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PRIVATE CAPITAL FORMATION, PUBLIC SECTOR CAPITAL FORMATION AND ECONOMIC GROWTH IN SOUTH AFRICA

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Abstract
This study examines the relationship between private capital formation, public sector capital formation and economic growth in South Africa. Annual data is used and sourced from WDI to evaluate the study, which spans from 1986-2021. The ARDL approach is employed to analyze the data. The unit root tests indicate that the data are stationary and the bounds test signify that the variables are cointegrated at the long-run. Furthermore, the findings revealed A rise in private capital formation will result in a notable increase in economic growth, as indicated by the coefficients of all the variables in the ARDL long-run result. Private capital formation positively and significantly influenced the nation's economic expansion. The study recommends increasing private sector capital formation for resilience and offering incentives that encourage adaptation investments, the government should concentrate on creating an environment that allows the private sector to flourish.

Keywords: Economic growth, private capital, public capital, South Africa

1.0 Introduction

Particularly in emerging market and developing economies, public investment is regarded as one of the most important policy levers to promote economic growth because it is essential to the development of infrastructure, such as utilities and roads, which lowers transaction costs and boosts efficiency (Adekunle, 2024; Bekun et al., 2023; Batool et al., 2021; Ngalawa et al., 2024; Tovar et al., 2024; World Bank, 2017). It also tackles the underinvestment problem in markets where the private sector can be reluctant to make investments because of high risks or poor private returns. In addition, government spending on social services, health care, and education is essential for developing human capital, which is a need for both steady economic growth and a productive labor force. The profit motivation, on the other hand, drives private investment, and efficiency and innovation boost competitiveness and productivity. Private investment in start-ups and growth initiatives boosts earnings and creates jobs, which encourages more spending and investment. Furthermore, private investment contributes significantly to the growth of financial markets by expanding financing options and encouraging further investment. De Gregorio (1992) has demonstrated how mechanisms such as capital accumulation and efficiency increases can have a favorable impact on economic growth.

The link between public and private sector capital production is an important topic that has generated a lot of discussion in the recent literature, despite the near-unanimity that gross capital formation is required for economic growth. According to several writers, public capital development may serve as a near substitute for private capital, lowering the rate of return on private investment (Epaphra, 2017). Some argue that public sector capital formation attracts private investment (Adekunle, 2023; Monastiriotis et al., 2023; Abbas et al., 2017). Conversely, others are hesitant to make a firm commitment, stating that there is significant ambiguity regarding the relationship between public and private sector investment, and

emphasizing that there is no valid reason to assume that they are equivalent (Adekunle, 2023; Al-Sadiq, 2013).

It is incorrect, from a policy perspective, to suggest reducing one form of capital production while increasing another before determining how each will affect macroeconomic performance. Regardless of their connection, the impact of either type of capital formation on macroeconomic performance overall stands out as a pertinent topic in developing nations.
To the best of our knowledge, not many studies have looked into the relative contributions of capital formation in the public and private sectors to macroeconomic performance in South Africa (SA) or the nature of the relationship between the two types of capital formation in the nation. Thus, this research adds to the body of knowledge on the empirical and theoretical aspects of the relationship between economic growth in an emerging country (SA) and capital formation in the public and private sectors. The study aims to accomplish two main goals. The first is to calculate the total effect of capital formation in the public and private sectors on economic growth; the second is to look at the nature of the link between the two types of capital formation. The study's conclusions are anticipated to assist in educating decision-makers about the folly of creating policies that promote capital development in the public or private sectors at the expense of the other, as has been the practice in South Africa.

