Long-run cointegration between foreign direct investment, direct investment and unemployment in South Africa

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LONG-RUN COINTEGRATION BETWEEN FOREIGN DIRECT INVESTMENT, DIRECT INVESTMENT AND UNEMPLOYMENT IN SOUTH AFRICA

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ABSTRACT: The primary objective of this paper is to investigate the relationship between foreign direct investment, domestic investment and unemployment in South Africa. Our mode of empirical investigation is the autoregressive distributive lag (ARDL) cointegration model which provides the advantage of accommodating for a mixture of levels stationary and difference stationary time series variables and is applied to quarterly data collected between 1970 and 2014. Our empirical results point to the existence of a negative effect of domestic investments on unemployment levels whereas foreign direct investment appears to have no significant effect on reducing unemployment levels. Collectively, these results hold crucial implications for South African policymakers.

Keywords: FDI; domestic investment; unemployment; ARDL; cointegration; South Africa; developing country.

JEL Classification Code: C22; C32; E22; E24.

1 INTRODUCTION

South Africa's democratic elections of 1994 stands out as the singular, most prominent political and economic historic landmark that the country has ever experienced. Having previously faced periods of severe social and economic distress, as economic sanctions placed on the former Apartheid government which virtually resulted in a complete withdrawal of foreign direct investment (FDI) from the country. Nevertheless, since 1994 FDI began to increase as sanctions were lifted off the economy and the newly-elected African National Congress (ANC) government embarked on a series of large scale expenditure programmes aimed at eradicating the social ills inherited by the former Apartheid rule. Part and parcel of these policies programmes were the creation of a conducive environment for domestic and foreign direct investment, lower unemployment and improved economic growth rates.

Up-to-date, unemployment performance appears to be the most problematic concern for South African policymakers as the country is hailed as boasting one of the world's highest youth unemployment rates. Nonetheless, policymakers have continued to engage in expenditure programmes with the new growth path (NGP) and the National Development Plan (NDP) being the current fiscal blueprint which were both adopted subsequent to the global recession period of 2009. On the monetary side, the inflation targeting regime has ensured that inflation has been kept between 3 and 6 percent and yet is highly debatable on whether the regime has created a conducive environment for domestic and foreign direct investment, which in turn can be instrumental in reducing unemployment. The literature has not reached a unified consensus on the empirical relationship between the three variables.

In our study, we investigate the relationship between domestic investment, FDI and unemployment for the South African economy between 1970 and 2014 using the autoregressive distributive lag (ARDL) model of Pesaran et al. (2001). We consider our study as being worthwhile for a number of reasons. Firstly, previous empirical studies have either directly or indirectly focused on the relationship between direct investment and unemployment or between FDI and unemployment, but no previous studies, to the best of our knowledge, has

examined the effect of both domestic and FDI on unemployment. Secondly, many recent studies have found that domestic investment exerts an insignificant effect on economic growth or unemployment for South African data (Phiri, 2017), a result which may be attributed to the common problem of omission of a relevant variable such as FDI. Lastly, if a relationship between investment, FDI and unemployment is established for the South Africa, policy makers can adjust their policy programmes to cater for constraints in achieving lower unemployment rates in that country and that will directly enhance productivity of the country. That way, South Africa can maintain its position as the hub of the African continent.

Against this backdrop, we structure the remainder of the paper as follows. The next section of the article provides a brief theoretical and empirical review of the associated literature. The third part of the paper presents the data and outlines the ARDL methodology used in the empirical study. The fourth section present the empirical findings of the study whereas the fifth section concludes the study.

2 LITERATURE REVIEW

2.1 Theoretical review

Following the emergence and popularization of dynamic growth theory in the 1960's, the engine of such growth within the dynamic economy has remained the evolution of capital stock or investment. The neo-classical models of Solow (1965) represents the blueprint of growth theory and one of the most prominent features of the Solow growth model has been the 'golden rule of capital accumulation'. Generally this rule postulates that in order to keep consumption per capita constant along a balanced growth path requires that marginal product of capital should be equal to the natural rate of growth plus the rate of capital depreciation (Mankiw, Romer and Weil, 1992). Therefore if the marginal product of capital is found to be lower than the natural rate of growth, this implies that an addition to the capital stock can raise consumption. Conversely, if the rate of return to capital exceeds the natural rate of growth, then an addition to the capital stock raises output by less than the marginal investment requirement

and hence lowers consumption (Dornbusch and Frenkel, 1973). Ultimately, the basic neo-classical model predicts that the combination of capital accumulation and technological progress will lead to growth in output and consumption over the steady-state.

Nevertheless, much has been documented concerning the theoretical placement of domestic investment on unemployment within the neo-classical framework and in general such a relationship within the neo-classical model has been ill defined. In fact one of the most prominent contributions to the theoretical literature comes courtesy of Layard et al. (1991) who developed an economy with wage bargaining dynamics between firms and labour unions and operates under a Cobb-Douglas production technology such that the elasticity of capital labour substitution is equal to unity. Under such a setting, capital accumulation does not exert any influence on unemployment. An important policy implication derived from the works of Layard et al. (1991) is that policymakers cannot reduce unemployment via capital inducing programmes. However, these dynamics were subsequently challenged by Rowthorn (1995, 1999) who showed that within a CES production technology with an elasticity substitution of unity, investment is negatively correlated with unemployment since weaker capital accumulation is associated with a lower wage and consequentially higher unemployment. Similarly, Yabuuchi (1999) finds that under constant returns-to-scale technologies with diminishing marginal products investment reduces urban unemployment as FDI flows to more multinational corporations which are established in more urban areas.

On the other end of the spectrum, the role of FDI within the steady-state dynamics under the neo-classical paradigm has not been expounded on much since the neo-classical model operates under the assumption of diminishing returns to capital. In particular, FDI can only affect steady-state growth dynamics in the short-run, as the recipient economy would only converge to its steady-state as if FDI had never taken place (De Mello, 1997). As a consequence, the theoretical support of FDI had no explicit role in dynamic growth theory and has been typically centred around the eclectic paradigm of international production which is configured to three forces namely, i) the net competitive ownership MNC's possess vis-à-vis foreign firms ii) the extent to which firms perceive it to be in their best interests to internalize

the markets for the generation and/or the use of these assets; and by so doing add value to them; and iii) the extent to which firms choose to locate these value-adding activities outside their national boundaries (Dunning, 1973).

