacturing has decelerated significantly in recent years, although these sectors have fared better than the primary, other secondary, and tertiary sectors. In particular, mining, footwear and textiles, fiber and rubber products, electricity and water supply, construction, transport, and non-financial private services recorded large and sustained drops in TFP levels since 2008.

Figure 1.7: TFP growth within sectors



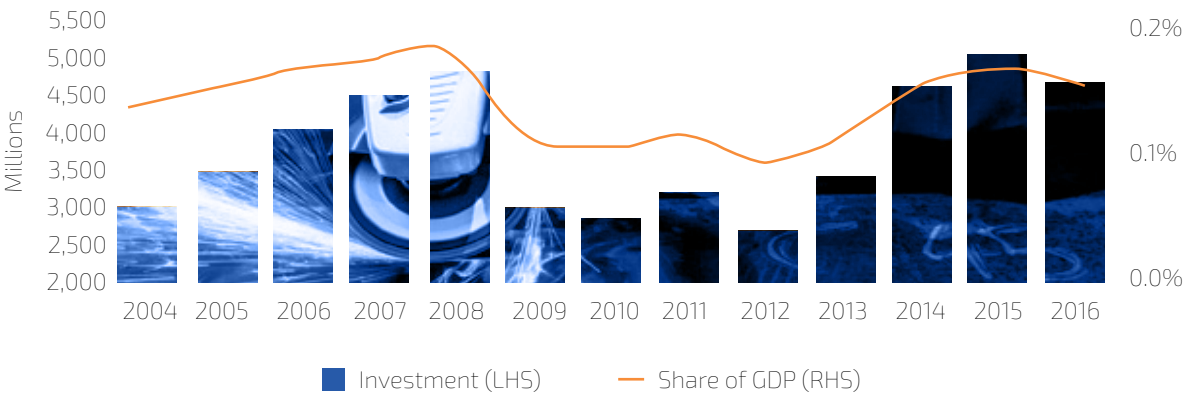
Source: World Bank staff calculations based on Quantec (2017). Note: Unweighted TFP growth averages across sectors groups.

Several factors could have contributed to this trend of within-sector productivity losses in South Africa since 2008.

In the manufacturing sector, where innovation efforts are typically concentrated, the deceleration in TFP growth could result from a decline in capital-embodied

innovation (that is, the acquisition of equipment that drives innovation). Adler et al. (2017) suggest that the decline in capital-embodied innovation cost about 0.2 percentage points of foregone GDP growth in emerging economies annually in 2013 and 2014. The decline in machinery and equipment investment in the South African high-tech manufacturing sector after 2008 would support this claim. After stagnating from 2009 to 2013 at about two-thirds of its 2008 level, high-tech investment regained strength in 2014, but did not quite return to the level and share of GDP recorded in 2008 (Figure 1.8).

Figure 1.8: High-tech manufacturing investments in machinery and equipment in South Africa



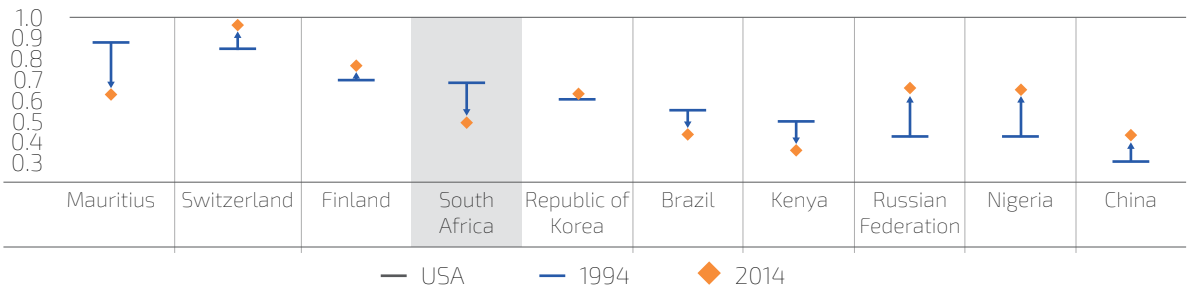
Source: World Bank staff calculations based on Quantec (2017)

Another potential reason for the decline in within-sector productivity is the reduction in spillover effects from technological leaders in advanced economies. Adler et al. (2017) suggest that the slowdown in TFP growth in the United States since 2008 could have cost other advanced economies up to 0.2 percentage points of TFP growth.

Viewed through this lens, the deceleration in U.S. TFP growth since 2008 could have cost South Africa 0.4 percentage points of annual TFP growth.[7] However, the same model also suggests that South Africa's capacity to absorb foreign technology has been low, and is insufficient to compensate for domestic factors hampering TFP growth. As a result, South Africa's TFP levels have diverged from that of the United States since 1994 (Figure 1.9). This strongly contrasts with other BRICS countries, such as India and China, which have managed to sustain high TFP growth rates since the early 1990s, including through the financial crisis of 2008/09 (Figure 1.10).

Figure 1.9: Total factor productivity levels relative to the United States (1994 and 2014)

(Purchasing power parity index: U.S.=1)

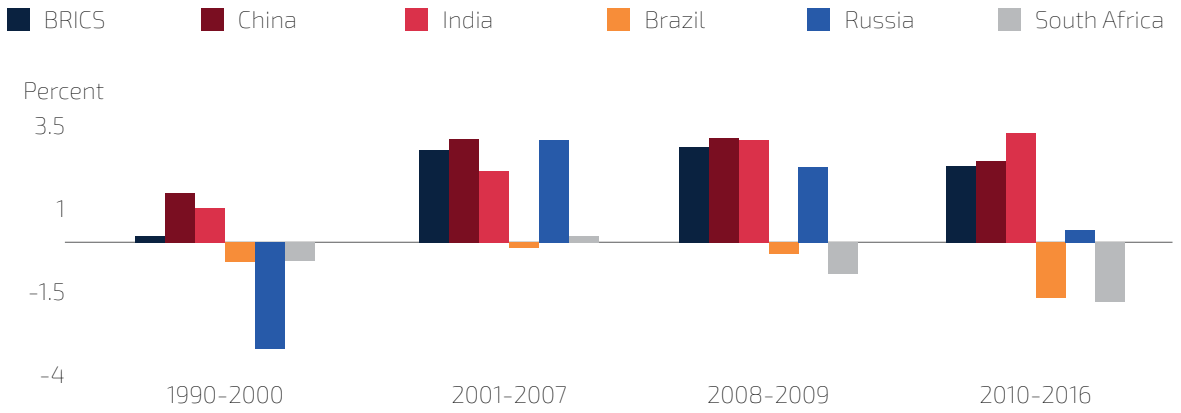


Source: World Bank staff calculations based on Penn World Tables, Center for International Data (2017)

[7] In comparison with a scenario in which the U.S. TFP would have grown from 2008 at the pace recorded over the period 1994–2007. This conclusion is obtained by estimating a leader-follower econometric model, whereby South Africa's TFP growth would depend positively on U.S. TFP growth and the difference between U.S. and South African TFP levels.

Figure 1.10: TFP growth in BRICS

(Annual, %)



Source: World Bank staff calculations based on Penn World Tables, Center for International Data (2017)

A loss of skills may also have contributed to productivity losses in recent years. According to LinkedIn data, South Africa is losing more professionals than it is gaining. This is mostly driven by emigration to OECD countries such as the United States, the United Kingdom, and Australia. These individuals tend to be skilled in business, information technology, or health care. According to the OECD (2017), about 19,000 skilled South African nationals emigrated to OECD countries in 2015. Conversely, most of the skills South Africa has gained have been through the migration of individuals from neighboring countries, as well as BRICS and Scandinavian countries, although at a slower pace.

Additional factors contributing to (within-sector) productivity losses include:

- Reduced use of installed productive capacities as a result of lower demand (notably in mining sectors, in anticipation of a rebound in global prices).[8]
- The long time needed for mega-investment projects to become operational (in the electricity sector, for example).

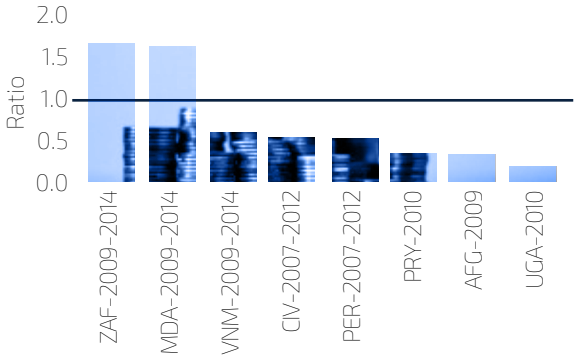
Finally, analysis by the National Treasury and World Bank staff[9] suggests that since 2009 large, less productive firms (as measured by value added per worker) have grown faster in terms of employment than small, more productive firms. This misallocation of resources within sectors may be partly attributed to the difficulties small firms experience in attracting skilled workers (who are interested in the professional development and job security prospects offered by larger firms), and in complying with tax and regulatory obligations when exceeding some economic activity thresholds.[10]

*South Africa is **losing** more professionals than it is gaining.*

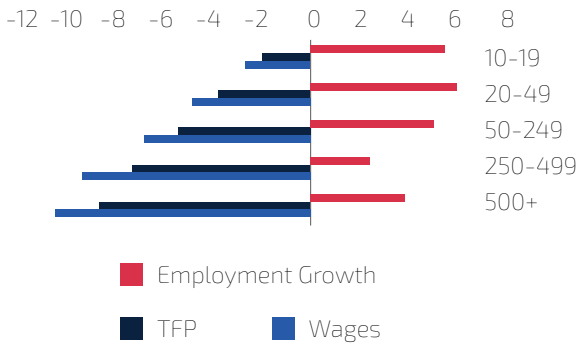
[8] Adler et al. (2017) suggest that TFP cycles of commodity exporters can be correlated to commodity price cycles, which indeed seems to be the case in South Africa.
[9] Aterido et al. (2017).
[10] See Boonzaaier et al. (2016), for a discussion on the response of small firms to tax schedule discontinuities.

Figure 1.11: Firm performance – micro to large enterprises

A. Value-added per worker of micro to large firms ratio by country



B. Firms performance by size with respect to micro



Size for Employment Growth regression refers to "average" size in the growth period.

Micro Firms: size 1 to 9
Large Firms: size 100+
ZAF: South Africa; MDA: Moldova; VNM: Vietnam; CIV: Cote d'Ivoire; PER: Peru; PRY: Paraguay; UGA: Uganda.

Source: National Treasury and World Bank staff calculations based on SARS and National Treasury data

Labor Market Developments in South Africa

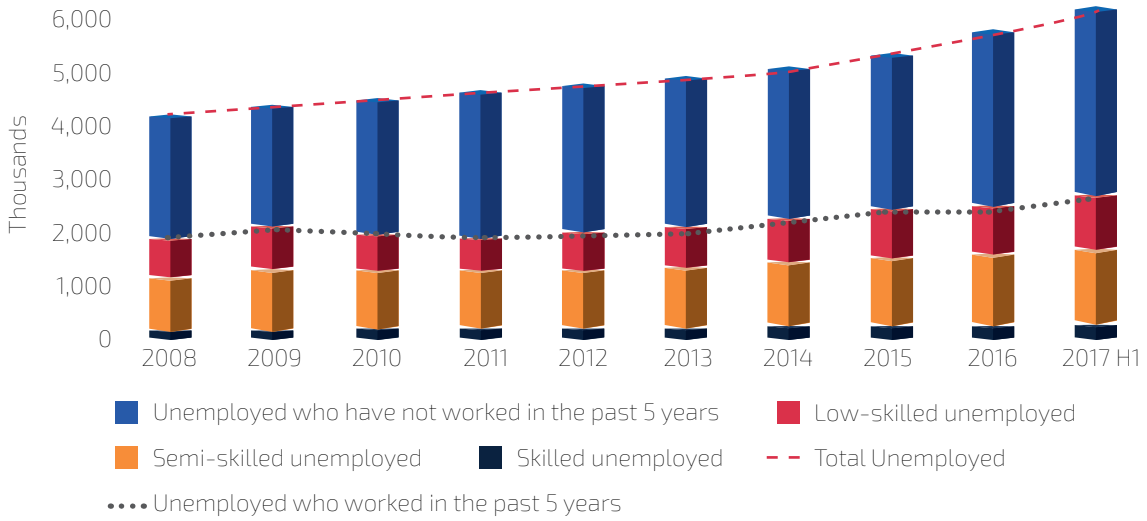
The economy remains too weak to reduce high unemployment rates

Since 2008, 3.5 million people have entered the labor force, but only 1.6 million additional jobs have been created. The unemployment rate has risen from 22.5 percent in 2008 to 27.7 percent in the first half of 2017.

Nearly 6.2 million people are unemployed, or 9.3 million if those who have stopped looking for work are included. Including these discouraged workers, South Africa's unemployment rate is 36.6 percent. Of those looking for employment, 3.5 million (57.1 percent) have not worked in the past five years (Figure 1.12). This number has increased by nearly 1.2 million since 2008. There are far more unemployed low-skilled and semi-skilled workers than there are unemployed skilled workers.

Figure 1.12: Unemployment by skills level, 2008–17

(Unemployment by skills level and duration of unemployment)

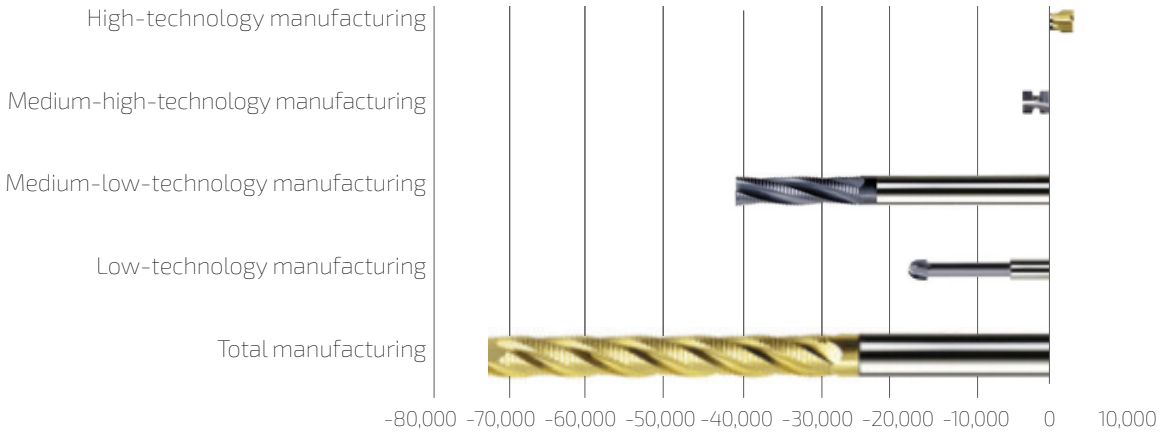


Source: World Bank staff calculations based on StatsSA

Only high-tech manufacturing sectors have managed to keep employment relatively stable between 2010 and 2016 (Figure 1.13).

Figure 1.13: Employment in the manufacturing sector

(Change in number of employees by sector, 2016 compared to 2010)



Source: World Bank staff calculations based on Quantec (2017)

Growth in the labor force was the main contributor to the 14-year peak in unemployment in 2017, as 427,000 new job-seekers joined the unemployed, but only 31,000 jobs were created. Economic growth is too low to generate sufficient jobs, especially in light of the country's maturing youth bulge (Box 1.1).

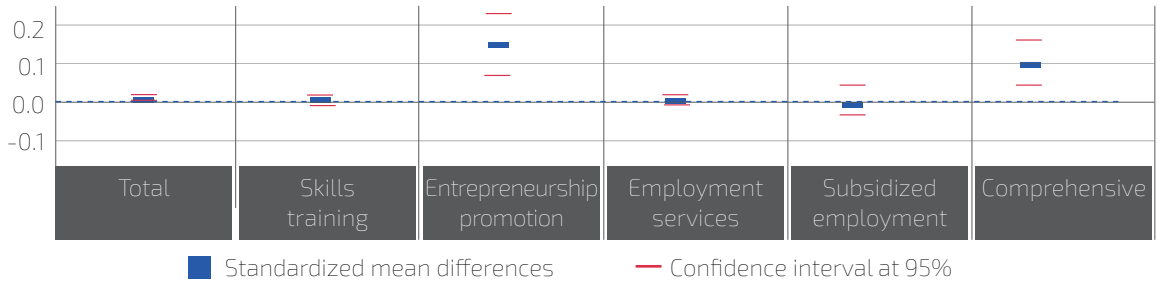
Box 1.1: Addressing the youth employment crisis

Entrepreneurship, training, and active labor market programs are essential components of a jobs strategy, but cannot be expected to solve the youth employment challenge alone.

Kluve et al. (2016), reviewing a large set of interventions across the world, show that most employment programs have a relatively small effect on beneficiaries' earnings. Part of the challenge lies in the nature of these programs. A few weeks or months of training cannot generally be expected to address the mismatch between the quality of the education system and the needs of the job market. But, despite their limitations, some programs show encouraging results. For example, livelihood and entrepreneurship programs that provide the self-employed with training and seed capital have, on average, more of an impact. So do comprehensive programs that complement training with other components, such as internships, capital injection, certification, or labor insertion support.

Box 1.1 figure 1: Impact on earnings outcomes across categories of youth employment programs

(Standardized mean differences, percentage)



Source: S4YE (2015)

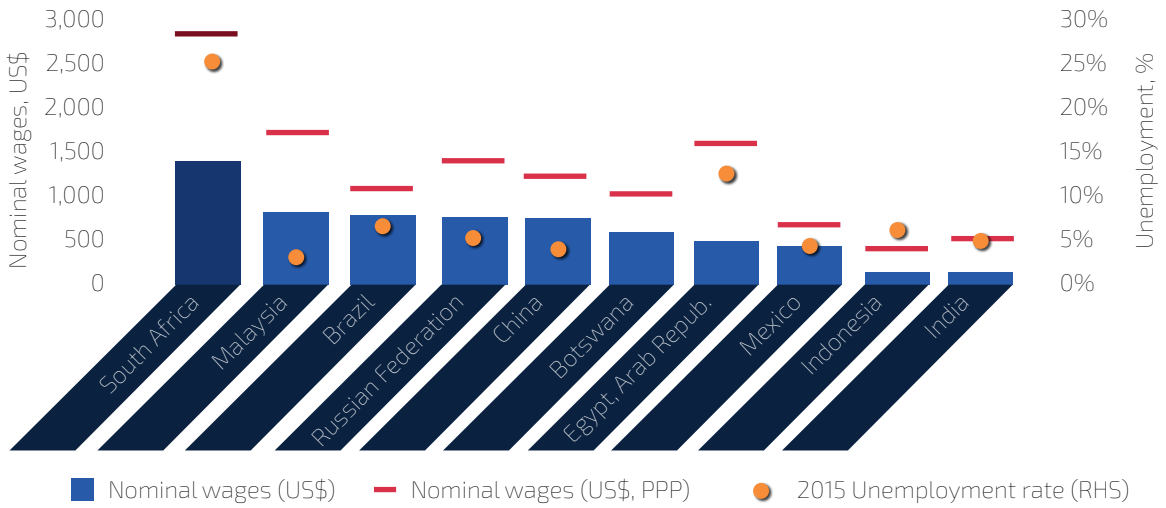
Given the costs involved, it is important to rigorously evaluate and continuously improve the performance of entrepreneurship, training, and active labor market programs. South Africa is spending billions of rands a year on such programs. The Jobs Fund has facilitated more than 70,000 jobs over five years, the Expanded Public Works Program employs more than half a million people on a short-term basis, and in 2014/15 the Employment Tax Incentive Program supported close to 700,000 jobs with a budget of more than R2 billion. Despite these massive efforts, it remains unclear how many net jobs these programs have generated overall. These programs need to be closely monitored, and their performance assessed against objectives so they can improve and become more cost-effective. The National Treasury's ongoing evaluation of employment tax incentives is a good step in this direction, as discussed in the 9th South Africa Economic Update.

In addition, programs should adapt to the diversity of beneficiaries and adjust to different educational and skills levels.[11] One-size-fits-all programs are bound to have little impact: understanding the profile of beneficiaries is essential. In South Africa, labor centers could take the lead, directing beneficiaries to the right programs. Finally, effective coordination must be based on integrated information systems to design, monitor, and evaluate programs.

South Africa's unemployment rate is high compared to other BRICS countries and emerging markets (Figure 1.14). Wage levels are also comparatively high for several reasons:

- Skilled, productive labor commands a high wage given the country's skills shortage.
- Collective bargaining arrangements yield higher wages for unionized workers, resulting in wages growing faster than productivity in many sectors.
- Living costs are high in South Africa, requiring wages to be above a certain level to be attractive for workers. Reducing living costs would allow for more competitive wages without hurting worker welfare. Costs can be further reduced through greater competition policy[12] or better spatial planning[13] that lowers transportation costs.

