IDR : VOL. 14, NO. 2, (JULY-DECEMBER, 2016) : 133-150 | ISSN : 0972-9437|

# ECONOMIC GROWTH AND EMPLOYMENT: IS THRE A RELATIONSHIP IN BOTSWANA?

***Mothusi Lotshwao*, Obonye Galebotswe** and Jonah Tlhalefang*****

**ABSTRACT**

*Despite registering impressive economic growth rates for a period of over three decades, unemployment has remained stubbornly high in Botswana. This paper uses Auto-Regressive Distributed Lag (ARDL) Bounds-Testing approach to investigate the short and long run relationships between output and employment in Botswana. The results show that output growth has no influence on labour absorption both in the short run and long run. Sectoral analysis suggests that this is a result of washing out effect where the positive effect of output on employment in some sectors is cancelled out by negative or no effect in others. Personal services, manufacturing and government have larger and positive employment elasticities of output. At the aggregate economy level, the results also show that the main determinant of labour employment is the wage rate. Changes in the wage rate negatively affect employment growth both in the short run and long run, with the influence being stronger in the latter case. The interest rate affects employment rate only in the long run. The study therefore recommends that i) government policy on inclusive growth needs to be targeted at employment-intensive sectors, ii) future wage awards need to be matched by labour productivity improvements and iii) labour markets reforms are needed allow firms more flexibility to substitute between labour and other factors.*

***Key words:*** *employment elasticity, ARDL Bounds –testing, Botswana*

## INTRODUCTION

Until recently, the government of Botswana's main strategy thrust has focused on promoting economic growth, with the belief that improvement in other socio-economic indicators will follow. This approach to economic development has, indeed, helped the country achieve one of the fastest economic growth rates in the world. The country recorded an average real gross domestic product (GDP) of about 6.6 percent between 1981 and 2014. However, this phenomenal economic growth rates did not translate into

* Botswana Competition Authority

** Department of Economics, University of Botswana, obonye.galebotswe@mopipi.ub.bw

*** Department of Economics, University of Botswana

significant growth in employment. Paid formal sector employment grew at an average annual rate of 4 percent during the same period. Consequently, the country's unemployment rate doubled from 10.2 percent in 1981 to about 20 percent in 2014. The failure of this phenomenal GDP growth to translate into significant job creation has long been recognized by the government and several attempts have been made to address the situation. However, the situation does not seem to improve.

The emergence of the spectre of increasing and persistent unemployment has led analysts to focus attention on this seemingly weak relationship between output growth and employment creation. Ajilore and Yunisa (2011) explore the employment intensity of sectoral output growth in Botswana for the period 1990 to 2008 with a view to identifying sectors of the Botswana economy that are employment intensive. Leshoro (2014) estimated employment elasticities both at the aggregate output and sectoral levels. This paper continues in this vein by analysing the determinants of employment both at the aggregate and sectoral levels. From a methodological point of view, the paper follows that of Ajilore and Yunisa (2011) who estimated employment equations that include output and factor prices in an error correction model. First, while Alijore and Yinusa (2011) ran the regressions up to 2008, this study extends the analysis to 2011. Second, unlikeAjilore and Yinusawho use a two-step approach to Cointegration analysis by Engel and Granger (1987), this paper uses the more recent autoregressive distributed lag (ARDL) bounds testing approach by Pesaran *et al.* (2001). The weaknesses of the Engel and Granger methodology in estimations involving more than two variables are well document (see e.g., Benerjee *et al.*, 1986; Phillips and Ouliars, 1990, Watson and Teelucksingh, 2002).

The rest of the paper is organized as follows. The next section presents a brief overview of the evolution of employmentand output over the last four decades. This is followed by a review of some relevant literature on the relationship between employment and output changes in section three. Section four discusses the theoretical and empirical framework of the study. This is followed by a presentation, interpretation and analysis of the study's empirical results. Section six concludes the study and offers some policy suggestions.

## OVERVIEW OF OUTPUT GROWTH, EMPLOYMENT AND UNEMPLOYMENT IN BOTSWANA

At independence in 1966,Botswana was one of the poorest countries in the world with a real GDP per capita income of about US$ 60 and only 13 kilometres of tarred road (Edge and Lekorwe, 1998). As is well documented elsewhere, the discovery and exploitation of minerals, especially diamonds,

soon after independence changed the country's fortunes and economic structure (Harvey and Lewis, 1990; Hill, 1990; Coclough, 1991; Good, 1992). For instance, while the share of agriculture in GDP was 39 percent in 1966, it fell to 5.7 percent in 1986 and continued to drop, reaching 2.4 percent in 2014. The share of industry (mining and manufacturing) rose from 14 percentin 1966 to reach a high of 66 percent in 1988 and then slowly declined to 39 in 2014. During the same period, services dropped from 46 percent of GDP to a low of 29 percent in 1988 and then gradually increased to 58 percent in 2014. Accompying the structural change was a rapid economic growth, which changed the country's classification from the category of the world's poorest to that of middle-income developing country within a period of less than three decades (Harvey and Lewis, 1990).According to data from the World Development Indicators of the World Bank[1], real GDP growth between 1966 and 2014 averaged 6.3 percent per annum, with much of the growth experienced between 1968 and 1990.With the population growing at a much slower rate of about 2.6 percent, this high economic growth transformed the country into an upper middle income economy status by 1993.