2.0 Literature Review

Growing access to data has sparked an explosion of empirical research examining the connection between growth and investment. Romp et al. (2007), and Bom et al. (2014b) offer thorough reviews of the literature assessing the growth effects of public investment. The production elasticity of public capital is estimated in a wide range of ways by Bom et al. (2014b), ranging from -1.7 to 2.04, with an average elasticity value of 0.106. According to Kraay's (2014) analysis of 102 developing nations from 1970 to 2010, the one-year spending multiplier is roughly accurate at 0.4. Furthermore, Gbohoui (2021) investigates how, in times of high uncertainty, increases in public investment have stronger and longer-lasting effects on production, investment, and employment, with multipliers surpassing 2. Though more sparsely studied, the empirical research on public investment multipliers in EMDEs likewise reveals that public investment has major short- and medium-term growth effects (Agenor, 2010; Berg et al., 2013; Furceri et al., 2022; Greiner, 2007; Ganelli et al., 2020; Miyamoto et al., 2020). According to Ramey (2019), who examines fiscal multiplier estimates from the literature, most of which are for industrialized economies, they typically fall between 0.61 and 1.

Although the estimating techniques used in different investigations vary, De Jong et al. (2017) identify a number of shared outcomes. First, output is positively impacted by public investments, with basic infrastructure roads, trains, and telecommunications having a comparatively larger impact. Second, compared to intra-country regional impacts, the overall country-level impact of public investment is considerable, suggesting large network effects and spillover beyond a country's regions. Third, public capital's growth-promoting effects could eventually wane. Public investment multipliers are also consistently found to be larger than those for government consumption by econometric and DSGE-based estimates (Coenen et al., 2012; Auerbach et al., 2013; Leduc et al., 2012; Eden et al., 2014; Calderon et al., 2010; Furceri et al., 2022; Izquierdo et al., 2019). Owing to the region's evolving economic structures, manufacturing boom, and growing openness, Asia may offer insightful information on the connection between growth and public investment. Clements et al. (2022) explore the ways in which fiscal policy might support more equitable growth in emerging Asia by examining various spending options as well as doing a comparative study with Latin America. According

to the research, cutting out efficiencies in public investments, health care, and education would produce the equivalent of 3% of GDP. Reducing subsidies for fossil fuels may potentially provide funds for increased redistributive expenditures.

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According to Heshmati et al. (2015), Asian countries employed fiscal policy to create the conditions for macroeconomic stability and, eventually, economic growth by avoiding budget deficits. By making large investments in infrastructure and education, budgetary policy has also contributed to the prosperity of Asia's economy by raising the region's stock of both human and physical capital. A few studies that concentrate on specific nations examine the impacts of public investment multipliers in various Asian nations. Ilzetzki et al. (2013) examined China's fiscal multipliers. In addition, Zhang (2023) conducted a national and provincial analysis for China from 1978 to 2022, accounting for the country's distinct institutional frameworks for development and considerable discretion in executing local policies.

The Indian experience of public investment and its impact on economic growth has generated interest. Mallick (2016) examines the impact of shocks to government spending on private investment and national revenue, with a particular focus on the "crowding-in" or "crowding-out" phenomenon in India. The main reason for the study's conclusions about the crowding-out effect of government investment is the non-infrastructure component of spending. The impact of private investment on income is higher than that of either or both types of governmental investment. Public investment has a bigger short- and medium-term influence on infrastructure-related revenue than the non-infrastructure component. However, the infrastructure component continued to receive the lion's share of government spending on non-infrastructure.

Rangarajan et al. (2008) examined the fiscal policy and economic progress of India. Choi and Son (2016) investigate the effect of expansionary government expenditure shocks on GDP growth in Korea since the 1980s using the time-varying parameter structural vector autoregression (TVP-SVAR) method. Haughton et al. (2016) evaluate the effectiveness of Thailand's policy response to the global financial crisis with a particular emphasis on government spending. Empirical studies on the factors that could explain the differences in government expenditure multiplier estimates between countries have increased. Several nonlinearities could have an impact on these findings.

