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Sources of output growth in the countries of the Common Monetary Area and the provinces of South Africa

Dukhabandhu Sahoo, Auro Kumar Sahoo, Jayanti Behera, Diptimayee Mishra, and Phendulwa Zikhona Makunga

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Abstract: This paper aims to decompose the sources of growth in economies in the Southern African region's Common Monetary Area and in the provinces of South Africa. Decomposition results for the Common Monetary Area reveal that the growth of aggregate and sectoral gross domestic product is driven by input, without increasing efficiency in production or benefiting from technological progress, which is unsustainable. Negative technical change implies that countries are unable to reap the benefits from shifts in technology. Countries experiencing input-driven growth in the secondary sector, such as Namibia and Eswatini, have the potential to achieve growth through efficiency improvements and by adopting technology. Output growth in the provinces of South Africa is negatively contributed by changes in technical efficiency, which suggests that policy makers should raise growth further by emphasizing improvements in efficiency in these provinces.

Key words: growth, efficiency, technology, Southern African region, decomposition

JEL classification: C23, O33, O47, O55

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1 Introduction

Economies in the Southern African Common Monetary Area (CMA)—i.e. South Africa, Namibia, Lesotho, and Eswatini—have experienced low growth rates. Low growth performance can be analysed by decomposing output growth into its different sources. The decomposition of output growth enables us to analyse the contributions of various sources to output growth. Moreover, the identification of possible strengths and weaknesses in different sources of output growth can guide policy makers to frame policy concerning triggering factors. This paper is an attempt to understand the slow economic growth in CMA countries by decomposing output growth at aggregate and disaggregated sectoral levels. It provides important policy suggestions to frame independent country-specific and sector-specific policies, focusing on potentials for output growth.

The study also decomposes output growth at the provincial level in the hegemonic economic power in the region, i.e. South Africa. All of the provinces of South Africa are considered for this study: Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North West, and Western Cape. The output growth decomposition at the disaggregated level enables us to understand the sources of output growth. As the provinces are characterized by low growth performance, understanding the sources of growth provides scope for framing appropriate policies to overcome the situation.

The rest of the paper is organized as follows: the next section presents a review of existing literature on output and productivity growth decomposition; the third section presents stylized facts on the economic performance of the area under study; the fourth section discusses the analytical framework, the variable descriptions, and the data sources; the results and discussion are provided in the fifth section. The final section concludes the paper with some policy suggestions.

2 Overview of the literature

Economic growth decomposition has been a focal point of intellectual discourse in the past few decades, particularly among social scientists. This is essential from the point of view of sources of growth. There have been many empirical and theoretical studies conducted in different parts of the globe, at aggregate (cross-country) as well as disaggregated (country) levels, to capture the reasons for variations in output growth. This has practical importance, particularly for developing economies that are still struggling for a better standard of living. Growth components consist of two factors. One is attributable to production inputs, and the other to total factor productivity (TFP) (Garzarelli and Limam 2019). The empirical literature is divided on the issue of the importance of these two factors.

Empirically, the study of growth components made its debut with the advent of the 'Solow residual' in long-run economic growth and development (Solow 1957). Taking data for the period 1909–49 for the USA, Solow concluded that it was technical change or TFP that contributed more to gross output per work hour, rather than a mere increase in capital and labour inputs. Since then, the debate has been enriched with numerous empirical findings.

2.1 Productivity growth decomposition

Kumbhakar and Lovell (2000) proposed to estimate TFP growth with a decomposition formulation. The decomposition procedure allowed them to estimate TFP growth in the components of technical change, technical efficiency change, allocative efficiency change, and change in returns to scale. In the literature, studies such as Kumbhakar et al. (2014), Tsionas and Kumbhakar (2014), and Colombi et al. (2014) decomposed the error term into the components of firms' latent heterogeneity, time-varying inefficiency, persistent inefficiency, and random shocks. As this four-component model could accommodate the persistent inefficiency and latent heterogeneity of a firm, it was named the 'generalized true random effect model' by Tsionas and Kumbhakar (2014). The generalized true random effect model was further extended by incorporating the determinants of inefficiency in models such those by as Kumbhakar and Lai (2016), Badunenko and Kumbhakar (2017), and Lien et al. (2018).

After going through the literature, we can say that the scope of productivity decomposition has grown over the years, but the source of the debate is still relevant. Recent years have seen the development of new models that are able to estimate technical efficiency along with their determinants. Further, they are also able to tackle problems arising in the process of efficiency measurement, such as endogeneity and heterogeneity issues, even taking account of time properties. However, a major problem for the adoption of these recent techniques is the availability of data relating to production units.

2.2 Sources of output growth

Kalirajan et al. (1996) tried to study the source of TFP growth by applying the varying coefficient production function to Chinese provincial data on agriculture. Their study concluded that most provinces in China experienced negative TFP growth in the pre-reform period, whereas the post-reform period witnessed positive TFP growth in many provinces. By using the stochastic frontier model, the study by Li et al. (2008) in China concluded that technical progress and scale economies were the major contributors to productivity growth, while technical efficiency edged downwards. The study by Wu (2020) showed moderate technical efficiency in farms in eastern India. Dumagan and Ball (2009) used Fisher and Törnqvist to study growth decomposition in the agricultural sector of the USA, and concluded that output growth was mainly due to the growth of TFP in the sector. Navin (2014) and Kumar and Shekhar (2017) ascertained than the growth performance of the Indian economy was due to TFP growth. Applying the Shapley decomposition method, Ajakaiye et al. (2015) argued that growth in Nigeria was accompanied by unemployment and revealed the migration of labour from the primary and secondary sectors to the tertiary sector. Using decomposition techniques, Drobyshevsky et al. (2018) predicted further stagnation in the Russian Federation.

Taking data for 127 countries for the year 1988, Hall and Jones (1999) tried to unravel the reasons for the vast differences in output per worker by decomposing output per worker into inputs used and productivity. They found that the long-run economic performance of a country is primarily driven by its social infrastructure, which includes various institutions and government policies that establish the economic environment. Their study results show that a 0.01 per cent change in social infrastructure can cause a 5.14 per cent change in output per worker. A study by Senhadji (1999) concluded that production inputs (capital and labour) are the primary determinants of the long-run level of output, whereas capacity utilization and other factors are the major causes of short-run fluctuations in output in 88 countries for the period 1960–94. Carlsson and Lundström (2002) studied the decomposition of the Economic Freedom Index into seven components and examined the importance of each of these components in a growth analysis, taking a sample of 74 countries for a period of 25 years (1970–95). The sample comprised 16 African countries, 19 European, eight in South America, 13 in North America, 16 in Asia, and two in Oceania. The findings suggested an insignificant effect on gross domestic product (GDP) growth from components such as monetary policy and price stability, economic structure and use of markets, and freedom of exchange in capital markets. Size of government and freedom to trade with foreigners were found to have a significant negative effect on growth. However, the variables of legal structure, private ownership, and the freedom to use alternative currencies had a positive and robust relation to GDP growth. The study revealed that increasing economic freedom in general may not always increase economic growth in terms of its different components. Unlike the findings by Kumar and Russell (2002), which emphasized capital accumulation as the principal agent in average worldwide productivity growth, Makieła (2010) concluded that there is no 'golden rule' in general for the growth of an economy. It all depends on the status of the economy and the stage of development. Thus, the effects of technological progress depend not only on the structure of the current input ratio (capital-labour), but also on the evolution of this structure over time. Using the Bayesian stochastic frontier technique and output change decomposition method for panel data from 16 countries over ten years (1995–2005), Makieła analysed the economic growth of each country in terms of three apparatuses: input growth, technological progress, and change in efficiency. Technological progress in general was found to have a positive influence on economic growth. However, the magnitude differed depending upon the 'input growth path' of the different economies. Further, these study findings were in line with the finding by Badunenko et al. (2008) that there was a decrease in technical efficiency over the studied period.

Foster-McGregor and Verspagen (2017) tried to capture differences in TFP growth, taking a sample of 40 economies over the period 1995–2009. The study decomposed TFP growth by introducing a novel technique of structural decomposition into three components: change in factor requirements per unit of gross output, change in value-added per unit of gross output, and change in the structure and composition of intermediate and final goods. The findings suggested that a decline in labour requirements per unit of gross output was the major influencing factor in the growth of TFP over the studied period.

A slightly different approach was taken by Limam et al. (2019), which incorporated the quality of physical capital and labour in terms of the age of physical capital and human capital in the decomposition analysis. Accordingly, the study constructed a data set for five regions (Africa, East Asia, Latin America, South Asia, and the West) comprising 90 countries for the period 1960– 2007. Using the frontier methodology, the study tried to extract efficiency from TFP. The findings demonstrated the importance of physical capital accumulation, which accounted for the growth of output more largely than the other two factors, i.e. quality of factors and growth of TFP.

2.3 Literature on specific countries

Li and Liu (2011) investigated the decomposition of economic and productivity growth in 30 provinces in China's post-reform economy. Labour, physical capital, and human capital were used as inputs, while the real GDP was used as the output. By using stochastic frontier analysis with a translog production function, they found that input growth contributed more (i.e. 63 per cent) to output growth for 30 provinces in China's post-reform economy for the period 1984–2006, and physical capital contributed more to China's economic growth in comparison with other inputs. Similarly, technical progress and adjusted scale effects contributed more to productivity growth.

Liu et al. (2020) examined the heterogeneity of production technologies in 29 provinces of mainland China for 2001–15 and growth decomposition bias in traditional methods. To measure the existence of the heterogeneity of production technologies, and to check for significant differences in factor elasticity, they used a finite mixer model and Wald tests respectively. Labour, physical capital stock, and energy consumption were used as inputs, and GDP was used as the output. The study concluded that economic growth in China consisted of sector productivity growth, factor endowment growth, and factor market efficiency growth. This result showed that different production technologies (growth regimes) existed in three industries across 29 provinces of China. It was also found that China's economic growth was largely dominated by growth in factor endowment during the period 2011–15. Further, a growth decomposition bias existed in traditional methods because they assumed homogeneous production technologies within the same industry across the 29 provinces, thereby neglecting heterogeneous production technologies. This overvalued the role of factor endowment growth by 11.2 per cent, and it undervalued the role of sector productivity growth by 10.9 per cent, but it did not greatly affect the role of factor market efficiency growth.

2.4 Review on the South African economy

A study by Wong (2007) tried to explore the channels of economic growth in the Organization for Economic Cooperation and Development and 77 other countries (including Southern African countries) and concluded that the prime reason for convergences between economies was technological catch-ups. The study also found that the speed of convergence was faster among relatively richer countries, and the contribution from human capital went towards divergence rather convergence, signifying the importance of endogenous growth models. The study concluded that it was TFP growth, not factor accumulation, that was the reason for conditional convergence, and it found no evidence that rich and poor countries converged through different channels. Fedderke's (2002) study on the structure of growth in the South African economy concluded that the economy's growth performance largely depended on the gain from TFP during 1970–97. Further, the study revealed that at the sectoral level, the growth of agriculture, forestry, and fishing was also induced by TFP. However, the growth of the manufacturing sector was associated with capital accumulation after the structural break in 1990, and the efficiency gain was concentrated in a small number of firms. Another study of the South African economy, by Arora and Bhundia (2003), suggested that an increase in the trend of GDP after 1994 was primarily due to TFP growth. However, the study further asserted that the growth in TFP in South Africa after 1994 was driven by trade liberalization and the relatively higher participation of private players in economic activities.

Similarly, the study by Treggena (2009), which tried to analyse sources of growth by sector in South Africa by using data for 1970–2007, concluded that the growth in the economy was primarily dependent on domestic demand expansion. However, the study also found that sectors and/or subsectors that were primarily dependent on domestic demand did not perform to the best of their potential, although technological change had a positive impact on the sectors' growth performance. Similarly, Mohamed et al. (2016) decomposed TFP changes in the agriculture sector in ten African countries by using a panel data set for 1980–2008, with a fixed effects model applied to a translog production function. The results of the study supported the claim that the agricultural sector in these ten African economies had low TFP—a result already established in the literature—but technological change had a positive impact on the growth of the sector, leading to the suggestion that credit should be made available to farmers as part of the agricultural development programme in the region, to improve TFP. However, the study by Dorosh and Thurlow (2018) on the South African economy addressed the TFP issue a little differently, and linked TFP growth in the agriculture and non-agriculture sectors with the poverty of the region. This study concluded that TFP growth in the non-agricultural sector was equally important for reducing poverty, and thus the non-agricultural sector should receive balanced treatment in South Africa's policy regime.

By using alternative models (Hendry's general-to-specific instrumental variable method, and Gregory and Hansen's structural break technique), Kumar et al. (2010) concluded that the major impetus of growth in South Africa came from human capital and foreign direct investment.

Further, the study revealed that financial reforms and the democratic form of government could improve TFP and productivity growth in South Africa. Gupta et al.'s (2018) study of the South African economy analysed TFP growth differently and highlighted the importance of forward-looking components in forecasting South Africa's output growth.

The foregoing literature has highlighted the importance of studies of growth decomposition across the globe. However, the fundamental question about growth still remains as to whether economic growth stems from input or technology. While technology-driven growth is sustainable for any economy, studies along these lines on the economies of the CMA and within South Africa might help to usher in appropriate policy changes during the current situation of low growth. However, before we empirically decompose the growth in the region, it is necessary to understand the economic performance and growth dynamics of the CMA countries and the provinces of South Africa. The next section gives a presentation of the region's economic performance.

3 Stylized facts about the economic performance of the studied area

This section is divided into two subsections. The first outlines the dynamics of the CMA; the second is about the economic performance of the provinces of South Africa.

3.1 Economic performance of the CMA countries

Table 1 presents the annual average growth rate (AAGR) of the per capita GDP (PCGDP) in purchasing power parity (PPP) of some of the major economies of the world during 2001–19. The table reveals that the performance of the leading economy of the CMA, i.e. South Africa, is lower than the world average for the entire period as well as subperiods. Indeed, compared with other major economies in the world, South Africa's AAGR is higher than only two 'matured and advanced' economies (i.e. Japan with an AAGR of 0.570, and the USA with an AAGR of 0.823) in one subperiod (i.e. 2001–10, when South Africa's AAGR is 2.147). Brazil is the only sampled economy with a negative AAGR during 2011–19 (although for the entire period the AAGR of Brazil is higher than South Africa's).