Nevertheless, great strides were made in growth theory as endogenous growth theorists emerged as the new school of thought and has since dominated the exposition. In essence, endogenous growth theories describe economic growth which is generated by factors within the production process, for example, economies of scale, increasing returns or induced technological change as opposed to outside (exogenous) factors such as increases in population. As a consequence, within an endogenous growth model FDI can be shown to reduce unemployment endogenously since it generates returns to production via externalities and productivity spillovers (de Mello, 1997). For instance, Brander and Spencer (1987) treats unemployment short-run cyclical problem as exerting an influence on tax and tariff and consequentially on FDI. Specifically, multinational firms have the choice of adopting an exporting or investment regime which is influenced by tax and tariff policies and in circumstances were foreign firms choose to invest in domestic country is accompanied with lower unemployment levels. Others who found similar negative relationship between FDI and unemployment under endogenous growth setting are Fung et al. (1999) and Mitra and Ranjan (2010).

2.2 Empirical review

Due to the novelty of our study there is, to the best of our knowledge, no previous empirical studies which have investigated the simultaneous effects of FDI and direct investment on unemployment. Therefore our literature review primarily focuses on two closely related strands of empirical literature. The first strand of empirical literature investigates the relationship between FDI on unemployment and can further segregated into three sub-categories of empirical works, being those which focus on industrialized countries (Seyf (2000) for 4 EU countries, Alexiou and Pitelis (2003) for 13 European countries, Palat (2011) for Japan, Strat et al. (2014)for 13 EU members, Stamatiou, and Dritsakis (2014) for Greece,

Schmerer (2014) for 19 OECD countries), those concerned with transition, emerging or developing economies (Chang (2005, 2007) for Taiwan, Subramaniam (2009) for Malaysia, Aktar et al. (2009) for Turkey, Balcerzak and Zurek (2011) for Poland, Shaari et al. (2012) for Malaysia, Mucuk and Demirsel (2013) for 7 developing countries, Kurtovic et al. (2015) for Western Balkans countries, Irpan et al. (2016) for Malaysia, Haddad (2016) for Jordan, Zdravkoic et al. (2017) for 17 transition economies and Yildirim and Yildirim (2017) for Turkey) and those which include a mixture of developing and industrialized economies in their analysis (Lin and Wang (2008) for 19 industrialized and 33 developing countries).

In quickly scrutinizing through these studies we note that the studies of Alexiou and Pitelis (2003), Chang (2007), Lin and Wang (2008), Balcerzak and Zurek (2011), Palat (2011), Shaari et al. (2012), Schmerer (2014), Kurtovic et al. (2015), Irpan et al. (2016), Haddad (2016) and Yildirim and Yildirim (2017) all find a negative relationship between FDI and unemployment whereas the studies of Seyf (2000), Chang (2005), Aktar et al. (2009), Subramaniam (2009), Mucuk and Demirsel (2013), Strat et al. (2014), Stamatiou, and Dritsakis (2014), Zdravkoic et al. (2017) all found an insignificant relationship or inconclusive evidence, whilst the works of Mucuk and Demirsel (2013) being the sole study which finds a positive relationship between the variables. In summary, concerning industrialized economies FDI appears to have a negative effect on unemployment whereas for emerging or developing countries the evidence is more inconclusive.

The second strand of studies focuses on the relationship between direct investment and unemployment and the available literature is strictly limited to industrialized economies with the works of Arestis and Mariscal (2000) for Germany and the UK, Miaouli (2001) for 5 South-European countries, Malley and Moutos (2001) for 17 OECD countries, Herbettsson and Zoega (2002) for 17 industrialised countries, Stockhammer (2004) for five of the G7 countries, Karanassou et al. (2008) for 3 European countries, Driver and Munoz-Bugarin (2010) for the UK and 7 EU countries, Martinez-Canete and Palacio-Vera (2011) for Canada, representing prominent examples. We note that the studies of Arestis and Mariscal (2000), Miaouli (2001), Malley and Moutos (2001), Herbettsson and Zoega (2002), Stockhammer (2004), Karanassou

et al. (2008), Martinez-Canete and Palacio-Vera (2011) find a negative relationship between domestic investment and unemployment whereas the sole study of Driver and Munoz-Bugarin (2010) finding a positive relationship between the two variables. Collectively and for the sake of convenience, a summary of the reviewed empirical literature in this sub-section of the paper has been provided for in Table 1 below.

Table 1: Summary of reviewed literature

FDI AND UNEMPLOYMENT				
AUTHOR	PERIOD OF STUDY	COUNTRY(S)	METHODOLOGY	RESULTS
Seyf (2000)	1996	4 EU countries	Longitudinal linear and non-linear estimates	FDI has no effect on unemployment
Alexiou and Pitelis (2003)	1961-1998	13 European countries	FE	FDI reduces unemployment in European countries
Chang (2005)	1981-2003	Taiwan	VAR	FDI has an insignificantly related on unemployment.
Chang (2007)	1981-2003	Taiwan	VAR	FDI reduces unemployment in Taiwan
Lin and Wang (2008)	2000-2004	19 industrialized and 33 developing countries	Panel OLS and GLS	FDI reduces unemployment in developing countries but insignificant in industrialized economies
Subramaniam (2009)	1975-2004	Malaysia	VECM	FDI has an insignificantly related on unemployment.
Aktar et al. (2009)	2000-2007	Turkey	VAR	FDI has an insignificantly related on unemployment.
Balcerzak and Zurek (2011)	1995-2009	Poland	VAR	FDI has a negative effect on unemployment.
Palat (2011)	1983-2009	Japan	Correlation analysis	FDI has a negative effect on unemployment.
Shaari et al. (2012)	1980-2010	Malaysia	OLS	FDI has a negative effect on unemployment.
Mucuk and Demirsel (2013)	1981-2009	7 developing countries	DOLS and FMOLS	Positive relationship between FDI and unemployment for 2 countries, negative relationship for 1 country and the relationship is insignificant for remaining countries.
Strat et al. (2014)	1991-2012	13 EU member countries	Toda-Yamamoto causality tests	6 of the countries should no evidence of causality between FDI and unemployment whereas the remaining countries found causality in one direction.
Stamatiou, and Dritsakis (2014)	1970-2012	Greece	ARDL	FDI is negatively and insignificantly related with unemployment.
Schmerer (2014)	1980-2003	19 OECD countries	OLS, FE, GLS and GMM	FDI assists in reducing unemployment
Kurtovic et al. (2015)	1998-2012	Western Balkans countries	VECM	FDI has a negative effect on unemployment.
Irpan et al. (2016)	1980-2012	Malaysia	ARDL	There is a negative relationship between FDI and unemployment.

