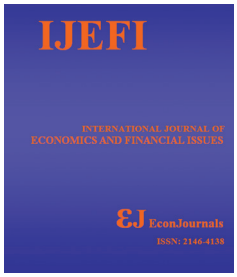

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The Nexus among Unemployment, Economic Growth and Crime: New Evidence from Nine South African Provinces

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ABSTRACT

This study investigated the long-run impact of key economic factors—including general unemployment, disaggregated youth and adult unemployment, economic growth (GDP), the Food Poverty Line (FPL), and disposable income—on crime rates across South Africa's nine provinces. Utilising the 2002-2022 panel datasets, a Fully Modified Ordinary Least Squares (FMOLS) model was employed to estimate these long-run equilibrium relationships. The findings revealed a consistent and statistically significant positive long-run relationship among all forms of unemployment and crime, with adult unemployment showing a more pronounced impact. The FPL also consistently exhibited a positive and reliable link to higher crime. Conversely, disposable income demonstrated a robust inverse relationship with crime, indicating that increased income reliably reduces criminal activity. The relationship between economic growth (GDP) and crime was found to be mixed and varied, reflecting the complexity observed in broader literature. These results resolve part of the mixed empirical evidence dilemma by highlighting significant provincial heterogeneity, underscoring that crime in South Africa is deeply embedded in local socio-economic structures and historical legacies, thus enriching the understanding of economic models of crime and Strain Theory. The study recommends abandoning uniform national crime prevention strategies in favour of localised, evidence-based approaches. Policy must prioritise and aggressively target job creation, particularly for adults, given their pronounced impact on crime rates.

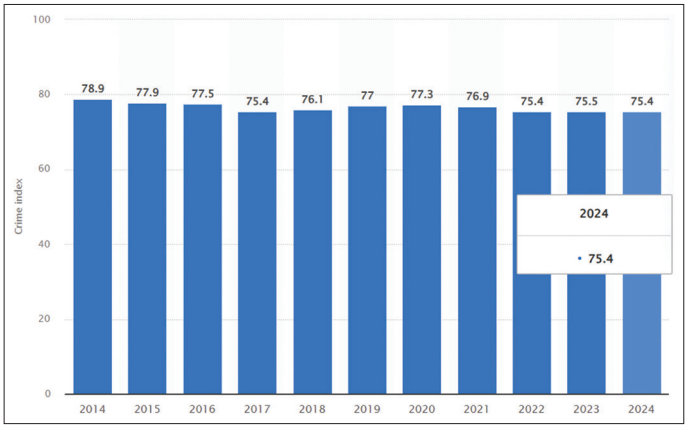
Keywords: Crime, Poverty, Economic Growth, FMOLS, South Africa
JEL Classifications: I38, J64, O15, O55

1. INTRODUCTION AND BACKGROUND

Crime remains one of the most pressing socio-economic challenges in South Africa, and this has been undermining social cohesion, economic development and quality of life. Over the past two decades, South Africa has been consistently ranked poorly on global peace and crime indices. In 2023, South Africa dropped eight places to 130th on the Global Peace Index (GPI), thus reflecting a deterioration in safety and stability (Institute for Economics and Peace, 2023). Simultaneously, socio-economic conditions, particularly unemployment, poverty and inequality, have been noted to worsen as well, with the official unemployment rate reaching 32.9% in 2023 (Stats SA, 2023). Thus far, the relationship between economic conditions and crime in South Africa has long been debated in economic and criminological literature. Classical theories such as Becker's (1968) economic model of crime suggest that individuals engage in criminal activities when the expected benefits outweigh the costs. This implies that poor economic conditions, such as unemployment and low income, may be increasing crime rates. Conversely, the strain Theory by Merton (1938) posits that crime arises from the inability to achieve socio-economic goals through legitimate means. However, empirical evidence remains mixed with some studies finding a strong link between economic hardship and crime (Bhorat et al., 2017), while others highlight the role of inequality, governance and social capital (Fajnzylber et al., 2002).

South Africa presents a unique case study due to its high inequality, noted with a Gini coefficient of 0.63 in 2022 (Stats SA, 2023),

Figure 1: Crime index in South Africa 2014-2024



Source: Statista (2024)[1]

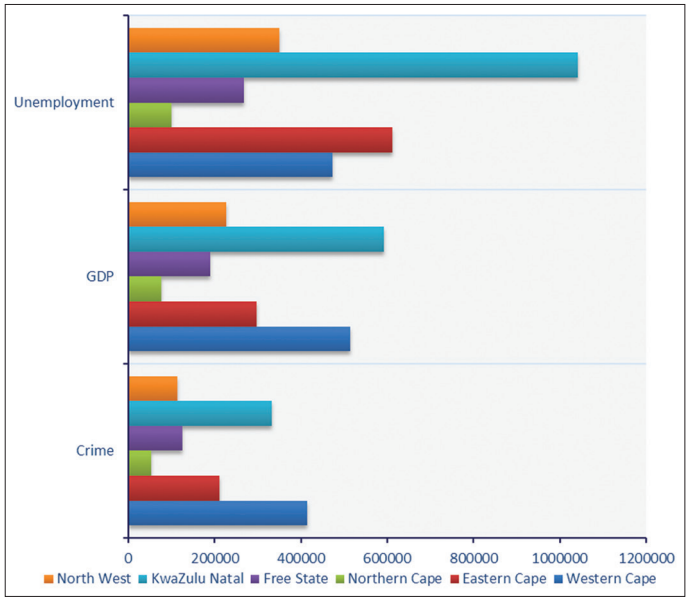
spatial disparities and historical legacies of apartheid. Despite extensive research on crime determinants globally, fewer studies have applied advanced panel econometric techniques to examine the long-run and short-run dynamics among economic growth, unemployment, and crime at the provincial level, let alone in South Africa. This study fills that gap by analysing 20 years (2002-2022) of panel data across the country's nine provinces.

Figure 1 depicts a fluctuating yet generally downward trend in the crime index from a high of 78.9 in 2014 to 75.4 in 2024. This suggests a marginal, but not consistently linear, improvement in the perceived safety or actual incidence of certain crimes over the decade. South Africa continues to face severe challenges with violent crimes like murder, rape, and aggravated robbery, which have significant social and economic consequences. A high crime index, even with a slight downward trend, can deter foreign investment, impact tourism, lead to increased private security spending by businesses and individuals, and contribute to a pervasive sense of fear and insecurity among the populace. The consistently high numbers also indicate ongoing systemic issues like poverty, inequality, social stress, and potentially weaknesses within the criminal justice system in terms of investigation and conviction rates. Therefore, while Figure 1 shows a positive direction, the underlying challenges and their wide-ranging implications for South African society and economy remain significant.[1]

Provincial-level analysis is crucial because economic performance and crime trends vary significantly across South Africa's provinces. For instance, Figure 2 shows that KwaZulu-Natal and Western Cape have higher GDP, which is also associated with high unemployment rates and crime rates. With a lower GDP than the Western Cape, the Eastern Cape exhibits a higher unemployment rate than other provinces, except KwaZulu-Natal.

Figure 2 compares unemployment, gross domestic product (GDP), and crime across South African provinces, demonstrating significant provincial disparities. KwaZulu Natal exhibits the highest unemployment and the second-highest GDP and crime figures, pointing to a large, active province facing substantial

Figure 2: Current status levels of unemployment, GDP and crimes



Source: Author's computations

social challenges. Conversely, the Western Cape leads in both GDP and crime but not in unemployment, suggesting that economic prosperity does not uniformly translate to lower crime rates. The Northern Cape consistently shows the lowest figures across all three indicators, reflecting its smaller size or less developed economy, while Northwest, Free State, and Eastern Cape fall in the middle ranges. Overall, Figure 2 underscores considerable provincial heterogeneity in these indicators, implying that socio-economic and crime dynamics are deeply rooted in specific local contexts rather than uniform national trends.

While classical theories such as Becker (1968) and Merton (1938) suggest that unemployment and low economic growth drive crime by reducing legitimate opportunities and the empirical evidence is mixed, where some studies find a strong link, Bhorat et al. (2017), and others highlight the role of inequality or governance (Fajnzylber et al., 2002). These contradictions persist due to three key gaps: (1) limited sub-national analysis where most studies focus on national trends despite stark regional disparities in GDP, unemployment (for example, Eastern Cape's 45% joblessness versus Western Cape's 25%), and crime rates; (2) inadequate attention to dynamics, noted with few studies testing long-run cointegration or causality between economic shocks and crime; and (3) oversimplified unemployment measures, as youth unemployment (exceeding 60%) is rarely disaggregated from adult rates, despite its potential unique influence (Stats SA, 2023). Thus, the study has the following specific objectives;

- To analyse the relationship among economic growth, unemployment, and crime in South Africa's nine provinces
- To determine whether disaggregated unemployment among youths and adults has a differential impact on crime, and
- To assess the long-run equilibrium relationships between economic growth and unemployment on crime rates.

