

The Sectoral Employment Intensity of Growth in South Africa

Njabulo Innocent Mkhize

<https://orcid.org/0000-0001-6207-7538>

University of South Africa

mkhizni@unisa.ac.za

Abstract

Concerns have been expressed recently about the inability of the South African economy to provide adequate employment for the increasing number of job seekers. This paper investigates how sectoral employment intensity of output growth in the eight non-agricultural sectors of the South African economy has evolved in the period from the first quarter of 2000 to the fourth quarter of 2012, with a view to identifying key growth sectors that are employment intensive. Empirical findings of the study suggest that total non-agricultural employment and GDP do not move together in the long run, implying that jobless growth occurred in South Africa during the period under review. This supports the view that South Africa has become less labour-intensive and more capital-intensive. Results of a sectoral composition confirm a long-run relationship between employment and growth in the finance and business services, manufacturing, transport and utilities sectors. In particular, the results suggest that sectors within the tertiary sector are the best performing sectors in terms of employment intensity of output growth, reflecting the changing structure of the economy and the nature of employment shifting away from primary towards the tertiary sector. Investment in the tertiary sector is necessary to foster new employment opportunities and can assist in improving overall employment intensity in South Africa.

Keywords: sectoral output growth; employment; employment intensity

Introduction

The theoretical background to most studies that analyse the relationship between employment and growth (i.e. the employment intensity of output growth) is provided



Southern African Business Review
<https://upjournals.co.za/index.php/SABR>
Volume 23 | 2019 | #4343 | 24 pages

<https://doi.org/10.25159/1998-8125/4343>
ISSN 1998-8125 (Online)
© The Author(s) 2019



Published by Unisa Press. This is an Open Access article distributed under the terms of the Creative Commons Attribution-ShareAlike 4.0 International License (<https://creativecommons.org/licenses/by-sa/4.0/>)

by Okun's Law and the production function theoretical framework. In his study, Okun (1962) formalised the inverse relationship between the unemployment rate and growth in real output into a statistical one. He estimated a coefficient (commonly known as Okun's coefficient) that postulates a specific empirical relationship between economic growth and the change in the rate of unemployment (output-unemployment elasticity), using US data. More specifically, his study concluded that there was a ratio of 1:3 describing the relationship between unemployment rates and output, which simply means that a one percentage point increase in unemployment will cause real growth of output to fall by approximately three per cent. Reversing the causality, a one percentage point increase in growth (above potential output) would lead only to a 0.3 per cent reduction in unemployment (Khemraj, Madrick, and Semmler 2006).

The production function theory has been used to answer the question as to how decisions related to employment are linked to decisions related to production. While production functions were originally designed for the individual firm within the microeconomic context, macroeconomists recognised the usefulness of this methodology as an important tool for estimating certain parameters that cannot be directly measured from national accounts data (Miller 2008). Work by Solow (1956) contributed significantly to the new theory of macroeconomic dynamics by introducing a new type of aggregate production function with constant elasticity of substitution (CES). His neoclassical production function allowed for substitution between labour and capital, with technology assumed to be an exogenous factor that allows the transformation of input into outputs (Mankiw 1995). Later, Arrow, Chenery, Minhas, and Solow (1961) and Brown and de Cani (1963) made further contributions by developing the theoretical and econometric foundations of the CES production function. Further inventions of new methods of production concerned the transfer of ideas and human capital among firms, industries and nations. According to Lucas (1988) and Romer (1986), human capital is a key ingredient to economic growth due to its positive external spill-overs in production functions and is responsible for infinite aggregate elasticity of substitution. This was also reaffirmed by Goldin (2001) who attributed much of the United States' economic success in the twentieth century to the growth of human capital. It is thus further argued that low average spending on investment in education is a policy distortion that retards progress in a number of developing countries (Heckman 2003).

Following these formations, the CES production function has been applied to analyse the transmission of economic growth into employment where multiple structural mechanisms account for job creation and destruction. Hence, this paper will employ the neoclassical growth model with CES production function to explain sectoral employment intensity of output growth in South Africa.

Situation in South Africa

The general perception of employment performance in South Africa has been rather negative. The key issue in the long-lasting debate about this problem is the inability of

South Africa's economic growth, generally regarded as the creator of employment, to create sufficient employment opportunities for the growing labour force. The rate of unemployment remains stubbornly high in spite of vastly improved macroeconomic fundamentals compared with the situation in the 1990s (Hodge 2009). According to the South African Reserve Bank (SARB 2012), South Africa registered positive average growth rates of 4.9 per cent in 2005–2008 and 1.7 per cent in 2009–2011. However, despite these growth rates, employment has not increased significantly. During these two periods, total non-agricultural employment was on a declining trend from a level of 2.4 per cent in 2005–2008 to -0.6 per cent in 2009–2011.

According to the National Treasury (2011), currently only two out of five persons of working age (41 per cent) have a job, compared with 65 per cent in Brazil, 71 per cent in China and 55 per cent in India. It is further asserted that in order to match the emerging markets average of 56 per cent, South Africa would need to employ approximately 18 million people, which would be 5 million more than are employed.

Figure 1 below shows the relationship between gross domestic product (GDP) and employment. As can be seen, between the 1970s and 1980s, GDP growth and private sector employment were highly correlated. However, structural shifts together with increasing capital intensity in the early 1990s have led to the deterioration of this relationship. According to SARB's 2001 report, this relationship broke down in the 1990s. During this period, the unemployment rate began to increase in each successive year, with the most rapid increase having occurred in the mid- and late-1990s. The average labour force absorption capacity declined from 79.6 per cent during the 1973–1977 period to zero during the 1990–1995 period (Loots 1998).

In an effort to stem the contraction of the labour market, government launched an Expanded Public Works Programme in the mid-2000s which was aimed at creating jobs and providing training opportunities through investment in physical infrastructure. The impact of this initiative is indicated in the figure below by the once-off sharp increases over this period.

The SARB (2001) reaffirmed that the deteriorating relationship between employment and growth was in part attributed to rising capital intensity. An International Labour Organisation (ILO) study by Hayter, Reinecke, and Torres (1999) indicated that some of the causes for increasing capital intensity in developing countries included trade liberalisation, which shifts production in favour of capital-intensive sectors and to the detriment of the labour-intensive ones. This reaffirms the view by Nattrass (1998) that since South Africa embarked on trade liberalisation in the 1990s, exports have become relatively less labour-intensive and more capital-intensive. A study by Schoeman, Botha, and Blaauw (2010) highlighted hostile labour relations, sunk costs and uncertainty about labour as a production factor as some of the reasons that contributed to high capital intensity in South Africa. This suggests that South Africa has specialised

in capital-intensive products, which in turn facilitated a structural adjustment that has led to a weakening employment-growth relationship.