Haddad (2016)	1998-2015	Jordan	OLS	FDI has a negative effect on unemployment.
Zdravkoic et al. (2017)	2000-2014	17 transition economies	FMOLS and DOLS	No long-run relationship between FDI and unemployment.
Yildirim and Yildirim (2017)	2005-2016	Turkey	SVAR	Positive shocks to investment reduce unemployment rates.
DOMESTIC INVESTMENT AND UNEMPLOYMENT				
AUTHOR	PERIOD OF STUDY	COUNTRY(S)	METHODOLOGY	RESULTS
Arestis and Mariscal (2000)	1966-1995	Germany and the UK	Cointegration VAR	Investment reduces unemployment
Miaouli (2001)	1954-1995	5 South-European countries	ARDL	Investment reduces unemployment
Malley and Moutos (2001)	1961-1995	17 OECD countries	ARDL and NLS	Faster rate of capital accumulation will reduce unemployment
Herbettsson and Zoega (2002)	1960-1997	17 industrialised countries	Panel fixed effects	Negative relationship between investment and unemployment
Stockhammer (2004)	1960-1995	5 of the G7 countries	SUR	Negative relationship between investment and unemployment
Karanassou et al. (2008)	1973-2005	3 European countries	3SLS	Reduced capital stock explained increased unemployment rates in European countries
Driver and Munoz-Bugarin (2010)	1985-2007	United Kingdom and 7 EU countries	Cointegration and panel cointegration analysis	Domestic investment has a negative impact on the labour market and positive effect on unemployment.
Martinez-Canete and Palacio-Vera (2011)	1976-2003	Canada	FMOLS	Negative relationship between capital investment and employment.
Iacovoiu (2012)	2004-2012	Romania	Correlation analysis	There is a positive relationship between net investment and unemployment.

3 ARDL METHODOLOGY

3.1 Empirical strategy

Our empirical strategy consists of using two bivariate and four multivariate empirical specifications. The bivariate specifications separately regresses FDI and direct investment on unemployment as respectively shown in equations 1 and 2, respectively i.e.

$$UNEM = \alpha_1 + \alpha_2 FDI_t + \varepsilon_t \quad (1)$$

$$UNEM = \alpha_1 + \alpha_2 DI_t + \varepsilon_t \quad (2)$$

Where $unem_t$ is the unemployment rate, FDI_t is a measure of foreign direct investment and e_t is a well behaved error term. On the other hand, the first multivariate regression simultaneously regresses both FDI and direct investment i.e.

$$UNEM = \alpha_1 + \alpha_2 FDI_t + \alpha_3 DI_t + \varepsilon_t \quad (3)$$

The second multivariate equation regresses direct investment and a vector of control variables, X_t, on the unemployment rate i.e.

$$UNEM = \alpha_1 + \alpha_2 FDI_t + \alpha_3 X_t + \varepsilon_t \quad (4)$$

The third multivariate equation regresses FDI and other control variables on the unemployment rate i.e.

$$UNEM = \alpha_1 + \alpha_2 FDI_t + \alpha_3 X_t + \varepsilon_t \quad (5)$$

The last multivariate equation regresses FDI, direct investment and other control variables on the unemployment rate i.e.

$$UNEM = \alpha_1 + \alpha_2 FDI_t + \alpha_3 DI_t + \alpha_3 X_t + \varepsilon_t \quad (6)$$

Concerning the vector of conditioning variables, our study employs three conditioning variables of the unemployment rate. Our first conditioning variable is government size (i.e. GE_t) of which this variable is expected to produce a negative effect on unemployment since increased government expenditure reflects increased spending on social-economic programmes aimed at directly reducing the unemployment rate. The second conditioning variable is the inflation rate (i.e. $INFL_t$), of which according to the traditional Phillips cure postulation is expected to have trade-off effects with unemployment. Our third conditioning

variable is the terms of trade variable (i.e. TOT_t), of which according to Heckscher-Ohlin model should be inversely correlated with unemployment especially if the economy under investigation is labour-abundant.

3.2 *Unit root testing procedures*

Before introducing our ARDL empirical specifications, it is important that we out5line the unit root tests that will be used to examine the integration properties of the time series. This is important because the ARDL cointegration is only suitable for a set of variables which consist of both levels stationary ad difference stationary variables and does not accommodate variables integrated of order I(2) or higher. In our study, we use three unit root tests namely, the ADF, PP and DF-GLS tests. The ADF tests augments the Dickey-Fuller test to cater for uncorrelated errors and is represented by the following test regression:

$$\Delta y_t = \alpha y_{t-1} + \sum_{i=1}^{p} \Psi_i \Delta y_{t-i} + e_t \quad (7)$$

Where the null hypothesis of a unit root is tested as H_0: $\alpha = 0$ against the alternative of a stationary process (i.e. H_1: $\alpha \neq 0$). The ADF tests statistics is computed as:

$$ADF_t = \alpha^*/SE(\alpha^*) \quad (8)$$

Where α^* is the actual coefficient estimate of α and $SE(\alpha^*)$ is the standard error of the coefficient estimate. The second unit root test used, the PP test, involves an automatic correction to the DF test which allow for autocorrelated and heteroscedasticity in the errors. To initiate the PP unit root test, the following test regression is run:

$$\Delta y_t = \beta' D_T + \alpha y_{t-1} + u_t \quad (9)$$

Where u_t is a stationary process which may be heteroscedastic. The null hypothesis of a unit root is tested as H_0: $\alpha = 0$ and is tested using the following PP tests static is formulated/computed as:

$$t_\alpha = t_\alpha \left(\frac{\gamma_0}{F_0}\right)^{1/2} - \frac{T(F_0 - \gamma_0)(se(\hat{\alpha}))}{2f^{1/2}s} \quad (10)$$

Where α is the estimate, t_α and the t- ratio of α, $se(\hat{\alpha})$ is the coefficient standard error, s is the standard error of the test regression, γ_0 is a constant estimate of the error variance and F_0 is the estimator of the residual spectrum at frequency zero. Both ADF and PP unit root tests have certain empirical limitations. Firstly, the aforementioned unit root tests exert low powers in distinguishing between a unit root and a close-to-unit-root process. As such, the unit root null hypothesis may be accept the presence of a unit may be accepted due to insufficient information (Brooks, 2008: 330). Therefore, we further employ the DF-GLS unit root test of Elliot et. al. (1996) which is essentially the Dickey-Fuller test applied without a deterministic component to the regression residuals and relies of generalized least squares (GLS) estimates from the following test regressions:

$$\Delta y_t^d = \alpha y_{t-1}^d \sum_{i=1}^{p} \Psi_i \Delta y_{t-1}^d + e_t \quad (11)$$

Where y_t^d is the detrended time series. As with the ADF test, the unit root null hypothesis under the DF-GLS test is tested as H_0: $\alpha = 0$ against the stationary null hypothesis of H_1: $\alpha \neq 0$.

