The Effects of Industrialisation on Economic Growth: Panel data evidence for SADC countries

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Abstract
Drawing on balanced panel data of 6 Southern African countries in 1978–2019, this paper examines the impact of industrialisation on economic growth using several econometrics methods: pooled mean group, mean group, dynamic fixed effects and takes account of common correlated effects. Estimation is conducted using manufacturing value added as the proxy for industrialisation. Empirical results reveal that an increase in industrialisation is positively associated with economic growth in both the short and long-run and the positive relationship is more significant when we use common correlated factors to address the issue of cross-sectional dependence. The policy implications of this research are that industrialisation remains one of the important tools of economic transformation in Southern Africa and the successful implementation of the industrialisation strategies in the countries of Southern Africa is one of the clear pathways to economic development.

Keywords: Industrialization; Economic Growth; ARDL; SADC; Pooled Mean Group; Dynamic Fixed Effects

JEL Classification Codes: C33, O14, O47, O55

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1 Introduction

Industrialisation is one of the channels through which growth can be achieved. Industrial growth and diversification lead to the expansion of production which can facilitate the fulfilment of the developmental needs of an economy. Other positive attributes of industrialisation include accelerated technological changes and faster integration into global production networks (Szirmai, 2012; Lavopa and Szirmai, 2018). Despite these positive attributes, the role of industrialisation in economic development has been questioned. One of those questions related to whether poor countries need to follow the historical trajectory of the current industrialised countries (Fagerberg, Guerrieri and Verspagen, 1999; Dasgupta and Singh, 2005; Maroto-Sánchez and Cuadrado-Roura, 2009; Lee and McKibbin, 2018).

Agenda 2063 of the African Union identifies industrialisation as one of the critical contributors to a prosperous Africa based on inclusive growth and sustainable development. The role of manufacturing, value addition, science, and technology-driven innovation in the social and economic transformation of the continent is key to the achievement of the agenda (AUC, 2015).
In the southern African region, the industrialisation process is acknowledged as an important ingredient in the quest for sustainable economic and political stability such that the regional economic blocks of Southern African Development Community (SADC) and the Common Market for Eastern and Southern Africa (COMESA) have both anchored their economic development on industrialisation.[1]

Since the two key regional economic blocks for the region prioritise industrialisation as a key ingredient in its development, the paper empirically examines the impact of Industrialisation on economic growth in the region. This paper will inform policy makers on where they have fallen short and point out areas which may need attention to reap the benefits of industrialisation.

This paper has used various economic models to examine the link between industrialisation and economic growth. Firstly, a simple bivariate model is used to assess the direct impact of industrialisation on economic growth. Then the panel autoregressive distributed lag (ARDL) of pooled mean group (PMG), mean group (MG) and dynamic fixed effects (DFE) are employed to examine the relationship. To address the possible problems of cross-sectional heterogeneity and correlation, the Common Correlated Effects Mean Group (CCEMG) and Common Correlated Effects Pooled Mean Group (CCEPMG) estimators have also been used in the analysis.

The remainder of this study is organised as follows: section 2 presents a review of the literature, section 3 explains the data and sample selection, section 4 presents the empirical methodology and section 5 discuss the empirical results. Finally, section 6 concludes.

[1] SADC member States adopted the SADC' Industrialisation Strategy and Roadmap (2015-2063). The COMESA member States adopted the COMESA Industrialisation policy (2015-2030) in 2015 This policy was followed by an implementing strategy, the COMESA Industrialisation Strategy (2017-2026) adopted in 2017 (COMESA 2015; 2017).

2 Literature Review

2.1 Theoretical Literature Review

Industrialisation in a broader sense can be considered as an increase in the value added of non-agricultural and non-services sectors to GDP arising from a set of economic processes that associated with more efficient ways for value creation (Simandan, 2009). Several studies have established that economies that have grown and accumulated wealth after investing in manufacturing industries (Kaldor, 1966; Chenery, 1982; Syrquin, 1986; Chenery and Syrquin, 1989; Obioma, Anyanwu and Kalu, 2015). Countries that have industrialised have created new jobs, increased productivity, increased access to capital, in addition to enhanced innovation (Necmi, 1999; Alexiou and Tsaliki, 2010; Lin and Monga, 2013; Szirmai and Verspagen, 2015; Haraguchi, Cheng and Smeets, 2017). Indeed, several studies have concluded that industrialisation is an engine of economic growth (Wong and Yip, 1999; Page, 2012; Opoku and Yan, 2019).

