Marginal Employment Growth Effects In The South African Economy

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ABSTRACT

South Africa relative to its peers (upper middle income countries) suffers from high unemployment and sub-optimal economic growth. This study investigates the 'marginal effects of employment' with respect to real output and capital in South Africa, using annual data covering the period 1946-2015. It estimates the responsiveness of employment to real output growth and capital, employing the short and long-run dynamic interactions between these variables via the application of the VAR/VECM Johansen (1991) framework.

The results show that there exists a statistically significant long-run co-integrating relationship between labour employment and real GDP growth. Marginal employment growth effect is positive; a one per cent increase in GDP tends to increase employment by about one third of one per cent. Employment adjusts consistent with expectations when it overshoots its structural relationship with other variables. However, real output tends to adjust contrary to expectations, implying significant diminishing returns to employment in the economy. Growth in capital impacts positively on output and employment. The study concluded that greater labour market flexibility and higher worker productivity is needed across all sectors of the economy.

Keywords: South Africa; Economic Growth; Unemployment; Marginal Employment Effect; VAR-VECM

1. INTRODUCTION

The South African economy is characterised by high income inequalities and low levels of labour absorption. In order to narrow income inequalities, more people need to gain income from employment and investment. It is economic growth that brings labour and capital together and hence generates employment expansion. South Africa registered an average growth rate of 2.9% over the post-apartheid 1998-2015 period. Accompanying this economic expansion, employment increased by over 3.5m during the past twenty years. However, with retrenchments and down-sizing by firms, and a rising number of job seekers entering the labour market each year, 'official' unemployment increased from 20% in 1994 to over 25% in 2015 (Kerr, Wittenberg and Arrow, 2014; SARB, 2016). If one includes the discouraged worker effect, the unemployment rate is close to 35% in 2015, with youth unemployment nearing almost 50%. According to South Africa's National Development Plan (NDP), unemployment is expected to fall from 27% in 2011 to 14% by 2020 and 6% by 2030, and the country should achieve an average annual GDP growth of 5.4% over this period. The NDP envisages that the small firm sector would be critical in generating employment growth. A key question this study attempts to assess is whether growth in real output and capital creates jobs.

If South Africa can register high economic expansion as its BRIC partners, in particular India and China, it can no doubt create more employment opportunities. It is often argued that militant trade unions securing high real wage increases in excess of productivity gains, inflexible anti-business labour policies, and a generous unemployment insurance or state welfare system conspire to prevent labour markets from clearing in a manner that it occurs in other leading emerging markets (Johnson, 2015). Against this backdrop, this study attempts to analyse the responsiveness of labour employment to real GDP growth, and capital input, using data covering the period 1946-2012. The study also investigates the nature of the dynamic interactions between the variables under consideration, using the Johansen VAR/VECM technique. The paper consists of four sections. The first presents a review of the literature. This is followed by the methodology section and the presentation and discussion of the findings. It concludes with some policy and final remarks.

2. LITERATURE REVIEW
2.1 Theoretical Perspectives

The national accounting identity, which captures the Keynesian perspective on economic growth, suggests that an increase in government spending, investment and consumption results in an increase in income and output - and hence in employment, as demonstrated by Okun (1970). This expansion in expenditure via the multiplier effect leads to further rounds of increases in consumption, employment and income until the impact of the initial stimulus is exhausted. Thus, one ought to expect a positive impact of real output (q) on employment (l). Accordingly, the output elasticity of labour demand (also termed employment elasticity) is expected to be positive ($\frac{\partial q}{\partial l}\frac{l}{q} > 0$) and by a similar argument, the output elasticity of capital (k) is also positive ($\frac{\partial q}{\partial k}\frac{k}{q} > 0$). According to the Harrod-Domar model, growth depends on the quantity of labour and capital. Increasing the savings rate and investment generates economic growth (Mankiw, 2012).

Okun (1970) considered Keynesian and the neoclaasical notions within the context of business cycles, where he associated output deviations from its trend (potential growth path) with variations, in the opposite direction, of the unemployment rate around its natural level. A stable empirical association between the variables was found; a one percentage rise of unemployment above its natural rate causes a three percentage drop in US GNP. Such an interpretation according to Slimane (2015) suggests a supply- side perspective of the economy where fluctuations of unemployment around its natural rate assumed to give rise to output deviations from its long term equilibrium level, may not necessarily be true and can be answered through empirical analysis. Moreover, Palley (1993) and Aksoy (2013) further assert that the association suggested by Okun's Law ought to be viewed as causality running in the opposite direction from a rise in economic growth to a reduction in unemployment and *vice versa*. In particular, they suggest, the relationship is asymmetrical where the magnitude of the response of unemployment is higher during a recession than over an expansion. Daly and Hobjin (2010) supported this perspective and noted that post 2008 'credit crunch', although production levels remained stable an exceedingly high number of workers were retrenched, hence they concluded that Okun's Law. Herman (2011) and Seyfried (2014) both of whom studied a selection of EU member economies noted that the response of employment to economic growth varied across countries depending on the flexibility of labour markets: more unionised economies tend to have lower employment intensities while economies with a larger percentage of workers on temporary contracts tended to have higher employment intensities. Aksoy (2013) considered the association between Turkish industrial growth and employment intensity and found causal relations in four of the ten industries studied, with some of them involving bidirectional causality. Moosa (2008) found that Okun's law does not apply in four economies, Morocco, Tunisia, Algeria and Egypt due to extensive state involvement in the respective countries.