Table 2 presents the comparative economic performance of the CMA economies vis-à-vis the rest of the world. The table reveals that in terms of PCGDP at PPP, South Africa, Namibia, and Eswatini can be compared to the world's middle-income countries (MIC), whereas landlocked Lesotho can be compared to the low-income countries (LIC). However, the PCGDP at PPP of all members of the region is lower than the global average in all years. The recent (2016–19) economic performance of the CMA indicates that excluding Eswatini, the other three members have all experienced a negative growth rate in per capita income. Indeed, the COVID-19 pandemic may make the situation even worse in the region. Even Eswatini, the best performer in the region, has the meagre growth rate of 1.321 in 2018, a very low figure in comparison with the leading economies of the world (Table 1)

Table 1: AAGR of PCGDP (PPP) of some important economies

Period	Brazil	India	China	Russia	**South Africa**	Japan	USA	**World**
2001-10	2.543	5.104	9.929	5.207	**2.147**	**0.570**	**0.823**	**2.306**
2011-19	-0.134	5.351	6.844	1.339	**0.030**	1.120	1.553	**2.227**
2001-19	1.275	5.221	8.468	3.375	**1.144**	0.831	1.168	**2.269**

Note: GDP is at 2010 constant prices.

Source: authors' calculations based on data from World Development Indicators.

Table 2: Comparative economic performance of the CMA economies

	Year	LIC	MIC	HIC	SuSA	World	Eswatini	Lesotho	Namibia	South Africa
GDP (billion US$)	2016	485.2	26766.5	50674.7	1720.2	77904.1	5.2	3.0	14.5	420.2
	2017	506.4	28089.8	51880.6	1764.0	80445.3	5.3	2.9	14.4	426.2
	2018	524.6	29396.0	53021.4	1806.5	82892.7	5.4	2.9	14.5	429.5
	2019	544.9	30556.9	53912.3	1847.7	84944.4	5.5	2.9	14.4	430.2
GDP annual growth (%)	2016	**3.9**	4.3	1.7	1.2	**2.6**	**1.3**	**5.0**	**-0.3**	**0.4**
	2017	**4.4**	4.9	2.4	2.5	**3.3**	**2.0**	**-1.3**	**-0.3**	**1.4**
	2018	**3.6**	4.7	2.2	2.4	**3.0**	**2.3**	**-0.4**	**0.7**	**0.8**
	2019	**3.9**	3.9	1.7	2.3	**2.5**	**2.0**	**1.5**	**-1.1**	**0.2**
GDP (PPP) (billion US$)	2016	1441.2	59011.4	57828.8	3846.4	117512.8	9.4	5.9	24.2	714.0
	2017	1516.2	62027.5	59224.9	3962.1	121948.6	9.6	5.8	24.1	724.1
	2018	1576.8	65021.9	60597.5	4074.3	126314.8	9.8	5.8	24.3	729.8
	2019	1644.2	67672.7	61647.9	4186.5	130020.5	10.0	5.9	24.0	730.9
GDP (PPP) annual growth (%)	2016	**5.0**	4.7	1.8	1.7	**3.2**	**1.3**	**5.0**	**-0.3**	**0.4**
	2017	**5.2**	5.1	2.4	3.0	**3.8**	**2.0**	**-1.3**	**-0.3**	**1.4**

	2018	**4.0**	4.8	2.3	2.8	**3.6**	**2.4**	**-0.5**	**0.7**	**0.8**
	2019	**4.3**	4.1	1.7	2.8	**2.9**	**2.0**	**1.5**	**-1.1**	**0.2**
PCGDP (PPP) (US$)	2016	2329.1	10563.3	47437.5	3761.6	**15828.2**	**8405.8**	**2842.7**	**10266.7**	**12703.8**
	2017	2388.4	10979.8	48345.7	3772.9	**16240.2**	**8493.9**	**2783.1**	**10050.5**	**12703.4**
	2018	2420.9	11387.2	49245.6	3778.4	**16638.0**	**8606.1**	**2748.5**	**9932.0**	**12630.7**
	2019	2459.8	11729.9	49882.9	3782.0	**16944.0**	**8688.1**	**2767.7**	**9637.2**	**12481.8**
PCGDP (PPP) annual growth (%)	2016	**2.4**	3.5	1.2	-1.0	**2.1**	**0.4**	**4.2**	**-2.1**	**-1.1**
	2017	**2.5**	3.9	1.9	0.3	**2.6**	**1.0**	**-2.1**	**-2.1**	**0.0**
	2018	**1.4**	3.7	1.9	0.1	**2.5**	**1.3**	**-1.2**	**-1.2**	**-0.6**
	2019	**1.6**	3.0	1.3	0.1	**1.8**	**1.0**	**0.7**	**-3.0**	**-1.2**

Note: LIC: low-income countries. MIC: middle-income countries. HIC: high-income countries. SuSA: Sub-Saharan African countries. GDP is at 2010 constant prices.

Source: authors' calculations based on data from World Development Indicators.

Table 3: AAGR and standard deviations of the annual growth rate (AGR) of GDP and its components in the CMA economies

	South Africa	Namibia	Lesotho	Eswatini	South Africa	Namibia	Lesotho	Eswatini
	AAGR				**Standard deviation of AGR**			
GDP at constant prices	2.69	4.04	3.22	3.11	1.87	3.12	2.29	1.72
PCGDP	1.27	2.26	3.02	2.41	1.91	3.40	2.72	1.83
PGDP	1.19	1.76	1.36	1.44	8.35	8.86	18.40	9.11
SGDP	1.51	5.10	3.60	2.16	2.91	8.62	10.72	3.11
TGDP	3.73	4.05	4.62	7.62	3.14	5.88	14.04	8.53
PCPGDP	-0.21	0.01	1.04	0.76	8.25	8.64	17.50	9.08
PCSGDP	0.10	3.31	3.37	1.47	2.90	8.65	10.51	3.21
PCTGDP	2.30	2.27	4.48	6.89	3.16	5.96	14.62	8.46

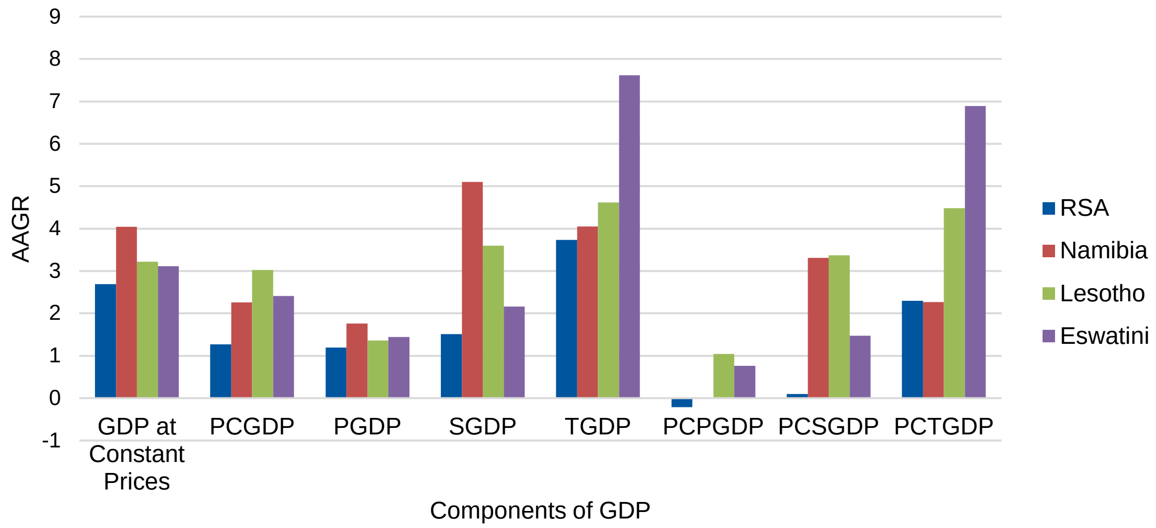
Note: PCGDP: per capita GDP. PGDP: GDP of primary sector. SGDP: GDP of secondary sector. TGDP: GDP of tertiary sector. PCPGDP: per capita GDP of primary sector. PCSGDP: per capita GDP of secondary sector. PCTGDP: per capita GDP of tertiary sector. Standard deviation of the AGR of a variable is an indication of its volatility. GDP is at 2010 constant prices.

Source: authors' calculations based on data from World Development Indicators.

Further, it is revealed in Table 2 that the annual growth rates (AGR) of the GDP and PCGDP of the CMA economies are lower than LIC and the entire world. The CMA economies (except Eswatini) have experienced negative growth rates in PCGDP since 2016, although the global average growth rate is positive. Similarly, the average growth rate in the LIC during the same period is also positive. This shows the dismal performance of the CMA economies in both absolute and relative terms. Even matured high-income countries (HIC) and MIC have positive growth rates of PCGDP at PPP during 2016–19.

The AAGR of GDP, PCGDP, sectoral GDP, and sectoral PCGDP for the entire study period (2000–19) in the region also shows very dismal performance (Table 3 and Figure 1). The performance of the primary and secondary sectors in the region is a matter of concern: except for Namibia, the AAGR of the secondary sector GDP (SGDP) is 5.10. However, the fairly acceptable performance of the tertiary sector is the region's silver lining: the AAGR of this sector is 3.37, 4.05, 4.62, and 7.62 for South Africa, Namibia, Lesotho, and Eswatini respectively, and the sector also performs better in per capita terms. It also reflects the structural change in the region (i.e. moving from the primary to the secondary and tertiary sectors, see Figure 1). The negative AAGR of the primary sector PCGDP (PCPGDP) (-0.21), and the very low AAGR of the secondary sector PCGDP (PCSGDP) (0.10) in South Africa, is an indication of the growth-reducing structural change in the economy (i.e. policies to induce resource allocation from one sector to another).

Figure 1: AAGR of GDP and its components in the CMA economies



Note: RSA: South Africa. GDP is at 2010 constant prices.

Source: authors' illustration based on data from World Development Indicators.

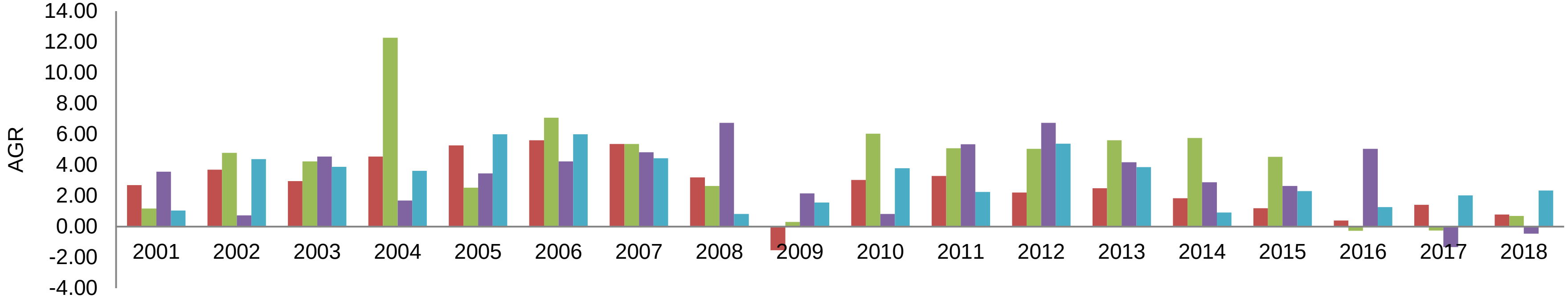
The AGR of the aggregate and PCGDP of the CMA economies is presented in Figures 2 and 3. The AGR of the aggregate GDP of the region's leading economy, i.e. South Africa, shows that until the global crisis of 2008 it maintains a steady growth rate, before it collapses in 2009 (when the AGR is -1.54). However, the economy recovers until it enters another slowdown in 2016 and thereafter. A similar trend in AGR is also observed for the other CMA member economies, although none of them experience a negative growth rate until 2015. The economy of Namibia shows periodic fluctuations in its AGR of the aggregate GDP (reaching a maximum in 2004 at 12.27, and a minimum in 2016 at -0.28), whereas Eswatini has a relatively stable growth rate (it never experiences negative growth). The figures also reveal that Lesotho is not seriously affected by the global financial crisis of 2008 (the AGR of GDP for Lesotho in 2009 is 2.15), although the economy experiences negative growth after 2016. The economies in the region also have similar AGR with respect to their PCGDP (Figure 3). This shows that both South Africa and Namibia are negatively affected by the global crisis, although all the economies have a downward trend throughout the period (most of them have negative growth after 2015).

The performance of the primary sector of the CMA economies is presented in Figures 4 and 5. Both figures show heavy periodic fluctuations in the AGR of GDP from the primary sector and its PCGDP in all the CMA economies. Indeed, the performance of the sector is very poor in the region. Since the growth rates are on a year-to-year basis, the high positive growth in some years for some economies (e.g., Lesotho) may be due to negative growth in the previous year(s). However, the overall performance of the sector is poor in the CMA region (the trend line for PCGDP for the sector for all the economies is close to the x axis).

The AGR of the GDP from the secondary sector (both in aggregate and per capita) is presented in Figures 6 and 7. Both figures portray the dismal performance of the sector in the region since 2000. The figures show that the AGR is negative for three economies—South Africa, Namibia, and Lesotho—immediately after 2008, i.e. in 2009, as the effect of the 2008 global crisis is visible after a one-year lag. Indeed, in per capita terms, apart from Namibia, the other three economies in the region all show poor performance of the sector.

The performance of the tertiary sector is an indication of the structural shift of the region. The AGR of the aggregate as well as PCGDP from the tertiary sector shows periodic fluctuations in all the CMA economies (Figures 8 and 9). The degree of variation varies across economies (e.g., Lesotho has a greater variation than the other economies, see Table 3). However, as shown in Table 3, the AAGR of the sector (in both aggregate and per capita terms) is positive for all the economies in the region.

Figure 2: AGR of GDP at constant prices



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
RSA	2.70	3.70	2.95	4.55	5.28	5.60	5.36	3.19	-1.54	3.04	3.28	2.21	2.49	1.85	1.19	0.40	1.41	0.79
Namibia	1.18	4.79	4.24	12.27	2.53	7.07	5.37	2.65	0.30	6.04	5.09	5.06	5.61	5.76	4.53	-0.28	-0.26	0.70
Lesotho	3.56	0.72	4.56	1.69	3.47	4.23	4.83	6.74	2.15	0.82	5.36	6.74	4.19	2.88	2.65	5.05	-1.32	-0.45
Eswatini	1.05	4.38	3.88	3.62	6.00	5.99	4.44	0.82	1.57	3.79	2.25	5.39	3.86	0.91	2.31	1.27	2.02	2.35

Note: RSA: South Africa. GDP is at 2010 constant prices.

