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The Main Macroeconomic Drivers of Economic Growth in the Western Cape

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Abstract

This paper examines the key macroeconomic factors that contribute to economic growth in the Western Cape using time series data from 1995 to 2022. The study adopts the error correction model to investigate both the long-run and the short-run relationship between certain macroeconomic variables and real GDP per capita. The empirical results show that gross fixed capital formation, multifactor productivity, international trade, and population growth are positively associated with real GDP per capita in the Western Cape.

1. Introduction

The economic performance of a country or region is crucial to the well-being of its citizenry. A high performing economy, in terms of economic growth and development, can provide its people with a better standard of living. For this reason, achieving a high growth rate remains an important macroeconomic objective and a socially desirable goal. The discussion on the main factors driving economic growth has received a lot of attention in both the theoretical and the empirical literature. The general consensus is that physical capital accumulation, human capital development, and technological advancement are important macroeconomic determinants of economic growth.

This paper attempts to investigate the main macroeconomic determinants of economic growth in the Western Cape using data from 1995 to 2022. The study analyses factors such as physical capital, trade openness, productivity, and population growth rate to ascertain their impact on real gross domestic product (GDP) per capita. The remaining sections of the paper are organised as follows: Section 2 reviews the literature on the determinants of economic growth. Section 3 explains the research methodology and econometric technique of the study. The empirical results are presented in Section 4 while Section 5 gives concluding remarks.

2. Literature review

This section reviews both the theoretical and empirical literature on the main factors that contribute to economic growth and development.

2.1 Theoretical literature

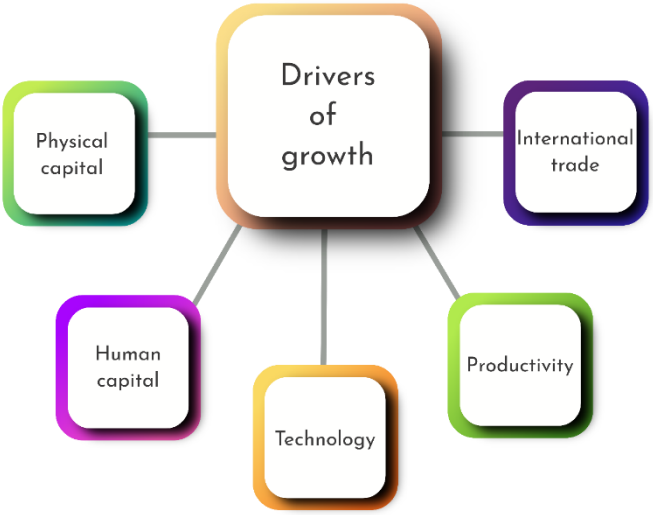
Economic growth theory is underpinned by three main approaches, namely, the classical growth theory, the neoclassical or exogenous growth theory and the endogenous growth theory. The classical growth theory suggests that an increasing population and limited resources will cause a decline in economic growth. The neoclassical growth theory emphasises the roles that capital, labour and technology play in economic growth. The theory stipulates that technological progress is the sole determinant of growth in the long term, while capital and labour play key roles in the short-run economic equilibrium.

In contrast, the endogenous growth theory emphasises that internal factors, such as human capital and technological knowledge, are responsible for economic growth. Romer (1990) and Ben-David and Loewy (1998), who are some of the major proponents of the endogenous growth theory, assert that the enhancement of a nation's human capital, or the accumulation of knowledge, helps to boost economic growth. It is evident from the above theories that physical capital accumulation, human capital development and technology are important determinants of economic growth.

2.2 The basic determinants of economic growth

Some of the factors that contribute to economic growth are the accumulation of capital stock, human capital, technological advancement, productivity and international trade, as shown in Figure 1. It is argued that macroeconomic policy settings and institutions also have a significant role to play in the growth of an economy.

Figure 1: Factors that contribute to economic growth



2.2.1 Physical capital accumulation

The accumulation of physical capital is regarded as one of the main determinants of economic output in any economy in both the theoretical and empirical literature. The magnitude of the impact of physical capital accumulation on output depends on the extent to which technological innovation is embodied in new capital (Bassanini, Scarpetta and Hemmings, 2001). Where part of the capital employed in the production process is utilised as innovative capital that leads to technological progress, the aggregate production function can exhibit increasing returns to scale (Frankel, 1962). Empirical evidence shows that there is a positive relationship between the ratio of investment to GDP and economic growth (Dao, 2014; Barro, 2003; Mankiw, Romer and Weil, 1992; and DeLong and Summers, 1991).

2.2.2 Human capital

Human capital is regarded as one of the main factors of economic growth because there seems to be a significant link between education, productivity and the level of output. Human capital development, which entails the acquisition of skills, knowledge and experience by a country's labour force, is an important factor in the production process. Human capital's impact on the economy can be analysed from three channels (Abdelmajied and Safijllin, 2018). First, human capital leads to an increase in labour productivity and subsequently output. Second, an increase labour productivity results in an increased demand for labour which causes output and income to rise. Third, growth in a country's stock of human capital can lead to the attraction of foreign investment.