Morrison and Berndt (1981) argued that the short-run output elasticity of labour demand is less than unity and is less than its long-run value. Ricardo (1821) expounded the concept of jobless growth, arguing that there exists a negative relationship between investment, output expansion and job creation, since capital investment can be regarded as a perfect substitute for labour. Mortensen and Pissarides (1998) asserted that the introduction of new technologies replaces old jobs but simultaneously creates new and more productive job opportunities. Faria (2002) noted that technical progress destroys jobs largely because it is labour saving in nature with high productivity growth. However, Aghion and Howitt (1994) and Romer (2012) contend that technology induces productivity growth, reduces costs and prices, and raises per capita income, thus stimulating aggregate demand and creating new jobs. Therefore, a positive relationship is to be expected between investment, technology and employment (O'Neill, 2011; Mankiw, 2012).

2.2 Empirical Perspectives

Recent empirical studies on the relationship between economic growth and employment seem to be mixed, positive in certain sectors or regions and negative or low in others. Basu and Foley (2011), and Milberg and Winkler (2010) found a positive relationship between the partial effect of output and employment growth for the US economy.

Owyang *et al.*, (2013), considered the relationship between output and employment from Okun Law perspective for the United States economy, using both aggregate regional (state level) and sub-sectoral data. They found that the

relationship between output and employment is weak when output is at low levels, but it is strong and positive in the manufacturing and energy sub-sectors.

Caporale and Skare (2011) examined the short and long-run dynamic relationships between employment growth, inflation and output for 119 countries, using both individual and panel VECM models. They found evidence of Granger causality running from output growth to employment growth in the short-run. With regard to the long-run, their panel studies pointed to a negative relationship between employment growth and output growth for most countries, with a predominant unidirectional causality running from employment to output. However, for South Africa their individual country study did find a positive relationship between output and employment.

Sahin *et al.,* (2011), investigated via the VECM methodology, the relationship between employment and output using quarterly Turkish aggregate data, as well as, data involving nine sub-sectors over the 1988-2008 period. They found a long-run cointegrating relationship between aggregate output and non-agricultural sector employment. Moreover, they found long-run cointegrating relationships between sectoral employment and output for seven of the sub-sectors. However, they failed to find any short-term relationships at the aggregate level and for eight of the nine sub-sectors. Thus, they concluded that over the long-run sustainable growth is essential for employment generation, despite the weak linkages in the short-run.

The literature pertaining to the cointegrating relationship between physical capital and employment is sparse. Juselius (2005) employed the cointegrating VAR/VECM methodology to estimate a constant elasticity of substitution (CES) production function involving aggregate output, total employment and physical capital for the Finnish economy. He found a cointegrating relationship between capital and employment. Employing a Cobb Douglas specification, Josheski *et al.,*(2011) obtained similar findings to Juselius. Apart from the international studies of Juselius (2011) and Josheski *et al.,* (2011) no other recent studies seem to have focused on the marginal growth effect of employment. Hence this paper is an attempt to fill that gap.

To the best of our knowledge only two recent South African studies attempted to estimate the employment-growth elasticity, viz., the Hodge (2009) and Mahadea and Simson (2011) papers, both of which indicated that the ratio between the rate of growth in employment and GDP growth in South Africa is about 0.5%. This implies that only about half of the economic growth is translated into a rise in the labour employment rate. The Hodge study used six year moving averages to estimate the simple employment output ratios. He noted that since 1946 the elasticity was fairly stable, however, in the mid-1990s this elasticity turned negative during the period of 'jobless growth' before returning to its long-run average of 0.5% in the late 1990s to the present. Loots (1998) who employed a bivariate OLS approach confirmed the findings that South Africa experienced a partial stage of jobless growth during 1996-2000 when the GEAR strategy was implemented. The Mahadea and Simson study which also employed a bivariate OLS framework reiterated the conclusions reached by Hodge. Examining the problem of economic growth and unemployment over the period 1994-2001 in South Africa, Altman (2006) found that there is not a strong correlation between GDP and employment growth. She found that formal sector employment decreased from 69% in 1994 to 49% in 2001, while unemployed labour increased from 17% to 30%, whilst the proportion of underemployed increased ,from 14% to 21% over the same period.

None of the mentioned studies considered the issues of stationarity and cointegration between the variables which this study attempts to address. Moreover, the study hypothesises that the employment-growth elasticity for South Africa ought to be much lower than previous estimates which ignored the role of capital, and once it is accounted for as a control variable the elasticity is expected to be much lower. A lower elasticity is expected due to the severe constraints the economy faces in regard to employment creation.