Figure 1.14: Nominal wages and unemployment in emerging markets
(2013-2015 averages, US$; and percent)



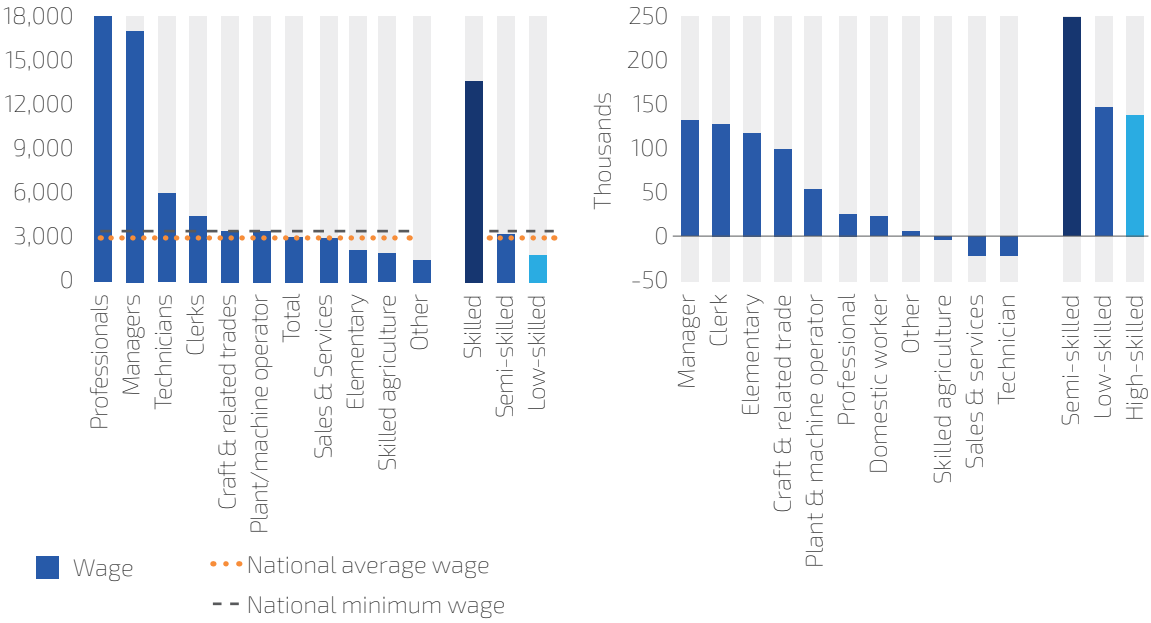
Sources: World Bank staff calculations based on International Labour Organization (2016) and World Bank (2017a)

The average wage in South Africa masks the country's high wage inequality. The average skilled worker earns nearly 7.5 times more than the average low-skilled worker (Figure 1.15). The income inequality is even clearer when considering that the top 10 percent of income earners make 66 times that of the bottom 10 percent.

[11] In South Africa, Harambee, an organization supported by the Jobs Fund, has shown that less than two months of targeted training could significantly improve the employability of unemployed youth.
[12] World Bank (2016c).
[13] World Bank (2016a).

Figure 1.15: South African average monthly wages and employment creation by skill-set

(Mean monthly earnings in 2015, ZAR, left panel, job creation 2016 H1 – 2017 H1 in thousands, right panel)



Source: International Labour Organization (2016)

The R20 per hour national minimum wage announced in February 2017, equivalent to just under R3,500 per month, is expected to take effect by May 2018. This will affect more than 5 million workers who currently earn less than R3,500 a month. A National Minimum Wage Commission will be set up to assess its effect on poverty, inequality, and unemployment, and make recommendations on adjusting wages accordingly. To minimize adverse effects on employment, domestic and agricultural workers will receive lower rates (75 percent and 90 percent respectively), with both sectors reaching 100 percent two years after implementation. The national minimum wage will improve the welfare of many workers, but it is also anticipated to increase unemployment in the short term for low- and semi-skilled workers in sectors where the minimum wage is greater than the current sectoral determination wage (Table 1.2).[14] This will be especially true if economic growth does not generate additional income to be passed on to workers through wages.

[14] Bhorat and Stanwix (2017).

Table 1.2: Sectoral determinations and the national minimum wage (2015 prices)

Sectoral Determination	Lowest sectoral determination	National minimum wage [15]	National minimum wage less lowest sectoral determination	Covered Workers
Agriculture	R2,607	R2,678	R71	668,048
Forestry	R2,607	R2,976	R369	38,710
Domestic Work	R1,813[16]	R2,232	R419	1,131,424
Private Security	R2,067[17]	R2,976	R909	523,870
Wholesale & Retail	R2,514[18]	R2,976	R462	1,382,320
Taxi	R2,113	R2,976	R863	253,358
Hospitality	R2,761	R2,976	R215	333,656
Contract Cleaning	R2,8447[19]	R2,976	R132	743,723
Avg. / Total	**R2,522**	**R2,846**	**R430**	**5,075,109**

Source: Bhorat et al. (2016). Notes: Wages are in monthly terms, and the sample has been restricted to employees who earn less than the Basic Conditions of Employment Act earnings threshold.

The extent and duration of poverty is strongly linked to location and labor market status

In its most recent report on poverty trends, StatsSA (2017) shows that the proportion of poor individuals in the total population increased across all poverty lines between 2011 and 2015:

UPPER-BOUND POVERTY LINE

R1,138

per person per month

LOWER-BOUND POVERTY LINE

R758

per person per month

FOOD POVERTY LINE

R531

per person per month

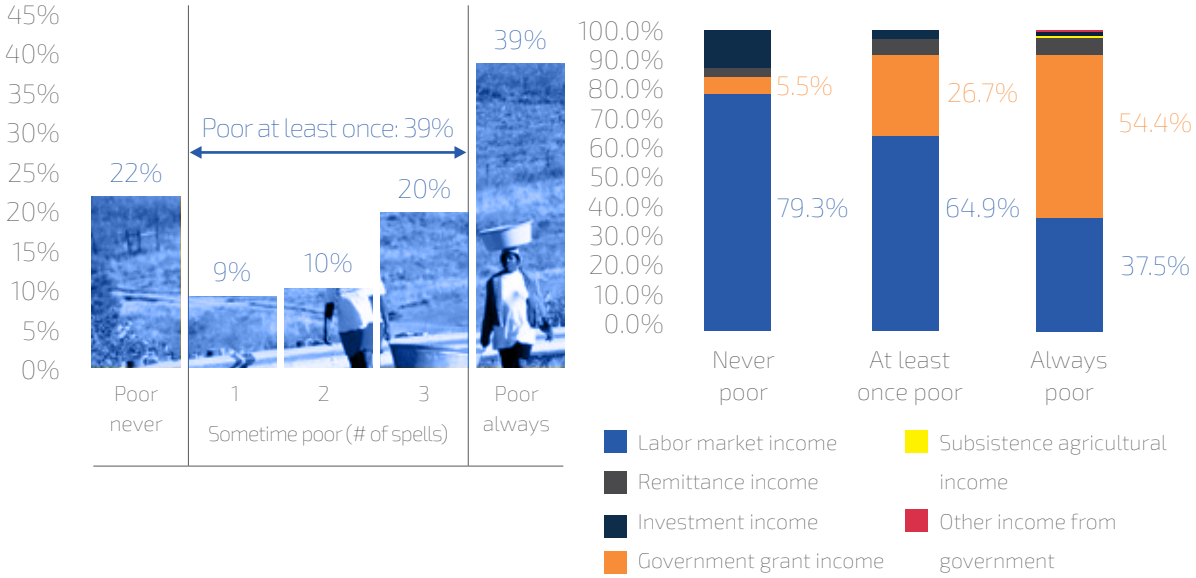
Using the upper-bound line, the proportion of poor individuals rose from 53.1 percent of the population in 2011 to 55.5 percent in 2015. Analysis conducted by StatsSA and the World Bank on a large dataset following individual households over the period 2008 to 2015[20] distinguishes transient poverty from chronic poverty. It suggests that 78 percent of the population experienced upper-bound poverty at some point over

[15] The national minimum wage is agreed to be instituted by no later than May 2018 at a nominal rate of R3,500 per month. Assuming a constant five-year average inflation rate, the real figures in 2015 prices are presented in the table above for comparison purposes.
[16] Domestic workers who work fewer than 27 hours a week are excluded from this calculation.
[17] This figure only includes private security guards.
[18] This figure excludes the legislated wages for a manager, assistant manager, supervisor, and trainee manager, which are far above the other legislated wages in the wholesale and retail sector.
[19] The contract cleaning sectoral determination only specifies a minimum hourly wage. To convert this hourly wage to a monthly wage, it was assumed contract cleaners work for 8 hours a day for 21.6 days a month.
[20] National Income Dynamics Study panel survey carried out four times between 2008 and 2015 used to assess the extent of chronic poverty in South Africa. The survey collects a wide range of information about households and individual wellbeing following the same households over time.

the period – about half were permanently poor, while the other half either fell into poverty or escaped from it during the period (Figure 1.16). Only 22 percent of the population did not fall below the poverty line over this period.

StatsSA and the World Bank also assessed the factors associated with a household's probability of escaping chronic poverty.[21] Large families, children, and people in rural areas are especially vulnerable to chronic poverty. The chronically poor live in households that have an average of seven members, which is more than twice the size of households in the wealthiest quintiles. Chronic poverty particularly affects children, with every other child below age 15 growing up in chronic poverty. Chronic poverty is most dominant in rural areas with traditional villages and communally owned land. Accordingly, chronic poverty is overly concentrated in KwaZulu-Natal, followed by the Eastern Cape, while those resilient to poverty predominantly live in Gauteng and the Western Cape. Race is strongly associated with the incidence and duration of poverty.

Figure 1.16: Poverty duration and income source



Source: StatsSA and World Bank staff calculations

There is a strong relationship between education and the incidence and persistence of poverty. Of those who did not experience a single poverty spell, 93 percent lived in households where the household head had attained at least secondary schooling. Poverty tends to be a temporary phenomenon for higher earners in the labor market. Those who have remained out of poverty between 2008 and 2015 live in households where the head is more likely to actively participate in the labor market. Those who remain out of poverty generally have a household head who is formally employed with a permanent work contract. In contrast, half of the household heads in chronic poverty are self-employed in the informal sector, in casual employment, or work as farmers on their own plot or food garden.

More than half of those experiencing chronic poverty rely on government grants as the main source of income (Figure 1.16, right panel). Unsurprisingly, the chronically poor also tend to lack access to basic goods and services. Of the chronic poor, only 21 percent had access to electricity, flowing water, a flushable toilet, and formal housing, while close to 77 percent of those who had never been poor had access to all of the above.

This analysis suggests that protracted economic growth deceleration in recent years mostly affected the 22 million people vulnerable to transient poverty. A rebound in economic growth is unlikely to directly affect the chronic poor, which include another 22 million people.

[21] Based on panel regression. The dependent variable of the panel regression is the probability of the household to get out of chronic poverty and not fall back into poverty. The explanatory variables included a set of demographic characteristics, location, labor, education, and skills variables, as well as changes in these variables.

Fiscal Developments in South Africa

South Africa lost its prized investment grade credit rating

Minister of Finance Pravin Gordhan tabled the 2017 Budget in Parliament in February 2017. The Budget focused on broad-based transformation through inclusive growth, focusing on the following five areas set out in the 2012 National Development Plan:

- Education and skills development.
- Stronger competition law to reduce barriers to entry and allow for more inclusive product markets and corporate ownership.
- Increased private sector participation in state-owned enterprises.
- Support and incentives to labor-intensive sectors, such as agriculture, agro-processing, and tourism.
- Strengthened cities as growth and employment hubs.

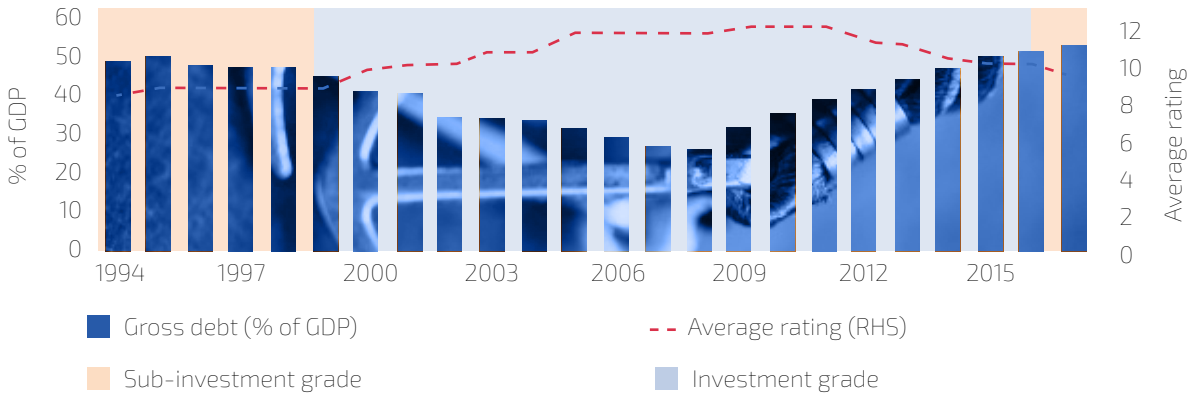
The Budget recognized a weaker-than-expected growth outlook and proposed both expenditure containment and new revenue measures to ensure continued fiscal consolidation. The aim is to stabilize the debt-to-GDP ratio within three years, as public debt has increased significantly since 2009. The spending ceiling was lowered by R10.2 billion (0.2 percent of GDP) for 2017/18 and by R15.9 billion (0.3 percent of GDP) for 2018/19. The Budget thus continued a policy of five years of fiscal consolidation, where the government managed to reduce the primary deficit from 2.3 percent of GDP (and a consolidated deficit of 5.0 percent) in 2012/13 to 0.5 percent (and consolidated deficit of 3.9 percent) by 2016/17—a notable achievement, especially in an environment of low growth.

Minister Gordhan was replaced by Minister Malusi Gigaba in a Cabinet reshuffle on 30 March 2017. Markets strongly reacted to this event in anticipation of a downgrade of South Africa's credit rating. The following week, Standard and Poor's downgraded South Africa's long-term foreign currency credit rating from BBB- to BB+, moving it from an investment-grade rating to a sub-investment (or junk) rating. Fitch followed suit shortly after, also downgrading South African debt to sub-investment grade both on the foreign and the local currency rating—and given that only 10 percent of South African public debt is denominated in foreign currency, the local currency downgrade was noteworthy and adds additional urgency to avert further downgrades by Moody's or S&P (on the local rating). Both S&P and Fitch stated that governance concerns were central to their decisions. Consequently, the rating agencies also downgraded South African banks and other corporates. With the S&P and Fitch downgrades in April 2017, South Africa ceased to be an investment-grade-rated country for the first time in 18 years (Figure 1.17).

This was followed by significant bond disinvestment by institutional investors, as the downgrades resulted in the automatic exclusion of South African government bonds from JP Morgan's Emerging Market Bond Index and Government Bond Index. This prompted estimated outflows of US$1.5 billion, according to NKC African Economics. Capital outflows saw yields on 10-year Treasury bonds increase by 40 basis points, while the rand depreciated by 5 percent within days. This was broadly in line with World Bank simulations in the 9th South Africa Economic Update.

Figure 1.17: Public debt and South Africa's credit rating

(Gross public debt in % of GDP and South African credit rating [average of S&P, Fitch, and Moody's])

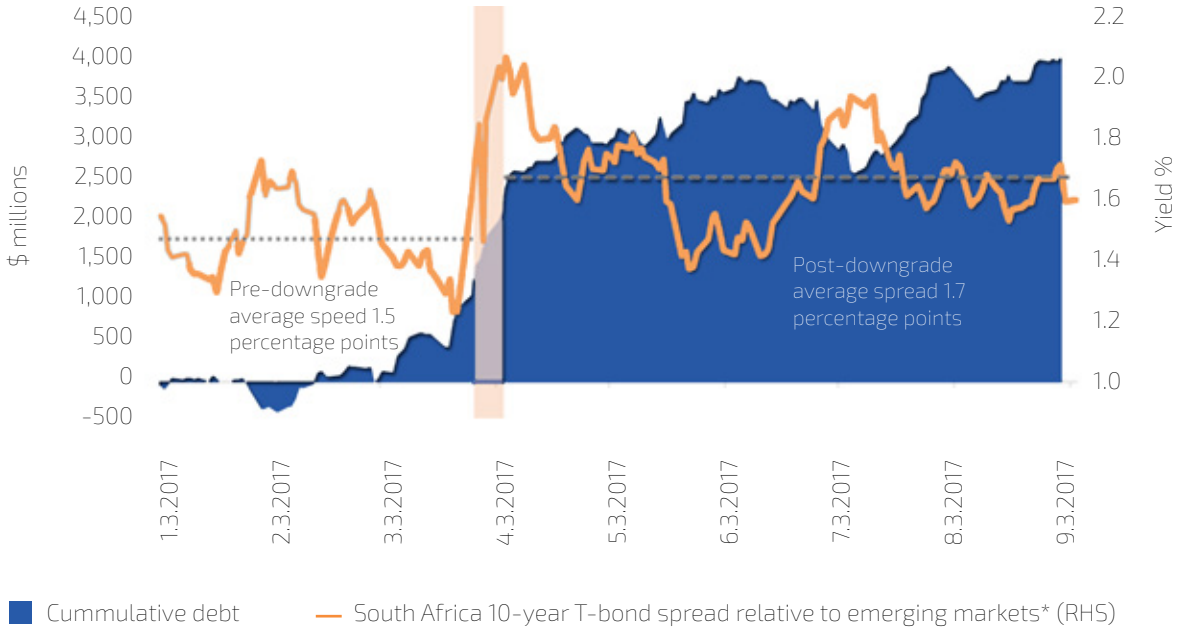


Source: National Treasury, Bloomberg, and World Bank staff calculations

The situation normalized shortly thereafter, with both yields and the rand stabilizing closer to levels seen before the downgrades. Minister Gigaba quickly committed to implementing the Budget that had been proposed by Minister Gordhan, which helped calm markets. At the same time, global investors' appetite for emerging market fixed income remained strong, especially as yields on South African long-term bonds continue to be attractive compared to other emerging markets. This helps explains the increase in South African debt held by non-residents following the reshuffle (Figure 1.18). Although bond yields have settled somewhat since April, they remain higher than before the reshuffle. This suggests that investors consider South African long-term debt to have become riskier and wish to be compensated for this risk with higher yields.

Figure 1.18: Credit rating downgrades and foreign-held debt

(10-year Treasury bond [R186] yield (spread over selected emerging markets), LHS, and cumulative acquisition in South African debt held by foreigners, RHS, January 1, 2017 = 0)



*Brazil; China; Colombia; India; Indonesia; Malaysia; Mexico and Turkey are included in emerging markets T-bond yield

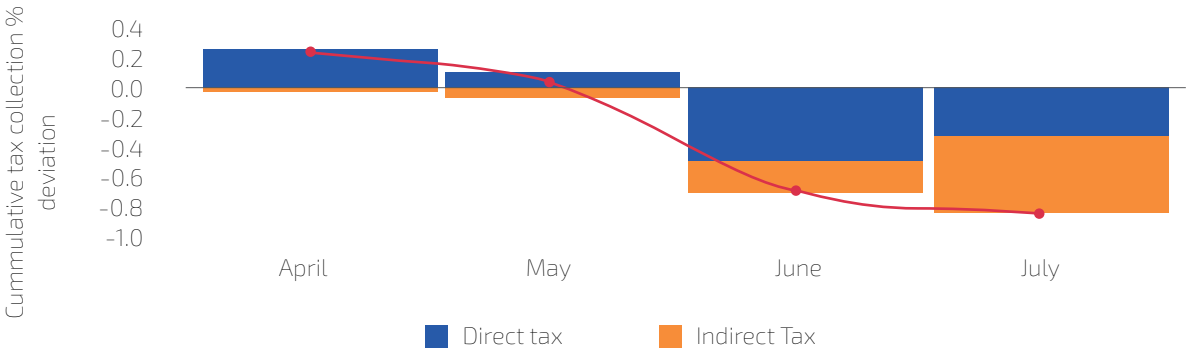
Source: IIF, Haver Analytics, and World Bank staff

Maintaining fiscal consolidation remains important for South Africa's creditworthiness – not least as Moody's continues to rate South African debt as investment-grade, a rating that could be at risk if there is fiscal slippage – i.e. deviations from what was announced in the 2017 Budget. Yet tax collections appear to have been falling behind in June and July (Figure 1.19), making it more difficult to attain the collection target set out in the Budget. This is driven especially by taxes on income and profits, and to an extent by taxes on goods and services and international trade. According to the South African Revenue Service, tax revenue collections were R13.1 billion below estimate between April and June alone, equivalent to 0.3 percent of forecasted annual GDP.

Under-collection is consistent with a weaker economy than anticipated in the Budget. It will likely require an announcement of further fiscal effort in the Medium Term Budget Policy Statement of October 2017, with additional revenue measures and expenditure cuts expected. This in turn will weigh on growth, as discussed further in the outlook section.

Figure 1.19: Revenue collection (fiscal year 2017/18)

(Estimated cumulative deviation from Budget tax collection target, and contributions by tax category)



Source: National Treasury, SARS, and World Bank staff. Note: Calculated as deviation from monthly collections required to meet 2017/18 Budget tax revenue target, accounting for typical monthly collections (5-year average tax collection as percentage of total collection).

Inflation and Monetary Policy in South Africa

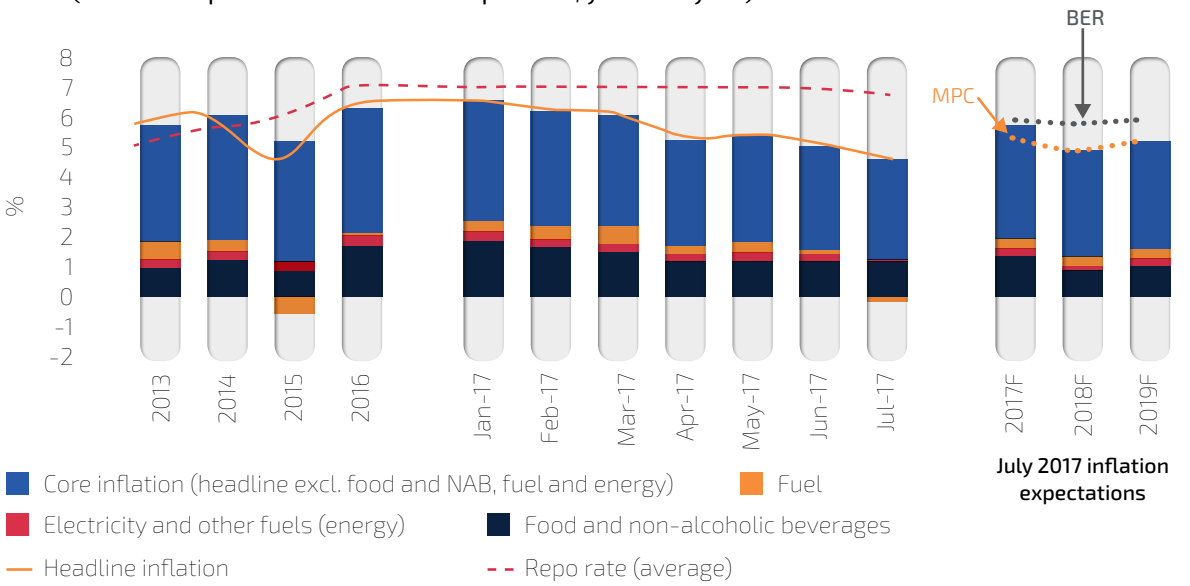
Inflation has fallen back into the target range, resulting in looser monetary policy

Consumer price inflation accelerated in 2015, breaching the South African Reserve Bank's 6 percent upper target in January 2016. This was largely due to the depreciating currency and rising food prices as a result of drought. As the rand strengthened and the drought lifted, inflationary pressures eased. Headline inflation fell to 4.6 percent in July 2017, helped significantly by food prices: food inflation fell from a high of 12.0 percent in December 2016 to 6.8 percent in July 2017. Core inflation also declined to 4.5 percent in 2017. Inflation expectations for 2017 and subsequent years are well within the 3-6 percent inflation target range (Figure 1.20).