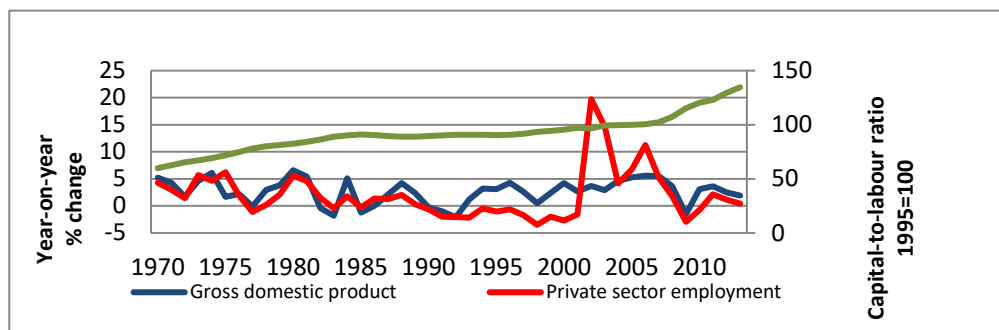


Figure 1: Private sector employment, GDP and capital labour ratio

Source: SARB (2001b); SARB (2014); QUANTEC (2014)

The objective of this study is to investigate how the sectoral employment intensity of output growth in the eight non-agricultural sectors of the South African economy has evolved, with a view to identifying key growth sectors that are employment intensive. To achieve this, the study will evaluate the employment elasticities in the major SIC divisions to establish whether growth is employment intensive in these sectors. Although several studies have explored the relationship between economic growth and employment for specific countries and across countries, no previous research has analysed this for the single-digit disaggregation into the eight major Standard Industrial Classification (SIC) divisions of the South African economy. This is the main contribution of this paper.

This paper is organised into six sections. Following the introductory section is Section 2, which provides a literature review of the relationship between growth and employment. Section 3 derives an empirical model of employment demand in South Africa using a production function approach. Some methodological issues related to the econometric estimation of the demand model are also discussed in Section 3. Section 4 discusses data issues while Section 5 presents and analyses the empirical results. Section 6 concludes the study.

Literature Review

A number of studies, including work by Ajilore and Yinusa (2011), Borat and Oosthuizen (2008), Fofana (2001), Gabrisch and Buscher (2005), Hodge (2009), Kapsos (2005), Mahadea and Simson (2010), Pianta, Evangelista, and Perani (1996), Pini (1997), Sawtelle (2007), and Upender (2006) have investigated employment intensity of output growth in various countries, including South Africa. Most of these studies were a response to the immediate challenge of employment creation faced by a number of these countries. In some of the countries analysed, it seems that growth,

generally regarded as the creator of employment, was not able to create adequate employment opportunities for the growing unemployed population.

Some of these studies have investigated how the employment intensity of growth has evolved over time. For instance, a study by Dopke (2001) gives some of the reasons why employment intensity has changed over time. In his study he suggests that employment intensity evolves due to changes in the rate of technical progress, changes in institutional settings within the labour market as well as amendments in wage policies. In this vein, Pini (1997) adapted the CES theoretical approach to examine employment intensity between different countries, over specific periods. He found that employment elasticities in Germany and Japan increased during the period 1979–1995, as compared to the period 1960–1979. In his study, he also found negative employment elasticities in Italy and Sweden for the period 1990–1995. In a similar study that analysed employment intensity among the G7 countries, Pianta, Evangelista, and Perani (1996) found evidence suggesting that the reforms introduced in major economic sectors had moderated the relationship between employment and economic growth. Another study by the International Labour Organisation (1996) on industrialised economies, revealed mixed results showing an insignificant relationship for Germany, UK and Italy.

With regards to transition economies, a study by Gabrisch and Buscher (2005) provided a comprehensive perspective on unemployment dynamics in transition countries to measure the responsiveness of labour markets to economic growth. It analysed the unemployment-growth dynamics in the eight new member countries from Central-Eastern Europe namely Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia. The study results revealed that during the first transition stage, which was until 1994, declining output was responsible for unemployment only in the Czech Republic. During this period, unemployment in most of these Central-Eastern European countries seemed to be affected by transition-specific determinants. Estimates of the later period of the transition, between the first quarter of 1998 to the fourth quarter of 2004, showed a strong improvement in the significance and sensitivity of the results. A study by Schiff et al. (2006) revisited this issue. It undertook a cross-country analysis of 11 countries in Central and Eastern Europe between 1993 and 2002, in order to explain the labour market dynamics during the transition, as well as differences between these countries. The results suggested that both employment and unemployment rates were persistent. In other words, lagged unemployment was found to have a large positive effect on unemployment, as indicated by the fact that a one-percentage-point increase in the lagged unemployment rate raises the current unemployment rate by almost 0.6 of a percentage point. Similar results were recorded for employment, where a one-percentage-point rise in lagged employment generated around 0.6 of a percentage point increase in employment. The results of the study also suggested that, as expected, the impact of growth on employment depended upon the country's stage of transition. In this regard, the employment elasticity value in the early transition was found to be insignificant and negative, but as the transition advanced, the link between growth and employment became more profound. However, the study made little reference

concerning the factors affecting employment intensity of economic growth in transition economies.

Within developing economies, Fofana (2001) used the production function approach to investigate the empirical relationship between employment and GDP in Cote d'Ivoire and concluded that it was negative. In his study he used simple regression analysis to assess the linkage between employment and other selected variables such as GDP, public expenditure, investment and development aid. After undertaking a series of tests on the data, including a unit root test for stationarity in the variables and a co-integration test, his study found that the employment elasticities of growth, aid, public expenditure and investment were -0.11, -0.09, 0.02 and 0.26 respectively. Since employment and growth were found to be negatively correlated, the study concluded that the possibility of jobless growth exists in the country and that relying solely on macroeconomic equilibrium was not enough to tackle the challenge of unemployment. Although the results of the study suggest that the link between economic growth and employment is still useful for macroeconomic policy, there is no evidence on how the link can be influenced and exploited by economic policy.

A study by Mahadea and Simson (2010) examined the problem of low employment economic growth performance in South Africa for the period 1994 to 2008. Their study adopted the Harrod-Domar model as a heuristic guide to analyse the economic growth of South Africa, as well as the least squares regression method to examine the long-term relationship between growth and employment (Domar 1946). The results of the regression analysis found that during the 1994 to 2008 study period, the output elasticity of employment in South Africa was low at 0.1541. Moreover, it found that the long-run growth-employment effect was also weak. However, in their study, the authors neglected the influence of relative prices, and thus it could be argued that the estimated equation is not appropriate since it is incorrectly specified. In another study, by Marinkov and Geldenhuys (2007), the authors estimated the unemployment/growth relationship for the South African economy, using data from 1970 to 2005. Unlike this study, which has adapted the CES theoretical approach, in their study the authors estimated the Okun's coefficient for the South African economy and found no co-integrating relationship between the unemployment and output series. Their study recommended that the extent to which total unemployment (not only cyclical unemployment) responds to output, be investigated as well as the factors associated with other types of unemployment before any definite policy recommendations can be made.

While some of the studies reviewed analysed the employment/growth relationship from an aggregate perspective, others have explored the sector composition of employment with the view to determine industry-specific elasticities that describe structural changes over time. A study by Kapsos (2005) analysed cross-country panel data for 160 economies to examine, among others, the employment elasticities for the three broad economic sectors (agriculture, industry and services) between 1991 and 2003. A multivariate log-linear regression model with country dummy variables was used to

generate the sectoral employment elasticities. The results of the study supported the notion that the economies' share of the services sector accounted for the highest employment elasticities, hence indicative of much flexibility and dynamism of the sector. A similar study by Mourre (2004) further examined employment intensity of growth in different economic sectors and concluded that in the Euro area, the services sector reflected high employment elasticities between 1997 and 2001, which contributed to the region's overall employment elasticity.