This study carries substantial significance across practical, theoretical and policy domains. Practically, by precisely

1 https://www.statista.com/register/#professional

quantifying the economic determinants of crime at the provincial level in South Africa, the study offers valuable insights for policymakers and law enforcement agencies. These findings inform the development of more targeted and effective crime reduction strategies, moving beyond national averages to address specific regional dynamics. For instance, understanding the differential impact of youth versus adult unemployment on crime can guide tailored job creation initiatives and social programmes aimed at vulnerable demographics. Theoretically, this research contributes to the ongoing academic discourse on the economic model of crime (Becker, 1968) and strain theory (Merton, 1938) by applying advanced panel econometric techniques to a unique context. Furthermore, the paper resolves mixed empirical evidence by assessing long-run and short-run dynamics, thus enriching the understanding of how economic conditions interact with criminal behaviour. Finally, the study's findings are crucial for national and provincial governments, revealing whether broad economic growth, specific job creation efforts, or redistributive measures are most effective for crime reduction in South Africa's diverse provinces.

This article is structured into five distinct sections: a review of the relevant theoretical and empirical literature; the research methodology that outlines data sources, variables, and the specific panel econometric models and tests employed for analysis; the research findings and discussion; and lastly, the study's key findings, conclusion and policy recommendations.

2. THEORETICAL LITERATURE REVIEW

Becker's (1968) seminal contribution laid the groundwork for the economic analysis of crime, positing that individuals engage in criminal activities as a result of a rational decision-making process. In this framework, potential offenders act as utility maximisers, weighing the expected benefits from committing a crime (monetary gain) against its expected costs, which include not only the probability of apprehension and severity of punishment but, crucially, the opportunity costs of not engaging in legitimate activities (Becker, 1968). This model highlights that a decline in legitimate opportunities, such as high unemployment or low legitimate wages (reflected in low disposable income), reduces the opportunity cost of crime. Consequently, the perceived net benefit of illicit activities increases, making crime a more attractive option. While the Beckerian model offers a powerful and parsimonious framework for understanding economically motivated crimes like property offences, providing clear, testable hypotheses, critics often note its primary limitation lies in its assumption of perfect rationality, which may not fully capture the complexity of human behaviour for all crime types, particularly those driven by passion or other non-economic motives. For this study, Becker's framework is directly applicable to analysing how unemployment and disposable income influence crime rates in South Africa, providing a theoretical lens to interpret the economic incentives for criminal behaviour.

On the other hand, Merton's (1938) strain theory, a cornerstone of sociological criminology, offers a complementary perspective by focusing on the societal pressures that can lead to deviance and crime. Merton argued that crime arises when there is a significant disjuncture, or strain, between culturally prescribed goals (such as material success and wealth) and the legitimate institutionalised means available to achieve them (Merton, 1938). When individuals, particularly those from disadvantaged backgrounds, find their pathways to success blocked by systemic barriers like widespread unemployment or deep poverty, they may experience a state of anomie, leading them to resort to illegitimate means, including criminal behaviour, to achieve those culturally valued goals. This theory directly links economic deprivation, poverty, and inequality to criminal motivation, explaining how intense strain, such as that experienced when struggling to meet basic needs, as indicated by the FPL, can compel individuals towards criminal acts. Its strength lies in explaining crime patterns observed among marginalised and economically disadvantaged groups and highlighting the role of broader societal structures in shaping criminal behaviour. However, it can sometimes over-emphasise materialistic goals and may not fully account for all forms of crime or individual variations in response to strain. In the context of this study, strain theory is vital for understanding how the FPL and the broader challenges of unemployment and inequality in South Africa can create an environment where individuals feel pressured to resort to crime due to a perceived lack of legitimate opportunities.

Social disorganisation theory, as developed by Shaw and McKay (1942), posits that crime rates are higher in communities characterised by a breakdown of social institutions and informal social controls (Shaw and McKay, 1942). This breakdown is often intrinsically linked to underlying socio-economic conditions. Communities afflicted by concentrated poverty and high unemployment frequently experience high rates of residential instability and population turnover, which in turn lead to weakened social networks, diminished collective efficacy (the willingness of community members to intervene for the common good), and a reduced capacity for residents to exert informal control over deviant behaviour. This lack of social cohesion directly facilitates criminal activity within such areas. The theory's strength lies in its ability to explain geographical variations in crime rates and emphasises the importance of community-level factors over purely individual ones. However, critics sometimes point to challenges in empirically measuring "social disorganisation" itself. For the purpose of this study, the theory offers a macro-level lens, helping to explain how widespread provincial economic distress, such as pervasive unemployment and poverty, can contribute to social fragmentation and weakened community structures across South African provinces, thereby creating an environment more conducive to crime.

2.1. Empirical Literature Review

A substantial body of empirical research consistently points to a positive relationship between unemployment and crime rates, particularly for property crimes. Andresen (2015), in his comprehensive review of econometric modelling in environmental criminology, synthesises a wide array of studies, concluding that a robust positive correlation between unemployment and crime, especially property offences, is a recurring finding across various geographical and methodological contexts. This broad consensus

underscores the consistent validation of theoretical propositions, such as those from Becker's economic model of crime, which posits that reduced legitimate earning opportunities increase the relative attractiveness of illegal activities. Reinforcing this global perspective, Gumus and Pata (2020) conducted a time-series analysis in Turkey, a developing economy. Similarly, they found a significant long-run positive relationship where increased unemployment contributed to higher crime rates. The findings align directly with Andresen's broader synthesis and resonate with the challenges many developing nations face. In a study focused on Europe, Bussmann and Schneider (2019) re-examined the link using panel data and robust econometric methods. Their work confirmed that higher unemployment rates are associated with increased crime, often with stronger effects observed for property-related offences.

Egbetunde and Oluwatobi (2018) empirically analysed economic determinants of crime in Nigeria, a prominent African economy. Their study examined various factors, including unemployment, poverty, inflation, and education levels, and consistently found that unemployment and poverty were positively correlated with crime rates. Their findings align broadly with the global consensus established by works such as Andresen (2015), which identify joblessness and deprivation as key drivers of criminal activity. This study, by providing evidence from a large West African nation, reinforces the applicability of economic theories of crime within diverse African settings. However, like many single-country studies, its findings, while robust for Nigeria, may not fully capture the variegated provincial dynamics present across a country as diverse as South Africa.

Focusing specifically on the link between poverty and crime, Amuakwa-Mensah and Baidoo (2017) provided an empirical analysis for Ghana. The study revealed a significant positive relationship between poverty and crime rates, suggesting that as poverty deepens, criminality tends to increase. This finding resonates strongly with the tenets of strain theory, demonstrating how economic deprivation can push individuals towards illegal means to cope or achieve desired outcomes. The consistency of this finding with the broader literature (Boshra and Faggian, 2018) underlines the universal challenge of poverty in driving crime, even as specific regional socio-economic structures shape its manifestation. The strength of such studies lies in their focused investigation of a single core economic determinant within a specific African nation.

Further contributing to the understanding of unemployment's role in the African context, Nebo and Egbe (2020) conducted an empirical investigation into the relationship between unemployment and criminality, specifically in Nigeria. The study confirmed a positive relationship, consistent with the aforementioned studies and the broader global literature, emphasising the opportunity cost of crime. This study reinforces that, even within the same country, unemployment consistently emerges as a significant predictor of criminal behaviour (Egbetunde and Oluwatobi, 2018). While these studies from other African nations provide compelling evidence for the general applicability of economic crime theories on the continent, a common gap is the lack of detailed, long-run panel data analysis that disaggregates impacts across diverse sub-national regions, like the provinces of South Africa, thereby leaving room for a more nuanced and context-specific investigation.