With inflation falling within the target band since April 2017 and lower inflation expectations in the mid-term, in July 2017 the South African Reserve Bank reduced the policy rate by 25 basis points, to 6.75 percent – to the surprise of many analysts. A relatively low inflation environment in a weak economy, and a healthy banking sector with a low incidence of nonperforming loans at 3.2 percent, mean that further monetary easing is possible in 2017.

Figure 1.20: Consumer price index inflation

(Consumer price index inflation in percent, year-on-year)



Source: StatsSA and South African Reserve Bank. Inflation expectation by Bureau of Economic Research.

The External Sector in South Africa

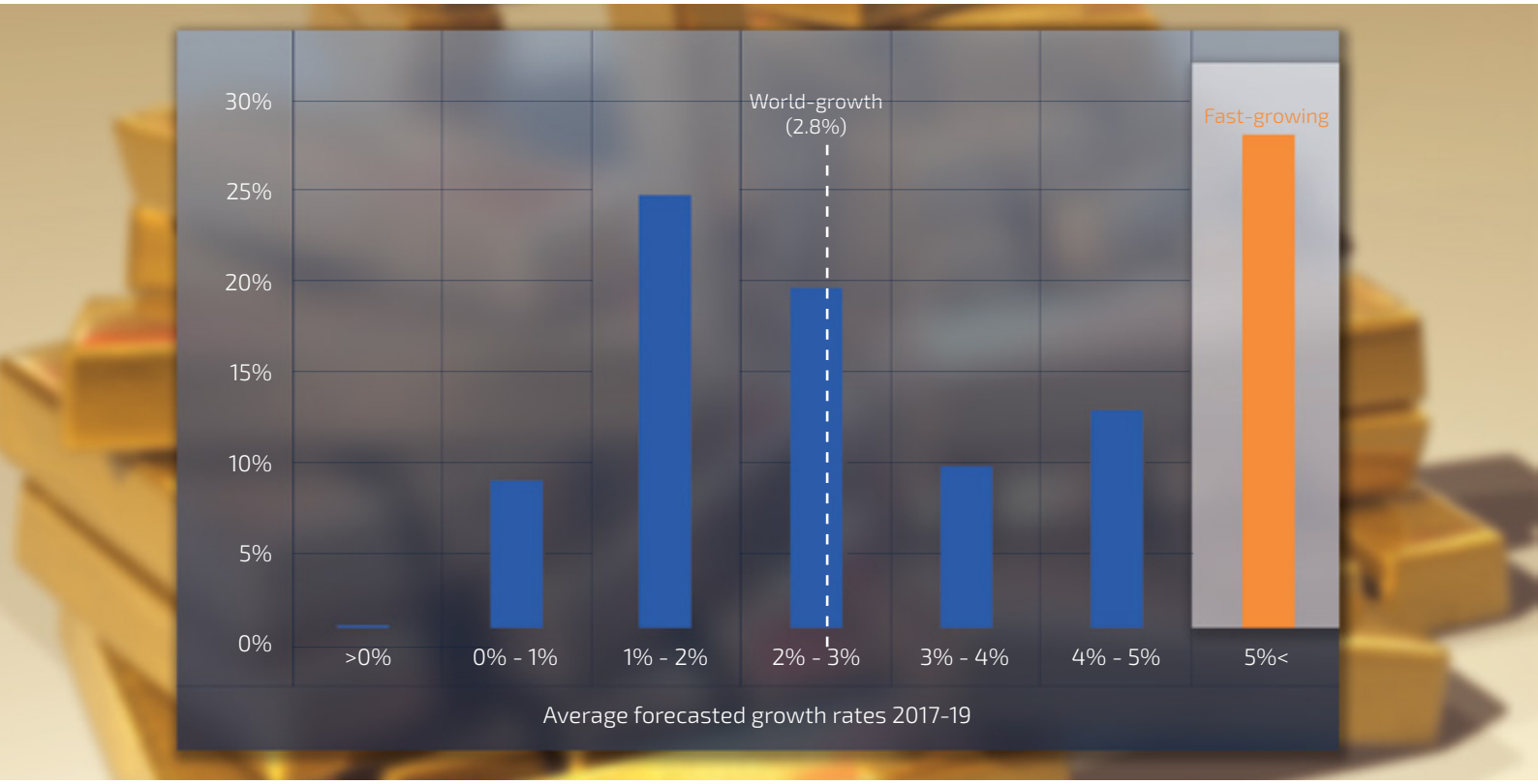
The current account is improving but its financing is reliant on volatile portfolio flows

South Africa's current account deficit has narrowed since a high of 5.0 percent of GDP in the first quarter of 2016. It stood at 2.0 percent of GDP a year later. The trade balance has been the key driver: it was net positive between February and July 2017, and reached a high of a R10.6 billion trade surplus in June. In value terms, exports rose 4.4 percent year-on-year between January and July 2017, compared to 2.2 percent growth in imports. This is largely due to more favorable terms of trade, a consequence of both higher commodity prices and a somewhat stronger rand (although still low by historical standards). Between the fourth quarter of 2016 and the first quarter of 2017 alone, the South African terms of trade improved by 2.6 percent. When comparing the first quarters of 2016 and 2017, they improved by 7.1 percent.

Significant opportunities exist for South African exports abroad. More than a quarter of South Africa's exports go to fast-growing economies, and more than half go to economies that grow faster than the global average (Figure 1.21). It is easier to penetrate growing markets than to gain a share in stagnant ones. South African exporters tend to be better at seizing opportunities from growing markets than obtaining competitiveness gains associated with currency depreciation. Yet the export response to these opportunities has been relatively limited.

Figure 1.21: Credit rating downgrades and foreign-held debt

(Percentage share of South African 2015 merchandise exports to countries [sorted by growth rate])



Source: Comtrade and World Bank staff calculations

Given the positive trade balance, the main reason for a large current account deficit continues to be a relatively sticky negative income balance on the balance of payments. The overall narrowing current account deficit is good news because it reduces South Africa's vulnerability to international capital flows. Given weak foreign direct investment, South Africa's financial account is dominated by portfolio investment. Following the downgrade earlier this year, South Africa experienced some capital flight, including disinvestment by institutional bond investors tracking JP Morgan's investment grade sovereign bond indices. However, as discussed earlier, these flows have somewhat reversed since then, although yields remain higher.

By September 2017, South Africa faced uncertainty around two rating decisions: whether Moody's would downgrade from two notches above sub-investment grade to junk status, and whether Standard and Poor's would downgrade the local currency rating to junk, with the risk of exclusion from additional bond indices. Either downgrade would result in South Africa being excluded from the Barclays Global Aggregate, which NKC African Economics estimates could result in capital outflows of up to US$4 billion. South Africa would also be excluded from the Citibank World Government Bond Index if both agencies downgraded, which could result in outflows of between US$6 billion and US$9 billion. The estimates suggest that the amounts affected by these downgrades would be considerably larger than that of the April downgrades and could place additional pressure on the rand and bond yields. The current account deficit continues to remain an external vulnerability for the country.

The Outlook for South Africa

The economy remains too weak to meaningfully reduce poverty

The South African economy improved in the first half of 2017, largely due to one-off effects in agriculture and mining. By the second quarter of 2017, agricultural output was back at 95 percent of production levels before the drought struck, suggesting that the significant rebound is unlikely to last throughout the year. Agriculture added 0.5 percentage points to headline growth in the first half of the year, but this performance is unlikely to be sustained. In mining, favorable terms of trade effects are expected to have largely been seized in the first half of the year.

Capacity under-utilization in the manufacturing sector is likely to limit investment. Unless South African companies seize opportunities from the global economy, there is unlikely to be an increase in demand. The automotive sector is a shining light in manufacturing: although 2017 will see a temporary drop in vehicle production (by an estimated 20,000 cars, compared to 2016), this is largely due to the scheduled phase out of the BMW 3 series (to be replaced by production of the new X3 model) and a scheduled reduction in the Mercedes Plant in East London. A ramp up of production in BMW, Volkswagen, Nissan and Mercedes in 2018 is expected to result in 633,000 vehicles produced, an increase of 20 percent, with another 10 percent increase expected in 2019. Automotives are thus expected to provide some boost to exports in 2018 and 2019. But overall, South African manufacturing needs to look to the world for demand, and tailor its exports accordingly. Greater innovation, as discussed in Chapter 2, will be required for this.

On the expenditure side, easing inflation has helped South African consumers, supporting private consumption. South Africa is an arid country and the risks of drought increase with climate change and global carbon dioxide (CO_2) emissions. Barring further periods of drought, inflation is likely to remain contained and household consumption is expected to grow modestly. Household consumption may be further supported by somewhat easier credit conditions in light of potential cuts to the policy rate. The minimum wage may raise consumption further in 2018, although the boost to wages for some may be offset by job losses for others – the net effect remains unclear.

Investment is likely to remain weak, except perhaps in automotives. Uncertainty around the future of the Mining Charter is expected to continue weighing on investor confidence, and no significant additional investment is expected in mining. Given excess capacity in manufacturing, little investment is expected in that sector either. Public investment may decelerate as it tends to be more discretionary than consumption spending, such as civil service wages, and may therefore be cut as the government attempts to stick to its fiscal consolidation goals.

Generally, given the performance of revenue, little support to growth can be expected from the Budget going forward. Additional revenue measures and expenditure cuts will likely be needed to control the budget deficit and demonstrate to foreign investors and South Africans alike a commitment to the country's creditworthiness. This is likely to be a further drag on growth.

A timid recovery is still expected in the next three years, but the economy is anticipated to grow barely faster than the population. The World Bank forecasts growth of 0.6 percent in 2017, with a moderate increase in 2018 and 2019.

Although downside risks to the outlook have lessened somewhat, they remain considerable throughout the forecast period. One is fiscal policy: fiscal slippage is a risk given signs of revenue under-collection; and the general election in 2019 may put pressure on public expenditure in anticipation. Moreover, contingent liabilities in State-Owned Enterprises (including South African Airways and Eskom) could delay the fiscal consolidation course. Fiscal slippage would likely result in additional downgrades by international credit rating agencies. This would increase the cost of public debt, crowding out other expenditures. Downgrades could also result in significant international capital movements, putting pressure on the exchange rate and inflation, and in turn on household budgets and consumption. Political confidence shocks can have similar

effects on the exchange rate, as could a shift in global investor demand for emerging market assets, for example, from tighter monetary policy in developed economies.

South African growth is diverging from global growth and the country risks falling behind its peers. This would be to the detriment of South Africans, particularly the poor, for whom a growing economy is necessary for jobs, decent wages, and a sustainable system of social grants. Structural reforms could offer value for money, especially in an environment where the national budget is constrained. Fostering growth in TFP is particularly important to put South Africa on a higher growth trajectory. Innovation policy, discussed in Chapter 2, is one key area of focus here.

It remains crucial to limit policy uncertainty. An agreement on the Mining Charter that is acceptable to all relevant parties is needed to encourage investment in mining – including in innovative production methods, where South Africa has a good record. It will also be important to consolidate previous achievements. Electricity load shedding, which was previously a considerable bottleneck, is not presently limiting output.

More broadly, there needs to be predictability to secure private investment, which has driven innovative, nimble, and cost-effective solutions such as the independent power producer initiative. Reducing uncertainty around power purchasing agreements will therefore be vital. The February 2015 Cabinet decision that all bills and regulations should include a socioeconomic impact assessment could better demonstrate possible trade-offs between investment and equity imperatives, and facilitate informed debates on proposed policy orientation.

At the current rate, growth is likely to be insufficient to significantly reduce poverty. Both 2017 and 2018 are expected to have negative per capita growth, which means poverty rates will remain fairly consistent with 2016 levels. By 2019, 15.7 percent of the population is expected to remain below the US$1.9/day poverty line (purchasing power parity) and 33.7 percent under the US$3.1/day line. Policies for growth are crucial for South Africa's poor.

Table 1.3: Baseline annual growth forecasts

	2014	2015	2016	2017f	2018f	2019f
Real GDP growth, at constant market prices	1.7	1.3	0.3	0.6	1.1	1.7
Private consumption	0.7	1.7	0.8	1.0	1.9	2.0
Government consumption	1.1	0.5	2.0	-0.2	0.3	0.5
Gross fixed capital investment	1.7	2.3	-3.9	-1.2	1.6	2.3
Exports, goods, and services	3.2	3.9	-0.1	0.4	2.4	1.7
Imports, goods, and services	-0.5	4.5	-3.7	2.1	1.7	1.9
Real GDP growth, at constant factor prices	1.8	1.3	0.4	0.6	1.1	2.7
Agriculture	6.9	-6.1	-7.8	15.0	5.8	2.4
Industry	0.1	1.1	-1.3	0.2	1.1	1.6
Services	2.3	1.6	1.3	0.3	0.9	1.7
Inflation (consumer price index)	6.4	4.6	6.3	5.7	5.8	5.9
Current account balance (% of GDP)	-5.3	-4.4	-3.3	-2.6	-2.9	-3.0
Fiscal balance (% of GDP)[1]	-4.3	-4.1	-3.9	-3.8	-3.7	-3.5
Debt (% of GDP)[1]	46.6	49.4	50.7	52.7	53.8	53.4
Primary balance (% of GDP)[1]	-1.3	-1.0	-0.5	-0.4	-0.2	0.1
Poverty rate ($1.9/day 2011 purchasing power parity terms)[a,b,c]	15.6	15.7	16.0	16.0	15.9	15.7
Poverty rate ($3.1/day 2011 purchasing power parity terms)[a,b,c]	33.6	33.7	34.1	34.2	34.1	33.7

Source: World Bank staff calculations. Notes: f=forecast; 1/Fiscal year; a/calculations based on 2010-IES survey; b/ Projection using neutral distribution (2010) with pass-through = 0.87 based on GDP per capita constant PPP; c/ Projections are from 2013 to 2018.

Box 1.2: Incubating small businesses

Elias Makhubu (45) owns the Black Star Coffee Bar, a start-up designer beverages company. His company is one of 332 businesses in an innovative Riversands Incubation Hub near Diepsloot in the north of Johannesburg. Owned by Century Property Developments, the hub was founded by a family, who saw an opportunity to help small businesses and entrepreneurs in a densely populated and marginalized area of the city with limited economic prospects.

Diepsloot residents often have to walk long distances to work or spend a disproportionate amount of resources and time on transport (World Bank, 2014). By creating jobs close to Diepsloot, the businesses in the hub help residents cut their transport costs and raise their economic participation. The hub is supported by the Jobs Fund in a 50/50 joint venture, as part of a government initiative launched in 2011 to co-finance projects by public, private, and nongovernmental organizations that create jobs. The hub aims to contribute to the Gauteng government's efforts to integrate the township economy into the mainstream economy.

"We are an enabler and we offer tailor-made support for businesses and interventions, with a very low barrier to entry," says Tracy Henley, the hub's director. The hub takes in entrepreneurs at different stages of developing their business. It houses 152 businesses on campus and about 180 off campus. The businesses range from farming, textiles, bakeries, and restaurants, legal, engineering, ICT, technical services to cleaning services, uniform makers, carpentry, and construction.

For Elias and many entrepreneurs who benefit from the hub, the affordable rental is one of the main drawcards. An engineer by training, Elias arrived at the hub about two years ago looking for premises for his construction business and spotted an opportunity to feed people. This led to the opening of his coffee bar, which also serves light meals. He has a portfolio of four business concerns housed at the hub, and employs at least 40 people, mostly young, and 99 percent of whom are from Diepsloot. "I am scared of poverty, I know that world and that is why I have diversified my portfolio so much so that I can always stay afloat. But I also know it is not just about me. I am responsible for other people too and therefore I cannot be reckless".

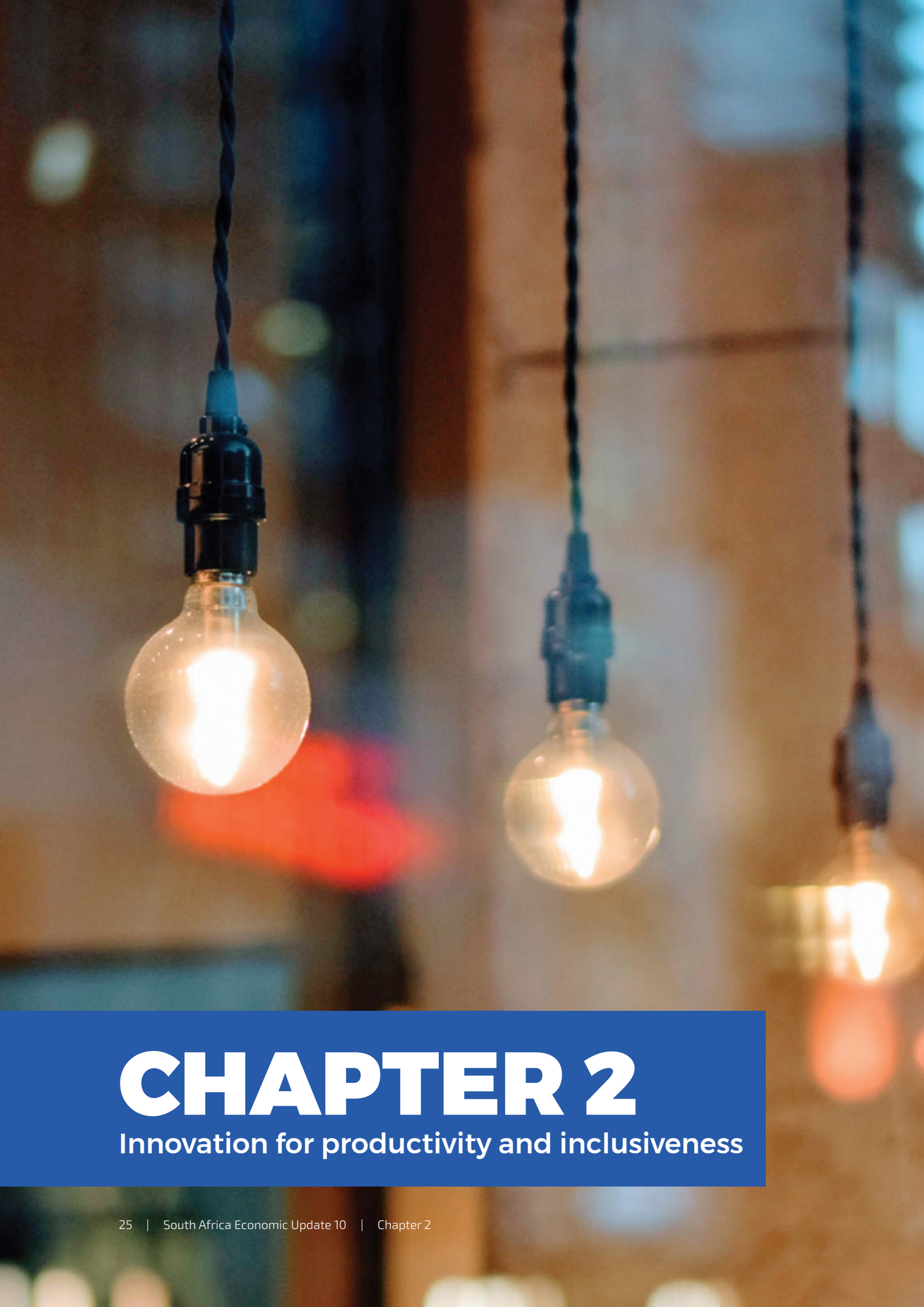
In addition to subsidized rentals, the hub offers a comprehensive mentorship and support program to the SMMEs. The hub's screening program determines whether a business can be incubated, indicating the viability of the envisaged business. Thereafter, businesses go through a structured three-year

incubation process, with training and mentorship programs on all stages of setting up and running a business. In fact, the training programs are considered an on-site practical business university.

The proximity of the hub to upmarket residential and commercial development centers presents excellent opportunities for SMMEs. Elias, for example, caters to surrounding businesses as well as to functions held at the hub. The surrounding area is undergoing extensive mixed development construction, providing a market for products and services from the SMMEs. The hub also provides easy access to and from the Johannesburg-Midrand-Tshwane corridor.

Being housed under one roof also provides an opportunity for entrepreneurs to network and learn from each other. Businesses can work together to come up with innovative collective solutions to challenges they face. Elias hosts "coffee conversations", which provide a platform for peer-to-peer learning at his coffee bar.

True to the hub model of incubating businesses to the point where they are able to expand and compete in a mainstream business environment, Elias will be opening a branch of his coffee bar in the neighboring upmarket suburb of Dainfern. The Riversands SMME Incubation Hub makes a clear case for public-private partnerships that can help create jobs, stimulate activity in marginalized areas, and contribute to economic growth.



CHAPTER 2

Innovation for productivity and inclusiveness

The Role of Innovation in Meeting South Africa's Economic and Social Goals

South Africa has a long history of embracing science, technology, and innovation. But its innovation, in terms of productivity, may be losing ground.