However, this phenomenal economic growth was not accompanied by similar growth in employment, especially since 1991. As shown in Table 1, while GDP grew at an average annual rate of 7.5 percent between 1973 and 2015, paid formal sector employment grew slowly at 5.2 percent per annum. Moreover, most of the jobs were created between 1973 and 1990, where an annual average real GDP growth rate of 11.6 percent is associated with employment growth of 9.5 percent. The relationship weakens between 1991 and 2008, with a real GDP growth rate of 5.0 associated with average annual employment growth of 2.4 percent. The rise in total employment growth recorded between 2009 and 2015 was as a result of the introduction of the Ipelegeng programme by the government in 2009.[2]If Ipelegeng jobs are excluded the average annual employment growth drops to just 1.1 percent. The weakening relationship between the employment and output growth between the two time periods is also reflected in the private and parastatal sector category.

**Table 1**
**Real GDP and Employment growth (1973 – 2015)**

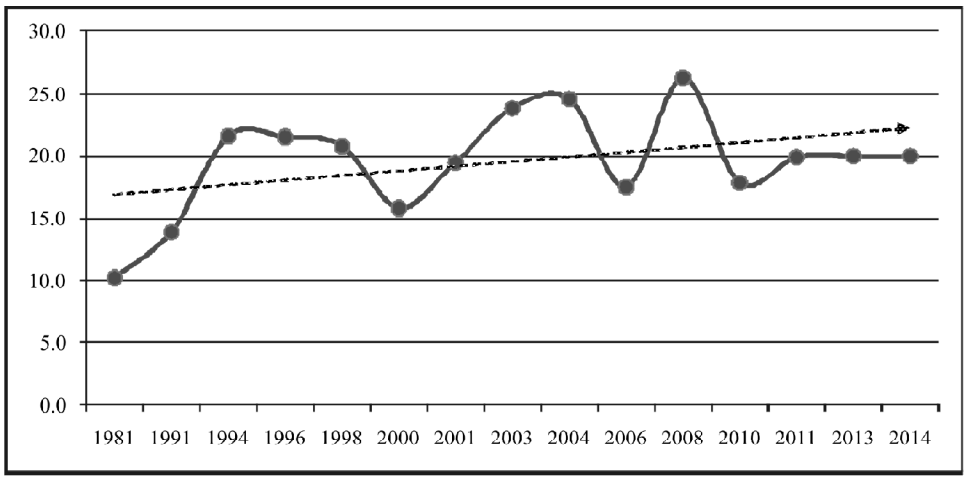
| | *1973-2015* | *1973-90* | *1991-2008* | *2009-2015* |
|---|---|---|---|---|
| Real GDP | 7.52 | 11.61 | 5.02 | 3.5 |
| Total employment | 5.2 | 9.5 | 2.36 | 3.7 |
| Private & Parastatal | 4.8 | 9.08 | 1.84 | 1.3 |

*Source:* Authors' computation based on data from World Development Indicators

The slowdown in employment growth resulted in high and persistent unemployment. As Figure 1 shows, unepmoyment increased from 10.2

percent in 1981 to reach a high of 26.2 percent in 2008 before falling to around 20.0 percent in 2013 and 2014. Moreover, the proportion of those experiencing long-term unemployment[3] increased from 45 percent in 1996 to 60 percent in 2006, further indicating the increasing difficulty of finding jobs in Botswana.Furthermore, long-term unemployment may discourage people from searching for jobs and, thus, distorting the unemployment measure. This suggests that the unemployment rate could be much higher than the official rate.

**Figure 1: Unemployment Rate in Botswana (1981-2014)**




*Source:* Statistics Botswana

The unemployed in Botswana comprise mainly of the young,aged 15-24 years. According to data from the World Economic Indicators of the World Bank, youth unemployment increased from 13.6 percent in 2000 to 36 percent in 2010. Within this age group, female unemployment increased from 14 percent to 43.5 percent, while that for male increased from 13.2 to 29.6 percent.Estimates from the Botswana HIV/AIDS Impact Survey of 2013 indicate that uemployment rate in the 15-19 years age group was 41.4 percent, with females facing a rate as high as 50.5 percent.

## REVIEW OF SOME RELEVANT LITERATURE ON OUTPUT-EMPLOYMENT RELATIONSHIPS

There are two main theoretical traditions that can be used to study the relationship between output and employment: the orthodox tradition, associated with the work of Okun (1962) and the heterodox, associated with the works of Verdoorn (1949) and Kaldor (1966). Okun (1962) argued that there was a stable and statistically significant relationship between a country's unemployment rate changes and its rate of growth of real gross

domestic product (GDP). Specifically, he argued that each extra percentage point of cyclical unemploymet is associated with about 2 percentage point increase in the output gap (Frank and Bernanke, 2011). This relationship between output growth and unemployment rate has come to be known as Okun's law. Thus the use of Okun's law is an indirect approach of estimating the relationship between output growth and employment generation. The idea behind the law is that output depends on the amount of labor used in the production process, hence there is a positive relationship between output and employment. Since total employment equates to the labor force minus the unemployed, so there is a negative relationship between output growth and unemployment rate.