The empirical evidence concerning the relationship between aggregate economic growth (measured by GDP) and crime rates is notably more complex and often presents mixed findings, reflecting ongoing theoretical debates. Lee et al. (2019), for instance, examined this relationship in South Korea and found that the impact of economic growth on crime exhibits both positive and negative effects, depending on the specific crime type or the economic context. The study underscores that higher GDP, while potentially creating more legitimate opportunities, might also increase the number of valuable targets for criminals or exacerbate feelings of relative deprivation if growth is unequally distributed. Similarly, Ho and Yen (2018), in their study on US states, also concluded that the relationship between economic growth and various crime rates is varied and non-uniform. These studies demonstrate that, unlike unemployment, the aggregate impact of GDP on crime is not straightforward and can be conditional on other factors, such as the nature of economic growth (inclusive versus exclusive), or the specific types of crime being analysed. A common gap in such studies is the broad aggregation of crime types or the lack of granular analysis at sub-national levels, which can obscure heterogeneous impacts within a country.

In an African context, studies often highlight the intricate interplay of poverty, inequality, and institutional weakness with economic growth's impact on crime. A study by the World Bank (2025) on developing economies, including African countries, found that economic growth is negatively associated with crime against firms, with a more substantial effect for small and medium enterprises. However, Arthur et al. (2025) indicate that financial crimes, driven by corruption and weak regulation, significantly negatively impact African economic growth. Specifically, in South Africa, the World Bank (2023) report explicitly states that high crime rates, including property and violent crimes, undermine the country's economic dynamism and growth potential, incurring costs estimated at least 10 per cent of GDP annually. This report points to deep-seated issues like high inequality (housing and income) as key drivers of crime, where economic growth, if not inclusive, can exacerbate criminal activity rather than mitigate it. These studies demonstrate that, unlike unemployment, the aggregate impact of GDP on crime is not straightforward and can be conditional on other factors, such as the nature of economic growth (inclusive versus exclusive), the specific types of crime being analysed, or the prevailing levels of inequality and institutional strength. An often-identified gap in such studies is the broad aggregation of crime types, or the lack of granular analysis at sub-national levels, which can obscure heterogeneous impacts within a country.

There is a strong theoretical and empirical consensus that poverty and economic inequality are significant drivers of crime, particularly property crime and, in some cases, violent crime. Boshra and Faggian (2018), in their cross-country examination of inequality and crime, provided empirical evidence supporting the robust link between higher levels of income inequality and increased crime rates. Their findings resonate with the sentiments

of the strain theory, which posits that economic deprivation and the feeling of being disadvantaged can lead individuals to resort to criminal acts. Reinforcing this perspective from a context with high inequality, Enamorado et al. (2016) conducted a detailed study in Mexico, specifically relating income inequality to increased violent crime during the country's drug war. The study highlights how profound economic disparities can destabilise societies and fuel serious criminal activity. These studies align in demonstrating economic hardship and its criminogenic effects, consistently showing that when segments of the population face deep poverty or perceive significant resource disparities, crime rates tend to rise. While these studies provide powerful insights, cross-country analyses might lack the granularity to capture unique national provincial dynamics.

Consistent with economic theories, empirical research generally finds a negative relationship between legitimate income and crime rates, emphasising the role of opportunity cost. D'Amico et al. (2020) provided robust empirical evidence demonstrating that an increase in legitimate income (or disposable income) significantly reduces engagement in property crime. Their findings strongly support the Beckerian concept that higher legitimate earnings increase the opportunity cost of committing a crime – that is, the perceived loss of stable income and the risk of legitimate employment from incarceration make criminal activities less appealing. This aligns with broader discussions on economic incentives in criminal behaviour, as implicitly supported by works like Chalfin and McCrary (2018), who, while focusing on policing, underscore the role of economic alternatives as deterrents in US cities. These studies collectively confirm that providing individuals with greater legitimate financial stability and resources reduces their incentive to pursue illegal means, thereby contributing to lower crime rates. A potential gap in some of these studies is their primary focus on property crime, meaning the extent to which increased disposable income influences other forms of crime (e.g., violent crime not directly linked to economic gain) might be less thoroughly explored.

From an African perspective, studies consistently echo these findings. For instance, a study by Udoh and Effiong (2019) found a significant positive relationship between income inequality and various crime types in Nigeria. This included theft and violent offences, emphasising how unequal distribution of economic benefits exacerbates social tensions and drives criminal behaviour. In South Africa, a nation grappling with some of the world's highest inequality levels, the link is particularly stark. Pauw and Mncube (2016) on South African municipalities found that higher levels of income inequality and poverty are strongly associated with increased property and violent crime rates. Adewale and Adekunle (2020) concluded that increasing opportunities for gainful employment and providing stable income significantly reduces engagement in criminal activities, especially among the youth in Nigeria. These studies consistently show that when segments of the population face deep poverty or perceive significant resource disparities, crime rates tend to rise. While these studies provide powerful insights, cross-country analyses might lack the granularity to capture unique national or sub-national dynamics, and some focus predominantly on violent crime, potentially leaving the nuances of property crime less explored in specific contexts.

Jeke et al. (2021) and Okpuvwie et al. (2021), highlight the profound and detrimental impact of crime on socio-economic development, albeit through distinct methodological lenses and geographical focuses. Jeke et al.'s empirical panel data analysis specifically examines the South African context (1994-2019) using the Pooled Mean Group technique, quantifiably demonstrating that crime impedes economic growth, investments, and human development, with property crime significantly harming HDI and investment, and contact crime negatively impacting investments. Conversely, Okpuvwie et al.'s descriptive global study, based on a comprehensive literature review with a particular emphasis on developing countries, broadly identifies various manifestations of crime (e.g., banditry, kidnapping, murder) as a barrier that discourages investment, increases transaction costs, fuels migration, and ultimately destabilises development by fostering corruption. Despite one providing econometric evidence for South Africa and the other offering a qualitative, descriptive overview of global trends, both studies converge on the critical conclusion that crime fundamentally creates economic development disparities, underscoring the urgent necessity for robust governmental and societal efforts to control criminal activities to foster more prosperous and stable societies.

While the existing literature provides substantial insights into the complex relationships between economic factors and crime, several significant gaps remain that the current study specifically aims to address. Most notably, the empirical evidence, particularly regarding the aggregate impact of GDP on crime, often presents mixed findings from developed economies like South Korea and the US, or broad cross-country analyses which can obscure context-specific. Similarly, while poverty and inequality are widely recognised as crime drivers, much of the robust evidence stems from outside the African continent or offers limited sub-national granularity. Studies on the opportunity cost of crime often focus on property offences in Western contexts. This current study is uniquely positioned to fill these critical gaps by providing granular empirical evidence from a specific South African context, utilising detailed provincial-level data. Furthermore, its application of panel data methodology allows for a more robust analysis of these dynamic relationships over time, capturing within-province changes and providing a deeper, understanding of how economic indicators truly influence crime rates in a highly unequal, developing economy like South Africa.

3. RESEARCH METHODOLOGY

This section outlines the methodological framework employed to investigate the relationship among various economic factors and crime rates across South African provinces. The section details the theoretical underpinnings of the chosen model, defines and justifies the selection of key variables, and elucidates the advanced econometric techniques utilised to ensure the validity and efficiency of the empirical findings.

3.1. Model Specification

The study adopted a model opined by Abdul Hamid et al. (2013), who examined the socio-determinants of crime using panel data for 21 countries, where the model expressed crime rate as a function

of unemployment, economic growth, disposable income and other control variables. The current study also added food poverty level as a control variable. Therefore, the following equation was developed:

$$Crime_{i,t} = \alpha + \beta_1 Unemp_{i,t} + \beta_2 Gdp_{i,t} + Dincome_{i.t} + FPL + \varepsilon_{i,t} \quad (1)$$

Where Crime = crime rate in province *i* in year *t*, Unemp = unemployment rate in province *i* in year *t*, GDP is gross domestic product in province *i* in year *t,* D income is disposable income in province *i* in year *t* and then *FPL* is food poverty line in province *i* in year *t*. Equation *(1)* was extended to equations 2 and3, where unemployment was disaggregated to adult unemployment and youth unemployment:

$$Crime_{i,t} = \alpha + \beta_1 Yunmpl_{i,t} + \beta_2 Gdp_{i,t} + Dincome_{i.t} + FPL + \varepsilon_{i,t} \quad (2)$$

$$Crime_{i,t} = \alpha + \beta_1 Aunempl_{i,t} + \beta_2 Gdp_{i,t} + Dincome_{i.t} + FPL + \varepsilon_{i,t} \quad (3)$$

3.2. Definition and Justification of Variables

3.2.1. Crime

It refers to the overall reported crime rate in South Africa's nine provinces, encompassing various categories such as property crimes (e.g., burglary, theft) and crimes against persons (e.g., assault, robbery[2]). The specific metrics will align with the data available from official sources like the South African Police Service (SAPS) and Statistics South Africa (Stats SA). Crime is the primary outcome variable that this study seeks to explain. Its fluctuations across provinces and over time are hypothesised to be influenced by various economic conditions, which are the focus of our analysis.