The impact of manufacturing economic growth was theorised by Kaldor (1966, 1967), in the theory, surplus labour in the non-manufacturing sectors migrates to the manufacturing sector and in turn increases the labour productivity of the manufacturing sector. The manufacturing sector experience increasing returns and the non-manufacturing sectors experience diminishing returns. The associated faster growth in the manufacturing output and productivity contribute to GDP growth through the rise in demand for manufactured goods leading to higher investments and exports in the economy (Kaldor, 1975; Alexiou and Tsaliki, 2010).

Other theoretical models have been developed to explain the relationship between economic growth, Wong, and Yip (1999) postulated that in a two-sector economy (agriculture and manufacturing), the manufacturing sector expands overtime due to the accumulation of physical and human capital because of learning by doing and yet the agricultural sector does not benefit from learning by doing leading to lack of technological growth (Wong and Yip, 1999; Szirmai and Verspagen, 2015).

However, the importance of industrialisation to economic growth is not without opponents. Kitching (1989) argues that it is possible to raise per capita incomes without having to pass through the unhappy industrial stage since services are more productive than manufacturing which could be the source of economic growth and not manufacturing and deliver a more socially, environmentally, and technically acceptable process of industrialisation (Kitching, 1989; Ggombe and Newfarmer, 2018). There is also the argument that policy makers obsession with manufacturing is based on the lack of imagination on other possible paths (Gollin, 2018). Services have replaced manufacturing as the engine of economic growth (Ghani and O'Connell, 2014) and has become an additional engine in some cases.

2.2 Empirical Literature Review

Several empirical studies using both single and cross-country data have examined the link of industrialisation to economic growth. In Africa, Thirwall and Wells (2003) studied 45 countries between 1980 and 1996 and confirmed the positive relationship between manufacturing and economic growth. Adugna (2014) investigated the role of manufacturing in Ethiopia's economic growth using the OLS approach and found that manufacturing played a key role in the Ethiopian economy. However, Obioma *et al*. (2015) studied the role of industrial development in Nigeria's economic growth using time series data concluded that industry's role in economic growth was statistically insignificant even if its sign coincided with economic theories. This result is like that of Jelilov and Musa (2016), who investigated the role of industrial development in Nigerian economy using OLS and found that industrial development had a statistically insignificant and negative impact on the economy. Bakari and Mabrouki (2018) found a negative and non-statistically significant relationship between industrialisation and economic performance in Tunisia. Alexiou and Tsaliki (2010) using fixed and random effects models found a positive relation between resource mobilization in manufacturing and attaining higher levels of economic growth and development for data for the period 1975 to 2006.

On the contrary, the empirical impact of manufacturing as an engine of growth is mixed (Szirmai and Verspagen, 2015), for example Mamgain (1999) found that in newly industrialised countries of Thailand, Singapore, Indonesia, Malaysia, South Korea, and Mauritius, high growth in manufacturing did not translate into economic growth in Thailand, Singapore, Indonesia, and Mauritius but it did affect the South Korean economy. Further mixed results were reported by Kniivilä (2007) which confirmed that industrial development played a significant role in the economies of China, Taiwan, Indonesia, and the Republic of Korea. Zhao and Tang (2018) compared the relationship between manufacturing and economic growth in China and Russia using data from 1995-2008, the results were mixed in that in China the data confirmed the positive impact of manufacturing on economic growth and yet in Russia, it was the service sector that had a positive relationship with economic growth.

Some African countries like Ethiopia, Malawi, Senegal, and Tanzania experienced significant growth-promoting structural change despite the absence of industrialisation (Rodrik, 2017). He found that labour moved from low-productivity agricultural activities to higher-productivity activities, but the latter are mostly services rather than manufacturing, supporting the argument that developing countries can now leapfrog manufacturing.

Using fixed effect and feasible generalised least squared (FGLS) for data between 1992 and 2012 for 11 countries (United Kingdom, United States, Canada, Australia, Germany, France, Sweden, Greece, Japan, Korea, and Taiwan), McCausland and Theodossiou (2012) confirmed Kaldor's hypothesis of the positive relationship between manufacturing and economic growth. The same relationship was confirmed in 45 developed and developing countries by Necmi (1999) using two least squared methods for data spanning the period 1960-1994.