Kaldor-Verdoorn effect approach measures this relationship more directly by regressing employment or its change on output changes (Basu and Foley, 2011). Verdoorn (1949) observed an empirical regularity that employment growth tended to lag output growth in many capitalist economies recovering from WWII (op. cit). Kaldor (1966, 1967) provided a theoretical basis for this observation by arguing that economies of scale associated with increased production are responsible for the positive relationship between output growth and productivity growth, with the causality line running from the former to the latter. That is, higher production tends to result in increased division of labour and productivity gains. Basu and Foley (2011) contend that, since productivity growth increases less than one-for-one with output growth, the latter must be positively correlated to employment growth with a coefficient of less than one. Therefore, if the conventional Kaldor-Verdoorn law of the relationship between productivity growth and output growth can be represented as:

$$p_t = -\alpha + (1 - \delta)y_t + \varepsilon_t;\ \ 0 < \delta < 1 \tag{1}$$

Where $p_t$, and $y_t$ represents growth rate of productivity and output, respectively and $(1 - \delta)$ is the Verdoorn coefficient or the Kaldor-Verdoorn effect, then the same relationship can be expressed as:

$$e_t = \alpha + \delta y_t + \varepsilon_t \tag{2}$$

Where $e_t$ represents growth rate of employment and $\delta$ is the Verdoorn coefficient or the Kaldor-Verdoorn effect (Basu and Foley, 2011).

Studies that examine the relationship between output and employment have either estimated the Okun's Law or the Kaldor-Verdoorn Effect.Lee (2000) evaluates the robustness of the Okun's relationship based on post war data (1955-1966) for 16 Organization for Economic Co-operation and Development (OECD) countries(Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, japan, Netherlands, Norway, Sweden, Switzerland, United Kingdom and United States of America). The study empirically investigated whether the statistical and qualitative

properties of Okun's law have been altered during this period. The study also evaluated the model robustness by comparing results from both the first difference and the gap specifications of the model. From the first difference specification, the study found that while Okun's law was statistically valid for most countries, the quantitative as opposed to the qualitative estimates are far from being uniform. The study concludes that labor markets and industrial structures in developed countries evolved in new ways to the extent that the relationship between output and employment by Okun's law needed re-examination. For the gap specification, Lee found that the data generally supported the validity of the Okun's law in the sense of statistical significance in parameter estimates. Just like in the case of first difference specification, quantitative estimates differed remarkably across countries as well as across alternative detrending methods. The study argued that the observed substantial disparity between the estimates of the United States and other OECD countries was attributable to structural rigidities in the European labor markets.

A study by Villarverde and Maza (2009) tested Okun's law for Spanish regions over the period 1980-2004. Based on its gap specifications theyfound that an inverse relationship between unemployment and output held for most of the regions and the whole country. The quantitative values of Okun's coefficients were however quite different, a result that that they argue was partially explained by regional disparities in productivity growth. Lal *et al.* (2010) examined the validity of Okun's law for some Asian countries (China, Pakistan, India, Sri Lanka and Bangladesh) using data for the period 1980 to 2006. The studyfound existence of a long run relationship between the unemployment rate and output gap in all of the countries. However Okun's law did not hold in the short run.

In Africa, Marinkov and Geldenhuys (2007) estimated the Okun's coefficient for South Africa using annual data for the period 1970-2005. They found a statistically significant relationship between cyclical output and cyclical unemployment in both symmetric (estimates ranging from -0.77 to -0.16) and asymmetric (estimates ranging from -0.77 to -0.18) specifications of Okun's law irrespective of the detrending technique. Abiodum and Basiru (2013) estimated the Okun's coefficient and tested the validity of Okun's law in Nigeria using annual data for the period 1980-2008. They found a positive coefficient in the regression, implying that Okun's law interpretation was not applicable to Nigeria for that period.

Basu and Foley (2011) tested the Kaldor-Verdoorneffect in their study on the dynamics of output and employment in the United States Of America (USA) economy using data for the period 1948-2010. The main interest of the study was in investigating how the relationship between employment and output has changed overtime. The empirical results generally showed

a declining trend in the relationship between output and employment growth during the post war period. The whole economy and the non-financial value adding sector of the economy showed a sharp fall in both the short and long run Kaldor–Verdoorn coefficient. Moreover, the private goods producing industries displayed a significant downward trend in both the short run and long run Kaldor -Verdoorn coefficient over the post war period.By contrast, private services producing industries taken together did not display any declining trend for the whole post war period.

Oelgemöller (2013) examinedvalidity of the Kaldor-Verdoorneffectat the sectoral level for Germany for the period 2000-2009. The results showed that the construction sector output had a strong connection to the labour market, while the same outcome did not hold in the finance, insurance and services sector.