Various studies on economic growth, from classical growth models to endogenous growth models, have explored the relationship between human capital development and the level, as well as growth, of GDP per capita. Investment in human capital can lead to economic growth if it is accompanied by an increase in research and development and a high rate of technological advancement (Bassanini and Scarpetta, 2001). Fernandez and Mauro (2000) found that human capital makes a significant contribution to economic growth. Likewise, Wilson and Briscoe (2004) claim that there is a positive and significant relationship between investment in education and training, and economic growth.

2.2.3 International trade

The role of international trade in promoting economic growth and development has been debated for several decades. Sun and Heshmati (2010) claim that economies participating in international trade tend to be more productive than those that only produce for their domestic markets. It is argued that developing countries which are more open experience higher economic growth rates than those that are inward-oriented (Balassa, 1986, and Dollar, 1992). Tsai and Huang (2007), after investigating the relationship between openness, economic growth and poverty in Taiwan, observed that trade openness has a positive impact on economic growth. This view is supported by Dollar and Kraay (2002) and by Bolaky and Freund (2004).

A significant portion of the literature on the relationship between trade and economic development (including Ekanayake, 1999, and Helpman and Krugman, 1985) points to the fact that exports accelerate growth in line with the export-led growth hypothesis. Some of the channels through which the expansion of exports contributes to economic growth include efficient allocation of resources, increased capacity utilisation, economies of scale, and enhanced productivity of the factors of production (Khan, Azra, Umar, Zaman, Ahmad and Shoukat, 2012, and Abou-Stait, 2005). On the other hand, studies such as those by Mazumdar (2001) and Lee (1995) emphasise the importance of imports in the transfer of foreign technology into a local economy. Uğur (2008) is of the view that imports enhance production possibilities and promote growth.

According to Mehrara and Firouzjaee (2011), the relationship between international trade policies and economic growth can be viewed from three angles, namely, the neoclassical approach, the endogenous growth model, and the institutional approach. First, the neoclassical approach regards the benefits of trade as static. Sun and Heshmati (2010) argue that the static gains from trade centre on the enhancement of output and national welfare. Second, the endogenous growth model hinges on dynamic gains. Accordingly, trade policies could have an impact on both the level of output and the long-run growth rate (Mehrara and Firouzjaee, 2011). Sun and Heshmati (2010) assert that the dynamic gains from trade concentrate on changes in the structure of production, which arise from the adoption of new technologies and from the impact of economies of scale. Finally, the institutional approach focuses on the role and effect of institutions on economic growth. According to this approach, trade policies induce economic growth under the right institutional framework.

2.2.4 Population growth

The Malthusian theory of population states that a lower rate of population growth is positively correlated with GDP per capita growth, whereas a higher rate of population growth has an inverse relationship with an increase in GDP per capita. Moreover, Golley and Wei (2015) assert that demographic changes which lead to a rise in the working-age population could propel growth in GDP per capita in the long run. According to Boserup (1996), an increase in population can bring about invention and innovation which could help to boost productivity and output. Empirical results regarding the relationship between population growth and economic growth are inconclusive. Some studies (including Sachs and Marner, 1997) found a positive relationship between the rate of population growth and economic growth. Others, such as Most and Vann de Berg (1996) found the relationship between the two variables to be negative.

3. Data and methodology

This study makes use of the aggregate production function approach to ascertain the key determinants of economic growth in the Western Cape. Production function is defined by Miller (2008) as a mathematical expression that demonstrates the relationship between input and output. The application of the aggregate production function has become an important practice in economic analysis according to Fisher (1969), and this is because it allows one to estimate the individual contributions relating to the determinants of economic growth (Epstein and Macchiarelli, 2010).

The general aggregate production function can be expressed as:

$$Y = f(K, H, T) \quad \text{_____(1)}$$

where Y represents the level of output

K is physical capital

H is human capital

T is the total factor productivity, which is endogenously determined according to the endogenous growth model

Moreover, the variable T relates to the factors of growth and productivity other than capital and labour (Parjiono, 2009). It entails all economic factors that can be influenced by policy, such as trade openness, government expenditure, macroeconomic stability, governance, and institutional development. Two forms of neoclassical aggregate production functions can be identified in the growth literature. These are the Cobb-Douglas[1] production function and the constant elasticity of substitution (CES)[2] production function.

