South African unemployment in the post-financial crisis era: What are the determinants?

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27 May 2019

SOUTH AFRICAN UNEMPLOYMENT IN THE POST-FINANCIAL CRISIS ERA: WHAT ARE THE DETERMINANTS?

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Abstract: High unemployment rates is one of the greatest economic challenges facing post-apartheid South African government over the past two decades and this problem has become more worrisome in the post-global financial crisis period. Our study examines the determinants of unemployment for the South African economy in the post-crisis period over a quarterly frequency period of 2009:Q1 to 2018:Q4. The determinants are examined for 4 classes of unemployment rates (total, male, female and youth) and we further partition possible unemployment determinants into fiscal, monetary and macroeconomic variables. The estimation results from the employed autoregressive distributive lag (ARDL) models find income tax, repo rates, economic growth, trade, investment, household debt and savings to be significant determinants of unemployment in the post-crisis South African economy and yet we note discrepancies of the significance of these determinants amongst different unemployment categories. Relevant policy implications are matched against our obtained empirical findings.

Keywords: Unemployment, determinants, ARDL, financial crisis South Africa.

JEL Classification Code: C13; C32; C52; E24.

1 INTRODUCTION

South Africa, being arguably the leading nation in Africa in terms of economic development, as reflected in her advanced infrastructure, financially developed sector and relatively sound fiscal stance, surprisingly suffers from one of the highest unemployment rates worldwide. In overcoming her brutal legacy of an Apartheid regime in the 1990's whereby African citizens were socially marginalized, the post-Apartheid government has since dedicated itself towards devising policies aimed at tackling unemployment and poverty. For instance, the earlier Reconstruction and Development Plan (RDP) of 1994; the Growth, Employment and Redistribution (GEAR) programme of 1996 as well as the Accelerated and Shared Growth Initiative of South Africa (ASGISA) of 2005 all set numerical targets of attaining higher fiscal and macroeconomic prosperity as a means of addressing high unemployment levels in the country. Moreover, unemployment-specific policies such as the targeted Wage Subsidy as well as the Immigration reform policy were further introduced to directly address the problem of high unemployment amongst as caused by labour market imperfections. Nevertheless, historical unemployment measurements as reported by Statistics South Africa (STATSSA) reflect the unsuccess of these policies in addressing the unemployment problem seeing that the unemployment rate has escalated from 19 percent in 1994 to 28 percent in 2018.

In an earlier study, Kingdon and Knight (2007) noted that two factors have mainly accounted for the observed increased unemployment rate in the post-Apartheid period. Firstly, the authors ascertain that increase in women labour participation rate which increased from 38.3% (in 1995) to 47.8% (in 2003) compared to the labour force participation rate increase in men from 58.6% to 61.2%, experienced during the same period. Secondly, the authors further acknowledge that the experienced increase in the unemployment rate occurred due to economic growth being insufficient for job creation and hence unable to match the growth in the labour force that occurred during this period. This is evident by the growth in total employment, which

grew by 2 million new jobs between 1995 and 2003, was much less than the growth in the labour force, which grew by 6.3 million new entries to the labour market over the same time period. In a more recent study, du Toit et al. (2018) attribute the high rate of unemployment in South Africa to socio-political issues such as lack of tertiary education, lack of proper skills training, heavy regulations that affect foreign direct investments (FDI) inflows as well as slow economic growth. Moreover, Patel and Choga (2018), note that unemployment may be caused by fiscal variables such as government expenditure or by financial variables such as the Central Bank's repurchase (repo) rate.

According to the International Labour Organization (ILO, 2018) South Africa unemployment rate worsened in the post-financial crisis period, recording an unemployment rate of 27.3% worsened in the post-in 2017, and recorded about 71 million unemployment youth. Notably, this statistics are more than double (and even triple!) that of fellow BRICS associates (China (3.9% in 2017), Brazil (13.1% in 2017), India (6.9% in 2017), Russia (6.0% in 2017)). Our research is concerned with identifying fiscal, monetary and macroeconomic determinants of unemployment for the South African economy for the post-global financial crisis period of 2007 to 2018. Our study focuses on the post-crisis period since it represents a new era of policy design, with the NGP and NDP recently introduced as public policy guidelines in coordinating fiscal, monetary and macroeconomic objectives in addressing problems relating to unemployment and poverty. Notably, previous South African literature (Naude and Serumaga-Zake (2001), Kingdon and Knight (2007), Kyei and Gyekye (2012), Dagume and Gyekye (2016) and du Toit et al. (2018)) has not exclusively investigated possible unemployment determinants for the post-crisis era hence ignoring important structural breaks existing over long periods of data. Our study addresses this empirical hiatus. Nevertheless in doing so we are restricted into selecting time series data available in quarterly frequency to ensure that we obtain enough observations for cointegration/empirical analysis. To further ensure the rigidity of our analysis, we further disseminate our data into four classes corresponding to total, male, female and youth unemployment rates. In carrying out our empirical analysis, we depend on the ARDL cointegration model of Pesaran et al. (2001) which

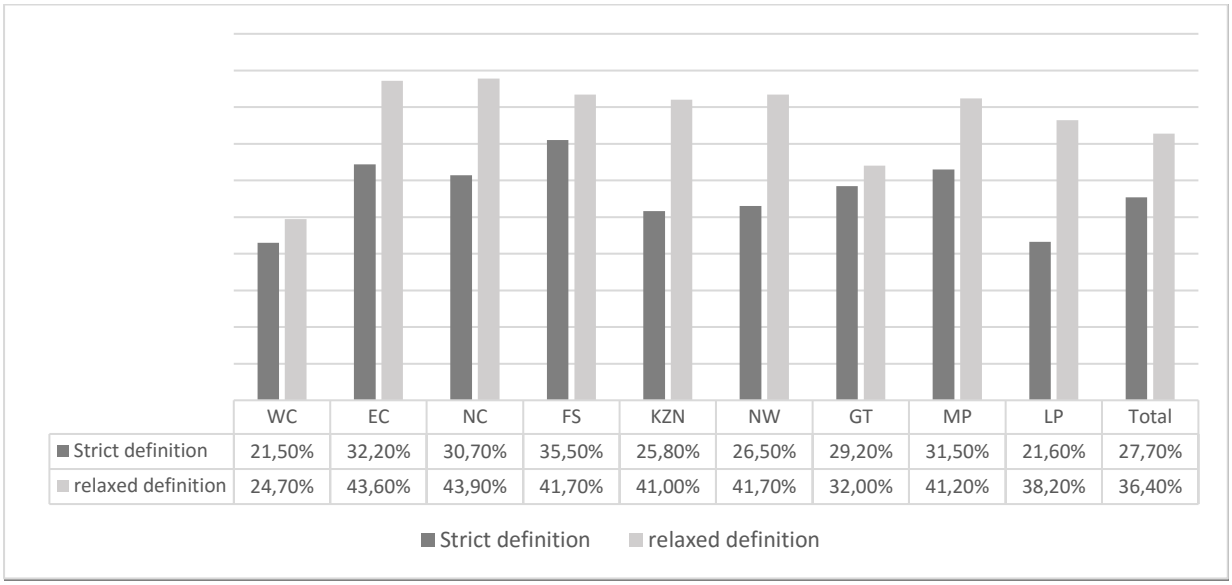
presents methodological advantages such as catering for small sample sizes as well as being applicable with time series with differing orders of integration.