In the case of Botswana two studies have attempted to investigate the relationship between output and employment growth.Ajilore & Yinusa (2011) investigated the employment intensity of the sectoral output growth in Botswana using data of the period 1990-2008. Their main objective was to identify the key sectors of the Botswana economy that are employment-intensive. The results of the study reflected extremely small employment intensity of output growth of about 0.01. The banking, commerce, construction, manufacturing and mining had positive employment elasticities, while government, transport, electricity and water sectors had negative employment elasticities. The study used the two-step approach to Cointegration analysis which is not suitable for multivariate analysis. It is possible that the economically insignificant coefficients and counter-intuitive results for some sectors are a result of the use of this approach.

Leshoro (2014) estimated the employment elasticity of growth for Botswana using data from 1980 to 2011. The results showed a negative and statistically significant short run relationship between output growth and employment generation. Leshoro interprets this negative relationship as indicating that Botswana's growth was mainly driven by increases in productivity. However, with all sectoral output coefficients being positive, it is difficult to see where the negative relationship at the aggregate level came from. Therefore, these results should be treated with caution as the study did not control for factor prices. Moreover, for a country whose labour productivity is considered low (see, e.g. Bank of Botswana Annual Report, 2015), labour costs can be significant determinants of the choice between labour-intensity and capital-intensity of production. Bank of Botswana Annual Report (2015) show that labour productivity growth fell from 2.4 percent between 1991 and 2001 to 2.1 percent between 2001 and 2011.

## METHODOLOGY AND DATA

### Theoretical Framework

The review of literature shows that studies that examine the relationship between output and employment have either estimated the Okun's law or the Kaldor-Verdoorn effect. Estimable models can be derived either directly using the production function approach as in (Mourre, 2004) or alternatively using cost minimization subject to an output constraint approach as in (Pessinoand Gill, 1996). Since in the case of Botswana output cannot be assumed to be constant and the economy is not at full employment, the former is eschewed in preference for the latter. Using the latter approach, the total cost is specified as:

$$C = C\,(w, r, Y);\;\; C_w > 0, C_r > 0 \tag{3}$$

where C is the total cost of production, w is the price of labour, r is the price of capital and Y is output. Using Shephard's lemma, a conditional labour demand ($L^d$) can be derived from equation (3) as a function of the prices of labour, capital, output and technologies as follows;

$$\frac{\partial C}{\partial w} = L^d = L(w,r,Y) \tag{4}$$

Where L embodies the technology. Equation (2) says that the demand for labour depends on the input prices, the level of output and technology. Studies have estimated equation (1) assuming different technologies such as the Cobb-Douglas (C-B), constant elasticity of substitution (CES), Generalized Leontief (GL) or the transcendental logarithmic (translog) technology.

### Empirical Model

The modelling approach followed in this study assumes that a representative firm minimizes its costs subject to an output constraint. From theCobb-Douglas technology, $Y = A.K^{\beta} L^{\varphi}$, the cost function is specified as:

$$C = c(w,r,Y) = Z.\, w^{\varphi} r^{\beta} Y^{\delta} \tag{5}$$

Where Z is a constant. Using the Shephard Lemma, the labour demand equation is written as:

$$L^d = \varphi w^{\varphi-1}\, r^{\beta}\, Y^{\delta} \tag{6}$$

Taking logarithm on both sides, equation (6) becomes;

$$ln\, L^d = ln\varphi + (\varphi - 1)\, lnw + \beta lnr + \delta lnY \tag{7}$$

Standard economic theory suggests that since wage rate is the price of labour, the demand for labour is expected to fall as the wage rate increases.

By contrast the demand for labour is expected to increase when the user cost of capital increases because of the substitution effect. Lastly a positive relationship is expected between employment and output.

**Econometric Framework**

The empirical counterpart of the relationships specified is Equation(7) is given by:

$$ln\, L^d = \lambda - \omega ln w_t + \beta r_t + \delta ln Y_t + \varepsilon_t \quad (8)$$

Where $\lambda = \ln \varphi$; $\omega = (\varphi - 1)$, $\varepsilon_t$ is white noise disturbance term, $L^d$ represents employment level,w represents wages, r represents the user cost of capital (interest rate) and Y represents output or real GDP. Equation (8) represents the long run equilibrium relationship between emplyment and its main determinants. However, the main purpose of this study is to analyze both long run and short run impacts of these variable son employment. In order to achieve this, the study adopts the auto regressive distributed lag (ARDL) bounds testing approach to Cointegration developed Pesaran *et al.* (2001). The approach has the advantage over other Cointegration approaches such as the Engle and Granger (1987) and Johansen and Juseluis (1990) because it can work regardless of whether the series are I(0) or I(1) or a combination of both I(0) and I(1) at the same time. Furthermore the approach is said to perform better for small sample sizes than other Cointegration techniques, which is a decisive advantage when working with developing countries data.