2.3 Constraints to Labour Absorption

Hodge (2009), Kingdon and Knight (2009) and Wittenberg (2002) noted that with the ushering in of democracy in 1994 there was a massive rise in the supply of labour (females and young blacks), while labour demand stagnated. Spaull (2013) asserted that new entrants into labour market have low quality skills due to the challenges faced in the education system, thus resulting in a mismatch between the supply and demand of skills which is an important determinant of high unemployment rate in the economy.

Bannerjee et al. (2008) argue that pro-trade union inflexible labour policies have resulted in above market clearing real wages for union members (insiders) while the unemployed (outsiders) struggle to find employment. Another related factor is that of real wage costs, outstripping improvements in labour productivity, tend to destroy low-skilled employment given that this type of labour typically exhibits low marginal productivity (Fedderke, 2010; Fedderke and Simkins, 2012). Moreover, Edwards et al. (2015) argued that centralised bargaining councils dominated by larger firms tend to set sectoral wage rates that are unaffordable to smaller firms. Hence many such firms, which are major absorbers of unskilled and semi-skilled labour in other emerging market economies, have exited the economy while the few remaining ones have resorted to casual labour practices to keep costs low. Kerr, Wittenberg and Arrow, (2014) confirm that from 2005 to 2011 the net job destruction has been occurring among smaller firms (below the threshold of 500 workers) while larger firms have been net job creators, hence implying that larger firms have been the dominant labour absorbers in the economy.

Cheap imports (especially Chinese) due to trade liberalisation resulted in substantial decreases in employment in the labour intensive, as well as, semi-and unskilled sectors, including mining, furniture, clothing and leather apparel subsectors (Bhorat and Hodge, 1999; Edwards and Jenkins, 2013). Additionally, there has been structural changes in the economy favouring skilled-biased technological type of production processes involving a substitution away from unskilled labour to skilled labour and capital across many sectors, thereby reducing the capacity of the economy to absorb labour (Edwards 2002; Edwards and Golub, 2003, Rodrik, 2008).

Anand et al. (2016) argue that other important determinants of the high unemployment rate include large travelling costs to work due to poor public transport infrastructure and huge distances between residential areas and workplace; high crime rate discouraging informal start-ups; product market restrictions and supply-side bottlenecks like exchange rate depreciations tend to raise production costs.

3. DATA AND METHODOLOGY

In order to examine the marginal employment effects of output, i.e, the effect of a 1% increase in output on labour force employed, the study considered the long-run relationship between labour input, and output while including capital input as a control variable. This study used VAR/VECM framework, consistent with the approach used by Sahin *et al.,* (2011). The methodology is outlined below.

This study utilized the yearly formal sector employment data that Hodge (2009) compiled from various sources cited in his paper, which extends as far back as 1946 and ends in 2007. Wittenberg and Pirouz (2013) and Wittenberg (2014) provide detailed accounts of the challenges faced and the assumptions and imputations that had to be made in compiling a coherent dataset on labour statistics from disparate sources; the Hodge dataset, in part, used similar sources and made reasonable assumptions and imputations in arriving at a plausible employment series. The authors updated the series to 2015, by averaging the quarterly data reported in various issues of the Quarterly Labour Force Surveys (QLFS) published by Statistics South Africa. Furthermore, the study used aggregate real GDP measured in 2005 constant prices to represent real aggregate output. Additionally, gross fixed capital formation served as an estimate of aggregate capital accumulation. The annual series for real GDP and capital for the 1946-2015 period under study were downloaded from the South African Reserve Bank website.

Graph-panel1, in the Appendix shows the trending triple series comprising the natural log of GDP, labour and capital. An observation of the labour series post 2007, reflects that there were massive retrenchments over the global financial crises period, which bottomed out in 2010 and thereafter realigned to its long run trend from 2013 onwards. All the series were found to be I(1) non-stationary variables with the inclusion of a trend and intercept, the results of which are not reported in the interest of brevity but are available upon request from the authors. Moreover, all three factors exhibited significant serial correlation, as detected by the autocorrelation and partial autocorrelation statistics, also not reported but available upon request.

Table 4, in the Appendix, displays the summary descriptive statistics for the three variables. An observation of the respective minimum, median and maximum values, as well as, the standard deviations may lead one to conclude that outliers are not a problem with the variables under consideration. The skewness statistics for GDP and capital are approximately normal for they range between ±0.5, while labour is moderately skewed for it is just above this

threshold level. All three series exhibit distributions with kurtosis less than 3 (ie with excess kurtosis ≈ -0.8) thus compared to a normal distribution the tails are shorter and thinner and the central peak is lower and broader. However, the Jarque-Bera test, which considers both skewness and kurtosis in order to measure the extent to which a series deviates from a normal distribution, suggests that all the variables are above the 5% significance level, thus indicating that all the series are approximately normally distributed. Hence, given that the series are normally distributed and demonstrate I(1) properties no further transformations are needed in order to undertake the Johansen Vector autoregression (VAR) and vector error correction type analyses.

