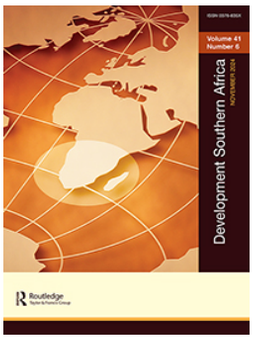

Development Southern Africa

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/cdsa20

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To cite this article: Erisher Woyo & Blessing Tafirenyika (13 Nov 2024): Do the 'poor matter' in regional integration among SACU countries?, Development Southern Africa, DOI: 10.1080/0376835X.2024.2424898

To link to this article: https://doi.org/10.1080/0376835X.2024.2424898

Published online: 13 Nov 2024.

DEVELOPMENT SOUTHERN AFRICA
https://doi.org/10.1080/0376835X.2024.2424898

Routledge
Taylor & Francis Group

Do the 'poor matter' in regional integration among SACU countries?

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ABSTRACT

This study examines the linkages between regional integration, poverty, and inequality reduction in the South African Customs Union. This was achieved by applying an econometric analytical technique to panel data on the five-member countries covering 2000–17. Results confirmed that regional integration is important in poverty and inequality reduction. This study has revealed that poverty can be reduced by increasing the levels of integration with other economies, increasing Human Development Indexfst and reducing inequalities. Therefore, these findings show that SACU governments' commitment to enhancing each of these variables is critical in achieving zero or reduced poverty among member states.

ARTICLE HISTORY
Received 21 October 2021
Accepted 28 October 2024

KEYWORDS
Poverty; inequality; regional integration; sustainable development goals

1. Introduction

Regional integration in Africa began in early the 1900s but gained momentum after countries gained independence in the mid-twentieth century (Awad, 2019; De Lombaerde, 2018; Leshoele, 2023). By the late twentieth century, numerous regional blocs had formed, and Africa now has 17 regional groupings aimed at promoting cooperation and expanding markets (Awad, 2019; Awad & Yussof, 2017). These blocs aim to stimulate intra-regional trade as a driver for economic growth and development (De Lombaerde, 2018). However, the actual outcomes have fallen short of expectations, with intra-African trade lagging behind other regions (McKay et al., 2023). Contributing factors include political instability, poor governance, inconsistent policies, and inadequate infrastructure investment (Fanta et al., 2013; De Melo & Tsikata, 2014; McKay et al., 2023). Despite these challenges, many African countries continue to pursue integration as a means of stimulating growth and development (Awad & Yussof, 2017; McKay et al., 2023).

While research from both developed and developing countries supports the importance of regional integration for sustainable development (Akinyemi et al., 2019;

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Otsuka, 2020; Sinha et al., 2023), there are still significant theoretical gaps in understanding its role in reducing poverty (Goal 1) and inequality (Goal 10). Despite Africa's numerous regional blocs, it remains a continent with the highest poverty (Senbet & Simbanegavi, 2017) and inequality rates globally, raising questions about the effectiveness of these initiatives. Although integration is expected to promote economic development (Tumwebaze & Ijjo, 2015) and sustainable development (McKay et al., 2023; Ullah et al., 2021), its direct impact on poverty and inequality remains underexamined (Pan et al., 2021). Addressing this theoretical gap is critical for developing more effective policies that ensure regional integration benefits disadvantaged populations.

Existing research focuses on inequality and rarely considers both inequality and poverty, despite their bidirectional relationship. Income inequality has been shown to have negative impact on poverty and growth (Amponsah et al., 2023). While some studies suggest that integration can reduce inequality (Furceri & Ostry, 2019; Ravinthirakumaran & Navaratnam, 2018), others argue that the effects depend on factors such as economic development (Dorn et al., 2022; Ean et al., 2020; Tung et al., 2020), suggesting a lack of consensus. Addressing poverty and inequality remains a key challenge for developing countries (Alvaredo & Gasparini, 2015; Giannetti et al., 2023; Pan et al., 2021; Woyo, 2020), and understanding how regional integration can alleviate these challenges is crucial. Studies in other regions, such as the European Union, have found positive links between integration and income inequality (Zulfiu Alili & Adnett, 2018; Tridico, 2018), but Africa's low growth elasticity of poverty, due to high inequality (Odusola, 2017), demonstrates the complexity of reducing poverty in unequal growth conditions (Kouadio & Gakpa, 2022). Understanding regional integration's role could provide policymakers with insights for developing targeted strategies to address poverty and inequality while advancing integration objectives.

This study examines the relationship between regional integration, poverty reduction, and income inequality within the South African Customs Union (SACU). The primary aim is to assess how regional integration impacts poverty and inequality among member countries. To achieve this, we employ econometric analysis using panel data from 2000 to 2017 for five SACU countries – Botswana, Eswatini, Lesotho, Namibia, and South Africa. The study uses Least Squares Dummy Variable (LSDV) technique, with fixed and random effects models, to provide comprehensive results.

The paper is structured as follows: the next section reviews the relevant literature on regional integration, followed by the methodology. The results are presented and discussed in subsequent sections, with conclusions and policy implications in the final section.

2. Literature review

2.1. Poverty and inequality

Poverty is a multifaceted phenomenon where individuals or families lack sufficient income to meet socially acceptable living standards (Zhou et al., 2020). Thus, resulting in the 'deprivation of basic capabilities', and an 'impoverished life' (Sen, 2001, 87) and negative well-being through the absence of essentials like food and clothing (Niu et al., 2020), suggesting that a 'lack of income is [deemed] the underlying cause of

poverty' (Njoya & Seetaram, 2018, 513). This perspective has prompted the United Nations Development Programme to create a range of poverty indices including the Human Development Index, the Human Poverty Index, and the multidimensional poverty index (UNDP, 2011).