3.3 *ARDL cointegration analysis*

ARDL has gained significant popularity in the past few years due to the advantages it carries over other methods of cointegration such as the vector autoregressive (VAR) model and vector error correction model (VECM). For instance, the ARDL model can be applied to variables which are integrated of order I (0) or I (1) or both. Furthermore, the ARDL model is

more efficient in the case of small sample cases. In our study, we transform our baseline regression 1 to 6 into the following ADL regression equations:

$$\Delta unem_t = \sigma_0 + \sum_{i=0}^{p} \sigma_1 \Delta unem_{t-i} + \sum_{i=0}^{p} \sigma_2 \Delta FDI_{t-i} + \beta_1 \Delta unem_{t-i} + \beta_2 \Delta FDI_{t-i} + e_t \quad (12)$$

$$\Delta unem_t = \sigma_0 + \sum_{i=0}^{p} \sigma_1 \Delta unem_{t-i} + \sum_{i=0}^{p} \sigma_2 \Delta DI_{t-i} + \beta_1 \Delta unem_{t-i} + \beta_2 \Delta DI_{t-i} + e_t \quad (13)$$

$$\Delta unem_t = \sigma_0 + \sum_{i=0}^{p} \sigma_1 \Delta unem_{t-i} + \sum_{i=0}^{p} \sigma_2 \Delta FDI_{t-i} + \sum_{i=0}^{p} \sigma_3 \Delta DI_{t-i} + \beta_1 \Delta unem_{t-i} + \beta_2 \Delta FDI_{t-i} + \beta_3 \Delta DI_{t-i} + e_t \quad (14)$$

$$\Delta unem_t = \sigma_0 + \sum_{i=0}^{p} \sigma_1 \Delta unem_{t-i} + \sum_{i=0}^{p} \sigma_2 \Delta FDI_{t-i} + \sum_{i=0}^{p} \sigma_3 \Delta GE_{t-i} + \sum_{i=0}^{p} \sigma_4 \Delta INFL_{t-i} + \sum_{i=0}^{p} \sigma_5 \Delta TOT_{t-i} + \beta_1 \Delta unem_{t-i} + \beta_2 \Delta FDI_{t-i} + \beta_3 \Delta DI_{t-i} + \beta_4 \Delta GE_{t-i} + \beta_5 \Delta INFL_{t-i} + \beta_6 \Delta TOT_{t-i} + e_t \quad (15)$$

$$\Delta unem_t = \sigma_0 + \sum_{i=0}^{p} \sigma_1 \Delta unem_{t-i} + \sum_{i=0}^{p} \sigma_2 \Delta DI_{t-i} + \sum_{i=0}^{p} \sigma_3 \Delta GE_{t-i} + \sum_{i=0}^{p} \sigma_4 \Delta INFL_{t-i} + \sum_{i=0}^{p} \sigma_5 \Delta TOT_{t-i} + \beta_1 \Delta unem_{t-i} + \beta_2 \Delta DI_{t-i} + \beta_3 \Delta DI_{t-i} + \beta_4 \Delta GE_{t-i} + \beta_5 \Delta INFL_{t-i} + \beta_6 \Delta TOT_{t-i} + e_t \quad (16)$$

$$\Delta unem_t = \sigma_0 + \sum_{i=0}^{p} \sigma_1 \Delta unem_{t-i} + \sum_{i=0}^{p} \sigma_2 \Delta fDI_{t-i} + \sum_{i=0}^{p} \sigma_3 \Delta DI_{t-i} + \sum_{i=0}^{p} \sigma_4 \Delta GE_{t-i} + \sum_{i=0}^{p} \sigma_5 \Delta INFL_{t-i} + \sum_{i=0}^{p} \sigma_6 \Delta TOT_{t-i} + \beta_1 \Delta unem_{t-i} + \beta_2 \Delta FDI_{t-i} + \beta_3 \Delta DI_{t-i} + \beta_4 \Delta DI_{t-i} + \beta_5 \Delta GE_{t-i} + \beta_6 \Delta INFL_{t-i} + \beta_7 \Delta TOT_{t-i} + e_t \quad (17)$$

Where σ_i's are the short-run coefficients, β_i's are the long run coefficients and e_t are the well behaved residual terms. The bounds test for cointegration is performed by testing the following joint null hypothesis of no cointegration effects, $\beta_1 = \beta_2 = \ldots. = \beta_i = 0$, and is tested against the alternative hypothesis of cointegration effects (i.e. $\beta_1 \neq \beta_2 \neq \ldots. \neq \beta_i \neq 0$). This test is tested using a F-statistic and there are three possible outcome from these tests. Firstly

cointegration effects are confirmed if the computed F0statitics is found exceed the upper bound critical value. Secondly, cointegration effects are denied if the statistics is below the lower bound critical value. Lastly, there evidence is assumed to be inconclusive if the computed statistics lies between the lower and upper bounds of the critical values. According to the Granger representation theorem, once cointegration effects are established between a set of time series variables, then there exists a corresponding error correction mechanism. In our study, the following unrestricted error correction models (UECM) are formulated in correspondence to the above ARDL specifications:

$$\Delta unem_t = \sigma_0 + \sum_{i=0}^{p} \sigma_1 \Delta unem_{t-i} + \sum_{i=0}^{p} \sigma_2 \Delta FDI_{t-i} + \Psi ECT_{t-1} + e_t \quad (18)$$