3.1 The Johansen Vector Error Correction Model (VECM)

The dynamics between labour and real output and capital can be analysed using the following VAR model, summarised in equation 1 below:

$$\begin{pmatrix} l_t \\ yr_t \\ k_t \end{pmatrix} = \begin{pmatrix} a_{10} \\ a_{20} \\ a_{30} \end{pmatrix} + \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{pmatrix} l_{t-1} \\ ry_{t-1} \\ k_{t-1} \end{pmatrix} + \begin{bmatrix} a_{14} & a_{15} & a_{16} \\ a_{24} & a_{25} & a_{26} \\ a_{34} & a_{35} & a_{36} \end{bmatrix} \begin{pmatrix} l_{t-2} \\ yr_{t-2} \\ k_{t-2} \end{pmatrix} + \begin{pmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \end{pmatrix} \qquad 1$$

Equation 1, above represents a reduced form second order vector autoregression (VAR) model which treats the natural logs of labour (*l*), real output (*yr*) and capital (*k*) as endogenous variables and assesses them jointly in the system. The above VAR model can only be estimated in that form if all the variables are I(0). But, since the mentioned variables are I(1), equation 1 could not be estimated in its existing form. However, since the variables in question are cointegrated they can be estimated using the Johansen (1991) VAR/VECM methodology whereby a pth order (second order in the current case) reduced form VAR system as represented by equation 1 can be represented by the following Johansen (1991) augmented VECM that is used by this study, and shown in difference form in equation 2, below:

$$\Delta y_t = \mu_0 + \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_{iy} \Delta y_{t-i} + \varepsilon_t \qquad 2$$

where, y_t is a k x 1 vector of endogenous I(1) variables, μ_0 represents the intercept coefficients, Π is a k x k long-run multiplier matrix and Γ_{iy} are k x k coefficient matrices describing the short-run dynamic effects. p is the VAR order (or lag length), since the VECM representation is in differenced form the lag order reduces to p-1. Furthermore, ε_t is a vector of independently and identically distributed innovations with zero mean. In regard to this study a battery of lag order selection tests, including the Akaike, Schwarz-Bayesian and Hannan-Quinn information criterion tests (not reported but available upon request) suggested that a second order (p=2) VAR model is most appropriate, hence a first order (p-1) VECM was estimated.

The Johansen VECM methodology is based on asymptotic properties, i.e. the results are valid only for large samples; hence the study opted to use the longest possible data set. However large time series data sets are vulnerable to structural breaks. The study applied the Bai and Perron (2003) structural break tests (not reported but available upon request) which identified three structural breaks viz., 1961.1991 and 2007. However when accommodating for one or more of the breaks in the form of dummy variables in the VAR specification, plausible results were not obtained. Hence the study opted for the reported model without accommodating for structural breaks on the premise that the structural breaks have been averaged out and subsumed in the cointegration relation over the 67 year span of the data.

Within the context of equation 1 above, the presence of cointegration is tested for by examining the rank of the Π matrix, through the use of the trace and maximum eigen value tests (Table 2). The presence of a reduced rank of Π (ie., where the rank of $\Pi = r < n$, where n is the number of endogenous variables), implies that there exists r cointegrating vectors and the matrix can be written as $\Pi = \alpha\beta$, with β containing the *r* cointegrating vectors and α the adjustment matrix describes the speed of adjustment of the variables as a result of previous period's deviation from the long-run equilibrium. If r>1, then the issue of identification of r cointegrating vectors arises. However, with reference to Table 2, both the trace and maximum eigen-value statistics confirm that r=1, hence the identification issue is superfluous in this context.

In light of the preceding discussions, the Πy_{t-1} term (equation 3), which is also known as the vector error correction mechanism (VECM), captures the long-run relationship between labour, real output and capital, and the short-run adjustments consistent with the long-run relationship. Hence this study exploits this feature in order to estimate the long-run marginal employment effects arising from real GDP and capital, and the short-run adjustment to this long-run equilibrium as a result of disequilibria, arising in the previous period that causes employment to deviate from this long-run cointegrating relationship. The Πy_{t-1} term can be expanded as follows:

$$\Pi y_{t-1} = \begin{bmatrix} \alpha_{11} \\ \alpha_{21} \\ \alpha_{31} \end{bmatrix} (\beta_{11} \quad \beta_{12} \quad \beta_{13}) \begin{bmatrix} l \\ yr \\ k \end{bmatrix}_{t-1} \qquad\qquad 3$$

where β_{11} is normalized to equal 1, which is the standard practice in estimating cointegrating relationships. This implies that natural log of labour is treated as the dependent variable in its relationship with the natural logs of real output and capital. Thus β_{12}, the elasticity of employment with respect to real output, may be interpreted as the long-run impact of output on labour, i.e. the marginal employment effects of output over the long-run. In a similar manner β_{13}, the elasticity of employment with respect to capital, may be interpreted as the long-run impact of capital on employment. A priori it is expected that the respective impacts of real output and capital on employment are positive. The adjustment coefficients $(\alpha_{ij}, i = 1,2,3; j = 1)$ must be considered with respect to the long-run cointegrating relationship which may be expressed in an Error Correction Mechanism (ECM) format as follows in equation 4:

$$\varepsilon = (l - \beta_{12} yr - \beta_{13} k)_{t-1} \qquad\qquad 4$$

Suppose employment in the previous period increases by more than its cointegrating relationship with output and capital dictates, then in the next period some or all three variables have to adjust in order to restore equilibrium to this long-run relationship. The adjustment coefficients describe the nature of this adjustment. Thus it is expected that $\alpha_{11} < 0$ since in the current period employment must decrease in order to restore the long-run equilibrium, while real output and capital must increase in the next period to restore equilibrium, which translates into $\alpha_{21} > 0$ and $\alpha_{31} > 0$.