While traditionally measured through economic lens, poverty is now understood to encompasses social and cultural dimensions (Bourguignon & Chakravarty, 2019). As a result, it is categorised into various forms, including absolute vs. relative poverty (Chen & Ravallion, 2013), chronic vs. transient poverty (Ward, 2016), regional vs. individual poverty (Liu et al., 2017), and urban vs. rural poverty (Du et al., 2005). However, discussion of these types of poverty is beyond the scope of this study, and we focus on regional poverty, particularly within the SACU region. A lack of socio-economic progress and infrastructure are significant contributors to regional poverty (Medeiros et al., 2021; Villalobos et al., 2021).

Reducing poverty is a top priority for Agenda 2030 (United Nations, 2015). Though income growth is critical for reducing poverty and inequality, as argued earlier, there is a general lack of consensus among scholars (Nakabashi, 2018). However, ending poverty is critical because it has strong synergies with most other SDGs and is highly correlated with progress on other goals (Jolliffe & Prydz, 2016; Spada et al., 2023). Additionally, prior research argues that solving regional poverty could potentially eliminate individual poverty (Liu & Xu, 2016; Liu et al., 2017). This demonstrates the importance of reducing poverty and inequality within regional economies.

2.2. Regional integration, poverty, and inequality

Regional integration, broadly defined as the reduction of trade barriers such as tariffs and non-tariffs measures between countries, has been widely promoted for its potential to enhance trade, stimulate economic growth, and improve access to goods and services (Motelle & Biekpe, 2015; Tafirenyika, 2020). While institutions like the African Development Bank (AfDB, 2012) highlight the potential of regional integration to alleviate poverty and reduce inequality, the reality is more complex, with outcomes varying significantly across regions and sectors.

In Africa, the historical context of regional integration dates back to the post-independence movements of the 1950s and 1960s, when newly sovereign nations sought collaboration for economic development (De Lombaerde, 2018; Leshoele, 2023). The signing of the Abuja Treaty of 1991 marked an important milestone, aiming to establish the African Economic Community (Aniche, 2018). More recently, the African Continental Free Trade Area (AfCFTA), formally launched in 2019, seeks to promote inclusive trade in line with the African Union's Agenda 2063, which aims for structural economic transformation and poverty alleviation (Aniche, 2020; Nega & Seidi, 2021). Despite these initiatives, research gaps remain in literature, particularly concerning the specific impacts of regional integration on poverty and inequality reduction, such as within the South African Customs Union (SACU) region.

The effects of regional integration are far from being uniform. Martuscelli & Gasiorek (2019) argue that asymmetric liberalisation – where reduced tariffs benefit consumers but hurt domestic producers – can exacerbate inequality, especially in poorer regions. Reduced tariff revenues can further weaken government spending on critical social

programmes, disproportionately affecting the vulnerable populations. For example, in Bolivia, regional integration has benefited resource-rich sectors like mining and agriculture, while low-wage, labour-intensive sectors have lagged behind, leaving inequality unresolved (Nina & Andersen, 2004). These examples demonstrate that trade liberalisation without targeted policies to ensure equity can worsen socio-economic disparities. Critiques of regional integration in Africa, such as those by Nshimbi (2018), emphasise that the focus on trade liberalisation is too narrow to address the broader socio-economic challenges across the continent. For regional integration to meaningfully reduce poverty, greater attention must be given to wealth distribution, labour market inclusion, and access to social services. Success in reducing poverty, therefore, depends on the ability of institutions to support labour market adaptability and manage structural changes that regional integration brings (Martuscelli & Gasiorek, 2019).

Previous studies on regional integration in Africa have typically focused on individual countries like Tanzania (Kweka & Mboya, 2017) and South Africa (Tekere, 2012), or on regional blocs like the Southern African Development Community (Kweka & Mboya, 2017; Oloruntoba, 2015). However, there has been inadequate examination of the broader implications of regional integration on socio-economic outcomes like poverty. In the case of SACU, research has centered on infrastructural and regulatory barriers rather than the socio-economic effects of integration (Ginindza et al., 2017). This limited focus suggests the need for more research to examine the impacts of regional integration on poverty and inequality.

2.3. SACU, poverty, and inequality

In SACU, which has existed for over 100 years, development challenges such as poverty and inequality remain pervasive (Manwa et al., 2019; Tafirenyika, 2020). Despite its longevity, member states continue to struggle with high levels of poverty and inequality. Previous research suggests that restrictive trade policies have contributed to weak economic growth in several developing countries (Pham et al., 2024; Rose, 2004; Steenkamp & Ferreira, 2020). However, the evidence regarding the impact of trade liberalisation through regional economic integration is inconclusive (Manwa et al., 2019), suggesting the need for further research on its role in addressing these challenges.

2.3.1. Namibia

Namibia is an upper-middle-income country that has more than 43% of its population living in poverty (Bailey, 2023). Efforts to deal with poverty and inequality appear to have been ineffective (Marenga & Amupanda, 2021; Woyo, 2020). Even though they joined SACU in 1990 (Manwa et al., 2019), there is limited knowledge regarding the impact of regional integration on reducing poverty and inequality in Namibia.

2.3.2. Botswana

Botswana, a SACU member since 1910, has largely ceded much of its control over its trade policy instruments to the union (Manwa et al., 2019). Trade liberalisation and the promotion of investment are critical components of its trade policy framework. Though Botswana has made tremendous progress in terms of reducing poverty (Diraditsile, 2021), youth unemployment remains unchanged (Diraditsile & Mokoka, 2020), thus

contributing to poverty. Consequently, poverty remains a serious problem regardless of several social welfare programmes (Mupedziswa, 2018; Mookodi, 2021). However, the relationship between regional integration, poverty, and inequality in the empirical context of Botswana, are thus, limited.