3.1 Model specification

This study adopts the Cobb-Douglas production function based on its simplicity, the fact that it is an excellent fit for most data and its property of homogeneity. Thus, the model can now be expressed as:

$$GDPPC = f(GFCF, PROD, TR, POP) \quad \text{_____(2)}$$

In equation 2, real GDP per capita (GDPPC) is set as a function of gross fixed capital formation (GFCF), productivity (PROD), trade ratio (TR) and population growth rate (POP). All variables are transformed into natural logarithms to measure the elasticity directly from the coefficients and to reduce the existence of heteroscedasticity. The log-log[3] form of the model can be written as:

$$\ln GDPPC_t = \beta_0 + \beta_1 \ln GFCF_t + \beta_2 \ln PROD_t + \beta_3 \ln TR_t + \beta_4 \ln POP_t + \varepsilon_t \quad \text{_____(3)}$$

where β_0 is the intercept, β_1 to β_4 are the coefficients, and ε_t is the error term. The relationship between real GDP per capita and physical capital, productivity and international trade is expected to be positive.

[1] The Cobb-Douglas production function assumes a unitary elasticity of substitution and exhibits constant returns to scale.
[2] The CES production function, which has a non-unitary elasticity of substitution, is more general and allows the elasticity of substitution to be determined by the data.
[3] This is a model where both the dependent variable and the independent variables are transformed into natural logarithms.

Thus, β_1, β_2, β_3, are expected to be greater than one. β_4, on the other hand, could either be positive or negative because the relationship between economic output and population growth is inconclusive.

3.2 Data and variables

This study uses annual time series data sourced from Quantec for the period 1995 to 2022 to estimate the model specified in the previous section. The list of variables used in this study and their definitions are provided in Table 1.

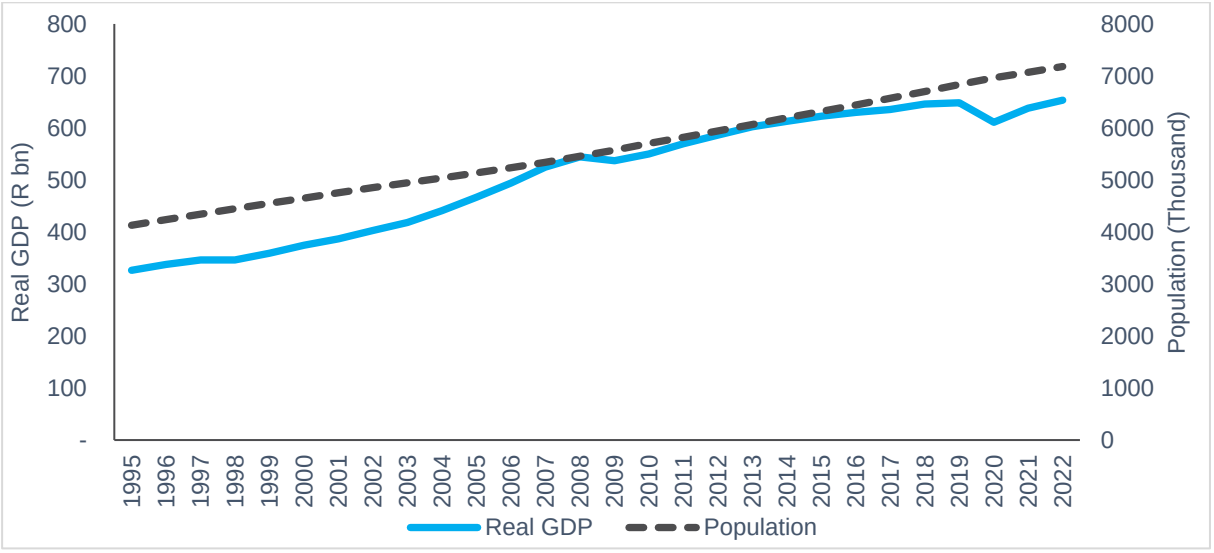
Table 1: List of Variables

Variable	Definition	Source
Real GDP per capita (GDPPC)	Real GDP at constant 2015 prices divided by population	Quantec
Gross fixed capital formation (GFCF)	Gross fixed capital formation at constant 2015 prices as a share of real GDP	
Productivity (PROD)	Multifactor productivity, which is an index of the sum of labour productivity and capital productivity. It is a measure of technical progress, improvement in the workforce, improvement in management practices, economies of scale, etc.	
International trade (TR)	The ratio of exports plus imports to real GDP	
Population growth (POP)	The annual rate of change of total population	

4. Descriptive statistics

Figure 2 shows the Western Cape's real GDP and population trends from 1995 to 2022. Real GDP doubled from R326.37 billion in 1995 to R653.40 billion in 2022, representing an average annual growth rate of 2.63%. The average growth rate of the population was relatively lower at 2.07%, having increased from 4.13 million in 1995 to 7.18 million in 2022.