The rest of our study is organized as follows. The next section of the paper presents an overview of unemployment in South Africa. The third section of the paper presents the literature review whereas the empirical framework of the study is outline in the section four of the paper. The empirical findings are detailed in section five whilst the study is concluded in section six.

2 OVERVIEW OF UNEMPLOYMENT IN SOUTH AFRICA

In this section of the paper, we provide an overview of unemployment in South Africa based on demographic factors such as geographical/provincial distribution, race, age group and gender. Figure 1 presents the distribution of unemployment rates across the nine South African provinces. As of 2017, the Free State Province was recorded to have the highest unemployment rate at 35.5%, followed by the Eastern Cape province with 32.2%, then the Mpumalanga province at 31.5%, the Northern Cape province at 30.7%, the North West Province at 26.5%, the Kwazulu-Natal province at 25.8%, the Gauteng province at 29.2%, the Limpopo province at 21.6% and lastly the Western Cape province which boasts the lowest unemployment rate of 21.5%. Note that the Free State, the Eastern Cape, Mpumalanga and the Northern Cape provinces all have unemployment rates exceeding the national average of 27.7% whereas the unemployment rates for the North West, Kwazulu-Natal Gauteng, Limpopo and the Western Cape provinces are below the national average.

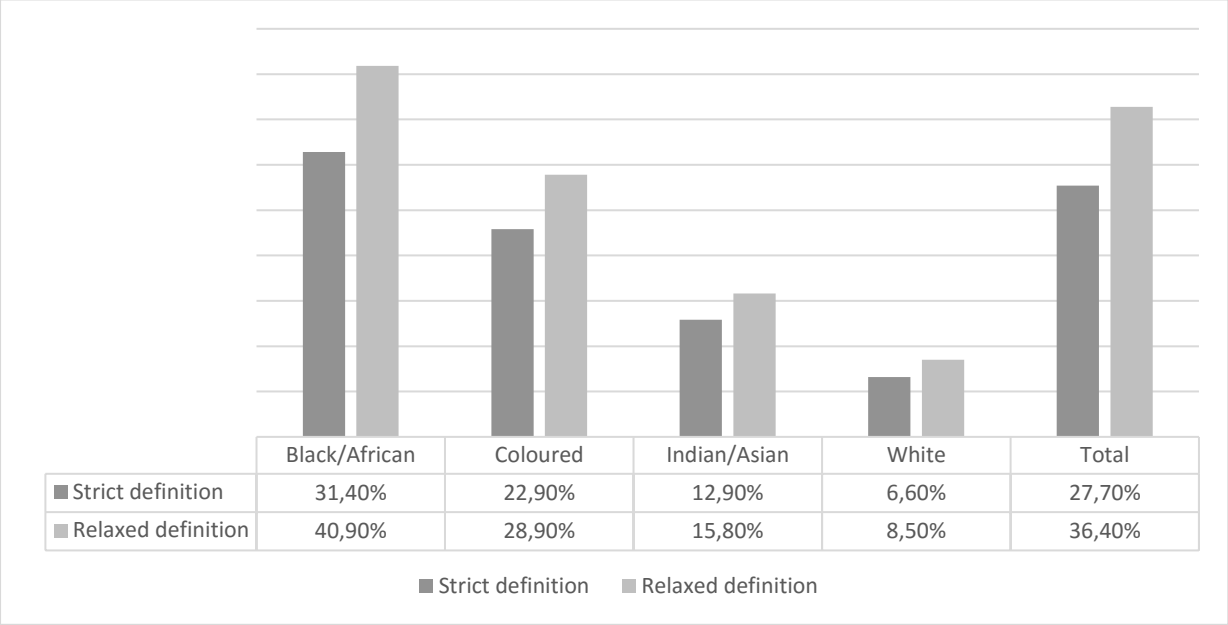
Figure 1: Unemployment Rate by Province



Source: Statistics South Africa Quarterly Labour Force Survey 2017

In further disseminating South African unemployment rates based on population groups, as reported in Figure 2, the black population has historically maintained the highest unemployment rates, recording 31.4%, followed by the coloured population (22.9%), the Indian/Asian population (12.9%) and lastly the White population (6.6%). Part of the reasons linked to the high 'black' unemployment rates is that majority of this population falls under the 'previously disadvantaged' group and they do not have sufficient tertiary qualifications in order to secure the necessary skills required to meet the minimum requirements of the majority of the jobs available in the South African economy. The South African government has made it a priority in recent years to try and assist these previously disadvantaged individuals by creating necessary skills training programmes aimed at equipping them with necessary skills and knowledge in order for them to be employable (Mlatsheni and Leibbrandt, 2011). Nevertheless, the positive effect of these programmes have not yet reflected much on the country's unemployment rate as it is still unacceptably high.