Source: authors' illustration based on data from World Development Indicators.

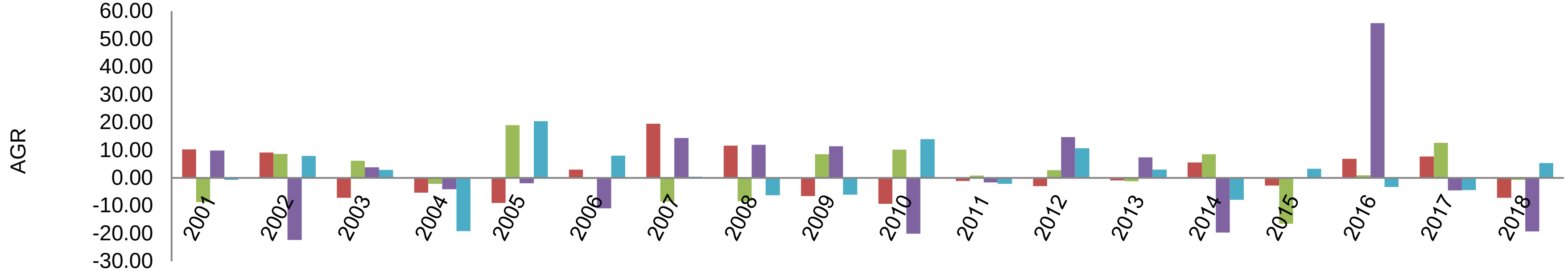
Figure 3: AGR of PCGDP at constant prices

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
RSA	1.34	2.40	1.70	3.29	3.98	4.28	4.01	1.82	-2.90	1.55	1.72	0.61	0.85	0.25	-0.34	-1.06	0.00	-0.57
Namibia	-0.44	3.21	2.71	10.58	0.91	5.28	3.53	0.80	-1.52	4.15	3.25	3.24	3.78	4.48	4.19	-0.73	-2.71	-4.05
Lesotho	3.41	1.02	5.15	2.32	3.98	4.55	4.99	6.73	2.00	6.14	6.19	5.31	1.47	2.07	1.94	2.42	-3.04	-2.30
Eswatini	0.24	3.82	3.50	3.27	5.56	5.43	3.78	0.12	0.84	3.08	1.56	4.68	3.14	0.16	1.48	0.36	1.05	1.32

Note: RSA: South Africa. GDP is at 2010 constant prices.

Source: authors' illustration based on data from World Development Indicators.

Figure 4: AGR of PGDP

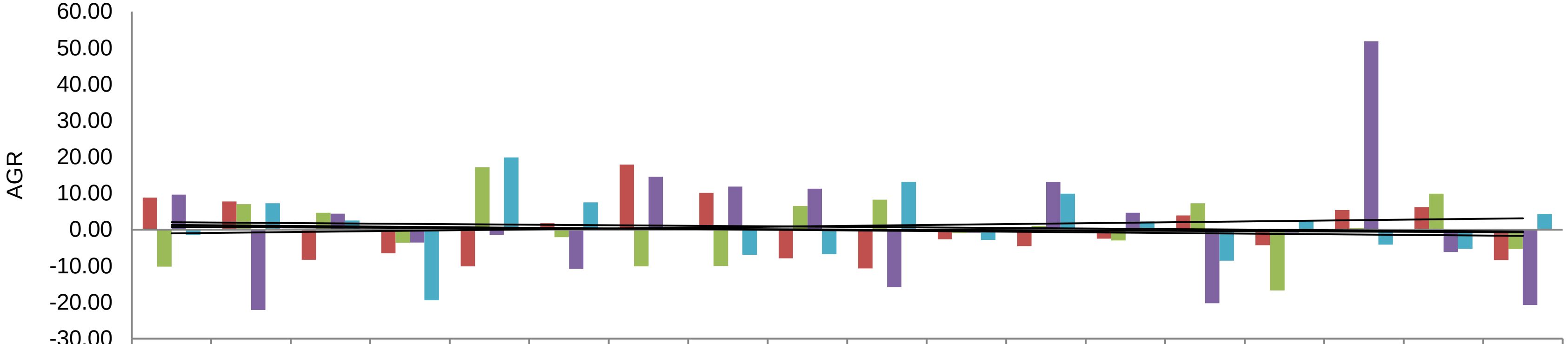


	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
RSA	10.30	9.12	-7.15	-5.34	-8.96	3.03	19.46	11.63	-6.57	-9.34	-1.12	-2.97	-0.90	5.58	-2.81	6.90	7.67	-7.12
Namibia	-8.75	8.64	6.21	-2.13	19.01	-0.39	-8.52	-8.36	8.49	10.21	0.85	2.80	-1.26	8.54	-16.48	0.93	12.63	-0.66
Lesotho	9.80	-22.38	3.77	-4.12	-1.94	-10.99	14.40	11.85	11.41	-20.08	-1.65	14.67	7.43	-19.62	-0.16	55.72	-4.47	-19.24
Eswatini	-0.72	7.86	2.91	-19.18	20.40	8.04	0.42	-6.25	-6.04	13.96	-2.15	10.63	2.97	-7.86	3.27	-3.29	-4.38	5.38

Note: RSA: South Africa. GDP is at 2010 constant prices.

Source: authors’ illustration based on data from World Development Indicators.

Figure 5: AGR of PCPGDP

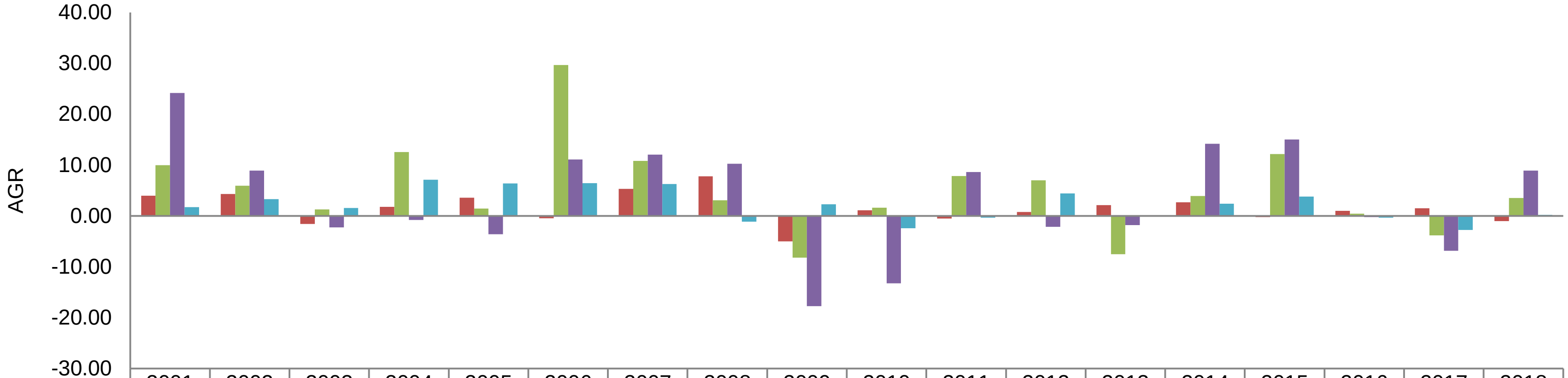


	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
RSA	8.84	7.75	-8.28	-6.49	-10.08	1.74	17.93	10.15	-7.86	-10.65	-2.62	-4.50	-2.48	3.92	-4.28	5.35	6.16	-8.37
Namibia	-10.21	7.01	4.65	-3.59	17.13	-2.06	-10.13	-10.02	6.52	8.24	-0.92	1.01	-2.97	7.23	-16.75	0.48	9.87	-5.35
Lesotho	9.64	-22.15	4.36	-3.53	-1.46	-10.72	14.58	11.84	11.24	-15.86	-0.86	13.13	4.63	-20.26	-0.85	51.83	-6.14	-20.74
Eswatini	-1.52	7.28	2.53	-19.46	19.90	7.47	-0.21	-6.91	-6.71	13.17	-2.80	9.89	2.25	-8.55	2.42	-4.15	-5.30	4.32

Note: RSA: South Africa. GDP is at 2010 constant prices.

Source: authors’ illustration based on data from World Development Indicators.

Figure 6: AGR of SGDP

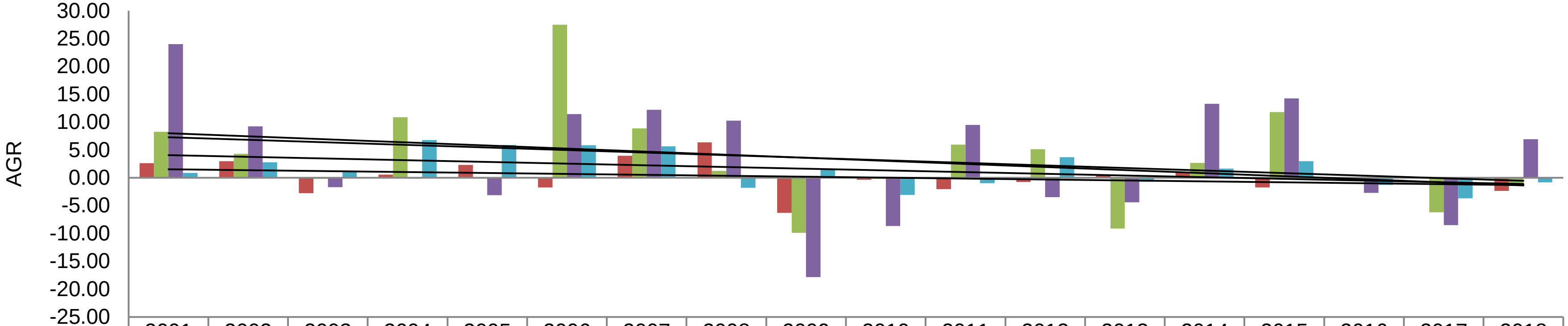


	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
RSA	3.99	4.29	-1.58	1.79	3.58	-0.47	5.33	7.78	-5.00	1.11	-0.54	0.80	2.14	2.71	-0.23	0.99	1.50	-1.04
Namibia	9.99	5.92	1.30	12.57	1.46	29.66	10.83	3.10	-8.20	1.62	7.87	7.01	-7.51	3.92	12.15	0.44	-3.82	3.51
Lesotho	24.20	8.91	-2.26	-0.78	-3.60	11.11	12.05	10.28	-17.72	-13.23	8.63	-2.16	-1.83	14.21	15.05	-0.22	-6.87	8.93
Eswatini	1.71	3.31	1.55	7.14	6.36	6.42	6.29	-1.10	2.27	-2.41	-0.33	4.40	-0.02	2.42	3.81	-0.37	-2.75	0.21

Note: RSA: South Africa. GDP is at 2010 constant prices.

Source: authors' illustration based on data from World Development Indicators.

Figure 7: AGR of PCSGDP

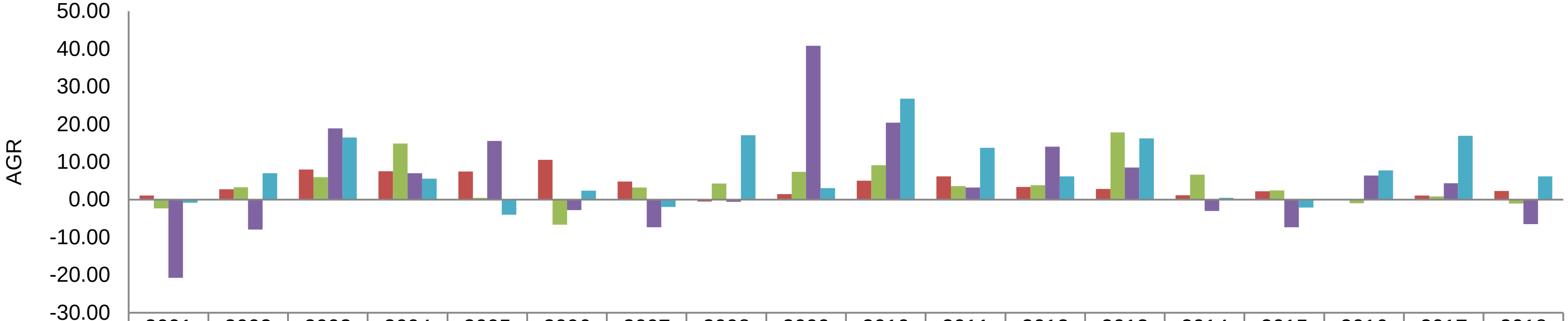


	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
RSA	2.61	2.98	-2.78	0.56	2.31	-1.72	3.98	6.35	-6.31	-0.36	-2.04	-0.79	0.51	1.09	-1.74	-0.48	0.08	-2.38
Namibia	8.24	4.33	-0.19	10.88	-0.14	27.49	8.89	1.24	-9.87	-0.20	5.98	5.15	-9.11	2.67	11.79	-0.01	-6.18	-1.37
Lesotho	24.02	9.22	-1.70	-0.17	-3.12	11.46	12.22	10.27	-17.84	-8.65	9.50	-3.47	-4.38	13.31	14.25	-2.71	-8.50	6.91
Eswatini	0.89	2.76	1.17	6.78	5.92	5.85	5.62	-1.79	1.54	-3.09	-0.99	3.70	-0.72	1.66	2.96	-1.26	-3.68	-0.80

Note: RSA: South Africa. GDP is at 2010 constant prices.

Source: authors' illustration based on data from World Development Indicators.