2.3.3. Lesotho

Lesotho, a low-income country, and member of SACU since 1910, has largely adopted its trade policy (Manwa et al., 2019). Efforts to reduce poverty and inequality through social protection programmes have been effective (World Bank, 2019). However, beyond social protection programmes, there is limited understanding regarding the impact of regional integration on reducing poverty and inequality.

2.3.4. South Africa

South Africa, a member state since 1910, is the largest economy (Manwa et al., 2019; Tafirenyika, 2020). Consequently, trade policies adopted by the country has significant impacts on the economic performance of member states (Manwa et al., 2019). Several African countries are faced with extensive poverty, and South Africa is no exception regardless of being classified as an upper-middle-income country (Fofana et al., 2024). Although poverty in South Africa has been linked to race and gender due to structural challenges from apartheid (Calitz et al., 2019), the country also faces extreme inequality, with a Gini coefficient estimated at 0.63 (Fofana et al., 2024; World Bank, 2021).

2.3.5. Eswatini

Eswatini follows a customs union trade policy that is largely influenced by South Africa's trade and industrial policies (Manwa et al., 2019). Compared to other SACU members, Eswatini has made minimal progress in trade liberalisation. As a lower-middle-income country with population of 1.2 million, it faces several economic challenges, including a national poverty rate of 63%, the highest income inequality, and unemployment of at 41% (Adams et al., 2022; Raju & Younger, 2021). Additionally, 39.7% of the population lived below the international poverty line of $1.90 between 2016 and 2017 (World Bank, 2021). However, research on the effects of regional integration on poverty reduction remains limited.

3. Methodology and data

This study used panel data from five SACU member countries – Botswana, Lesotho, Namibia, Eswatini, and South Africa – spanning from 2000 to 2017. Given that SACU is one of Africa's oldest regional blocs, it was expected expected to improve living standards in its member countries by reducing poverty and inequality. To achieve these goals, SACU has implemented fair policies, such as a unified external tariff, revenue sharing from a common pool, coordinated policies, and harmonised decision-making processes (Manwa & Wijeweera, 2016). However, the economies of SACU member states are largely undiversified, dominated by primary sectors, and heavily reliant on South Africa, the largest economy among them (Kirk & Stern, 2005; Mlipha & Kalaba, 2020; Soko, 2008). Socio-economic indicators reflect poor performance in areas like economic

growth, gross capital formation, human development, with persistent poverty and inequality (Mlipha & Kalaba, 2020). These factors raise questions about whether regional integration has truly benefited member countries.

We employed data from the period 2000–17, generating a balanced panel of 90 observations (18 periods for each of the 5 member states). The time frame was chosen based on the new SACU agreement of 2002, which addressed issues such as member participation, revenue sharing, and integration strategies aimed at protecting smaller economies. Thus, it is critical to assess the role of regional integration in reducing poverty and inequality during this period. We employed the SACU Regional Integration Index (SRII) to measure regional integration levels, real gross domestic product (GDP), growth rates, human development index (HDI), and poverty metrics. Data was sourced from databases including SACU and United Nations Development Programme (UNDP).

3.1. SACU regional integration index

The SACU regional integration index (SRII) was constructed using four dimensions to assess the level of integration within the bloc. The first dimension, trade integration, is measured by shares of intraregional exports and imports as percentages of GDP, as well as the share of intraregional trade in the total trade within the Regional Economic Community (% of intra-REC trade). The second dimension, infrastructure integration, is evaluated using two key indicators: the infrastructure development index which tracks infrastructure improvements, and regional electricity trade (net) per capita (absolute value), which reflects energy cooperation among member states. Third dimension is the production integration which focuses on the share of intraregional intermediate goods exports and imports as percentages of total intraregional trade, alongside the merchandise trade complementarity index, which assesses how well the production structures of member states complement each other. Lastly, the finance and macroeconomic policy integration is measured by the inflation rate differentials between member countries, indicating the alignment of financial and economic policies across the region.

3.2. Inequality

In this study, inequality is measured by the Gini coefficient, which assesses how income or consumption distribution deviates from perfect equality (UNDP, 2011; Qin et al., 2024). The Gini coefficient is applied to measure inequality of income among SACU member countries. According to United Nations standards, a Gini coefficient below 0.2 reflects average distribution, while values above 0.5 indicate significant inequality (Qin et al., 2024).

3.3. Human development index

Human development index (HDI) data was extracted from the UNDP data base (UNDP, 2011). It is a summary measure of average achievement in key dimensions of human development: longevity, healthy life, education, and a decent living standard.

3.4. Poverty

The national poverty headcount ratio, extracted from the UNDP database (UNDP, 2011), was used as an indicator of poverty. It represents the percentage of the population living below the national poverty line.

4. Estimation methodology: Panel data analysis

This study used panel data analysis using the Least Squares Dummy Variable (LSDV) technique, along with the fixed and random-effects models, to analyse cross-sectional data over time. These methods provided robust results and insights into the impact of regional integration on poverty and inequality. We also tested whether countries' economic growth rates converged to a long-term value using the Im-Pesaran-Shin (IPS) test, which relaxes the assumption of a common autoregressive parameter and works with unbalanced datasets (Baltagi & Kao, 2001). Unit root tests typically assume that all panels share the same autoregressive parameter, but IPS test accounts for variations in how the number of panels, N, and periods, T, trend over time, whether fixed or growing. In macroeconomic panels, this might involve increasing the number of firms (N) while keeping the number time periods (T) constant. The choice between fixed and random effects was determined by the Hausman test, and three models were estimated: LSDV, fixed effects, and random effects. Spatial correlations were considered to avoid biased estimates, as noted by Anselin (2013). A total of 12 equations were estimated as follows:

Equations for the fixed effects with dummies (LSDV)

$$SRII_t = \beta_0 + \sum_{i=1}^{3} \beta_1 GINII_t + \sum_{i=1}^{3} \beta_2 HDI_t + \sum_{i=1}^{3} \beta_3 POV_t + \emptyset_{ij} Country\ dummies + \varepsilon_t \quad (1)$$

$$GINII_t = \beta_0 + \sum_{i=1}^{3} \beta_1 SRII_t + \sum_{i=1}^{3} \beta_2 HDI_t + \sum_{i=1}^{3} \beta_3 POV_t + \emptyset_{ij} Country\ dummies + \varepsilon_t \quad (2)$$

$$HDI_t = \beta_0 + \sum_{i=1}^{3} \beta_1 SRII_t + \sum_{i=1}^{3} \beta_2 GINII_t + \sum_{i=1}^{3} \beta_3 POV_t + \emptyset_{ij} Country\ dummies + \varepsilon_t \quad (3)$$

$$POV_t = \beta_0 + \sum_{i=1}^{3} \beta_1 SRII_t + \sum_{i=1}^{3} \beta_2 GINII_t + \sum_{i=1}^{3} \beta_3 HDI_t + \sum_{i=1}^{3} \emptyset Country\ dummies_t + \varepsilon_t \quad (4)$$

Equations 14 indicate the formulate of pooled Ordinary Least Squares (LSDV) models used in this study. Unlike fixed and random effects models, these equations include dummy variables, such as the country dummies. The exogenous variables employed

included the national poverty headcount ratio (POV), income inequalities ratio (Gini), and the human development index (HDI). The SACU Regional Integration Index (SRII) serves as the measure of regional integration, while ε_t represents the uncorrelated disturbances (white noise residuals), and β_0 is the drift component.

The FE model without dummies has the following formation:

$$SRII_t = \beta_0 + \sum_{i=1}^{3} \beta_1 GINII_t + \sum_{i=1}^{3} \beta_2 HDI_t + \sum_{i=1}^{3} \beta_3 POV_t + \emptyset_{ij} T + \varepsilon_t \quad (5)$$

$$GINII_t = \beta_0 + \sum_{i=1}^{3} \beta_1 SRII_t + \sum_{i=1}^{3} \beta_2 HDI_t + \sum_{i=1}^{3} \beta_3 POV_t + \emptyset_{ij} T + \varepsilon_t \quad (6)$$

$$HDI_t = \beta_0 + \sum_{i=1}^{3} \beta_1 SRII_t + \sum_{i=1}^{3} \beta_2 GINII_t + \sum_{i=1}^{3} \beta_3 POV_t + \emptyset_{ij} T + \varepsilon_t \quad (7)$$

$$POV_t = \beta_0 + \sum_{i=1}^{3} \beta_1 SRII_t + \sum_{i=1}^{3} \beta_2 GINII_t + \sum_{i=1}^{3} \beta_3 HDI_t + \sum_{i=1}^{3} \emptyset T_t + \varepsilon_t \quad (8)$$

The random-effects model has the following formation:

$$SRII_t = \beta_0 + \sum_{i=1}^{3} \beta_1 GINII_t + \sum_{i=1}^{3} \beta_2 HDI_t + \sum_{i=1}^{3} \beta_3 POV_t + \mu_t + \varepsilon_t \quad (9)$$

$$GINNI_t = \beta_0 + \sum_{i=1}^{3} \beta_1 SRII_t + \sum_{i=1}^{3} \beta_2 HDI_t + \sum_{i=1}^{3} \beta_3 POV_t + \mu_t + \varepsilon_t \quad (10)$$

$$HDI_t = \beta_0 + \sum_{i=1}^{3} \beta_1 SRII_t + \sum_{i=1}^{3} \beta_2 GINII_t + \sum_{i=1}^{3} \beta_3 POV_t + \mu_t + \varepsilon_t \quad (11)$$

$$POV_t = \beta_0 + \sum_{i=1}^{3} \beta_1 SRII_t + \sum_{i=1}^{3} \beta_2 GINII_t + \sum_{i=1}^{3} \beta_3 HDI_t + \mu_t + \varepsilon_t \quad (12)$$

The fixed effects (FE) and random effects (RE) models differ from fixed effects models with pooled country-specific dummy variables. In the FE model, no dummy variables are included. The primary distinction between RE and FE models is that RE models have two error terms: one for differences between countries and another for within-variable errors the variables.

The study used OLS with 18 time periods ($T = 18$) and 5 countries ($N = 5$), resulting in 90 observations. OLS was used to estimate a single intercept and slope coefficient for each explanatory variable.

5. Empirical results and discussion

This section presents the empirical analysis and discussion. Descriptive, Pooled OLS, fixed effect and random effects with pooled dummies results are presented and discussed. The least-square dummy variable fixed, and REs models were all generated from the panel data.

5.1. Summary statistics

Panel data analysis shows mixed results regarding the impact of regional integration on poverty in SACU countries (Figure 1). In Botswana, poverty continuously declined, suggesting a positive impact of regional integration. Eswatini and Lesotho saw declines in poverty until 2010, after which levels stabilised. These results align with previous research (Adams et al., 2022; Magombeyi & Odhiambo, 2018; Raju & Younger, 2021; World Bank, 2019), supporting the positive role of regional integration. However, in Namibia, poverty increased after 2015, suggesting that the benefits of integration were short-lived, consistent with studies highlighting social injustice, inequality, and persistent poverty levels (Marenga & Amupanda, 2021; Woyo).