Figure 2: Unemployment Rate by Population Group

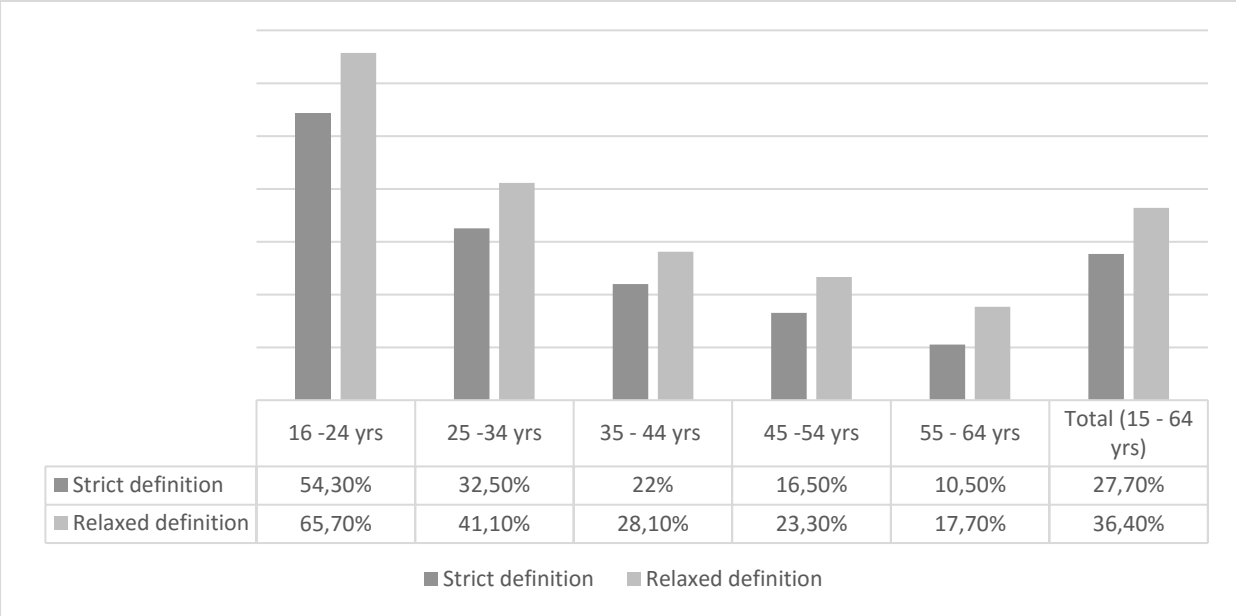


Source: Statistics South Africa Quarterly Labour Force Survey 2017

Figure 3 shows the distribution of unemployment rate across different age groups. Notably, youth unemployment rates (16-24 years) are the highest at 54%, even more than doubling a majority of the other unemployment rates associated with other age groups. One of the issues that could be linked to this predicament is the lack of education and skills among the youth. Another issue is that a large number of the youth who complete their tertiary education and enter the labour market in search of employment, remain unemployed for long periods of time. Seemingly, the South African economy is not capable enough of absorbing this huge amount of labour inflow in the market in terms of job creation, and thus resulting in this high rate in unemployment among the youth (Mlatsheni and Leibbrandt, 2011). According to Statistics South Africa (2017), the labour participation rate quarterly change among the youth was 1.6%, thus increasing the labour participation rate of the youth to 27.9% from the previous quarter. Nonetheless, the unemployment rate among the elderly (55 – 64 years) was reported to be the lowest at 10.5% by Statistics South Africa (2017). This low rate among the elderly could also be linked to the fact that majority of them could decide not to be involved in the

labour market due to their age and also other various factors they face as they approach retirement.

Figure 3: Unemployment Rate by Age Group

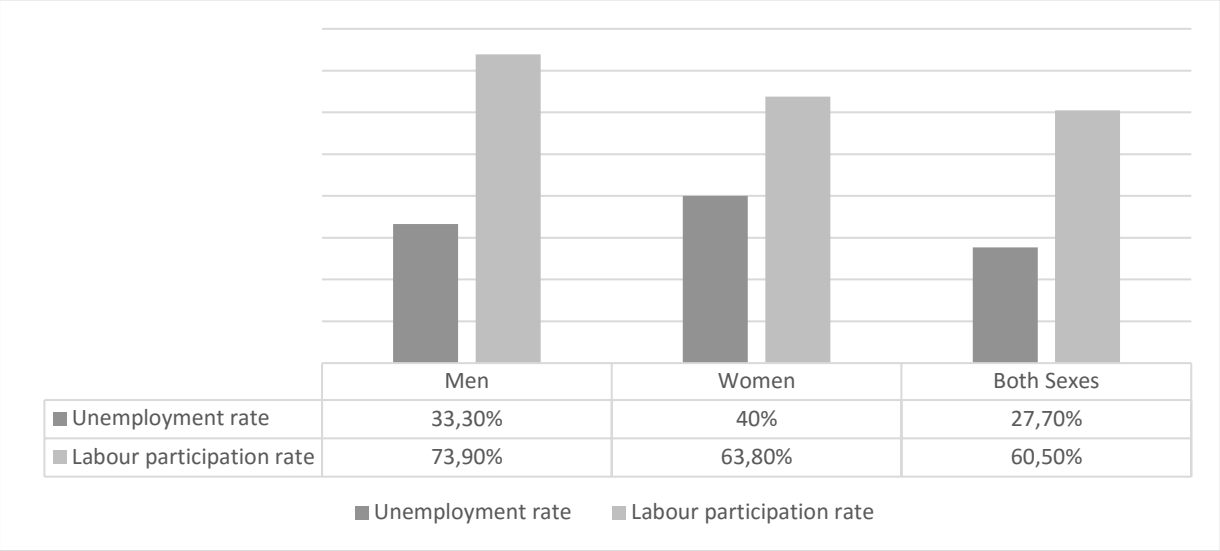


	16 -24 yrs	25 -34 yrs	35 - 44 yrs	45 -54 yrs	55 - 64 yrs	Total (15 - 64 yrs)
Strict definition	54,30%	32,50%	22%	16,50%	10,50%	27,70%
Relaxed definition	65,70%	41,10%	28,10%	23,30%	17,70%	36,40%

Source: Statistics South Africa Quarterly Labour Force Survey 2017

Furthermore, there is a great deal of gender differences in the labour market of the South African economy as demonstrated in Figure 4. Women unemployment rate (40%) is seen to be greater than their male counterparts, whom are sitting at 33.3% during the first quarter of 2017. According to Kingdon and Knight (2007), the drastic increase in the labour participation rate of females in the post-Apartheid era (which almost doubled from 38.3% in 1995 to 63.8% in 2017) has significantly contributed to the overall increase in South Africa's unemployment rate. The increase in the labour participation rate of females means that more women have entered into the labour market and that more jobs are required to accommodate this size of the labour force, which the South African economy has not been able to effectively do. However, South African policymakers will need to address these discrepancies in the labour force in various attempts to encourage gender equality in South Africa.

Figure 4: Unemployment Rate by Gender



Source: Statistics South Africa Quarterly Labour Force Survey 2017

3 FISCAL, MONETARY AND MACROEOCNOMIC DETERMINANTS OF UNEMPLOYMENT AS DICTATED BY THE LITERATURE

The first order of complexity in selecting determinants of unemployment stems from the fact that there exists no single encompassing theory of unemployment and instead one is left to review a handful of independent theories linking different economic variables to unemployment. One of the oldest theories linking unemployment with economic activity is Okun's (1962) law, which assumes a negative relationship between unemployment and economic output. Notably this relationship has received much empirical support in industrialized economies such as United States (Grant (2018) and Guisinger et al. (2018)), Spain (Porras-Arena and Martin-Roman, 2019), OECD countries (de Mendonca and de Oliveira, 2019) and yet has received very little empirical support for the South African economy (see Moroke et al. (2014) and Banda et al. (2016)). Another popular theory describing the dynamics of unemployment across the steady-state comes courtesy of the Phillips curve which assumes an inverse relationship between inflation and unemployment. Yet again, whereas the Phillips curve received empirical support in the earlier studies of Gordon (1990) and Fuhrer (1995), the traditional Phillips curve has been found wanting for the South African

economy (Hodge (2002), Fedderke and Schaling (2005) and Burger and Marnikov (2006) and Phiri (2016)).