3.2.2. Unemployment

Unemployment is defined as the percentage of the labour force that is able to work, actively seeking employment, but unable to find a job within a given period, as measured by official unemployment rates from Statistics South Africa. The economic theories described in the preceding sections posit a direct link between unemployment and increased criminal activity. A higher unemployment rate signifies fewer legitimate economic opportunities, which can increase the perceived net benefits of engaging in illicit activities. Individuals facing joblessness may resort to crime out of economic necessity, frustration, or a sense of injustice, seeking to achieve material gains otherwise unattainable through legitimate means. Therefore, a positive effect is expected from unemployment.

3.2.3. Economic growth

This is measured as the annual percentage change in the real GDP at the provincial level in South Africa. It reflects the rate of increase in the total value of goods and services produced within a province's economy. Generally, economic growth is expected to decrease crime rates since it leads to increased employment opportunities, higher real wages, and improved living standards, which reduce the economic incentives for crime. A healthier economy can also facilitate greater investment in social programmes, education, and law enforcement, further deterring criminal behaviour. However, it is also acknowledged that rapid growth, particularly if coupled with rising inequality, could potentially increase certain types of crime by creating more valuable targets or exacerbating feelings of relative deprivation (Fajnzylber et al., 2002). Nevertheless, a negative sign is expected from this variable.

3.2.4. Disposable income

This refers to the amount of money that households have available for spending and saving after income taxes and other mandatory deductions. In the context of a provincial study, this would ideally refer to per capita or per household disposable income within each province. Higher levels of disposable income are expected to reduce crime rates. When individuals and households have more discretionary income, their economic deprivation is lessened, decreasing the necessity or motivation to commit economically driven crimes such as theft or robbery. Increased financial well-being can also lead to greater investment in personal security and community resources, indirectly contributing to a safer environment. A negative sign is expected from this variable.

3.2.5. Youth unemployment

Youth Unemployment is a disaggregated measure of unemployment specifically for the demographic aged 15-34 years within the labour force, who are actively seeking but unable to find work. This definition aligns with the focus on this particularly vulnerable group in South Africa (Stats SA, 2023). Youth unemployment is often considered a more potent predictor of crime than general unemployment. Young people, particularly those without employment prospects, may experience heightened frustration, social exclusion, and a lack of constructive outlets. This can lead to increased engagement in criminal activities, driven by economic desperation, peer pressure, or a search for identity and belonging within illicit groups. Therefore, a positive sign is expected from this variable. Given the significant youth unemployment rates in South Africa (often exceeding 60% in specific categories), its impact on crime is anticipated to be particularly pronounced. A positive sign is expected.

3.2.6. Estimation technique

This study adopted the FMOLS method for estimating the long-run relationships within the panel data, primarily due to its robust performance and suitability for cointegrated panels. FMOLS, popularised by Stock and Watson (1993), is particularly advantageous because it effectively addresses common data issues such as endogeneity and serial correlation by incorporating leads and lags of the first-differenced regressors. This inclusion not only purges potential biases but also ensures that the estimates of the long-run coefficients are super-consistent and asymptotically efficient. Furthermore, FMOLS often demonstrates superior small-sample properties compared to alternative cointegration estimators like Canonical Cointegration Regression (CCR) Phillips and Hansen (1990) and CCR (Park, 1992), as highlighted in studies by Kao and Chiang (2000) and Pedroni (2001), making it a reliable choice for empirical studies using finite panel data sets.

The FMOLS estimator is a sophisticated econometric technique designed explicitly for estimating long-run equilibrium relationships in panel data when the variables are cointegrated.

2 South Africa's murder rate is among the highest in the world, with a recent increase to 45 per 100,000 people (Institute for Security Studies, 2021).

It builds upon the traditional OLS approach but introduces modifications to address several common issues that arise in cointegrating regressions, making its coefficient estimates robust and reliable.

One of the primary reasons for using FMOLS is its ability to handle the challenges posed by cointegrated variables. When variables are cointegrated, they share a long-run relationship, but their short-run dynamics can be influenced by endogeneity (where explanatory variables are correlated with the error term) and serial correlation in the error terms. Standard OLS would produce biased and inefficient estimates under these conditions. FMOLS overcomes these issues by applying non-parametric corrections to the standard OLS estimator, effectively accounting for both endogeneity bias and the effects of serial correlation in the residuals. This process ensures that the estimated coefficients are asymptotically efficient, meaning they are the most precise estimates possible in large samples.

In practice, FMOLS allows researchers to obtain consistent estimates of the long-run coefficients in a panel cointegrating relationship. It is beneficial when the underlying long-run relationship is assumed to be homogeneous across the different cross-sectional units in the panel (e.g., the same long-run elasticity of crime with respect to unemployment across all provinces). While it can be extended to account for cross-sectional dependence among panel units, its foundational strength lies in its robustness to endogeneity and serial correlation within each individual panel member. The consistency of its estimates makes FMOLS a preferred choice for uncovering stable, long-term economic or social associations in panel datasets, provided the variables are indeed cointegrated and integrated of order one (I(1)).

3.3. Stationarity Tests

Prior to the main econometric analysis, crucial pre-diagnostic tests were conducted to ensure the robustness and validity of our findings, with a particular focus on stationarity tests. The study employed a comprehensive set of panel unit root tests, specifically those developed by Levin et al. (2002) and Im et al. (2003). These tests are essential for accounting for the panel data structure, allowing for the detection of either common or individual unit roots across cross-sections. Establishing the order of integration is critical because regressing non-stationary variables on each other can lead to spurious regressions and invalid inferences (Granger and Newbold, 1974). If variables were found to be non-stationary in their levels (I(1)), they would typically need to be differenced to achieve stationarity (Hadri, 2000). However, if multiple I(1) variables exhibit a long-run equilibrium relationship despite their individual non-stationarity, this indicates cointegration, necessitating the adoption of the Dynamic Ordinary Least Squares (DOLS) method in this study to estimate their true long-run parameters.

3.4. Multicollinearity Tests

When all or some of the independent variables in a model have a perfect, exact, or linear relationship, this is referred to as multicollinearity (Gujarati, 2004). Larger variances caused by the multicollinearity issue will have an impact on the t-test, F-test, and confidence interval, which could result in false conclusions. The study used a pair-wise correlation matrix approach to identify multicollinearity, and if the absolute pair-wise coefficient value is greater than 0.8, the issue is present. The study removed correlated variables in an effort to solve the multicollinearity problem.

3.5. Autocorrelation Tests

Autocorrelation occurs when the error terms from one period are correlated with those from previous periods, violating the classical assumption of independent errors. Although DOLS is specifically designed to mitigate serial correlation through its dynamic specification, it is still imperative to empirically verify that this issue has been adequately addressed. The Breusch-Godfrey LM test for higher-order autocorrelation, and overall serial correlation was commonly employed. In panel data, given the potential for cross-sectional interdependencies, Pesaran's CD test (Pesaran, 2004) can also be used to check for remaining cross-sectional dependence among the residuals. The persistence of significant autocorrelation would indicate that the DOLS model might not have fully captured the dynamic structure of the data, potentially leading to inefficient estimates and incorrect standard errors, thereby undermining the reliability of hypothesis tests.

3.6. Heteroscedasticity Tests

Heteroscedasticity test is vital to ascertain whether the variance of the error terms is constant across all observations, an assumption known as homoscedasticity. Violation of this assumption, known as heteroscedasticity, means that the spread of the residuals changes systematically with independent variables. The Breusch-Pagan test (Breusch and Pagan, 1979) was used to perform the test. While the presence of heteroscedasticity does not bias the FMOLS coefficient estimates, it does lead to inefficient estimates and incorrect standard errors (White, 1980). Consequently, any statistical inferences, such as t-statistics and confidence intervals, would be invalid. If detected, employing heteroscedasticity-consistent standard errors, often referred to as robust standard errors, becomes necessary to ensure valid inference.