The SRII showed an upward trend across all SACU countries (Figure 2), indicating strong government commitment to regional integration. The steps to develop Figure 2 involved data normalisation, aggregation, weight generation, and index calculation. Despite slow individual development, efforts to enhance integration have led to a constant decline in inequality levels among member states (Figure 3). This contradicts studies suggesting growing inequality (Calitz et al., 2019; Marenga & Amupanda, 2021; Ramphoma, 2014). Contrary to recent research (Mookodi, 2021), Botswana has made significant progress in reducing inequality, likely due to the government's safety nets and social programmes like public works, old-age pensions, and home-based care (Mupedziswa, 2018).

The Human Development Index is a composite measure of development levels across regions or countries. Data indicates an upward trend in HDI for all countries (Figure 4).

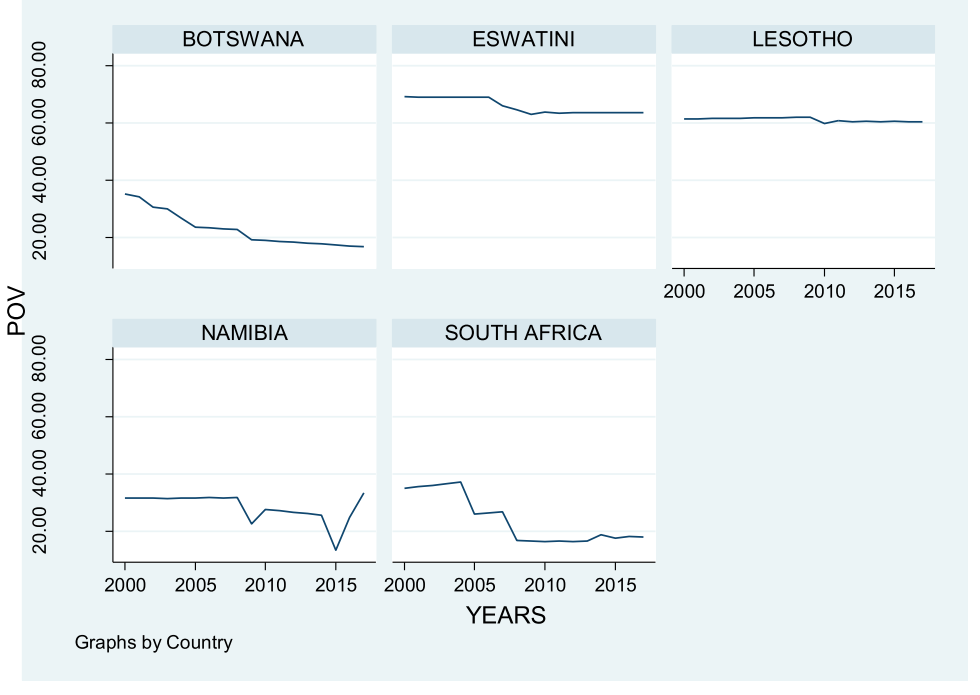

Figure 1. Line graph for POV for individual countries.

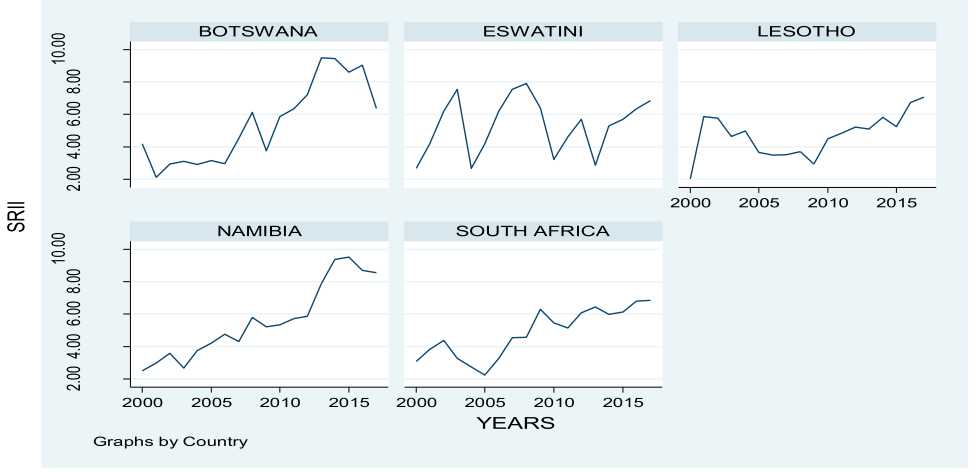

Figure 2. Line graph for SRII for individual countries.

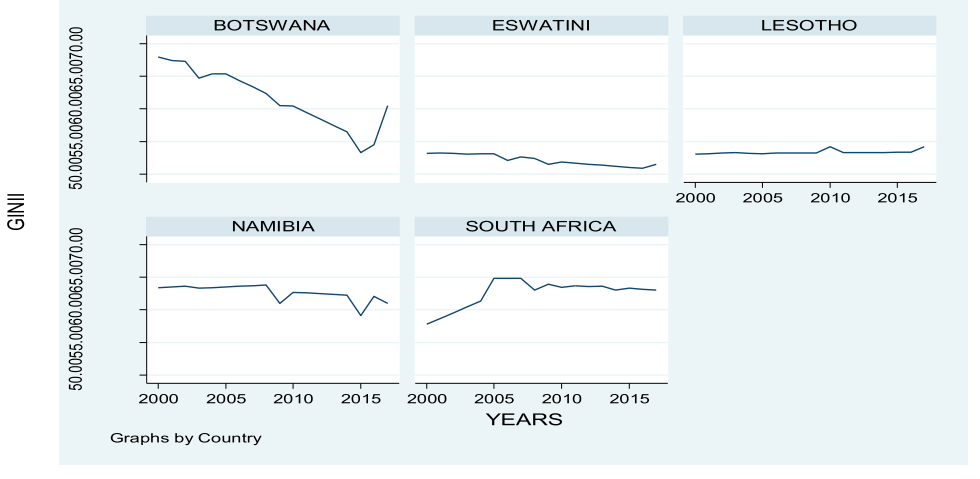

Figure 3. Line graph for GINII for individual countries.