In another study by Ajilore and Yinusa (2011), the authors used an econometric technique to calculate employment elasticity in Botswana over the period 1990 to 2008. The study sought to estimate a labour demand model of a double-log linear specification of the linkage between sectoral employment and other variables included in the demand for labour model, comprising the real wage rate, user cost of capital, sectoral gross value added and a measure for international exposure. The model was also tested for co-integration in order to determine the existence of a long-run relationship between the model variables. At a sectoral level, the study found that the employment elasticity of sectoral output growth in banking, commerce, construction, manufacturing and mining were positive but weak, indicating that growth in these sectors was more productivity-driven rather than labour-employment-driven.

Upender (2006) found that in India during the post-reform period, which was after 1991, the positive magnitude of employment elasticity in the finance, insurance and real estate sectors was relatively high compared to the negative employment elasticity in the agriculture and hunting sector. Similarly, Sawtelle (2007) reported a high employment elasticity value in the finance, insurance and real estate sectors in the US during the period 1991 to 2001. Her findings strongly suggest that simultaneous targeted-industry labour market transition initiatives were desirable, in order to assist overall employment growth and distribute the effects of such growth evenly across sectors.

The Model

In investigating the macro production function of an economy, the labour input (demand for labour) and other complementary factors of production produce a national output. This study adopted the methodology of Upender (2006) to derive the demand function for labour from the CES production function by solving the marginal product of labour equation. Hence, the following CES production function is considered in this paper to derive the empirical demand function for labour. The CES production function can be specified as:

$$GVA_{it} = A \{ \alpha K_{it}^{-\rho} + (1-\alpha) E_{it}^{-\rho} \}^{-\eta/\rho} \quad (1)$$

where,

GVA_{it} = Gross Value Added (sectoral output)

K_{it} = Capital (input)

E_{it} = Employment/labour (input)

A = Efficiency parameter; $A > 0$

η = Returns to scale parameter; $\eta > 0$

α = Distribution parameter; $0 < \alpha < 1$

ρ = Extent of substitution (between K and E) parameter, $\rho > -1$, and related to elasticity of substitution; $\sigma = 1 / 1 + \rho$

The derivative of labour (i.e. marginal product of labour (MP_L)) from Equation (1) can be written as:

$$dGVA_{it} / dE_t = \eta (1-\alpha) / A^{\rho/\eta} \cdot GVA_{it}^{(1+\rho)/\eta} / E_{it}^{\rho+1} \quad (2)$$

The above MP_L expression is solved for the E_{it} input variable in order to derive the empirical labour (employment) demand function:

$$\begin{aligned} \eta (1-\alpha) / A^{\rho/\eta} \cdot GVA_{it}^{(1+\rho)/\eta} &= E_{it}^{\rho+1} \\ [\eta (1-\alpha) / A^{\rho/\eta} \cdot GVA_{it}^{(1+\rho)/\eta}]^{1/\rho+1} &= E_{it} \\ E_{it} &= [\eta (1-\alpha) / A^{\rho/\eta} \cdot GVA_{it}^{(1+\rho)/\eta}]^{1/\rho+1} \\ E_{it} &= [\eta (1-\alpha) / A^{\rho/\eta}]^{1/\rho+1} \cdot GVA_{it}^{(1+\rho/\eta)(1/\rho+1)} \\ E_{it} &= \beta_0 GVA_{it}^{\beta_1} \end{aligned} \quad (3)$$

where,

$$\beta_0 = [\eta (1-\alpha) / A^{\rho/\eta}]^{1/\rho+1}$$

$$\beta_1 = (1+\rho/\eta)(1/\rho+1)$$

$$\beta_1 = 1+\rho/\eta \cdot \sigma$$

$$\sigma \text{ (elasticity of substitution)} = 1/\rho+1$$

However, if we log-transform Equation (3) above we obtain the following employment function:

$$\begin{aligned} \ln E_{it} &= \ln \beta_0 + \beta_1 \ln GVA_{it} \\ &= \beta_0 + \beta_1 \ln GVA_{it} + \dots \beta_n \ln X_{nit} + \varepsilon_{it} \end{aligned} \quad (4)$$

Thus written, the model is linear in parameters β_0 and β_1 and it is, therefore, a linear regression model. Although from Equation (1) it is clear that the relationship between output and the two inputs (capital and labour) is non-linear, but it is linear in the logs of these variables. Hence, Equation (4) is a double-log linear regression model.

Estimation Methodology

The estimation methodology to be used in this study is the Engle and Granger (1987) “four-step” testing procedure which seeks to determine whether the residuals of the equilibrium relationship are stationary. This procedure had gained comparative popularity due to its simplicity to estimate a static model using Ordinary Least Squares (OLS) and then performing unit root tests on residuals. Furthermore, while the Engle-Granger procedure is well established in the statistical literature, it has also proved to be able to avoid pitfalls tending to give spurious co-integration due to misspecifications of long-memory components of variables (Gonzalo and Lee 1998). Also, estimating the short-run Error Correction Model itself using the estimates of disequilibrium makes it possible to obtain information on the speed of adjustment to equilibrium. This method has been widely used in the context of employment intensity of output growth by Ajilore and Yinus (2011), Fofana (2001), Kapsos (2005), Sawtelle (2007), and Upender (2006).

In order to capture the employment elasticities of the main SIC divisions of the economy and the differential partial elasticities of employment with respect to the wage rate, inflation and user cost of capital, the double-log linear regression Equation (4) is extended and estimated. Equation (4) is rewritten as:

$$\ln E_{it} = \beta_0 - \beta_1 \ln W_{it} + \beta_2 \ln r_{it} + \beta_3 \ln GVA_{it} + \beta_4 \ln \pi_{it} + T_{it} + \varepsilon_{it} \quad (5)$$

where, $t = 1, \dots, 52$ indicates quarters and $i = 1, \dots, 8$ represents industry sectors, as well as aggregate (or total) non-agricultural. The dependent variable, E_{it} represents total non-agricultural employment comprising formal and informal sectors, in thousands of persons in the specific economic sectors i , in quarter t . A dummy variable, D_t , was created to cater for the 2008/9 financial crisis in the estimation.

The eight economic sectors for employment are:

- EMP_MIN = mining
- EMP_MAN = manufacturing
- EMP_UTIL = utilities
- EMP_CON = construction
- EMP_TRAD = trade
- EMP_TRANS = transport
- EMP_FIN = finance and business services
- EMP_SOC = social and community services

The explanatory variables are:

W_{it} = quarterly sector specific nominal wages, seasonally adjusted, measured in thousand rands.

r_t = is the user cost of capital, proxied by long-term bond interest rates.

π_t = inflation rate measured in terms of the Consumer Price Index (CPI).

$D_t = 1$ (if there is recession)

= 0 (otherwise)

GVA_{it} = sector specific gross value added (GVA) in constant 2005 prices.

