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An Examination of Economic Development Causation through Time Series Analysis in South Africa

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Abstract. Recent literature considers gross fixed capital formation (formally referred to as gross domestic fixed investment) to be crucial to accelerate economic growth and increase employment levels. The current body of knowledge presents conflicting empirical evidence regarding the causal pathway among domestic investment, economic growth, and employment. This research provides an empirical contribution to the present discourse by analysing the positive and negative causal linkages in the South African economy among economic growth, domestic investment, and employment, incorporating the novel aspect of the current account over the period from the first quarter of 1999 to the fourth quarter of 2019. The investigation of causal relationships employs autoregressive distributed lag estimation techniques, the bounds cointegration test, and the Toda–Yamamoto causality test. We empirically demonstrate that a significant bidirectional causality relationship exists between real GDP and employment, employment and real GDP, real GDP and total investment, total investment and real GDP, the current account and employment. Furthermore, it demonstrated that a long-run relationship exists between the variables, which is further supported by the short-run dynamic interaction.

Keywords: causality, econometrics, economic development, domestic investment

JEL Classifications: B23, C22, E13, O11

1. Introduction

One of the most pressing and formidable challenges facing South Africa today is the lack of sustained economic growth and the creation of employment opportunities, both of which are absolutely vital for alleviating poverty and significantly uplifting

the standard of living for its citizens (Lewis, 2002). We may characterize the development of an individual's standard of living as occurring when there is improved and broadened access to a diverse array of goods and services that markedly boost their quality of life, coupled with notable advancements in their social and economic status (Bolganbayev et al., 2022). Conversely, the authors refer to regional development as the process of elevating a region's overall welfare by advancing human resource capabilities and strategically leveraging economic and social capacities (Bolganbayev et al., 2022).

Keynesian general theory (1936) compellingly argues that as the magnitude of investment surges, the employment landscape will witness a proportional elevation. Moreover, an accelerated growth rate within an economy serves as a potent catalyst for invigorating domestic investments. This upward momentum occurs as established enterprises bolster their holdings with fresh investments or as nascent domestic investors courageously venture into the market. John Maynard Keynes astutely asserted that aggregate demand within an economy expands when new and additional investments are enthusiastically made by existing economic agents (Keynes, 1936). Neoclassical growth models are intricately crafted to be dynamic, with their convergence assumptions intriguingly focused on growth rate convergence as opposed to factor price convergence, unlike their predecessors. Solow (1956) and Swan (1956) ingeniously pioneered two enlightening forms of convergence. Conditional convergence delineates the process of attaining a steady-state growth rate that assures stability in per capita incomes, consumption levels, and capital/labour ratios. This is aptly termed conditional because savings rates, depreciation rates, and population growth rates distinctly vary across nations. Conditional convergence may not necessarily result in parallel per capita income levels between nations, reiterating its complex nature. On the other hand, absolute convergence emerges when all countries share identical growth model parameters. This scenario implies that richer nations will inevitably progress at a more languid pace compared to their poorer counterparts, ultimately leading to a harmonious equalization of per capita incomes across countries, epitomized in the Hercksher–Ohlin–Samuelson model of international trade (Solow and Swan, 1956). While both models suggest the inevitable long-term convergence of per capita incomes across different regions, the mechanisms through which this transformation unfolds diverge when contrasting the neoclassical trade and growth paradigms. Within the neoclassical economic framework, the unhindered mobility of production inputs coupled with the strategic exploitation of comparative advantages catalyses a resounding alignment of labour and capital flows over time. As a result, developing nations and rapidly expanding areas are making significant strides towards mirroring the prosperity levels of the world's more affluent regions. Furthermore, as posited by neoclassical growth theory, regions with diminished capital per worker are poised to witness elevated rates of return and accelerated

early-stage growth trajectories in stark contrast to those areas already boasting a higher capital concentration per individual (Barro and Sala-i-Martin, 1991). Proponents of endogenous growth theory, including Solow (1988) and Mankiw, Romer, and Weil (1992), posited that technological innovation is central to the processes of economic growth in the long term (Ascani et al., 2012). This study employs the principles and assumptions articulated within the framework of endogenous growth theory.

South Africa, historically rooted as a mineral economy, has been ensnared by the pervasive challenges of the resource curse – an enigmatic predicament where a nation abundant in resources paradoxically lags in economic performance (Altman and Meyer, 2003). Typically, mineral-based economies endure seismic structural shifts, trail behind non-mineral exporters in growth, and cultivate a production structure that is heavily capital-intensive (Altman and Mayer, 2003). According to the authors, the strategic imperative for the forthcoming phase of economic evolution is centred on the development of manufacturing capabilities, which would integrate numerous low-skilled workers into labour-intensive production sectors at minimal cost (Altman and Mayer, 2003). In a pivotal twist, South Africa leapfrogged this critical phase, vaulting directly into tertiary sector operations, particularly within financial services, where the infusion of skilled workers expanded only slightly. As a result, the neglected secondary sector has entrenched ongoing levels of subdued growth, pronounced inequality, and significant unemployment rates that persistently define its economic landscape today (Altman and Meyer, 2003).

The South African economy has been plagued by lacklustre growth and dismal employment outcomes over the past few decades, starkly indicative of a prolonged and deeply entrenched downturn. Once the beacon of robust economic health, the GDP expansion has steadily dwindled, plummeting dramatically from an average of over 6% in the vibrant 1960s to a mere shadow of itself with roughly 3% in the 1970s, a further disappointing 2% in the 1980s, and an erratic performance throughout the challenging 1990s (Lewis, 2002). According to Lewis (2002), during the tumultuous 1990s, South Africa faced an ominous and relentless decline in formal employment, while unemployment rates escalated to alarming levels, eventually ensnaring 37% of the working-age population, including those disheartened individuals who had ceased their job search altogether. In a brief respite from stagnation, the economy managed a meagre expansion of 0.1% per year from 1990 to 1994, only to see a modest rally to a 2.6% growth per year between 1995 and 1999 (Hodge, 2009). Moreover, from 2000 to 2007, the nation witnessed a commendable yet insufficient surge, achieving an average yearly growth rate of 4.3%. However, the global financial crisis of 2008–2009 unleashed a storm of volatility that battered global markets and did not spare South Africa from its ravages. The GDP nosedived to a staggering -1.5% in 2009, following a decent 3.2% in the previous year (World Bank, 2024), shattering investor confidence, stalling

any semblance of recovery, and imperilling macroeconomic stability (Lewis, 2002). Subsequently, the trajectory from 2010 to 2022 presented an uninspiring decline, with the country merely crawling at an average growth rate of 1.82% (World Bank, 2024). Such dismal growth rates are woefully inadequate to effectively dismantle and rectify the entrenched system of economic exclusion crippling the country.