This suggests that regional integration has increased access to income, services, empowerment, and sustainability in African region (UNDP, 2011). Additionally, this could also be due to governments' efforts in building institutions and capacities for inclusive growth, improving education, skills, and overall welfare.

5.2. Unit root tests using Im-Pesaran-Shin

The Im-Pesarn-Shin unit root test allows for heterogeneous panels with serially uncorrelated errors to run assuming that the number of periods, T, is fixed. IPS produces statistics both for the case where N is fixed and for the case where $N \to \infty$. Under the null hypothesis of a unit root, the usual $t-$ statistic, t_i, for testing $H_0 : \emptyset_j = 0$ does not have a

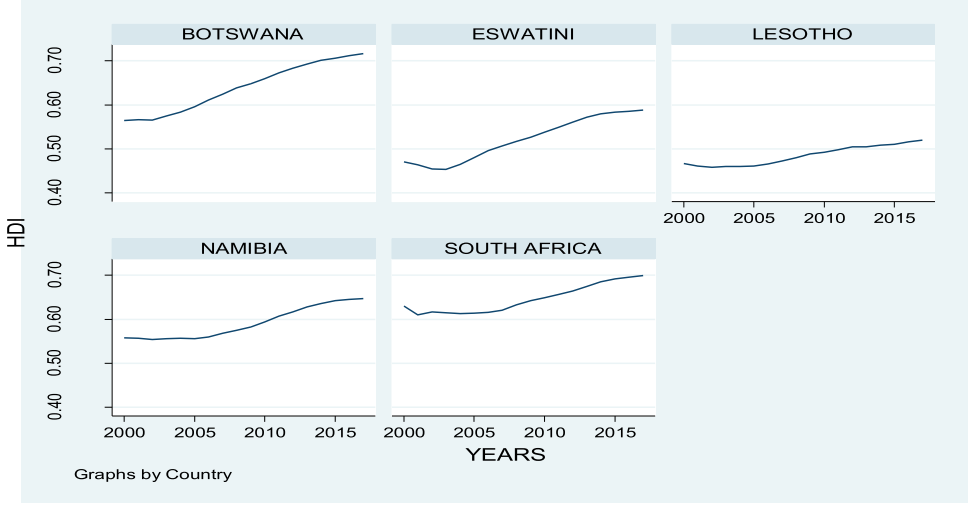

Figure 4. Line graph for HDI for individual countries.

Table 1. Results of IPS Unit root test.

Variable	SRII	POV	GINI	HDI
Parameters:				
t − bar	−1.7311	−1.8704	−2.0892*	0.7677
t − tilde − bar	−1.5309	−1.6854	−1.8538	0.7605
Z − t − tilde − bar	−0.4526	−0.9058	−1.3996	6.2684
P − value	0.3254	0.1825	0.0808	0.0000
Critical values:				
1%	−2.500	−2.500	−2.500	−2.500
5%	−2.190	−2.190	−2.190	−2.190
10%	−2.040	−2.040	−2.040	−2.040

Note: * denotes significance at 10% level, and the *p*-value is greater than 0.0000.

mean of zero. Based on results presented in Table 1, we first consider the statistic labelled $t - bar$, which IPS denote as $t - bar_{NT}$. This statistic was considered appropriate as the study assumed that both N (number of observations) and T (time in years) are fixed. The exact critical values reported in the IPS results schedule are reported in Table 1. Critical values are essentially cut-off values that define regions where the test statistic is unlikely to lie. Based on the findings, the null hypothesis, which states that all series contains a unit root, implying that they are non-stationary, was therefore rejected because $t - bar_{NT}$ is less than its 1% critical value (2.500). We strongly reject the null hypothesis that all series contains a unit root in favour of the alternative that a nonzero fraction of the panels represents stationary processes for SRII, POV, GINII and HDI.

It should be noted that the statistic labelled $t - tilde - bar$ is IPS's $t - bar_{NT}$ statistic and is similar to the $t - bar_{NT}$ Statistic, except that a different estimator of the Dickey-Fuller regression error variance is used. Furthermore, a standardised version of this statistic, $Z_{\tilde{t}-bar} - bar$, is labelled $Z - t - tilde - bar$ in the output and has an asymptotic standard normal distribution. Here the *p*-value corresponding to $Z - t - tilde - bar$ is essentially greater than zero, so we strongly reject the null that all series (SRII, POV, GINII and HDI) contain a unit root.

5.3. Pooled estimates models result

The results presented in this section are based on the model described in the methodology section. In total, 12 equations are estimated. This includes the four LSDV, four FE and four REs, based on the iterating interchange of the dependent variable. Summarised results of the models are estimated based on three-panel data techniques on each variable.

5.3.1. POV results of LSDV, fixed effects and random-effects model

The study found that lower SRII, HDI and Gini values are associated with higher values of poverty (POV) for all estimators (Table 2).

HDI and Gini variables are significant across all the three models, whereas SRII is only insignificant in the random effects model. Additionally, the Gini coefficient is statistically significant ($p < 0.001$) while the SRII remains insignificant. These results explained 96% of the variation, suggesting that none is due to an idiosyncratic error for the pooled OLS and random effects. The variation within the estimator is explained by 53.9% for fixed effects and 51.8% for random effects. The variation between estimators is explained by $R^2 = 95.2\%$ for the fixed effects and $R^2 = 96.5\%$ for the random effects. Therefore, it is deduced that pooled OLS, fixed and random results across countries and over time, indicate a decrease in SRII, HDI, and Gini leads to an increase in poverty within the SACU region. For example, the combined effect of SRII, HDI and Gini for Eswatini is 27.71% (−0.662 + 27.833); 58.12% (−85.95 + 27.833) and 27.32% (−5.12 + 27.833) respectively, while for Lesotho, the impact of SRII, HDI and Gini is 19,448% (−0.66205 + 20.14); 65.81% (−85.95 + 20.14) and 19.63% (−0,512 + 20.14) respectively. Regarding the rest of the SACU's three better-performing economies, the explanatory variables remain statistically insignificant, considering that Botswana is the reference point in the model. The argument for this finding implies that countries (Lesotho and Eswatini) with lower SRII and HDI. Furthermore, the analysis of the results shows that poverty is a complex construct that needs continuous investigation to generate key insights to influence policy (Table 3).