The eight economic sectors for gross value added are:

GVA_MIN = mining

GVA_MAN = manufacturing

GVA_UTIL = utilities

GVA_CON = construction

GVA_TRAD = trade

GVA_TRANS = transport

GVA_FIN = finance and business services

GVA_SOC = social and community services

TIME (T_t) = quarterly time trend variable where $t = 1$ is April 2000 and $t = 52$ is

December 2012

ε_{it} = error term.

Thus, the sector specific functional relationship to be analysed in this study is as follows:

(-) (+/-) (+/-) (+) (+) (+) (+)

$E_{it} = f_i (W_t, r_t, \pi_t, GVA_MIN_t, GVA_MAN_t, GVA_UTIL_t, GVA_CON_t,$

(+) (+) (+) (+)

$GVA_TRAD_t, GVA_TRANS_t, GVA_FIN_t, GVA_SOC_t)$

The model hypothesises that employment in persons (not hours) responds to macroeconomic variables, and that employment decisions by firms depend upon the most recent data (previous quarter) known prior to the employment activity. The signs hypothesised for the model coefficients are as follows:

W_{it} : *negative*. An increased percentage change in nominal wages creates upward pressures on the cost per unit of production, causing employers to reduce their demand for labour.

r_t : *positive or negative*. An increase (decrease) in long-term bond interest rates will decrease (increase) the demand by employers for capital and will decrease (increase) the demand for consumer goods and services. The decreased (increased) demand for capital will decrease (increase) labour productivity and the decreased (increased) demand for consumer goods and services will decrease (increase) the derived demand for labour. In these circumstances, employment would be inversely related to long-term

interest rates. However, in some industries capital may be a substitute for labour. Therefore, an increase in long-term bond interest rates may decrease the demand for capital and consequently increase the demand for labour. In this case, long-term interest rates would be positively related to employment.

π_t : *positive or negative*. An increase in the rate of inflation as measured by CPI implies higher marginal revenue products of labour and hence a subsequent increase in demand for labour by employers. Alternatively, an increase in the rate of inflation may decrease consumer demand for goods and services and thus decrease the derived demand for labour.

GVA_{it} : *positive*. The expansion of sector real gross value added will generate increased derived demand for workers (not only worker hours) as employers view increased real sector output as a signal of future increased demand for consumer final goods and services.

The logarithmic specification of Equation (5) ensures that β_i can be interpreted as elasticities (Kapsos 2005). For instance, β_2 is the (partial) elasticity of employment with respect to user cost of capital, holding all other things constant. Likewise, β_3 is the (partial) elasticity of employment with respect to output. It measures the percentage change in employment for a one-percentage change in sectoral output, holding other things constant. The parameter of primary interest in this study will be β_3 , the sectoral output elasticity of employment, which will enable the identification of those sectors in the economy that are employment intensive. Hence, a positive elasticity value of 0.5, for instance, implies that a percentage increase in gross value added is associated with half a percentage increase in employment. The estimates of employment elasticity that will be generated from Equation (5) above are based on the assumption that employment is a primary function of output (Ajilore and Yinusa 2011). Hence, the elasticity coefficients that will be generated for individual economic sectors are indicative of the responsiveness of the quantity of employment persons to sectoral output.

Data Sources and Description

The study utilises secondary, quarterly data covering the period from the first quarter of 2000 to the fourth quarter of 2012. The variables used in this empirical study include total employment, real GDP, sectoral GVA, nominal wages as price for labour, long-term bond interest rates as price of capital, and the inflation rate. The data on employment in the non-agricultural sector were sourced from the Quarterly Labour Force Survey of Statistics South Africa (StatsSA). Data on GDP and GVA were also obtained from StatsSA. Data on wages, long-term bond rates and inflation rate were sourced from the South African Reserve Bank database. Employment is measured as the total number of employees in the South African non-agricultural sector. Sectoral output is proxied by gross value added at constant 2005 prices. The nominal wage variable is measured as average employee earnings by sector in thousand rands. The

choice of using nominal wages (instead of real wages) data was in order to avoid the problem of serial correlation between the variables estimated. The inflation rate is measured in terms of CPI published in the South African Reserve Bank's Quarterly Bulletin statistics.

Empirical Evidence: Results and Interpretation

This section presents the results and the interpretation of the regression analysis based on the empirical tests and estimation undertaken. As a preliminary step to the empirical analysis, the study commences by investigating the integration properties of the series. This is in order to establish the presence of unit roots in the data and to apply appropriate modelling procedures to avoid a spurious regression (Harris 1995). By differencing data to remove the non-stationary (stochastic) trend, spurious regression problems can be avoided. While there are several ways of testing the presence of unit roots in the data, this study utilises the Augmented Dickey-Fuller approach to test the null hypothesis that a series contains a unit root against the alternative of stationarity. The results of the Augmented Dickey-Fuller test suggested that none of the variables is stationary in levels (except for interest rates, inflation and the utilities' employment series). This implies that the non-stationary variables must be differenced. Further tests indicated that the non-stationary variables are stationary after the first and second differencing, suggesting generally differenced stationary series of orders one, $I(1)$, and two, $I(2)$, respectively.

A long-run relationship between sectoral employment and other selected variables was also examined using co-integration regression methodology, whereby the residuals obtained from the OLS estimation were subjected to unit root analysis. Empirical studies indicate that series that are co-integrated move together in the long run at the same rate, meaning that they obey an equilibrium relationship in the long run (Davidson and MacKinnon 1993). The implication of this is that if economic growth and employment are co-integrated, they should move together in the long run at the same rate. That is, economic growth should be employment intensive (Fofana 2001). However, if the two series were not co-integrated, this indicates the possibility of jobless economic growth. Based on the Engle-Granger (1987) co-integration test, the results suggested that the residuals from certain regressions were stationary, hence co-integrated. These results are presented in Table 1 below, which indicates four co-integrating regressions, namely: in finance and business services; manufacturing; transport; and the utilities industry sectors, suggesting a long-run relationship between employment and the other variables.

Table 1: Co-integration test on residuals from sectoral employment and other selected variables

<i>Industry Sector</i>	<i>t-Statistic (ADF test on residuals)</i>	<i>Decision</i>
Aggregate economy	-3.02	Not co-integrated
Construction	-2.66	Not co-integrated
Finance and business services	-5.20***	Co-integrated
Manufacturing	-4.98**	Co-integrated
Mining	-3.23	Not co-integrated
Social and community services	-3.83	Not co-integrated
Trade	-2.89	Not co-integrated
Transport	-5.00***	Co-integrated
Utilities	-5.57***	Co-integrated

Notes: The critical values for the Engle-Granger co-integration test on regression residuals at 1%, 5% and 10% are -5.00173, -4.31461 and -3.97286, respectively. (*) indicate parameters are significant at 10% level; (**) significant at 5% level; and (***) significant at 1% level.

These results also show the other sectors which are not co-integrated. In these cases, the absolute value of the computed test statistic is lower than the critical value at 10 per cent confidence level, suggesting that employment and sectoral growth do not move together in the long run, at the same rate. Most importantly, the residual-based co-integration test showed that total non-agricultural employment and the GDP variables are not co-integrated. Consequently, this implies that jobless growth did occur in the economy during the first quarter of 2000 to the fourth quarter of 2012 period. This indicates the inability of the economic growth to create adequate employment for the increasing number of job seekers. This is reaffirmed in the study by Marinkov and Geldenhuys (2007), who also found that unemployment and GDP were not co-integrated, hence concluding that, for South Africa, these variables do not share the same long-run properties. Similarly, a sectoral division of the employment-output relationship revealed no co-integration detected in the construction, mining, social and community services and trade sectors. Therefore, this also implies that jobless growth did occur in these sectors during the period under review.