Figure 8: AGR of GDP of tertiary sector

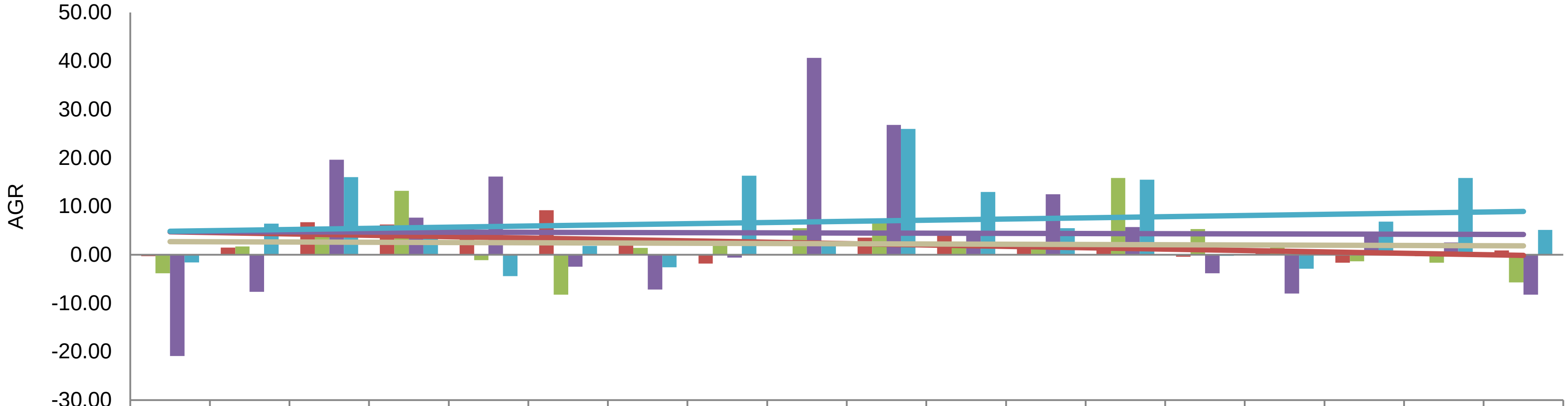


	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
RSA	1.06	2.79	8.01	7.56	7.43	10.58	4.80	-0.53	1.44	5.06	6.17	3.35	2.83	1.16	2.27	-0.20	1.13	2.28
Namibia	-2.28	3.28	5.95	14.89	0.49	-6.67	3.20	4.26	7.40	9.11	3.61	3.83	17.88	6.60	2.47	-0.93	0.83	-1.06
Lesotho	-20.77	-7.92	18.94	7.00	15.58	-2.76	-7.31	-0.55	40.85	20.42	3.21	14.04	8.54	-3.03	-7.34	6.42	4.35	-6.48
Eswatini	-0.78	6.97	16.46	5.55	-4.02	2.40	-1.96	17.10	3.08	26.83	13.74	6.16	16.27	0.52	-2.10	7.78	16.96	6.18

Note: RSA: South Africa. GDP is at 2010 constant prices.

Source: authors’ illustration based on data from World Development Indicators.

Figure 9: AGR of PCGDP of tertiary sector



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
RSA	-0.28	1.50	6.69	6.26	6.11	9.19	3.46	-1.84	0.04	3.54	4.56	1.73	1.19	-0.42	0.71	-1.65	-0.29	0.90
Namibia	-3.84	1.73	4.39	13.17	-1.10	-8.24	1.39	2.38	5.46	7.16	1.79	2.03	15.83	5.32	2.14	-1.37	-1.64	-5.73
Lesotho	-20.88	-7.65	19.62	7.66	16.14	-2.46	-7.17	-0.56	40.63	26.77	4.03	12.51	5.71	-3.80	-7.98	3.76	2.53	-8.21
Eswatini	-1.58	6.40	16.03	5.19	-4.42	1.85	-2.57	16.29	2.35	25.95	12.97	5.45	15.46	-0.23	-2.90	6.82	15.84	5.11

Note: RSA: South Africa. GDP is at 2010 constant prices.

Source: authors' illustration based on data from World Development Indicators.

3.2 Economic performance of the provinces of South Africa

The economic performance and AAGR of the various indicators of growth of the nine provinces of South Africa during the studied period are presented in Table 4. The higher growth rate of GDP at current prices compared with GDP at constant prices in all nine provinces is an indication of the growth of the price level in all the provinces (Figure 10).

The provinces that contain the legislative and administrative capitals of South Africa, namely Western Cape and Gauteng[1] (with growth rates of 3.33 and 3.22 respectively), have higher growth rates than other provinces. This phenomenon highlights the agglomeration effect and the role of policies, institutions, and proximity to these in determining economic performance. Sector-wise performance in the region shows that in both per capita and absolute terms, the performance of the tertiary sector is better than the primary and secondary sectors. Indeed, in per capita terms, except for three provinces (Eastern Cape, KwaZulu-Natal, and Limpopo), the other provinces have a negative AAGR in the primary sector. Similarly, in the secondary sector, provinces such as Western Cape, Northern Cape, and Gauteng have negative growth in per capita terms.

There is an increasing trend of PCGDP at current prices for all provinces for the period 1998–2017. Among all the provinces, Gauteng has the highest PCGDP followed by Western Cape, while Eastern Cape and Limpopo languish. The AGR of GDP at current prices is positive for all the provinces throughout the studied period except Northern Cape, which has a negative AGR in 2009 (-0.52), an incidence arising from the global crisis of 2008 (Figure 11). There is fluctuation in the growth rate of PCGDP in all the provinces over the period (Figure 12 and Table 4).

Figures 13 and 14 show the AGR of GDP and PCGDP at constant prices for the nine provinces over the period 1998–2017. Both figures depict fluctuation in AGR, but it is relatively higher for PCGDP (Table 4). The presence of a 'V' in all the AGR of GDP for all the provinces in 2009 indicates the reduction and recovery due to the global crisis of 2008. However, the recovery is temporary, as all the provinces experience a permanent reduction in AGR of GDP at constant prices (the decline is prominent for North West).

The growth performance of the primary sector in the provinces is presented in Figures 15 and 16. Both figures display the dismal performance of the sector in both absolute and per capita terms. Northern Cape, North West, Mpumalanga, and Limpopo have the highest PCGDP from the primary sector, while Eastern Cape, Western Cape, KwaZulu-Natal, and Gauteng have the lowest. There is fluctuation in the growth rate of PCPGDP for the provinces, but the fluctuation is greater for North West and Eastern Cape. Moreover, in 2009 the growth rate also falls for all the provinces due to the global financial crisis of 2008.

[1] The legislative capital Cape Town is in Western Cape, and the administrative capital Pretoria is in Gauteng.

Table 4: AAGR and standard deviations of AGR of GDP and its components in the nine provinces of South Africa

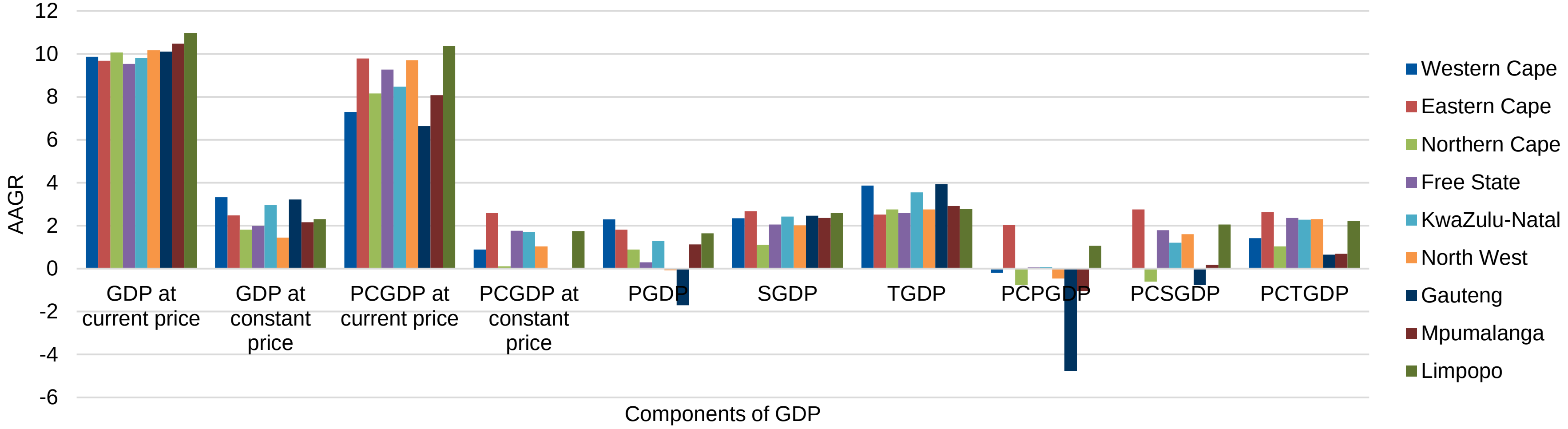
	Western Cape	Eastern Cape	Northern Cape	Free State	KwaZulu-Natal	North West	Gauteng	Mpumalanga	Limpopo
					AAGR				
GDP at current prices	9.87	9.68	10.06	9.54	9.81	10.17	10.10	10.47	10.98
GDP at constant prices	3.33	2.48	1.81	1.99	2.96	1.45	3.22	2.16	2.30
PCGDP at current prices	7.29	9.79	8.16	9.27	8.48	9.71	6.64	8.08	10.37
PCGDP at constant prices	0.89	2.59	0.11	1.76	1.71	1.03	-0.03	-0.04	1.75
PGDP	2.29	1.82	0.89	0.29	1.29	-0.08	-1.70	1.13	1.64
SGDP	2.35	2.67	1.11	2.05	2.42	2.02	2.47	2.36	2.60
TGDP	3.87	2.52	2.75	2.60	3.55	2.75	3.93	2.91	2.77
PCPGDP	-0.20	2.03	-0.77	0.06	0.07	-0.46	-4.78	-1.04	1.06
PCSGDP	-0.04	2.76	-0.61	1.79	1.20	1.61	-0.76	0.17	2.06
PCTGDP	1.42	2.62	1.04	2.36	2.28	2.30	0.65	0.69	2.23
					Standard deviation of AGR				
GDP at current prices	3.33	3.24	5.42	4.54	3.22	4.40	3.25	4.00	3.41
GDP at constant prices	1.94	1.73	1.79	2.05	2.00	2.72	1.96	1.52	2.00
PCGDP at current prices	5.42	5.65	6.78	4.89	4.28	7.02	5.90	4.50	4.27
PCGDP at constant prices	4.08	4.62	5.36	3.34	3.29	5.97	4.84	2.92	3.55

PGDP	6.14	9.32	3.79	6.22	7.89	7.00	5.12	2.76	4.28
SGDP	3.19	3.38	4.56	2.41	3.63	4.34	3.81	2.78	3.57
TGDP	1.99	1.54	2.07	1.70	1.67	2.00	1.71	1.64	1.87
PCPGDP	5.56	11.46	6.55	6.85	8.36	8.97	6.90	3.78	4.52
PCSGDP	5.36	5.15	6.07	3.07	4.84	7.09	5.94	3.87	4.81
PCTGDP	3.97	4.50	5.50	3.12	2.80	5.33	4.65	2.77	3.89

Note: PCGDP: per capita GDP. PGDP: GDP of primary sector. SGDP: GDP of secondary sector. TGDP: GDP of tertiary sector. PCPGDP: per capita GDP of primary sector. PCSGDP: per capita GDP of secondary sector. PCTGDP: per capita GDP of tertiary sector.

Source: authors' calculations based on data from Statistics South Africa, National Treasury of South Africa, and South African Reserve Bank.

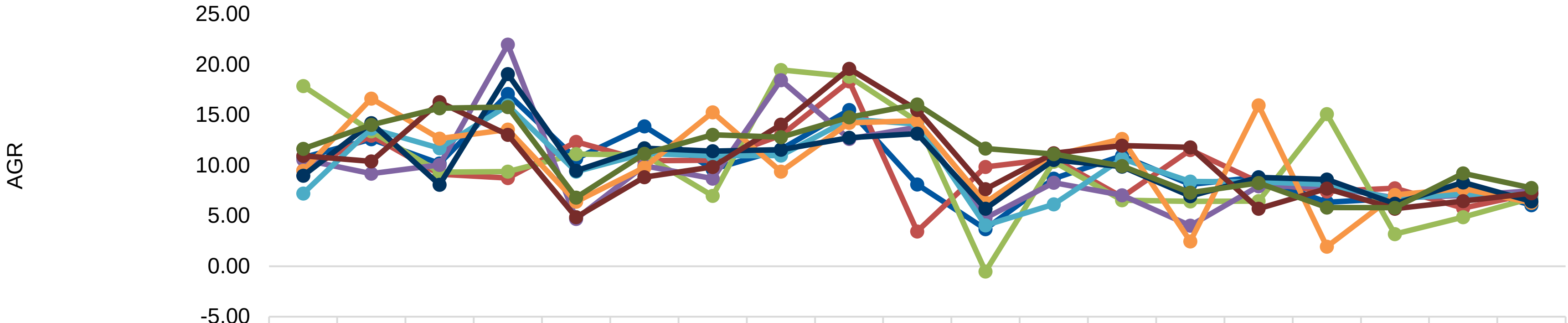
Figure 10: AAGR of the components of GDP of the nine provinces of South Africa



Note: PCGDP: per capita GDP. PGDP: GDP of primary sector. SGDP: GDP of secondary sector. TGDP: GDP of tertiary sector. PCPGDP: per capita GDP of primary sector. PCSGDP: per capita GDP of secondary sector. PCTGDP: per capita GDP of tertiary sector.

Source: authors' illustration based on data from Statistics South Africa, National Treasury of South Africa, and South African Reserve Bank.