In a comprehensive analysis, Izquierdo et al. (2019) identifies significant aspects that affect multiplier size. Trade openness, institutions, monetary policy position, debt levels, cyclical conditions, exchange rate flexibility, and the effectiveness of public investment are some of these elements. Furthermore, studies consistently demonstrate that fiscal multipliers are higher during times of accommodative monetary policy (Carvelli, 2024; Paczos et al., 2023)**.**

Additionally, recent empirical evidence suggests that the magnitude of fiscal multipliers may also be positively correlated with macroeconomic uncertainty (Koh, 2017), financial development (Colombo et al., 2022), and the degree of economic informality (Ilzetzki et al., 2013). Furthermore, Barnichon et al. (2022) assert that fiscal actions' orientation matters. More specifically, they find that the contractionary multiplier increases to larger magnitudes and is bigger than 1 during recessions. However, regardless of the cyclical state of the economy, the expansionary multiplier is significantly less than 1. Gaspar et al. (2015), stronger infrastructure governance is linked to lower average additional public capital to output ratios and, thus, higher growth "bang" for the investment "buck." They also found that in countries with higher public investment efficiency, the production dividends from public investment are larger. Poor infrastructure governance, on the other hand, may raise the national debt without having any positive economic effects. The amount of public capital generated by a unit of public investment may be reduced by governance concerns in project implementation, even while inefficient project selection methods may lead to the construction of "white elephants" that make very little contribution to economic activity.

METHODS

The study used the Autoregressive Distributed Lag (ARDL) bound testing method described in Pesaran et al. (2001) to check the integration order and find the long-term link between the variables. There are several advantages of using ARDL over previous cointegration techniques. It might be applied to mixed integration orders with small sample quantities, for instance. Furthermore, endogeneity problems can be addressed by model design by employing an appropriate lag. An unlimited error correction model was employed to estimate the ARDL bounds testing approach.

testing approach.

$$Gdp = Pcap,, Pucap\ fdi, exch \quad (1)$$

$$Gdp = \emptyset_1 + \emptyset_2 Pcap + \emptyset_3 Pucap + \emptyset_4 fdi + \emptyset_5 Exch + \mu \quad (2)$$

$$\Delta Gdp = \emptyset_0 + \sum_{m=1}^{J} . \emptyset_{1m} \Delta Gdp_{.t-n} + \sum_{m=1}^{J} . \emptyset_{2m} \Delta Pcap_{.t-n} + \sum_{m=0}^{J} . \emptyset_{3m} \Delta Pucap_{.t-n} + \sum_{m=0}^{J} . \emptyset_{4m} \Delta Fdi_{.t-n} + \sum_{m=0}^{J} . \emptyset_{5m} \Delta Exch_{.t-n} + \partial_1 Gdp_{t-1} + \partial_2 Pcap_{t-1} + \partial_3 Pucap_{t-1} + \partial_4 Fdi_{t-1} + \partial_5 Exch_{t-1} + \mu \quad (3)$$

Equation (4) makes use of the first difference operator, represented by Δ, in which the error term is μ, the constant term is ∅_1, and the coefficients in the short and long terms are represented by θ and ∂. The Wald test or F test is used in the ARDL limits testing method to determine the long-run relationship. By comparing the F-statistics to the crucial value, one can ascertain the existence or absence of a long-term link. We can determine the existence of a long-term link if the estimated F-statistics value is greater than the crucial value, and vice versa. In the event that the projected value is within the critical value range, no conclusions on cointegration may be drawn. A framework for estimating the long-term elasticities is given by equation (3). On the other hand, the following equation represents the error correction model:

:

$$\Delta Gdp = \emptyset_0 + \sum_{m=1}^{J} . \emptyset_{1m} \Delta Gdp_{.t-n} + \sum_{m=1}^{J} . \emptyset_{2m} \Delta Pcap_{.t-n} + \sum_{m=0}^{J} . \emptyset_{3m} \Delta Pucap_{.t-n} + \sum_{m=0}^{J} . \emptyset_{4m} \Delta Fdi_{.t-n} + \sum_{m=0}^{J} . \emptyset_{5m} \Delta Exch_{.t-n} + \partial_1 Gdp_{t-1} + \partial_2 Pcap_{t-1} + \partial_3 Pucap_{t-1} + \partial_4 Fdi_{t-1} + \partial_5 Exch_{t-1} + + \in ECT_{t-1} + \in_t \quad 4$$

According to the ECM, the error correction term accurately represents the dynamics of the process of adjustment leading to the long-term equilibrium in the short term. The ECM coefficient, represented by ξ, quantifies the rate of adaptation towards the long-term equilibrium. It is anticipated to be negative and less than one, with a bigger magnitude indicating a quicker process of adjustment. In addition, we employed the time-varying exogeneity causality test, which enables us to track alterations in causal linkages across time. There are two reasons why this strategy is better than other approaches. It does this by first removing the requirement to run a unit root test to verify variable stationarity. Secondly, there is no need to conduct cointegration tests between the variables.