Table 2. Model results with dependent variable POV.

Variable	Pooled OLS	Fixed effects	Random effects
SRII	−0.6620549*	−0.6620549*	−0.5423169
HDI	−85.95672***	−85.95672***	−114.9837***
Gini	−0.5121892*	−0.5121892*	−1.005061***
eSwatini	27.83316***		
Lesotho	20.14207***		
Namibia	1.927255		
South Africa	1.688844		
Constant	113.1201***	123.4385***	168.3782***
Observation (N)	90	90	90
	Pooled OLS	Fixed Effects	
R^2	0.9685		
Adjusted R^2	0.9658		
R^2-within		0.5392	0.5176
R^2-between		0.9516	0.9649
R^2-overall		0.8676	0.9120

Note: ** p < 0.05; ** p < 0.01; *** p < 0.001.*

Table 3. Hausman test results comparing the fixed and random effects model.

Variables	Fixed Coef.	Random Coef.	Difference	S. E
SRII	−0.6620549	−0.5423169	−0.119738	
HDI	−85.95672	−114.9837	29.02701	4.605
GINI	− 0.5121849	−1.005061	0.4928759	0.082404
Chi2	26.73			
Prob.	0.0000			

In comparing the fixed and RE, the test indicates that using the fixed effect is better because it yields similar coefficients with pooled OLS. SRII, HDI and Gini significantly explain the dependent variable (poverty) level in both models. The Hausman test indicates significant differences between the coefficients for the FE and REs model. The Chi-Square value is 26.73, and the probability is 0.0000. Consequently, it can be inferred that employing FE pooled OLS (LSDV) yields a more effective explanation compared to the fixed and random effects (REs) models.

5.3.2. Breusch–Pagan LM test of independence

The null hypothesis in the B-P/LM test of independence is that residuals across entities are not correlated. The errors (*Uit*) are assumed to be independent and identically distributed over the periods and sectional units. The alternative states that (U_{it}) may be correlated. Based on the results presented in Table 4, the chi-square of 6.566 and the probability of 0.7656 are greater than 0.05, indicating no cross-sectional dependence.

5.3.3. SRII results of LSDV, fixed effects and random effects model

HDI was found to be significantly associated with higher values of SRII for all estimators. This means that HDI has a notable impact on the ability of a country to integrate with other countries. Lower values of GINI and POV are associated with higher values of SRII, implying that when a country has less poverty and inequality, it has higher chances or ability to integrate. The combined effects of HDI, GINI and POV are mostly enjoyed in Lesotho and Eswatini, which are the smallest economies in terms of economic activities and more vulnerable to poverty. Pooled OLS, and fixed effects results across countries and over time, indicate that an increase in HDI in each period leads to 18% increase in the ability to integrate within the SACU region. This has an indirect impact because this increased ability to integrate will spill over to reducing poverty once the country integrates with other economies. The results indicate the combined effects as follows for Eswatini the combined effect is 4.486666% + 18.1%, Namibia's

Table 4. Breusch-Pagan LM test of independence.

Residuals	ε_1	ε_2	ε_3	ε_4	ε_5
ε_1	1.0000				
ε_2	−0.0788	1.0000			
ε_3	−0.2725	0.0135	1.0000		
ε_4	−0.1906	−0.0583	0.2220	1.0000	
ε_5	0.0334	0.0577	0.4366	−0.0144	1.0000

Breusch-Pagan LM test of independence: chi2(10) = 6.566, Pr = 0.7656.
Based on 18 complete observations.

Table 5. Model results with dependent variable SRII.

Variable	Pooled OLS	Fixed effects	Random effects
POV	−0.0933913	−0.0933913	−0.0470016
HDI	18.11792	18.11792	14.52309
GINI	−0.1633774	−0.1633774	−0.2845158***
Eswatini	4.486666		
Lesotho	4.297652		
Namibia	1.707768		
South Africa	−0.4684986		
Constant	6.071572	8.076289	15.35544
Observation (N)	90	90	90

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

combined effect is 1.707768% + 18.1%, Eswatini's combined effect is 4.297652% + 18.1%. As for South Africa, the effect is statistically insignificant, considering its level and pace of development it has more outward-looking policies in which it aims to expand its external markets. Botswana is the reference point in the model (Table 5).

All the estimators' results have indicated that the SRII is increasing as inequalities and poverty are reducing. For Lesotho, the combined effect of Poverty and Gini are (4.297652–0.933913) and (4.297652–0.1633774), respectively. For Eswatini, it is (4.486666–0.933913) and (4.486666–0.1633774), respectively. For Namibia, it is (1.707768–0.0933913) and (1.707768–0.1633774), respectively. The negative signs carried by the GINI and POV coefficients shows a negative relationship between the two variables and SRII, implying that as integration levels increase, inequalities and poverty are expected to reduce in the countries mentioned, at the same time, as poverty and inequality reduce, they increase the ability of the countries to integrate. This reveals a two-way relationship between these variables. Integrating has high chances of reducing poverty, and low poverty levels also increase the ability to integrate. The argument for this finding implies that integrated countries tend to bring more benefits that are crucial in raising the well-being and living standards of citizens.