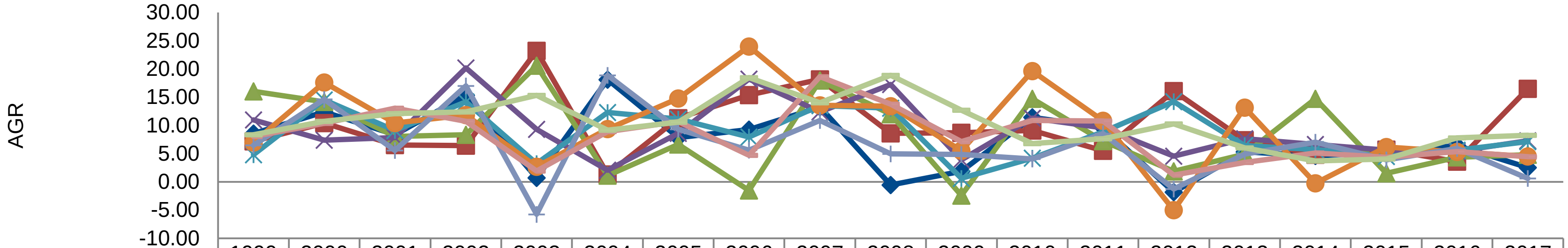
Figure 11: AGR of GDP at current prices



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Western Cape	10.79	12.61	10.20	17.08	10.66	13.88	9.61	11.59	15.49	8.11	3.69	8.69	10.95	8.13	8.84	6.36	6.73	8.03	6.05
Eastern Cape	9.50	12.97	9.14	8.75	12.34	10.46	10.51	12.98	18.35	3.46	9.85	10.66	6.87	11.52	8.35	7.43	7.73	5.76	7.22
Northern Cape	17.89	13.40	9.34	9.40	11.14	11.03	6.98	19.48	18.81	14.38	-0.52	10.36	6.55	6.45	6.47	15.09	3.19	4.88	6.77
Free State	10.59	9.20	10.06	21.98	4.70	9.98	8.70	18.45	12.64	13.78	4.79	8.28	7.05	4.03	7.95	7.91	6.77	7.03	7.47
KwaZulu-Natal	7.21	13.66	11.72	15.95	9.38	11.18	10.97	10.97	14.57	14.10	4.06	6.16	10.65	8.40	8.37	8.11	6.70	7.15	7.08
North West	9.47	16.64	12.67	13.56	6.41	9.78	15.26	9.40	14.22	14.44	6.32	10.99	12.65	2.47	15.97	1.94	7.07	7.70	6.30
Gauteng	8.99	14.21	8.08	19.06	9.49	11.72	11.42	11.57	12.75	13.16	5.70	10.56	9.88	6.96	8.82	8.60	6.21	8.31	6.45
Mpumalanga	10.96	10.41	16.28	13.05	4.86	8.84	9.85	14.05	19.59	15.50	7.66	11.21	11.97	11.79	5.70	7.71	5.71	6.45	7.25
Limpopo	11.65	14.02	15.69	15.80	6.82	11.15	13.03	12.82	14.79	16.06	11.67	11.14	9.94	7.30	8.25	5.82	5.81	9.23	7.76

Source: authors' illustration based on data from Statistics South Africa, National Treasury of South Africa, and South African Reserve Bank.

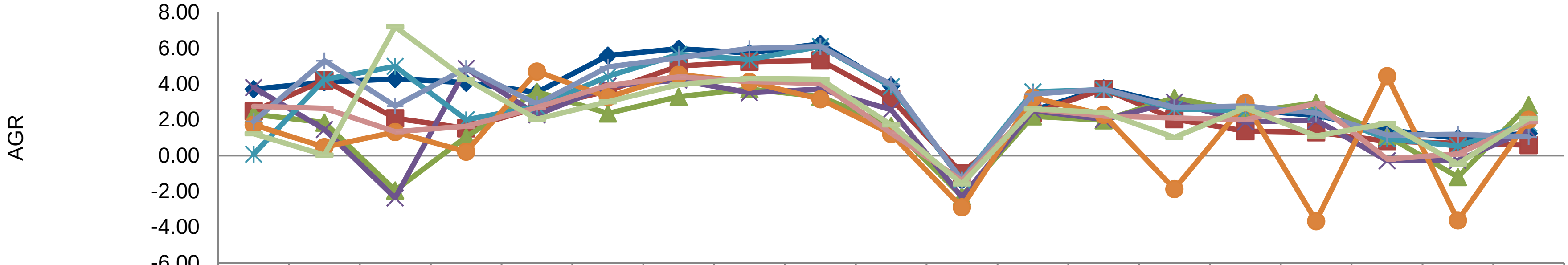
Figure 12: AGR of PCGDP at current prices



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Western Cape	8.55	12.41	8.36	15.34	0.70	18.13	7.85	9.24	13.24	-0.57	1.86	11.46	9.61	-1.80	5.33	4.63	5.28	6.43	2.51
Eastern Cape	7.21	10.43	6.53	6.41	23.21	1.34	11.29	15.36	18.14	8.60	8.70	9.10	5.53	16.08	7.40	4.79	5.71	3.58	16.51
Northern Cape	16.03	14.17	8.04	8.33	20.58	1.09	6.63	-1.50	17.98	11.97	-2.40	14.73	7.25	1.88	4.91	14.71	1.54	4.34	4.80
Free State	11.00	7.38	7.85	20.19	9.32	2.06	8.61	18.22	12.38	17.26	3.90	11.26	9.57	4.56	7.65	6.61	5.60	5.40	7.28
KwaZulu-Natal	4.83	14.52	9.10	14.17	3.23	12.27	11.14	7.92	13.53	13.07	0.63	4.20	8.88	14.23	6.40	5.71	4.51	5.60	7.13
North West	6.98	17.61	10.43	11.84	2.70	9.34	14.77	23.98	13.54	13.41	5.54	19.65	10.83	-5.02	13.14	-0.24	6.19	5.33	4.49
Gauteng	6.49	14.60	5.56	17.01	-5.74	18.89	9.32	5.62	10.86	4.94	4.86	4.04	8.55	-1.27	4.92	7.03	3.91	5.92	0.63
Mpumalanga	8.05	10.36	13.05	10.71	1.94	8.92	10.68	4.68	18.64	13.78	7.16	10.88	10.76	1.20	3.45	5.13	4.36	5.36	4.45
Limpopo	8.33	10.73	12.11	12.38	15.31	9.16	10.56	18.49	13.99	18.88	12.68	6.80	7.66	10.27	6.03	3.71	4.03	7.78	8.23

Source: authors' illustration based on data from Statistics South Africa, National Treasury of South Africa, and South African Reserve Bank.

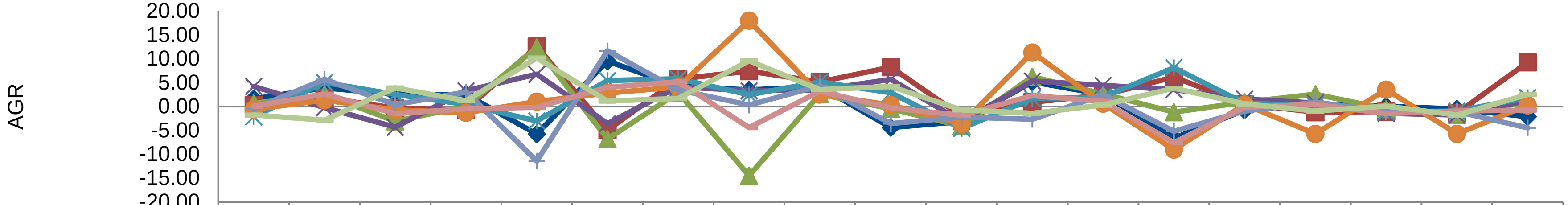
Figure 13: AGR of GDP at constant prices



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Western Cape	3.71	4.11	4.28	4.07	3.53	5.58	5.98	5.73	6.25	3.90	-1.39	2.53	3.77	2.81	2.57	2.24	1.43	0.97	1.25
Eastern Cape	2.48	4.20	2.09	1.53	2.67	3.62	5.01	5.24	5.32	3.16	-0.98	2.35	3.72	2.03	1.37	1.30	0.81	0.68	0.59
Northern Cape	2.31	1.85	-1.94	1.05	3.57	2.36	3.30	3.72	3.30	1.66	-2.26	2.20	1.97	3.23	2.42	2.95	1.10	-1.21	2.84
Free State	3.81	1.46	-2.36	4.87	2.27	3.89	4.23	3.51	3.71	2.56	-2.32	2.52	2.02	3.00	1.88	1.99	-0.29	-0.28	1.43
KwaZulu-Natal	0.07	4.26	4.98	2.00	2.74	4.43	5.66	5.36	6.10	3.85	-1.36	3.57	3.68	2.62	2.52	2.45	0.93	0.55	1.81
North West	1.72	0.48	1.31	0.22	4.70	3.27	4.52	4.13	3.16	1.21	-2.89	3.25	2.28	-1.87	2.93	-3.66	4.44	-3.62	2.01
Gauteng	1.90	5.31	2.76	4.87	2.89	4.95	5.46	5.99	6.10	3.98	-1.39	3.44	3.70	2.70	2.77	2.38	1.15	1.20	1.05
Mpumalanga	2.75	2.64	1.33	1.64	2.70	3.94	4.40	4.14	4.03	1.26	-1.40	2.59	2.22	2.10	2.01	2.91	-0.19	0.10	1.89
Limpopo	1.23	0.03	7.20	4.27	2.05	3.01	3.97	4.32	4.27	1.71	-1.59	2.61	2.41	1.02	2.66	1.10	1.81	-0.47	2.09

Source: authors' illustration based on data from Statistics South Africa, National Treasury of South Africa, and South African Reserve Bank.

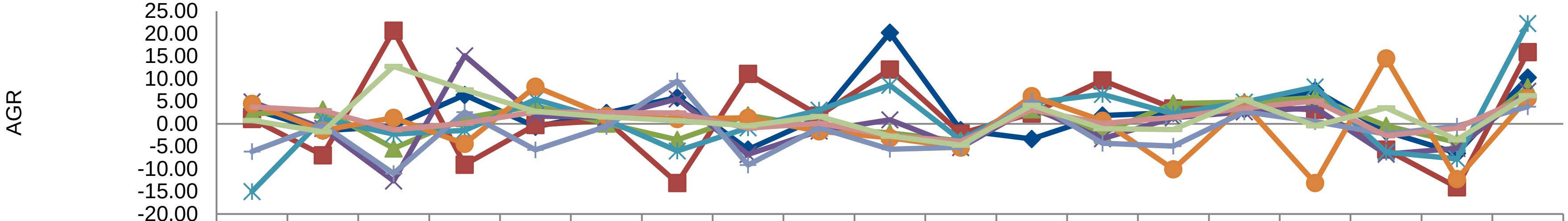
Figure 14: AGR of PCGDP at constant prices



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Western Cape	1.62	3.92	2.54	2.52	-5.79	9.52	4.27	3.50	4.18	-4.44	-3.14	5.14	2.51	-6.63	-0.74	0.58	0.06	-0.53	-2.13
Eastern Cape	0.34	1.87	-0.35	-0.66	12.60	-4.93	5.74	7.45	5.14	8.29	-2.01	0.91	2.41	6.20	0.48	-1.19	-1.08	-1.39	9.31
Northern Cape	0.70	2.55	-3.10	0.06	12.37	-6.80	2.96	-14.50	2.58	-0.48	-4.11	6.25	2.64	-1.20	0.92	2.62	-0.51	-1.71	0.95
Free State	4.19	-0.23	-4.32	3.33	6.79	-3.59	4.14	3.31	3.47	5.70	-3.15	5.35	4.42	3.53	1.60	0.76	-1.39	-1.80	1.25
KwaZulu-Natal	-2.15	5.05	2.52	0.44	-3.03	5.45	5.82	2.47	5.14	2.91	-4.60	1.67	2.02	8.13	0.66	0.17	-1.14	-0.91	1.85
North West	-0.59	1.31	-0.70	-1.30	1.05	2.85	4.07	18.00	2.55	0.30	-3.61	11.30	0.63	-9.04	0.43	-5.73	3.57	-5.75	0.27
Gauteng	-0.44	5.67	0.36	3.07	-11.42	11.68	3.47	0.34	4.32	-3.58	-2.18	-2.66	2.45	-5.20	-0.92	0.90	-1.04	-1.03	-4.47
Mpumalanga	0.05	2.59	-1.49	-0.47	-0.16	4.01	5.19	-4.41	3.20	-0.26	-1.86	2.29	1.11	-7.58	-0.17	0.45	-1.47	-0.93	-0.77
Limpopo	-1.78	-2.86	3.89	1.19	10.16	1.17	1.70	9.56	3.54	4.18	-0.69	-1.40	0.29	3.82	0.56	-0.92	0.09	-1.79	2.54

Source: authors' illustration based on data from Statistics South Africa, National Treasury of South Africa, and South African Reserve Bank.

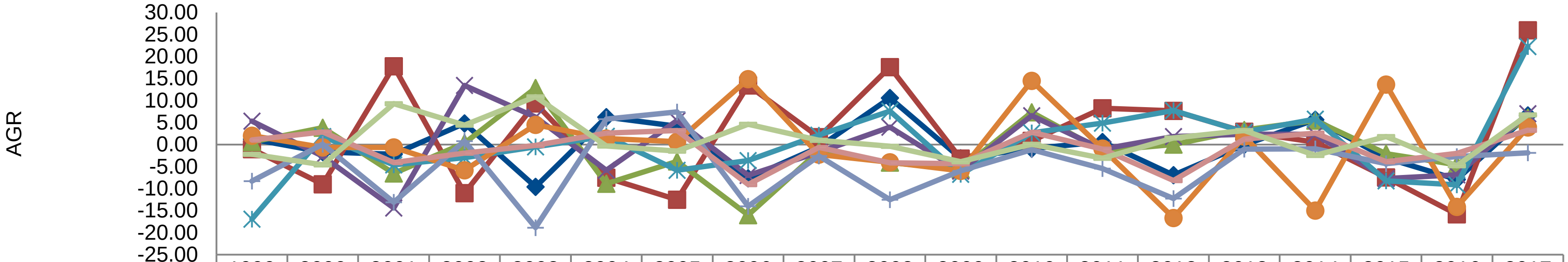
Figure 15: AGR of PGDP



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Western Cape	3.34	-1.50	-0.55	6.38	-0.64	2.40	5.84	-5.69	1.43	20.22	-1.37	-3.38	1.85	2.46	3.28	7.43	-1.68	-6.50	10.28
Eastern Cape	1.12	-6.95	20.69	-9.04	-0.26	0.78	-13.13	11.11	1.84	12.05	-2.12	2.30	9.67	3.44	3.85	3.09	-5.69	-14.07	15.91
Northern Cape	2.18	3.16	-5.44	1.30	4.03	0.05	-3.53	1.89	-0.80	-2.02	-3.82	3.26	-2.07	4.51	4.85	5.83	-0.45	-4.11	8.10
Free State	4.92	-0.98	-12.65	15.13	1.74	1.44	5.53	-6.80	-1.55	0.87	-5.22	3.69	-3.28	1.31	2.65	3.57	-6.68	-5.46	7.22
KwaZulu-Natal	-15.03	1.07	-2.30	-1.43	5.43	0.92	-5.99	-0.88	3.05	8.58	-3.58	4.62	6.57	2.25	4.80	8.20	-6.29	-7.78	22.25
North West	4.43	-1.47	1.36	-4.40	8.24	1.81	1.09	1.36	-1.65	-3.12	-5.24	6.18	0.72	-10.06	4.34	-13.10	14.56	-12.21	5.73
Gauteng	-6.11	-0.25	-11.01	2.59	-5.75	-0.59	9.49	-9.13	-0.90	-5.65	-5.19	5.07	-4.28	-4.91	2.67	0.52	-2.24	-0.52	3.84
Mpumalanga	3.75	2.93	-1.31	0.15	2.68	2.50	2.44	-0.92	0.13	-2.67	-3.86	3.10	0.09	1.47	3.47	5.11	-2.66	-0.96	6.04
Limpopo	0.80	-1.79	12.76	7.58	2.72	1.51	0.69	-0.41	1.66	-2.73	-4.73	4.16	-1.06	-1.25	5.34	-0.45	3.56	-3.54	6.29

Source: authors' illustration based on data from Statistics South Africa, National Treasury of South Africa, and South African Reserve Bank.