Beyond the Phillips curve, the monetary transmission mechanism depicted in Mishkin (1995) and Ireland (2005), outlines the pass-through effect from both the Central Bank's policy instrument and the exchange rate through to the real variables such as unemployment. In a nutshell, this transmission assumes a positive relationship between interest rates and unemployment (i.e. expansionary policy lowers unemployment whilst contractionary policy increases unemployment). Along the same mechanism, an appreciation (depreciation) of currency lowers (increases) unemployment via an improved (deteriorated) current account balance. Closely related with this later transmission, is the possibility of an inverse relationship between trade and unemployment. Dutt et al. (2009) developed a formal model of trade and search-induced unemployment, where trade results from Heckscher-Ohlin (H-O) and Ricardian comparative advantage results in negative trade-unemployment relationship more especially for labour intensive economies. Empirical evidence presented by Egger and Kreickemeier (2009) as well as Felbermayr et al. (2011) demonstrate that higher trade openness is associated with a lower structural unemployment whereas Hasan et al. (2012) find no evidence of any unemployment reduction effects caused by increased trade activity.

On the real economy side of the monetary transmission mechanism, are the investment and savings variables, which are both a consequence of consumption decisions and these variables directly transmitted into other real macroeconomic variables like unemployment. We note a significant number of academic studies which depict domestic investments as being a crucial determinant of unemployment over the steady-state. For instance, Malley and Moutos (2001) find that for OECD countries, an increase in the domestic capital stock relative to the foreign capital stock allows domestic firms to compete more effectively and to capture market shares at the expense of increased unemployment in foreign countries and decreased unemployment in domestic countries. On the other hand, Driver and Munoz-Bugarin (2010)

present a wage bargaining theoretical model in which the labour share increases with improved capital accumulation over the steady state. More recently Guerrazzi (2015) develop a DSGE model with a search framework in which households decide about consumption while firms consider recruiting efforts and investment decisions and find that lower (higher) investment and lower (higher) consumption pushes unemployment upwards (downwards).

Using a vector autoregressive (VAR) framework, Bande-Ramudo et al. (2014) find that permanent shifts in the consumption-savings patterns exert permanent effect on investment and consequentially this spillovers to the unemployment rate, with the savings-unemployment relationship being established to being positive. This evidence is contrary to the earlier findings of Latif (1996), who observe that increased savings is not significantly related with unemployment over the steady-state. Another important macroeconomic determinant of unemployment found in the literature is household debt, with a handful of authors exploring how household debt interacts with the labour market via aggregate demand. Turinetti and Zhuang (2011) find that for the US economy, unemployment is reduced with higher household debt. Similarly, Bethune et al. (2015) as well as Shaffer and Zuniga (2016) establishes a negative household debt-unemployment relationship for the US economy and further assert that unemployment is more responsive to household debt than to interest rates.

The theoretical framework for the relationship between unemployment and fiscal variables is not as concrete as those for monetary and other macroeconomic variables. However, there are a handful of studies which establish an empirical relationship between unemployment and fiscal variables although the overall evidence can be best describes as inconclusive. For instance, Planas et al. (2007) as well as Berger and Everaert (2010) find that labour taxes have a positive effect on unemployment in EU and OECD countries, respectively. On the other hand, Blanchard and Wolfers (2000) find the estimated elasticity of unemployment to labour taxes is zero for European countries. Concerning fiscal spending, Feldman (2006) and Linnemann (2010) find that government size is most likely to increase

unemployment because i) it crowds out private investment ii) a large government size is accompanied by small private sector and hence undermines the ability of the private sector to absorb potential labours into the workforce iii) high government expenditure requires high taxes, which in turn, reduces disposable income of private households and hence aggregate demand. Conversely, Abrams (1999) and Mahdavi and Alanis (2013) find that increased government spending does not assist in reducing unemployment and highlight that a large government sector is more likely to increase unemployment particularly for female and low skilled labourers. In separate studies, Simeon and Alexandrakis (2015) and Dias (2017) show that high government debt levels as opposed to government spending in the Eurozone area have been the underlying cause of unemployment in the Euro area for periods subsequent to the Sovereign debt crisis of 2010.

In tying together the observed theoretical and empirical intuition gathered from the review of the associated literature, we find it best to categorize the possible determinants of unemployment into three broad categories. Firstly, are the monetary determinants of unemployment which are inclusive of interest rates, exchange rates and the inflation rate. Secondly are the fiscal determinants of unemployment which are inclusive of government expenditure, income taxation and government debt. Thirdly, are other macroeconomic determinants of unemployment which include economic growth, trade, savings rate, domestic investment and household debt. In the following section of the paper we outline the empirical framework used to investigate these possible determinants for the South African economy.

4 ANALYTICAL FRAMEWORK

Having reviewed the literature for possible fiscal, monetary and macroeconomic determinants of unemployment, we empirically model three regression functions encompassing the possible determinants of unemployment. The first regression function models the fiscal determinants of unemployment:

$$U = f\,(DEBT, TAX, EXP) \qquad [1]$$

Where U is the unemployment rate, DEBT is government debt, TAX is income taxation and EXP is government expenditure. The second regression function models the monetary determinants of unemployment:

$$U = f\,(REPO, INF, EXC) \qquad [2]$$

Where REPO is the repurchase rate, INF is the inflation rate and EXC are exchange rated. The third regression function models the macroeconomic determinants of unemployment:

$$U = f\,(GDP, TRADE, INV, HHDEBT, SAV) \qquad [3]$$

Where GDP is output growth, TRADE is trade openness, INV is domestic investment, HHDEBT is household debt and SAV is savings. Even though the econometric literature is filled with different cointegration techniques suitable for estimating regressions [1] to [3], many of these methods significant shortcomings. For instance, the traditional Engle and Granger (1987) two-step procedure and Johansen (2001) VECM approach require the time series to be integrated of similar order. This, in turn, requires pre-testing of the variables which introduce a further element of uncertainty in performing cointegration analysis over the steady-state (Pesaran and Shin, 1995). We therefore rely on the ARDL bounds testing approach of Pesaran et al. (2001) which presents advantages other competing models such as exerting the ability to take up a combination of I(0) and I(1) variables and providing unbiased long-run estimates, and valid t-statistics even when some of the regressors are endogenous. Re-specifying equations [1] to [3] in ARDL format results in the following three estimation regressions:

$$\Delta U_t = \beta_0 + \sum_{i=1}^{n}\beta_1\Delta DEBT_{t-i} + \sum_{i=1}^{n}\beta_2\Delta TAX_{t-+i} + \sum_{i=1}^{n}\beta_3\Delta EXP_{t-i} + \alpha_1 DEBT_{t-1} + \alpha_2 TAX_{t-1} + \alpha_3 EXP + \varepsilon_t \quad [4]$$

$$\Delta U_t = \beta_0 + \sum_{i=1}^{n}\beta_1\Delta REPO_{t-i} + \sum_{i=1}^{n}\beta_2\Delta INF_{t-i} + \sum_{i=1}^{n}\beta_3\Delta EXC_{t-i} + \alpha_1 REPO_{t-1} + \alpha_2 INF_{t-1} + \alpha_3 EXC + \varepsilon_t \quad [5]$$

$$\Delta U_t = \beta_0 + \sum_{i=1}^{n}\beta_1\Delta GDP_{t-i} + \sum_{i=1}^{n}\beta_2\Delta TRADE_{t-i} + \sum_{i=1}^{n}\beta_3\Delta INV_{t-i} + \sum_{i=1}^{n}\beta_4\Delta HHDEBT_{t-i} + \sum_{i=1}^{n}\beta_5\Delta SAV_{t-i} + \alpha_1 GDP_{t-1} + \alpha_2 TRADE_{t-1} + \alpha_3 INV_{t-1} + \alpha_4 HHDEBT_{t-1} + \alpha_5 SAV_{t-1} + \varepsilon_t \quad [6]$$