5.3.4. HDI results of LSDV, fixed effects and random effects model

HDI is explained better by Gini, poverty and SRII (Table 6). The results show that higher values of GINI and POV tend to reduce the HDI in all estimations. Again, this exposes how the smaller economies like Lesotho and Eswatini are disadvantaged.

Table 6. Model results with dependent variable HDI.

Variable	Pooled OLS	Fixed effects	Random effects
SRII	0.0052676	0.0052676	−0.0050168
POV	−0.0035253***	−0.0035253***	−0.0037954***
Gini	−0.0059618	−0.0059618	−0.0056711***
Eswatini	−0.0226392		
Lesotho	−0.0657671		
Namibia	−0.0242138		
South Africa	0.0186559		
Constant	1.05951***	1.040717***	1.035954***
Observation (N)	90	90	90

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

The combined effects of Poverty and Gini are, for Lesotho (−0.0657671–0.0035253) and (−0.0657671–0.0059618), for Eswatini it is (−0.0226392–0.0035253) and (−0.0226392–0.0059618), for Namibia (−0.0242138–0.0035253) and (−0.0242138–0.0059618) and for South Africa (0.0186559–0.0035253) and (0.0186559–0.0059618). These results reveal that there is a negative relationship between HDI and poverty and inequality, implying that increased poverty and inequality hinders human development. The combined effects are worse off as the total impact is a higher negative figure for Lesotho, Eswatini and Namibia. For South Africa, the combined effects are reducing the HDI values. This indicate that the more the population experiences poverty, the less access to factors that can increase human development, such as education, good health, and income and high-income disparities hinder development among the population within the country. However, the pooled OLS and fixed effects show that the more economically integrated the economy, the more the HDI values. This is as follows: Lesotho (−0.0657671 + 0.0052676), for Eswatini (−0.0226392 + 0.0052676), Namibia (−0.0242138 + 0.0052676) and SA (0.0186559 + 0.0052676). The benefits to HDI from integrating with the other countries could be due to the transfer of skills, knowledge, technology, and education. In the combined effects, South Africa remains the pacesetter for the SACU region.

5.3.5. GINI results of LSDV, fixed effects and random-effects model

The study's findings show that higher values of SRII, POV, and HDI are associated with lower values of Gini for all estimators (Table 7). POV is significant at 0.001 level for some estimators (pooled OLS and fixed effect) and at 0.01 level in the RE. The analysis of pooled OLS, fixed and random results across countries and over time, indicates an increase in poverty index in each period leads to a decrease in Inequality in the SACU region. The same results indicate that for Eswatini, the combined effect of HDI on inequality is – 8.316071 + −35.5533 and HDI combined effects for Lesotho is – 9.185565 + −35.5533. The combined effect of SRII on Eswatini is – 8.316071 + −0.283266 and Lesotho is – 9.185565 + −0.283266. Meanwhile, results for Namibia and South Africa remain statistically insignificant. The results for Lesotho and Eswatini indicate the vulnerability of small nations in regional integrations. Considering their status quo in income inequalities, further opportunities which could arise from integrating continue to benefit the privileged members of the society and further widening the gap between the rich and the poor. The argument for this finding implies that countries

Table 7. Model results with dependent variable Gini.

Variable	Pooled OLS	Fixed effects	Random effects
SRII	−0.283266	−0.283266	−0.5117094***
POV	−0.1252686	−0.1252686	−0.2769732***
HDI	−35.5533	−35.5533***	−36.07505***
Eswatini	−8.316071		
Lesotho	−9.185565		
Namibia	−0.0034067		
South Africa	1.107274		
Constant	88.79811***	85.51855***	93.14569***
Observation (N)	90	90	90

Note: ** p < 0.05; ** p < 0.01; *** p < 0.001.*

with income equality are classified as upper, and middle income and consequently have inward-looking policies.

6. Conclusions

This study examined the impact of regional integration on reducing poverty and inequality among SACU member countries. Results show regional integration play a significant role in reducing poverty and inequality among SACU economies, though its impact is not uniform across all economies. While larger SACU economies benefit from integration, as seen in reduced poverty and inequality, smaller economies of Eswatini and Lesotho experience limited advantages, highlighting the uneven distribution of benefits (Myrdal, 1953). This suggests that while regional integration is a valuable pathway reducing poverty and inequality, it may be less effective for smaller or middle-income countries within the bloc such as Namibia. Myrdal's (1953) theories of cumulative causation and backwash effects explain these disparities, showing how bigger economies gain disproportionately, pulling resources away from smaller economies.

This study makes a significant theoretical contribution by addressing a gap in the existing literature on regional integration. While previous studies primarily focused on economic aspects, trade dynamics, and policy implications, (Manwa & Wijeweera, 2016; Manwa et al., 2019; Steenkamp & Ferreira, 2020), our work is unique in its focus on quantifying and assessing the impact of regional integration on poverty and inequality reduction. Extending literature beyond the traditional economic lens provides a comprehensive understanding of how integration efforts affect social outcomes in developing economies. This perspective broadens the scope of literature and provides insights for policymakers seeking to design more equitable and effective regional integration policies.

This study has several limitations, primarily related to the use of secondary panel data, which makes it challenging to measure complex variables like poverty, inequality, and regional integration. Indicators such as HDI and the GINI coefficient are difficult to track on a regular basis, so the findings should be interpreted with caution. Future research could address these limitations by adopting a trend analysis approach, which would enhance theory development of the impacts of regional integration. Further theory development could also examine the complex dynamics of labour market integration, monetary policy coordination, socio-political challenges like xenophobia in relation to how they interact with and potentially hinder effects of regional integration on poverty alleviation. Lastly, future studies could also consider incorporating primary data, especially from underrepresented SACU member states.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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