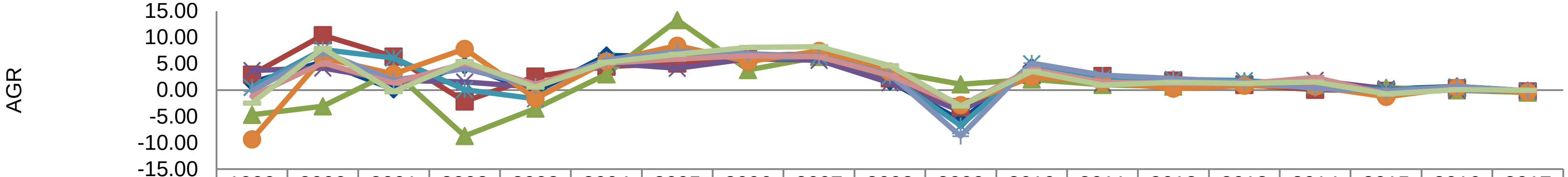
Figure 16: AGR of PCPGDP



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Western Cape	1.25	-1.68	-2.21	4.80	-9.59	6.22	4.14	-7.68	-0.55	10.58	-3.12	-0.92	0.61	-6.95	-0.06	5.69	-3.01	-7.88	6.60
Eastern Cape	-1.00	-9.04	17.80	-11.00	9.39	-7.54	-12.52	13.44	1.67	17.62	-3.14	0.86	8.28	7.66	2.94	0.56	-7.46	-15.84	25.95
Northern Cape	0.57	3.87	-6.56	0.31	12.86	-8.90	-3.84	-16.00	-1.49	-4.08	-5.64	7.35	-1.43	0.02	3.32	5.49	-2.04	-4.61	6.11
Free State	5.30	-2.62	-14.40	13.44	6.23	-5.86	5.44	-6.98	-1.77	3.95	-6.03	6.55	-1.00	1.83	2.37	2.32	-7.71	-6.90	7.02
KwaZulu-Natal	-16.91	1.83	-4.59	-2.95	-0.50	1.91	-5.85	-3.61	2.12	7.60	-6.75	2.69	4.86	7.75	2.90	5.80	-8.22	-9.12	22.30
North West	2.05	-0.65	-0.65	-5.84	4.47	1.39	0.65	14.87	-2.23	-4.00	-5.93	14.46	-0.91	-16.64	1.80	-14.96	13.61	-14.15	3.93
Gauteng	-8.27	0.09	-13.08	0.82	-18.85	5.79	7.42	-13.98	-2.55	-12.50	-5.95	-1.13	-5.43	-12.22	-1.01	-0.93	-4.36	-2.71	-1.84
Mpumalanga	1.02	2.87	-4.05	-1.92	-0.18	2.58	3.22	-9.05	-0.67	-4.13	-4.31	2.79	-0.99	-8.14	1.26	2.59	-3.90	-1.97	3.28
Limpopo	-2.19	-4.62	9.27	4.39	10.88	-0.30	-1.51	4.59	0.96	-0.37	-3.87	0.09	-3.11	1.49	3.18	-2.44	1.82	-4.82	6.76

Source: authors' illustration based on data from Statistics South Africa, National Treasury of South Africa, and South African Reserve Bank.

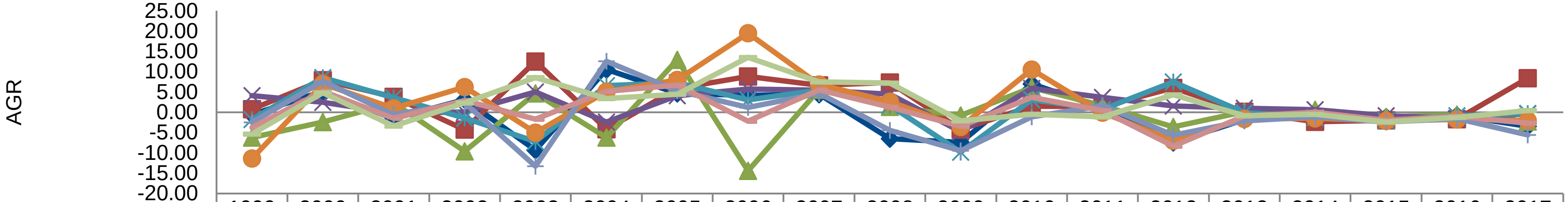
Figure 17: AGR of SGDP



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Western Cape	1.51	5.33	0.14	4.70	-0.32	6.58	6.39	6.42	6.50	1.68	-5.77	4.36	2.37	1.93	1.41	0.61	0.17	0.70	-0.14
Eastern Cape	2.95	10.42	6.36	-2.16	2.60	4.48	5.10	6.58	6.85	2.23	-3.22	2.93	2.68	1.83	1.00	0.11	-0.11	0.37	-0.23
Northern Cape	-4.70	-3.04	3.58	-8.71	-3.52	3.02	13.31	3.83	6.34	3.53	1.14	2.07	0.99	0.69	1.62	0.99	0.47	-0.02	-0.45
Free State	3.72	4.23	1.86	1.56	0.60	5.15	4.16	5.95	5.66	1.38	-3.95	3.04	1.26	1.03	1.27	1.89	0.28	-0.01	-0.15
KwaZulu-Natal	0.50	7.71	6.09	0.10	-1.64	5.56	7.12	5.92	6.44	2.64	-6.72	5.02	2.33	2.02	1.80	0.88	0.00	0.61	-0.32
North West	-9.32	6.08	3.05	7.83	-1.60	5.48	8.46	5.42	7.46	3.52	-2.86	2.55	1.56	0.32	0.86	0.69	-1.28	0.45	-0.33
Gauteng	-0.18	7.29	1.81	4.10	0.74	5.77	7.35	6.90	6.41	3.04	-8.73	5.10	2.86	2.19	1.49	0.36	-0.24	0.69	-0.12
Mpumalanga	-1.17	5.18	1.35	5.07	1.10	5.10	5.90	6.55	6.33	2.80	-3.00	4.00	1.51	1.26	1.23	2.44	-0.72	0.08	-0.07
Limpopo	-2.46	7.95	-0.30	5.44	0.56	5.30	6.80	8.09	8.25	4.64	-3.02	3.55	0.94	1.52	1.26	1.55	-0.70	0.08	-0.03

Source: authors' illustration based on data from Statistics South Africa, National Treasury of South Africa, and South African Reserve Bank.

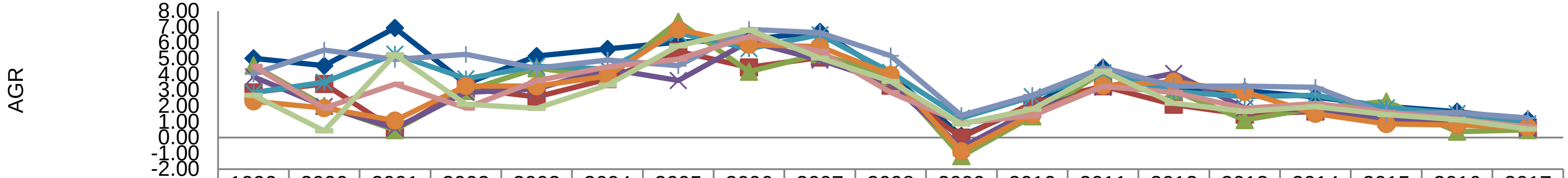
Figure 18: AGR of PCSGDP



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Western Cape	-0.54	5.14	-1.53	3.14	-9.30	10.55	4.67	4.18	4.43	-6.48	-7.44	7.02	1.13	-7.43	-1.86	-1.02	-1.18	-0.79	-3.47
Eastern Cape	0.79	7.94	3.82	-4.26	12.53	-4.15	5.84	8.83	6.67	7.31	-4.22	1.48	1.38	5.99	0.11	-2.35	-1.97	-1.70	8.41
Northern Cape	-6.21	-2.38	2.35	-9.60	4.68	-6.20	12.94	-14.41	5.60	1.36	-0.77	6.11	1.65	-3.62	0.13	0.66	-1.14	-0.53	-2.28
Free State	4.10	2.49	-0.18	0.06	5.04	-2.42	4.07	5.75	5.41	4.48	-4.77	5.89	3.64	1.55	0.99	0.66	-0.83	-1.53	-0.33
KwaZulu-Natal	-1.73	8.52	3.60	-1.44	-7.17	6.60	7.29	3.01	5.48	1.71	-9.79	3.09	0.69	7.50	-0.04	-1.36	-2.05	-0.85	-0.27
North West	-11.38	6.96	1.00	6.20	-5.03	5.05	7.99	19.47	6.82	2.59	-3.57	10.54	-0.08	-7.01	-1.60	-1.46	-2.10	-1.76	-2.03
Gauteng	-2.48	7.65	-0.57	2.31	-13.27	12.56	5.33	1.20	4.63	-4.45	-9.46	-1.10	1.62	-5.67	-2.14	-1.09	-2.40	-1.53	-5.58
Mpumalanga	-3.77	5.13	-1.47	2.90	-1.72	5.18	6.70	-2.20	5.48	1.26	-3.46	3.69	0.41	-8.34	-0.93	-0.01	-1.98	-0.95	-2.68
Limpopo	-5.36	4.84	-3.38	2.32	8.55	3.42	4.47	13.52	7.50	7.18	-2.13	-0.49	-1.15	4.33	-0.82	-0.48	-2.37	-1.25	0.41

Source: authors' illustration based on data from Statistics South Africa, National Treasury of South Africa, and South African Reserve Bank.

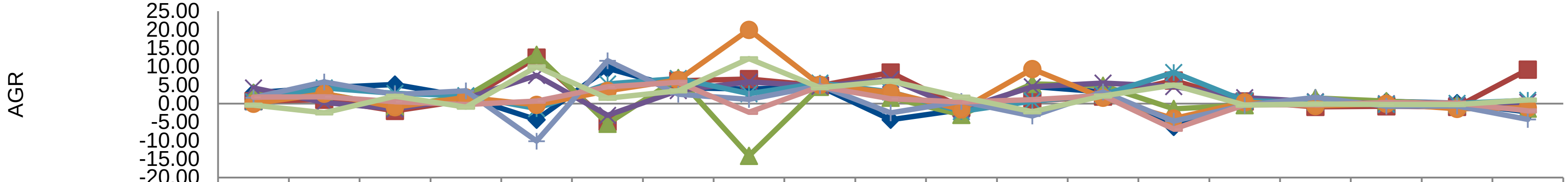
Figure 19: AGR of GDP from the tertiary sector



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Western Cape	5.02	4.54	6.93	3.39	5.16	5.61	6.04	6.21	6.68	3.97	0.10	2.03	4.42	3.19	2.97	2.57	1.97	1.64	1.14
Eastern Cape	2.85	3.40	0.48	3.11	2.56	3.69	5.46	4.44	5.06	3.29	0.01	2.17	3.25	2.09	1.46	1.65	1.20	1.18	0.49
Northern Cape	4.56	2.01	0.48	2.94	4.38	3.85	7.34	4.16	5.29	3.82	-1.18	1.35	4.16	2.98	1.12	1.88	2.29	0.37	0.48
Free State	3.84	1.98	0.59	2.85	3.08	4.35	3.61	6.08	4.91	3.44	-0.63	1.75	3.17	4.06	1.88	1.72	1.11	1.05	0.58
KwaZulu-Natal	2.83	3.50	5.28	3.73	4.51	4.34	6.62	5.63	6.50	4.13	1.23	2.58	4.09	2.92	2.59	2.67	1.89	1.53	0.88
North West	2.30	1.87	1.07	3.28	3.25	3.89	6.84	5.88	5.74	3.97	-0.86	1.45	3.29	3.54	2.89	1.50	0.86	0.80	0.65
Gauteng	4.03	5.54	4.95	5.26	4.39	4.90	4.54	6.84	6.62	5.18	1.40	2.68	4.43	3.24	3.25	3.18	1.48	1.57	1.24
Mpumalanga	4.52	1.86	3.38	1.87	3.60	4.48	4.97	6.40	5.46	2.85	0.93	1.39	3.24	2.86	1.85	2.15	1.60	1.18	0.67
Limpopo	2.68	0.42	5.24	2.11	1.85	3.32	5.80	6.81	5.04	3.55	0.87	1.80	4.21	2.17	1.65	1.96	1.46	1.13	0.54

Source: authors' illustration based on data from Statistics South Africa, National Treasury of South Africa, and South African Reserve Bank.

Figure 20: AGR of PCGDP from the tertiary sector



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Western Cape	2.90	4.35	5.15	1.85	-4.31	9.55	4.33	3.97	4.60	-4.37	-1.67	4.63	3.16	-6.29	-0.36	0.91	0.60	0.14	-2.24
Eastern Cape	0.70	1.08	-1.93	0.88	12.48	-4.87	6.20	6.64	4.88	8.42	-1.04	0.73	1.95	6.26	0.57	-0.84	-0.69	-0.90	9.19
Northern Cape	2.91	2.71	-0.71	1.93	13.24	-5.44	6.98	-14.13	4.55	1.63	-3.04	5.37	4.84	-1.43	-0.36	1.54	0.66	-0.15	-1.37
Free State	4.22	0.29	-1.43	1.34	7.63	-3.17	3.52	5.88	4.67	6.60	-1.47	4.56	5.60	4.59	1.60	0.50	-0.01	-0.49	0.40
KwaZulu-Natal	0.55	4.28	2.81	2.13	-1.36	5.36	6.78	2.72	5.54	3.19	-2.10	0.69	2.42	8.45	0.73	0.39	-0.20	0.06	0.92
North West	-0.03	2.72	-0.94	1.71	-0.35	3.47	6.38	19.99	5.12	3.03	-1.59	9.35	1.62	-4.03	0.39	-0.67	0.02	-1.43	-1.06
Gauteng	1.64	5.90	2.50	3.45	-10.12	11.63	2.56	1.14	4.84	-2.47	0.59	-3.38	3.17	-4.70	-0.45	1.70	-0.71	-0.67	-4.29
Mpumalanga	1.77	1.81	0.51	-0.24	0.71	4.56	5.76	-2.34	4.62	1.31	0.46	1.09	2.12	-6.88	-0.32	-0.30	0.30	0.14	-1.96
Limpopo	-0.37	-2.47	1.99	-0.91	9.94	1.48	3.49	12.18	4.31	6.07	1.78	-2.17	2.05	5.00	-0.44	-0.07	-0.24	-0.22	0.98

Source: authors' illustration based on data from Statistics South Africa, National Treasury of South Africa, and South African Reserve Bank.