According to the SARB's 2001 Annual Report, the country's jobless growth, which has affected a number of sectors, can be attributed to a number of factors including rising capital intensity, pressures on domestic producers to remain competitive within the global economy, and the slow pace of foreign direct investment inflows into South Africa (SARB 2001a). Similarly, an ILO report by Hayter, Reinecke, and Torres (1999) identified other factors that may have increased jobless growth, including the shortage of skilled labour, which hinders the development of labour-intensive sectors. Another factor mentioned is trade liberalisation, which may have shifted production in favour of capital-intensive sectors to the detriment of labour-intensive ones. Unless the

construction, mining, trade and social and community services sectors are specifically orientated towards activities that are labour-intensive, the employment elasticity in these sectors will remain significantly low.

Table 2 presents coefficient estimates of the model based on the ordinary least squares estimation of the relationship between employment and selected macroeconomic variables.

Table 2: OLS estimates of the relationship between employment and other macroeconomic variables

<i>Dependent variable: Employment (Dlemp_t)</i>	<i>Aggregate economy</i>	<i>Construction</i>	<i>Finance and business services</i>	<i>Manufacturing</i>	<i>Mining</i>	<i>Social and community services</i>	<i>Trade</i>	<i>Transport</i>	<i>Utilities</i>
Constant	12.47***	-8.55***	6.29*	10.42	10.20	5.29	12.20	12.07***	12.35**
	(32.85)	(-2.90)	(1.85)	(1.14)	(1.05)	(1.10)	(1.37)	(3.79)	(2.08)
Output (proxy by GDP and sectoral GVA)	0.45***	0.90***	1.56***	0.46***	0.19	0.83***	0.29*	0.47*	0.27
	(4.82)	(3.67)	(6.24)	(2.92)	(0.32)	(2.39)	(1.88)	(1.85)	(0.71)
Labour costs (wages)	-0.12***	-0.95***	-0.57***	-0.07*	0.09	-0.01	-0.03	-0.28*	-0.19
	(-2.63)	-3.68	(-2.65)	(-0.13)	(0.20)	(-0.08)	(-0.05)	(-1.63)	(-0.63)
User cost of capital (Interest rates)	0.004	-0.02***	0.02***	-0.01	-0.03	0.02***	-0.01	0.03***	-0.05***
	(1.32)	(-2.51)	(2.73)	(-1.12)	(-1.06)	(2.31)	(-1.02)	(2.78)	(-2.79)
Inflation rate	0.005**	-0.03**	0.02***	-0.003	-0.03	0.02***	-0.01	0.03***	-0.06***
	(2.14)	(-2.97)	(3.51)	(-0.60)	(-1.30)	(2.33)	(-0.90)	(3.47)	(-3.19)
Time trend		-0.04***	0.01*	6.02	(-0.02)	-0.004	0.002	0.01***	-0.0004
		(-5.47)	(1.90)	(-0.01)	(-1.08)	(-0.81)	(0.17)	(3.08)	(-0.04)
Dummy (2008/9 recession)	-0.01	0.04	0.07**	0.11***	-0.07	0.08***	0.04	0.04	-0.04
	(-0.54)	(0.63)	(2.11)	(2.60)	(-0.64)	(2.11)	(0.65)	(0.90)	(-0.43)

Summary statistics									
Adjusted R ²	0.91	0.92	0.97	0.62	0.73	0.23	0.49	0.88	0.28
F-statistic	90.33	102.13	295.85	15.15	21.23	3.56	9.06	62.53	4.38
Prob (F-statistic)	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
Number of observations	52	52	52	52	52	52	52	52	52
Estimation method	Least squares	Least squares	Least squares	Least squares	Least squares	Least squares	Least squares	Least squares	Least squares

* statistically significant at 10% level.

** statistically significant at 5% level.

*** statistically significant at 1% level.

t-statistics are shown in brackets

In the above table, the coefficients assigned to sectoral output correspond to the employment elasticity of output growth, ε , whereby its interpretation points to the interrelationship between employment and output growth. Therefore, in the above results, employment and sectoral output growth were positively correlated in all eight sectors during the period from the first quarter of 2000 to the fourth quarter of 2012. The absolute values of the elasticities across sectors differed substantially. For example, the employment elasticity in the construction sector is 0.90, but in the trade sector it is only 0.47. This signifies the degree of variance of employment elasticities across industry sectors, from very inelastic (0.27 in the utilities sector) to quite elastic (1.56 in the finance sector) responses to changes in sectoral output.

The overall employment elasticity of output growth in South Africa during this study period was quite inelastic at 0.45, though statistically significant at the 1 per cent level. This suggests that total non-agricultural employment was relatively unaffected or rather less responsive to changes in GDP growth, hence signalling an increase in capital input and total factor productivity. This is in line with the findings by other studies. For instance, according to Mahadea (2012), the average capital-labour ratio increased from R166 016 in 2000 to R186 631 in 2010, reflecting rising capital intensity in production. In addition, Nattrass (1998) reported that a number of jobs in South Africa had been lost as a result of investment being channelled increasingly into capital-intensive sectors and technologies.

A study by Marinkov and Geldenhuys (2007) also found that employment growth has become less responsive to economic growth since the mid-1980s. It found that, between 2001 and 2005, a 1 per cent increase in real GDP was associated with a 0.45 per cent increase in employment (which is the same as that reported in our findings). Their study identified the sluggish growth as well as structural shifts in output as the main causes that led to structural shifts in the demand for certain categories of labour. A number of other studies seem to suggest that these structural shifts, together with the increasing capital intensity of production, have led to a decrease in the elasticity of employment growth with respect to output growth (Bhorat 2004; Terreblanche 2002; UNDP 2003).

Within the primary sector, the above table shows that employment intensity of output growth in the mining sector is insignificant, suggesting that structural shifts in this sector could not induce an increase in employment opportunities. According to Bhorat and Oosthuizen (2008), the nature of output shifts across the economy's main sectors provides clues to the changing structure of the economy, which is moving away from primary towards tertiary or service-based output. A sectoral analysis by the South African Reserve Bank (2009) showed that during the prolonged 1999–2007 upward phase of the business cycle, growth in real gross domestic product was widely spread among the main sectors, with the exception of the mining sector, where production increased only slightly as a whole. The weakening of this sector, therefore, impacted on the nature of sectoral employment shifts, with the least growth occurring in this sector. This sector, having been directly influenced by the substantial decline in international commodity prices in 2008/09, experienced a reversal of earlier employment gains.

In addition, bearing in mind that the mining sector is obviously capital-intensive, these structural changes also account for the greater impact of technological and productivity improvements in the mining sector, to the detriment of labour absorption in this sector. A study by Samson, MacQuene, and Van Niekerk (2001) explained that the capital-to-labour ratio in the major sectors of the economy is indicative of rising capital intensity in the mining sector. This study found that sectors which are not education-intensive, such as mining, are growing more slowly or even contracting as their capital intensity increases, and they are shedding jobs. This serves to confirm the low labour absorptive capacity in the mining sector and the corresponding high levels of unemployment.