In order to implement the ARDL bounds testing approach, equation (8) is re-specified as a conditional ARDL of the form:

$$\Delta \ln L^d = \lambda + \Sigma_{i=1}^{p} \alpha_i \Delta \ln L_{t-i}^d - \Sigma_{i=1}^{p} \omega_i \Delta \ln w_{t-i} + \Sigma_{i=1}^{p} \beta_i \Delta r_{t-i} + \Sigma_{i=1}^{p} \delta_i \Delta \ln Y_{t-i} + a_1 \ln L_{t-1}^d + a_2 \ln w_{t-1} + a_3 r_{t-1} + a_4 \ln Y_{t-1} + u_t \quad (9)$$

Where $\alpha_i$, $\omega_i$, $\beta_i$ and $\delta_i$ are the short run dynamic coefficients, $a_1$, $a_2$, $a_3$ and $a_4$ are the long run coefficients and $p$ is the lag order, $\Delta$ is the difference operator while $u_t$ is a white noise disturbance term. Equation (9) is used to test for level relationships amongst the model variables. The null hypothesis of no-Cointegrationis tested against an alternative hypothesis that there is Cointegration. That is;

$$H_0: a_1 = a_2 = a_3 = a_4 = 0$$
$$H_1: a_1 \neq a_2 \neq a_3 \neq a_4 \neq 0$$

The test for the existence of level relationships among the variables is done by comparing the model's F and Wald statistics with the critical values computed by stochastic simulations using 20000 replications. At a chosen

level of significance, if the Wald statistic is greater than the upper bound of the tabulated value, the null hypothesis is rejected in preference for the alternative, confirming that there isCointegration among the model variables. If it lies within the bounds, a conclusive inference cannot be made without knowing the order of integration of the underlying regressors. In this case unit root tests are performed. If the statistic is less than the lower bound null hypothesis of no-Cointegration is not rejected

If there is evidence of long run equilibrium relationships among the variables, the next step is to estimate both the long run and short run error correction models (ECM) specified as equation (10) and (11), respectively.

$$\ln L_t^d = \theta_t + \Sigma_{i=1}^{p} \alpha_i \ln L_{t-i}^d - \Sigma_{i=0}^{p} \omega_i \ln w_{t-i} + \Sigma_{i=0}^{p} \beta_i r_{t-i} + \Sigma_{i=0}^{p} \delta_i \ln Y_{t-i} + u_t \quad (10)$$

$$\Delta \ln L_t^d = \lambda_t + \Sigma_{i=1}^{p} \sigma_i \Delta \ln L_{t-i}^d - \Sigma_{i=0}^{p} \varpi_i \Delta \ln w_{t-i} + \Sigma_{i=0}^{p} \kappa_i \Delta r_{t-i} + \Sigma_{i=0}^{p} \rho_i \Delta \ln Y_{t-i} + \vartheta ECT_{t-1} + u_t \quad (11)$$

where, $\vartheta$ is the coefficient of the error correction term and it measures the speed of adjustment of the relationship to equilibrium, $\theta_t$ is a drift (constant) parameter and $u_t$ is a white noise disturbance term. $\Sigma_{i=0}^{p} \omega_i$; $\Sigma_{i=0}^{p} \beta_i$; $\Sigma_{i=0}^{p} \delta_i$ are long run employment elasticities of wages, interest rate and output, respectively. $\varpi_i$; $\kappa_i$ and $\rho_i$ are the short run dynamic coefficients of wages, interest rate and output, respectively.

### Data and measurement of variables

This study uses bi-annual time series data for Botswana for the 1998 to 2011. The data was obtained from Statistics Botswana and Bank of Botswana (BoB) Annual Reports. The choice of the period was restrictedby availability of wages data at sectoral level. Aggregate employment is measured in absolute numbers of workers, output (Real GDP) is measured in millions of Pula at 2006 constant prices, the user cost of capital is proxied by the real prime lending rate and is measured as percentages, while monthly wages are used as proxy for the price of labour.

## ESTIMATIONS AND ANALYSIS OF RESULTS

### Unit Root tests

The unit root tests were performed using the Augmented Dickey Fuller (ADF) and Phillips-Perron tests of stationarity. The tests were carried out in two stages. In the first stage, the tests were carried out using the intercept only and the second stage using both intercept and the trend. Table 2 below presents the unit root test results where only the intercept was used.

**Table 2**
**Unit root test (intercept only)**

| | *Augmented-dickey-fuller (Adf)* | | | *Phillips-perron (Pp)* | | |
|---|---|---|---|---|---|---|
| *Variable* | *Levels* | *First Difference* | *Order of integration* | *Levels Difference* | *First integration* | *Order of* |
| | *t-statistics* | *t-statistics* | *I(d)* | *t-statistics* | *t-statistics* | *I(d)* |
| | 1.0645 | 4.6103*** | I(1) | 0.5822 | 6.7078*** | I(1) |
| **lnY** | 1.6780 | 11.0416** | I(1) | 1.9221 | 11.0412*** | I(1) |
| **r** | 0.9071 | 3.4565** | I(1) | 0.5253 | 3.2505** | I(1) |
| **lnw** | 2.4155 | 5.8894*** | I(1) | 3.9267*** | | I(0) |

*Note:* All variables except the user cost of capital (r) are expressed in natural logarithm.*, **, ***, means significant at 10%, 5% and 1% respectively. I(0) means the variable is stationery at levels while I(1) means that the variable is stationary at first difference.

The results show that all variables are I(1) when using the ADF method. When using the PP method, all variables are I(1) except for wages which are I(0). The null hypothesis of non stationarity is rejected at 5 percent for all variables. Table 3 below presents the results where both the intercept and trend were used to test for stationarity.