Gross fixed capital formation (GFCF), a concept formally recognized as gross domestic fixed investment, is imperatively acknowledged as an indispensable catalyst in propelling economic growth and significantly bolstering employment levels (Meyer and Sanusi, 2019; World Bank, 2025). An impressive array of scholars (Levine and Renelt, 1992; Mankiw et al., 1992; De Long and Summers, 1992; Romp and de Haan, 2005; Fedderke and Garlick, 2008; Estache and Fay, 2009; Heintz et al., 2009; Kumo, 2012) have elucidated a robust positive correlation between investment and economic growth, reinforcing the essential nature of this relationship. In addition, several authors (Coombs and Green, 1981; Abedian and Schneier, 1987; Bell, 1997; Hodge, 2001; Casale et al., 2004 and Hodge, 2009) have effectively illuminated that innovations in research, development, and cutting-edge technology have catalysed the substitution of human capital with machinery, creating a notable disjunction in the previously bidirectional relationship between investment and employment. Furthermore, insightful studies conducted by Vermeulen (2015), Mkhize (2016), and Meyer (2017) have identified profound long-term cointegrating relationships among employment and economic growth in South Africa, albeit manifesting at varying coefficients.

Meyer and Sanusi (2019) conducted a profound investigation into the intricate causal relationship binding domestic investment, employment, and economic growth within South Africa. Their study, rich in analytical depth, deftly utilized quarterly data spanning from 1995Q1 to 2016Q4 under the sophisticated frameworks of the Johansen cointegration and the Vector Error Correction Models (VECM). The empirical analysis offered compelling evidence of a robust long-term linkage interconnecting domestic investment, employment, and economic growth, remarkably highlighting that the causation primarily flows from economic growth towards investment and not the other way around. Moreover, the insightful findings reveal that investment exerts a positively significant and favourable long-term influence on employment. The data further underscores a bidirectional causation existing between employment and economic growth, complemented by a unidirectional causality originating from investment to employment. The study's seminal revelation is profound: despite the evidence of bidirectional causation between economic development and employment, economic expansion does not necessarily translate into higher employment levels in the long term, thereby validating the phenomenon of "jobless growth". Most importantly, investment emerges as a vital and long-term catalyst driving employment in South Africa's dynamic economy (Meyer and Sanusi, 2019).

This study tests and builds on the work of Meyer and Sanusi (2019), making contributions to the current academic discourse in three distinct ways. Firstly, although numerous studies have explored the intricate causal relationships between economic growth, the current account, and investment, there has been a predominant focus on foreign direct investment, overlooking the critical aspect of domestic investment. Our research meticulously addresses this gap, offering a comprehensive causal examination of real GDP per capita, employment, domestic investment, and the current account. Secondly, by implementing the advanced autoregressive distributed lag (ARDL) estimation technique and incorporating structural breaks within our analysis, we enable an exceptionally in-depth investigation, which fosters the formulation of nuanced and impactful country-specific policy recommendations. Thirdly, from the vantage point of an emerging economy, this study unveils empirical insights, thereby fortifying and enriching the existing literature with depth and clarity.

The remainder of this paper is structured to enhance clarity and impact: Section 2 embarks on an insightful journey through the historical, political, and empirical literature, providing a robust foundation for the study. Section 3 then unveils the intricacy of the empirical model, meticulously detailing the data and econometric methodology employed to yield accurate results. In Section 4, the empirical findings are dissected with precision, offering compelling insights and deep analysis. Finally, Section 5 illuminates the study's pivotal discoveries, putting forth specific, actionable policy recommendations and drawing powerful conclusions that underscore the significance of this research.

2. A Brief Historical and Political Background and Review of Empirical Literature

South Africa's turbulent history reveals the intricate web of factors contributing to its present-day economic challenges. The indelible mark left by the colonial powers – first, the Dutch in 1652, followed by the British in 1820 – continued until 1921 and set the stage for a calculated blueprint of economic and social restructuring. This blueprint laid the groundwork for the apartheid regime's infamous separate development, which was meticulously legislated to segregate racial groups, fostering systemic inequities (Rogerson, 1997). Policy frameworks meticulously designed to infiltrate every facet of daily life – from mobility to education, commerce, and residential areas – were skewed to perpetuate the elevated living standards of a white minority, systematically marginalizing others (Rogerson, 1997). The dawn of democracy in 1994 ushered in a new era where the onus fell upon the nascent government to navigate the economy away from

exclusionary practices towards a horizon of economic inclusivity (World Bank, 2018). Under the scrutiny of international giants like the International Monetary Fund and the World Bank, who cast doubt on the economic stability and credibility of South Africa, the government had no choice but to thrust macroeconomic concerns into the spotlight (Lewis, 2002). The newly empowered democratic government took the helm of an economy that had languished in decline for over a decade. In response, it unveiled the Reconstruction and Development Plan (RDP) in 1994, positioning it as a pivotal policy framework (Wehner, 2000). Building on this foundation, the Department of Finance unveiled the Growth, Employment, and Redistribution (GEAR) plan, ardently championing the necessity of sustaining robust and unwavering growth through a fiercely competitive outward-oriented economy (Department of Finance, 1996: 1). Under the guidance of President Thabo Mbeki, meticulous macro-econometric analyses were employed to set targets for 1996–2000, emphasizing the critical necessity of "moderation of wage demands to circumvent a pernicious cycle of wage and price increases that would destabilise financial markets and erode competitiveness" (Department of Finance, 1996: 20). Following this, the South African government embarked on a comprehensive journey, crafting additional strategies, frameworks, and plans to identify and confront its challenges. This was achieved through strategic investments in public infrastructure (Wehner, 2000). By forging a solid and prudent fiscal path, efforts to curb inflation and unify the dual exchange rate system were designed to alleviate international anxieties regarding this fledgling democracy's future (Lewis, 2002). Bui and Kiss (2021) further underscore that, since the 1990s, a number of developing economies have embraced inflation targeting. Within this strategic context, interest rates emerge as key tools to achieve inflation targets, while market dynamics play a decisive role in shaping other instruments such as money supply and currency rates. These meticulously crafted measures have brought about the endurance, stabilization, and legitimacy of macroeconomic policies (Lewis, 2002).