Innovation, defined as the introduction of new-to-the-world and new-to-the-firm goods, services, business practices, and organizational methods,[22] can play a significant role in supporting the country's pressing economic and social priorities.

This chapter focuses on analyzing the opportunities for private innovation to become a more central part of South Africa's shared growth model. It begins with an overview of how innovation can boost economic growth and help address social challenges. Following an assessment of the strengths and weaknesses of the science and innovation ecosystem, we focus on the take-up and impact of R&D investments (seen as inputs to the innovation process), and on the technology content of exports (seen as outputs of the innovation process) to better assess innovation trends, and their possible determinants. This is made possible by the availability of the South African Revenue Service-National Treasury (SARS-NT) tax dataset from 2008 to 2016, which allows for the first economy-wide investigation of private innovation of all formal firms in the country. The chapter ends with a discussion of policy implications, both in terms of the enabling environment and the public instruments that support private innovation.

Making the economy more competitive for job creation and poverty reduction

South Africa's commodity-based growth model exacerbates the volatility of exports and output, with knock-on effects on domestic revenue mobilization and the funds available for critical social transfers and public investment. High wage levels make it difficult for South Africa to compete in low and medium-tech goods markets where cost is the deciding factor. In this context, innovation can boost productivity in existing industries. It can also promote diversification in new manufacturing and service sectors with good job-creation potential, and where the country can build long-term competitive advantages. For example, sharply decreasing ICT costs are improving cross-border communications and reducing the minimum scale needed to enter global markets. This creates tremendous growth opportunities for existing firms and new entrants alike.[23]

But innovation is also perceived as a threat to social progress, given that it often leads to automation, eliminating unskilled or lower-skilled employment. The consequences of innovation are hotly debated in both developed and developing economies.

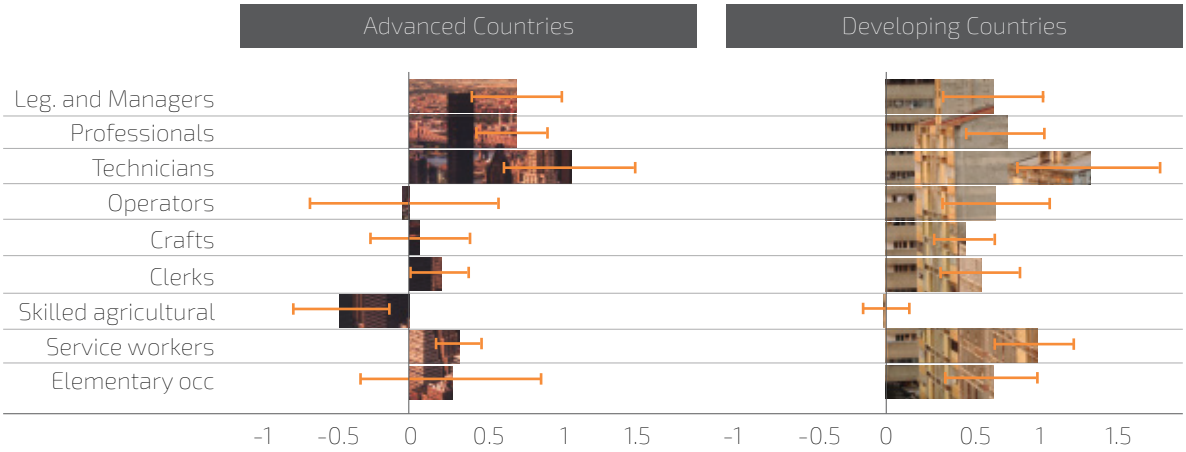
A recent World Bank[24] study focusing on developing economies provides some useful nuance in this debate. Using a survey sample of 15,000 firms across Africa, Eastern Europe, Central and South Asia, and Middle East and North Africa, the study suggests that:

- Innovation, when successful (leading to increased sales), generates additional employment, even if entailing more capital-intensive production processes.
- Product innovation (a new or better quality product) creates more jobs than process (such as automation) innovation or organizational (such as outsourcing, or changes in management structures) innovation.
- The farther the country/sector is from the production frontier (the most innovative product/process), the more innovation generates jobs (as opposed to replacing jobs with robots).

[22] Similar to the OECD/Eurostat (2005). New-to-the-world services and products have not been introduced to the world before, nor are they derived from existing products or services. New-to-the-firm refers to products or services that a particular firm has begun to offer, which they had not done previously.
[23] World Bank (2016b).
[24] Cirera and Sabetti (2016).

Figure 2.1: Growth in employment by occupation, 1979-2012

(Percentage change in employment)



Source: Comtrade and World Bank staff calculations

Job creation in South Africa is often deemed to benefit from product innovation, including the adaptation and adoption of innovation developed elsewhere. Yet the impact of innovation on employment creation varies by sector. Innovation can directly reduce production costs within a company. It can also indirectly reduce the cost of production in sectors using intermediate inputs that benefited from innovation.

The magnitude of the impact depends on growth and job multipliers, and the response in domestic and international demand to changes in prices. In turn, poverty and inequality will be affected by the impact that innovation has on creating jobs for the poorest sections of the population and on the price of goods consumed by these households.

The World Bank measures these effects using a computable general equilibrium model for South Africa, comprising 55 sectors and four labor types differentiated by skill level. The model considers substitution possibilities between labor types, and between labor and capital, allowing for the progressive automation of productive systems. It simulates the impact of generating an additional R1 of output using existing factors of production in each sector – a gain in TFP resulting from innovation.

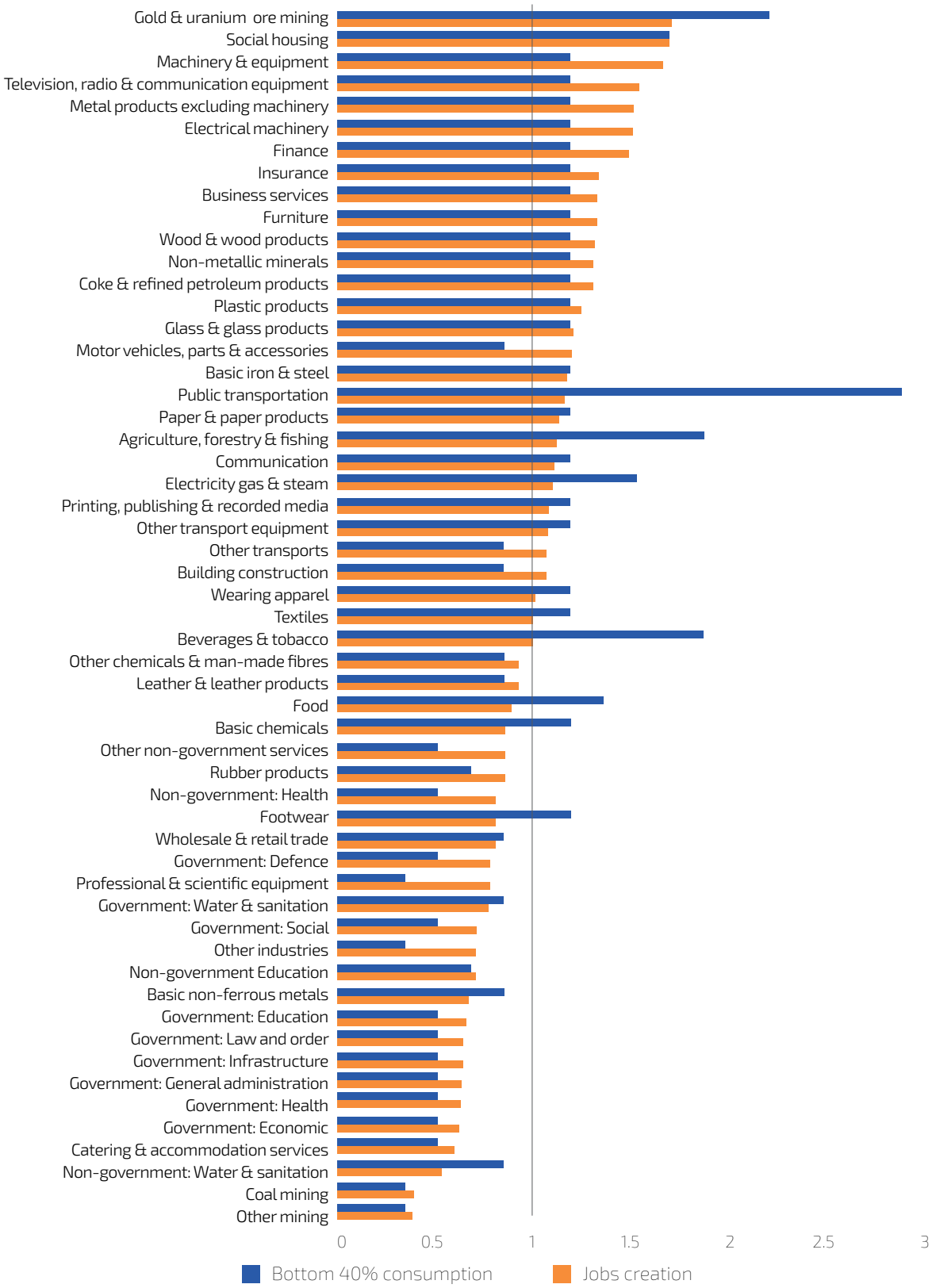
Figure 2.2 displays the relative impact of innovation in a given sector on net job creation and the real consumption of the poorest 40 percent of households. A measure above 1 (the average impact) indicates that innovating in this sector will have a higher impact on, respectively, job creation and the consumption of the poorest 40 percent of households than the average for all sectors.

Results suggest that innovation in any sector creates jobs and raises the consumption of the poorest 40 percent of households at the aggregate level,[25] with results varying by sector. Innovation in gold, machinery, and housing, for example, has a pronounced impact as a result of higher exports, cheaper investments, and strong multiplier effects. Innovation in coal, other mining activities, and government services, in contrast, has a less pronounced effect on jobs creation. Similarly, innovation by sector has different effects on the consumption patterns of poor households. This reflects, to a large extent, the lack of capacity in the poorest households to supply skilled labor. One implication is that innovation mostly influences the welfare of low-income households by reducing their cost of living, as opposed to increasing their revenue. As a result, innovations in public transportation, electricity, food, footwear, beverages, and agriculture have the largest positive effect on poor households. Innovations in gold mining (given its use of unskilled labor) and social housing combine high job creation and pro-poor impact. These results illustrate the different channels through which innovation can play a role in reducing poverty and creating jobs.

[25] Simulating a productivity increase equivalent to 1 percent of GDP across all sectors generates a 0.2–0.25 percent increase in the number of jobs (and a 0.9–1.8 percent increase in real wages), depending on whether innovation is embedded in capital or labor.

Figure 2.2: Impact of sectoral innovation on job creation and consumption by poorest households

(Relative impacts of sectoral innovation on jobs creation and the consumption of the poorest households)



Source: World Bank staff calculations

Providing better goods and services to poor households

Innovation is often perceived as a policy area with little bearing on poverty, creating products affordable only to rich households. Yet rapid technological progress has made it possible for most of South Africa's poor to purchase mobile phones and take advantage of mobile applications, leapfrogging advanced economies where consumers only 10 years ago spent considerable amounts of money on fixed broadband and desktop computers. Similarly, health outcomes have dramatically improved as a result of the availability of new medicines, the outreach and quality of education is improving through online platforms, and public services are gradually coming online.

The private sector can be a powerful player in addressing the needs of the poor by developing affordable products and services, and creating opportunities for the unemployed. Sometimes these efforts come from the large incumbent firms, but more often than not they are the creation of social entrepreneurs.

Two recent examples show how local companies are using digital technologies to increase low-skilled employment and improve the provision of social services:

- *Job matching:* SweepSouth is a start-up that connects domestic workers with potential clients. The primary aim of the company is to provide flexible working opportunities at a fair wage for those in this less-skilled segment of the population. The company has already helped more than 3,000 individuals who were previously unemployed or underemployed to find full-time work.
- *Health care:* Vula was founded by an ophthalmologist who volunteered in rural areas of Swaziland and Eastern Cape. He realized that the distance and lack of specialists in rural areas kept many people blind despite the existence of medical treatments. This inspired him to develop a mobile app. "Vula" means "open" and was taken from the name of the eye clinic Vula Amehlo – Open Your Eyes in Swaziland. The app enables primary health care workers to fill in a standard questionnaire, take photos, do a basic medical test, and send it to the on-call specialist. The response time is 15 minutes and the doctor can see other patients while waiting for the advice of the specialist. Along with subsequent treatments, the app has helped restore the vision of hundreds of people living in rural areas. Now Vula has expanded beyond ophthalmology and covers about a dozen different fields, including dermatology, HIV, cardiology, and oncology, benefiting more than 1,000 patients a month. In addition to direct health benefits for the patients, Vula has also resulted in cost savings as more patients receive care by primary doctors rather than specialists. In addition, rural health workers benefit from the continuous support of specialists.

These two examples demonstrate the way new technologies developed by entrepreneurs with a social vision are transforming people's lives. There is a mass of potential customers, patients, employees, and suppliers, which until recently was largely untapped because of distance to markets and limited access to information and finance. Improvements in the logistics infrastructure in rural areas, and the roll out of ICT networks, are creating opportunities to change this.

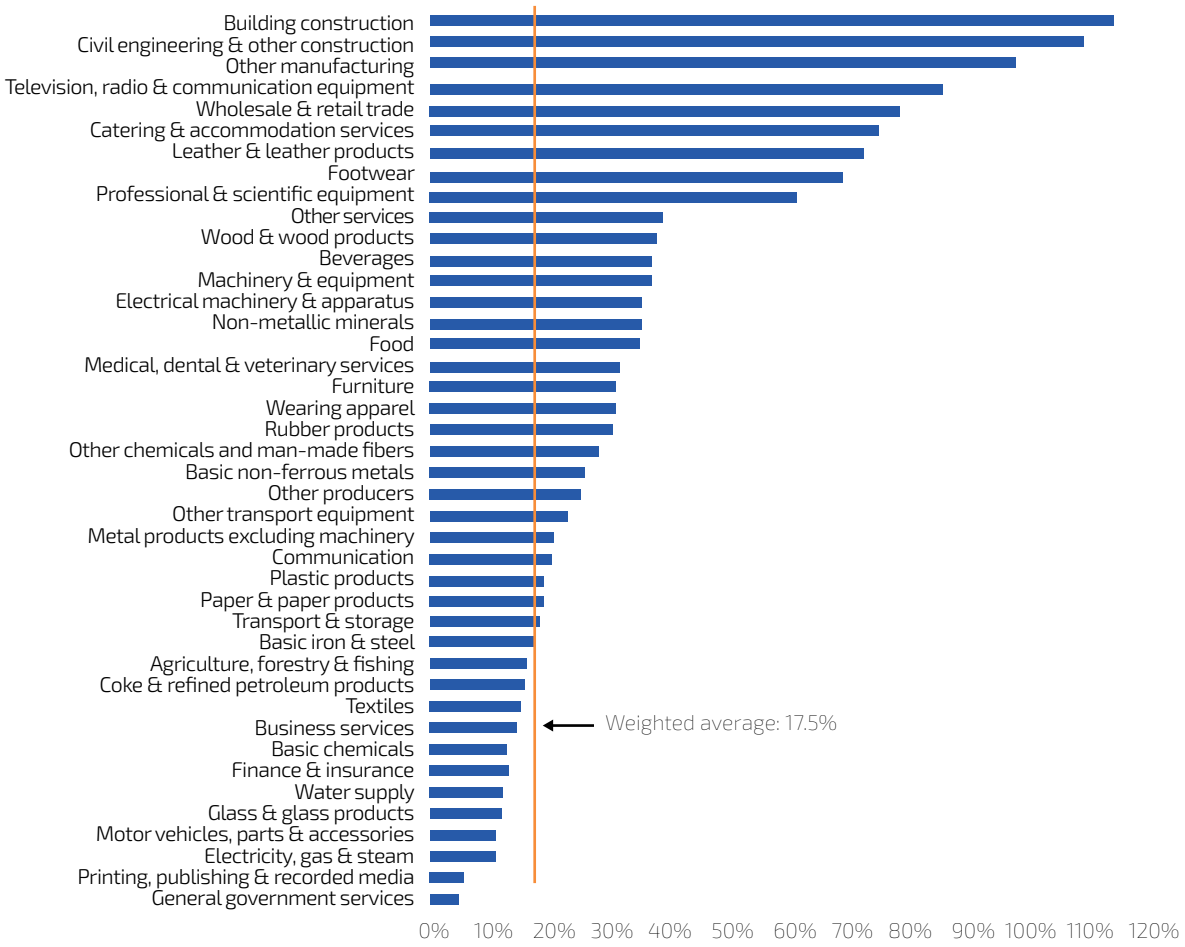
Reinforcing competition through disruptive technologies

Economic competition is low in South Africa. This is notably reflected in the large dispersion of returns to capital across sectors (Figure 2.3). Low competition is likely to result in suppressed demand for capital and labor in these firms and sectors, reduced price competitiveness, and a high cost of goods and services sold to the poor. World Bank staff analysis suggests that progressively halving mark-ups resulting from dominant market position could create 300,000 additional jobs and lift 600,000 people out of poverty.

Local companies are using digital technologies to increase low-skilled employment

Figure 2.3: Sectoral rates of return to capital

(Gross operating surplus over capital stock, 2006-15)



Source: World Bank staff calculations based on Quantec (2017).

The causal relationship from competition to innovation is not straightforward. Market dominance may be required to innovate when intellectual property rights are insufficiently protected. But lack of competition may prevent the emergence of innovative new firms. Lack of competition in key enabling sectors, such as ICT, may also deter innovation in other sectors, as discussed in the sections below.

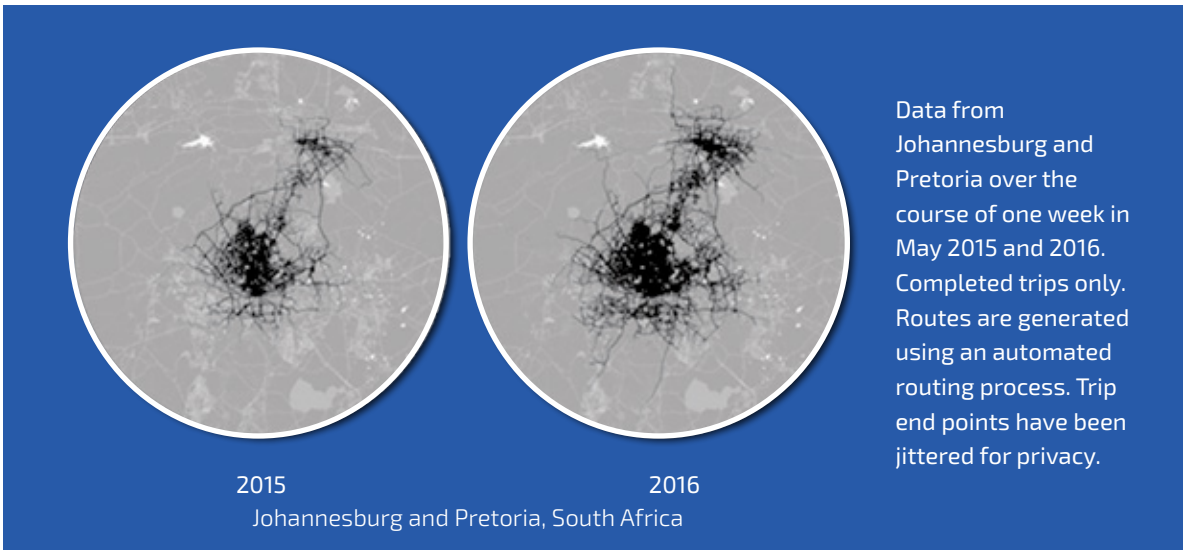
The impact of innovation on competition is clearer. The introduction of disruptive technologies can play an important role in strengthening competition. The rapid success of the e-hailing platform Uber surprised many observers because of the regulatory constraints and vested interests in the traditional taxi industry.

Uber revolutionized conventional passenger transport systems by establishing a digital marketplace that matches suppliers (drivers) with customers (passengers) for an efficient, generally safe, and affordable service to commuters around the world. Since its launch in 2009, Uber has expanded into more than 600 cities in over 77 countries on six continents. Globally, there are more than 65 million monthly active Uber riders and over 2 million driver partners.

South Africa is one of Uber's fastest growing markets globally, highlighting a gap in the existing transport market. The company has joined with drivers in the country that come from a wide range of occupational backgrounds.

Figure 2.4: Uber trips in Johannesburg-Pretoria (2015, 2016)

(Uber trips over time)



Source: Uber (2017)

The introduction of Uber had various spillover effects into other segments of the transport industry. It has inspired the entry of other firms and even greater competition. Taxify is a platform that followed the Uber model, and adapted it worldwide – further increasing efficiency and competition within the market. The South African-born company Afta Robot has inserted itself into the minibus taxi sector, which generally serves lower-income South Africans and accounts for about 70 percent of daily commuters.

Tailoring this technology to the South African market (especially lower-income earners) has the potential to multiply the impact of this type of innovation. Uber requires the end-user to have access to a smartphone (between 37 percent and 45 percent of South Africans), while Afta Robot only requires the user to have an Internet-enabled phone (about 86 percent). By being able to access the service for only 20 cents to the Rand (1.5 U.S. cents) per dial, the average South African commuter can afford to be connected to the transport grid in a way that they could not before.

Improving the management of public goods

New technologies can contribute to addressing environmental issues. Faster adaptation and diffusion of clean technology[26] products and services throughout the household and corporate sectors can create opportunities for more efficient and sustainable water and energy use while creating thousands of new jobs. The International Labour Organization estimates that South Africa can create 462,000 additional jobs by 2025 through investments in the green economy, including in clean energy generation, energy efficiency, pollution control, and natural resource management.[27]

*South Africa can create **462,000** new jobs by 2025 through investments in the green economy*

[26] A product or service that reduces negative environmental effects.
[27] World Economic Forum (2017).