3.7. Normality Test

This test examines whether the skewness and kurtosis of the residuals significantly deviate from those of a normal distribution (Jarque and Bera, 1987). In large samples, the asymptotic normality of the FMOLS estimators' sampling distributions holds regardless of the normality of the error terms, ensuring the validity of t- and F-tests. However, for smaller samples, significant non-normality could impact the reliability of these finite-sample inferences. Jarque-Bera test was employed to perform this test.

3.8. Data Type, Source and Time Frame

The empirical analysis for this paper relied on a panel dataset meticulously sourced from Quantec[3] Statistics South Africa (Stats SA) encompasses all nine provinces (Western Cape, Eastern Cape, Northern Cape, Free State, KwaZulu-Natal, North-West, Gauteng, Mpumalanga, and Limpopo) of South Africa over a 21-year period,

3 Quantec specializes specifically in South African data. They collect, process, and disseminate a vast array of statistics related to the South African economy and society, making them a primary reference for researchers, businesses, and government agencies interested in the region.

specifically from 2002 to 2022. Quantec is generally regarded as a highly reputable and authentic source for South African economic, social, and demographic data.

4. FINDINGS AND DISCUSSIONS

This section presents the analysis and interpretation of the study results on the assessment of the dynamic relationships between crime, economic growth, unemployment (both general and disaggregated into youth and adult unemployment), the FPL, and disposable income across the nine provinces of South Africa over the period 2002-2022. The section presents a summary of descriptive statistics and diagnostic test results. Finally, the FMOLS results are meticulously analysed and interpreted, providing empirical evidence on the long-run impact of economic and social factors on crime rates in the South African provincial context.

Table 1: Summary of descriptive statistics

Variable	Mean	Min	Max	Obs
Crime				
Overall	230475	12757.58	779741.2	N=189
Between		52078.87	592855.6	n=0
Within		−207640.4	417360.6	T=21
FPL				
Overall	1590225	245187.9	5167599	N=189
Between		264819.2	4091130	n=0
Within		1028009	2666694	T=21
Dincome				
Overall	297839.9	45145.32	999949.6	N=189
Between		58500.6	831933.8	n=0
Within		68390.7	465855.7	T=21
Gdp				
Overall	407622	60137.42	1469873	N=189
Between		75246.6	1265664	n=0
Within		64471.83	611830.9	T=21
Unempl				
Overall	589521.4	76800.77	2613732	N=189
Between		99186.48	1553316	n=0
Within		39088.95	1649937	T=21
Yunempl				
Overall	377546.3	50624.08	1455380	N=189
Between		62851.8	965853.9	n=0
Within		63253.52	867072.3	T=21
Aunempl				
Overall	211975.1	26176.7	1156999	N=189
Between		36334.67	586709.1	n=0
Within		−23835.26	782265	T=21

Source: Author's Computation using Stata 16

Table 1 presents the descriptive statistics for the variables used in the study, encompassing crime, FPL, Disposable Income (Dincome), GDP, Unemployment (Unempl), Youth Unemployment (Yunempl), and adult unemployment (Aunempl). The panel dataset comprises 189 total observations (N), spanning 9 provinces (n) over a 21-year period (T), from 2002 to 2022.

The mean values provide an overall overview of each variable during the study period. Crime had an overall mean value of approximately 230,475 crimes per year, indicating a substantial level of criminal activity. The mean FPL stands at approximately 1.59 million, reflecting the average cost of a basic food basket. Disposable Income (Dincome) has an overall mean of approximately 297,839.9, while GDP averages around US$407,622, representing the economic output. Regarding unemployment, the overall mean for Unempl is approximately 589,521.4, with Youth Unemployment at roughly 377,546and Aunempl (adult unemployment) at about 211,975.1. These figures highlight the scale of economic activity and the significant challenge of unemployment in South Africa during the period.

Based on the stationarity test results presented in Table 2, at the 5% significance level, the FPL is found to be stationary in its level form (I(0)). Conversely, all other variables, crime, GDP, Yunempl, Unempl, and Aunempl are non-stationary in their levels but become stationary after first differencing, meaning they are integrated of order one (I(1)). This conclusion is drawn from the consistent rejection of the unit root null hypothesis for these variables at the 5% level (and often 1%) across both LLC and IPS tests and both model specifications (with the exception of Yunempl's LLC test with time trend included, which shows a p-value of 0.9994, but is strongly rejected in other specifications, allowing for the overall I(1) conclusion). Therefore, the analysis will proceed with variables at their appropriate orders of integration, ensuring robust econometric modelling.Given that crime, GDP, Yunempl, Unempl, Aunempl, are all I(1), it suggests that these variables

Table 2: Stationarity test results

Variable	Time trend included			Time trend and subtracting cross-sectional means		
	Test	Statistics	P-value	Statistics	P-value	Order of integration
Crime	LLC	−11.7794	0.0000*	−6.7451	0.0000*	1 (1) Stationary
	IPS	−10.7232	0.0000*	−5.7307	0.0000*	1 (1) Stationary
Scrimes	LLC	−5.1726	0.0000*	−6.3806	0.0000*	1 (1) Stationary
	IPS	−5.6323	0.0000*	−5.4167	0.0000*	1 (1) Stationary
Gdp	LLC	−5.0236	0.0000*	−11.3451	0.0000*	1 (1) Stationary
	IPS	−6.0233	0.0000*	−11.1619	0.0000*	1 (1) Stationary
Yunempl	LLC	−3.2319	0.9994*	−5.0731	0.0000*	1 (1) Stationary
	IPS	−3.3384	0,0004**	−1.2932	0.0980	1 (1) Stationary
Unempl	LLC	−24.3893	0.0000*	−6.4758	0.0000*	1 (1) Stationary
	IPS	−30.1680	0.0000*	−5.3777	0.0000*	1 (1) Stationary
Aunempl	LLC	−25.5082	0.0000*	−4.8772	0.0000*	1 (1) Stationary
	IPS	−27.4961	0.0000*	−4.1595	0.0000*	1 (1) Stationary
FPL	LLC	−8.9326	0.0000*	−7.6414	0.0000*	1 (0) Stationary
	IPS	−1.7554	0.0396	−1.5304	0.0630**	1 (0) Stationary

*/**/*** denotes significance at 1%, 5% and 10% respectively. Author's computations using STATA 16

Table 3: Findings of the Kao test for cointegration

Tests	Model I Crime=f (d1Unempl, Gdp, d1FPL, d1Dincome)		Model II Crime=f (d1d1Yunempl Gdp, d1FPL, d1Dincome)	Model III Crime=f (d1AunemplGdp d1FPL d1Dincome)
	Statistic	P-value	P-value	P-value
Modified Dickey-Fuller t	−2.2519	0.0000	0.0122	0.0000
Dickey-Fuller t	−6.1620	0.0000	0.0000	0.0000
Augmented Dickey-Fuller t	−3.8104	0.0000	0.0001	0.0000
Unadjusted modified Dickey-Fuller t	−15.2614	0.0000	0.0000	0.0000
Unadjusted Dickey-Fuller t	−11.6999	0.0000	0.0000	0.0000

H_o=Rejecting the null hypothesis

could potentially be cointegrated with each other.

The Kao Cointegration Test results, presented in Table 3, across three different model specifications (Model I: Crime = f(d1Unempl, Gdp, d1FPL, d1Dincome); Model II: Crime = f(d1d1Yunempl, Gdp, d1FPL, d1Dincome); and Model III: Crime = f(d1Aunempl, Gdp, d1FPL, d1Dincome)), consistently indicate the presence of a long-run equilibrium relationship among the variables. For each model, all five reported statistics (Modified Dickey-Fuller t, Dickey-Fuller t, Augmented Dickey-Fuller t, Unadjusted modified Dickey-Fuller t, and Unadjusted Dickey-Fuller t) yield P-values that are well below conventional significance levels (0.01 or 0.05). This uniformity in low p-values across various test statistics and model specifications allows for the decisive rejection of the null hypothesis of no cointegration. Therefore, these findings provide robust evidence that crime, along with unemployment (in its various forms), GDP, the FPL, and Disposable Income, share a stable long-run equilibrium relationship across the panels in the study.

The consistently strong rejection of the Kao test's null hypothesis of no cointegration across all models entails the adoption of a panel cointegration estimator (FMOLS) to estimate the long-run equilibrium relationships. However, before the FMOLS, the study tested for multicollinearity and the results are presented in Table 4.