Empirical studies, with a sharp focus on the intricate nexus between foreign direct investments, trade, and economic growth, have illuminated powerful insights (Balasubramanyam et al., 1996; Lipsey, 2000; Ibarra and Moreno-Brid, 2004, 2005; Pahlavani et al., 2005; Goyal and Rajput, 2019). These pivotal investigations decisively indicate that inflows of foreign direct investment (FDI) coupled with dynamic trade activities are robust catalysts that fuel economic growth. Antelo and Valverde (1994) deeply examined private investment in Bolivia, drawing on the profound Keynesian theory that views investment as a potent driver of economic growth, fundamentally hinged on the anticipated rate of return on capital. Furthermore, the authors astutely observed that within the framework of neoclassical theory, investment is intricately dependent upon the mechanisms of economic growth and prevailing interest rates (Antelo and Valverde, 1994).

Ibarra and Moreno-Brid (2004) meticulously examined the intricate linkage between economic growth, investment, and FDI in Brazil, spanning the dynamic period from 1990 to 2004. In a strategic move, the Brazilian government launched a transformative privatization programme in 1996, which remarkably attracted a substantial influx of FDI into the thriving manufacturing sector. Their compelling results unequivocally demonstrated that investment is intensely dependent on economic growth and real wages, showcasing a positive and significant causal effect. In a complementary study, Bond et al. (2004) uncovered that a substantial portion of investment in economic growth leads to a marked increase in output per worker, thereby enhancing the long-term growth rate. Meanwhile, researchers such as Mordecki and Ramirez (2014) and McKinnon (2010) have pointedly emphasized that causality does not typically flow from investment to growth, as investment levels are often swayed by preceding business cycles. Delving deeper, Mordecki and Ramirez (2014) explored the intricate connection between domestic investment, economic growth, and employment in Uruguay, leveraging a sophisticated vector error correction model (VECM) framework and determining an undeniable long-term link between economic growth, investment, and employment. On a broader scale, Mohsen and Maysam (2013) investigated the causal link between gross domestic investment and economic growth in the Middle East and North African regions. By employing rigorous panel unit root tests and panel cointegration analysis over the extensive period from 1970 to 2010, their empirical findings reveal a compelling strong causality from economic growth to investment within these countries. Conversely, they highlighted that investment holds no significant influence on economic growth in either the short or the long term. Their conclusions harmonize with existing literature that convincingly suggests economic growth is the true driver of investment.

Eminent scholars have meticulously observed and asserted that elevated levels of employment (Walsh and Yu, 2010) along with strategic investments (Lee et al., 2012; Belloumi et al., 2014) act as crucial and powerful indicators that vividly reflect and underscore a nation's stride towards economic advancement. These vital elements have been extensively and popularly utilized to delve into and unravel the intricate causal interactions about economic growth (Blomstrom et al., 1996; Podrecca and Carmeci, 2001; Bekhet and Othman, 2011; Kumo, 2012; Mohsen and Maysam, 2013; Meyer, 2017). Ampah and Kiss (2018), in conjunction with Kiss and Ampah (2018), embarked on an exploration of the profound influence exerted by capital flight and external debt on sub-Saharan nations. Their analysis unearthed that due to constrained and limited savings, these countries lean heavily on foreign loans to reach their aspirational targets of economic growth and societal advancement for their populations. Typically, external debt is meticulously procured from economically pivotal institutions like the IMF and the World Bank, serving as instrumental in bridging current account shortfalls and bolstering a

country's financial standing, particularly when indigenous investment resources are scarce and insufficient.

In a comprehensive exploration, McFarlane, Jung, and Das (2020) embarked on unravelling the intricate webs of interconnections between the current account balance, domestic savings, and domestic investment in the United States, spanning the extensive time frame from 1947: Q1 to 2017: Q3. Their study meticulously leveraged sophisticated time series methodologies, employing rigorous tools such as unit root testing, vector autoregression (VAR), cointegration, and vector error correction (VECM) methods to methodically probe into three pivotal research inquiries that define economic discourse: (1) Is there compelling empirical support that validates the twin deficit hypothesis? (2) Does the weight of empirical evidence suggest that the current account wields considerable influence over government saving, private saving, and investment? (3) Is there an enduring, stable relationship woven among private saving, government saving, and investment? The evidence amassed throughout the entire sample period compellingly indicates a significant short-run causal connection, in the Granger sense, between government savings and the current account balance. This frequent association, observed in the Granger sense, of government saving interfacing with the current account balance in the short term, persuasively suggests that there is a stark insufficiency in empirical evidence necessary to corroborate the Ricardian Equivalence hypothesis in the United States. The enlightening cointegration results regarding private savings and investment during this era imply a substantive long-run association; however, the incisive findings of the VECM bring to light that this relationship disappointingly fails to achieve mean reversion, as the error correction term is both statistically significant and positive.

Daoud et al. (2023) embarked on a pivotal investigation into the determinants of the current account in Jordan, meticulously analysing the period between 1995 and 2018. With a sharp focus on uncovering the profound impacts of these factors on the nation's current account balance, they employed the sophisticated Autoregressive Distributed Lag (ARDL) model. This model was adeptly used to untangle and scrutinize the intricate relationships among the current account balance, the general budget deficit, private savings, trade exposure rate, effective real exchange rate, international exchange rate, gross investment, and GDP growth rate. Their empirical analysis did not just reveal but illuminated the existence of significant long-term relationships among the variables studied. Astonishingly, it was unveiled that the general budget deficit, private savings, and trade exposure rate exerted a detrimental and negative impact on the current account balance. On the other hand, the effective real exchange rate, gross investment, and GDP growth rate were identified as having a potent and positive influence on enhancing the current account balance. The study reached a compelling conclusion: Jordan is grappling with a current account deficit, predominantly attributed to the adverse effects spawned by the negative budget deficit and the trade balance deficit.