4. RESULTS AND DISCUSSION

First the empirical approach used in estimating the cointegrating vector is outlined, thereafter the conclusions of the trace and maximum Eigenvalue statistics are discussed and finally the findings of the VECM and impulse response functions are presented.

Table 1. Summary of Cointegrating Test Assumptions

Data Trend:	Case 1: None	Case 2: None	Case 3: Linear	Case 4: Linear	Case 5: Quadratic
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend
Trace	1	2	3	0	0
Max-Eigen	2	1	0	0	0

Table 1 shows the five different assumptions that can be made with regard to the possible cointegrating relations that might exist among the variables in the dataset. However, in practice cases 1 and 5 are considered to be implausible for macroeconomic time series data and are rarely applied. Thus of the remaining three cases, the results show that under case 2 there might be one or two cointegrating relationships while case 3 implausibly suggests three cointegrating relationships exist among the variables. The study selected Case 2 and decided to give credence to the maximum Eigen which asserts the existence of one cointegrating relationship.

Table 2. Cointegration Test Results

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.434415	59.99502	35.19275	0.0000
At most 1 *	0.179948	21.24214	20.26184	0.0366
At most 2	**0.107740**	**7.751810**	**9.164546**	**0.0920**

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.434415	38.75289	22.29962	0.0001
At most 1	**0.179948**	**13.49033**	**15.89210**	**0.1150**
At most 2	0.107740	7.751810	9.164546	0.0920

As Table 2 above shows, the hypothesis of no cointegrating vector is rejected by both the trace (55.10 > 35.19) and maximum Eigenvalue statistics (38.75 > 22.3) at the 0.05% significance level. However, the trace statistic rejects the hypothesis of at most 1 cointegrating relationship (21.24 > 20.26) in favour of there being two such relationships (7,75<9.16). As noted above this study gave greater credence to the maximum Eigenvalue (13.57 < 15.89) statistic which supports the alternative hypothesis of a single cointegrating relationship which is then estimated.

Table 3. Three-Variable VECM Results of Long-run Relationship and Adjustment Coefficients

Cointegrating Eq:	CointEq1 (β	Coefficients)	
LL(-1)	1.000000		
LYR(-1)	-0.282675		
	(0.14162)		
	[-1.99606**]		
LK(-1)	-0.080930		
	(0.12579)		
	[-0.64336]		
C	-11.00681		
	(0.59268)		
	[-18.5712***]		
Error Correction:	D(LL)	D(LYR)	D(LK)
CointEq1 (α = adjustment coefficients)	-0.071087	-0.100179	0.063988
	(0.02830)	(0.01886)	(0.06607)
	[-2.5128**]	[-5.311***]	[0.96841]

Notes: Standard errors in curly brackets while students t statistics in square brackets.
'**' and '***' denote significance at the 95% and 99% significance levels respectively.
The short-run adjustment equations for labour, real income and capital are not reported for most of the coefficients were insignificant and this study was concerned with the long-run relations and adjustments to the conintegration relationship.

The results presented in Table 3, above, show the cointegration equation in a similar format to equation 4, above, where, β_{12} and β_{13} appear with negative signs due to the ECM rendition of the equation. Hence the two coefficients are to be interpreted as positive elasticities. Coefficient β_{12} (0.28) is the marginal employment effect and is statistically significant at the 95% confidence level. The magnitude of this suggests that in the long-run a 1% rise in real GDP will cause employment to increase by 0.28% per annum. In other words, it will take about 3.6 years for employment to rise by 1 percent. . Moreover, previous studies by Loots (1998), Hodge (2009) and Mahadea and Simson (2011) tended to overestimate this elasticity. Additionally, this paper's estimate is deemed to be more accurate than previous studies for apart from using the rigorous cointegration and VECM approaches it also controls for capital the other critical input into the production process.

On the other hand, the elasticity of employment to capital, β_{13} (0.08) is of the correct sign but is statistically insignificant. This is plausible because capital investment increases at a slow rate and favours the employment of a few skilled workers. In regard to the long-run relationship, similar results were found by Sahin *et* al., for their aggregate relationships of the Turkish economy. However, as noted above they failed to find short-run relationships. Juselius (2011) found similar long and short-run relationships for Finland's economy.