Figure 2: Western Cape's real GDP and population trends (1995–2022)

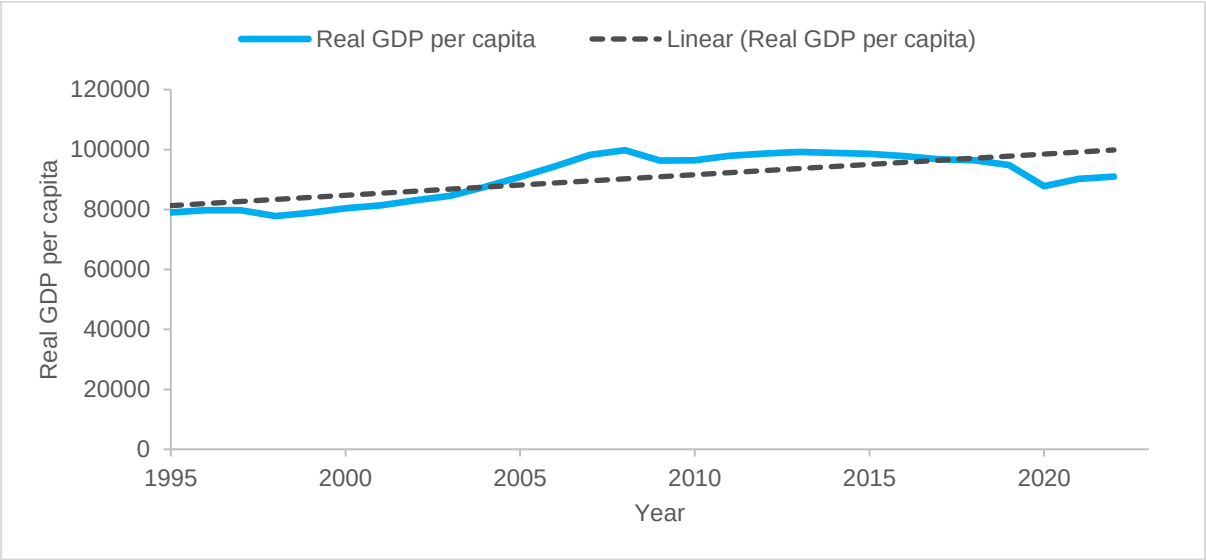


Source: Quantec (2023)

As shown in Figure 3, real GDP per capita increased from R79 035.53 in 1995 to R90 981.20 in 2022, representing a growth rate of 0.55% per annum on average. This is lower than both the average GDP

growth rate and the population growth rate during the same period. The average real GDP per capita for this period was R90 590.06.

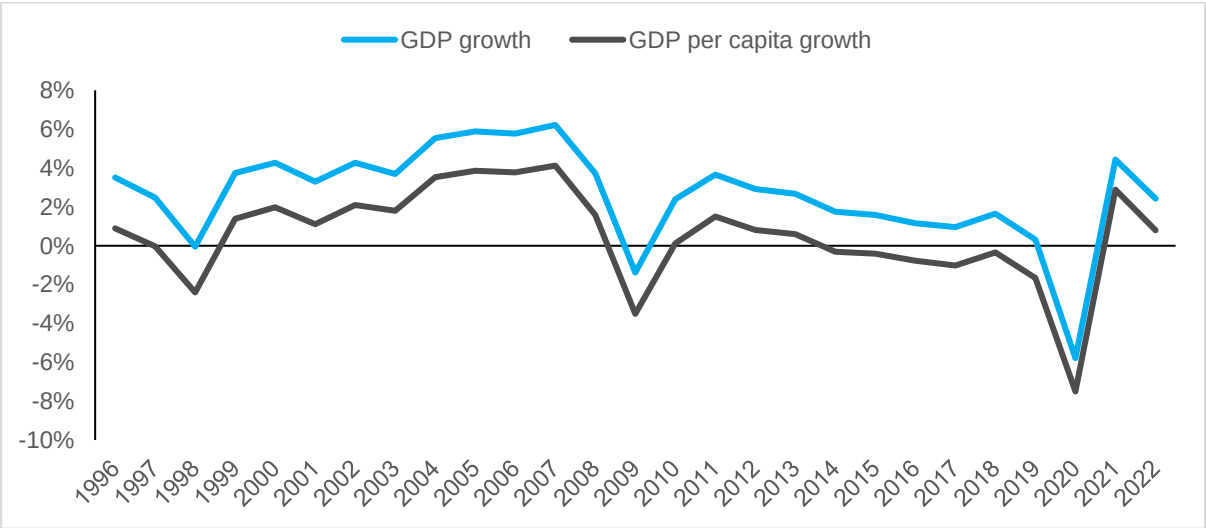
Figure 3: Real GDP per capita trends (1995–2022)



Source: Quantec (2023)

Figure 4 indicates that the growth rates of real GDP and of real GDP per capita mimic each other. Throughout the period under consideration, the growth rate in real GDP per capita was constantly lower than the growth rate of GDP. The impact of Covid-19 on the Western Cape's economy was relatively more severe than the 2008–2009 financial crisis. Both real GDP and real GDP per capita contracted by 5.79% and 7.50% respectively in 2020.