Numerous authors, including Walsh and Yu (2010), Masron and Abdullah (2010), and Mugo et al. (2021), have meticulously explored the current account as a pivotal variable. This component of the balance of payments robustly illustrates a country's vibrant economic interactions with the global community through international trade. Mugo et al. (2021) provided an in-depth analysis of the ramifications of the current account deficit, specifically on Kenya's economic trajectory. Their groundbreaking findings revealed that, in the grand scheme, the current account deficit imparts a substantial and enduring positive impact on Kenya's economic development. The study unearthed a complex, bidirectional relationship between the current account deficit and economic growth, alongside significant feedback effects that further energize this dynamic interplay. The current account balance emerges as an indispensable barometer of a country's economic vitality. When foreign investors detect a nation's current account imbalances as perilously unsustainable, they swiftly adopt a cautious stance, displaying a marked hesitance to maintain assets denominated in the currency of such a nation.

This research breathes new life into the scholarly discourse by boldly exploring the complex web of positive and negative causal relationships that exist among domestic investment, real GDP, employment, and the current account in South Africa. Firmly rooted in the robust foundations of neoclassical growth theory (Keynes, 1936; Solow and Swan, 1956), this econometric investigation harnesses the power of advanced econometric techniques, deploying the sophisticated ARDL bounds test by Pesaran, Shin, and Smith (2001). It progresses through a comprehensive cointegration test, ultimately applying the rigorous Toda–Yamamoto (1996) tests to definitively ascertain causal directionality. A meticulous review of the existing literature unveils several critical shortcomings, which this study decisively addresses with precision and depth. This analysis shines a spotlight on domestic investment as a pivotal driver of both economic growth and employment in South Africa, stepping away from the traditional focus on FDI (Balasubramanyam et al., 1996; Lipsey, 2000; Ibarra and Moreno-Brid, 2004; Pahlavani et al., 2005; Goyal and Rajput, 2019). Furthermore, the audacious inclusion of the current account as a study variable boldly ventures into uncharted territory, examining its causal ties with real GDP, employment, and domestic investment. This fills a noticeable void in the literature, where these variables are rarely contemplated in such an innovative configuration. This influential research study crafts tailor-made policy suggestions specifically for South Africa, meticulously based on quarterly data spanning from 1999 to 2019, a period that encapsulates pivotal post-apartheid economic transformations, daunting global financial crises, and persistent chronic unemployment. These formidable contributions significantly expand the empirical framework, paving the way for crafting astute policies in emerging economies grappling with similar structural challenges.

3. Methodology

3.1. Research Goal

The primary objective of this comprehensive study is to meticulously explore the intricate causal relationship that interlinks real GDP per capita, domestic investment, employment, and the current account within the unique economic framework of South Africa over a significant twenty-year span, from the first quarter of 1999 to the final quarter of 2019.

3.2. Data

Table 1 provides an insightful summary of the examined variables within the study, where the formidable real GDP assumes the pivotal role of the dependent variable, while the influential employment, the dynamic current account, and the crucial total investment assert their positions as the powerful independent variables. Employment is compellingly depicted as the number of diligent individuals engaged in "working for at least one hour per week for some form of payment, including a wage, profit, or commission, or without pay in a family enterprise" (Junankar, 2004: 42). The compensation received encapsulates the value of the individuals' dedicated services, with the comprehensive amount displayed as an integral share of GDP. The OECD (2022) equips us with a precise definition of total investment, or gross fixed capital formation, in robust real terms as the acquisition of newly created, bought, and even previously owned assets. This concept broadens to encompass the creation of such invaluable assets by proactive producers – industries, government service providers, and non-profit services for households – for their internal utilization, diminishing only by the assets discarded or depreciated. These assets powerfully serve as critical inputs in the intricate production process of other goods and services that boast an impressive economic lifespan exceeding one year. A country's current account balance emerges as an essential metric, defined by the total of its exports of goods and services minus the imports of goods and services, augmented by net income and unilateral transfers, encompassing the pivotal remittances (Mugo et al., 2021). This thorough investigation embarks on the utilization of quarterly time series data for real GDP, employment, the current account, and investment spanning from 1999: Q1 to 2019: Q4 for South Africa, meticulously compiling an impressive count of 84 observations (n = 84).

Table 1. *Variables' description and sources*

Macroeconomic variable	Measurement	Source
Real GDP (GDP)	Millions in USD	St Louis Federal Reserve Bank
Employment (EMP)	Millions of persons	St Louis Federal Reserve Bank
Current account (CA)	Millions in USD	St Louis Federal Reserve Bank
Domestic investment (GFCF)	Millions in USD	St Louis Federal Reserve Bank

Delving into *Table 2*, we encounter a compelling summary of descriptive statistics that provide insight into the central tendency and variability of these crucial economic variables. The mean values serve as the foundational average, offering a snapshot of the typical values these variables manifest across the overarching model. Meanwhile, the standard deviation unveils the breadth of data distribution, meticulously illustrating the proximity of the dataset in relation to the mean value over the selected period. Additionally, dissecting the maximum and minimum values across each model presents an opportunity to analyse the data range thoroughly, which exemplifies the extent of variance inherent in the variables. Those variables demonstrating a broader spectrum of values reveal a higher degree of variance, whereas a narrow range indicates less fluctuation. Within this segment, we deliver an in-depth elucidation of the econometric methodologies employed throughout this investigation, rigorously scrutinizing the dynamic causal relationships among the real GDP per capita, employment, domestic investment, and the current account specific to South Africa from 1999: Q1 to 2019: Q4. Employing the ARDL regression test introduced by Shin and Pesaran in 1999, we sought to ascertain the existence of any enduring long-run relationships among these variables. Subsequently, the application of the Toda and Yamamoto causality test, originating in 1995, facilitated a meticulous determination of the causal direction linking these pivotal economic indicators.

Table 2. *Descriptive statistics*

Variable	N	Mean	Median	Maximum	Minimum	Std. Dev.
Real GDP per capita	84	13,051	13,084	13,396	12,591	0,241
Employment	84	15,908	16,039	18,737	13,326	1,773
Domestic investment	84	11,034	11,130	11,342	10,529	0,272
Current account	84	6,831	6,838	7,215	6,187	0,198

Source: author's construction from EViews 12 output (2024).
All econometric modelling was performed in EViews 12 software.