Atesoglu (1993) and Marconi, Reis, and Araújo (2016) finds evidence of the positive impact of industrialisation on economic development using the data for the United States for the period 1965-1988 and the ordinary least squares (OLS) and for 63 middle and high-income countries 1990-2011 using the GMM respectively. Martinho (2012) investigated Verdoorn's law in the Portugal economy which confirmed the increasing returns to scale hypothesis of the law and that the industry's output growth affected productivity growth and that in this sector increasing returns to scale existed. In Turkey, Yamak *et al.* (2016) using quarterly data and the ARDL (autoregressive distributed lag) approach and confirmed that industry was an engine of growth in the economy. In a study of 88 developed countries over the period 1950-2005, Szirmai and Verspagen (2015) employing the fixed effect model and the Hausman–Taylor estimation on the full sample, found a moderately positive effect of manufacturing on economic growth.

The hypothesis of manufacturing as an engine of economic growth was confirmed by Chakravarty and Mitra (2009) and Kathuria and Natarajan (2013) in India even though the services sector contribution to economic growth is significant contributor to economic growth. Chakravarty and Mitra (2009) using data for the period 1973 to 2004 that manufacturing is one of the drivers of growth.

Mercan *et al.* (2015) found positive causal relation between the growth of manufacturing output and the growth of GDP in South Africa, Mexico, Brazil, China, India, Indonesia, Malaysia, Philippines, Thailand, and Turkey using panel cointegration method for the 1965-2012 data. This positive relationship was also evidence in panel data analysis of 7 Latin countries for the period 1985-2001 (Libanio, 2006) and China using both time series and panel data in China's between 1979 and 2004 (Jeon, 2006).

Cantore *et al.* (2017) employed generalised method of moments to study the hypothesis of a positive relationship between industrialisation and economic growth in 80 countries between 1980 and 2013 and could not reject it. Su and Yao (2017) employing panel granger causality methods found a positive relationship between industrialisation and economic growth by analysing data from 1950 to 2013.

3 The Data Set

The paper analyses annual data of 6 countries[2] in SADC and over 42 years from 1978 to 2019, resulting in a total of 252 observations. The selection of the starting period and countries was constrained by the availability of data.

Panel estimation is chosen in this study to control for individual heterogeneity, to identify unobservable characteristics and to give more information on reliable estimation (Baltagi, 2007). Since the data consists of a panel of 6 countries for 42 years, where N = 6, is much less than T = 42 the GMM estimator is not appropriate. The appropriate methodology in cases where T is larger than N (as in this case) is the ARDL approach. Data is obtained from the World Development Indicators (WDI-WB) of the World Bank.

Following Gui-Diby and Renard (2015); Hansen and Zhang (1996); Marconi, Reis, and Araújo (2016); McCausland and Theodossiou (2012); Necmi (1999); Szirmai and Verspagen (2015); Wells and Thirlwall (2003), the value added of manufacturing (MANU) is used as a proxy for industrialisation.

The other explanatory variables as the traditional covariates of economic growth in the literature are: Human capital variables: Total Population (POP) and secondary school enrolment (EDUC); Physical Capital variable: domestic investment measured as Gross fixed capital formation (INV); External economy variable; Trade as a share of Gross Domestic Product (TRADE); Macroeconomic Stability variables; Government expenditure measured as government final consumption expenditure (GEXP); official exchange rate (EXCR); All monetary variables are expressed in constant US 2010 dollars.

[2] The countries in this study are Botswana, Democratic Republic of Congo, Eswatini, Lesotho, Mauritius, and South Africa

4 Methodology

The paper draws its econometric inspiration from Pesaran and Smith (1995) and Pesaran *et al.* (1999) and uses the ARDL to estimate the short and long-run relationships. The structure of the analysis is in the following order (i), the cross-section dependence test to determine whether it is necessary to consider an unobserved common factor; (ii) a unit root test to determine the stationary proprieties of the time series of the examined variable; and (iii) a cointegration test to investigate the long-run relationship of industrialisation and economic growth.

4.1 Cross-sectional dependency Test

Breusch and Pagan (1980) and Pesaran (2008) argued that in the presence of cross-sectional dependence (CSD) in panel data results in biased and inconsistent estimates. It is therefore necessary to test for cross sectional dependence before conducting any further analysis of the data. CSD may arise from the presence of common shocks and unobserved components (Robertson and Symons, 2000; Anselin, 2003; Pesaran, 2006; Baltagi, 2007). The most common tests for CSD are the Breusch and Pagan (1980) Lagrange Multiplier (LM) statistic and the Pesaran (2007) CSD test. In this study, the Pesaran (2007) is used. The choice of the Pesaran CD test is made since unlike the LM test, Pesaran CD statistic has exactly mean at zero for fixed values of T and N, under a wide range of panel data models, including heterogeneous models, non-stationary models, and dynamic panels. It also provides reliable results for samples with large and small cross-sectional dimensions.