Figure 4: GDP growth and GDP per capita growth in the Western Cape (1996–2022)

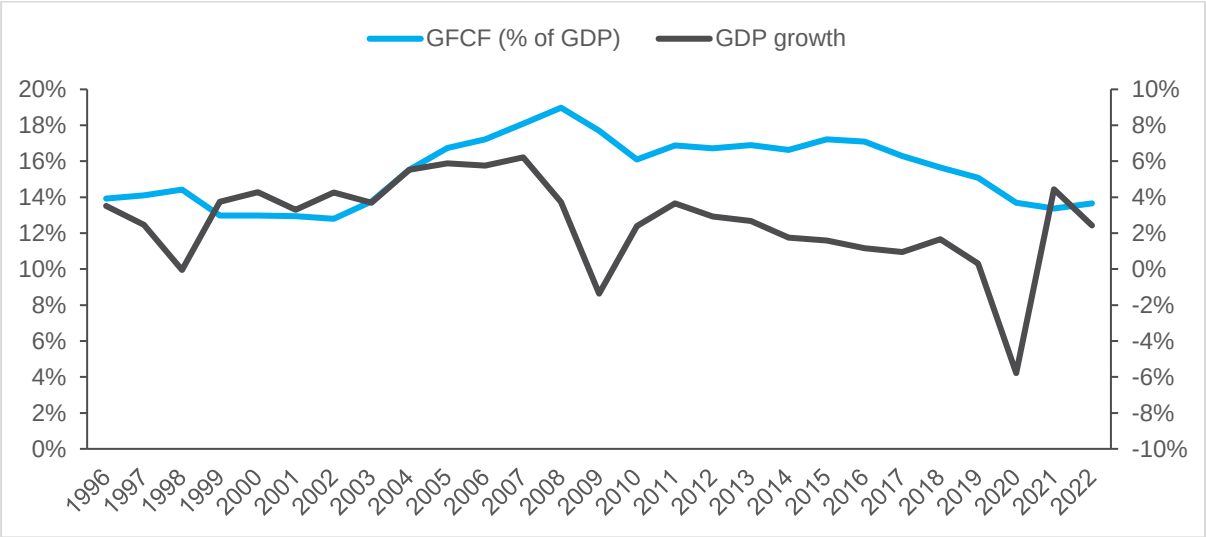


Source: Quantec (2023)

Figure 5 shows the relationship between GDP growth and the share of GFCF in GDP. It can be observed from the figure that there is a positive relationship between real GDP growth and physical capital accumulation in the Western Cape. As a percentage of real GDP, GFCF declined slightly from 13.92%

in 1996 to 13.66% in 2022. On average, GFCF accounts for 15.46% of the province's GDP, with the highest share of 18.98% recorded in 2008.

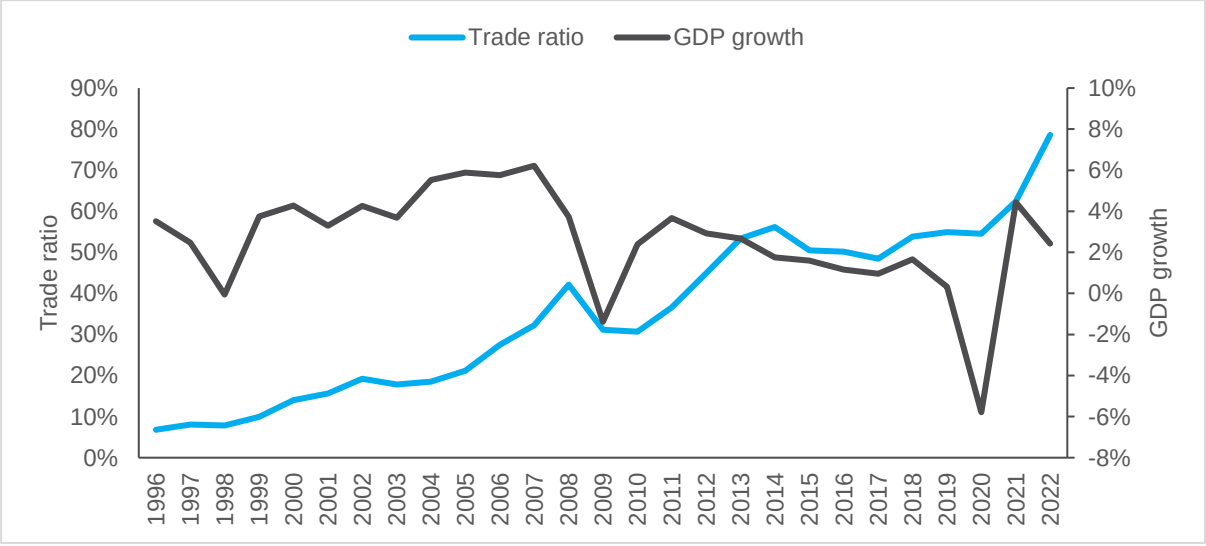
Figure 5: Gross fixed capital formation and GDP growth (1996–2022)



Source: Quantec (2023)

A positive co-movement between trade and real GDP growth in the Western Cape can be observed in Figure 6. The province has witnessed a significant increase in trade as a proportion of real GDP since 1996. Figure 6 shows that the trade ratio increased from 6.80% in 1996 to 78.59% in 2022, which is an indication that the economy has become more open in recent years.