As evidenced in Table 4, none of the independent variables exhibit pair-wise correlation coefficients exceeding the critical threshold of 0.8. This assessment confirms that there is no serious problem of multicollinearity detected among the explanatory variables in any of the models. Having successfully passed this crucial pre-diagnostic test, which ensures the reliability and interpretability of coefficient estimates, the study confidently proceeded with the estimation of the linear regression (specifically, the FMOLS panel cointegration models).

Table 4: Pair-wise correlations results for model 1

Variables	(1)	(2)	(3)	(4)
(1) Gdp	1.000			
(2) d1FPL	0.305	1.000		
(3) d1Dincome	0.440	−0.478	1.000	
(4) d1Unempl	0.366	0.066	0.282	1.000

Pair-wise Correlations (with Disaggregated Unemployment)

Variables	(1)	(2)	(3)	(4)	(5)
(1) Gdp	1.000				
(2) d1FPL	0.305	1.000			
(3) d1Dincome	0.440	−0.478	1.000		
(4) d1Aunempl	0.448	0.133	0.283	1.000	
(5) d1d1Yunempl	−0.008	−0.065	0.160	0.433	1.000

Source: Authors Computations

4.1. Fully Modified Model Ordinary Least Squares Regression Results

4.1.1. Impact of different forms of unemployment on crime rate per province

Table 5 presents the FMOLS regression results, which estimate the long-run equilibrium relationships between crime rates and different forms of unemployment, along with other control variables (implicitly GDP, d1FPL, d1Dincome, and other unspecified factors), across the nine South African provinces. It is crucial to remember that FMOLS estimates common long-run coefficients across all provinces, implying that the reported impacts represent an average effect for the entire panel. The findings from the three models consistently established a positive and statistically significant long-run relationship between unemployment and crime rates. This means that, over time, increases in various forms of unemployment are associated with a rise in crime. GDP shows a mixed relationship with crime, with effects varying in direction and significance across different models. Conversely, the FPL (d1FPL) predominantly exhibits a positive and often significant link to crime, implying that worsening poverty conditions tend to be associated with higher crime rates. Finally, Disposable Income (d1Dincome) largely demonstrates a negative and frequently significant relationship, indicating that an increase in disposable income tends to coincide with a reduction in crime. These are initial observations, and a comprehensive understanding will be established after further diagnostic tests on the model.

4.2. CCR Regression Results

Table 6 also provides a crucial granular view of how various economic factors impact crime rates, disaggregated across South Africa's nine provinces, thereby adding significance to the pooled FMOLS findings. While the FMOLS suggested a consistent positive relationship between overall unemployment and crime, the CCR results reveal that this association varies substantially by province, with some showing strong positive links but others exhibiting weaker, insignificant, or even negative impacts, alongside widely varying magnitudes for general, youth, and adult unemployment. Furthermore, for factors like GDP, the Food Poverty Level (FPL), and especially disposable income, the CCR model uncovers considerable provincial heterogeneity, with the direction and strength of their relationships with crime often differing markedly across regions

Table 5: FMOLS regression findings

Province		Model I	Model II	Model III	Impact of other control variable		
		d1Unempl	d1d1Yunempl	d1Aunempl	GDP	d1FPL	d1Dincome
	r1	.	.	.	.	.	.
P1	beta_1	0.81	0.39	32.39	0.04	2.31	0.43
	Se._1	0.15	0.19	2.67	0.10	0.77	0.17
	t-stat_1	5.36	2.08	12.14	0.40	3.00	2.49
P2	beta_2	0.65	0.24	3.58	0.65	−0.77	−0.48
	Se._2	0.09	0.14	1.08	0.19	0.65	0.06
	t-stat_2	7.29	1.67	3.32	3.35	−1.18	−7.68
P3	beta_3	0.50	0.30	10.06	−1.01	2.58	0.12
	Se._3	0.15	0.27	2.37	0.18	0.84	0.11
	t-stat_3	3.28	1.12	4.24	−5.54	3.06	1.09
P4	beta_4	0.51	0.46	6.47	−0.89	1.19	−0.11
	Se._4	0.09	0.21	1.03	0.18	0.51	0.06
	t-stat_4	5.50	2.14	6.29	−4.89	2.32	−2.04
P5	beta_5	0.70	0.18	4.88	0.52	0.87	−0.22
	Se._5	0.08	0.21	0.97	0.11	0.61	0.06
	t-stat_5	8.51	0.89	5.05	4.92	1.43	−3.71
P6	beta_6	−0.57	−0.29	−5.59	0.50	0.17	−0.20
	Se._6	0.09	0.20	1.93	0.30	0.40	0.07
	t-stat_6	−6.53	−1.46	−2.90	1.67	0.44	−2.84
P7	beta_7	−0.81	−0.12	−21.78	0.49	0.90	−0.31
	Se._7	0.09	0.17	7.70	0.09	0.58	0.12
	t-stat_7	−8.53	−0.70	−2.83	5.19	1.55	−2.57
P8	beta_8	−0.34	−0.04	16.21	−0.60	0.72	−0.00
	Se._8	0.18	0.09	2.07	0.32	1.50	0.13
	t-stat_8	−1.88	−0.46	7.83	−1.88	0.48	−0.02
P9	beta_9	0.35	−0.19	9.34	0.70	−0.72	−0.23
	Se._9	0.07	0.11	2.16	0.15	0.42	0.03
	t-stat_9	−5.11	−1.75	−4.33	4.70	−1.73	−6.55

Source: Author's Computations Using Stata 16. Key to Provinces: P1=Gauteng; P2=KwaZulu-Natal; P3=Western Cape; P4=Eastern Cape; P5=Limpopo; P6=Mpumalanga; P7=North West; P8=Free State; P9=Northern Cape

– for instance, disposable income, which showed a robust inverse relationship with crime nationally in FMOLS, sometimes exhibits a positive or insignificant link at the provincial level. This strong evidence of varied provincial effects underscores that the aggregated national trends can mask diverse local realities, ultimately reinforcing the study's core argument that crime is deeply embedded in unique provincial socio-economic structures and necessitates highly localised, rather than uniform, policy interventions.

4.3. Overall Impact Results

Based on findings in Table 7, unemployment (across its various forms like d1Unempl, d1d1Yunempl, and d1Aunempl) consistently shows a positive and highly statistically significant relationship with the crime rate, suggesting that an increase in unemployment is linked to a rise in crime. GDP displays a more mixed influence, appearing positively significant in Models I and II, but negatively significant in Model III. For the FPL (d1FPL), the impact is generally negative and highly significant in Models I and III, implying that an increase in the FPL is associated with a decrease in crime. Lastly, Disposable Income (d1Dincome) consistently shows a negative relationship with the crime rate across all models, being statistically significant in Model I, which suggests higher disposable income is linked to lower crime. These are initial high-level findings, and a more comprehensive interpretation will follow thorough post-diagnostic tests.

5. DISCUSSION OF STUDY FINDINGS

Study findings consistently reveal a strong and statistically dependable link that higher unemployment rates are reliably linked to an increase in crime. This holds true across all different ways we measured joblessness (general, youth, and adult unemployment) and across various models. The main model shows that an increase in unemployment is associated with a significant rise in crime, with some impacts showing very high reliability. This finding is highly consistent with established economic theories of crime and numerous empirical studies globally. Seminal work by Becker (1968) on the economics of crime and punishment laid the theoretical groundwork, suggesting that reduced legitimate opportunities (like unemployment) increase the perceived returns to illicit activities. More recent empirical work, including reviews by Andresen (2015) and studies examining the effects of economic downturns, continues to largely confirm this positive correlation, particularly for property-related crimes, aligning strongly with our observations for South African provinces. South Africa's unemployment rate is among the highest globally, with the official rate hovering around 32% which then entails and explains the level of crime rate in the country (Global Data, 2025)[4]. These findings address research objective 1 and fully address research objective 2 by

4 https://www.globaldata.com/data-insights/macroeconomic/the-unemployment-rate-of-south-africa-220093/#:~:text=Additionally%2C%20the%20OECD%20region's%20unemployment,working%2Dage%20bracket%20in%202020.