4.2 Slope Homogeneity Tests

The second issue in a panel data analysis is to decide whether the slope coefficients are homogeneous. Failure to consider heterogeneity can lead to misleading results (spurious inference) (Pesaran, 2015).

4.3 Cross-sectional augmented IPS (CIPS) unit root test

Most of the unit root tests assumes CSD of the panels. However, in the presence of CSD, conventional methods of calculating the panel unit roots increases the probability of inaccurate results (Pesaran, 2007). In the presence of CSD and slope heterogeneity, the traditional unit root tests are not suitable because the tests are designed to test the individual time series and not unobserved heterogeneity that exist in panel data, Pesaran (2015).

This study employs the CIPS test for the unit root to mitigate the problems mentioned above. The null hypothesis of the CIPS panel unit root test is that the series is not stationary. If the statistic of the CIPS corresponding p-value is significant then then null hypothesis is rejected. The test is carried on the levels and then the first difference depending on whether the levels test was significant or not (Pesaran, 2007).

4.4 Panel cointegration test

Cointegration tests is carried out to determine if there exists a linear combination of variables in the long run and there are many tests that have been used in panel data analysis, however the most common is the Pedroni cointegration test (Pedroni, 2004). This test results in valid results in panels where the is no cross-sectional dependence but not in the presence of CSD. Westerlund (2007) developed an error-correction-based panel cointegration test that is valid in several cases like (i) correlated cross-sectional units; (ii) structural breaks in the intercept and slope of the cointegrated regression; (iii) error terms with serial correlation and (iv) heteroscedasticity. The test has four statistics for examining the cointegration, two of which examine the cointegration in at least one cross-section and the others examine the cointegration within the whole panel (Westerlund, 2007).

4.5 Autoregressive distributed lag (ARDL) models

In the absence of cointegration the suitable econometric method of analysis is the ARDL. This method is superior even in circumstances in which the variables are integrated of order zero I(0) or integrated of order one I(1) or a mixture of the two (Pesaran, Shin and Smith, 1999) as long as the time span is over 20 years. Another econometric method that gives superior results is the GMM estimator. However, in this case, the GMM estimator is not appropriate since it requires that the data set should be on N > T nature.

When cointegration is established, the long- and short-run causal relationships can be estimated using a panel error-correction model (ECM). Given that an ECM includes lags of dependent variables, it requires a dynamic panel ARLD model. The dynamic nature of the relationship between variable s means that the more traditional fixed and random effects methods might result in invalid estimates. Therefore, the recommended models for dynamic ARDL data for non-stationary dynamic panels with heterogeneous coefficients are the Mean Group (MG), Pooled Mean Group (PMG), Dynamic Two-Way Fixed Effect (DFE) estimators (Pesaran and Smith, 1995; Pesaran, Shin and Smith, 1999).

The main model of panel ARDL approach is to obtain the relationship between industrialisation and economic growth:

$$y_{it} = \alpha_i + \sum_{l=1}^{p} \beta_0 y_{i,t-l} + \sum_{l=0}^{q} \beta_1 d_{i,t-l} + \sum_{l=0}^{q} \beta_2 x_{i,t-l} + \mu_{it} \quad (1)$$

By reparameterising eq. (1):

$$\Delta y_{it} = \propto_i + \Phi_i\left(y_{i,t-l} - \theta_1 d_{i,t-l} - \theta_2 x_{i,t-l}\right) + \sum_{l=1}^{p-1} \lambda_{il} \Delta y_{i,t-l} + \sum_{l=0}^{q-1} \lambda'_{il} \Delta d_{i,t-l} + \sum_{l=0}^{q-1} \lambda''_{il} \Delta x_{i,t-l} + \mu_{it} \quad (2)$$

with i and t representing country and time respectively, y is the dependent variable, GDP per capita as a proxy for economic growth, d is the measure of industrialisation, x is a set of control variables which include the traditional covariates of economic growth; total population, gross fixed capital formation, general government final consumption expenditure, and inflation (Akinlo, 2004; Adams, 2009; Azman-Saini, Baharumshah and Law, 2010; Gui-Diby, 2014; Adams and Opoku, 2015; Szirmai and Verspagen, 2015). Notation λ, λ', λ'' are the short-run coefficients of the lagged dependent variable, manufacturing and other control variables respectively. The long-run coefficients are θ_1 and θ_2 for industrialisation and other control variables. Lastly, θ_i shows the speed of adjustment.