Where β_0 is the constant, Δ is the first difference operator, α_i's are the long-run coefficients of the ARDL model, β_i's are the short-run coefficients, t is time period, n is number of lags, and ε_t is a normally distributed disturbance term. To test for cointegration effects in regressions [4] to [6], Pesaran et al. (2001) propose testing the following joint null hypothesis of no cointegration, i.e.

$$H_0: \beta_1 = \beta_2 = \ldots\ldots = \beta_i = 0 \quad [7]$$

Against the alternative hypothesis of significant cointegration effects, i.e.

$$H_1: \beta_1 \neq \beta_2 \neq \ldots\ldots \neq \beta_i \neq 0 \quad [8]$$

The estimated F-statistic value is then matched against the critical values drawn by Pesaran et al. (2001) and ARDL cointegration effects are only validated if the computed F-statistic value lies above the upper critical bound values. In the presence of significant cointegration effects, the following associated unconditional error correction models (UECM) regressions can be estimated:

$$\Delta U_t = \beta_0 + \sum_{i=1}^{n}\beta_1\Delta DEBT_{t-i} + \sum_{i=1}^{n}\beta_2\Delta TAX_{t-i} + \sum_{i=1}^{n}\beta_3\Delta EXP_{t-i} + \psi ECT_{t-1} + \varepsilon_t \quad [9]$$

$$\Delta U_t = \beta_0 + \sum_{i=1}^{n}\beta_1\Delta REPO_{t-i} + \sum_{i=1}^{n}\beta_2\Delta INF_{t-i} + \sum_{i=1}^{n}\beta_3\Delta EXC_{t-i} + \psi ECT_{t-1} + \varepsilon_t \quad [10]$$

$$\Delta U_t = \beta_0 + \sum_{i=1}^{n}\beta_1\Delta GDP_{t-i} + \sum_{i=1}^{n}\beta_2\Delta TRADE_{t-i} + \sum_{i=1}^{n}\beta_3\Delta INV_{t-i} + \sum_{i=1}^{n}\beta_4\Delta HHDEBT_{t-i}$$

$$+ \sum_{i=1}^{n}\beta_5\Delta SAV_{t-i} + \psi ECT_{t-1} + \varepsilon_t \quad [11]$$

Where ETC_{t-1} is the error correction term, which measures the speed of the adjustment back to steady-state equilibrium after external shocks in the economy, and ψ is the coefficient of the error correction term.

5 DATA AND EMPIRICAL RESULTS

5.1 Data description and integration properties

As mentioned before, our study examines the determinants of unemployment in South Africa for the post-crisis period. Due to this constraint, it is important that we obtain quarterly time series data from various sources to ensure enough observations for empirical analysis. The quarterly data employed in the study has all been obtained from the Federal Reserve Economic Data (FRED) and the South African Reserve Bank (SARB) online databases. From the FRED database we collect our unemployment series for four categories of unemployment, namely total unemployment rate aged 15 and over for all persons (U_{TOTAL}), total unemployment rate aged 15 and over for all males (U_{MALE}), total unemployment rate aged 15 and over for all females (U_{FEMALE}) and total unemployment rate aged 15 to 24 for all persons (U_{YOUTH}). On the other hand, the remaining time series variables have been collected from the SARB database and include i) national government debt as a % of GDP (DEBT), ii) total government

expenditure as a % of GDP (EXP), iii) taxes on income, profit and capital gains as a percentage of total revenue (TAX), iv) CPI inflation (INF), v) the repurchase rate (REPO), vi) the US/ZAR exchange rate (EXC), vii) economic growth (GDP), viii) Household debt to disposable income of households (HHDEBT) ix) Ratio of gross savings to GDP (SAV) x) Exports of goods and services (TRADE) xi) Ratio of gross fixed capital formation to GDP (INV). Our data has been collected over a uniform quarterly period of 2008:Q1 to 2018:Q4.

Prior, to estimating our empirical ARDL models described in the previous section of the paper, it is important for us to determine the integration properties of the time series variables to ensure that none of them is integrated of order an order I(2) or higher. Recall that the ARDL model is only functional with a mixture of I(0) and/or I(1) variables. We therefore perform ADF, PP and DF-GLS unit root tests to the variables in their levels as well as to their first differences and we further perform two variations of each tests i) with an intercept, and ii) with an intercept and trend. As can observed from Table 1, when the unit root tests are performed on the levels of the time series, we find that total unemployment, male unemployment, youth unemployment, repo rate and investment variables produce tests statistics which cannot reject the unit root null hypothesis across all tests, whereas, income taxes, exchange rates, economic growth and trade produce tests statistics which cannot reject the unit root null hypothesis at a critical levels of least 5%. On the other hand, the remaining variables, (i.e. female unemployment, government debt, government expenditure, inflation, household debt and savings) obtain all sorts of conflicting evidences on the integration properties of the time series, not only amongst the variables but also for the same variables using different tests. However, after testing unit roots in the first differences of the time series, as reported in Table 2, all the variables managed to reject the null hypothesis at first differences in favour of stationarity for all three tests regardless of whether performed with and intercept or with a trend and an intercept. What is important is that none of our time series data is integrated of I(2) or higher, thus fulfilling the requirement to implement the ARDL methodology.

Table 1: Unit root test results (levels)

Levels	ADF		PP		DF-GLS	
	drift	drift and trend	drift	drift and trend	drift	drift and trend
U_{TOTAL}	-1.330	-2.197	-1.148	-2.820	-0.308	-2.881
$U_{FEMALES}$	-0.771	-2.258	-1.157	-3.711**	-0.464	-2.161
U_{MALES}	-2.063	-2.599	-1.530	-2.600	-0.547	-2.522
U_{YOUTH}	-2.499	-2.951	-2.389	-2.813	-1.287	-2.722
DEBT	-2.092	-0.142	0.454	-3.720***	-0.359	-3.943***
TAX	-3.207**	-3.200*	-3.180**	-3.263*	-2.411**	-3.057*
EXP	-2.185	-7.258***	-5.226***	-7.216***	-1.885	-7.436***
INF	-5.549***	-5.551***	-5.967***	-5.637***	-0.421	-2.620
EXC	-5.323***	-5.237***	-5.261***	-5.143***	-4.227***	-5.049***
REPO	-2.490	-1.586	-2.357	-1.612	-0.828	-2.128
GDP	-4.402***	-4.360***	-4.175***	-4.098**	-4.450***	-4.466***
TRADE	-6.060***	-4.983***	-6.210***	-6.323***	-2.704***	-5.485***
INV	-1.224	-1.734	-1.535	-1.734	-1.014	-1.781
HHDEBT	-1.731	-3.768**	-1.695	-2.690	0.905	-1.965
SAV	-2.373	-3.119	-2.280	-3.119	-2.262**	-3.181*

Notes: "***", "***", "*" denote the 1%, 5% and 10% significance levels respectively.