Box 2.1: Pioneering carbon capture and storage in South Africa

As one of the 20 largest emitters of fossil fuels globally, South Africa has committed to reducing its carbon footprint. Accordingly, it is exploring the potential of innovative climate change mitigation technologies, notably piloting the capture and storage of carbon.

Carbon capture and storage involves the integration of three processes: the separation of CO2 from other gases and its compression into a dense state; transport of the CO2 to an appropriate site; and the injection of CO2 into an underground geological formation where it can be safely stored and monitored. Integrated carbon capture and storage is a new and rapidly evolving technical area. Globally, only 15 large integrated carbon capture and storage projects were in operation by the end of 2015.

The first investigations into the viability of carbon capture and storage in South Africa began in 2004. Following the establishment of a South African Centre for Carbon Capture and Storage in 2009, the South Africa Council for Geoscience together with Sasol, Eskom, PetroSA, Anglo-American, and the South African National Energy Development Institute jointly developed a comprehensive atlas, identifying the optimal geological sites for large-scale carbon storage. Several universities, the Council for Scientific and Industrial Research, and the World Wide Fund for Nature have also been actively involved.

A five-year demonstration program is under way to capture and store carbon at scale. This includes the design, construction, and operation of a CO2 capture plant at Eskom's Kusile power plant, with the goal of providing a testing and learning facility for industry and academia across Southern Africa and beyond. Explorations are also under way to identify a site within the Zululand basin for the injection, storage, and monitoring of up to 50,000 metric tons of CO2. The successful completion of this demonstration program will pave the way for commercial carbon capture and storage.

The uptake of this technological innovation will likely depend on changes in the regulatory environment. The proposed national Carbon Tax Bill, by providing for carbon offsets, would help incentivize companies to invest in greenhouse gas and CO_2 mitigation projects to reduce their carbon tax liabilities, including accelerating the use of capture and storage technologies.

Big data collected through various platforms can also reduce coordination costs and facilitate the development of evidenced-based policy. Labor matching, traffic congestion, and identifying skills shortages (using LinkedIn data, for example) can all be improved with big data.

Agriculture, transport, health care, education, and poverty are among the areas that can benefit from big data, particularly when it is open data that can be used to develop new services. South African firm WhereIsMyTransport is using big data to provide solutions in local informal transport networks. By capturing data on routes, commute times, and costs, the company can optimize travel plans for commuters for a cost-efficient journey.[28] This project has already been rolled out in five major cities, and has led to a partnership with local government – a crucial element of big data operations. The use of big data is most effective when there is both private and public cooperation, creating a space for new ideas and research.

Leveraging innovation for inclusive growth

The government's recognition of the role innovation plays in advancing social goals is reflected in the Industrial Policy Action Plan of 2017. The Department of Science and Technology's forthcoming white paper will also look at the contribution science and innovation can make to the country's development, and will shape the future of public policies in this area. The importance of innovation (especially for under-served communities) is also recognized in the private sector, as discussed in previous sections.[29]

South Africa already has a sophisticated research system. It boasts well-recognized universities and a tradition of academic excellence. It has also invested in world-class

[28] The Guardian (2016).

[29] Mark Shuttleworth was not only the first South African in space, but also the founder and developer of technologies such as Ubuntu (a Linux operating system) and Thawte (a secure payment technology). These technologies have (in part) created the world of secure online payments and open-source computing. South African-born Elon Musk is the founder of PayPal, Tesla, and Space-X. Continually pushing the boundaries of clean and space technology, Musk has been hailed as an icon of innovation. Young South African scientist Siyabulela Xuza has had a planet named after him in honor of his work in developing a record-breaking rocket and more energy-efficient rocket fuel.

science facilities, including the fastest computer on the continent and one of the largest telescopes in the world. It has powerful role models who can inspire young people to study science and engineering, become social entrepreneurs, and develop careers in the innovation sphere. From the first heart transplant to the first digital laser, South African advances in science and technology have reached far beyond the country's borders. Ubuntu, Thawte, and Paypal have more in common than meets the eye: not only are they are all pioneering software in the modern age of computing, but they were all created by South Africans.[29]

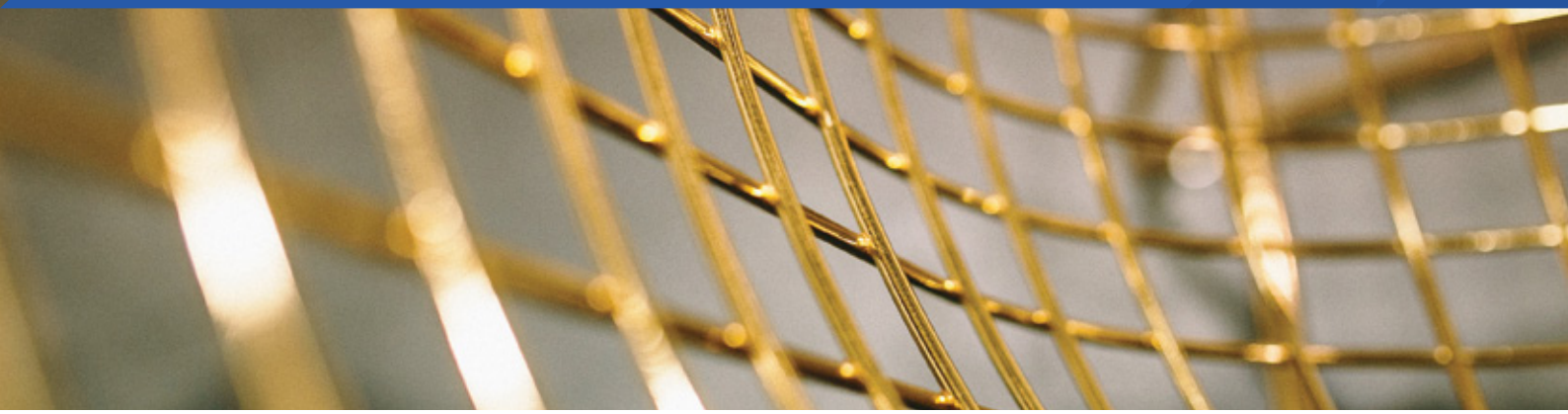
In addition, South Africa's private sector is one of the most dynamic and diversified on the African continent. Domestic companies are active across a number of sectors – from mining and minerals to electronics and clean technologies. Recognizing the size and potential for growth in the South African market, and the country's strategic position as a finance hub, several multinational companies established their offices in the country, including Google and Microsoft. South Africa continues to be the top foreign direct investment destination in Sub-Saharan Africa and is ranked 25th globally on the 2017 A.T. Kearney investor confidence index.[30]

But competitive pressures have increased dramatically. Emerging economies, particularly fast-growing countries in East Asia, and more recently in South Asia, are making massive investments in education and skills, ICT infrastructure, technology upgrades, and national R&D systems. As underlined in Chapter 1, these pressures are reflected in faster TFP growth in many countries compared with South Africa. As a result, South Africa's companies are squeezed on two fronts (World Bank, 2011). They must compete with developed economies that dominate the global market for knowledge-intensive products, but they also face strong competition from Asian economies with much lower labor costs. This means that South Africa will need to invest in innovation (including technological absorption) or it will face the threat of falling further behind its peers.

An Overview of South Africa's Ecosystem for Innovation and its Performance

South Africa ranks relatively high on the international metrics for innovation and competitiveness (Table 2.1). This is attributable to the generally positive business environment, good intellectual property framework, a tradition of excellence in public research institutions, a history of manufacturing, and an ICT sector that, while small, has been able to adapt some global platforms and create innovative local applications. However, declining private sector R&D investment, relatively weak performance in high-tech and new industries, and lack of new high-growth firms, threaten the country's longer-term competitiveness.

*South Africa needs to invest in **innovation** or **fall** further behind its peers.*



[30] A.T. Kearney (2017).

Table 2.1: Innovation and competitiveness indices

Country	Global Innovation Index 2016		Global Competitiveness Index 2016-17	
	Ranking (1-128)	Score (0-100)	Ranking (1-138)	Score (1-7)
South Africa	**54**	**35.85**	**47**	**4.47**
BRICS				
Brazil	69	33.19	81	4.06
China	25	50.57	28	4.95
India	66	33.61	39	4.52
Russia	43	38.50	43	4.51
Knowledge economies				
Finland	5	59.90	10	5.44
South Korea	11	57.15	26	5.03
Switzerland	1	66.28	1	5.81
United States	4	61.40	3	5.70
Other African economies				
Kenya	80	30.36	96	3.90
Mauritius	53	35.86	45	4.49
Nigeria	114	23.15	127	3.39

Source: WEF (2016), Cornell University, INSEAD, and the WIPO (2016)

The innovation system can rely on a strong tradition of academic excellence

One of South Africa's areas of strength is the tradition of excellence in academia and public research. This can provide a foundation for strengthening innovation activity in the private sector. Three of South Africa's universities – the University of Cape Town, the University of the Witwatersrand, and Stellenbosch University – are ranked among the world's 500 best universities.[31]

The standard indicators of science impact also show an above-average performance (see Table 2.2). The international collaboration on publications is also more widespread than in other BRICS countries, indicating deeper integration in the global scientific community. Furthermore, public research institutions traditionally account for most of South Africa's patents (Table 2.3).

Table 2.2: Scientific production in BRICS countries

Country	Normalized citation impact index: 2003–2012	International collaboration among institutions (% of documents): 2003–2012
Brazil	0.77	24.9
China	0.66	15.0
India	0.71	17.4
Russia	0.50	30.9
South Africa	**1.10**	**42.7**

Source: OECD (2015a)

[31] Based on Times Higher Education (2017a, 2017b).

Table 2.3: Patent Cooperation Treaty top applicants
(publication year 2015)

Applicant	Publication
Stellenbosch University South African Sugarcane Research Institute	18
University of Cape Town	10
University of The Witwatersrand	9
Detnet South Africa (Pty) Ltd	8
University of Pretoria	8
CSIR	7
Sasol Technology (Proprietary) Limited	5
Stopak (Pty) Ltd	5
Discovery Limited	4
NCM Innovations (Pty) Ltd	4

Source: WIPO (2017)

South African researchers have produced a number of globally important innovations over the years – including the CAT scan, the tellurometer (the first successful microwave distance measurement device), the digital laser, and genetically modified disease-resistant crops suitable for African soil. A strong intellectual property rights regime plays an important role in protecting domestic inventions.

South Africa also continues to make major investments in "big science" facilities, often as part of international consortia. For example, the Council for Scientific and Industrial Research introduced the fastest supercomputer on the African continent in 2016, opening new possibilities for conducting world-class research projects. The Southern African Large Telescope in Sutherland is the largest single optical telescope in the southern hemisphere. The Square Kilometer Array project, which is under way in collaboration with 11 other countries, will bring foreign investment into the country and create jobs.

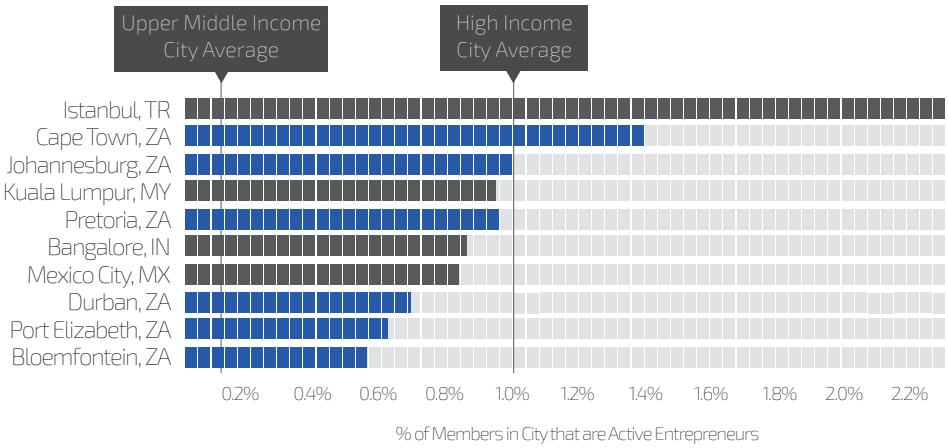
Entrepreneurs and innovative activities cluster in a few cities

Cape Town is home to the largest number of information technology-based companies on the African continent, including between 700 and 1,200 active start-ups. Johannesburg has between 200 and 500 active start-ups. LinkedIn data show that Cape Town, Johannesburg, and Pretoria have a large base of active entrepreneurs that outstrips that of similar cities in other countries (Figure 2.5). The Global Startup Ecosystem Report 2017 ranks Cape Town and Johannesburg relatively high for their availability of experienced software engineers.[32] Even at the lower end of the spectrum, Durban, Port Elizabeth, and Bloemfontein have more active entrepreneurs than the upper-middle-income city average. Taken as a whole, the results support the view that South Africa is an attractive environment for entrepreneurs, and is building a steady pipeline of entrepreneurship-related skills.

LinkedIn data also suggest that the percentage of members who are active entrepreneurs in the South African metros is closely associated with the capacity of the universities in the same cities to produce entrepreneurs and the capacity of the cities to retain skilled migrants. The share of immigrant start-up founders of 18 percent in Cape Town and 17 percent in Johannesburg is comparable to the global average of 19 percent. However, start-ups in both cities experience difficulties with bringing in foreign employees – the visa success rate is 36 percent in Cape Town and 20 percent in Johannesburg.[33] As a result, most start-ups focus on the domestic market. Foreign customers comprise only 14 percent of clients for start-ups in Cape Town and 11 percent in Johannesburg, compared to the global average of 23 percent.

[32] Startup Genome (2017).
[33] Startup Genome (2017).

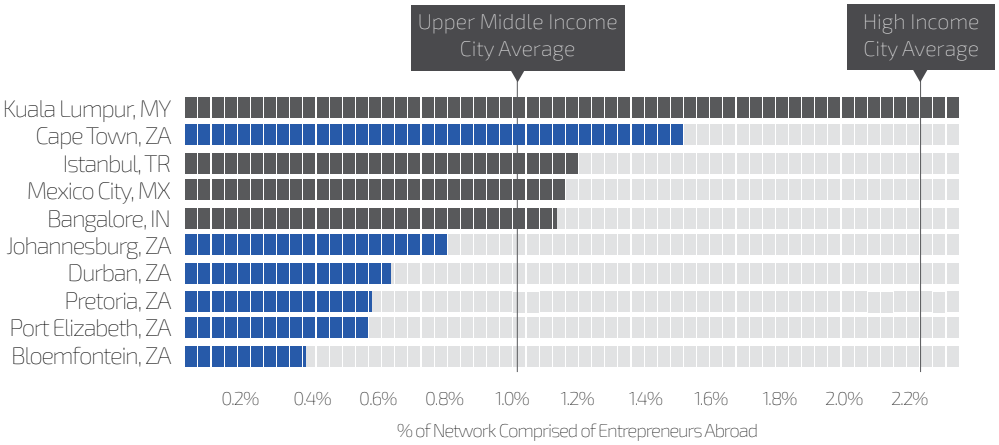
Figure 2.5: Percentage of LinkedIn members per city that are active entrepreneurs



Source: World Bank staff calculations based on LinkedIn data, 2017

The success of entrepreneurs is often closely linked to the support systems and networks available to them. Large metros in South Africa are relatively good at building local entrepreneur support communities such as meet-ups, incubators, and accelerators. But more could be done in smaller cities. The bigger opportunity seems to be international connectedness, where most South African cities, bar Cape Town, lag behind comparable cities and global benchmarks (Figure 2.6). This may contribute to South Africa's limited capacity to catch up with global technological leaders.

Figure 2.6: Percentage of LinkedIn networks comprised of entrepreneurs abroad



Source: World Bank staff calculations based on LinkedIn data (2017)

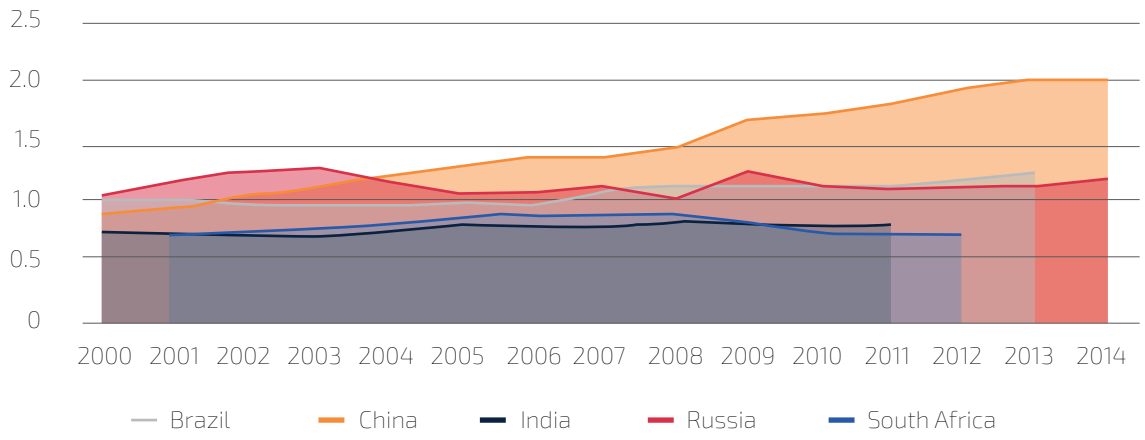
Overall R&D intensity in South Africa is low

Although the private sector accounts for most of South Africa's R&D spending, it is also the main contributor to its decline since 2008. At 0.8 percent of gross sales of medium and large firms,[34] South Africa lags far behind top performers such as South Korea and Finland, but also behind comparable countries like Estonia and Slovenia. As most innovations are brought to the market by firms, low and declining R&D spending by South Africa's private sector may have negative consequences for the competitiveness of the economy (Figure 2.8).

[34] SARS-NT dataset.

Figure 2.7: R&D expenditure in BRICS countries

(Percentage of GDP)

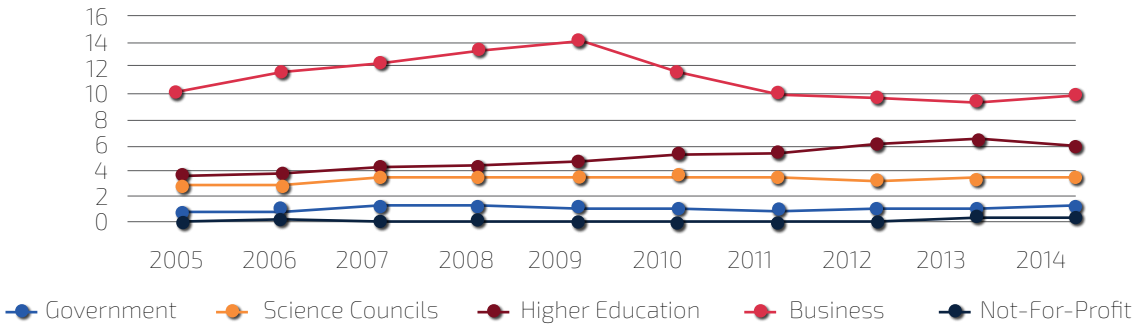


Source: World Bank (2017a)

Although the private sector accounts for most of South Africa's R&D spending, it is also the main contributor to its decline since 2008. At 0.8 percent of gross sales of medium and large firms,[35] South Africa lags far behind top performers such as South Korea and Finland, but also behind comparable countries like Estonia and Slovenia. As most innovations are brought to the market by firms, low and declining R&D spending by South Africa's private sector may have negative consequences for the competitiveness of the economy (Figure 2.8).

Figure 2.8: Private R&D spending by sector in South Africa

(billions, in 2010 rand values)



Source: HSRC (2017)

The decrease in private R&D spending may signal a growing disconnect between the capabilities and focus areas of public research institutions and the activities of the private sector. If true, the impact of public investment in science can be multiplied by putting in place mechanisms for industry collaboration. For example, public-private partnerships on carbon capture and storage have contributed to progress on climate change mitigation (see Box 2.1). The South African government has established several programs to promote technology transfer and collaboration between public research institutions and industry, some of which are described below. However, these programs have not yet been systematically evaluated.

[35] World Bank (2011).

Mining, manufacturing, and ICT innovation

South Africa's mining industry has historically been a major contributor to intellectual property. South African producers received global recognition for their expertise in deep mining and related services. Many local mining equipment manufacturers compete successfully with multinational companies in global markets. South Africa's leadership in mining technology is also reflected in its large number of high-quality patents.[35] Strong expertise in mining is an important asset that can be leveraged to diversify into other sectors of the economy.

The manufacturing sector has traditionally relied on reverse engineering and manufacturing "clones" of products developed elsewhere. Most locally manufactured products fall in the medium-tech category. Although there are some pockets of excellence in high technology, they remain fairly disconnected from each other, with no strong clusters or inter-industry linkages. They also find expression in the regional (rather than global) value chain: South Africa has emerged as a hub for exports of manufactured goods into other African countries.

New industries such as ICT, biotechnologies, and clean technologies have emerged and grown over the years. However, with a few exceptions, South Africa is far behind OECD and emerging economy champions in these fields. ICT capabilities have become particularly important: innovation across different sectors is increasingly driven by digital technologies and the new business models they enable. The average allocation of global R&D spending for software and services increased from 54 percent to 59 percent between 2010 and 2015, and is expected to grow to 63 percent by 2020, according to a study on the 1,000 most innovative companies.[36]

South Africa has benefited from the global spread of information technologies. The increasing rates of Internet access and the nearly universal access to mobile phones have laid a foundation for delivery of basic e-services, online job platforms, and the spread of e-commerce. It has also enabled the adaptation of digital platforms invented elsewhere. Although there are several success stories in financial technology (such as Snapscan and Yoko), education (GetSmarter and Snapplify), e-health (LifeQ), online job platforms (Giraffe, SweepSouth, Domestly, OfferZen), and other fields, the information technology industry in South Africa remains relatively small. It contributes less than 3 percent of GDP and 17.5 percent of service exports, compared to 55 percent of service exports in Brazil and 40 percent in China.[37]

Where have "gazelles" and "unicorns" gone?