The main variable that has been used in the literature to proxy industrialization is value added of manufacturing (Hansen and Zhang, 1996; Necmi, 1999; Wells and Thirlwall, 2003; Alexiou and Tsaliki, 2010; McCausland and Theodossiou, 2012; Gui-Diby and Renard, 2015; Szirmai and Verspagen, 2015; Marconi, Reis and Araújo, 2016).

Pesaran, Shin, and Smith (1999) show that the Mean Group (MG) and the Pooled Mean Group (PMG) allow for more parameter heterogeneity in economic growth models than the fixed and random effects estimators. This is because the MG model estimates a separate equation for each country while the coefficients for the whole panel are computed as unweighted averages of the individual coefficients.

The MG model allows the slope coefficients, the intercepts, and error variances to differ across the groups. As this estimator does not impose any restrictions, all coefficients in the long-run and short-run are different and heterogeneous.

The PMG estimator assumes (i) the error terms are serially uncorrelated and are distributed independently of the regressors; (ii) there is a long run relationship between the dependent and explanatory variables and (iii) the long run parameters are the same across countries (Pesaran, Shin and Smith, 1999). The PMG estimator is flexible in that it allows for long run coefficient homogeneity over a single subset of regressors and/or countries.

The Dynamic Fixed Effects (DFE) is another estimator used to estimate these types of panels. It keeps the coefficients of the co-integrating vector to be the same across all panels and equalises the speed of adjustment coefficient and short-run coefficients (Blackburne and Frank, 2007). However, when the sample size is small, the DFE modes are subject to simultaneous equation bias caused by the endogeneity existing between the lagged dependent variable and error term (Baltagi, Griffin and Xiong, 2000).

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This study then uses the CCEMG estimator because the variables are heterogeneous and cross-sectionally correlated. The presence of CSD means that unobserved factors in the error term could be correlated with the explanatory variables. The Common Correlated Effects (CCE) approach corrects cross-sectional dependence of the error terms due to unobserved common factors. Neglecting such dependencies could lead to biased estimates and to spurious inference.

This approach permits the common effects to have differential impacts on individual units, while at the same time allows them to have an arbitrary degree of correlation among themselves as well as with the individual-specific regressors. The CCE estimator has the additional advantage that it can be computed by ordinary least squares (Pesaran, 2006) and the estimator performs well where the unobserved factors follow unit root processes (Kapetanios, Pesaran and Yamagata, 2011).

Chudik and Pesaran (2015) extend the CCE approach to dynamic heterogeneous panel data models with weakly exogenous regressors. They show that the CCE mean group estimator continues to be valid but the following two conditions must be satisfied to deal with the dynamics: enough lags of cross section averages must be included in individual equations of the panel, and the number of cross section averages must be least as large as the number of unobserved common factors.

5. Empirical results

The empirical analysis starts by conducting ross-sectional dependence test using the Pesaran CD test (Pesaran, 2006) for the variables, and the first differences of the variables. The results are reported in Table 1. The null hypothesis assumes cross-sectional independence, in comparison with cross-sectional dependence in the series' alternative hypotheses.

Pesaran's CD test reveal the presence of cross-sectional dependence most of the variables in levels apart from LTRADE. The first difference variables are also significant in all but two of the variables (DLINV and DLGEXP) meaning that the null hypothesis of cross-sectional independence could not be rejected. Overall, there is strong evidence of cross-sectional dependence among the countries in the panel.

This result shows the importance of conducting the CIPS unit root and Westerlund panel-data co-integration tests, which add robustness to the estimation result between the cross-sections in the panel.

Table 1:Pesaran Cross Sectional Dependence Test

Variables	Cross-Sectional Dependence (CD)			
	CD Test	P-value	Corr	Abs (Corr)
LGDP	7.89	0.000***	0.314	0.753
LMANU	8.68	0.000***	0.346	0.894
LPOP	24.35	0.000***	0.970	0.970
EDUC	17.70	0.352	0.705	0.705
LTRADE	0.93	0.000***	0.037	0.287
LINV	13.48	0.000***	0.537	0.597
LGEXP	9.62	0.000***	0.974	0.974
LEXCR	24.45	0.000***	0.856	0.862
DLGDP	2.17	0.030**	0.087	0.163
DLMANU	2.97	0.003***	0.120	0.181
DLPOP	10.65	0.000***	0.430	0.647
DEDUC	17.20	0.000***	0.694	0.694
DLTRADE	3.54	0.000***	0.143	0.160
DLINV	1.39	0.165	0.056	0.143
DLGEXP	0.82	0.145	0.033	0.122
DLEXCR	13.76	0.000***	0.555	0.555