$$\Delta unem_t = \sigma_0 + \sum_{i=0}^{p} \sigma_1 \Delta unem_{t-i} + \sum_{i=0}^{p} \sigma_2 \Delta DI_{t-i} + \Psi ECT_{t-1} + e_t \quad (19)$$

$$\Delta unem_t = \sigma_0 + \sum_{i=0}^{p} \sigma_1 \Delta unem_{t-i} + \sum_{i=0}^{p} \sigma_2 \Delta FDI_{t-i} + \sum_{i=0}^{p} \sigma_3 \Delta DI_{t-i} + \Psi ECT_{t-1} + e_t \quad (20)$$

$$\Delta unem_t = \sigma_0 + \sum_{i=0}^{p} \sigma_1 \Delta unem_{t-i} + \sum_{i=0}^{p} \sigma_2 \Delta FDI_{t-i} + \sum_{i=0}^{p} \sigma_3 \Delta GE_{t-i} + \sum_{i=0}^{p} \sigma_4 \Delta INFL_{t-i} + \sum_{i=0}^{p} \sigma_5 \Delta TOT_{t-i} + \Psi ECT_{t-1} + e_t \quad (21)$$

$$\Delta unem_t = \sigma_0 + \sum_{i=0}^{p} \sigma_1 \Delta unem_{t-i} + \sum_{i=0}^{p} \sigma_2 \Delta DI_{t-i} + \sum_{i=0}^{p} \sigma_3 \Delta GE_{t-i} + \sum_{i=0}^{p} \sigma_4 \Delta INFL_{t-i} + \sum_{i=0}^{p} \sigma_5 \Delta TOT_{t-i} + \Psi ECT_{t-1} + e_t \quad (22)$$

$$\Delta unem_t = \sigma_0 + \sum_{i=0}^{p} \sigma_1 \Delta unem_{t-i} + \sum_{i=0}^{p} \sigma_2 \Delta fDI_{t-i} + \sum_{i=0}^{p} \sigma_3 \Delta DI_{t-i} + \sum_{i=0}^{p} \sigma_4 \Delta GE_{t-i} + \sum_{i=0}^{p} \sigma_5 \Delta INFL_{t-i} + \sum_{i=0}^{p} \sigma_6 \Delta TOT_{t-i} + \Psi ECT_{t-1} + e_t \quad (23)$$

Where ECT_{t-1} is the error correction term which measures the speed of adjustment back to steady-state equilibrium following a shock to the system.

4 DATA AND EMPIRICAL RESULTS

4.1 Data description and unit root tests

The empirical data used in our study has been collected from the World Bank and South African Reserve Bank (SARB) online database and has been collected on an annual basis for a period ranging from 1970 to 2014. The dataset consists of the unemployment rate of all persons (i.e. UNEM), the growth in foreign direct investment inflows (i.e. FDI), the ratio of gross fixed capital formation to GDP (i.e. DI), the percentage change in CPI inflation (i.e. INFL), the ratio of government expenditure to GDP (i.e. GOV_EXP) and the terms of trade (i.e. TOT). As part of a preliminary analysis of the utilized time series, we report the summary statistics and correlation matrix of the time series variables in Table 2 whilst the time series plots are presented in Figure 1.

The basic descriptive statistics shown in Panel A of Table 2 depict average values of 24.00, 1.46, 18.31, 26.48, 6.28 and 1.90 for unemployment, FDI, domestic investment government size, inflation and terms of trade, respectively. We also note that the corresponding standard deviations of the time series are of low value hence implying that the variables are not too volatile. The reported Jarque-Bera statistics imply that both unemployment and FDI are not normally distributed whereas the remaining time series are normally distributed. On the other hand, the reported correlation matrix reported in Panel B of Table 2 produces a number of plausible results. For instance we find negative correlations between unemployment and domestic investment, government size, inflation as well as terms of trade which all concur with the predictions of conventional growth theory. However, this observation of a positive correlation between FDI and unemployment is quite puzzling in the sense of being contrary to conventional theory hence warranting a more formal investigation into the cointegration relationship amongst the time series.

Table 2: Descriptive statistics and correlation matrix

	UNEM	FDI	DI	GOV_EXP	INFL	TOT
Panel A: Descriptive statistics						
Mean	24.00	1.46	18.31	26.48	6.28	1.90
Median	24.67	0.99	18.09	26.40	5.86	2.10
Maximum	27.14	5.98	23.51	29.90	11.54	7.80
Minimum	16.90	0.23	15.15	23.30	1.39	-4.00
Std. Dev.	2.37	1.34	2.23	2.06	2.17	3.33
Jarque-Berra	9.30	25.51	1.06	1.53	0.42	0.89
Probability	0.00	0.00	0.59	0.46	0.81	0.64
Panel B: Correlation matrix						
UNEM	1.00					
FDI	0.10	1.00				
DI	-0.13	-0.22	1.00			
GOV_EXP	-0.08	-0.16	0.60	1.00		
INFL	-0.42	0.21	0.19	-0.01	1.00	
TOT	-0.14	-0.13	0.06	-0.09	-0.13	1.00

Prior to performing our ARDL cointegration analysis, it is imperative that we test for unit roots in the time series variables. To recall, this is important since the ARDL methodology requires all time series variables to be integrated of either order I(0) or I(1) but not of order I(2) or higher. Therefore, to ensure that our time series variables are suitable for the ARDL model we perform ADF, PP and DF-GLS unit root tests on the variables. The results of this empirical exercise are reported in Table 3 below and each test performed with i) an intercept and ii) a trend. As can be observed at face value, the results obtained from the unit root tests present a variety of mixed results between the variables and within the different unit root testing procedures for the same variables.

To be more precise, when the ADF test is performed on the time series with either a drift or trend, only direct investment and government size fail to reject the unit root null hypothesis at a 10 percent significant level. However, when the PP tests are employed with

either a drift or a trend the unemployment rate, direct investment and government size fail to reject the unit root hypothesis at all critical levels whereas the other time series remain stationary in their levels and first difference. Furthermore, the DF-GLS test indicate that only the unemployment and government size variables contain a unit root in their levels but are I(0) in their first differences. Regardless of this mixture of empirical evidences presented, the important conclusion to be drawn from the unit root tests is that none of the variables are found to be integrated of an order higher than I(1) hence permitting the use of these variables in modelling our ARDL cointegration regressions.