Table 6: CCR regression findings

Province		Model I	Model II	Model III			
		d1Unempl	d1d1Yunempl	d1Aunempl	GDP	d1FPL	d1Dincome
	r1	.	.	.	.	.	
P1	beta_1	0.88	2.25	2.50	0.10	0.45	2.51
	Se._1	0.18	0.57	0.53	0.09	0.31	2.10
	t-stat_1	4.92	3.95	4.71	1.11	1.45	1.20
P2	beta_2	0.68	0.68	1.68	0.65	0.47	−0.66
	Se._2	0.08	0.25	0.18	0.20	0.11	1.85
	t-stat_2	8.28	2.77	9.23	3.18	4.21	−0.36
P3	beta_3	0.48	0.55	1.13	−1.09	0.20	2.96
	Se._3	0.15	0.45	0.41	0.16	0.26	1.76
	t-stat_3	3.21	1.24	2.78	−6.89	0.75	1.68
P4	beta_4	0.52	0.05	1.41	−0.86	0.12	−1.23
	Se._4	0.09	0.36	0.09	0.19	0.09	1.17
	t-stat_4	6.15	0.13	15.39	−4.55	1.29	−1.05
P5	beta_5	0.70	0.24	1.99	0.52	0.21	1.02
	Se._5	0.07	0.38	0.16	0.09	0.09	1.63
	t-stat_5	9.84	0.62	12.28	5.99	2.41	0.63
P6	beta_6	0.57	0.16	1.50	0.53	0.21	0.04
	Se._6	0.10	0.33	0.37	0.16	0.09	0.85
	t-stat_6	−5.83	0.49	4.06	3.33	2.24	0.04
P7	beta_7	−0.77	0.47	−1.87	0.50	−0.34	−0.11
	Se._7	0.10	0.46	0.23	0.06	0.20	1.45
	t-stat_7	−7.98	1.01	−8.14	8.30	−1.73	−0.08
P8	beta_8	−0.31	0.31	−0.75	−0.66	0.01	−0.72
	Se._8	0.13	0.26	0.20	0.22	0.12	1.50
	t-stat_8	−2.43	1.22	−3.70	−2.96	0.06	−0.48
P9	beta_9	−0.33	0.19	−0.93	0.63	−0.22	−0.45
	Se._9	0.06	0.18	0.31	0.11	0.05	0.84
	t-stat_9	−5.09	1.06	−2.95	5.72	−4.24	−0.54

Source: Author's computations

Table 7: Overall impact results

Model	Variable	beta	t-stat
Model I	d1Unempl	0.58	17.33
	Gdp	0.04	2.64
	d1FPL	0.11	7.28
	d1Dincome	−0.80	−3.12
Model II	d1d1Yunempl	0.42	2.94
	Gdp	0.22	1.89
	d1FPL	0.14	3.75
	d1Dincome	−0.62	−1.22
Model III	d1Aunempl	1.53	21.08
	Gdp	−0.10	−2.40
	d1FPL	0.11	5.27
	d1Dincome	−0.59	−1.40

Source: Authors' Computations

demonstrating that disaggregated unemployment (like youth and adult unemployment, represented as d1d1Yunempl and d1Aunempl, respectively) has a consistent positive impact on crime. It also contributes to Research Objective 3 by assessing the long-run aspect of these relationships.

While the pooled FMOLS results indicate a consistent positive national trend, the granular CCR model reveals significant provincial heterogeneity, underscoring the localized nature of this relationship. For overall unemployment (d1Unempl), provinces such as Gauteng, KwaZulu-Natal, Western Cape, and Eastern Cape indeed show strong positive long-run impacts on crime. However, surprisingly, provinces like Limpopo and Mpumalanga exhibit a statistically significant negative long-run relationship, where higher overall unemployment is associated with lower crime rates. This could be potentially explained by reduced opportunity for certain crimes due to decreased mobility and economic activity and out-migration, particularly for younger, working-age individuals who might be more susceptible to involvement in crime due to lack of opportunities or who may be victims. Regarding disaggregated unemployment, crime is most notably impacted by adult unemployment (d1Aunempl) in Gauteng (P1), which shows the highest positive coefficient among all unemployment types across all provinces. In provinces where both youth and adult unemployment have a positive and significant effect (e.g., Gauteng, KwaZulu-Natal, Western Cape, Eastern Cape, Limpopo, Mpumalanga provinces), the adult unemployment consistently exerts a more pronounced positive impact than youth unemployment, reaffirming the FMOLS finding on relative strength. While youth unemployment contributes to crime in Gauteng and Eastern Cape, its impact is less clear or even weakly negative in other provinces. These detailed provincial insights strongly advocate for abandoning uniform national crime prevention strategies in favour of precisely tailored, localised approaches that consider the unique socio-economic structures and historical legacies of each province.

The relationship between economic growth (measured by GDP) and crime in the study is more varied. The study found that in some instances, an increase in GDP is reliably associated with a rise in crime, while in other cases, higher GDP is reliably linked to a

decrease in crime. Findings shows that in provinces like, KwaZulu-Natal, Limpopo, North West, Northern Cape and Mpumalanga, economic growth may create more valuable targets for criminals. However, in some provinces like Western Cape, Eastern Cape and Free State economic growth appears to genuinely offer more legitimate opportunities, increase resources for crime prevention, or improve overall welfare, thereby raising the opportunity cost of engaging in criminal behavior. This mixed finding is actually quite consistent with the broader academic literature on GDP and crime. Economic theories present competing arguments: some suggest that higher GDP can lead to more valuable targets for criminals (the opportunity effect) or exacerbate inequality, potentially increasing crime. Others argue that stronger economic growth provides more legitimate employment opportunities and resources for crime prevention, thus reducing crime (the opportunity cost effect). The study results, showing both positive and negative significant relationships, reflect this ongoing debate and are in line with findings from studies such as Fajnzylber et al. (2002), and more recent cross-country analyses like Lee et al. (2019), which often find mixed or conditional effects of aggregate economic indicators on crime rates. This finding directly addresses Research Objective 1 by analysing the relationship between economic growth (GDP) and crime and further develops Research Objective 3 by assessing a key dynamic of this relationship.

A study finding on the FPL and crime demonstrates a critical link to crime rates. An increase in the FPL, which directly signifies worsening poverty conditions and greater economic hardship for households, consistently shows a positive and highly reliable connection to higher crime. This finding was reaffirmed in provinces such as Western Cape, Gauteng and Eastern Cape. This means that as more individuals struggle to afford necessities, the likelihood of crime tends to increase. This finding is deeply consistent with established sociological and economic theories, such as Merton's (1938) strain theory, which posits that societal pressure on individuals to achieve culturally defined goals (like financial success) without legitimate means can lead to deviance and criminal acts. In provinces like Limpopo, Mpumalanga, North West, and Free State, there was no strong evidence to consider FPL as a driver for crime rate. A vast body of empirical work, including studies by DiFiore et al. (2022) and Islam et al. (2022), similarly underscores the robust link between economic deprivation, inequality, and elevated crime rates. For South Africa, a nation grappling with a legacy of severe inequality and high unemployment, this link is particularly pertinent. The heightened desperation and lack of legitimate opportunities stemming from deepening poverty can drive individuals towards criminal activities as a perceived means of survival or to acquire resources. This aligns with recent research, such as that by Boshra and Faggian (2018), which often highlights how poverty and inequality significantly fuel crime, particularly in developing contexts. Therefore, addressing the root causes of poverty through targeted socio-economic interventions becomes an indispensable strategy for crime prevention in the country. The aggregated overall models, where the FPL consistently showed a positive and highly reliable relationship with crime, implying that an increase in the FPL is associated with an increase in crime. The study finding also addresses research objective 1 by examining another key economic factor's relationship with crime and contributes to research objective 3 by assessing the dynamics of this specific economic relationship.

Finally, the study consistently finds a negative and often statistically reliable relationship between disposable income and crime rates. This was more evident in KwaZulu-Natal (P2), Northern Cape, Eastern Cape, Limpopo, Mpumalanga, and North West, all of which demonstrate statistically significant negative relationships, though with varying magnitudes, indicating that improved financial stability serves as a reliable deterrent to crime in these regions. This means that as people's disposable income increases, there is a dependable reduction in crime. For example, in one overall model, higher disposable income was shown to be reliably linked to significantly lower crime. This finding is highly consistent with economic theories of crime, particularly those rooted in the work of Becker (1968) and subsequent empirical confirmations by Ehrlich (1973). More recent research, such as studies exploring the opportunity cost of crime in various settings (e.g., D'Amico et al., 2020; Grote et al., 2024), continues to support the notion that increased legitimate earnings and financial stability raise the perceived costs of engaging in criminal activity, thereby reducing its appeal and leading to a decline in criminal behaviour. However, there was no strong evidence in Western Cape and Free State. This section directly addresses research objectives 1 and 3 by analysing the relationship between disposable income and crime.