Table 1: Measurement of Variables and Data Sources

Variables	Measurements	Data Sources
FDI inflow	net inflow of FDI (% of GDP)	WDI, 2021
Private capital formation	PCF (as % of GDP)	WDI, 2021
Public capital formation	PUCF (as % of GDP)	WDI, 2021
Exchange rate	real effective exchange rate index	WDI, 2021
Economic growth	GDP growth (annual %)	WDI, 2021

Source: Author's Compilation, 2024

Finding and Discussion

ADF and DF Unit Root Testing

The study adopts the robust version of Augmented Dickey-Fuller (ADF) and Dickey-Fuller unit root tests to ascertain the stationarity of the data set. The two approaches were adopted to ensure consistency and to compare and validate the results. As shown in Table 2 the data employed are stationary at I(0) and I(1).

Table 2. Unit Root Testing @ I(0) and I(1)

		ADF (H_0)				DF (H_0)			
		DF_α				ERS_α			
	$z_{.t}$	$\tau_{.\mu}$	1%	5%	Prob.	τ_τ	1%	5%	Prob.
Intercept without Time Trend	GDP	2.15	1.56	2.95	0.63	0.92	4.23	1.73	0.26
	$Pcap$	0.83	4.25	3.17	0.49	0.69	3.39	2.57	0.48
	$Pucap$	3.38	2.68	3.46	0.01	3.56	1.83	2.36	0.03
	Fdi	2.48	1.61	3.48	0.51	0.35	3.38	2.59	0.54
	Exch	3.13	3.22	1.92	0.29	1.74	4.61	1.90	0.52
	ΔGDP	3.93	2.38	4.46	0.00	4.39	2.36	4.46	0.05
	$\Delta Pcap$	3.29	2.58	3.87	0.00	4.56	4.85	4.87	0.02

	$\Delta Pucap$	2.35	1.86	1.90	0.00	4.29	4.54	2.59	0.00
	ΔFdi	2.56	3.72	4.27	0.00	2.39	2.58	1.75	0.00
	$\Delta Exch$	2.63	2.39	4.71	0.40	1.03	1.82	1.42	0.00
Intercept with Time Trend	Gdp	3.91	2.63	1.59	0.00	1.84	1.46	3.58	0.00
	$Pcap$	3.59	2.48	2.82	0.58	3.72	3.49	3.29	0.00
	$Pucap$	4.63	2.92	3.24	0.00	2.71	3.39	3.42	0.00
	Fdi	3.28	4.53	4.68	0.00	2.22	4.43	3.83	0.00
	Exch	4.91	3.54	4.71	0.00	3.39	2.75	3.99	0.00
	ΔGdp	2.48	2.77	2.28	0.00	2.38	2.68	2.39	0.00
	$\Delta Pcap$	3.28	5.44	2.29	0.00	3.03	1.92	5.23	0.00
	$\Delta Pucap$	2.74	3.72	1.61	0.00	2.58	4.94	2.82	0.00
	ΔFdi	3.73	5.82	2.74	0.00	5.92	3.89	2.39	0.00
	Exch	2.84	3.90	2.31	0.00	4.32	2.52	2.72	0.00

Source: Author's Compilation, 2024

Table 3. Descriptive statistics for variables

Variable	Observation	mean	Std.Dev	Min	Max
CE	36	5.69	0.18	6.90	5.72
ForDI	36	2.33	1.37	0.31	7.56
GrDP	36	0.58	3.42	-5.22	3.95
$GrDP^2$	36	8.00	8.52	0.01	41.24
RENE	36	7.92	0.42	5.24	6.23
URB	36	3.24	0.92	1.62	3.41

Source: Author's Compilation, 2024.

Table 3 presents an overview of the descriptive statistics for the variables the study employed in the analysis. The number of observations is 36, with five variables that are being employed in this study to establish a better understanding of the connection amid these variables.