Table 3: Unit Root Tests results

	ADF		PP		DF-GLS	
	Intercept	trend	intercept	trend	intercept	trend
UNEM	-3.10	-3.00	-1.94	-1.82	-1.58	-2.69
ΔUNEM	-4.95	-5.39	-1.94	-5.13	-3.74	-4.64
FDI	-4.82	-4.67	-5.64	-5.37	-4.56	-4.86
ΔFDI	-5.92	-5.82	-5.64	-5.37	-4.56	-4.86
DI	-1.83	-2.65	-1.58	-1.94	-1.80	-2.80
ΔDI	-3.16	-3.08	-3.16	-3.07	-3.22	-3.23
GE	-0.05	-1.21	-0.31	-1.21	-0.23	-1.21
ΔGE	-3.75	-4.13	-3.75	-4.13	-3.82	-4.34
INFL	-3.92	-3.91	-2.91	-2.70	-3.47	-4.02
ΔINFL	-4.88	-4.91	-6.11	-6.77	-5.03	-5.24
TOT	-3.95	-3.85	-3.95	-3.85	-4.03	-4.03
ΔTOT	-7.45	-7.24	-9.85	-10.53	-6.71	-7.49
			Critical Values			
1%	-3.81	-4.50	-3.77	-4.44	-2.67	-3.77
5%	-3.02	-3.66	-3.00	-3.63	-1.96	-3.19
10%	-2.65	-3.27	-2.64	-3.25	-1.61	-2.89

Notes: "***", "**", "*" denote the 1 percent, 5 percent and 10 percent significance levels. Denotes a first difference operator.

4.2 ARDL cointegration analysis

In light of the realization that all-time series variable are either integrated of order I(0) or I(1) and not of any higher order, permits us to proceed with ARDL modelling process. Therefore, as a next step, we perform our bounds test on our six empirical specifications and report the obtained results in Table 4 below. For regressions F(unem| fdi, di), F(unem| fdi), F(unem| di), F(unem| fdi, inf, gov, tot), F(unem| di, inf, gov, tot) and F(unem| fdi, di, inf, gov, tot). We obtain F-statistics of 10.93, 2.75, 3.65, 12.41, 31.76 and 24.73 and we note that each of these test statistics exceed the upper bound 90 percent critical bound, hence providing evidence of cointegration effects within the formulated regressions. Given this positive result we proceed to estimate the full long-run and short run ARDL estimates.

Table 4: Bounds test for ARDL cointegration effects

Regression specification	F-statistic	95% lower bound	95% upper bound	90% lower bound	90% upper bound	decision
F(unem| fdi, di)	10.93	2.56	3.49	2.2	3.09	cointegrated
F(unem| fdi)	2.75	2.56	3.49	2.2	3.09	cointegrated
F(unem| di)	3.65	2.56	3.49	2.2	3.09	cointegrated
F(unem| fdi, inf, gov, tot)	12.41	2.56	3.49	2.2	3.09	cointegrated
F(unem| di, inf, gov, tot)	31.76	2.56	3.49	2.2	3.09	cointegrated
F(unem| fdi, di, inf, gov, tot)	24.73	2.56	3.49	2.2	3.09	cointegrated

The long run ARDL estimates for our six regressions are collectively reported in Panel A in Table 5. As can be observed when both FDI and domestic investment are individually or collectively regressed on unemployment without controlling for other determinants of unemployment (i.e. regressions/equations 1 through to 3), the effects of both variables on unemployment are insignificant. However, after including other control variables, as shown in regressions 4 through 6, the regression results be more optimistic. With specific reference to regression 5 and 6, we note that the negative and statically significant influences of domestic investment on unemployment whereas FDI remains statistically insignificant in both regressions.

Concerning the explanatory variables, we firstly note a positive and statistically significant coefficient on the inflation variable in regressions 5 and 6, a finding which goes contrary to the Phillips curve which hypothesizes of a negative trade-off between the two variables. We also find a negative coefficient on the terms of trade variable, albeit only statically significant at a 10 percent level in regression 6. This particular result emphasizes the positive employment effects of trade as has been previously advocated for in the study of Dutt et al. (2009) and Hasan et al. (2012). Lastly, we observe a positive effect of government size on unemployment, a finding which is contradictory to Wagner's law but yet confirmed in the study of Chipaumire et al. (2014) for similar South African data.

In turning our attention to the short-run dynamics as report in Panel B of Table 5, significant coefficient estimates are consistently shown throughout the regressions for direct investment and inflation which the later variable produce a negative effect on unemployment whereas the later variable produces a positive effect and both findings are consistent with conventional theory. The significance of the remaining variables under the UECM model vary from one regression to the next are mixed yet what is most important it that the error correction terms in all estimates regression produce significant estimates ranging from -0.37 to -0.49 thus implying that between 37 to 49 percent of all deviations from the steady state as caused by exogenous shocks to the system. This later results further implies long-run causality between the time series variables.

Table 5: Long run ARDL estimates

VARIABLES	f(unem| fdi, di)	f(unem| fdi)	f(unem| di)	f(unem| fdi, inf, gov, tot)	f(unem| di, inf, gov, tot)	f(unem| fdi, di, inf, gov, tot)
Panel A: Long-run estimates						
UNEM(-1)*	-0.51	-1.17	-0.44	-0.50	-0.35	-0.48
	(0.00)***	(0.02)	(0.01)**	(0.00)***	(0.00)***	(0.00)***
FDI	-0.03	-0.26	-	0.50	-	0.09
	(0.84)	(0.30)		(0.26)		(0.76)
DI	-0.09		-0.06	-	-0.17	-0.19
	(0.31)		(0.60)		(0.06)*	(0.05)*
GE	-	-	-	0.19	0.23	0.10
				(0.10)	(0.02)**	(0.28)
INFL	-	-	-	0.21	0.41	0.25
				(0.32)	(0.00)***	(0.03)**
TOT	-	-	-	-0.04)	-0.01	-0.15
				(0.64)	(0.87)	(0.03)**
Panel B: Short-run estimates						
ΔUNEM(-1)	-	0.62	0.19	-	-0.19	
		(0.11)	(0.17)		(0.02)**	
ΔFDI	-0.09	-0.26	-	-0.04	-	-0.12
	(0.30)	(0.12)				(0.04)*
ΔDI	-0.36	-	-0.26	-	-0.31	-0.38
	(0.02)**		(0.09)*		(0.00)***	(0.00)***
ΔGE	-	-	-	-0.24	-0.13	0.17
				(0.01)**	(0.33)	(0.20)
ΔINFL	-	-	-	0.03	0.16	0.22
				(0.00)***	(0.00)***	(0.00)***
ΔTOT	-	-	-	-0.03	-0.01	-0.06
				(0.46)	(0.66)	(0.03)*
ECT(-1)	-0.51	-0.47	-0.44	-0.49	-0.35	-0.48
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***

Notes: "***", "**", "*" denote the 1 percent, 5 percent and 10 percent significance levels. First difference statistics reported in parentheses ().