The performance of the secondary sector in the provinces of South Africa is presented in Figures 17 and 18. Gauteng's secondary sector contributes the most PCGDP to national GDP, followed by Western Cape. This is because of the concentration of all the industries in Gauteng (Statistics South Africa 2017). On the other hand, Limpopo has the lowest PCGDP from the secondary sector, followed by Northern Cape and North West. There is also fluctuation in the growth rate of PCGDP from the secondary sector, but in 2009 the growth rate falls sharply due to the global financial crisis of 2008. Although it recovers somewhat from the global financial crisis, the growth rate then slows during 2012–17 for all provinces except Eastern Cape and Limpopo.

Figures 19 and 20 present the AGR of the absolute and PCGDP from the tertiary sector of the nine provinces. Gauteng has the highest PCGDP from the tertiary sector, followed by Western Cape, while Limpopo has the lowest. As with the other sectors, there is also fluctuation in the growth rate of PCGDP from the tertiary sector for the provinces. In 2009 the growth rate falls sharply due to the global financial crisis of 2008. Then it recovers somewhat, but the growth rate subsequently slows for 2012–17 in all provinces except Eastern Cape and Limpopo.

4 Analytical framework

4.1 Decomposition of output growth

Output growth can be analysed through a decomposition procedure. Growth in output can be driven by factors such as the rate of changes in inputs, changes in technology, and changes in efficiency (Kumbhakar et al. 2015). A single output production function with a panel data structure and output-oriented technical inefficiency can be written as

$$y_{it} = f(x_{it}, t)\; exp(-u_{it}) \qquad [1]$$

where y_{it} is the output for the i^{th} country or province (i = 1, 2, …, N) and time period t (t = 1, 2, …, T). $f(.)$ is the production technology with a vector of factor inputs x_{it}. In this model, u_{it} is a non-negative term $(u_{it} \geq 0)$ representing output-oriented technical inefficiency.

Differentiating equation [1] with respect to time gives

$$\dot{y}_{it} = TC + TEC + \sum_j \varepsilon_j \dot{x}_j \qquad [2]$$

Equation [2] shows that output growth is driven by input growth ($\sum_j \varepsilon_j \dot{x}_j$), technical change (TC), and technical efficiency change (TEC). Here, the output elasticity of input j is ε_j, which can be expressed as $\varepsilon_j = \frac{\partial ln\, f(x_{it},t)}{\partial ln\, x_j}$. Further, technical change and technical efficiency change can be defined as $\frac{\partial ln\, f(.)}{\partial t}$ and $-\frac{\partial u}{\partial t}$ respectively.

Now, adding TC, TEC, and input-driven growth (IDG) gives the explained output change:

$$Explained\ Output\ Change = TC + TEC + IDG \qquad [3]$$

The portion of output growth that is unaccounted for by TC, TEC, and IDG can be termed the unexplained output change, which can be measured as a residual after we deduct TC, TEC, and IDG from the output growth. This can be stated as

$$Unexplained\ Output\ Change = \dot{y}_{it} - (TC + TEC + IDG\ ) \quad [4]$$

4.2 Description of variables and data sources

For an empirical analysis of the decomposition of sources of growth in the CMA economies and the provinces of South Africa, we collected data from secondary sources for the periods 2000–01 to 2018–19 and 1998–99 to 2017–18 respectively. However, some issues related to the data need to be discussed here.

For the CMA country-level analysis, PGDP is constructed using the series 'Agriculture, Forestry and Fishing, Value Added (% of GDP)' extracted from the World Development Indicators. Similarly, SGDP is obtained by adding two series, 'Industry (Including Construction), Value Added (% of GDP)' and 'Manufacturing, Value Added (% of GDP)', extracted from the World Development Indicators. As these available series are in terms of percentage of GDP, the actual values of GDP for the primary and secondary sectors are arrived at by multiplying the sector share in terms of percentage by the aggregate GDP. The GDP from the tertiary sector (TGDP) is calculated as a residual by taking the difference between aggregate GDP values and the combined value of PGDP and SGDP (Tables 5 and 6).

Table 5: Variable descriptions

GDP	Gross domestic product at constant prices
PCGDP	Per capita GDP at constant prices
PGDP	GDP of primary sector at constant prices
SGDP	GDP of secondary sector at constant prices
TGDP	GDP of tertiary sector at constant prices
PCPGDP	Per capita GDP of primary sector at constant prices
PCSGDP	Per capita GDP of secondary sector at constant prices
PCTGDP	Per capita GDP of tertiary sector at constant prices

Source: authors' compilation.

Table 6: Data sources and variable construction for CMA

Variables	Source and construction
GDP	World Development Indicators (World Bank 2020b)
PCGDP	GDP and population data, World Development Indicators (World Bank 2020e)
PGDP	Available series on 'Agriculture, Forestry and Fishing, Value Added (% of GDP)', World Development Indicators (World Bank 2020a)
SGDP	Constructed by adding available series on 'Industry (Including Construction), Value Added (% of GDP)', World Development Indicators (World Bank 2020c) and 'Manufacturing, Value Added (% of GDP)', World Development Indicators (World Bank 2020d)
TGDP	Constructed as residual by subtracting percentage contribution of PGDP and percentage contribution of SGDP from 100%: $\{100\% - (\% \text{ of PGDP} + \% \text{ of SGDP})\} = \text{TGDP}$
PCPGDP	Constructed using PGDP by dividing population
PCSGDP	Constructed using SGDP by dividing population
PCTGDP	Constructed using TGDP by dividing population

Source: authors' compilation.

With respect to the data on the nine provinces of South Africa, the present study has analysed the annual data on GDP and its components for the period 1998–2017. The data on GDP of the provinces for the period 1995–2017 are extracted from Statistics South Africa (2020a). Mid-year population data extracted from Statistics South Africa (2020b) are used for the calculation of PCGDP (for both aggregate and sector levels). This study has considered three sectors for each provincial economy in South Africa, i.e. primary, secondary, and tertiary sectors. The primary sector consists of agriculture, forestry and fishing, and mining and quarrying; the secondary sector consists of manufacturing, electricity, gas and water, and construction; the tertiary sector consists of trade, catering and accommodation, transport, storage and communication, finance, real estate and business services, personal services, and general government services. Sector-level data for the provinces are available until 2017. Therefore, analysis at the provincial level is carried out using data for the period 1998–2017, i.e. 20 years. The choice of separate time periods for the economies of the CMA and the provinces of South Africa is largely guided by the availability of data. However, this does not invalidate the exercise, as both sets of data cover the major economic challenges that the globe and the regions have recently faced.

5 Results and discussion

A decomposition of output growth has been made for the CMA economies. Similarly, output growth is also decomposed for the provinces of South Africa. In order to understand the individual country-specific and province-specific dynamics of output growth, the decomposition is made at country and province levels. The output considered for the decomposition is the GDP at constant prices. The GDP of a country is largely comprised of the contributions from the three important sectors, i.e. the primary, secondary, and tertiary sectors. In order to unravel the sources of output growth, the decomposition is also made at the sectoral level. We have also considered the population factor and decomposed the output growth in per capita terms, at both national and sectoral levels.

5.1 Decomposition of output growth for the CMA

GDP growth for the four countries of the CMA is decomposed here. Also, the sector-specific PGDP, SGDP, and TGDP are decomposed into the components discussed in section 4. The results of the decomposition of aggregate and sector-specific GDP are presented in Table 7. The decomposition of GDP in per capita terms for the aggregate and sector levels is presented in Table 8.

Table 7: Decomposition of GDP growth at national and sectoral levels for CMA

	GDP	PGDP	SGDP	TGDP
Output growth	3.224	0.744	2.727	4.395
Technical change	-0.002	0.006	-0.009	-0.012
Input-driven growth	3.781	2.013	3.508	4.290
Technical efficiency change	0.000	0.000	-0.013	-0.002
Explained output growth	3.779	2.020	3.485	4.276
Unexplained output growth	-0.554	-1.276	-0.758	0.118

Note: GDP is at 2010 constant prices.

Source: authors' calculations based on data from World Development Indicators.

Table 8: Decomposition of GDP growth in per capita terms at national and sectoral levels for CMA

	Per capita			
	GDP	PGDP	SGDP	TGDP
Output growth	0.695	-0.037	0.511	0.989
Technical change	0.070	0.080	0.059	0.051
Input-driven growth	0.141	-1.618	-0.225	0.596
Technical efficiency change	0.021	0.020	0.026	0.008
Explained output growth	0.233	-1.518	-0.139	0.656
Unexplained output growth	0.462	1.480	0.651	0.332

Note: GDP is at 2010 constant prices.

Source: authors' calculations based on data from World Development Indicators.

Table 7 demonstrates that the GDP growth of 3.22 per cent is driven mainly by input changes of 3.78 per cent. The negative technical change shows that technical change makes a nominal contribution to GDP growth in a negative manner, meaning that efficient technology reduces growth. However, the GDP growth is offset by 0.55 per cent due to unexplained factors. Based on the decomposition results, it is found that the output growth of the tertiary sector is 4.39 per cent, the highest of all the sectors. This result reveals that the output growth of the tertiary sector is mainly due to input changes, and technical change, technical efficiency change, and input growth explain 4.27 per cent. Moreover, technical change and technical efficiency change are negative for both the secondary and tertiary sectors. This shows that both the secondary and tertiary sectors are unable to reap the full benefits from current technology in production. In addition, the decomposition results show that GDP growth due to unexplained factors is negative in the case of the aggregated figures as well as the primary and secondary sectors. This can be interpreted as indicating that some factors that are not captured in our model negatively affect the growth performance of the CMA countries.

The decomposition of output growth in per capita terms reveals interesting facts about the sources of output growth. The growth of PCGDP is 0.69 per cent, which is explained by 0.23 per cent arising from the combined sources of technical change, technical efficiency change, and input-driven change. Unlike the decomposition results for actual output growth, the per capita output growth for different sectors shows that the state of technology has been improving, and output growth benefits from the improved technology. It is observed that the output growth of PGDP, SGDP, and TGDP is sourced from improved technology by 0.08 per cent, 0.05 per cent, and 0.05 per cent respectively. Similarly, subject to the existing technology, per capita output has also grown through efficiency improvements in different sectors. However, the contribution of output growth as a result of efficiency changes has a negligible share.

5.2 Country-specific decomposition of output growth in the CMA

In this section, output growth is decomposed at country level to make a comparative analysis of the decomposed components across countries and sectors. The decomposition of output growth in actual and per capita terms is presented in Tables 9 and 10 respectively. The GDP growth of South Africa, Namibia, Lesotho, and Eswatini is found to be 3.01 per cent, 3.96 per cent, 2.96 per cent, and 2.94 per cent respectively. It is found that GDP growth is input-driven in all four countries, whereas growth achieved due to changes in technology has merely contributed to GDP growth. The decomposition results for Namibia and Eswatini show that the contribution of technical efficiency change to their respective GDP growth is -0.01 per cent, indicating a need to make efficiency improvements to catch up with best practice with existing technology. The growth of PGDP in Lesotho is found to be -0.06 per cent, whereas in South Africa, Namibia, and Eswatini the output growth is 0.86 per cent, 1.26 per cent, and 0.91 per cent respectively. The decomposition results show that output growth in the primary sector is largely unexplained by the factors of input growth, shifts in technology, and changes in technical efficiency.

Decomposition results for SGDP show that the source of output growth due to explained factors for South Africa, Namibia, Lesotho, and Eswatini is -0.32 per cent, 2.67 per cent, 0.32 per cent, and 1.36 per cent respectively. Moreover, the sources of SGDP in South Africa and Lesotho are different from those in Namibia and Eswatini. SGDP growth in South Africa and Lesotho is not much explained by the defined sources of technical change, technical efficiency change, and input-driven changes, but Namibia and Eswatini show input-driven output growth in the secondary sector. A comparative analysis of TGDP for the four countries shows that technical efficiency as an important source of output growth is negative. This refers to the countries' inability to attain efficient operations subject to existing technology. The countries also reap little benefit from the shifts in production technology.

Table 9: Country-wise decomposition of GDP growth

	Output growth	Technical change	Input-driven growth	Technical efficiency change	Explained output growth	Unexplained output growth
				GDP		
South Africa	3.014	0.002	2.362	0.000	2.364	0.650
Namibia	3.969	0.016	1.554	-0.015	1.555	2.414
Lesotho	2.965	0.020	0.952	0.000	0.972	1.993
Eswatini	2.946	0.021	0.335	-0.016	0.340	2.606
				PGDP		
South Africa	0.862	0.063	-6.519	-0.005	-6.462	7.324
Namibia	1.269	0.074	-6.271	-0.006	-6.203	7.472
Lesotho	-0.069	0.096	-7.065	0.028	-6.940	6.870
Eswatini	0.915	0.014	-0.934	-0.007	-0.928	1.843
				SGDP		
South Africa	1.612	0.016	-0.345	0.000	-0.328	1.941
Namibia	4.547	-0.004	2.679	-0.001	2.673	1.874
Lesotho	2.757	0.018	0.305	0.000	0.323	2.433
Eswatini	1.993	0.000	1.381	-0.021	1.360	0.633
				TGDP		
South Africa	4.048	-0.009	4.344	-0.001	4.333	-0.284
Namibia	3.780	0.034	1.266	-0.007	1.293	2.486
Lesotho	3.372	0.028	1.434	-0.002	1.459	1.912
Eswatini	6.378	0.102	-1.790	-0.004	-1.692	8.071

Note: GDP is at 2010 constant prices.

Source: authors' calculations based on data from World Development Indicators.