Bound Testing

The review evaluated long term coefficients and momentary unique relationship utilizing the ARDL cointegration system after the gross domestic product model showed that cointegration existed. Establishing the cointegration and lag length criteria is basically as urgent as establishing which factors to remember for any situation structure, and the ARDL technique requires a lag period which is completed in Table 2 below.

Table 4: ARDL Bound Testing

Test Statistic	Value	K
F-statistic	5.989528	4

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Source: Author's Compilation, 2024.

ARDL Long run Estimation

A rise in private capital formation (Pcap) will result in a notable increase in economic growth, as indicated by the coefficients of all the variables in the ARDL long-run result. For instance, it was discovered that Pcap positively and statistically significantly influenced the nation's economic expansion. This result is in line with Nyasulu's (2013) evaluation of the Pucap and Pcap on Malawi's economic growth from 1970 to 2010. The results showed that Pcap and economic growth were significantly positively correlated. Additionally, the results are consistent with Tekin (2012). Therefore, it can be said that a Pcap-oriented approach, such as a tax cut, should be encouraged to increase SA Pcap potential.

The literature on Pucap's effects on the economy contains a variety of opinions. While some studies have identified a long-term negative significant association, indicating that Pucap erodes the economy, others have found a positive significant influence, particularly when state intervention is excluded (Chirwa et al., 2016; Ziaja, 2013). Similar to Mallik's (2008) empirical study on the relationship between public and private aid and economic growth in the Central African Republic, Malawi, Mali, Niger, Sierra Leone, and Togo, this study also found that foreign aid significantly boosts Malawi's economic growth. This finding is also similar to views expressed by Sakyi (2011) and Kargbo (2012) that foreign aid comes with stringent terms and conditions, which have important benefits to recipient countries that have a good-policy environment.

Table 5: Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PUCAP	1.006631	0.625359	-1.609686	0.1515
PCAP	0.240637	0.208448	1.154422	0.0262
EXCH	0.051121	0.040876	1.250625	0.0513
FDI	5.192380	2.008773	2.584851	0.0362
C	-2.416338	4.748049	-0.508912	0.6265

Source: Author's Compilation, 2024

Given that the coefficient of the error correction term delayed one period (CointEq-1) is negative and significant at a 1% significance level, Table 4 results indicate that GDP, Pcap, Pucap, and FDI are all cointegrated. The ECM (-1) coefficient for the error correction term is 1.20 in absolute terms. This suggests that about 120% of the yearly correction of the long-term GDP divergence is due to the transition from the short run to the long run. This suggests that almost 120% of the GDP's previous year's imbalance has been resolved this year. The larger

the coefficient, the faster the variable will eventually stabilize after a shock, according to the absolute term of the error correction form's coefficient.