3.3. Empirical Model

Numerous esteemed authors have emphatically underscored employment (Walsh and Yu, 2010) and strategic investment (Levine and Renelt, 1992; Mankiw et al., 1992; De Long and Summers, 1992; Romp and de Haan, 2005; Fedderke and Garlick, 2008; Estache and Fay, 2009; Heintz et al., 2009; Kumo, 2012; Lee et al., 2012; Belloumi et al., 2014) as pivotal indicators of a nation's economic ascension. This groundbreaking research incorporates the nation's current account as a dynamic variable, manifesting its vigorous economic interactions via international trade (Walsh and Yu, 2010; Masron and Abdullah, 2010; Mugo et al., 2021). Scholarly discourse presents divergent evidence regarding the directional causal interplay among domestic investment, economic growth, and employment. This investigation meticulously examines the causal nexus between the independent variables: employment, the current account, and domestic investment, in relation to real GDP per capita, wherein it serves as the dependent variable, within the vibrant setting of South Africa from 1999: Q1 to 2019: Q4. An advanced ARDL regression is meticulously deployed to scrutinize both the enduring relationships and the transient dynamic interactions among the variables. The regression analysis is further enriched by the inclusion of two dummy variables, those being the U.S. September 2001 terrorist attacks and the transformative 2008/09 global financial crisis, owing to their profound disruptions on the global economic canvas and their coinciding with the study period. The intricate relationship among the study variables is thoroughly assessed using series-level values and is meticulously estimated as delineated in equation (1). The determination of the optimal lag value is judiciously guided by the minimal value of the Akaike Information Criterion (AIC) or the Schwarz Information Criterion (SIC), with a preference for the former when observations extend beyond the forty-mark threshold. Consequently, in this meticulous analysis, the AIC criterion identified lag 4 as the optimal. Moreover, the AIC was adeptly applied, as the dataset comprised 84 observations, ensuring rigorous analytic precision.

$$LnGDP_{t-4} = \beta_0 + \beta_1 EMP_{t-4} + \beta_2 LnCA_{t-4} + \beta_3 LnGFCF_{t-4} + \beta_4 D_{attacks} + \beta_5 D_{gfc} + u_t \quad (1)$$

The ARDL methodology is also appropriate for the short-run analysis of variables (Shin and Pesaran, 1999). This is performed using the first differences of the series, and ECT_{t-1} describes the relationship between the study variables as expressed by equation (2).

$$\Delta LnGDP_{t-4} = \beta_0 + \beta_1 \Delta EMP_{t-4} + \beta_2 \Delta LnCA_{t-4} + \beta_3 Ln\Delta GFCF_{t-4} + ECT_{t-(-0,028)} + u_t \quad (2)$$

In instances where the coefficient of the error correction term (δECT) is both negative and significant, it can be inferred that short-term deviations among the variables cease to be observable, consequently leading the series to reconverge with the long-run equilibrium.

4. Results

While our findings are dependent on a variety of statistical assumptions, they contribute to our knowledge of the long- and short-run dynamics of South Africa's real GDP per capita, domestic investment, employment, and current account over the last twenty years. The empirical findings demonstrate intricate causal linkages between real GDP (GDP), employment (EMP), gross fixed capital formation (GFCF; domestic investment), and the current account (CA) in South Africa. These dynamics are influenced by the country's distinct economic backdrop, which includes the resource curse legacy, jobless growth, and vulnerability to global shocks.

4.1. ADF Single Break Unit Root Test

In time series analysis, testing for stationarity is crucial before causality testing. The Dickey–Fuller (DF) test (1979) uses autoregression to check if a series is stationary. The null hypothesis (H_1) suggests a unit root (non-stationary) if $\gamma = 0$ and p-value is ($\rho = 1$). The alternative hypothesis suggests no unit root (stationary) if p-value is less than ($\rho < 1$). The Augmented Dickey–Fuller (ADF) test also checks stationarity while addressing autocorrelation by including lagged values (Dickey and Fuller, 1981). It assesses series with different combinations of intercepts and trends, using the AIC or SIC to find the optimal lag length. Traditional unit root tests miss structural breaks. Perron (1989) adapted the ADF test to account for structural breaks using a dummy variable, assuming one known break, though the date cannot be precisely determined due to exogenous factors. Perron updated this (1997) to endogenously identify the break date. Vogelsang and Perron (1998) built on this, creating a test that endogenously generates a break date using test or F-statistics and developed the Innovational Outlier (IO) Model for gradual changes and Additive Outlier (AO) Model for sudden breaks. The latter was detected; hence, the AO model zero was applied, as shown by equation (3); the non-trending data with an intercept break removes trends through Ordinary Least Squares (OLS) regression.

Model 0: Non-trending data with an intercept break.

$$y_t = \mu + \theta DU_t(T_B) + y_t^* \tag{3}$$

Table 3 provides a summary of the ADF with a single break test result, where each variable has been tested and illustrated. In *Table 3*, GDP became stationary at the first difference with a break date of 2008: Q3. Employment (EMP) was stationary at the first difference with a break date of 2019: Q1; the current account (CA) was stationary at the level with a break date of 2001: Q2. Finally, domestic investment (GFCF) was stationary at the first difference with a break date of 2009: Q1. No trend variation occurred in GDP, employment, or current account; however, there was an abrupt intercept or level change indicating a decline in both.

These break dates signify when variations happened in each variable at distinct intervals, 2001: Q2 marks the September 2001 terror attacks in the United States, which disrupted global trade, hindering export-led sectors in South Africa. Next, the global financial crisis marked by the break date 2009: Q1 led to GDP contraction and sharp declines in employment and investment. South Africa's open economy makes it more exposed to global shocks, accentuating the importance of domestic investment resilience.

The outcome of the ADF with a single break test reveals that GDP, EMP, and GFCF are stationary in the order of I(1), in contrast to CA, which was stationary at level I(0). With the order of integration established, the subsequent stage in analysis is to undertake cointegration tests. Considering the variables are stationary at diverse levels, the most suitable method to proceed with is the ARDL bounds test developed by Pesaran, Shin, and Smith (2001), designed for such scenarios. The series' break dates were also determined.

Table 3. *Results of ADF unit root test with one structural break*

ADF Test with a single break (Vogelsang and Perron 1998)			
Additive Outlier Test Model: 0 constant (intercept)			
	Order of integration	t-statistic	Break date
GDP	I(1)	-8.404*** (< 0.01)	2008: Q3
EMP	I(1)	-8.084*** (< 0.01)	2019: Q1
CA	I(0)	-4.977*** (< 0.01)	2001: Q2
GFCF	I(1)	-8.173*** (< 0.01)	2009: Q1

Source: author's construction from EViews 12 output (2024)

Notes: *** denotes 1% significance; () indicates the prob values.