Figure 6: International trade and GDP growth trends (1995–2022)



Source: Quantec (2023)

5. Econometric analysis and empirical findings

This study uses an error correction model (ECM), which is based on an ordinary least squares (OLS) regression. When using an OLS regression in time series data, the variable must be stationary to avoid a spurious regression. Time series data is regarded as stationary if the series' mean and variance remain constant over time. The study adopts the Augmented Dickey-Fuller (ADF) test to check whether each of

the variables of interest has a unit root or not. The Akaike Information Criterion (AIC) is used to determine the appropriate lag length.

Table 2 presents the unit root test results. The results show that all the variables are non-stationary in their levels just as the graphical analysis in Figure A1 in the appendix reveals. This is because the absolute values of the estimated ADF test do not exceed the critical value at the 5% level of significance. Hence, we fail to reject the null hypothesis, which states that the series has a unit root. In their first difference forms, however, the variables become stationary since their ADF test values exceed the critical value, in absolute terms, at the 5% level of significance. Thus, the null hypothesis that a unit root is present can be rejected after first differencing the variables.

Table 2: Augmented Dickey-Fuller test results

Variable	Levels			First difference		
	Without trend	With trend	Conclusion	Without trend	With trend	Conclusion
Log (GDPPC)	-1.5373	-0.2880	Non-stationary	-3.6560**	-3.9582**	Stationary
Log (GFCF)	-1.7385	-0.2125	Non-stationary	-3.3950**	-4.4613***	Stationary
Log (TR)	-2.8185	-2.0008	Non-stationary	-3.5538**	-3.3400*	Stationary
Log (POP)	-1.3075	-1.8790	Non-stationary	-4.5255***	-4.4080***	Stationary
Log (PROD)	-2.6008	-0.9838	Non-stationary	-3.8299***	-4.6298***	Stationary

*Note: *** 1% significance level; ** 5% significance level; * 10% significance level*

We proceed to test for cointegration to determine the long-run relationship between the variables using the Engle and Granger method. Non-stationary time series variables are said to be cointegrated if their linear combination is stationary. The cointegration results in Table 3 depict that the variables are cointegrated. This is because the absolute value of the ADF test of the residuals (ECT) exceeds the Mackinnon[4] critical value at the 5% level of significance. Hence, we can conclude that there is a long-run relationship between the variables.

Table 3: Cointegration test results – Engel-Granger

Residual	ADF Test Statistics Value	Mackinnon Critical Value 1%	5%	10%	Conclusion
ECT	-5.2004	-5.7970	-4.9327	-4.5196	Cointegrated

The variables in the model are cointegrated, which implies that they have a long-run relationship. This is an indication that one can draw a meaningful conclusion from the estimated long-run coefficients. Table 4 presents the long-run estimates for equation 3.

The long-run coefficients for GFCF, international trade and productivity all have the expected signs at the 1% level of significance. In the long run, GFCF has a positive impact on the Western Cape's real GDP per capita. The results suggest that a 1% increase in GFCF leads to an increase of approximately 0.30% in the province's real GDP per capita. This supports the argument that economic output increases when there is an increase in the factors of production.

[4] See Table A1 in appendix for the calculation of the Mackinnon critical values.

The estimated elasticity of real GDP per capita with respect to productivity is 0.39. This implies that a 0.39% increase in real GDP per capita can be achieved when productivity increases by 1%. Similarly, international trade has a positive and significant relationship with real GDP per capita in the long run. The results show that a 1% increase in trade openness will be accompanied by a 0.05% increase in real GDP per capita. The long-run relationship between population growth and real GDP per capita is found to be positive and significant. A 1% increase in population growth results in a 0.15% increase in real GDP per capita.