4.3 Stability analysis and residual diagnostics

As a final part of our empirical process we conduct stability analysis on the estimated regressions as well as the diagnostic tests on regression residuals. The diagnostic analysis of residuals consists of the LM version tests for normality, serial correlation, heteroscedasticity and functional form. Based on the test statistics as reported in Table 6, all estimated regressions fail to detect serial correlation and heteroscedasticity whilst further advocating for normality and correct functional form of the regressions. On the other hand, our stability tests are conducted via CUSUM and SUSUM squares stability plots as presented in Figures 1 to 6 in the Appendix of the paper. As can be clearly observed, the results of both CUSUM and CUSUMSQ tests indicate the absence of instability in all estimated regressions seeing that the recursive estimates fall within the 5 percent critical bounds.

Table 6: Diagnostic tests on regression residuals

Equation	1	2	3	4	5	6
Normality	0.38	1.01	0.97	0.60	1.16	0.63
	(0.83)	(0.60)	(0.62)	(0.74)	(0.56)	(0.73)
Serial Correlation	0.57	1.78	0.26	1.00	1.33	4.57
	(0.58)	(0.26)	(0.78)	(0.41)	(0.32)	(0.05)
Heteroscedasticity	0.42	1.91	2.41	0.82	0.32	2.73
	(0.66)	(0.19)	(0.12)	(0.46)	(0.73)	(0.10)
Ramsey RESET	0.15	0.12	1.11	0.47	0.42	0.29
	(0.86)	(0.90)	(0.31)	(0.65)	(0.54)	(0.76)

5 CONCLUSIONS

The main objective of this present study is to investigate the empirical relationship between domestic investment, foreign direct investment and unemployment for the South African economy between 1970 and 2014. To this end we use a three stage empirical process. In the first stage of the process, we employ a battery of unit root testing procedures to investigate the stationarity properties of the time series. In the second stage, we formulate six

different estimation regressions and apply the variable test for cointegration to the variables. The third stage consists of estimating long-run and short-run ARDL models for the six regression whereas in the last stage we perform residual tests and stability analysis.

Our empirical estimates first of all confirm that the employed time series are all integrated of either order I(0) and I(1) variables, an observation that deems the time series suitable for ARDL cointegration analysis. The results from our bounds test provided concrete evidence of cointegation relations between the variables. The main empirical results reveal that whilst direct investment is negatively and significantly correlated with unemployment, on the other hand, FDI does not exert any significant effect son unemployment. Residual diagnostics confirm that the regressions satisfy the classical regressions assumptions implying that the reported results can be considered reliable in terms of interpretation.

Notably, there are some important policy implications that can be derived from our empirical findings. For starters, our results show that policymakers should prioritise on providing a conducive financial and economic environment for direct investment as this would assist in reducing unemployment. In practice, monetary policy authorities should ensure that inflation rates should be kept low and stable in order to ensure financial stability which in turn would encourage a conducive investing environment. On the other hand, fiscal authorities are advised to implement more large scale expenditure programmes aimed at directly increasing domestic investment in an effort to combat long-term unemployment. ON a cautionary note, our results further imply that FDI are currently not being direct towards reducing unemployment and thus policymakers should discover ways of directing FDI flows towards improving labour market conditions and ultimately improving employment levels.

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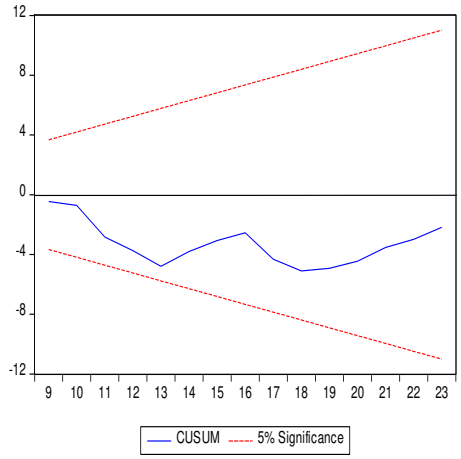
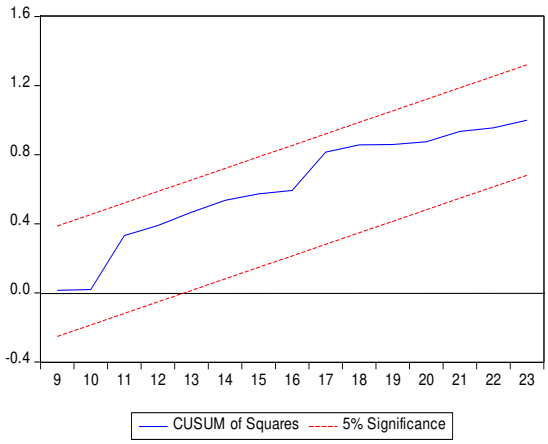
APPENDIX A: CUMSUM and CUSUMSQ plots for estimated regressions

Regression 1: f(UNEM | FDI, DI)

- Recursive estimates: CUSM TEST

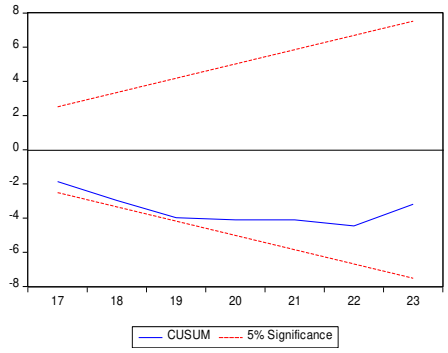


CUSUM SQUARES TEST

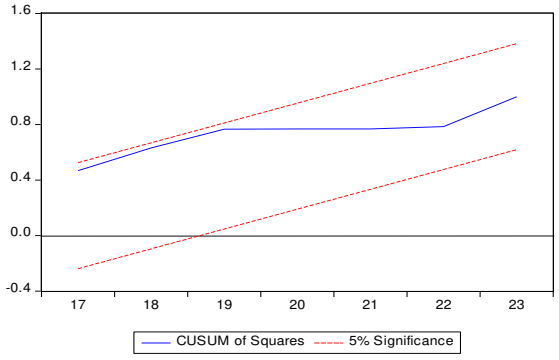


Regression 2: f(UNEM | FDI)