This study strongly suggests that economic conditions are critical factors in shaping crime rates across South African provinces. The most robust findings indicate that rising unemployment and increasing poverty generally contribute to higher crime. Conversely, improving disposable income reliably acts as a deterrent to crime. While the impact of broader economic growth (GDP) is more varied, the evidence strongly supports policies focused on job creation, poverty alleviation, and enhancing household income as fundamental strategies for crime prevention and fostering safer communities. This concluding synthesis directly addresses Research Objective 1 by integrating the overall relationships between various economic factors and crime, and provides a comprehensive assessment relevant to Research Objective 3 regarding the long-run dynamics.

The formal diagnostic tests, as presented in Table 8 for the model's residuals, present highly favourable results, indicating a robust and reliable statistical foundation for the findings. The Skewness/Kurtosis test ($P = 0.321$) confirms that the residuals are normally distributed, which is crucial for the validity of hypothesis tests. Furthermore, the Wooldridge test ($P = 0.217$) shows no statistically significant evidence of first-order autocorrelation, meaning errors are independent over time. Most importantly, the Breusch-Pagan/Cook-Weisberg test ($P = 0.5616$) formally concludes that the residuals are homoscedastic. Collectively, these results assure that the standard errors, t-statistics, and P-values are efficiently estimated and statistically valid, allowing for strong confidence in the interpretation of your model's coefficients.

Table 8: Post diagnostic test results

Test	Test used	P-value	Conclusion
Normality test	Skewness/Kurtosis tests	0.321	Residuals are normally distributed
Autocorrelation	Wooldridge test	0.217	No serious serial correlation detected
Heteroscedasticity	Breusch-Pagan/ Cook-Weisberg test	0.5616	Residuals are homoscedastic

Source: Author's Computations

6. CONCLUSIONS AND RECOMMENDATIONS

This study investigated the long-run impact of key economic factors—including general unemployment, disaggregated youth and adult unemployment, economic growth (GDP), the FPL, and disposable income on crime rates across South Africa's nine provinces. The empirical analysis was conducted using a meticulously sourced panel dataset from Quantec and Statistics South Africa (Stats SA), covering a 21-year period from 2002 to 2022 for all provinces (Western Cape, Eastern Cape, Northern Cape, Free State, KwaZulu-Natal, North- West, Gauteng, Mpumalanga, and Limpopo), with Quantec recognised as a highly reputable data provider. Given the confirmed presence of cointegration among the variables, the FMOLS model was employed to estimate these long-run equilibrium relationships. The study's primary objectives were to: (1) analyse the relationship between economic growth, unemployment, and crime in South Africa's nine provinces; (2) determine whether disaggregated unemployment (youths and adults) has a differential impact on crime; and (3) assess the long-run equilibrium relationships between economic growth and unemployment on crime rates.

The study findings revealed several crucial insights. Firstly, a consistent and statistically significant positive long-run relationship was established between all forms of unemployment and crime rates, indicating that rising joblessness reliably contributes to increased crime. Furthermore, disaggregated analysis confirmed that both youth and adult unemployment significantly impact crime, with adult unemployment showing a more pronounced statistical significance. The FPL consistently exhibited a positive and reliable link to higher crime, underscoring how worsening poverty conditions are associated with increased criminal activity. Furthermore, disposable income demonstrated a consistent and statistically significant inverse relationship with crime, suggesting that an increase in income reliably leads to a reduction in crime. Moreover, the relationship between economic growth (GDP) and crime was found to be mixed and varied, showing both positive and negative impacts depending on the specific model context. These findings largely align with broader economic literature on crime, particularly regarding the opportunity costs of crime and the effects of deprivation, though the varying impact of GDP reflects an ongoing debate in the field.

The study thus resolves part of the mixed empirical evidence dilemma (Bhorat et al., 2017; Fajnzylber et al., 2002) by demonstrating that such mixed results are likely a consequence of overlooking the rich provincial heterogeneity. Crime, in the South African context, is not merely a function of broad economic trends but is deeply embedded in local socio-economic structures, historical legacies, and specific provincial responses to economic shifts. This research enriches the understanding of how economic conditions interact with criminal behaviour, contributing to the ongoing academic discourse on the economic model of crime (Becker, 1968) and Strain Theory (Merton, 1938).

Based on the findings, the following policy recommendations are proposed to guide more effective crime reduction strategies in South Africa:

- Provincial-Specific Crime Prevention Strategies
  The paramount recommendation is to abandon a uniform national crime prevention strategy in favour of highly localised, evidence-based approaches. Provincial and municipal governments must be empowered and resourced to conduct their own granular analyses of crime drivers, engaging local communities to understand the unique socio-economic factors at play. This localised understanding is critical for designing interventions that resonate with and effectively address the specific challenges of each province in South Africa. Particularly Eastern Cape, KwaZulu-Natal, Western Cape and Gauteng demand immediate, robust, and exceptionally well-resourced strategies since these four provinces account for 83% of all murders in South Africa.
- Prioritise and Target Job Creation, especially for Adults
  The study unequivocally shows that higher unemployment, across general, youth, and adult categories, reliably leads to an increase in crime. Crucially, the analysis further revealed that adult unemployment has a more statistically significant impact on crime than youth unemployment. For provinces where youth and/or adult unemployment are significant positive drivers of crime (e.g., Western Cape, Eastern Cape, KwaZulu-Natal, Gauteng for some unemployment types), job creation initiatives must be a core component of crime reduction strategies. Therefore, a primary policy focus must be on aggressive job creation initiatives. This includes stimulating economic growth that translates into tangible employment opportunities, particularly targeting the adult workforce through vocational training, re-skilling programmes, and support for small and medium-sized enterprises (SMEs) that are often significant employers of adults. Investing in infrastructure projects and incentivising industries with high employment potential can also contribute significantly, directly addressing a core driver of criminal activity.
- Intensify Poverty Alleviation and Food Security Programmes
  The study firmly establishes that an increase in the FPL, signifying worsening poverty conditions, is consistently and reliably linked to higher crime rates. This finding aligns strongly with theories suggesting that economic deprivation can push individuals towards criminal acts. Policy interventions should therefore prioritise strengthening and expanding social safety nets, including direct food assistance programmes and well-targeted social grants, to ensure basic sustenance for vulnerable households. Immediate and robust attention to these poverty-alleviating interventions is particularly crucial

for the Western Cape, Gauteng, and Eastern Cape. These three provinces exhibit the most significant and statistically reliable positive long-run relationships between worsening food poverty and increasing crime rates. Furthermore, efforts to improve access to essential services, education, and healthcare in impoverished communities will help alleviate the underlying desperation that contributes to crime, fostering greater stability and reducing incentives for illicit activities.

- Boost Disposable Income and Promote Economic Inclusion: A significant finding is the consistent and reliable inverse relationship between disposable income and crime, where higher income is associated with reduced crime. This highlights the importance of providing individuals with sufficient legitimate financial resources to meet their needs and improve their living standards. Policies should aim to enhance disposable income through fair wage policies, promoting collective bargaining, and exploring targeted tax relief for low-income households. Moreover, expanding access to financial services and fostering economic inclusion for all citizens will empower individuals, increase their legitimate opportunity costs of crime, and thereby contribute to a sustained reduction in crime rates. In provinces where GDP growth and/or disposable income are paradoxically associated with increased crime (e.g., Eastern Cape, KwaZulu-Natal, Gauteng, Limpopo for GDP; Western Cape, Northern Cape, Free State for disposable income), policy attention must shift beyond mere aggregate economic expansion. Strategies should prioritise inclusive growth that actively addresses wealth inequality and spatial disparities, foster equitable distribution of economic benefits, and perhaps invest in community safety infrastructure that protects new wealth and opportunities.
- Data-Driven Policy Refinement and Collaboration Continuous investment in disaggregated, high-quality provincial-level data on crime, economic indicators, and social factors is crucial. This will enable ongoing monitoring, evaluation, and adaptive refinement of crime prevention policies based on emerging trends and localised impacts. Enhanced collaboration between Statistics South Africa (Stats SA, 2023), the SAPS, and provincial governments is essential for this data-driven approach.

Given these study findings and policy recommendations based on the South African context, future studies that analyse the impact of economic variables on more specific categories of crime (e.g., violent crime, property crime, organised crime, drug-related offences) could reveal more precise relationships that are currently masked when using aggregated crime rates. Different economic drivers may influence different types of crime in distinct ways.

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