Table 4: Estimates of the long-run effect on GDP per capita

Dependent variable: Log (GDP per capita) $_t$		
Independent variable	**Coefficients**	
Log (Gross Fixed Capital Formation) $_t$	0.2976***	(0.0335)
Log (Population growth rate) $_t$	0.1549***	(0.0362)
Log (International trade) $_t$	0.0484***	(0.0101)
Log (Productivity) $_t$	0.3897***	(0.0973)
Constant	10.859***	(0.4502)

Standard errors in parentheses
*** p < 0.01, ** p < 0.05, * p < 0.10

The short-run relationship arising from the estimated ECM is presented in Table 5. The first differences of the variables in equation 3 and the lag of the residuals from the long-run equation are used to estimate the ECM. Below is the equation for the ECM:

$$\Delta InGDPPC = \beta_0 + \beta_1 \Delta \ln GFCF + \beta_2 \Delta \ln PROD + \beta_3 \Delta \ln TR + \beta_4 \Delta \ln POP + \beta_5 ECT_{t-1} + \varepsilon \quad \_\_\_\_\_(4)$$

Where Δ denotes first difference and ECT_{t-1} is the lag of the error term from equation 3

The adjusted R-squared value of 0.7978 implies that the regressors in the model explain about 80% of the variations in the Western Cape's real GDP per capita. Moreover, the post-estimation diagnostic tests for heteroscedasticity, serial correlation and normal distribution show no concerns with the model. The Breusch-Pagan-Godfrey heteroscedasticity test checks whether the residuals are heteroscedastic or homoscedastic. Given the Chi-Square probability value in Table 5, we fail to reject the null hypothesis of no heteroscedasticity and conclude that the residuals are homoscedastic. With respect to the normality assumption, the Jarque-Bera statistic indicates that the residuals are normally distributed because the null hypothesis of normal distribution cannot be rejected at the 5% level of significance. Finally, the results from the Breuch-Godfrey serial correlation test depict no sign of serial correlation because the Chi-Square probability value is greater than 5%.

Like the long-run results, the accumulation of physical capital has a positively and statistically significant relationship with real GDP per capita in the short run. The results in Table 5 reveal that a 1% growth in the ratio of GFCF to GDP leads to a 0.36% growth in real GDP per capita. Likewise, a 1% growth in multifactor productivity, which shows the efficiency with which labour and capital are combined in the production process, leads to a 0.49% increase in growth in real GDP per capita in the short run. Moreover, a 1% change in trade openness increases growth in real GDP per capita by 0.07%. The

results also show a positive and statistically significant relationship between changes in population growth and real GDP per capita growth in the short run.

The coefficient of the error correction term (the lag of the residuals from the long-run equation) is negative and statistically significant at the 1% level, which indicates that the system returns to equilibrium after a shock. The speed of adjustment towards the long-run equilibrium path is estimated at -1, which indicates that 100% of the discrepancy between the long run and the short run is corrected within a year.

Table 5: Estimates of the short-run effect on GDP per capita

Dependent variable: ΔLog (GDP per capita) $_t$		
Independent variable	**Coefficients**	
ΔLog (Gross Fixed Capital Formation) $_t$	0.3583***	(0.0551)
ΔLog (Population growth rate) $_t$	0.1550***	(0.0556)
ΔLog (Trade ratio) $_t$	0.0733***	(0.0483)
ΔLog (Trade ratio) $_{t-1}$	-0.0042	(0.0181)
ΔLog (Productivity) $_t$	0.4917***	(0.1615)
ΔLog (Productivity) $_{t-1}$	-0.3006	(0.1813)
ECM $_{t-1}$	-1.0046***	(0.2793)
Constant	-0.0007	(0.0035)
Adjusted R-squared	0.7978	
Jarque-Bera	5.6430 prob. 0.05952	
Breusch-Pagan-Godfrey – Prob. Chi-Square(5)	0.2730	
Breusch-Godfrey – Prob. Chi-Square(2)	0.5543	

Standard errors in parentheses
*** p < 0.01, ** p < 0.05, * p < 0.10

6. Conclusion

The study results revealed that physical capital accumulation, multifactor productivity, international trade, and population growth were significantly associated with real GDP per capita in the Western Cape in both the long run and the short run. This is an indication that these factors are significant determinants of economic growth in the province.

Given that the share of GFCF in GDP has a positive effect on real GDP per capita in the Western Cape, government policy must be geared towards implementing programmes that increase the share of physical capital to ensure greater growth in GDP per capita. Policies which create incentives to attract private sector investment in both the short run and long run, while also reducing disincentives, will go a long way in boosting the province's real GDP per capita. Moreover, since gross domestic savings is an important avenue for domestic private investment, strategies that encourage domestic savings will also be beneficial to the economy.

The positive relationship between multifactor productivity and real GDP per capita shows the need to implement measures that efficiently combine labour, skills and capital. It is also an indication that factors such as technical progress, spillovers from the factors of production, economies of scale, general

knowledge, and improvement in the workforce play an important role in the Western Cape's economic growth.

The study gives credence to the important role that international trade plays in economic growth and development in the Western Cape. This means that exports can be used as a channel to boost economic growth in the province. Thus, trade policy should focus on export competitiveness and export growth.

The positive association between population growth in the Western Cape and real GDP per capita can be explained by the fact that population growth leads to an increase in labour and a larger pool of human capital, which in turn can increase economic output.