The second issue in a panel data analysis is to decide whether the slope coefficients are homogeneous. Failure to test for the homogeneity of means that the country-specific characteristics are missed (Bedir and Yilmaz, 2016; Pesaran, 2015; Pesaran and Yamagata, 2008; Bersvendsen and Ditzen, 2020). When the slope coefficients are fixed (over time) but vary systematically across the units, the application of the general-to-specific methodology to standard panel models (e.g., fixed effects) can yield misleading results (spurious inference) (Pesaran, 2015).

Table 2 shows the results of the slope homogeneity test. Testing for homogeneity is important as it has a bearing on the econometric methods to be used if the parameter of interest (slope) is homogeneous or heterogeneous. Panel data analysis that ignores slope heterogeneity leads to biased results (Pesaran and Smith, 1995).

Table 2: Pesaran and Yamagata (2008) Slope Homegeneity Test

	Model 1: Manufacturing value added	
	Δ statistic	p value
Δ test	17.409	0.000***
Δadj Test	19.640	0.000***

The null hypothesis of slope homogeneity is rejected in all cases because the probability values smaller than 0.01. The slope coefficients are not homogeneous confirming the presence of heterogeneity across sample countries; this then necessitates the employment of heterogeneous panel techniques.

Unit Root Tests

Table 3 list the outcome of a CIPS unit root test. The results include the logarithmic level and first differences of the variable in conjunction with the trend in the time series. The Zt-bar and the corresponding p-value are also reported in the table. Two models are considered. In the first model, the time series does not consider the deterministic trend, whereas this is considered in the second model. In both models, the number of lags included is specified by the Akaike information criterion (AIC).

Table 3: Second Generation Unit Roots Tests

Variables	Second-Generation unit root test CIPS (Zt-bar)			
	Without Trend	P-value	With Trend	P-value
LGDP	-0.245	0.403	2.426	0.992
LMANU	-0.786	0.216	-0.644	0.260
LPOP	-4.487	0.000***	-8.621	0.000***
EDUC	1.096	0.864	0.893	0.814
LTRADE	-0.646	0.259	-1.090	0.138
LINV	-0.024	0.491	-0.769	0.221
LGEXP	1.384	0.917	3.348	1.000
LEXCR	-2.144	0.016**	-2.983	0.001***
DLGDP	-5.014	0.000***	-5.386	0.000***
DLMANU	-5.058	0.000***	-4.715	0.000***
DLPOP	-7.669	0.000***	-5.994	0.000***
DEDUC	-1.585	0.057*	1.723	0.047**
DLTRADE	-7.434	0.000***	-6.388	0.000***
DLINV	-4.763	0.000***	-3.899	0.000***
DLGEXP	-4.288	0.000***	-3.750	0.000***
DLEXCR	-6.769	0.000***	-5.800	0.000***

The null hypothesis of the CIPS unit root test is that the series are non-stationary while the alternative hypothesis implies a stationary series. The p-value suggests that it is failing to reject the null hypothesis and that all but two variables (LPOP and LEXCR) are non-stationary concerning their logarithmic level. According to the result for the first differences in the table, the null hypothesis of non-stationarity is rejected at the one percent significance level and confirmed the stationary series of the variables in the first differences. Based on these results population and exchange rate are stationary at level, whereas the rest of the variables are stationary at first difference. The order of integration of the variables is therefore a mixture of I(0) and I(1), which suggests suitability for the application of panel ARDL estimators.