Table 2: Unit root test results (First differences)

	ADF		PP		DF-GLS	
	drift	drift and trend	drift	drift and trend	drift	drift and trend
U_{TOTAL}	-8.705***	-8.620**	-8.705***	-8.606***	-7.250***	-8.158***
$U_{FEMALES}$	-10.553***	-10.436***	-10.358***	-10.234***	-10.098***	-10.614***
U_{MALES}	-7.606***	-7.626***	-7.580***	-7.626***	-5.971***	-6.807***
U_{YOUTH}	-7.512***	-7.615***	-7.725***	-8.4222***	-6.136***	-7.193***
DEBT	-3.984***	-4.328***	-11.480***	-11.225***	-0.852	-2.943*
TAX	-7.758***	-7.694***	-7.732***	-7.677***	-7.713***	-7.840***
EXP	-14.030***	-13.870***	-14.944***	-14.718***	-2.630***	-11.872***
INF	-8.593***	-8.536***	-13.065***	-14.113***	-8.028***	-.9121***
EXC	-7.443***	-7.350***	-20.600***	-24.253***	-8.072***	-8.598***
REPO	-3.356**	-4.086**	-3.567**	-3.965**	-2.719**	-3.538**
GDP	-5.834***	-5.914***	-19.120***	19.949***	-6.127***	-7.770***
TRADE	-5.542***	-5.653***	-16.603***	-15.231***	0.259	-7.246***
INV	-4.863***	-4.782***	-4800***	-4.702***	-2.406**	-4.025***
HHDEBT	-5.855***	-5.834***	-5.849***	-5.822***	-2.761***	-3.734**
SAV	-7.963***	-7.854***	-9.102***	-8.924***	-7.345***	-7.925***

Notes: "***", "***", "*" denote the 1%, 5% and 10% significance levels respectively.

5.2 Fiscal variables as determinants of unemployment

We begin our empirical analysis by examining the fiscal determinants of unemployment for our four classes of unemployment namely, total, male, female and youth categories. Three main findings are drawn from the empirical results reported in Table 3. Firstly, government debt is positively and significantly related with unemployment over both the long-run and short-run, even though the value of the coefficient estimates varies amongst the sample groups. Notably, Simeon and Alexandrakis (2015) as well as Dias (2017) recently find similar findings for Euro countries and attribute this observation to the fact that increased government debt chokes up the use of government resources in debt financing which makes it difficult to increase government investment funded projects aimed at job creation. Secondly, we observe a negative and statistically significant long-run relationship between income taxes and unemployment across all sample groups, albeit this significant relationship existing for total and male unemployment rates over the short-run. This result is not surprising since higher tax revenues collected by government would strengthen their ability to provide jobs for the unemployed. For instance, Goerke (1997) and Bohringer et al. (2005) find that by endogenising labour supply and the number of firms in efficiency wage models, an increase in labour income taxes will lead to lower unemployment rates. Lastly, government spending produces an insignificant short-run and long-run estimates across the four unemployment groups and this finding undermines government's ability to reduce unemployment rates through expenditure programmes. Notably our findings are in alignment with those obtained in Abrams (1999) and Mahdavi and Alanis (2013) but differ from Feldman (2006) and Linnemann (2010) who find that government size reduces unemployment in Eurozone countries.

However, as can be observed from the results of bounds test for cointegration reported in panel B of Table 3, only the two regression associated with total and male unemployment produces an F-statistic which exceeds their upper 10% and 5% critical levels, respectively. On the other hand, the F-statistic associated with the 'females' and 'youth' unemployment regression lies between the lower and upper 10% critical levels, hence rendering the reported results inconclusive. Pesaran et al. (2001) suggest that given such circumstances, in which the

obtained F-statistics lies between the lower and upper critical values, one should determine the cointegration rank of the 'system' using other cointegration methods. However, since the time series were previously found to not be integrated of similar order I(1), we are unable to determine the cointegration rank using conventional methods, such as Johansen's (2001) VECM's Eigen and Trace tests.

Table 3: ARDL estimates of fiscal determinants of unemployment

	U_{TOTAL} = f (DEBT, TAX, EXP)	U_{FEMALE} = f (DEBT, TAX, EXP)	U_{MALE} = f (DEBT, TAX, EXP)	U_{YOUTH} = f (DEBT, TAX, EXP)
Panel A: Long-run estimates				
DEBT	0.139***	0.130***	0.143***	0.181**
	(0.000)	(0.000)	(0.000)	(0.011)
TAX	-0.070***	-0.039*	-0.091***	-0.125*
	(0.001)	(0.064)	(0.004)	(0.051)
EXP	-0.016	-0.005	-0.030	0.04
	(0.648)	(0.912)	(0.429)	(0.735)
Panel B: Short-run estimates				
ΔDEBT	0.058***	0.062***	0.062***	0.032**
	(0.004)	(0.004)	(0.004)	(0.026)
ΔTAX	-0.029**	-0.018	-0.040***	-0.048
	(0.017)	(0.214)	(0.006)	(0.147)
ΔEXP	-0.007	-0.002	-0.013	0.041
	(0.730)	(0.924)	(0.543)	(0.201)
Panel C: Cointegration tests				
F-statistics	3.40*	3.05	3.76**	2.44
t-test	-0.419***	-0.473***	-0.436***	-0.37***
	(0.000)	(0.000)	(0.000)	(0.0022)

Notes: "***", "***", "*" denote the 1%, 5% and 10% significance levels respectively.

Optimal lag length selected via Schwartz information criterion

Lower bound critical values 10% (2.37), 5% (2.79), 1% (3.65)

Upper bound critical values 10% (3.20), 5% (3.67), 1% (4.66)

5.3 Monetary variables as determinants of unemployment

Having established evidence of fiscal variables such as government debt and income tax being significant short-run and long-run determinants of unemployment, we proceed our

analysis by investigating possible monetary determinants of unemployment for males, females and total populations. Table 4 presents the short-run and long-run ARDL estimates for the repo rate, inflation and exchange rates as possible determinants of unemployment. We observe insignificant short-run and long-run estimates for both inflation and exchange rate variables across all unemployment classifications as well as for the repo rate estimates on total and female unemployment. Note that the findings of an insignificant relationship between inflation and unemployment has been previously established for South African data (Hodge (2002), Fedderke and Schaling (2005) and Burger and Marnikov (2006) and Phiri (2016)) albeit these previous studies only focusing on aggregated unemployment rates. However, the findings of an insignificant relationship between exchange rates and unemployment is contrary to previous South African literature (Chipeta et al. (2017) and Mpofu and Nikolaidou (2018)) which hypothesizes on currency appreciations resulting in improved job creation.