Globally, young high-growth firms, known as "gazelles", are playing a leading role in innovation. Young firms tend to be responsible for a higher share of patents and to hold patents for more radical inventions.[38] South Africa has the lowest share of young firms among emerging economies for which data are available, and this share has been declining over time. Exit rates are also low, suggesting that less productive firms stay in business, limiting the reallocation of resources, such as skilled labor, towards more productive firms. Given the transformative role played by gazelles around the world, South Africa's small and diminishing cohort of young firms is a concern.

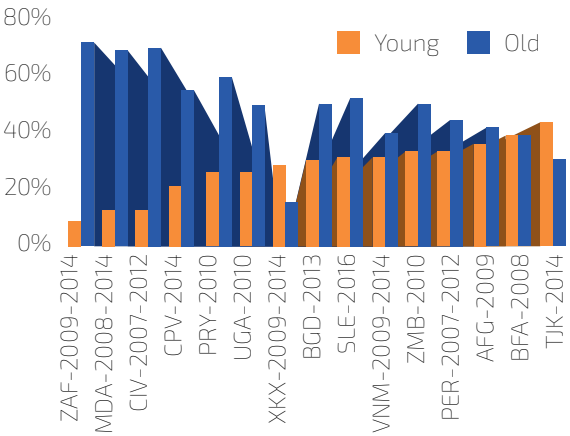
*Most South African startups operate at **a small scale***

[36] PricewaterhouseCoopers (2016).
[37] World Bank (2017a).
[38] OECD (2015b).

Figure 2.9: Share of young firms in South Africa and other emerging economies

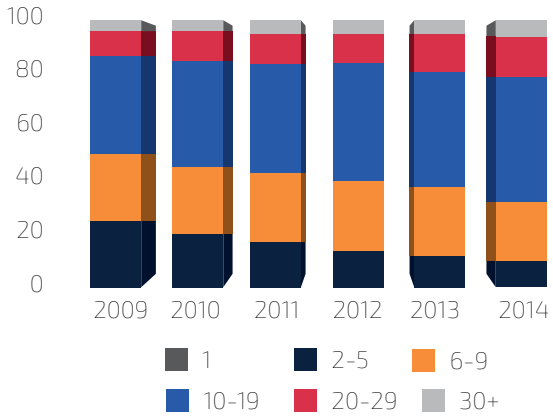
A. The share of young firms (age<=5) in South Africa is lower than in other emerging economies

Employment Distribution by Age



B. The share of young firms (age <=5) is declining over time

Distribution of Firms by Age



Young Firms: age 1 to 5
Old Firms: age 10+
ZAF: South Africa; MDA: Moldova; CIV: Cote d'Ivoire; CPV: Cape Verde; PRY: Paraguay; UGA: Uganda. XKX: Kosovo; BGD: Bangladesh; SLE: Sierra Leone; VNM: Vietnam; ZMB: Zambia; PER: Peru; AFG: Afghanistan; BFA: Burkina Faso; TKJ: Tajikistan

Source: National Treasury and World Bank staff calculations based on SARS-NT data

Most South African start-ups operate at a small scale; few have international customers or ambitions to enter global markets. Lack of outward orientation may have contributed to the absence of a "unicorn" in South Africa – a start-up with a stock market valuation of about US$1 billion. Some smaller nations have been more successful in producing high-value start-ups: Sweden, with a population of 10 million, has five unicorns, Poland has two, and Portugal has one. In contrast, South Africa is not creating and retaining new businesses valued at a quarter of this amount. Elevation Holdings concludes that the problem is not the absence of unicorns, but the shortage of young high-growth firms.[39]

Factors that stifle the emergence of gazelles include business environment constraints, the skills shortage, and inadequate ICT infrastructure. Furthermore, although there are several public programs that aim to promote private innovation, they tend to be poorly coordinated and underfunded.

Private sector R&D expenditure levels are low despite large returns

The availability of SARS-NT tax files data (covering about 600,000 firms each year) provides an opportunity to comprehensively assess patterns of private R&D and usefully complement regular R&D surveys conducted by authorities (Box 2.2). It also allows for improved comparison with countries such as France and the United States, where the same type of data and analytical frameworks were used.[40]

[39] Elevation Holdings (2017).
[40] Hall and Mairesse (1995, 1996).

Box 2.2: Using tax files data to assess private R&D patterns

Most studies of private innovation conducted in developing countries rely on surveys involving interviews with top executives from a sample of firms. This approach offers some advantages in the breadth and depth of issues that can be covered. However, as with all methodologies, there are shortcomings.

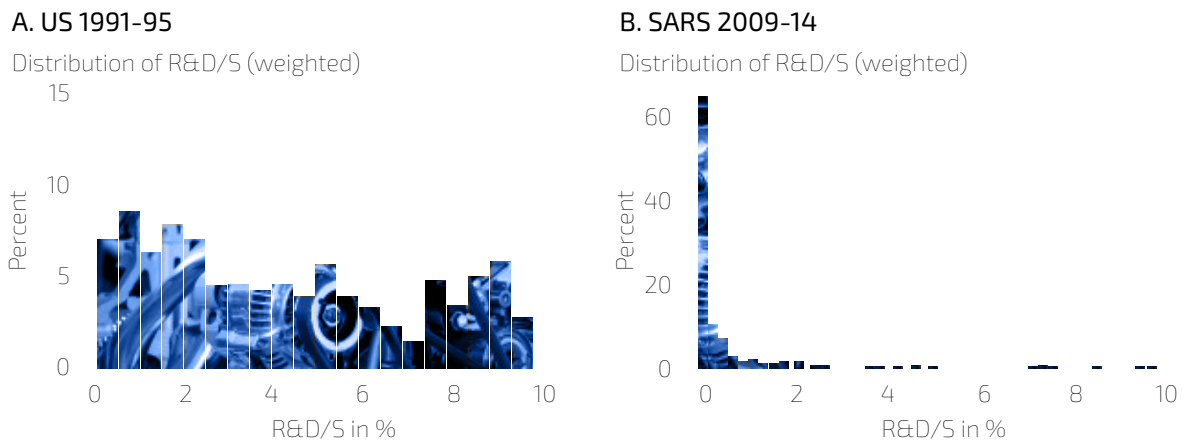
Questionnaire size and interview duration have been found to have a significant impact on the quality of responses, and it is not uncommon for self-reported financial information to be skewed. Surveys frequently target larger firms or firms in sectors where R&D is concentrated, which means the activities of a vast number of SMMEs go unreported. Micro and small firms are more likely to report marginal improvements as innovations, while large firms tend to report only new-to-the-market or new-to-the world innovations. Similarly, firms in less developed countries are more likely to report innovation activities than firms in higher-income economies because of different perceptions about what constitutes a significant improvement (World Bank, 2017c).

The approach used by this report uses a tax administrative dataset, which avoids the issues mentioned above. However, that does not mean that this analysis does not have its limitations: changes in tax reporting forms present a significant problem as the consistency across the panel of data is limited in certain aspects; only formal, registered firms are captured by such a database, and so the informal section of the economy is not represented; finally, there is no straightforward measure of innovation and, as a result, this study made use of proxies such as R&D expenditure and the export of products with high technological content embedded in them.

Descriptive firm-level findings using the SARS-NT dataset reinforce some of the issues already identified in R&D surveys,[41] but they also provide new information. Specifically, the data show that only a small percentage of predominantly old and large firms invest in R&D and they tend to do it on an ad hoc basis rather than through regular R&D programs. About 4 percent of medium and large South African firms invested in R&D between 2009 and 2014. Among the active R&D firms, only 4.9 percent reported R&D expenditure in every financial year over the same period, while about a third reported R&D expenditure in a single year only.

The intensity of R&D (sales weighted ratio of R&D expenditure divided by gross sales in percent) is much smaller in South Africa than in France and the United States (Figure 2.10 left panel). Manufacturing firms active in this space have an average R&D intensity of 0.4 percent, compared to 2.9 percent and 2.3 percent for U.S. and French firms respectively.[42] Figure 2.10 (right panel) shows that about 80 percent of South African firms have an R&D intensity ratio of less than 0.5 percent over the 2009 to 2014 period, compared to only 10 percent in a sample of R&D active firms in the United States from 1991 to 1995.

Figure 2.10: R&D intensity in the United States (1991–95) and South Africa (2009–14)



Source: Compustat and SARS-NT panel. Note: R&D intensity ratios weighted by sales

[41] Department of Science and Technology (2017).
[42] Hall and Mairesse (1996).

Manufacturing accounts for most of the R&D, followed by mining and the business services subsector (finance, insurance, and real estate). Within manufacturing, the pharmaceuticals, chemicals, and electrical machinery subsectors are most likely to invest in R&D (Table 2.4). R&D intensity in manufacturing is low compared to advanced economies, apart from aircraft and boats, where the R&D intensity exceeds that of the United States.

Table 2.4: R&D expenditure and intensity by sector

(Medium and large firms)

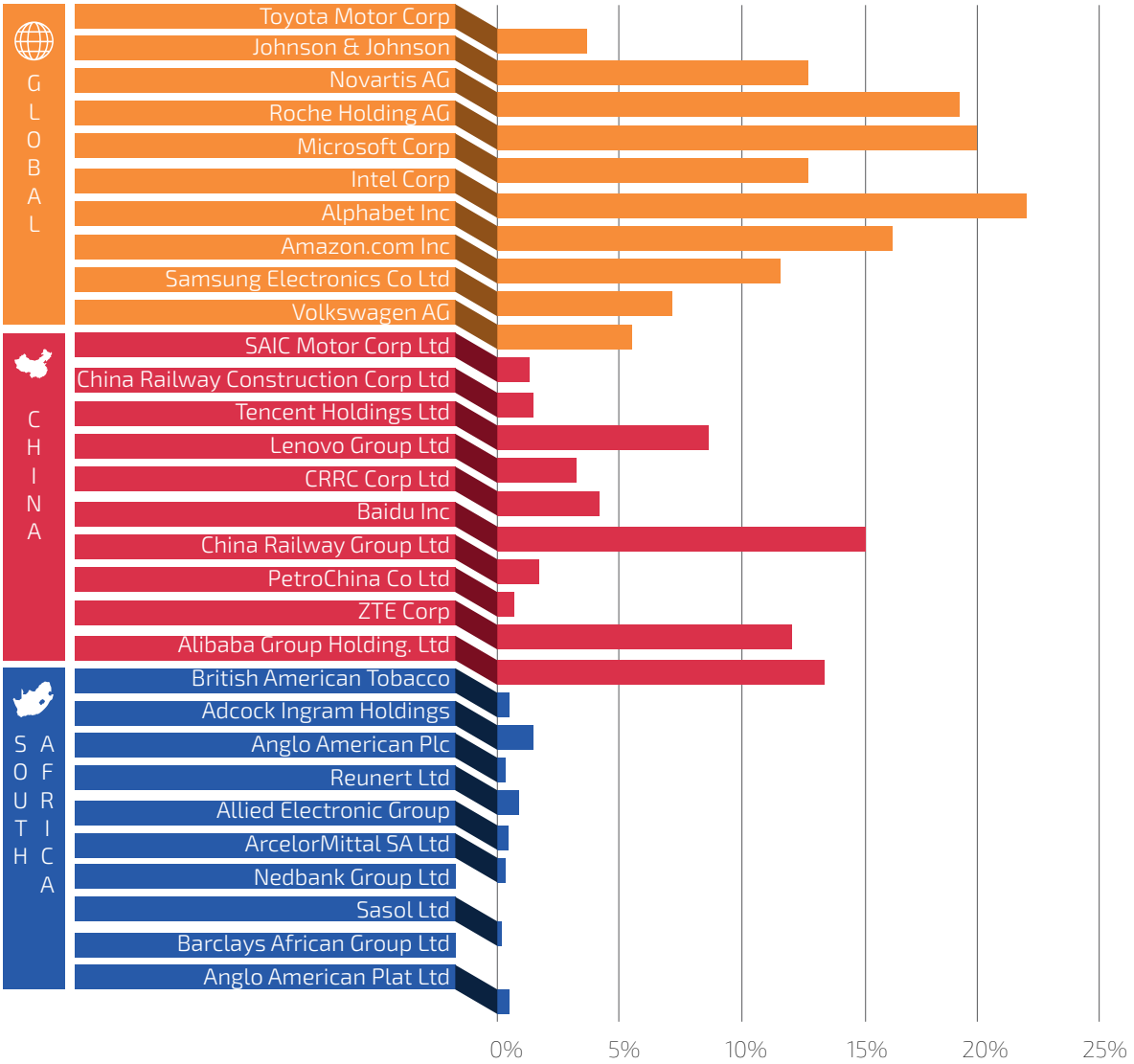
Sector	South Africa (2009–14)	
	% of firms with R&D expenditure by sector	Weighted mean R&D to sales ratio
Paper and printing	3.47	0.16
Chemicals	11.19	0.29
Rubber	6.41	0.19
Wood and miscellaneous	7.15	0.48
Primary metals	5.51	0.19
Fabricated metals	4.88	0.33
Machinery	5.67	0.88
Electrical machinery	9.78	0.27
Autos	3.04	0.37
Aircraft and boats	3.9	4.22
Textiles and leather	3.94	0.33
Pharmaceuticals	17.24	1.57
Food products	7.83	0.22
Computers and instruments	9.01	0.82
Oil products	4.05	0.45
Manufacturing	6.02	0.39
Agriculture	5.06	1.08
Mining	5.12	0.31
Electricity, gas, and water	6.16	0.26
Construction	1.4	0.1
Services	2.79	0.22
Total	4.02	0.32

Source: World Bank staff calculations based on SARS-NT data

A comparison of South Africa's top R&D spenders listed on the Johannesburg Stock Exchange (JSE) with world leaders and top Chinese companies also suggests a concentration in traditional activities, such as finance, mining, and minerals, as opposed to software, computing, and electronics. The R&D intensity of these international companies is also much higher on average than that of the top 10 JSE-listed R&D spenders (Figure 2.11).

Figure 2.11: R&D intensity of top global, Chinese, and South African R&D spenders

(Percentage of R&D spending over gross sales, 2012–16)



Source: World Bank staff calculations

Low economic returns for R&D could explain South Africa's low private investment levels. However, our research, using a methodology[43] linking firms' economic performance (measured by sales) to their cumulative R&D spending (as a proxy for innovation capacity), suggests otherwise.[44]

Results obtained based on all South African firms declaring R&D spending over the period 2009 to 2014 suggest that the R&D rate of return in South Africa is high, ranging from 118 percent to 294 percent depending on the specification. This is higher than the results[45] for France and the United States, where the R&D rate of return is estimated between 28 percent and 78 percent depending on the type of estimation used, and significantly higher than the estimated rate of return of between 8 percent and 35 percent in Taiwan.[46]

Low investment in R&D despite high returns is common in developing countries and has been recently described as "the innovation paradox". As argued by Schumpeterian economists, countries further from the technological

[43] Results were obtained using an econometric methodology similar to that used for France and the United States (and to our knowledge, never applied to any developing country before South Africa).
[44] See Schaffer et al. (2017) for detailed results.
[45] Hall and Mairesse (1995, 1996).
[46] Wang and Tsai (2003).

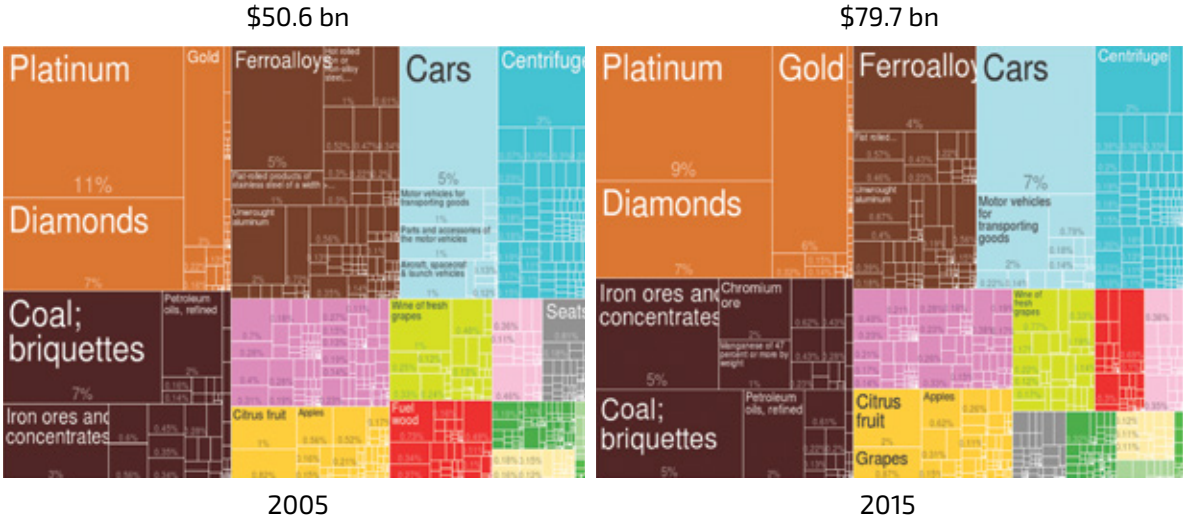
frontier can achieve strong gains from technological catch-up and should have higher rates of return. Griffith et al. (2004) find that the return to R&D in OECD countries increases with distance to frontier, and extrapolation of these results to developing countries shows a potential rate of return of between 200 percent and 300 percent.[47] However, developing countries invest much less in R&D as a share of GDP than developed economies.

Globally, a number of framework conditions and contextual factors contribute to this pattern. Weak human capital and management capabilities may result in a situation when firms are not able to identify the best technological solutions and organizational practices relevant for their business. Restrictive labor laws and policy uncertainty also reduce the appetite for risk associated with innovation. Distortions in capital and product markets can reduce firms' returns to R&D. In the case of South Africa, policy uncertainty, red tape, the skills shortage, and logistical bottlenecks (in transport and ICT, for example) likely contribute to this trend.

Innovation is concentrated in medium-tech products

Weak innovation in the private sector is reflected in the lack of export diversification over the past two decades, with high-tech exports constituting a small share of total manufacturing exports compared to other BRICS countries. However, there has been some improvement since 2010 (Figures 2.12 and 2.13).

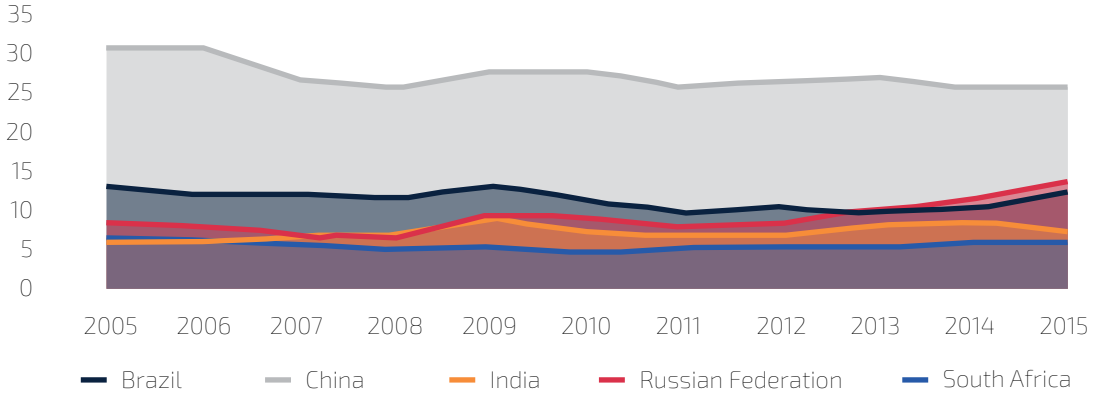
Figure 2.12: South African exports (2005 vs 2015)



Source: Haussman et al. (2017)

Figure 2.13: High-tech exports in BRICS countries

(As percentage of manufactured exports)



Source: World Bank Group (2017); Comtrade Database

[47] World Bank (2017c).

The availability of firm-level transaction data provides a more detailed view of how product innovation is affecting the export basket. South Africa is one of the first developing countries to conduct such a transaction-level analysis.

Following the OECD methodology, South African export products are classified into four categories: low technology, medium-low technology, medium-high technology, and high technology. Box 2.3 describes these groups of products from a qualitative perspective.[48]

Box 2.3: What does high-tech really mean?

Low technology: These products tend to have stable, well-diffused technologies. The technologies are primarily embodied in capital equipment, with relatively simple skill requirements in terms of the labor employed. Many traded products in this category are undifferentiated and therefore rely on price structures to be competitive. As a result, labor costs present a significant consideration for firms operating at this level. Scale economies and barriers to entry are generally low. Developing countries tend to express great interest in this technological area, and as a result place greater focus on price competition than quality competition. The majority of goods produced within this technological band have moved from high-income to low-income countries.

Medium technology: This technology makes up the bulk of skill- and scale-intensive technologies in capital goods and intermediate products, forming the mainstay of industrial activity in mature economies. They tend to have complex technologies with moderately high levels of R&D, advanced skill needs, and longer learning periods. This category is further broken down into medium-low and medium-high technology.

High technology: Products with advanced and fast-changing technologies, with high R&D investment, and an emphasis on product design. Advanced technologies often require sophisticated infrastructure, specialized technical skills, and close interactions between firms, as well as between firms and research institutions.

Using these definitions, high-tech products accounted for only 7 percent of the South African export basket in 2014, while "other" and medium technologies comprise the bulk of exports (Table 2.5). This is not surprising given that South Africa is known for its exports of minerals and resource-based products – all of which make up the category of "other". This indicates that South Africa mostly operates in the medium-tech space, which typically involves complex technologies, with moderate to high levels of R&D investment.

A detailed review of the export trends from 2010 to 2014 shows growth in both low- and high-tech products. There has been a gradual decline in the share of medium-tech and resource-based products, which were arguably South Africa's most competitive manufacturing industries. Unlike many other developing nations, South Africa is not trapped in low-technology exports, and has the capacity to further upgrade its technologies and compete on quality and price.