Table 4: Westerlund Cointegration Test

Variable	Statistic	Value	Z-value	P-value
LMANU	Gt	-1.541	-1.329	0.092
	Ga	-3.586	0.117	0.546
	Pt	-4.174	-2.504	0.006***
	Pa	-2.428	-1.186	0.118
LPOP	Gt	-1.77	-1.869	0.031**
	Ga	-2.767	0.557	0.711
	Pt	-3.34	-1.79	0.037**
	Pa	-1.455	-0.363	0.358
EDUC	Gt	1.139	4.982	1.000
	Ga	0.189	2.15	0.984
	Pt	2.974	3.619	1.000
	Pa	0.236	1.068	0.857
LTRADE	Gt	-1.01	-0.078	0.469
	Ga	-0.688	1.677	0.953
	Pt	-2.819	-1.343	0.090
	Pa	-0.768	0.218	0.586
LINV	Gt	-1.688	-1.675	0.047**
	Ga	-3.819	-0.009	0.496
	Pt	-3.089	-1.575	0.058
	Pa	-1.543	-0.437	0.331
LGEXP	Gt	-1.639	-1.559	0.060
	Ga	-5.498	-0.913	0.181
	Pt	-2.398	-0.983	0.163
	Pa	-1.934	-0.768	0.221
LEXCR	Gt	1.282	5.316	1.000
	Ga	0.181	2.145	0.984
	Pt	2.771	3.446	1.000
	Pa	0.147	0.992	0.840

To analyse the long run relationship between economic growth and industrialisation cointegration tests were conducted between the dependent variable and the explanatory variables (Table 4). The Westerlund (2007) cointegration test is used. Based on two different classes of tests to evaluate the null hypothesis of no cointegration and the alternative hypothesis: group mean (G) and panel tests (P) the Westerlund cointegration test uses four panel cointegration test statistics Gt, Ga, Pt and Pa). Two of the four statistics (Gt and Ga) examine the existence of cointegration in at least one cross-section while Pt and Pa examine cointegration in the entire panel. The results of the tests indicate that in general there is no cointegration between economic growth (LGDP) and industrialisation (LMANU)

Since the unit root tests indicate that the some of the variables are non-stationary and the there is no cointegration among economic growth and industrialisation, the panel ARDL is employed to account for long run and short run relationships. The ARDL method is analysed through three estimators: the pooled mean group (PMG); mean group analysis (MG); and dynamic fixed effect (DFE) and the results are presented in Table 5 and Table 6.

Table 5:Panel ARDL Estimation Results

	Bivariate Model			Multivariate Model		
Variable	MG(a)	PMG(b)	DFE(a)	MG(b)	PMG(b)	DFE(b)
Long run coefficients						
LMANU	0.371	0.373	0.523	0.078	0.316	0.430
	(0.025)***	(0.004)***	(0.051)***	(0.078)	(0.080)***	(0.183)**
LPOP				-0.382	-0.402	-1.414
				(0.082)***	(0.187)**	(0.621)**
EDUC				0.000	0.004	0.004
				(0.001)	(0.002)**	(0.003)
LTRADE				0.194	-0.016	0.310
				(0.069)***	(0.055)	(0.236)
LINV				0.176	0.086	0.286
				(0.063)***	(0.042)**	(0.154)*
LGEXP				0.363	0.258	0.023
				(0.064)***	(0.119)**	(0.123)
LEXCR				0.027	-0.090	0.027
				(0.009)***	(0.058)	(0.027)
Short run coefficients						
D.LMANU	0.274	0.281	0.169	0.238	0.154	0.142
	(0.102)***	(0.080)***	(0.023)***	(0.084)***	(0.077)**	(0.022)***
D.LPOP				-0.951	-1.059	-0.665
				(0.677)	(0.673)	(0.545)
D.EDUC				0.000	-0.001	-0.000
				(0.001)	(0.001)	(0.001)
D.LTRADE				-0.034	-0.028	0.025
				(0.036)	(0.031)	(0.011)**
D.LINV				0.025	-0.012	0.033
				(0.016)	(0.020)	(0.015)**
D.LGEXP				0.056	0.020	0.030
				(0.045)	(0.040)	(0.015)**
D.LEXCR				-0.004	0.017	-0.017
				(0.011)	(0.012)	(0.005)***
Error Correction terms						
ECT	-0.075	0.001	-0.064	-0.085	-0.427	-0.050
	(0.035)**	(0.018)	(0.013)***	(0.055)	(0.095)***	(0.015)***
Number	246	246	246	246	246	246

Standard errors in parentheses
* $p < 0.10$, ** $p < .05$, *** $p < .01$

The results in Table 5, the MG, PMG and DFE shows significant results that increased industrialisation as measured by manufacturing value added positively affects economic growth in both the short run and the long run in the bivariate model in all the three estimators of MG, PMG and DFE. The Error Correction terms have negative and significant signs for the MG and DFE models implying that this model converges to a long run relationship in those two estimators.

The next panel in Table 5 the analysis uses all the determinants of growth and shows similar results. In the short run there is a significant positive relationship between industrialisation and economic growth in all the three models of MG, PMG and DFE. In the long run, the positive relationship is only significant in the PMG and DFE model. The other estimator (MG) shows a positive but insignificant relationship between industrialisation and economic growth.