4.2. Bounds Test

Unit root tests showed variables are stationary at different integration orders, making the Pesaran, Shin, and Smith (2001) bounds test suitable for evaluating cointegration. This test requires the dependent variable to be I(1), with independents as I(0) or I(1). The null hypothesis of no cointegration is assessed using the F-test: if the F statistic is above the upper bound, reject the null, indicating cointegration; if it is below the

lower bound, do not reject the null, indicating no cointegration; if it is between bounds, results are ambiguous. Computational details are in equations (4) and (5).

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 X_{1t-1} + \beta_3 X_{2t-1} + \sum_{i=1}^{p} \alpha_i \Delta Y_{t-i} + \sum_{i=0}^{p} \gamma_i \Delta X_{1t-i} + \sum_{i=0}^{p} \varphi_i \Delta X_{2t-i} + \varepsilon_t \quad (4)$$

$$F = \frac{(SSR_R - SSR_{UR})/p}{SSR_{UR}/(n-2p)} \quad (5)$$

Table 4 presents the results of the bounds test, showing that the F-statistic (6.566) exceeds the upper bound critical value (5.960). Cointegration relationships are identified as they fall within the 1% upper bound. Consequently, the null hypothesis is rejected, indicating a long-term linkage between the dependent and the independent variables. The critical values for a finite sample (n = 80) were selected for analysis due to their proximity to the actual sample size (n = 81), which enhances their reliability.

Table 4. *F-bounds test results*

		Lower Bound			Upper Bound		
k	F-statistic	10%	5%	1%	10%	5%	1%
3	6.566***	2.823	3.363	4.568	3.885	4.515	5.960

Source: author's construction from EViews 12 output (2024)

Note: *** shows significance at 1% level.

4.3. Regression Procedure with Multiple Structural Breaks

Macroeconomic time series may have multiple structural breaks. Bai and Perron (1998) examined these in a linear regression model by minimizing the sum of squared residuals (SSR), treating break dates as variables to estimate. Their approach supports conclusions about structural changes and the number of breaks. A 15% trimming was used initially to derive SSR, with subsequent calculations incorporating individual observations. Break dates are identified where SSR is lowest. Bai and Perron (1998) identified two shocks: Q2 2002 (linked to the September 2001 attacks) and Q4 2009 (linked to the 2008/09 financial crisis). Dummy variables were included to mitigate these shocks, as shown in equation (1).

In this investigation, the Bai and Perron regression procedure suggested two break dates according to the Liu Wu Zidek criteria (LWZ, 2008), 2002: Q2 and 2009: Q4. Additionally, to verify the break dates suggested by the LWZ criterion, the Chow test was applied to the results, as summarized in *Table 5*. The null hypothesis is that there are no breaks on the specified dates, which is rejected, as the probability values are less than 0.10.

Table 5. *Results of the Chow test*

Chow Breakpoint Test: 2002: Q2, 2009: Q4			
F-statistic	70.841	Prob. F(8,72)	0.00
Log likelihood ratio	183.356	Prob. Chi-Square(8)	0.00
Wald Statistic	566.728	Prob. Chi-Square(8)	0.00

Source: author's construction from EViews 12 output (2024)

The initial break date of 2002: Q2 aligns with the 11 September 2001 terrorist attacks in the United States, leading to the shutdown of the securities exchange and triggering global economic disruptions. The impact of this event was noticed in the South African economy during the second quarter of 2002. The subsequent break date of 2009: Q4 corresponds with the global financial crisis that began in the US housing market in 2008, causing widespread financial and economic turmoil. The impact of this crisis became apparent in South Africa in the fourth quarter of 2009.

4.4. ARDL Long-Run and Short-Run Regression Analysis

In the field of economics, cointegration denotes a persistent and stable association among two or more time series variables, even though each variable may exhibit its own trends (non-stationarity). Fundamentally, it implies that variables are inclined to develop in tandem over the long term due to an inherent equilibrium relationship, notwithstanding any short-term divergences (Shin and Pesaran, 1999). Once a cointegration relationship is confirmed, a further exploration of the relationship's nature is necessary. The ARDL method, suitable for long-term analysis, complements the bounds test with a similar framework. Lagged values, reflecting past experiences, are important as explanatory factors in economic relationships (Shin and Pesaran, 1999). Introduced by Shin and Pesaran (1999), the ARDL method includes lag values in calculations. The delta method (Greene, 2002) calculates the standard errors of long-term coefficients. The model's reliability is supported if its error correction mechanism is effective, reducing deviations by δ% each period until they become undetectable by $1/\delta$ period (Shin and Pesaran, 1999). The optimal lag length, identified by the minimum AIC or SIC value, uses AIC due to observations exceeding 40, with an automatic lag 4 criterion, as shown in equation (1). Equations (6) and (7) illustrate this procedure:

$$\gamma = \frac{\sum_{i=0}^{p_2} \gamma_i}{1 - \sum_{i=1}^{p_1} \alpha_i} \tag{6}$$

$$\varphi = \frac{\sum_{i=0}^{p_3} \varphi_i}{1 - \sum_{i=1}^{p_1} \alpha_i} \tag{7}$$

According to the ARDL cointegration test results shown in *Table 6*, an investment increase of one percentage point resulted in an average GDP rise of 0.46% per quarter in South Africa from 1990: Q1 to 2019: Q4. Employment has an insignificant long-run impact on GDP, reflecting jobless growth, concurring with the findings of Meyer and Sanusi (2019). Moreover, the current account exhibits insignificant long-run trends, indicating that South Africa's trade balance has a minimal direct impact on GDP progression over time. In summary, investment plays a crucial role in influencing real GDP. The long-term analysis in *Table 7* indicates that the regression model, as demonstrated by the R-squared value, accounts for 99% of the variation seen in real GDP.

Table 6. *ARDL long-run results summary*

Variable	Coefficient
EMP	0.002 (0.965)
CA	-0.075 (0.464)
GFCF	0.461** (0.036)

Source: author's construction from EViews 12 output (2024)

Note: ** shows significance at 5%.