Table 2.5: Export value of different technology levels in South African total exports

(As percentage of manufactured exports)

Country	2010	2011	2012	2013	2014
Low technology	11.7	11.0	11.3	12.9	13.0
Medium-low technology	27.7	22.0	23.3	24.1	24.9
Medium-high technology	22.4	24.8	23.9	22.6	22.0
High technology	5.1	5.8	6.1	6.0	7.1
Other	33.2	36.4	35.4	34.4	33.0

Source: World Bank staff calculations based on SARS-NT data

[48] See Lall (2000) for a detailed discussion on the technological content of goods, and Flowerday et al. (2017) for an application to South Africa's exports.

The findings of Flowerday et al. (2017) show that a 1-unit increase in R&D intensity[49] results in a 2.7 percent increase in the probability of the firm being high-tech. In addition, sectors such as transport and storage; electricity, gas, and water; ICT; and professional technical and scientific activities show the greatest likelihood of having high-tech firms.[50] The results suggest that industries (and firms) that are investing in R&D are more likely to be high-tech. Limited private R&D is reflected in slow diversification of new products: the main exports per technology group remain the same. The five-year period under analysis showed little movement in the top five products per technology classification. Table 2.6 reports the top five exports per technology group in 2014.

Table 2.6: South Africa's top five export products per technology group (2014)

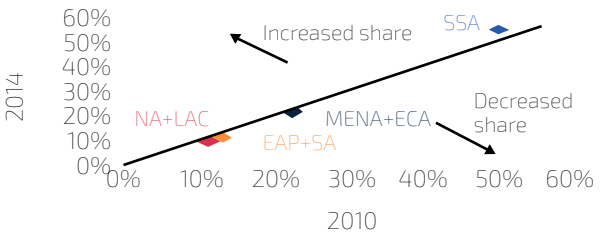
High Technology	Low Technology
Engines for aircraft	Wine
Turbo-jets	Wood pulp
Telephones for cellular networks	Wood
Aeroplanes and other aircraft	Diamonds
Ammunition	Coin
Medium-High Technology	**Medium-Low Technology**
Acyclic hydrocarbons	Petroleum oils
Alcohols	Metals; platinum, unwrought or in powder form
Machinery; for filtering or purifying gases	Metals; platinum, semi-manufactured
Machines for sorting, screening, separating, washing, crushing, agglomerating, shaping or molding	Metals; palladium, unwrought or in powder form
Vehicle parts and accessories	Ferro-alloys

Source: World Bank Group (2017); Comtrade Database

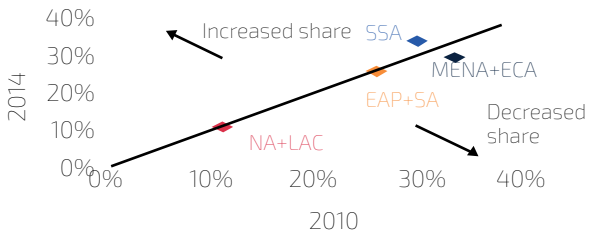
Limited diversification is also reflected in the technological composition of exports according to their destination, which remained almost unchanged between 2010 and 2014. South Africa increased its export share in Sub-Saharan Africa slightly, in both high and medium-high tech markets and low and low-medium tech markets. South Africa can enjoy a steady client-base, but has not been breaking into many new markets through innovation.

Figure 2.14: Technological content of exports per destination (2010-14)

High and Medium-High



Low and Medium-Low



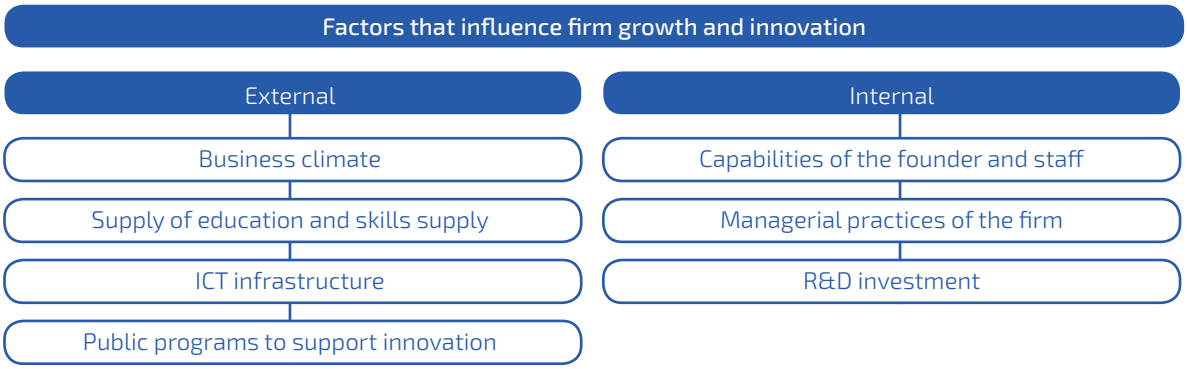
Source: World Bank Staff calculations using SARS-NT data. Notes: SSA: Sub-Saharan Africa; EAP: East Asia and Pacific; SA: South Asia; ECA: Europe and Central Asia; MEN: Middle-East and North Africa. NA: North America; LAC: Latin America and Caribbean.

[49] Either by increased R&D, decreased sales, or a faster increase in R&D expenditure than the increase in sales.
[50] When using the mining industry (the original backbone of the South African economy) as the basis for comparison.

What More Can Be Done to Encourage Private Innovation in South Africa?

Innovation activity is influenced by a range of internal and external factors, as shown in Figure 2.15. South Africa's business environment lags behind that of fast-growing knowledge economies. Policy uncertainty, red tape, expensive trade logistics, and limited competition in key product markets hinder the entry and growth of young and small firms. While the quality of the higher education and research system compares well to that of other emerging economies, it cannot resolve the highly uneven distribution of skills across the population alone, and migration data points to a large-scale net skills loss towards more advanced economies.

Figure 2.15: Internal and external factors affecting innovation



The government has put in place a sophisticated system to support entrepreneurship, technology absorption, and innovation in the private sector. Few upper-middle-income economies have developed such a wide range of instruments – including incubators, matching grant schemes, employee training, tooling centers and tax incentives – to encourage entrepreneurship and innovation. The availability of public support programs is a clear benefit for entrepreneurs, no less than for established firms. However, the design of some of the programs can be improved to make them more targeted to the needs of the domestic private sector. Furthermore, the multiplicity of programs, combined with relatively small budgets, fragments public efforts to support R&D, industrial development, and entrepreneurship.

Below we discuss some of the factors that influence innovation activity and outline policy considerations that could improve the environment for innovation.

Foster a business climate that is conducive to innovation

Nurturing South Africa's entrepreneurs and innovative companies requires a business climate that is more conducive to the entry and growth of new firms, and to risk-taking and experimentation.

Reviewing product market regulations that favor incumbents is a priority that was discussed in detail in the 8th South Africa Economic Update. A level playing field that creates competitive pressures for incumbents could stimulate investments in technological upgrades, and lead to the exit of less productive firms, enabling resources to be put to better use.

Cutting red tape is important to reduce regulatory compliance costs, which tend to affect small and young firms disproportionately. South Africa ranks 74th in the world for ease of doing business – the fourth-best performance in Sub-Saharan Africa (based on the World Bank's Doing Business 2017 Report). But it is far behind knowledge economies. SMMEs need to go through seven procedures and spend 43 days just to register a business. It takes on average 141 days to get a construction permit and 84 days to get an electricity connection. Hindering regulations and policies were recognized as the second most important

constraint after skills deficit by SiMODiSA, a South African nongovernmental organization that promotes entrepreneurship.[51]

One avenue to enhance the business environment is through legal reforms, but there are many areas where short-term improvements can be made through peer learning among subnational governments. This is one of the main findings of the Sub-National Doing Business 2015 Report:[52] by combining the best practices from the nine largest metros in obtaining construction permits, getting electricity connections, and enforcing contracts, South Africa's relative performance could be boosted to a level above the average in high-income OECD countries. The City Support Program at the National Treasury, with support from the World Bank, is rolling out several initiatives to foster regular dialogue, identify regulatory best practices, and share experiences between municipal authorities.

As mentioned in Chapter 1, policy uncertainty is a likely reason for the observed drop in investment. In the case of innovation, delays and uncertainties surrounding the reform of South Africa's intellectual property rights regime have been a longstanding cause of concern, and limits the usefulness of patents granted in the country. This translated into a slippage on global reviews of intellectual property policy: in the International Property Rights Index, the country's score stagnated from 2007 to 2016, and its ranking dropped from 25th to 46th place. Similarly, the Global Intellectual Property Center (2017) highlights weaknesses in the intellectual property rights regime, particularly in the area of patents. Disagreements about the direction of the reform[53] have left researchers, entrepreneurs, and companies having to operate in an environment with a legal framework that is two decades out of date. The government relaunched the consultation on intellectual property rights reforms last year and Cabinet has approved the draft Intellectual Property Framework. This is an important milestone. The reform has received positive reviews for its phased introduction of a substantive search for and examination of patents, as well as its alignment with the Agreement on Trade-Related Aspects of Intellectual Property to promote policy goals in spheres such as health, industrialization, and the environment. Uncertainty regarding the future of power purchase agreements, the copyright amendment bill, and the ICT regulatory framework (discussed below) may also deter investment in innovation.

Although South Africa has a well-developed and sophisticated financial system, access to finance is a major constraint to small business growth.[54] In fact, a survey in 2010 revealed that less than 5 percent of small businesses relied on formal financial institutions for funding.[55] Their access to credit is constrained by two factors – lack of suitable financial products offered by banks and inadequate capacity of small business founders to present their funding needs to financial institutions. The government, through its Small Enterprise Finance Agency, is working with banks to de-risk small business lending and provide direct loans to these enterprises. It will be important to scale up these programs.

Relative to the size of the financial system, the venture capital raised by South Africa's start-ups remains small, with a recent report estimating that in 2016, 28 start-ups received $98 million, putting the country in second place in the region behind Nigeria (to put this into perspective, Austrian start-ups raised a similar amount in 2016, whereas start-ups in Russia and Finland raised up to four times more in total).[56] Experts from the industry have commented that the venture capital deals in South Africa are helping to connect global investors with domestic start-ups focused on deploying clones of digital business models in the local market, but point to the scarcity of venture capital funding for new-to-the-world technology from South Africa that aims to reach global markets. To identify growth drivers, further research is needed into the types of early-stage companies that are getting funding. Policy options for growing equity investments into young high-growth firms then need to be reviewed.

As discussed earlier, a large share of innovation efforts are concentrated in goods. Innovative companies are more likely to export their products compared to those that do not innovate. Most South African products are exported by sea. Although port costs have declined significantly since 2012, they remain 88 percent higher than the global average in 2016/17.[57] Bringing down the cargo and inland handling costs, and improving port efficiency, can support innovation. Apart from the high

[51] SiMODiSA (2014).
[52] World Bank (2015a).
[53] As in many countries, one particularly contentious issue is how to strike a balance between protecting domestic inventions and ensuring affordable access to pharmaceuticals developed in the rest of the world.
[54] SiMODiSA (2016) and SME Survey (2015).
[55] Finmark (2010).
[56] Sources: https://www.linkedin.com/pulse/vc-funding-raised-african-tech-startups-totals-record-cyril-collon; https://blog.dealroom.co/wp-content/uploads/2017/01/2016-European-Venture-Capital-Report.pdf.
[57] Ports regulator of South Africa (2017).

cost relative to rival ports in emerging and developed countries, South Africa's port tariffs continue to favor the transport of minerals over manufactured goods. This increases the cost of technology absorption that occurs via the import of capital goods in the form of advanced technology. Importantly, port costs make the country a less competitive destination for export-oriented industries.

Innovation itself can play a major part in reducing costs and cutting red tape, because e-government solutions can simultaneously improve services and stimulate the growth of the domestic ICT industry. One-stop shops and electronic platforms for public service delivery introduced in various emerging economies have reduced the time and cost of complying with government regulation and mitigate the risk of corruption. For example, coordinating e-government solutions and spatial data infrastructure could improve the property registration process, because programs are currently running in parallel without common standards and clear interoperability. Cities are at different stages of automation and of updating records, but most would benefit from putting in place an online tracking system for checking the progress of registering deeds or a simple online database that links the deeds registry and the Surveyor-General's Office and includes information about associated mortgages, restrictions, and other encumbrances.

Nurture innovation ecosystems in cities

Around the world, the growth of cities has gone hand-in-hand with economic progress and social change. Competitive cities provide an enabling environment for firms and industries to create jobs, raise productivity, and increase the income of urban citizens. The World Bank's report on competitive cities shows that 70 percent of cities globally outperformed their countries in productivity.[58] Several South African metros are already hubs for innovation, and are actively attracting entrepreneurs and putting in place policies that will help them grow their businesses and create local jobs. As already noted, simply scaling up the best practices of the top performing cities can significantly improve the local and national business environment.

Cape Town and Johannesburg have received regional recognition for the quality of their entrepreneurial ecosystem. Their municipal governments are taking active measures to support entrepreneurship. For example, Johannesburg hosted 180 start-up events in 2016 and was the first African city to host the prestigious 2017 Global Entrepreneurship Congress. Both city governments invested in incubators and accelerators to provide financial and mentoring support for start-ups and have taken steps to improve public infrastructure and the business climate. Cape Town ranks better than other South African cities on the quality of its business environment, as measured by the Sub-National Doing Business 2015 Report.

Other cities in South Africa are also working to improve the environment for innovation. InnovateDurban has recently been established by the eThekwini Municipality and other key partners to create a common platform for innovation in the city. The entity will focus on creating awareness, building capacity and skills, encouraging community involvement, boosting public and private sector innovation, and creating fundamental linkages between all stakeholders.

South Africa's three largest metros – Johannesburg, Cape Town, and Durban – have emerged as hubs of innovation and magnets for talent, spurred by the excellence of their academic institutions, the quality and cost of living, and overall agglomeration economies.[59] In addition, these cities already have many of the critical building blocks for an innovation system, such as incubators, co-working spaces, fabrication labs, technology transfer offices, and technical and vocational education and training colleges. This is a fertile ground on which to grow. Interviews with city stakeholders (public, private, and civil society) suggest several opportunities:

- Developing city-level strategies for innovation and entrepreneurship, focusing on putting in place programs that tie together the network of fragmented initiatives already in place, and encouraging research and innovation facilities to be co-located to create real "innovation districts" that bring more global recognition and capitalize on existing strengths. The development of these strategies would also help to put the concepts of innovation and entrepreneurship closer to the center of the economic development agendas of municipal governments, mobilize bigger volumes of funding, and improve resource allocation.

- Fostering partnerships between the public and the private sector, and particularly between academic

[58] World Bank (2015b).
[59] Agglomeration economies originate from the geographical concentration of economic factors, notably human capital, which facilitates intellectual and commercial exchanges.

institutions and private companies of different sizes, to further leverage existing public research capacity. Programs that stakeholders mention range from open data initiatives that would use data collected by cities to develop commercial applications and improve service delivery, to projects enabling better access by start-ups and SMMEs to experts and equipment in the public research and education system, to creating centers of excellence and encouraging collaborative research programs between companies and research institutions. Some of these partnerships can be started at city level, but many would also require support and funding from national departments.

From a national perspective, consideration needs to be given to building on existing resources, networks, and partnerships in the largest metros when allocating resources to spur innovation. This may contradict balanced development objectives, but it will effectively raise the impact of public programs aimed at encouraging innovation.

Building the skills base: Invest in technical and entrepreneurial skills, and encourage the migration of skills to South Africa

Skilled labor is crucial to maintain the competitiveness of traditional sectors and develop new industries. Although South Africa's share of university graduates has increased, it remains low by international standards.[60] University graduates receive high returns on education; only 1.9 percent are unemployed. The skill premium in some occupations is so high that it may threaten the competitiveness of knowledge-intensive sectors. Overall, the average return for an additional year of schooling in South Africa is the second highest in the world after Rwanda.[61] Salaries in several knowledge-intensive occupations are higher than in other emerging economies (Table 2.7).

Table 2.7: Median annual salary of selected jobs

(As of March 24, 2017)

High Technology	South Africa, USD	India, USD	Malaysia, USD
Software developer	20,090	6,052	12,848
Software engineer	24,911	6,724	12,327
Senior software engineer	41,356	11,259	20,240
Systems engineer, IT	19,734	5,395	12,808
Project manager, IT	32,629	20,454	27,021
Senior project manager, IT	55,561	28,151	42,850
SAP consultant	25,793	9,183	21,699
Electrical engineer	26,860	5,419	11,546
Senior electrical engineer	59,311	8,850	28,037
Mechanical engineer	26,532	5,231	10,961
Senior mechanical engineer	53,997	9,658	19,507
Chemical engineer	23,117	6,576	10,446
Environmental scientist	18,060	n.a.	n.a.
Pharmacist	30,895	3,091	15,352
Production manager, manufacturing	27,059	11,117	21,766
Structural engineer	26,857	7,544	16,144

Source: Payscale (2017). Notes: Payscale does not provide similar data for Brazil, China, Russia, and Turkey; n.a. = not

[60] StatsSA (2016).
[61] Montenegro and Patrinos (2014).

Table 2.8: Skills in highest demand on LinkedIn, South Africa (2016)

1	Statistical analysis and data mining
2	Java development
3	Network and information security
4	Mobile development
5	Perl/Python/Ruby
6	User interface design
7	Middleware and integration software
8	Web architecture and development framework
9	Mac, Linux and Unix Systems
10	Public policy and international relations

Source: LinkedIn, 2017

Meeting the needs of high-skilled sectors, such as ICT, is important for economic transformation and productivity growth, because it can trigger a multiplier effect on employment and incomes through value chains or consumption.[62] For example, in the United States each ICT job generates 4.9 jobs in other sectors. [63] LinkedIn data show that nine of the top 10 skills in highest demand in South Africa are in ICT-related fields (Table 2.8). These occupations are also considered scarce skills according to the list compiled every year by the Department of Labor.

Increasing the supply of the highly skilled is a long-term agenda that is about both the quality and quantity of resources. It will involve strengthening primary and secondary education to equip school graduates with better skills and increase the pool of qualified candidates for tertiary education. It will also entail the design of sustainable funding mechanisms to allow more students from low- and middle-income families to enroll in universities, and incentives for students to major in fields that are in high demand.

In the short to medium term, adult education, vocational training, and entrepreneurship development programs can upgrade skills and generate employment. Evaluating and scaling up successful programs can support innovation and create new jobs.

Migration policy is another potential mechanism to improve skills supply. Creating incentives for South Africans who moved abroad to return and apply their acquired knowledge domestically, as well as reforming migration policy to facilitate immigration of the highly skilled, can help build the country's skills base (Box 2.4).

Box 2.4: Adjusting migration policy to build the skills base

The National Development Plan recognizes the potential of well-managed migration for the development of the South African economy. Within this context, it recommends the "adoption of a more open immigration approach to expand supply of high-level skills".
It is against this backdrop that the Department of Home Affairs is making changes to South Africa's International Migration Policy (1999). Among the proposed changes in the White Paper on International Migration (March 2017) are recommendations that could have significant implications for filling high-skills gaps in the labor market. The white paper notes that the current policy is inadequate for attracting and retaining international migrants with the requisite skills and capital to invest in the country.

The white paper proposes several key interventions, including: introducing a points-based system to determine the eligibility criteria for long-term residence visas; using a long-term residence visa to attract investors and skilled migrants; granting critical skills and business visas that cater for family members; allowing international students who graduate in critical skills occupations to apply for a long-term residence visa; and introducing a differentiated skills transfer mechanism to cater for different working conditions.

Although the South African economy does enjoy the interest of qualified professionals from throughout the region and beyond, it should not be assumed that the specifics of the new migration policy will spontaneously attract potential candidates. A proactive and wide-reaching communication strategy needs to be implemented to ensure the success of the initiative in attracting high-skilled labor.

Source: Payscale (2017). Notes: Payscale does not provide similar data for Brazil, China, Russia, and Turkey; n.a. = not

[62] World Bank (2017b).
[63] World Bank (2016b).

Improve ICT infrastructure

A modern economy requires fast and cheap ICT infrastructure to connect businesses with domestic and international consumers, and to enable efficient delivery of public services. Urgent reforms are needed to increase investments in mobile and fixed broadband infrastructure, strengthen competition among Internet service providers, and improve the quality and reduce the price of ICT services.

South African consumers are paying more for broadband services of lower speeds than other emerging economies in Africa and other regions.[64] A recent survey of prices across Africa concluded that 1GB of mobile data in South Africa costs five times more than in Egypt.[65] South Africa's high prices for Internet transit also negatively affect the market in its landlocked neighbors, such as Botswana, Lesotho, and Zimbabwe. By one measure, the ICT Development Index collated by the International Telecommunication Union, which is a multidimensional index of sector performance, South Africa's ranking worldwide has fallen from 77th in 2002 to 88th position in 2016, during a period when other African countries were making big gains.

The underlying constraint does not seem to be lack of capital for investment by the private sector, or lack of interest from foreign companies in the South African market. Instead, the constraint is attributable to outmoded regulatory approaches and the lack of competition among telecommunications service providers (as discussed in the 8th South Africa Economic Update). A particular failing is that 4G mobile services have still not been licensed in South Africa, even though such services are thriving elsewhere in Africa.

These costs take a toll on the development of e-commerce and the overall competitiveness of the economy. Already, South African firms that rely on e-commerce are more successful in overcoming distance constraints. Firms that trade on eBay reach an average of 30 different markets, while traditional exporters reach only five. Newcomers to this online platform (firms with no sales in the previous year) account for 27 percent of sales; the respective figure for traditional firms is 2 percent. Data from eBay also show that the concentration of sales among the top 5 percent of South African sellers is 33 percent, compared to 90 percent for traditional firms.[66]

Furthermore, South Africa's relatively high tariffs, low broadband penetration, and slow Internet speed are directly affecting the poorest households. High Internet costs constrain the growth of the ICT industry and contribute to the slow development of e-government applications, which makes it more difficult and costlier for citizens to access government services.