Table 6: Short-run Estimation

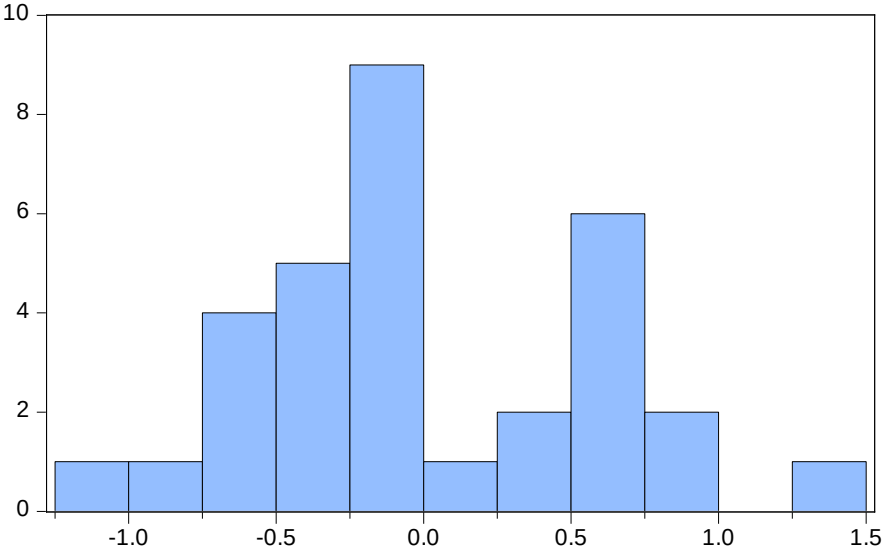
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-3.171934	0.959537	-3.305693	0.0130
D(GDP(-2))	-2.698694	0.767236	-3.517423	0.0098
D(GDP(-3))	-1.575478	0.460156	-3.423792	0.0111
D(PUCAP)	0.377056	0.058262	6.471694	0.0003
D(PUCAP(-1))	-0.384725	0.098647	-3.899999	0.0059
D(PUCAP(-2))	-0.135034	0.070642	-1.911509	0.0975
D(PUCAP(-3))	0.085862	0.066799	1.285381	0.2395
D(PCAP)	-0.978064	0.681664	-1.434819	0.1945
D(PCAP(-1))	0.073888	0.852488	0.086674	0.9334
D(PCAP(-2))	-1.127553	1.024014	-1.101110	0.3073
D(PCAP(-3))	-2.564078	0.992066	-2.584585	0.0362
D(EXCH)	-0.111579	0.049305	-2.263041	0.0581
D(EXCH(-1))	0.035276	0.077594	0.454620	0.6631
D(EXCH(-2))	-0.016802	0.065265	-0.257443	0.8042
D(EXCH(-3))	-0.076289	0.047919	-1.592058	0.1554
D(FDI)	0.058036	0.226412	0.256331	0.8051
D(FDI(-1))	1.676366	0.637492	2.629628	0.0339
D(FDI(-2))	2.298936	0.730068	3.148933	0.0162
D(FDI(-3))	0.972450	0.469976	2.069150	0.0773
CointEq(-1)	-1.204348	0.739683	-1.628195	0.0475

Source: Author’s Compilation, 2024

Stability Test for the Model

The findings of diagnostic tests performed on the ARDL models to evaluate their robustness and dependability are shown in Tables 5, Figure 1, and Figure 2. Using the Breusch-Godfrey Serial Correlation LM Test, the study is unable to rule out the null hypothesis that there is no serial correlation in the model in the first case. This indicates that there is no serial correlation in the model according to the tests. The model's stability was tested by the investigation. The results demonstrated the CUSUM and CUSUM Square, indicating that the instruments are pertinent to the study and quite robust. Therefore, it is reasonable to say that the ARDL models are dependable and consistent when examining the connection between SA's economic growth and private and public capital formation.

Figure 1: Normality Test



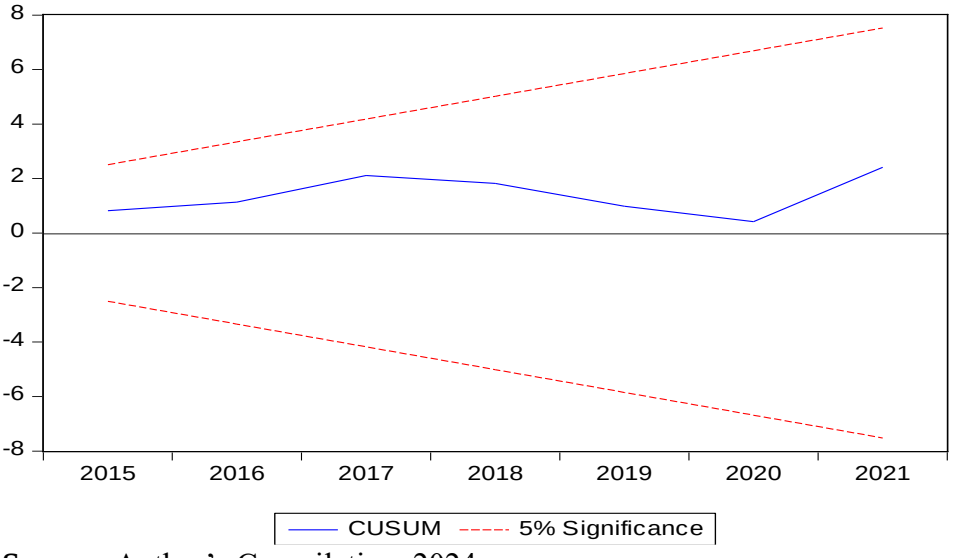
Source: Author's Compilation, 2024.