The short-run adjustment coefficient for labour, α_{11} (-0.07), as indicated in the lower section of Table 3, has the correct negative sign and is statistically significant. This suggests that when employment rises above its long-run structural average by 1% in the previous period, then in the succeeding period it adjusts downward by approximately 0.07%. The result implies that it will take about 14.3 years to eliminate the disequilibrium in employment resulting from exogenous factors causing it to exceed its long-run equilibrium relationship as captured by the cointegrating vector (i.e. its long-run relationship with real output and capital). This extremely slow return to equilibrium is perhaps indicative of high degree of inflexibility in the South African labour market. The result for the adjustment coefficient of real output, α_{21} (-0.1) is quite puzzling since it has the incorrect sign and is highly statistically significant. Assuming there is no specification bias in the econometric model, this result implies that when employment rises above its long-run structural relationship with the other variables in the previous period, then in the succeeding period real output adjusts downwards by 0.1%, instead of upwards. This explanation is perhaps supported by the persistent declining trend in real GDP growth since 1947, as indicated in the Appendix figure where the upper line shows a steadily declining trend.

The lower trend line, in Appendix (panel 2) figure, demonstrates the persistent decline in labour growth. Interestingly, both the labour growth and real GDP growth trend lines, which were calculated using a simple trend regression specification (not reported), appear to be parallel. These results from a microeconomic-production theoretic perspective, suggest the South African economy is operating in a terrain of severely diminishing marginal returns to employment. The adjustment coefficient for capital (0.06) is of the correct sign but is statistically insignificant; this result is plausible as investment takes a long time to adjust to environmental changes.

The Granger causality tests, recorded in the Appendix table 5, confirm that there is a predictive causal relationship between output and labour. However, the Granger causality test goes further and suggests that real output has a bi-directional causal relationship with labour. The causal relationship running from output to labour (i.e.,past output predicts future labour) is significant at the 10% significance level. While the causal relationship running in the opposite direction is significant at the 5% significance level (ie., past labour also predicts future real output). These results not only confirms the causal relationship assumed by the long-run cointegrating relationship, it also validates the significance of both the α_{11} and α_{21} short-run adjustment coefficients discussed above where previous period disequilibria are adjusted in the next period. Further, there is a significant causal relationship running from real output to capital.

4.1 Results of Impulse Responses

Figure 1. Impulse Responses to Cholesky One S.D. Innovations
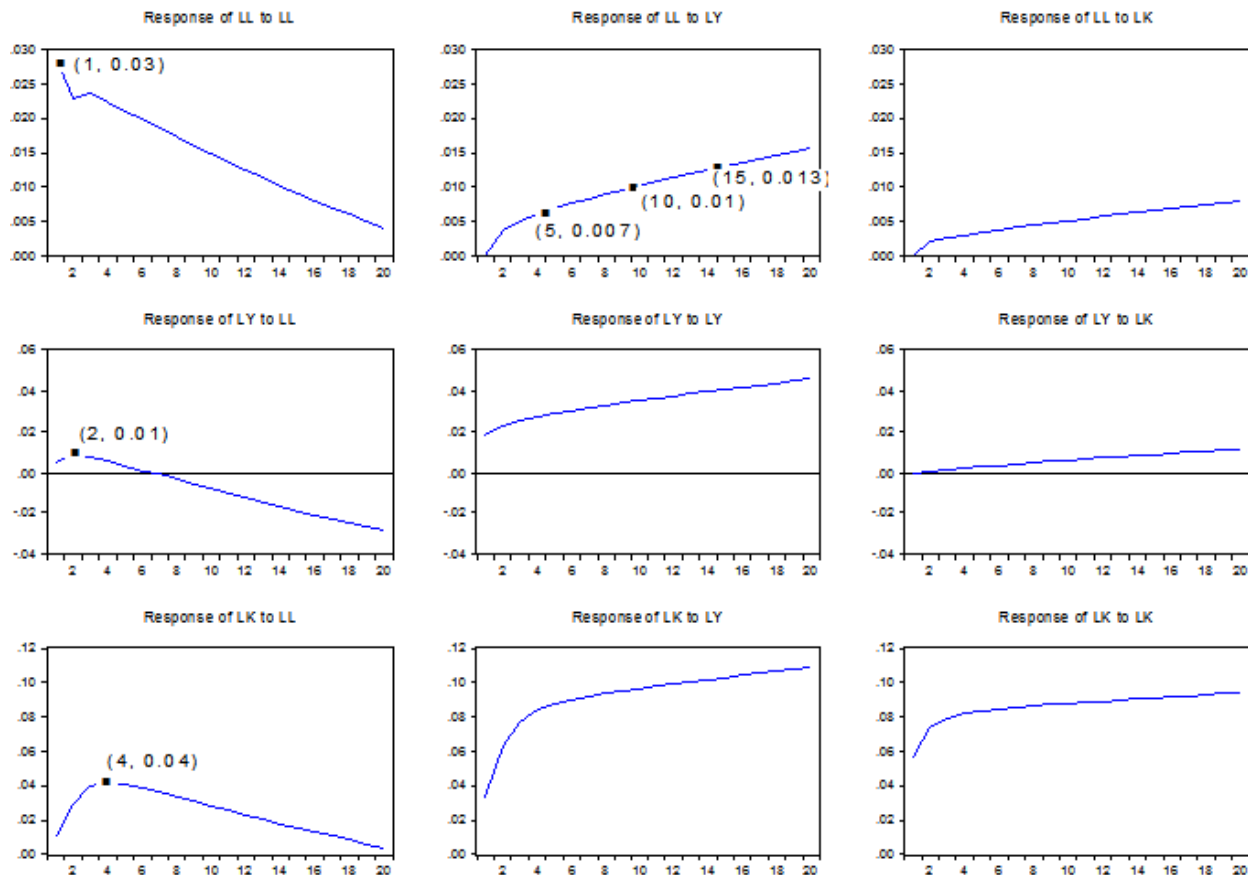
Within the VAR/VECM framework, where each variable in the system is treated as a function of the remaining variables, impulse responses trace out the response of the dependent variable to a unit shock to the error term associated with the independent variable. Figure 1 above displays the full set of responses. Of particular importance to the point of marginal employment effects is the middle panel of the first row, which shows that a unitary shock to real output leads to employment responding with a one period lag. However the response is a sustained rise over the 20 year horizon, with the response rates after 5, 10 and 15 years being, 0.007, 0.01 and 0.013, respectively. While, as expected, the third panel in row one shows that the response of employment to a shock to capital is positive but weak.