The only exception to the reported findings are the positive and statistically significant short-run and long-run estimates on the repo rate variable for male unemployment as well as for youth unemployment, although for the latter the significance of the estimates is restricted to the long-run and does not hold over the short-run. These latter findings are reminiscent of the interest rate monetary transmission mechanism described in Mishkin (1995) and Ireland (2005) which assumes that contractionary (expansionary) monetary policy will aggravate (improve) unemployment in the economy. However, the significance of these findings are only relevant for the 'male' unemployment regression, since it produces an associated F-statistic which exceeds the upper 5% bounds critical level. Altogether, our results imply that it is not the inflation outcome of monetary policy which determines unemployment but rather the manipulated monetary policy instrument which influences unemployment, at least for the South African male population. Moreover, exchange rates are found to be insignificant determinants of unemployment over both short-run and the long-run, a result which particularly justifies the adoption of flexible exchange rate system in which government does not interfere with currency determination in the foreign exchange markets.

Table 4: ARDL estimates of monetary determinants of unemployment

	U_{TOTAL} = f (REPO, INF, EXC)	U_{MALE} = f (REPO, INF, EXC)	U_{FEMALE} = f (REPO, INF, EXC)	U_{YOUTH} = f (REPO, INF, EXC)
Panel A: Long-run estimates				
EXC	-0.236	-0.152	0.041	0.005
	(0.453)	(0.551)	(0.887)	(0.945)
INF	0.071	-0.004	-0.124	0.258
	(0.658)	(0.972)	(0.312)	(0.308)
REPO	-0.211	-0.315	1.573**	0.655*
	(0.598)	(0.406)	(0.050)	(0.052)
Panel B: Short-run estimates				
ΔEXC	-0.025	-0.023	0.007	-0.018
	(0.471)	(0.590)	(0.885)	(0.412)
ΔINF	0.008	-0.016	-0.021	0.101*
	(0.546)	(0.970)	(0.176)	(0.093)
ΔREPO	-0.022	-0.048	0.617**	-0.436
	(0.683)	(0.459)	(0.061)	(0.349)
Panel C: Cointegration tests				
F-statistics	0.857	0.80	4.13***	1.907
t-test	-0.106**	-0.153**	-0.172***	-0.247***
	(0.036	(0.042)	(0.000)	(0.008)

Notes: "***", "***", "*" denote the 1%, 5% and 10% significance levels respectively.

Optimal lag length selected via Schwartz information criterion

Lower bound critical values 10% (2.37), 5% (2.79), 1% (3.65)

Upper bound critical values 10% (3.20), 5% (3.67), 1% (4.66)

5.4 Macroeconomic variables as determinants of unemployment

Having examined our possible monetary and fiscal determinants of unemployment, we now estimate ARDL regressions for the macroeconomic determinants of unemployment namely, GDP, trade, domestic investment, household debt and savings. Three main empirical findings can be extracted from the results reported in Table 5 below. Firstly, we find the expected negative and significant long-run as well as insignificant short-run estimates on the GDP variable for all four classes of unemployment. Clearly this finding corresponds to Okun's law which previous empirical supporting evidence for this relationship has been provided by

Geldenhuys and Marnikov (2007) and Phiri (2014) but differs from the findings obtained in Moroke et al. (2014) and Banda et al. (2016).

Secondly, trade, investment and household debt produce negative coefficient estimates in both the long-run and short-run equilibrium, a finding which concurs with those previously obtained in the studies of Felbermayr et al. (2011) and Guerrazzi (2015) for the trade-unemployment and investment-unemployment relationship, respectively, and yet differs from negative household debt- unemployment relationship established in Turinetti and Zhuang (2011), Bethune et al. (2015) and Shaffer and Zuniga (2016). However, the significance of these estimates varies across four sample groups. For instance, the coefficient estimates on the household debt variables are statistically significant at all critical values for all unemployment categories over both the long-run and short-run. Conversely, trade produces statistically significant estimates for only male unemployment over both the long-run and short-run whereas investment is statistically significant for total unemployment in the long-run as well as for total and male unemployment over the short-run. Moreover, the investment variable produces significant estimates for total and youth unemployment rates exclusively.

Lastly, we observe positive on the savings variable albeit only statistically significant for female and youth unemployment over both the long-run and short-run. For female unemployment, we find a positive relationship, which according to Bande-Ramudo et al. (2014) is principally correct since an increase in savings should cause unemployment rate to increase due to a fall in consumption especially if the savings are precautionary and society has limited access to credit facilities. On the other hand, we find a negative relationship between savings and youth unemployment which is in line with the earlier theoretical insinuations proposed by Ioannides (1981) who hypothesizes on savings being an important determinant of unemployment, if savings are effectively directed towards productive investments which stimulate aggregate demand. Altogether we interpret our regressions reported in Table 5 with a fair amount of confidence seeing that all regression produce F-statistics which exceed their respective 5 percent upper bounds critical levels.

Table 5: ARDL estimates of macroeconomic determinants of unemployment

	U_{TOTAL} = f (GDP, TRADE, INV, HHDEBT, SAV)	U_{FEMALE} = f (GDP, TRADE, INV, HHDEBT, SAV)	U_{MALE} = f (GDP, TRADE, INV, HHDEBT, SAV)	U_{YOUTH} = f (GDP, TRADE, INV, HHDEBT, SAV)
Panel A: Long-run estimates				
GDP	-0.061**	-0.081***	-0.095*	-0.307**
	(0.070)	(0.023)	(0.092)	(0.014)
TRADE	-0.002	-0.001	-0.080***	0.037
	(0.632)	(0.761)	(0.003)	(0.155)
INV	-0.201***	-0.072	-0.280	-0.891***
	(0.008)	(0.230)	(0.130)	(0.000)
HHDEBT	-0.277***	-0.288***	-0.266***	-0.066*
	(0.000)	(0.000)	(0.000)	(0.057)
SAV	0.102	0.145**	0.033	-0.399*
	(0.107)	(0.043)	(0.722)	(0.075)
Panel B: Short-run estimates				
ΔGDP	-0.056	-0.074	-0.057	-0.088
	(0.161)	(0.120)	(0.217)	(0.224)
ΔTRADE	-0.002	-0.001	-0.048***	0.009
	(0.757)	(0.875)	(0.002)	(0.379)
ΔINV	-0.183***	-0.066	-0.168**	-0.732***
	(0.018)	(0.406)	(0.070)	(0.007)
ΔHHDEBT	-0.253***	-0.264***	-0.160***	-0.168**
	(0.000)	(0.000)	(0.001)	(0.029)
ΔSAV	0.093	0.133*	0.020	-0.196
	(0.122)	(0.072)	(0.733)	(0.275)
Panel C: Cointegration tests				
F-statistics	4.70***	5.55***	6.37***	8.151***
t-test	-0.913***	-0.918***	-0.600***	-0.524***
	(0.000)	(0.000)	(0.000)	(0.000)

Notes: "***", "***", "*" denote the 1%, 5% and 10% significance levels respectively.