Table 7. *ARDL long-run diagnostic test results*

ARDL long-run diagnostic test results			
R-squared	0.999	Mean dependent var	13.068
Adjusted R-squared	0.999	S.D. dependent var	0.229
S.E. of regression	0.003	Akaike info criterion	-8.190
Sum squared resid	0.001	Schwarz criterion	-7.806
Log likelihood	344.713	Hannan-Quinn criter.	-8.036
F-statistic	24963.79	Durbin-Watson stat	1.902
Prob (F-statistic)	0		

Source: author's construction from EViews 12 output (2024)

Table 8 ARDL cointegration test results demonstrate the manner in which short-term fluctuations evolve into long-term integration. The error correction term -0.028 at 1% significance level (0.00) indicates variations from long-run equilibrium at 2.8% per quarter, demonstrating a slower response to shocks. In year $t-2$, when employment increases by 1%, GDP increases by 0.006 (0.030) percentage point at a 5% level of significance, highlighting the transient labour demand effects. Domestic investment demonstrates mixed effects on GDP. In year t, when total investment increases by 1%, GDP increases by 0.095 (0.019) percentage points at a 5% level of significance, supporting Keynesian demand stimulation. In year $t-2$, a 1% increase in domestic investment has a negative effect on GDP of -0.093 (0.014) percentage points at a 5% significance level, possibly influenced

by increased imports of capital goods, thereby weakening trade balances. The current account demonstrates no short-run significance on GDP, implying that current account imbalances do not immediately impact GDP. In summary, short-term GDP growth is influenced by investment cycles, but the limited relationship of employment highlights chronic labour market rigidities. The negative domestic investment effect may indicate a reliance on imported capital goods, aggravating current account pressures.

Table 9 shows the short-run diagnostics of the regression model; the R-squared value indicates that 49% of the variation seen in real GDP is explained by the model. The probability value of the F-statistic 7.551 (0.00) indicates that this result is significant.

Table 8. *ARDL short-run results summary*

Variable	Coefficient
ΔGDP_{t-1}	-0.013 (0.898)
ΔGDP_{t-2}	-0.202 (0.070)
ΔEMP_{t}	-1.220 (0.996)
ΔEMP_{t-1}	0.003 (0.222)
ΔEMP_{t-2}	0.006** (0.030)
$\Delta GFCF_{t}$	0.095** (0.019)
$\Delta GFCF_{t-1}$	0.030 (0.454)
$\Delta GFCF_{t-2}$	-0.093** (0.014)
ECT_{t-1}	-0.028*** (0.00)
Constant	0.245*** (0.00)

Source: author's construction from EViews 12 output (2024)

Note: ***, ** show significance at 1% and 5% resp.

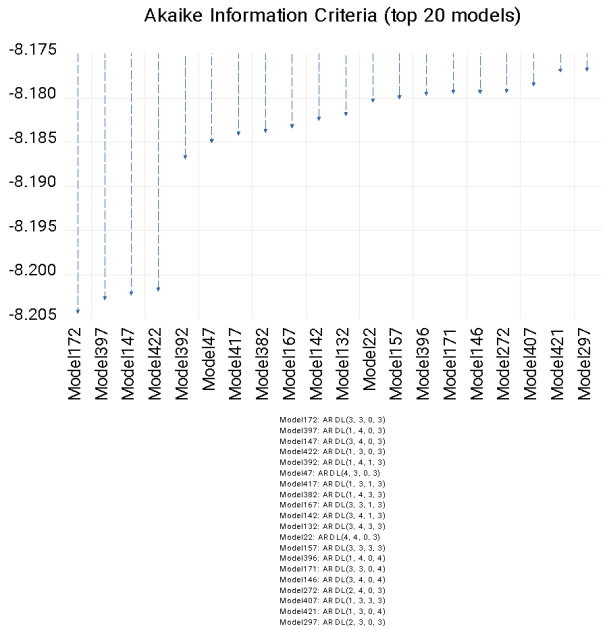
Table 9. *ARDL short-run diagnostic results*

ARDL short run diagnostic test results			
R-squared	0.489	Mean dependent var	0.009
Adjusted R-squared	0.424	S.D. dependent var	0.005
S.E. of regression	0.004	Akaike info criterion	-8.265
Sum squared resid	0.001	Schwarz criterion	-7.969
Log likelihood	344.713	Hannan–Quinn criter.	-8.146
F-statistic	7.551	Durbin–Watson stat	1.902
Prob (F-statistic)	0.00		

Source: author's construction from EViews 12 output (2024)

Further Diagnostics

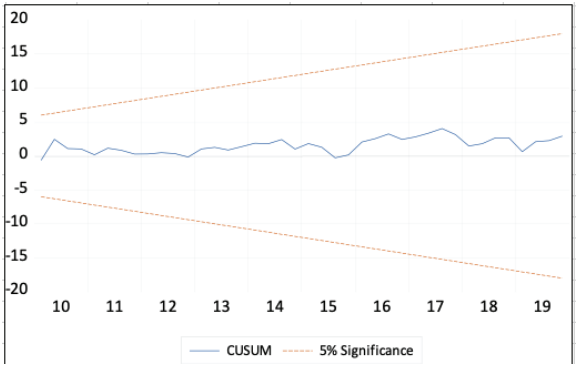
Earlier sections indicated that short-term dynamics confirm the steadiness of the long-term coefficient. The model of best fit is selected by the AIC criterion as per the long-run results of the ARDL analysis. The short-run model with the smallest AIC value is the model of best fit, as depicted by *Figure 1*; this is automatically selected by the ARDL Error Correction Regression test. A total of 297 models were simulated, and *Figure 1* presents the results of the top 20 models. The lowest AIC value amongst the total is -8.205 of model 172 ARDL (3,3,0,3), being recognized and applied as the most suitable model for this analysis.



Source: EViews 12 (2024)

Figure 1. *AIC top 20 model's graph*

Following the estimation of the ECM model, the cumulative sum of recursive residuals (CUSUM) and CUSUM of squares (CUSUMSQ) tests were conducted to further evaluate the stability of the parameters (Pesaran, 1997). *Figures 2–3* showcase the outcomes for the CUSUM and CUSUMSQ tests, indicating no instability in the coefficients, as their respective estimates lie within the 5% confidence interval's critical bands for parameter stability.