The first panel of row one, demonstrates that a 1% positive shock to labour employed results in an immediate decline in the percentage employed 0.03% and thereafter followed by a sustained declining trend. Finally, the other two panels that are of minor relevance to this study is the impulse responses of real output and capital to unitary positive labour shocks as captured in rows two and three of the first panel. Real output responds weakly to a positive shock, reaches a maximum of 0.01% in the second year and then tapers off rapidly to zero by the seventh year (panel 1, row 2). Capital's response is also quite weak, where it reaches a maximum of 0.04% in year four and then steadily declines. This reflects that the response of labour employment to a shock in capital is positive, but not robust. An overview of the impulse response functions suggests that the effects of real GDP on employment are significant and positive but low in magnitude, thus indicating high economic growth rates are needed for South Africa to resolve its unemployment problem, and this calls for drastic policy shifts on all fronts.

5. CONCLUSION

This study indicates that economic growth generates employment growth over the long-run at a significant rate of about 0.28% for every 1% growth in real GDP. This suggests GDP growth is positively employment-creating; for every 1% rise in real GDP it takes about three and a half years for employment to increase by 1%. However, the output-employment relationship is positive, but not very high, perhaps a reflection that the labour market in South Africa lacks flexibility, and this rigidity is robbing the market of its ease to encourage employment growth, thus possibly limiting the marginal employment effect.

The short term adjustment coefficient for labour indicates that should there be a shock, it takes about 14 years for economy to revert back to its equilibrium state; this is further evidence of a rather inflexible labour market. Indeed, according to the World Bank *Doing Business 2010* report, the rigidity of employment index in South Africa is quite high at 35, relative to its neighbour, for example Botswana, at 13. Similarly, the difficulty of hiring people is high in South Africa, at 56 relative to Botswana, where the index is 0. A lower absolute value for the rigidity index indicates a more flexible labour market (World Bank, 2010). If firms find it difficult to fire labour, they may not hire so easily. Thus, as South Africa is caught in a low employment-growth trap, the results of the study strengths the need for stronger economic growth with greater labour market flexibility to provide greater employment opportunities. This reinforces the suggestion of the NDP that South Africa needs to grow faster with less labour market rigidity and higher worker productivity for enhanced employment effects.

Employment elasticity with respect to capital was found to be positive but not significant. However, this does not mean that capital is unimportant for employment creation. While there might be some elements of factor substitution, the literature has generally shown that there is a close correlation with human capital (proxied by tertiary education) and capital. Through this 'embodied' channel it is most likely that capital has a significant effect on marginal employment effect.

For higher marginal employment growth effects, South Africa needs to secure high levels of inclusive economic growth and productive investment. This is not possible unless macroeconomic and microeconomic growth environmental factors are supportive of flourishing entrepreneurship and industry (Parsons, 2013). According to the Economic Forum's Growth Competitive Index, the country's performance on the macroeconomic environment declined from 43rd in 2010 to 69th in 2012, and to 85th position in 2015. This slippage is also reflected in our graph in the Appendix figure.

Accordingly, a big push approach is needed to enhance the marginal employment growth effect, so that an inclusive growth impacting on all economic sectors generates significantly more employment opportunities. As argued by Burns, Edwards and Pauw (2010), South Africa requires policies that should improve the country's economic growth, its labour absorption capacity, raise the skills of job seekers and reduce labour market rigidities.