Optimal lag length selected vai Schwartz information criterion

Lower bound critical values 10% (2.37), 5% (2.79), 1% (3.65)

Upper bound critical values 10% (3.20), 5% (3.67), 1% (4.66)

5.5 Diagnostic tests and stability analysis

As a final empirical exercise, we perform a battery of residual diagnostic tests as well as stability analysis on our esteemed ARDL regressions. In particular we perform the Jarque-Bera (J-B) tests for normality, the Breusch-Godfrey (BG) tests for serial correlation, the ARCH

test for heteroscedasticity, the Ramsey RESET test for correct functional form as well as providing CUSUM and CUSUM of squares plots for regression stability. The findings are systematically reported in Table 6. As should be observed, all regressions passed all residual diagnostic tests, that is, the regression errors are normally distributed as well as being rfee of serial correlation and heteroscedasticity and the CUSUM and CUSUMSQ plots indicate regression stability at critical levels of at least 5 percent. All-in-all, it is safe to assume that our estimated regression satisfy the classical regression assumptions and hence can be interpreted with a fair amount of confidence.

Table 6: Diagnostic tests and stability analysis

Regression	JB test	LM test	ARCH test	Ramsey RESET Test	CUSUM	CUSUMSQ
U_{TOTAL} = f (DEBT, TAX, EXP)	3.264 (0.195)	6.708 (0.112)	0.129 (0.728)	0.004 (0.951)	Stable	Stable
U_{FEMALE} = f (DEBT, TAX, EXP)	3.873 (0.144)	9.237 (0.140)	0.630 (0.440)	0.011 (0.915	Stable	Stable
U_{MALE} = f (DEBT, TAX, EXP)	1.274 (0.529)	5.926 (0.155)	0.002 (0.970)	0.009 (0.923)	Stable	Stable
U_{YOUTH} = f (DEBT, TAX, EXP)	0.424 (0.809)	0.802 (0.456)	1.454 (0.235)	0.631 (0.816)	Stable	Stable
U_{TOTAL} = f (REPO, INF, EXC)	0.437 (0.804)	4.157 (0.161)	0.200 (0.664)	0.094 (0.761)	Stable	Stable
U_{FEMALE} = f (REPO, INF, EXC)	1.317 (0.517)	9.438 (0.130)	0.092 (0.761)	0.169 (0.683)	Stable	Stable
U_{MALE} = f (REPO, INF, EXC)	0.788 (0.674)	9.521 (0.212)	3.994 (0.282)	0.001 (0.975)	Stable	Stable
U_{YOUTH} = f (REPO, INF, EXC)	0.117 (0.943)	0.636 (0.585)	1.942 (0.124)	0.359 (0.552)	Stable	Stable
U_{TOTAL} = f (GDP, TR, INV, HHDEBT, SAV)	1.141 (0.565)	12.217 (0.101)	0.253 (0.625)	0.492 (0.488)	Stable	Stable
U_{FEMALE} = f (GDP, TR, INV, HHDEBT, SAV)	0.853 (0.653)	0.744 (0.745)	0.261 (0.620)	1.876 (0.180)	Stable	Stable
U_{MALE} = f (GDP, TR, INV, HHDEBT, SAV)	1.595 (0.451)	1.196 (0.654)	0.097 (0.764)	0.116 (0.736)	Stable	Stable
U_{YOUTH} = f (GDP, TR, INV, HHDEBT, SAV)	0.162 (0.921)	0.175 (0.839)	0.984 (0.541)	1.272 (0.212)	Stable	Stable

Notes: S denotes stable, NS denotes not stable, JB denotes Jarque-Bera test, and LM denotes Lagrange Multiplier test.

6 CONCLUSION

Concerned by the outlook of unemployment in South Africa following the advent of the 2007-2008 global financial crisis, our study sought to examine certain monetary, fiscal and macroeconomic determinants of unemployment exclusively focusing on the post-crisis era. Our selection of variables as possible determinants of unemployment in our study is primarily guided by theoretical intuition based upon the existing academic literature in conjunction with the availability of time series data from various sources. To ensure we obtain a sufficient number of observations which are sufficient for empirical analysis we restrict our variables to time series which can are available in quarterly frequencies covering a period of 2008:q1 to 2018:q4. Our empirical regressions were estimated using the ARDL framework of Peseran et al. (2001) and there are three broad findings which we highlight from our empirical findings. Firstly, government debt and income taxation are important fiscal determinants of unemployment in the post-recession period. Secondly, the repo rate is the only significant monetary determinant of unemployment found in the post-recession era. Lastly, economic growth, trade, domestic investment household debt and to a lesser extent savings rate are important macroeconomic determinants of unemployment in the post-crisis period.

In further disseminating our results from a policy perspective, we observe that variables such as income taxes, economic growth, domestic investments, and to lesser extents trade (for male unemployment) and saving (for female and youth unemployment) all need to be stimulated by policymakers in order to reduce unemployment. On the other hand, fiscal variables such as government debt and the Reserve Bank's short-term policy instrument need to be supressed. This later finding implies the need for fiscal policy to increase income taxes yet simultaneously reduce government debt. We, however, note the insignificant effects of government spending on both short-run and long-run unemployment, which reflects inadequacy of recently-implemented fiscal expenditure projects in solely attempting to eradicate unemployment in the country. From a monetary policy standpoint, our results indicate that the Reserve Bank needs to relax their hikes on interest rates in the interest of stimulating the economy and consequentially reducing steady-state unemployment. Moreover, the observed insignificant effect of inflation on unemployment further questions the usefulness of inflation-targeting regime in addressing the issue of unemployment via price stability.

From the perspective of the different categories of unemployment, we observe that monetary-fiscal-macroeconomic coordination would only be beneficial to the male population seeing that this is the only category of unemployment that is responsive to monetary policy and fiscal instruments in the post-crisis era. We note that female and youth unemployment classifications are not significantly responsive to monetary and fiscal variables but are instead mutually responsive to output growth, household debt and savings whilst youth unemployment is solely responsive to domestic investments. Interestingly, GDP growth, household debt, savings and domestic capital accumulation have been on declining trends in the post-crisis periods, and based on our empirical findings, this will not beneficial to either female or youth unemployment. On the other hand, only the trade balance has improved in recent times and yet based on our empirical analysis, we find that only the male population gains from the associated trade benefits. Overall, our study shows a bias in the implementation of monetary-fiscal policy coordination efforts and trade policies towards improving male unemployment rates and urges policymakers to consider devising policies particularly focused on addressing female and youth unemployment.

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