Ensuring the regulator's policy independence and confirming its field of action should help expedite stalled actions such as 4G licensing. Ultimately, the importance of ICT lies in its role in facilitating innovation in the economy as a whole. A more liberal approach to spectrum management and price competition would support these objectives.

Increase the effectiveness of public instruments to support innovation and entrepreneurship

The government has put in place many financial and non-financial instruments to support private innovation, promote technology transfer, facilitate collaboration between public R&D institutions and industry, and encourage entrepreneurship. These programs are implemented by the Department of Science and Technology, the Department of Trade and Industry, the Ministry of Small Business Development, the Department of Public Enterprises, the Industrial Development Corporation, and city governments.

Availability of public support programs for entrepreneurship and innovation is one of the strengths of South Africa's innovation ecosystem compared to that of many other emerging economies. In fact, the range and type of support programs offered in South Africa resemble those in advanced OECD economies (Box 2.5). There is scope, however, to improve the effectiveness and targeting of these support mechanisms by consolidating program objectives, budgets, and management arrangements.

[64] Banda et al. (2015).
[65] Research ICT Africa (2017).
[66] eBay (2013).

Box 2.5: Public programs to support entrepreneurship, technology absorption, and innovation

Technology Innovation Agency: The South African government created the Technology Innovation Agency in 2009 to accelerate research commercialization and the creation of science-based firms. The agency supports technology development and pre-commercialization, and enables and supports innovation. This covers a broad range of interventions, including providing access to technology stations to improve entrepreneurs' access to modern equipment; implementing a youth technology innovation program that provides young people with different services from mentorship and business support to risk funding; and providing seed-funding grants for universities and SMMEs.

As a relatively young organization, the Technology Innovation Agency faced several challenges. Initially, it encountered difficulties in attracting the right set of proposals because many applicants lacked the capacity to develop bankable projects. Following the establishment of a seed fund, the number of successful applications to the agency's main funds increased significantly. The Technology Innovation Agency has struggled to commercialize a large share of its portfolio of early-stage technologies through licensing, technology transfer to industry, or spin-out companies. This is largely attributable to the overemphasis on technology readiness levels as a primary measure to assess opportunities. To mitigate this problem, the agency has recently introduced market and business readiness levels as additional measurements to assess applications.

The Technology Innovation Agency also suffers from institutional constraints. As part of successive budget cuts across government, the agency's budget has been reduced by 30 percent since 2014.[67] Overall, its allocation for 2015/16 was R460 million, which accounted for 8.6 percent of the Department of Science and Technology's total funds for that year.[68] The agency also experiences high staff turnover.[69]

R&D tax incentives: South Africa provides tax incentives for R&D expenditure. Companies can deduct 150 percent of their operational expenditure on qualifying scientific and technological R&D. The design of the tax incentives seems to prioritize development of new-to-the-world products and services over technological catch-up. This can give a boost to top innovators, but, given that most South African firms are small and far behind the technological frontier, the incentive applies to a very narrow range of firms.

Administration of tax credits is also important. Complex procedures and long waiting times discourage applications, particularly from small companies. Measures introduced in 2012 may have resulted in greater quality control and reduced fraudulent claims, but they have also made the application process more complex, and increased uncertainty about decision making and waiting times for application approvals.

The share of firms recording R&D activities more than halved following the reform, and this decline was concentrated among smaller companies. South Africa's Davis Tax Committee[70] has partnered with the World Bank to launch a full-scale impact evaluation of the R&D tax credit scheme in the near future.

Department of Trade and Industry programs: The department runs over a dozen programs intended to support industrial R&D, technology upgrade, and exports. There are both sector-specific and horizontal programs. For example, the Support Programme for Industrial Innovation provides financial assistance for the development of innovative products and processes. The department also supports sector-specific programs to increase competitiveness in the agro-processing, clothing and textiles, and automotive industries.[71] Recent evaluations of these programs are not available, so their reach and effectiveness is unclear.

Incubators: Soft assistance to SMMEs to improve business and managerial practices is an important mechanism to support the growth of less established businesses.[72] The results of a randomized control study of 852 small firms in South Africa that received a 10-week marketing or finance training confirm this finding. Such programs can be a cost-effective way to increase sales and profitability, and create more jobs.[73]

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[67] Urban-Econ Development Economists (2016).
[68] Department of Science and Technology (2016).
[69] Urban-Econ Development Economists (2016).
[70] The committee's objective is to assess South Africa's tax policy framework and its role in supporting the objectives of inclusive growth, employment, development, and fiscal sustainability.
[71] For more information see the financial assistance section of the Department of Trade and Industry website http://www.dti.gov.za/financial_assistance/financial_incentives.jsp?subthemeid=25
[72] World Bank (2017c).
[73] Anderson et al. (2016).

South Africa has 142 capacity development providers (of which more than 55 are government funded) in the area of entrepreneurship, according to the Aspen Network of Development Entrepreneurs.[74] Some of them hold promise for enhancing business skills and entrepreneurship. For example, the Jobs Fund supports a corporate vocational skills training and placement initiative that benefits youth with no education beyond matric. Several private initiatives have emerged as well. For example, more than 6,000 entrepreneurs have taken advantage of the Standard Bank Incubator since 2015. And South Africa's Raizcorp Incubator serves more than 3,000 entrepreneurs per year and was named by The Economist as the only incubator on the continent that is profitable without grants.[75]

However, many South African incubators are not equipping entrepreneurs with the skills they need to succeed in the global economy. Elevation Holdings (2017) concluded that South Africa has too many incubators and too many of them are of poor quality.

The multiplicity of government programs combined with limited budgets may be fragmenting and reducing the impact of public funding for private sector development. It is important to evaluate the effectiveness of these initiatives (including their targeting, cost-effectiveness, and economic impact, see Box 2.6), and consolidate and scale up the best performing programs. It is also vital to ensure predictable funding and adequate staffing of the agencies implementing innovation and entrepreneurship support programs.

Box 2.6: Impact evaluations of innovation support programs

Rigorous impact evaluation of South Africa's major innovation support programs would provide better evidence on the quality of the additionality, and help policymakers to decide which programs and incentives to scale-up, and which ones should be reformulated or eliminated.

As part of the national effort to strengthen evaluation, two evaluations were commissioned by the Department of Trade and Industry looking at its Support Program for Industrial Innovation[76] and its Technology and Human Resources for Industry Program.[77] The results suggested both programs remained relevant and should continue to be funded as they met their stated objectives, and demonstrated sufficient additionality in terms of innovation outcomes, job impact, and other metrics. They also suggested that grant programs with matching were more effective as an instrument to incentivize firms, which is in line with the conclusions of largescale studies in Israel. At the same time, the evaluations concluded that these programs could be better designed to meet the user needs and government objectives and that there was a need to review similar programs run by TIA, Seda, and other agencies to avoid duplication.

Two more recommendations emerging from these evaluations are worth considering for other programs: First, shortening the time for the approval of applications, as long delays can discourage the top companies from applying as their project cycles are shorter. For example, the Support Program for Industrial Innovation took close to 6 months from the submission of the application to the approval/rejection, whereas the global good practice would be to have a turnaround that is 60-90 days. In recent years, this issue has been noted in the case of the R&D tax incentives, and DST has put in place several measures to bring down the approval time while preserving quality. Second, evaluations had several limitations related to data, which restricted the impacts that could be assessed and/or policy questions that could be addressed. The main reason is that the evaluations had been commissioned ex post, and this meant that follow-up reporting was not sufficiently detailed or spanned a long enough period to generate robust conclusions. A toolkit published by the Inter-American Development Bank on evaluation of science, technology and innovation programs provides good practices and pointers on how to strengthen impact evaluations.[78]

[74] Aspen Network of Development Entrepreneurs (2017).
[75] The Economist (2017).
[76] Genesis Analytics (2014).
[77] Business Enterprises (2015).
[78] Crespi et al. (2011).

One final point is that impact evaluations generally do not aim to provide a sense of the alternative approaches, and to fill this gap it would be useful if South Africa's programs could be benchmarked against global and regional examples. For example, the European Commission commissioned a very comprehensive benchmarking and review of R&D incentives across many countries, which provides a wealth of information about the pros and cons of different approaches (e.g., tax credits vs. enhanced allowances, type of novelty requirements, carry-over provisions, etc.). Using this framework to assess South Africa's program would provide policymakers with pointers about options to align with international good practices.

The design of the fiscal incentives for investment and R&D can be improved to better account for the needs of the economy. For example, reorientation of investment incentives from mining toward industrial sectors can help create jobs at no additional fiscal cost. R&D tax incentives currently prioritize new-to-the-world products and services; extending the eligibility criteria to include investments in technology absorption will make the incentive much more relevant for the large number of domestic firms that are far from the technological frontier.

Simplifying the R&D tax incentive administration process can further encourage R&D activity, particularly among smaller firms that cannot afford the services of tax lawyers. The majority of OECD countries have a one-stop online application procedure. It would be good practice to limit the time for government officials to issue decisions on the applications, and for this period to not exceed a year. Some OECD economies provide an option of an immediate refund to small companies that tend to be more financially constrained.[79]

A review of the activity and best practices of the incubation programs can help identify the models that work best in the South African context. The government can also play a role in setting the minimum quality standards for incubators and facilitating the sharing of good practices among them.

Conclusion

This report argues that South Africa's has a large untapped innovation potential. Harnessing this potential through improved business climate for startups, skilled immigration, trade facilitation, competition in ICT, and easier access to R&D tax incentives would significantly help creating jobs and reducing poverty.

[79] European Commission (2014).

REFERENCES

- Adler, Gustavo, Romain Duval, Davide Furceri, Sinem Kiliç Çelik, Ksenia Koloskova, and Marcos Poplawski-Ribeiro. 2017. "Gone with the Headwinds: Global Productivity." IMF Staff Discussion Note, International Monetary Fund, Washington, DC.
- Anderson, Stephen J., Rajesh Chandy, and Bilal Husnain Zia. 2016. "Pathways to Profits: Identifying Separate Channels of Small Firm Growth through Business Training." Policy Research Working Paper 7774, World Bank, Washington, DC.
- ANDE (Aspen Network of Development Entrepreneurs). 2017. South Africa's Entrepreneurial Ecosystem Map. ANDE, South Africa.
- Aterido, Reyes, Ayanda Hlatshwayo, Duncan Pieterse, and Andre Steenkamp. 2017. "Firm Level Dynamics, Job Flows and Productivity: South Africa 2009-2014." Forthcoming Working Paper, National Treasury, Pretoria, and World Bank, Washington, DC.
- Banda, Fatsani, Genna Robb, Simon Roberts, and Thando Vilakazi. 2015. "Key Debates in Competition, Capabilities Development and Related Policies: Drawing the Link between Barriers to Entry and Inclusive Growth." Centre for Competition Regulation and Economic Development, Johannesburg.
- Bhorat, Haroon, Tara Caetano, Benjamin Jourdan, Ravi Kanbur, Christopher Rooney, Benjamin Stanwix, and Ingrid Woolard. 2016. "Investigating the Feasibility of a National Minimum Wage for South Africa." Working Paper 201601, Department Policy Research Unit, School of Economics, University of Cape Town, and Centre for Social Development in Africa, University of Johannesburg.
- Bhorat, Haroon, and Benjamin Stanwix. 2017. "Wage Setting and Labor Regulatory Challenges in a Middle Income Country Setting: The Case of South Africa." Mimeo. Department Policy Research Unit, School of Economics, University of Cape Town.
- Boonzaaier, Wian, Jarkko Harju, Tuomas Matikka, and Jukka Pirttilä. 2016. "How do small firms respond to tax schedule discontinuities? Evidence from South African tax registers." Working Paper 2016/36, UNU-WIDER, Helsinki.
- Business Enterprises. 2015. *Implementation and Impact Evaluation of the Technology and Human Resources for Industry Programme.* March. University of Pretoria.
- Center for International Data. 2017. Penn World Tables. University of California, Davis.
- Cirera, Xavier, and Leonard Sabetti. 2016. "The Effects of Innovation on Employment in Developing Countries: Evidence from Enterprise Surveys." Policy Research Working Paper 7775, World Bank, Washington, DC.
- Crespi, Gustavo, Alessandro Maffioli, Pierre Mohnen, and Gonzalo Vázquez. 2011. E*valuating the Impact of Science, Technology and Innovation Programs: a Methodological Toolkit.* Technical Notes No. IDB-TN-333, November, Inter-American Development Bank, Washington D.C.
- Cornell University, INSEAD, and WIPO. 2016. The Global Innovation Index 2016: Winning with Global Innovation. Ithaca, Fontainebleau, and Geneva.
- Cornell University, INSEAD, and WIPO. 2016. The Global Innovation Index 2017: Innovation Feeding the World. Ithaca, Fontainebleau, and Geneva.
- Department of Science and Technology. 2016. *Annual Report 2015–2016.* Pretoria: Department of Science and Technology.
- Department of Science and Technology. 2017. *South African national survey of research and experimental development: Statistical Report 2014/15.* Pretoria: Department of Science and Technology.
- eBay. 2013. *Commerce 3.0 for Development: The Promise of the Global Empowerment Network: An eBay Report.* Washington, DC: eBay Inc.
- European Commission. 2014. *A Study on R&D Tax Incentives: Final Report.* The Hague.
- Economist. 2017. "Encouraging African Entrepreneurship." April 6. https://www.economist.com/news/business/21720344-only-one-incubator-continent-profitable-without-grants-encouraging-african.
- Elevation Holdings. 2017. *Unicorns, Gazelles and Leapfrogs: Fast-tracking our Ecosystem.* Johannesburg: Elevation Holdings.
- Filmer, Deon, Louise Fox, Karen Brooks, Aparajita Goyal, Taye Mengistae, Patrick Premand, and Dena Ringold. 2014. *Youth Employment in Sub-Saharan Africa.* Washington, DC: World Bank.
- Finmark. 2010. *FinScope South Africa Small Business Survey 2010.* Johannesburg.
- Flowerday, Wayde, John Gabriel Goddard, and Andre Steenkamp. 2017. "The Technological Structure and

Performance of South African Manufactured Exports (2010–2014): Are South African Manufactured Goods Becoming More Sophisticated?" Forthcoming. Washington, DC: World Bank.
- Genesis Analytics. 2014. *Impact Evaluation of Support Program to Innovation.* April. Johannesburg: Genesis Analytics
- Genome Startup. 2017. *2017 Global Startup Ecosystem Report.* San Francisco: Startup Genome.
- Global Intellectual Property Center. 2017. *The Roots of Innovation.* Washington, DC: Global Intellectual Property Center.
- Goldin, Nicole, and Matthew Hobson with Peter Glick, Mattias Lundberg, Susana Puerto Gonzalez. 2015. *Toward Solutions for Youth Employment: A Baseline for 2015.* Washington, DC: Solutions for Youth Employment (S4YE).
- Goñi, Edwin, and William Maloney. 2017. "Why Don't Poor Countries Do R&D? Varying Rates of Factor Returns Across the Development Process." *European Economic Review* 94 (C): 126– 147.
- Griffith, Rachel, Rupert Harrison, and John van Reenen. 2004. "How Special is the Special Relationship? Using the Impact of U.S. R&D Spillovers on U.K. Firms as a Test of Technology Sourcing." *American Economic Review* 96 (5): 1859–1875.
- Hall, Bronwyn H., and Jacques Mairesse. 1995. "Exploring the Relationship between R&D and Productivity in French Manufacturing Firms." *Journal of Econometrics* 65 (1): 263–293.
- Hall, Bronwyn H., and Jacques Mairesse. 1996. "Estimating the Productivity of Research and Development: An Exploration of GMM Methods Using Data on French and United States Manufacturing Firms." Working Paper, National Bureau of Economic Research, Cambridge.
- Hausmann, Ricardo, César A. Hidalgo, Sebastián Bustos, Michele Coscia, Sarah Chung, Juan Jimenez, Alexander Simoes, and Muhammed A. Yildirim. 2017. The Atlas of Economic Complexity. Cambridge: Puritan Press.
- Hennig, Jennifer, Edmundo Murrugarra, Jamele Rigolini, and Melissa Zumaeta. 2015. *Linking Social Assistance and Productive Inclusion: New Challenges in Social Protection and Labor.* Washington, DC: World Bank.
- HSRC (Human Sciences Research Council). 2017. *R&D Survey 2014/2015: Main Analysis Report.* Pretoria: HSRC.
- ILO (International Labour Organization). 2016. *Global Wage Report 2016/17: Wage Inequality in the Workplace.* Geneva: ILO.
- Jackson, Tom. 2016. "Can Big Data Offer Hope for Africa's Exasperated Commuters?" The Guardian, October 7. https://www.theguardian.com/public-leaders-network/2016/oct/07/big-data-africa-cities-commuters-transport.
- Kearney, A.T. 2017. The 2017 A.T. Kearney Foreign Direct Investment Confidence Index. https://www.atkearney.com/gbpc/foreign-direct-investment-confidence-index.
- Kluve, Jochen, Susana Puerto, David Robalino, Jose Manuel Romero, Friederike Rother, Jonathan Stöterau, Felix Weidenkaff, and Marc Witte. 2016. *Interventions to Improve the Labour Market Outcomes of Youth: A Systematic Review of Training, Entrepreneurship Promotion, Employment Services, and Subsidized Employment Interventions.* Geneva: International Labour Organization.
- Lall, Sanjaya. 2000. "The Technological Structure and Performance of Developing Country Manufactured Exports: 1985–98." *Oxford Development Studies* 28 (3): 337–369.
- Montenegro, Claudio E., and Harry A. Patrinos. 2014. "Comparable Estimates of Returns to Schooling Around the World." Policy Research Working Paper 7020, World Bank, Washington, DC.
- OECD (Organisation for Economic Co-operation and Development)/Eurostat. 2005. *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data.* 3rd Ed. Paris: OECD Publishing.
- OECD (Organisation for Economic Co-operation and Development). 2015a. *OECD Science, Technology and Industry Scoreboard 2015: Innovation for Growth and Society.* Paris: OECD Publishing.
- OECD (Organisation for Economic Co-operation and Development). 2015b. *The Innovation Imperative: Contributing to Productivity, Growth and Well-Being.* Paris: OECD Publishing.
- OECD (Organisation for Economic Co-operation and Development). 2017. International Migration Database (accessed August 28, 2017), https://stats.oecd.org/Index.aspx?DataSetCode=MIG.
- Payscale. 2017. Salary Database.
- Ports Regulator of South Africa. 2017. Global Pricing Comparator Study 2016/17. Pretoria.
- PricewaterhouseCoopers. 2016. *Global Innovation 1000: Software as a Catalyst,* by Barry Jaruzels, Volker Staack, and Aritomo Shinozaki. strategy+business no. 85.
- Quantec. 2017. SA Standardised Industry Data. Pretoria.
- Research ICT Africa. 2017. "South African data prices static for two years but consumers not flocking to

cheapest product offering." Policy Brief No. 3/2017. Cape Town.
- Schaffer, Mark, Andre Steenkamp, Wayde Flowerday, and John Gabriel Goddard. 2017. "Innovation Activity in South Africa: Measuring the Returns to R&D." Forthcoming, World Bank, Washington, DC.
- SIMODISA. 2014. *Accelerating the Growth of SMEs in South Africa.* Johannesburg: SIMODISA.
- Startup Genome. 2017. *The Global Startup Ecosystem Report 2017.* San Francisco: Startup Genome.
- StatsSA. 2016. *Labour Force Survey Report: 4th Quarter 2016.* Pretoria.
- StatsSA. 2017. *Poverty Trends in South Africa: An Examination of Absolute Poverty between 2006 and 2015.* Pretoria.
- Times Higher Education. 2017a. Shanghai Academic Ranking of World Universities 2016.
- Times Higher Education. 2017b. World University Rankings 2016–2017.
- Urban-Econ Development Economists. 2016. *Technology Innovation Agency: Economic Impact Assessment 2010/11–2015/16 Financial Year.* Pretoria: Urban-Econ Development Economists.
- Wang, Jiann-Chyuan, and Kuen-Hung Tsai. 2003. "Productivity Growth and R&D Expenditure in Taiwan's Manufacturing Firms." Working Paper 9724, National Bureau of Economic Research, Cambridge.
- WEF (World Economic Forum). 2017. "The Future of Jobs and Skills in Africa: Preparing the Region for the Fourth Industrial Revolution." Geneva: WEF.
- WIPO (World Intellectual Property Organization). 2017. *PCT Yearly Review 2017: The International Patent System.* Geneva: WIPO.
- World Bank. 2011. *Fostering Technology Absorption in Southern African Enterprises.* Washington, DC: World Bank.
- World Bank. 2014. *The Economics of South African Townships.* Washington, DC: World Bank.
- World Bank. 2015a. *Doing Business in South Africa: Comparing Business Regulations for Domestic Firms in 9 Urban Areas and 4 Major Ports with 188 Other Economies,* Washington, DC: World Bank.
- World Bank. 2015b. Competitive Cities for Jobs and Growth: What, Who and How? Washington, DC: World Bank.
- World Bank. 2016a. *Africa's Pulse: Global Economic Weakness Continues to be a Drag on Africa's Economic Growth.* Washington, DC: World Bank.
- World Bank. 2016b. *World Development Report 2016: Digital Dividends.* Washington, DC: World Bank.
- World Bank. 2016c. "Promoting Faster Growth and Poverty Reduction Through Competition." *South Africa Economic Update* No. 8, Washington, DC: World Bank.
- World Bank. 2017a. *World Development Indicators.* Washington, DC: World Bank.
- World Bank. 2017b. *The Skills Balancing Act in Sub-Saharan Africa.* Washington, DC: World Bank.
- World Bank. 2017c. *Innovation Flagship Report.* Forthcoming, Washington, DC: World Bank.
- World Bank. 2017d. "Private Investment for Jobs." *South Africa Economic Update* No. 9, Washington, DC: World Bank.
- World Bank Group. 2017. COMTRADE database. Washington, DC.

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