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8. Appendix

Figure A1: Graphical analysis of the variables in their levels

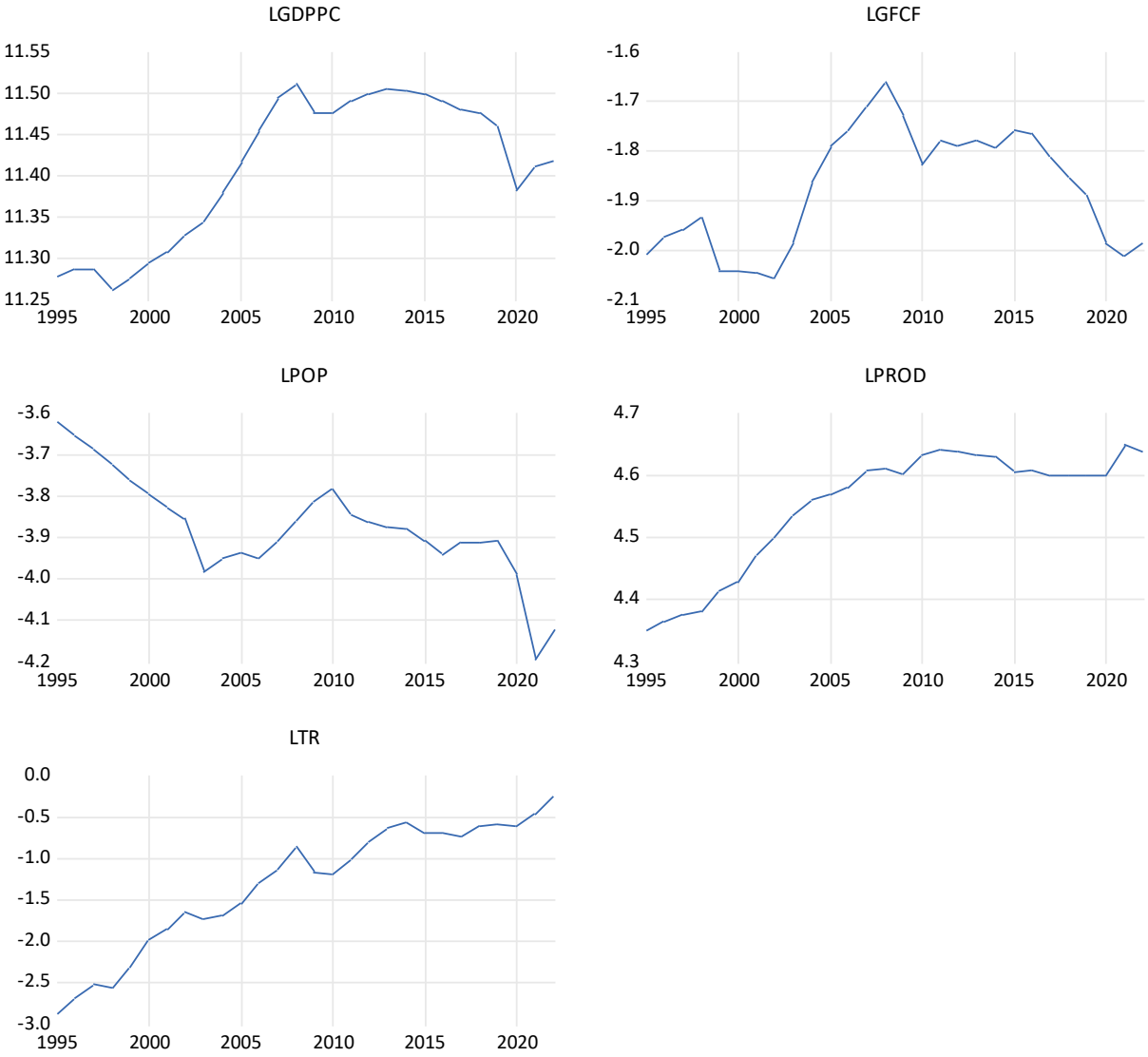

Table A1: Calculation of Mackinnon critical values

	$\beta\infty$	β_1	β_2	Critical values
No trend				
1%	-4.9587	-22.14	-37.29	-5.79698
5%	-4.4185	-13.641	-21.16	-4.93267
10%	-4.1327	-10.638	-5.48	-4.51962

The Mackinnon critical value formula is given as:

$$C(p) = \beta_\infty + \beta_1 T^{-1} + \beta_2 T^{-2}$$

Where T is the number of observations. The values for β_∞, β_1 and β_2 can be obtained from the Mackinnon table.

Using a no trend model, the Mackinnon critical values for five variables and 24 observations are:

Table A2: Descriptive statistics

Variable	Mean	Maximum	Minimum	Standard deviation
GDPPC (Rand)	90580.06	99801.02	77805.84	7842.02
GFCF (%)	15.39	18.98	12.80	1.84
TR (%)	34.04	78.59	5.73	20.19
POP (%)	2.09	2.67	1.51	0.26
PROD (Index)	95.14	104.37	77.66	8.80