Table 7: Breusch-Godfrey Serial Correlation LM Test

F-statistic	1.005294	Prob. F(24,7)	0.5413
Obs*R-squared	24.80369	Prob. Chi-Square(24)	0.4165
Scaled explained SS	0.853876	Prob. Chi-Square(24)	1.0000

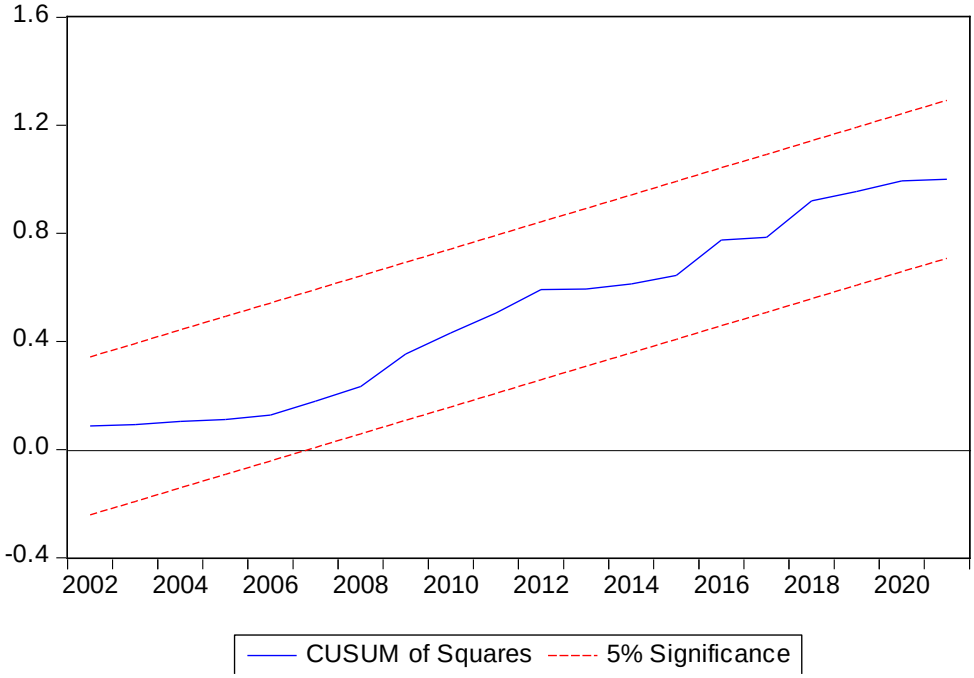
Source: Author's Compilation, 2024

Figure 2: Cusum



Source: Author's Compilation, 2024.

Figure 3: Cusum of Squares



Source: Author's Compilation, 2024.

5.0 Conclusion

The purpose of this study was to look at the connection between South Africa's economic growth and capital production in the public and private sectors. Both Pcap and Pucap capital are cointegrated and have a positive, significant functional relationship with economic growth, according to model estimates based on the ARDL approach and annual data for the years 1986–2021. This result is in line with several other findings, including Makuyana et al. (2019) and Chirwa (2017). The study also concludes that foreign direct investment (FDI) has a significant impact on SA's rate of economic growth. In a similar vein, the study shows that FDI boosts SA's economic expansion. Given these results, the study adds to the body of knowledge by elucidating the connection between economic growth and public and private capital formation, which has been a persistent problem in the literature (the relationship was poorly understood), particularly in South Africa where there has been little research in this field. To the best of our knowledge, the nation has very little research attempting to establish this association. Policymakers will benefit from this discovery by having a better understanding of how to create and carry out policies that improve capital formation in SA's public or private sectors. Therefore, by increasing private sector capital formation for resilience and offering incentives that encourage adaptation investments, the government should concentrate on creating an environment that allows the private sector to flourish.

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