Table 10: Country-wise decomposition of PCGDP growth

	Output growth	Technical change	Input-driven growth	Technical efficiency change	Explained output growth	Unexplained output growth
			PCGDP			
South Africa	0.439	-0.012	2.420	0.000	2.407	-1.967
Namibia	0.741	-0.008	2.081	-0.015	2.056	-1.315
Lesotho	0.819	0.000	2.660	0.000	2.660	-1.841
Eswatini	0.781	0.014	0.253	-0.012	0.255	0.526
			PCPGDP			
South Africa	-0.107	0.048	-6.519	-0.005	-6.476	6.368
Namibia	-0.084	0.055	-6.097	-0.006	-6.049	5.965
Lesotho	-0.046	0.082	-5.768	0.032	-5.654	5.607
Eswatini	0.087	0.007	-0.976	-0.007	-0.977	1.064
			PCSGDP			
South Africa	0.020	-0.002	0.108	-0.001	0.103	-0.083
Namibia	0.879	-0.022	2.787	-0.001	2.762	-1.883
Lesotho	0.701	-0.002	2.039	0.000	2.037	-1.335
Eswatini	0.445	-0.003	0.967	-0.017	0.946	-0.500
			PCTGDP			
South Africa	0.731	-0.024	4.358	-0.001	4.333	-3.601
Namibia	0.658	0.026	1.441	-0.002	1.465	-0.806
Lesotho	0.863	0.008	3.085	-0.003	3.091	-2.227
Eswatini	1.703	0.103	-2.354	0.000	-2.250	3.954

Note: GDP is at 2010 constant prices.

Source: authors' calculations based on data from World Development Indicators.

5.3 Decomposition of output growth of the provinces of South Africa

This section presents the decomposition of GDP from the South African provincial data. The GDP growth of the provinces at aggregate and sectoral levels is decomposed to understand the sources of output growth in each sector. Further, GDP growth is also decomposed in per capita terms to make a comparative analysis of the decomposed components. The results of the decomposition for the provincial data in absolute and per capita growth are presented in Tables 11 and 12 respectively.

Table 11: Decomposition of GDP growth at provincial and sectoral levels for South Africa

	GDP	PGDP	SGDP	TGDP
Output growth	1.191	0.069	0.953	1.474
Technical change	-0.092	0.024	-0.141	-0.105
Input-driven growth	5.604	-1.081	8.150	6.717
Technical efficiency change	-0.010	-0.003	-0.011	-0.010
Explained output growth	5.501	-1.060	7.997	6.600
Unexplained output growth	-4.309	1.130	-7.044	-5.126

Source: authors' calculations based on data from Statistics South Africa, National Treasury of South Africa, and South African Reserve Bank.

Table 12: Decomposition of GDP growth in per capita terms at provincial and sectoral levels for South Africa

	Per capita			
	GDP	PGDP	SGDP	TGDP
Output growth	0.419	-0.422	0.290	0.697
Technical change	-0.009	0.097	-0.053	-0.024
Input-driven growth	0.380	-5.539	2.091	1.120
Technical efficiency change	-0.010	0.003	-0.022	-0.016
Explained output growth	0.360	-5.437	2.015	1.079
Unexplained output growth	0.058	5.015	-1.725	-0.383

Source: authors' calculations based on data from Statistics South Africa, National Treasury of South Africa, and South African Reserve Bank.

After we go through the results of the decomposition for the sectors, it is found that like the national GDP, sector-specific GDP growth is largely driven by input changes. The benefits of efficiency and shifts in the efficiency frontier are still unexplored for these economies. The contribution of technical change to SGDP and TGDP are -0.14 per cent and -0.10 per cent of the total output changes in the respective sectors. This shows that the secondary and tertiary sectors in the provinces are unable to reap any benefits in terms of output changes from changes in technology over time. The output growth of all sectors at the province level as well as provincial GDP growth show that technical efficiency change is negative. This is due to the inability to improve efficiency subject to the given technology in all sectors. The results also reveal that SGDP and TGDP are input-driven, unlike PGDP. Similarly, GDP growth is found to be mainly input-driven, and there is enormous potential to explore how efficiency can contribute to GDP growth at the sectoral level in the provinces of South Africa.

A comparative analysis of provincial output growth in actual and per capita terms presents some interesting facts. Output growth in per capita terms for the primary sector in the provinces is found to be negative, unlike the positive output growth in actual terms. However, the source of output growth in per capita terms for the primary sector shows a positive and nominal contribution to GDP growth. This means that efficiency improvements subject to the given technology and technological improvements boost growth performance in the provinces. Input change contributes 0.38 per cent of the provinces' total PCGDP growth. It is found from the decomposition results that both the actual output growth and the per capita output growth show similar results regarding the input used for different sectors and provincial GDP.

5.4 Province-specific decomposition of output growth in South Africa

A province-wise decomposition of output growth and per capita output growth is made for the aggregated GDP and sectoral GDP of each province of South Africa in Tables 13 and 14 respectively. The decomposition results of GDP for the provinces show that Western Cape, KwaZulu-Natal, and North West have experienced mostly input-driven growth compared with the other provinces. The technical efficiency change component of GDP growth in Western Cape, Eastern Cape, and Limpopo is negative. Nevertheless, they have a negligible share, which indicates a tendency towards inability to catch up with the state of technology.

PGDP growth is found to be negative in Free State, KwaZulu-Natal, North West, and Gauteng. Further, the decomposition results show that negative technical change and technical efficiency change accompany the negative PGDP growth in Free State and North West. This reflects these provinces' inability to benefit from changes in the state of technology over time. Again, they diverge from best practice in technology. Between the two provinces, agricultural output growth in North West is comparatively more technology-driven than in Free State. The negative output growth in agricultural GDP in KwaZulu-Natal is primarily input-driven. Nevertheless, the province performs well in terms of its sources of output growth from technical change and technical efficiency change, which are positive.

Table 13: Province-wise decomposition of GDP growth

	Output growth	Technical change	Input-driven growth	Technical efficiency change	Explained output growth	Unexplained output growth
			GDP			
Western Cape	1.708	0.010	1.081	-0.005	1.086	0.622
Eastern Cape	1.234	0.012	0.685	-0.003	0.695	0.539
Northern Cape	0.755	0.005	0.718	0.000	0.724	0.031
Free State	0.937	0.007	0.885	0.000	0.893	0.044
KwaZulu-Natal	1.520	0.001	1.860	0.000	1.861	-0.341
North West	0.658	-0.016	1.628	0.000	1.611	-0.953
Gauteng	1.778	0.026	0.389	0.000	0.415	1.363
Mpumalanga	1.037	0.010	0.691	0.000	0.701	0.336
Limpopo	1.096	0.011	0.617	-0.001	0.628	0.467

			PGDP			
Western Cape	0.641	-0.011	1.778	-0.001	1.765	-1.123
Eastern Cape	0.216	0.057	-1.719	0.012	-1.648	1.865
Northern Cape	0.171	0.038	-1.876	0.000	-1.837	2.009
Free State	-0.111	-0.002	0.055	-0.004	0.048	-0.160
KwaZulu-Natal	-0.027	0.039	-0.799	0.006	-0.753	0.726
North West	-0.278	-0.041	1.765	-0.001	1.722	-2.001
Gauteng	-0.903	0.013	-2.276	-0.007	-2.270	1.366
Mpumalanga	0.357	0.042	-1.845	0.003	-1.799	2.157
Limpopo	0.561	0.055	-2.813	-0.002	-2.760	3.321
			SGDP			
Western Cape	1.069	0.008	0.763	-0.002	0.769	0.300
Eastern Cape	1.135	0.005	0.135	-0.012	0.129	1.005
Northern Cape	0.370	-0.019	1.797	-0.021	1.756	-1.385
Free State	0.839	0.008	0.888	-0.001	0.895	-0.055
KwaZulu-Natal	NA	NA	NA	NA	NA	NA
North West	0.786	-0.030	2.860	-0.001	2.828	-2.042
Gauteng	1.206	0.031	-0.461	-0.001	-0.431	1.638
Mpumalanga	1.020	-0.008	2.125	0.000	2.116	-1.096
Limpopo	1.018	-0.041	4.189	0.000	4.148	-3.130
			TGDP			
Western Cape	1.921	0.013	1.113	-0.006	1.119	0.802
Eastern Cape	1.221	0.011	0.907	-0.001	0.917	0.303
Northern Cape	1.148	-0.006	1.858	0.000	1.851	-0.703
Free State	1.198	0.011	1.058	0.000	1.069	0.128
KwaZulu-Natal	1.783	0.016	0.909	-0.008	0.918	0.865
North West	1.256	0.000	1.524	0.000	1.525	-0.268
Gauteng	2.099	0.020	1.106	-0.002	1.123	0.975
Mpumalanga	1.340	0.006	1.378	0.000	1.384	-0.043
Limpopo	1.298	0.001	1.682	-0.001	1.681	-0.383

Source: authors' calculations based on data from Statistics South Africa, National Treasury of South Africa, and South African Reserve Bank.

Table 14: Province-wise decomposition of PCGDP growth

Provinces	Output growth	Technical change	Input-driven growth	Technical efficiency change	Explained output growth	Unexplained output growth
				PCGDP		
Western Cape	0.430	-0.020	1.264	-0.007	1.235	-0.805
Eastern Cape	0.858	-0.014	2.333	0.000	2.318	-1.460
Northern Cape	-0.034	0.039	-2.353	-0.003	-2.318	2.283
Free State	NA	NA	NA	NA	NA	NA
KwaZulu-Natal	NA	NA	NA	NA	NA	NA
North West	0.385	-0.047	3.256	0.000	3.208	-2.823
Gauteng	0.045	-0.009	0.333	-0.002	0.321	-0.276
Mpumalanga	-0.016	-0.029	1.572	-0.001	1.540	-1.556
Limpopo	0.678	-0.035	3.232	-0.002	3.194	-2.516
				PCPGDP		
Western Cape	-0.228	-0.042	2.087	-0.002	2.042	-2.270
Eastern Cape	0.055	-0.010	2.146	0.011	2.148	-2.093
Northern Cape	-0.542	0.069	-4.550	0.000	-4.481	3.938
Free State	-0.199	-0.021	0.973	-0.002	0.950	-1.149
KwaZulu-Natal	-0.442	0.028	-0.947	0.006	-0.912	0.470
North West	NA	NA	NA	NA	NA	NA
Gauteng	-1.737	-0.001	-3.471	-0.004	-3.476	1.738
Mpumalanga	-0.520	-0.008	-0.473	-0.001	-0.483	-0.036
Limpopo	0.240	0.012	-0.529	-0.004	-0.521	0.762
				PCSGDP		
Western Cape	0.003	-0.017	0.825	-0.003	0.804	-0.801
Eastern Cape	0.775	-0.019	1.169	-0.014	1.135	-0.360
Northern Cape	-0.241	-0.013	0.382	-0.008	0.359	-0.601
Free State	0.656	-0.013	2.106	-0.001	2.092	-1.436
KwaZulu-Natal	0.421	0.006	-0.038	-0.003	-0.035	0.457
North West	0.522	-0.063	5.064	0.009	5.009	-4.487
Gauteng	-0.258	0.002	-0.878	-0.001	-0.876	0.618
Mpumalanga	0.094	-0.048	2.934	-0.002	2.882	-2.788
Limpopo	0.638	-0.116	8.637	0.005	8.525	-7.887

			PCTGDP			
Western Cape	0.649	-0.017	1.292	-0.009	1.265	-0.616
Eastern Cape	0.847	-0.013	2.278	0.000	2.264	-1.417
Northern Cape	0.413	0.023	-0.847	-0.001	-0.824	1.238
Free State	0.977	-0.015	2.113	-0.003	2.094	-1.117
KwaZulu-Natal	0.920	-0.003	1.751	0.000	1.748	-0.828
North West	0.924	-0.033	3.219	-0.001	3.183	-2.259
Gauteng	0.355	0.005	-0.135	-0.002	-0.133	0.488
Mpumalanga	0.319	-0.034	2.272	-0.002	2.235	-1.916
Limpopo	0.858	-0.053	4.817	0.000	4.763	-3.905

Source: authors' calculations based on data from Statistics South Africa, National Treasury of South Africa, and South African Reserve Bank.

The decomposition of GDP growth in per capita terms plots an entirely different picture of the provinces of South Africa. GDP growth in per capita terms is found to be -0.03 per cent and -0.01 per cent for Northern Cape and Mpumalanga. Even though Northern Cape experiences negative growth, it is the only province which has a positive contribution from technical change. The PCGDP growth of 0.03 per cent is sourced from technological change for Northern Cape. Output growth in terms of PCPGDP is negative for most of the provinces, except Eastern Cape and Limpopo. But the decomposition results indicate the dynamics of some important differences between the two provinces. Eastern Cape derives its output growth in the primary sector mainly from input changes and improvements in technical efficiency. The case of Limpopo is quite different from Eastern Cape, even though they exhibit a similar pattern in output growth. Limpopo derives its output growth from improvements in technology, but technical efficiency change is negative, showing divergence from best practice.

The results of the decomposition of SGDP growth in all provinces except Gauteng show input-driven output growth. But the results connected to PCSGDP growth show input-driven growth for both Gauteng and KwaZulu-Natal. PCTGDP shows that technical change and technical efficiency change are negative for most of the provinces.

6 Conclusions

In this study, output growth has been decomposed to understand its sources for the CMA and the provinces of South Africa. Decomposition results for the CMA reveal that GDP growth is derived mainly from input uses. Technical change is negative, which shows that countries are unable to benefit from shifts in technology. The decomposition of sectoral GDP shows that the sources of output growth for the primary sector are quite different from those for the secondary and tertiary sectors. All three sectors experience output growth driven by inputs. But the primary sector has been taking advantage of shifts in technology and improvements in efficiency, which is not in line with the secondary and tertiary sectors. Output growth accompanied by input uses, without increasing efficiency in production or benefiting from technological progress, is unsustainable. The country-specific decomposition of output growth provides important conclusions and policy suggestions for further improving the output growth in each country. Although the countries are in the CMA, their growth potentials through alternative sources are not alike. At this juncture, countries which are experiencing input-driven growth in the secondary sector, such as Namibia and Eswatini, have the potential to achieve growth through efficiency improvements and by adopting technology. However, the unexplained sources of secondary sector output growth in the cases of South Africa and Lesotho require further research to identify the particular sources of growth. Nevertheless, they also have potential for output growth through technical changes and efficiency improvements.

Provincial GDP growth is also found to be largely input-driven in South Africa. Provinces' output growth is negatively contributed by technical efficiency change, which suggest that policy makers should further improve growth by emphasizing improvements in efficiency in the provinces of South Africa. The impact of technological changes on output growth in the provinces of South Africa is not clearly evident. This suggests that the adoption of advanced technology in those sectors might improve output growth.

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