**Table 3**
**Unit root test (intercept and trend)**

| | *Augmented-dickey Fuller (Adf)* | | | *Phillips-perron (Pp)* | | |
|---|---|---|---|---|---|---|
| *Variable* | *Levels* | *First Difference* | *Order of integration* | *Levels* | *First Difference* | *Order of integration* |
| | *t-statistics* | *t-statistics* | *I(d)* | *t-statistics* | *t-statistics* | *I(d)* |
| | 4.5802*** | | I(0) | 2.2317 | 6.4806*** | I(1) |
| lnY | 1.8970 | 11.1424*** | I(1) | 3.9951 | | I(0) |
| r | 2.0656 | 3.6673** | I(1) | 1.9172 | 3.5215** | I(1) |
| lnw | 1.4605 | 6.5353*** | I(1) | 1.2727 | 7.4959*** | I(1) |

*Note:* All variables except the user cost of capital (r) are expressed in natural logarithm.*, **, ***, means significant at 10%, 5% and 1% respectively. I(0) means the variable is stationery at levels while I(1) means that the variable is stationary at first difference.

The unit root test results indicate a mixture of I(0) and I(1) variables and that none of the variables is I(2) or above. Therefore, the ARDL Bounds testing approach to Cointegration analysis can be applied.

## ARDL Bounds Tests and Cointegration

After confirming that all variables are either I(0) or I(1) as required by the ARDL approach, the next step is to estimate equation (9) and then test for the joint significance of the parameters of the lagged level variables. According to Pesaran and Pesaran (1997), the results of the regression in first differences are of no direct interest to the bounds Cointegration test, but it's the lagged level variables that are used to calculate the F- and Wald statistics. The results of estimating equation (9) are presented in Table 4.

The calculated F- and Wald statistics of 6.71 and 26.83 are higher than the upper critical values of 5.99 and 23.97 respectively, at the 5% level. Thus the null hypothesis of no Cointegration is rejected and it is concluded that there is a long run relationship amongst the variables in Equation (9).

**Table 4**
**Autoregressive Distributed Lag Estimates**

Autoregressive Distributed Lag Estimates
ARDL (1, 0, 1, 0) selected based on Schwarz Bayesian Criterion

Dependent Variable is LD
30 observations used for estimation from 1998Q2 to 2011Q3

| *Regressor* | *Coefficient* | *Standard Error* | *T-Ratio* | *Prob* |
|---|---|---|---|---|
| lnLD(-1) | 0.34013 | 0.14233 | 2.3898 | [.025] |
| lnw | -0.33643 | 0.14119 | -2.3828 | [.026] |
| r | -0.014806 | 0.013353 | -1.1089 | [.279] |
| r(-1) | 0.038374 | 0.011768 | -3.261 | [.003] |
| lnY | -0.06041 | 0.15779 | -0.39952 | [.693] |
| C | 10.8317 | 2.2892 | 4.7317 | [.000] |
| T | 0.025547 | 0.006642 | 3.8464 | [.001] |

| | |
|---|---|
| R-Squared0.92623 | R-Bar-Squared0.90699 |
| S.E. of Regression0.037621 | F-Stat.F(6,23)48.1333[.000] |
| Mean of Dependent Variable12.6145 | S.D. of Dependent Variable0.12336 |
| Residual Sum of Squares0.032553 | Equation Log-Likelihood59.8231 |
| Akaike Info. Criterion52.8231 | Schwarz Bayesian Criterion47.9189 |
| DW-statistic1.7808 | Durbin's h-statistic.95853[.338] |

Testing for existence of a level relationship among the variables in the ARDL model

| F-statistic | 95% Lower Bound | 95% Upper Bound | 90% Lower bound | 90% Upper Bound |
|---|---|---|---|---|
| 6.7076 | 4.6984 | 5.9936 | 3.9055 | 4.987 |
| W-statistic | 95% Lower Bound | 95% Upper Bound | 90% Lower bound | 90% Upper Bound |
| 26.8302 | 18.7937 | 23.9742 | 15.622 | 19.9479 |

If the statistic lies between the bounds, the test is inconclusive.
If it is above the upper bound, the null hypothesis of no level effect is rejected.
If it is below the lower bound, the null hypothesis of no level effect can't be rejected.
The critical value bounds are computed by stochastic simulations using 20000 replications.

| | *Diagnostic Tests* | |
|---|---|---|
| *Test Statistics* | *LM Version* | *F Version* |
| A: Serial Correlation | CHSQ(4)=17.0316[.102] | F(4,19)=6.2382[.002] |
| B: Functional Form | CHSQ(1)=2.2100[.137] | F(1,22)=1.7496[.200] |
| C: Normality | CHSQ(2)=22.7969[.000] | Not applicable |
| D: Heteroscedasticity | CHSQ(1)=2.4806[.115] | F(1,28)=2.5239[.123] |

## Diagnostic tests

Model adequacy check was performed through residual diagnostic tests. The tests show that the model passes most of the diagnostic tests. Normality is the only one that appears to be problematic. However, for samplesof more

than 30 observations normality issue can be ignored if it exists as per central limit theorem. Since the sample size is at the border line, normality problem is ignored and the model is considered fit for inference.