- Recursive estimates: CUSUM TEST



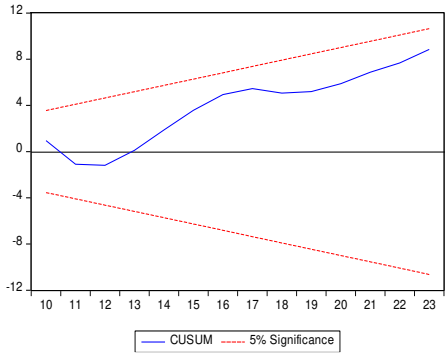
CUSUM SQUARES TEST

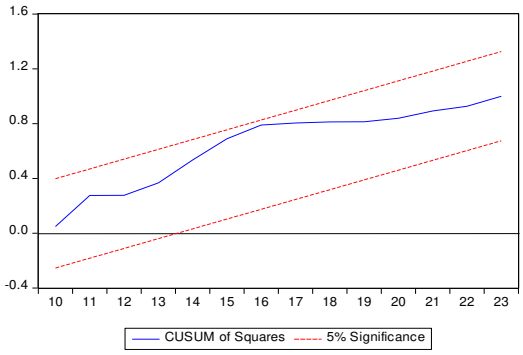


Regression 3: f(UNEM | DI)

- Recursive estimates: CUSUM TEST

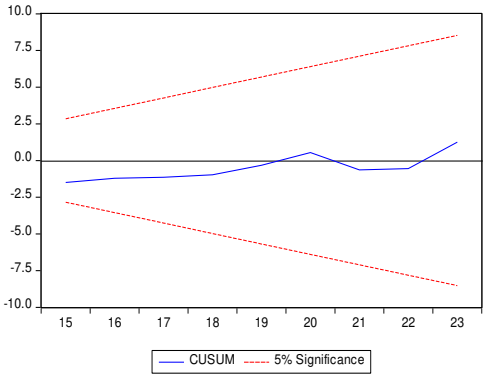
CUSUM SQUARES TEST

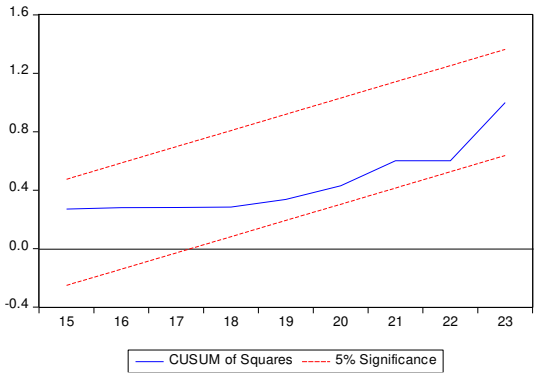




Regression 4: f(UNEM | FDI, GOV_EXP, INFL, TOT)

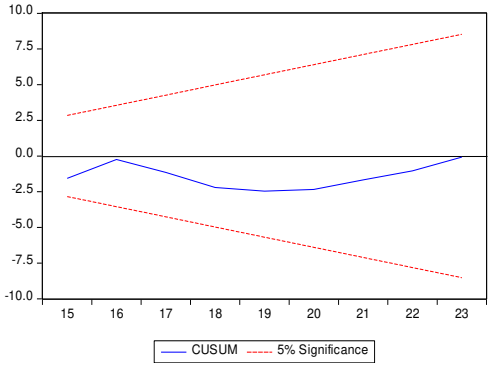
- Recursive estimates: CUSUM TEST CUSUM OF SQAURES TEST

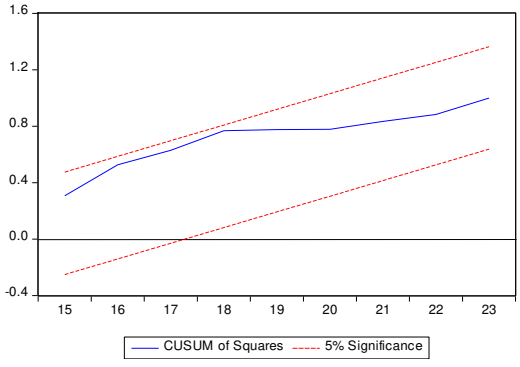




Regression 5: f(UNEM | DI, GOV_EXP, INFL, TOT)

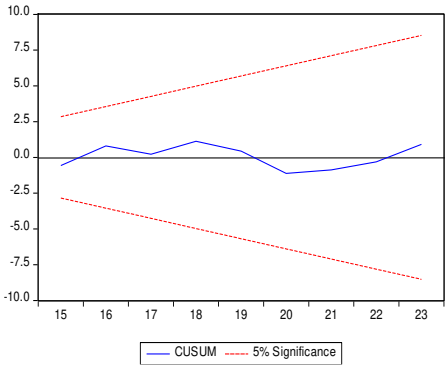
- Recursive estimates: CUSUM TEST CUSUM SQUARES TEST





Regression 6: f(UNEM | FDI, DI, GE, INFL, TOT)

- Recursive Estimates: CUSUM TEST CUSUM OF SQUARES TEST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2.5
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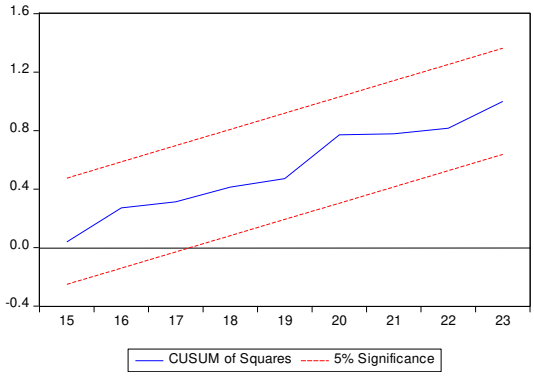
CUSUM
5% Significance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CUSUM of Squares
5% Significance