In the secondary sector, both construction and manufacturing are statistically significant and positively correlated with employment. The estimate of employment elasticity of sectoral growth in construction is significantly close to unity, which suggests that a one-percentage-point increase in output will increase employment by 0.90 per cent. The high elasticity coefficient in this regard points to the fact that the labour absorptive capacity in this sector is relatively high. Between 1995 and 2005, this sector

created the largest number of jobs within the secondary sector, where more than 500 000 employment opportunities were created. Despite a brief job-shedding experienced by the sector during the second and third quarters of 2008, partly due to electricity-related backlogs, the level of employment had recovered by the end of the year, as non-residential building activity countered the depressed state of residential building activity. This was attributed to infrastructural development related to the hosting of the 2010 FIFA World Cup tournament and various other infrastructural developments, such as the Gautrain Rapid Rail Link.

The employment elasticity of growth in the manufacturing sector is weak, although it is significant at the 10 per cent level. This indicates that growth experiences in this sector have been driven largely by productivity, rather than employment. The increase in productivity growth in the manufacturing sector can be linked to the growth in the capital/labour ratio in this sector. In their study, Samson, MacQuene, and van Niekerk (2001) confirmed rising capital intensity in the manufacturing sector in South Africa during the period 1992 to 1999. This rising capital intensity (declining labour intensity) is in part responsible for the sector's experience with regard to job losses. Employment levels in the manufacturing sector declined from a high of 1.6 million in 1995 to an estimated 1.1 million in 2011, reflecting the strong competitive forces and productivity imperatives in the sector (SARB 2012). This sector shed jobs almost uninterruptedly from the middle of the 1990s until the second quarter of 2011, with an estimated 30 per cent reduction in the manufacturing workforce over this period. This prompted government to step up various growth initiatives in an effort to promote job creation, including but not limited to the Industrial Policy Action Plan (IPAP), which aimed at providing support to relatively labour-intensive and value-adding manufacturing firms that had been adversely affected by the global financial crisis. These and other initiatives are an affirmation that sectoral output growth alone cannot guarantee substantial employment growth in this sector. Instead, simultaneous targeted industry labour market initiatives may be needed to assist with employment growth. These may include initiatives aimed at addressing the factors that account for labour market constraints, e.g. inflexibility in the labour market, collective bargaining and the impact of unions, low skill level and skills mismatch.

Employment in the utilities sector is indicated as having a positive but not significant relationship to sectoral output, which suggests that structural changes in the sector and other macro factors, besides GVA, play a more critical role in determining employment in this sector. Since the utilities sector is capital-intensive, increasing employment in this sector depends mainly on the expansion of installed capacity (Ajilore and Yinusa 2011). Therefore, sustained spending to meet the increased electricity demand in the country will support growth in employment in this sector.

Within the tertiary sector, the employment elasticity coefficients for finance and business services, social and community services, transport and trade indicate a positive and significant relationship between employment and sectoral output. The employment elasticity coefficients in finance and business services (1.56), social and community services (0.83), transport (0.47) and trade (0.29) are an indication of the important role of the tertiary sector's output in employment generation. According to Pattanaik and Nayak (2011), much of the increase in economic performance in the tertiary sector is because of the lack of employment opportunities in other sectors of the economy. This is indicative of the sectoral shift that characterised the output structure of the South African economy from the 1970s until recently, from primary and secondary sector activities to tertiary sector activities (Bhorat and Oosthuizen 2008). According to O'Connell (1999), developed economies that have succeeded in dealing with the challenge of high unemployment have relied on the expansion of high-value services such as finance, business and professional services. A study by Rodrik (2008) also asserted that the South African manufacturing sector had lost ground to the tertiary sector since the 1990s.

While these results confirm the growing importance of the role of the tertiary sector, it should be noted that this sector relies to some extent on the growth of other sectors. In other words, instead of being independent, the performance of the sectors within the tertiary sector is interdependent with the growth of other sub-sectors. The significant contribution by the manufacturing sector cannot be ignored in this

regard. According to Altman (2006), the interdependence that exists between the services and manufacturing sectors is suggestive of a bi-directional linkage between these sectors. That is, the causal direction can move either way, where manufacturing can stimulate demand in services (as in the transport sector) or services stimulating demand for manufacturing (as in retail for fast moving consumer goods). A classic example involves the success of the Motor Industry Development Plan that supports domestic production of vehicles for the local and export markets. This has knock-on positive effects on the transport and the services sector in general. However, given increasing segmentation and niching, sectors within the tertiary sector are still regarded as drivers for growth (Altman 2006).

The coefficients of the wage variable represent the elasticity of employment with respect to wages. The theoretical model suggested in this study assumes a negative relationship between wages and employment. In other words, higher wages put upward pressure on labour costs and cause firms to substitute capital for labour, thereby reducing the demand for labour (employment) and increasing the marginal productivity of labour (Wakeford 2004). This inverse relationship is confirmed by the negative coefficients of the wage variable found in all the sectors with the exception of the mining sector. The negative and significant coefficients of the wages variable in the construction (-0.95), finance (-0.57), manufacturing (-0.07), and transport (-0.28) sectors suggest that growth in wages occurred at the expense of employment.

With regard to the coefficients for the user cost of capital variable, the degree and signs of employment elasticity vary across individual sectors, which is in line with the model assumptions. The user cost of capital coefficients for the construction and utilities sectors is negative and significant. These results suggest that employment in the construction and utilities sectors is negatively correlated with the rising user cost of capital. Thus, we can conclude that in these capital-intensive sectors, the increase in long-term interest rates (a proxy for user cost of capital) has resulted in a decrease in the demand for consumer capital goods and services, which has in turn decreased the derived demand for labour (Sawtelle 2007). Similarly, the positive and significant elasticity coefficient in the finance, social services and transport sectors suggests that an increase in the user cost of capital will result in an expansion in employment in these sectors.

Lastly, as hypothesised, the signs for the inflation coefficient are mixed. The inflation coefficients in the finance, social services and transport sectors are positive and significant at the one-per cent level. This suggests that employment expansion levels were achieved at the expense of high inflation in these sectors. In contrast, the signs of the coefficients of the inflation variable in the construction and utilities sectors are negative and significant. This means that inflation has a negative impact on employment in these sectors. We can, therefore, deduce that in these sectors an increase in the rate of inflation will result in a decrease in the demand for consumer capital goods and services, which will in turn decrease the derived demand for labour.

With regard to the error-correction terms, the co-integrating vectors for finance, manufacturing, transport and utilities are statistically significant at 1 per cent level (Table 3). The error-correction terms correct between 42 and 72 per cent of the errors in the models after the short-run disturbances. These error-correction coefficients indicate that (with the exception of utilities) finance, manufacturing and transport adjust relatively more slowly towards the underlying equilibrium since the parameter estimate of their respective lag residual shows that 0.52, 0.53 and 0.42 percentage of disequilibrium is removed in each period, respectively.