## Analysis of Results

After confirming that there is Cointegration and that the model is fit to draw inference from, the following long-run equation (10) was estimated and the results are presented in Table 5.

**Table 5**
**Estimated Long Run Coefficients**

Estimated Long Run Coefficients using the ARDL Approach
ARDL (1,0,1,0) selected based on Schwarz Bayesian Criterion

Dependent Variable is LD
30 observations used for estimation from 1998Q2 to 2011Q2

| Regressor | Coefficient | Standard Error | T-Ratio | Prob |
|---|---|---|---|---|
| lnw | -0.50985 | 0.24281 | -2.0998 | [.047]** |
| r | 0.035716 | 0.0129 | 2.7686 | [.011]*** |
| lnY | -0.095536 | 0.2382 | -0.4011 | [.692] |
| C | 16.4149 | 2.1652 | 7.5814 | [.000]*** |
| T | 0.038716 | 0.011046 | 3.5051 | [.002]*** |

Testing for existence of a level relationship among the variables in the ARDL model

| *F-statistic* | *95% Lower Bound* | *95% Upper Bound* | *90% Lower bound* | *90% Upper Bound* |
|---|---|---|---|---|
| 6.7076 | 4.6984 | 5.9936 | 3.9055 | 4.987 |
| W-statistic | 95% Lower Bound | 95% Upper Bound | 90% Lower bound | 90% Upper Bound |
| 26.8302 | 18.7937 | 23.9742 | 15.622 | 19.9479 |

*,**,*** means significant at 10%, 5% and 1%, respectively

Since all variables, exceptthe interest rate, are expressed in natural logarithm, theestimation coefficients on the independent variables are interpreted as employment elasticities. The model coefficients are consistent with theoretical priors and evidence from much of the literature reviewed above. The results show that a 1 percent increase in real GDP is associated with 0.09 percentage fall in employment. This is qualitatively similar to the results in Leshoro (2014). According to Kapsos (2005), for a growing economy, a negative employment intensity of output indicates that economic growth is driven mainly by productivity improvements, rather thanlabour employment. However, this coefficient is not only quantitatively small, but is also statistically insignificant suggesting that there is no long run relationship between the two variables. This is not surprising for Botswana as the structural transformation that took place during the sample period

involved shift in production from labour-intensive sectors such as agriculture and manufacturing to mining, which is capital-intensive.

As expected, the employment elasticity of wage rate is negative and statistically significant at the 5 percent level. It shows that a 1 percent increase in wage rates will in the long run reduce employment by 0.51 percent.This finding is qualitatively similar to, although significantly greater than the -0.07 percent, result in Ajilore and Yinusa (2011). The relative importance of wages in this study could be as a result of the sample period covering the recession and post-recession periods. During recessions, weak demand tends to depress prices and firms will become more sensitive to wage increases. User cost of capital has a positive and statistically significant relationship with employment at the 1 percent level of significance. That is, a 1 percent increase in the interest rate will increase employment by 0.36 percent in the long run. This suggests that firms consider the relative costs of labour and capital in deciding techniques of production to adopt. Akkemik (2007) and Ajilore and Yinusa (2011) found similar relationships for Turkey and Botswana, respectively.

Table 6 presents results of the error correction representation of the ARDL model (Equation 11). First, it is worth highlighting that the error correction term (ECM (-1)) has the correct sign(negative) and is statistically significant at 1 percent level of significance.The sign and magnitude of the error correction term suggests that about 66 percent of the disequilibrium will be corrected within the first quarter. Second, the model fits the data relatively well as indicated by an adjusted $R^2$ of 0.47. This indicates that about 47 percent of the variation in the dependent variable is explained by changes in the independent variables. Finally, the F-statistic, which tests for the overall significance of the model, is also significant at the 1 percent level indicating that the model is good.

**Table 6**
**Error Correction Representation**

Error Correction Representation of the Selected ARDL Model
ARDL (1,0,1,0) selected based on Schwarz Bayesian Criterion

Dependent Variable is dLD
30 observations used for estimation from 1998Q2 to 2011Q2

| *Regressor* | *Coefficient* | *Standard Error* | *T-Ratio* | *Prob* |
|---|---|---|---|---|
| dlnw | -0.33643 | 0.14119 | -2.3828 | [.025]** |
| dr | -0.014806 | 0.013353 | -1.1089 | [.278] |
| dlnY | -0.06041 | 0.15779 | -0.39952 | [.693] |
| dT | 0.025547 | 0.006642 | 3.8464 | [.001]*** |
| ecm(-1) | -0.65987 | 0.14233 | -4.6362 | [.000]*** |

List of additional temporary variables created:
dLD=LD-LD(-1); dLW=LW-LW(-1); dR=R-R(-1); dLY=LY_LY(-1); dT=T-T(-1)
ecm = LD + .50985*LW - .035716*R + .0955636*LY - 16.4149*C - .038716*T

| | |
|---|---|
| R-Squared0.58091 | R-Bar-Squared0.47121 |
| S.E. of Regression0.037621 | F-Stat6.3684[.001] |
| Mean of Dependent Variable0.01508 | S.D. of Dependent Variable0.051736 |
| Residual Sum of Squares0.032553 | Equation Log-Likelihood59.8231 |
| Akaike Info. Criterion52.8231 | Schwarz Bayesian Criterion47.9189 |
| DW-statistic1.7808 | |