Source: EViews 12 (2024)

Figure 2. *CUSUM test of regression*

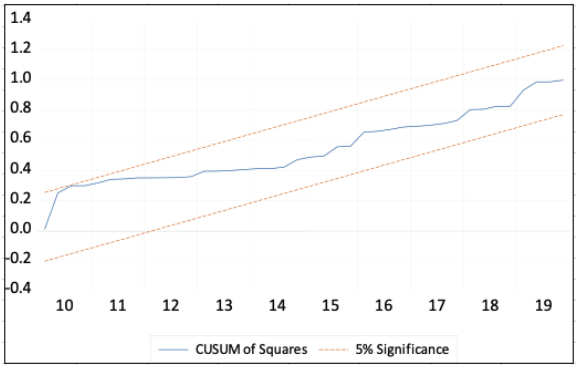


Figure 3. *CUSUM square test of regression*

4.5. Toda and Yamamoto Causality Test

The variables' integration orders are I(1), I(1), I(0), and I(1), and the Toda and Yamamoto causality test (1995) is ideal for testing causality in support of the ARDL methodology. This test applies regardless of variations in integration levels or cointegration presence (Toda and Yamamoto, 1995). Coefficient constraints derive from *dmax*, with the modified Wald (MWald) test for significance. The null hypothesis is no causality from *X* to *Y*. This section outlines the econometric methods used to analyse causal relationships among economic growth, employment, investment, and the current account for South Africa from 1999: Q1 to 2019: Q4. The ARDL regression test (Shin and Pesaran, 1999) identified long-term relationships, followed by the Toda and Yamamoto causality test (1995) for causality direction.

The Toda and Yamamoto test identified three bidirectional causation relationships as shown in *Table 10*. The first bidirectional relationship, GDP exerts a positive significant causal effect on employment (0.00), albeit weakly so, consistent with the notion of jobless growth in support of the long- and short-run ARDL results. Employment exerts a positive significant causal effect on GDP (0.01), which is probable through the Keynesian multiplier of consumption demand. In the second bidirectional relationship, GDP exerts a positive significant causal effect on domestic investment (0.00), suggesting an accelerator effect where growth stimulates investment. Adversely, domestic investment exerts an insignificant effect on GDP (0.56), suggesting investment inefficiencies. Lastly, in the final bidirectional relationship, employment exerts a positive significant causal effect on current account (0.03), implying that higher employment levels may reduce the current account deficit. Furthermore, the current account exerts a positive significant causal effect on employment (0.04), which may signify a current account surplus, perhaps due to increased exports in mineral resources, therefore financing the labour-intensive sectors that create employment opportunities. The bidirectional linkages reveal that the variables are interdependent, but their effects are unequal and dynamic. It is evident that GDP has a catalytic effect on domestic investment and employment; however, the feedback loop is weaker, possibly due to structural impediments of the South African economy.

Table 10. *Bidirectional causality relationship*

Bi-directional causality	**Chi-sq**
GDP ⟶ EMP	21.268*** (0.00)
EMP ⟶ GDP	20.100*** (0.01)
GFCF ⟶ GDP	7.060 (0.56)
GDP ⟶ GFCF	18.388*** (0.01)
EMP ⟶ CA	16.698** (0.03)
CA ⟶ EMP	16.066** (0.04)

Source: author's construction from EViews 12 output (2024)

Note: ***, ** show significance at 1% and 5% resp.

5. Discussion and Conclusions

The empirical findings of this groundbreaking study reveal a profound and significant two-way causal relationship, intricately connecting real GDP and employment, as well as employment and real GDP itself, uniting real GDP and total investment, total investment and real GDP, and weaving between the current account and employment. This revelation is in perfect alignment with the insightful results of Meyer and Sanusi (2019), who uncovered the critical impact of real GDP on

employment and vice versa. Moreover, this study's findings resonate harmoniously with the authoritative conclusions of a range of authors (Levine and Renelt, 1992; Mankiw et al., 1992; De Long and Summers, 1992; Romp and de Haan, 2005; Fedderke and Garlick, 2008; Estache and Fay, 2009; Heintz et al., 2009; Kumo, 2012) who assert that real GDP decisively influences total investment, establishing a robust and positive relationship. However, these dynamic results stand in contrast to the findings of Mordecki and Ramirez (2014) and McKinnon (2010), who concluded that total investment does not markedly impact real GDP. Furthermore, employment exerts a significant and noteworthy effect on the current account, creating a reciprocal relationship. The compelling results of this analysis clearly demonstrate a long-term relationship between the variables, strongly sustained by short-term dynamic interactions. This study has addressed the research question, offering substantial empirical evidence that paves the way for enriched discussion and future exploration.

Acknowledging the undeniable and symbiotic relationship between robust domestic investment and the flourishing of economic prosperity, it becomes imperative to cultivate a vibrant environment that not only invites but fervently nurtures the influx of both local and international investments. Strategic recommendations for the South African government encompass instituting robust measures designed to magnetize domestic investment into labour-intensive sectors, notably manufacturing, as a formidable strategy to decisively combat the scourge of jobless growth. Furthermore, by channelling substantial investment into sector-specific (manufacturing) education alongside comprehensive skills development training programmes, the workforce's employability could be significantly enhanced. It is essential to undertake profound structural reforms within the economy to diminish South Africa's dependence on imported capital. To effectively stabilize the current account balance, it is incumbent upon the government to tap into increasing exports, conscientiously striving to diversify the export portfolio beyond mere minerals to shield against the perils of trade deficits. By crafting and enacting trade policies that vigorously support local industries while substantially enhancing competitiveness, the current account position can be decisively fortified.

Propelling evidence-based policymaking into the forefront necessitates a significant investment in exhaustive economic research and the revolutionization of data collection methodologies. This strategic approach empowers policymakers to gain impactful insights into complex economic dynamics, allowing them to accurately identify critical areas that demand intervention and meticulously evaluate the implications of policy measures. The uniqueness of South Africa's intricate socioeconomic landscape underscores the imperative for these policy strategies to be meticulously tailored and expertly applied. Notably, the study's constraints emerge from the limited examination timeframe, which regrettably excludes the transformative onset of the COVID-19 pandemic in early 2020. To comprehensively navigate these dynamics, future research endeavours should

ambitiously employ panel data econometric modelling, extending the investigation period with annual data. Furthermore, an avenue for research lies in delving into multivariate relationships through the integration of additional variables.

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