Table 3: Results of the error-correction model

<i>Dependent variable: Employment (Dlemp_{it})</i>	<i>Finance</i>	<i>Manufacturing</i>	<i>Transport</i>	<i>Utilities</i>
EC term _{t-1}	-0.52***	-0.53***	-0.42***	-0.77***
	(-4.23)	(-4.30)	(-3.14)	(-5.42)
Dln_wage_fin(-1)	-0.47***			
	(-2.85)			
Dln_wage_man(-1)		-0.91***		
		(-2.45)		
Dlemp_man(-1)		0.22*		
		(1.64)		
Dlemp_trans(-1)			-0.35***	
			(-2.75)	
R_RATE			-0.004**	
			(-2.20)	
R_RATE(-2)				0.006*
				(1.50)
Diagnostic Tests				
Jarque-Bera (p-value)	0.02	0.00	0.05	0.10
Ljung-Box Q (p-value)	0.65	0.11	0.45	0.26
Breusch-Godfrey LM Test (p-value)	0.49	0.43	0.54	0.53
ARCH-LM (p-value)	0.64	0.42	0.35	0.95
White (p-value)	0.96	0.28	0.19	0.85
Ramsey RESET (p-value)	0.61	0.15	0.42	0.70

* statistically significant at 10% level.

** statistically significant at 5% level.

*** statistically significant at 1% level.

t-statistics are in brackets

Furthermore, the diagnostic tests reveal that the error-correction models are correctly specified and conform to the statistical assumptions of the classical linear model. The diagnostic checks performed include the Jarque-Bera test for normality in the residuals; the Ljung-Box Q test of no autocorrelation in residuals; the Breusch-Godfrey LM test for serial autocorrelation; the ARCH-LM test for no autoregressive conditional heteroscedasticity; White's test for heteroscedasticity; and Ramsey's RESET test for misspecification. Based on the tests that were performed, the results show that the residuals of the models do not have problems of misspecification, serial correlation and heteroscedasticity. Furthermore, the results of the normality test show that the residuals are normally distributed, with a zero mean and variance. These results suggest that the estimated regression model is well specified and generally conforms to economic theory and the assumptions underlying our modelling procedures.

Conclusion

Concerns have been raised recently about the inability of the South African economy to provide sufficient employment for the increasing number of job seekers. The rate of unemployment remains stubbornly high, despite South Africa registering positive and sustained growth rates since the demise

of apartheid more than 15 years ago. This paper explored these issues by examining how the employment intensity of growth in the non-agricultural formal sector has evolved, with a view to identifying key growth sectors that are employment intensive.

Results of co-integration analysis showed that total non-agricultural employment (both in the formal and informal sectors) and the GDP series are not co-integrated, and hence do not move together in the long run. Consequently, this implies that jobless growth did occur in the economy during the period reviewed. This reaffirms the view that South Africa is more capital-intensive (and less labour-intensive), which in turn facilitated a structural adjustment that led to the weakening of the employment-growth relationship. Findings of the sectoral division of the employment-output relationship revealed a long-run relationship between employment and growth in all sectors except the mining, construction, social and community services and trade sectors. In particular, this indicates that the observed growth performance in these sectors has been more labour productivity-driven than labour employment-driven. This confirms the rising capital intensity that has been experienced in these sectors. Hence, sectoral growth alone cannot guarantee substantial employment growth in these sectors, but simultaneous targeted industry labour market initiatives may be desirable to assist employment growth.

The positive and significant coefficients for employment elasticities in finance and business services, social and community services, trade and transport indicate that growth experiences in these sectors are more labour employment-driven. Moreover, the quite elastic employment elasticity values in the finance and business services sector, construction, social and community services and, to a lesser extent in the transport sector, are a strong indication of the role of the tertiary and secondary sectors in employment generation in South Africa. In particular, sectors within the tertiary sector are the best performing sectors in terms of employment intensity of output growth, reflecting the changing structure of the South African economy and the nature of employment shifting away from primary and more towards the tertiary sector.

Although the results confirm the growing importance of the role of the tertiary sector, this sector relied on the growth of other sectors. Its performance is interdependent on the growth of other sub-sectors. The significant contribution by the manufacturing sector cannot be ignored in this regard: it has helped support the demand in the services sector. Through the Motor Industry Development Plan, the manufacturing sector brought about positive spill-over effects on the transport and the services sector in general. However, due to growing segmentation and niching, the tertiary sector is still regarded as driver for growth.

A well-functioning tertiary sector can provide important opportunities to strengthen employment and productivity. Investment in the tertiary sector is necessary to foster new employment opportunities and can assist in improving the overall employment intensity in South Africa.

References

- Ajilore, T., and O. Yinusa. 2011. "An Analysis of Employment Intensity of Sectoral Output Growth in Botswana." *Southern African Business Review* 15 (2): 26–42.
- Altman, M. 2006. "Identifying Employment-Creating Sectors in South Africa: The Role of Services Industries." *Development Southern Africa* 23 (5): 627–647. <https://doi.org/10.1080/03768350601021871>.
- Bhorat, H. 2004. "Labour Market Challenges in the Post-Apartheid South Africa." *South African Journal of Economics* 72 (5): 940–977. <https://doi.org/10.1111/j.1813-6982.2004.tb00140.x>.
- Bhorat, H., and M. J. Oosthuizen. 2008. "Employment Shifts and the 'Jobless Growth' Debate." In *Human Resources Development Review 2008: education, employment and skills in South Africa*, edited by A. Kraak and K. Press, 50–68. Cape Town: HSRC Press.

- Brown, M., and J. S. de Carni. 1963. "Technological Change and the Distribution of Income." *International Economic Review* 3: 289–309. <https://doi.org/10.2307/2525309>.
- Davidson, R., and J. G. MacKinnon. 1993. *Estimation and Inference in Econometrics*. New York: Oxford University Press.
- Dopke, J. 2001. "The Employment Intensity of Growth in Europe" (Kiel Working Paper, No. 1021). Germany: Kiel Institute of World Economics.
- Domar, E. D. 1946. "Capital Expansion, Rate of Growth and Employment." *Econometrica* 14: 137–147. <https://doi.org/10.2307/1905364>.
- Engle, R. F., and C. W. J. Granger. 1987. "Co-Integration and Error Correction: Representation, Estimation, and Testing." *Econometrica* 55 (2): 251–276. <https://doi.org/10.2307/1913236>.
- Fofana, N. F. 2001. "Employment and Economic Growth in the Cote d'Ivoire: An Analysis of Structural Determinants." *African Development Review* 13 (1): 98–113. <https://doi.org/10.1111/1467-8268.00032>.
- Gabrisch, H., and H. Buscher. 2005. *The Unemployment-Growth Relationship in Transition Countries*. Germany: Institut Für Wirtschaftsforschung.
- Goldin, C. 2001. "The Human-Capital Century and American Leadership: Virtues of the Past." *Journal of Economic History* 61 (2): 263–292. <https://doi.org/10.1017/S0022050701028017>.
- Gonzalo, J., and T. Lee. 1998. "Pitfalls in Testing for Long Run Relationships." *Journal of Econometrics* 86: 129–154. [https://doi.org/10.1016/S0304-4076\(97\)00111-5](https://doi.org/10.1016/S0304-4076(97)00111-5).
- Harris, R. I. D. 1995. *Using Cointegration Analysis in Econometric Modelling*. New York: Prentice Hall.
- Hayter, S., G. Reinecke, and R. Torres. 1999. *ILO Report on the Social Impact of Globalisation*. Geneva: International Labour Organisation.
- Heckman, J. J. 2003. "China's Investment in Human Capital." *Economic Development and Cultural Change* 51 (4): 795–804. <https://doi.org/10.1086/378050>.
- Hodge, D. 2009. "Growth, Employment and Unemployment in South Africa." *South African Journal of Economics* 77 (4): 488–504. <https://doi.org/10.1111/j.1813-6982.2009.01226.x>.
- International Labour Organisation. 1996. *World Employment 1996/97: National Policies in a Global Context*. Geneva: International Labour Organisation.
- Kapsos, S. 2005. "Employment Intensity of Growth: Trends and Macroeconomic Determinants." Employment Strategy Paper 2005/12. Geneva: International Labour Organisation.
- Khemraj, T., J. Madrick, and W. Semmler. 2006. "Okun's Law and Jobless Growth." Schwartz Centre for Economic Policy Analysis, Policy Note 3.
- Loots, E. 1998. "Job Creation and Economic Growth." Paper presented at the Biennial Conference of the Economic Society of South Africa. Potchefstroom: South Africa. <https://doi.org/10.1111/j.1813-6982.1998.tb01256.x>.
- Lucas, R. E. 1988. "On the Mechanics of Economic Development." *Journal of Monetary Economics* 22 (1): 3–42. [https://doi.org/10.1016/0304-3932\(88\)90168-7](https://doi.org/10.1016/0304-3932(88)90168-7).
- Mahadea, D. 2012. "Prospects of Entrepreneurship to the Challenge of Job Creation in South Africa." *Journal of Developmental Entrepreneurship* 17 (4): 1–17. <https://doi.org/10.1142/S1084946712500203>.