The Error Correction terms are negative and significant in the PMG and DFE but insignificant in the MG estimator. Amongst all the estimators the Error Correction terms results show that the highest speed of adjustment of 9.5% (-0.0950) is derived from the multivariate panel of the implying a correction of about 10% of the discrepancy of the estimation.

The results in Table 5 indicate that industrialisation (manufacturing value added) provides evidence that in the Southern African region, industrialisation has contributed positively to economic growth between 1978 and 2019.

Despite significant results of the industrialisation variables, the ARDL methods disregard contemporaneous correlation across countries, which is caused by unobservable factors. Ignoring these factors lead to estimations that are less consistent (Baltagi 2014). This can be evidenced in the Pesaran CD test which indicates a high value of cross-sectional dependence in the error term and clearly rejects the null of weakly cross-sectional dependency in the bivariate models. To deal with this problem of cross-sectional dependence, the common correlation models are used.

Table 6: Panel ARDL Estimation with Common Correlated Effect

	Bivariate Model		Multivariate Model	
Variable	CCEMG(a)	CCEPMG(b)	CCEMG(b)	CCEPMG(b)
Long run coefficients				
LMANU	1.135	0.426	0.265	0.167
	(0.570)**	(0.781)	(0.085)***	(0.043)***
LPOP			-0.337	0.544
			(0.919)	(0.681)
EDUC			0.004	0.000
			(0.002)***	(0.002)
LTRADE			0.016	0.064
			(0.101)	(0.074)
LINV			0.050	0.063
			(0.072)	(0.053)
LGEXP			0.207	0.049
			(0.116)*	(0.047)
LEXCR			-0.090	-0.015
			(0.049)*	(0.017)
Short run coefficients				
D.LMANU	0.241	0.211	0.121	0.103
	(0.088)***	(0.075)***	(0.085)	(0.050)**
D.LPOP			-0.015	-2.738
			(1.365)	(1.164)**
D.EDUC			-0.000	0.001
			(0.001)	(0.001)*
D.LTRADE			-0.053	-0.039
			(0.036)	(0.027)
D.LINV			-0.010	-0.009
			(0.029)	(0.012)
D.LGEXP			0.017	0.032
			(0.050)	(0.070)
D.LEXCR			0.031	0.014
			(0.015)**	(0.009)
Error Correction terms				
ECT	-0.068	-0.032	-0.516	-0.587
	(0.036)*	(1.777)	(0.120)***	(0.147)***
Number	246	246	246	246

Standard errors in parentheses
$* p < 0.10$, $** p < .05$, $*** p < .01$

Table 6 shows the CCEMG and the CCEPMG estimators of the bivariate and multivariate models for the industrialisation using manufacturing value added as the proxy. The bivariate model yields significant results in the CCEMG model for the short run, long run and the error correction terms.

However, the CCEPMG shows a significant positive relationship between industrialisation only in the short run.

6. Conclusions

This paper employs data on 6 Southern African countries over the period 1978-2019 to empirically examine the effect of industrialisation on economic growth. The main findings can be summarised as follows: (i) there is a positive effect of industrialisation on economic growth, both in the short-run and long-run (ii) the positive relationship is significant when employing the econometric methods that consider slope heterogeneity and cross-sectional dependence among the countries of the region. Policy makers should continue to pursue the region's commitment to the implementation of the RISDP. As a result, the positive impact of industrialisation on economic growth buttresses the agenda of policy makers in the region. If the countries of the Southern African region implement their industrialisation strategy as spelt out in the RIDSP, it effects on economic growth shall be tremendous. In view of the potential transformational effect of industrialisation, Southern African governments should ensure that they domesticate, harmonise, and implement the RISDP which has that will promote industrialisation.

The policy implications of this research are that industrialisation remains one of the important tools of economic transformation in Southern Africa, as evidenced by the efforts of the countries to develop and implement the RISDP. Successful implementation of the industrialisation strategies in the countries of Southern Africa is one of the clear pathways to economic development. At the continental level, the AfCFTA and Agenda 2063 aims to reverse the continent's deindustrialisation and use the agreement to grab the manufacturing opportunities that come with the implementation of the Agreement. At the global level industrialisation is the number nine goal of the Sustainable Development Goals. Therefore, the call for industrialisation in Southern Africa has become more pressing issue to attain the development of its people.

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