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APPENDIX

Graph-Panel 1. Natural logs of GDP, Labour and Capital
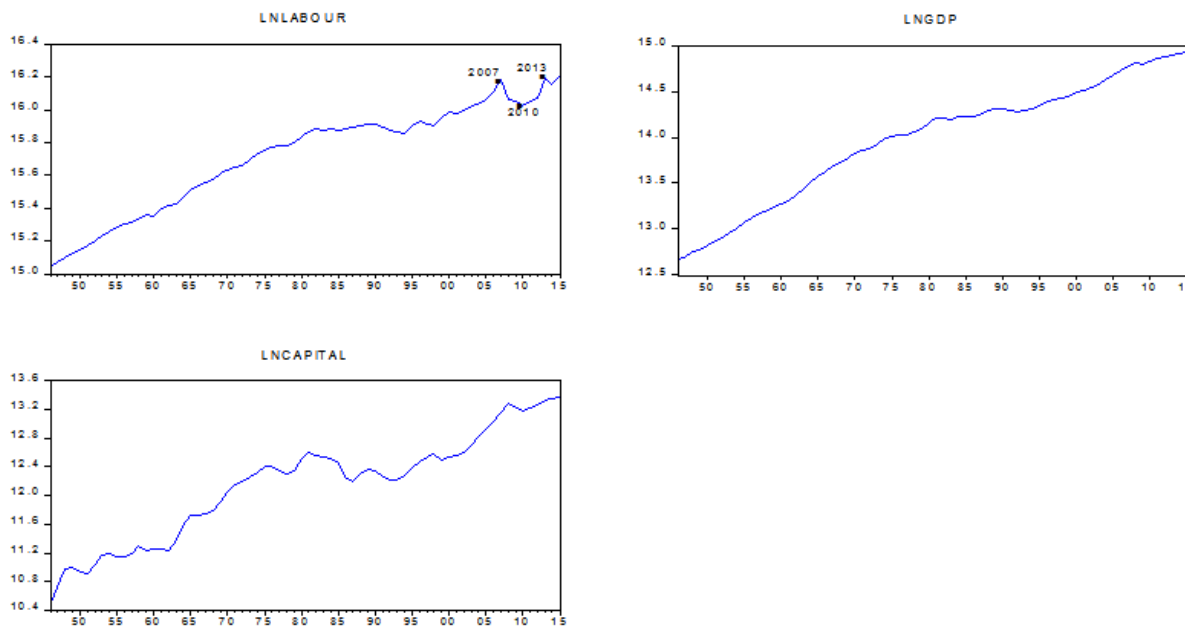
Table 4. Descriptive Statistics of GDP, Labour and Capital

Variable	LnGDP	LnLabour	LNCapital
Mean	13.97	15.72	12.14
Median	14.17	15.85	12.31
Maximum	14.93	16.21	13.37
Minimum	12.67	15.04	10.51
Std. Dev.	0.65	0.32	0.74
Skewness	-0.46	-0.55	-0.29
Kurtosis	2.11	2.13	2.18
Jarque-Bera	4.75	5.7	2.94
Probability	0.09	0.06	0.23
Sum	977.83	1100.1	849.51
Sum Sq. Dev.	29.5	7.12	37.97
Observations	70	70	70

Source: Own Calculations
Note: the 'Ln' prefix represents the natural log of the variable.

Graph Panel 2. South African Real GDP and Labour Growth Rates, 1947 – 2012
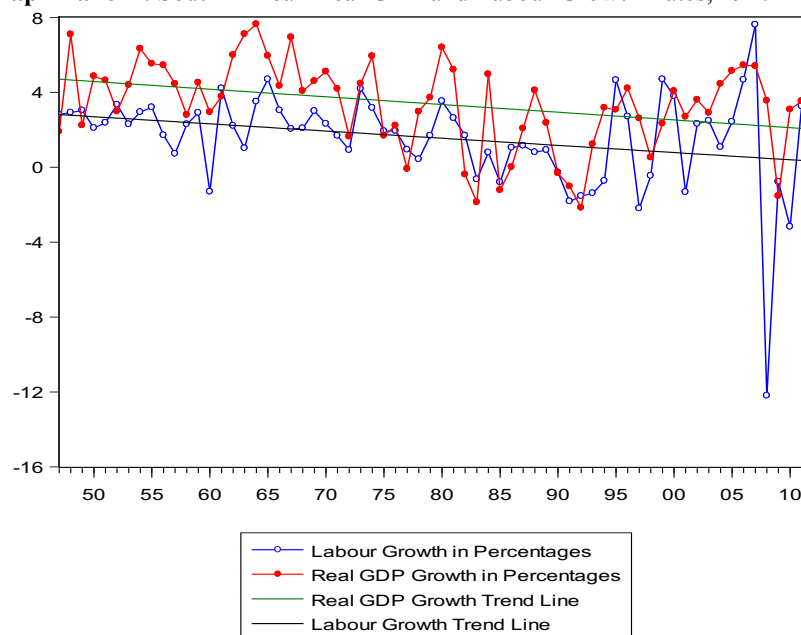
Source: Authors' own calculations.

Table 5. VAR Granger Causality/Block Exogeneity Wald Tests

Sample: 1946 2015			
Included observations: 68			
Dependent variable: LL			
Excluded	Chi-sq	df	Prob.
LY	8.865977	2	0.0119
LK	0.018477	2	0.9908
All	13.18280	4	0.0104
Dependent variable: LY			
Excluded	Chi-sq	df	Prob.
LL	7.834808	2	0.0199
LK	2.504152	2	0.2859
All	9.890093	4	0.0423
Dependent variable: LK			
Excluded	Chi-sq	df	Prob.
LL	3.104038	2	0.2118
LY	12.49857	2	0.0019
All	20.55310	4	0.0004