- Mahadea, D., and R. Simson. 2010. "The Challenge of 'Low Employment Economic Growth' in South Africa: 1994–2008." *South African Journal of Economic and Management Sciences* 13 (4): 391–406. <https://doi.org/10.4102/sajems.v13i4.92>.
- Mankiw, G. N. 1995. "The Growth of Nations." *Brookings Papers on Economic Activity*: 275–310. <https://doi.org/10.2307/2534576>.
- Marinkov, M., and J. Geldenhuys. 2007. "Cyclical Unemployment and Cyclical Output: An Estimation of Okun's Coefficient for South Africa." *South African Journal of Economics* 75 (3): 373–390. <https://doi.org/10.1111/j.1813-6982.2007.00134.x>.
- Miller, E. 2008. "An Assessment of CES and Cobb-Douglas Production Functions" (Congressional Budget Office Working Paper Series, No. 5). Washington DC: Congressional Budget Office.
- Mourre, G. 2004. "Did the Pattern of Aggregate Employment Growth change in the Euro Area in the Late 1990s?" (European Central Bank Working Paper Series, No. 358). Brussels: European Central Bank.
- National Treasury. 2011. *Estimates of National Expenditure*. Pretoria: National Treasury.
- Nattrass, N. 1998. *Growth Employment and Economic Policy in South Africa: A Critical Review*. Centre for Development and Enterprise, CDE Focus No. 2.
- O'Connell, P. J. 1999. "Astonishing Success: Economic Growth and the Labour Market in Ireland" (Employment and Training Papers (44)). Geneva: Employment and Training Department, International Labour Office.
- Okun, A. 1962. "Potential Output: Its Measurement and Significance." In *Proceeding of the Business and Economic Statistics Section of the American Statistics Society*, 98–104. USA: American Statistical Association.
- Pattanaik, F., and N. C. Nayak. 2011. "Employment Intensity of Service Sector in India: Trend and Determinants" (paper presented at the 2010 International Conference on Business and Economics Research, Vol.1). Kuala Lumpur: IACSIT Press.
- Pianta, M., R. Evangelista, and G. Perani. 1996. "The Dynamics of Innovation and Employment: An International Comparison." *Science Technology Industry Review* 18: 67–93.
- Pini, P. 1997. "Occupazione, Tecnologia e Crescita: Modelli Interpretativi ed Evidenze Empiriche a Livello Macroeconomico" (paper presented to the Conference of the Accademia Nazionale dei Lincei, Rome, January 16–18, 1997).
- QUANTEC. 2014. "QUANTEC database." Accessed August 27, 2014 <http://www.quantec.co.za/easydata/>.
- Rodrik, D. 2008. "Understanding South Africa's Economic Puzzles." *Economics of Transition* 16 (4): 769–797. <https://doi.org/10.1111/j.1468-0351.2008.00343.x>.
- Romer, P. M. 1986. "Increasing Returns and Long-run Growth." *Journal of Political Economy* 94: 1002–1037. <https://doi.org/10.1086/261420>.
- Samson, M., K. MacQuene, and I. van Niekerk. 2001. "Capital/Skills Intensity and Job Creation: An Analysis of Policy Options." Paper presented at the Tips 2001 Annual Forum, September 10–12, 2001. Misty Hills, Muldersdrift.
- SARB. 2001a. The South African Reserve Bank Annual Report 2001. Pretoria: SARB.
- SARB. 2001b. The South African Reserve Bank Quarterly Bulletin (data sets). Pretoria: SARB.
- SARB. 2012. The South African Reserve Bank Quarterly Report. Pretoria: SARB.

- SARB. 2014. The South Africa Reserve Bank Quarterly Bulletin (data sets). Pretoria: SARB.
- Sawtelle, B. 2007. "Analyzing the Link between Real GDP and Employment: An Industry Sector Approach." *Business Economics* 42: 46–54. <https://doi.org/10.2145/20070405>.
- Schiff, J. A., P. Egoumé-Bossogo, M. Ihara, T. Konuki, and K. Krajnyák. 2006. "Labor Market Performance in Transition: The Experience of Central and Eastern European Countries." IMF Occasional Paper No. 248, July. Washington: IMF.
- Schoeman, C. H., I. Botha, and P. F. Blaauw. 2010. "Labour Conflict and The Persistence of Macro Underemployment in South Africa." *South African Journal of Economic and Management Sciences* 13 (3): 272–290. <https://doi.org/10.4102/sajems.v13i3.23>.
- Solow, R. 1956. "A Contribution to the Theory of Economic Growth." *Quarterly Journal of Economics* 70: 65–94. <https://doi.org/10.2307/1884513>.
- StatsSA. 2003. *Labour Force Surveys September 2003*. Pretoria: Statistics South Africa.
- StatsSA. (2000–2012). *Labour Force Survey and GDP* (data sets). Pretoria: Stats SA.
- Terreblanche, S. 2002. *A History of Inequality in South Africa, 1652–2002*. Pietermaritzburg: University of Natal Press.
- United Nations Development Programme (UNDP). 2003. South Africa Human Development Report—The Challenge of Sustainable Development in South Africa: Unlocking People's Creativity. Cape Town: Oxford University Press.
- Uponder, M. 2006. "Output Elasticity of Employment in the Indian Economy: An Empirical Note." *Applied Econometrics and International Development* 6 (1): 197–206.
- Wakeford, J. 2004. "The Productivity-Wage Relationship in South Africa: An Empirical Investigation." *Development South Africa* 21: 109–132. <https://doi.org/10.1080/0376835042000181444>.