*,**,*** means significant at 10%, 5% and 1%, respectively

The coefficients of the short run model suggest that wage rate is the only variable that influences employment. A 1 percent increase in wage rate will lead to a decrease in employment by about 0.34 percent. This result is qualitatively similar to that in Alijore and Yinusa (2011) for Botswana and Fell (2001) for Ireland. The interest rate and output do not only have unexpected negative signs, but are also statistically insignificant. This result differs from those of the studies cited above, which found positive and statistically significant coefficients for the two variables. However, coefficient on output is qualitatively similar to that in Leshoro (2014) who found a negative and statistically significant relationship. The negative relationship between output and employment in this study and that by Leshoro could be a result of the coverage of the recession and post-recession period in these two studies. During these period, the government increased employment to mitigate the negative effects of the recession. As a result employment did not fall, but rather increased when output was contracting. The other possible explanation is the results confirm the weak link between mining-led economic growth and employment generation. The mining sector is a highly capital intensive economic activity which explains why output growth is high while employment remains low. Another reason advanced by Ajilore and Yinusa (2011) as to why employment remains low despite output growth is that, output growth has been spurred by labour productivity and labour substitutability brought about by advancements in technology. Industry structures could also explain these relationships. Most industries exhibit high levels of concentration, both in the product and factor markets. Economic theory suggests that firms operating in industries where they are near monopsonies in the factor markets may deliberately restrict employment levels.

The statistically insignificant relationship between interest rate and employment can be explained by the share of government in employment.Government accounted for about 48 percent of total formal employment (including Ipelegeng) between 1997 and 2011. Since the government does not borrow funds from the markets, changes in interest rates do not affect its choice between labour and capital. Another possible explanation is that the nature of employment contracts in the private sector could be such that they do not allow firms to instantaneously switch from labour to capital in response to changes in their relative prices.

Taken as a whole, the results show that wages negatively affect employment generation both in the short and long run, with influence being stronger in the latter case. This is consistent with economic reasoning because in the long run all factors of production can be varied which is not the case in the short run. This makes labour relatively more substitutable with other inputs, which in turn makes employment more sensitive to wage movements. In addition, this could be due to wages accounting for a high proportion of the total cost of production in most of the sectors, as is often the case in less developed countries. When wages account for a large proportion of a firm's costs, it is likely to be more sensitive to changes in wage rate. The influence of interest rate on employment is only felt in the long run. This is to be expected given the nature of employment contracts and labour market rigidities in most developing countries. A longer period allows for firms to vary their inputs, which explains why interest rate is an important variable in explaining employment in the long run. An increase in interest rates therefore increases the cost of acquiring capital which makes labour relatively cheaper and more attractive to employers. Finally, output did not have any influence on employment during the sample period, both in the short run and long run. The possible explanations for this have been suggested as improvements in labour productivity, the capital-intensity of production in the main drivers of growth and government counter-cyclical measures put in place during and after the economic recession of 2009.

In order to analyse the employment-output relationships at the sectoral level, equations (10) and (11) were re-estimated with for each sector. Output was decomposed into total value added for the sector under consideration and that of the remaining sectors (others' output). The results for sectoral estimates are presented in Table 7. The results show that insignificant relationship between output and employment found at the aggregate level was a result of "washing out effects", where positive effects of some sectors' growth were cancelled by negative or insignificant influence of others.

The results indicate that long run relationships are found in only three sectors – agriculture, manufacturing and personal services. Moreover, growth in agricultural output is associated with employment contraction. This indicates the change from labour-intensive subsistence farming to mechanized commercial production. Turning to the short-run dynamics, the results show that mining, government and personal services outputs have positive and statistically significant effects on employment generation. Taken as a whole, personal services sector appears to be the sector with the highest potential for employment creation.

**Table 7**
**Employment elasticities of sectoral outputs growth**

| *Dependent variable (employment)* | *Agriculture* | *Manufacturing* | *Pers. Service* | *Mining* | *Government* | *Transport* | *Electrical* | *Trade* | *Construction* | *Finance* |
|---|---|---|---|---|---|---|---|---|---|---|
| | (2,2,2,2,1) | (1,0,1,0,1) | (2,2,2,2,2) | (1,1,0,0,1) | (1,2,0,2,0) | (1,0,0,0,1) | (1,0,2,2,2) | (1,0,0,1,0) | (1,2,1,0,1) | (2,1,2,0,1) |
| | | | | | Cointegrating Form | | | | | |
| Employment(-1) | -0.25(0.02) | | -0.16(0.14) | | | | | | | 0.42(0.01) |
| Own output | 0.04(0.36) | -0.13(0.00) | 0.10(0.06) | 0.07(0.08) | 0.76(0.00) | 0.00(0.99) | 0.06(0.66) | 0.02(0.68) | 0.07(0.09) | 0.11(0.21) |
| Own output (-1) | -0.06(0.07) | | 0.15(0.00) | | -0.33(0.17) | | | | -0.10(0.00) | |
| Wage | 0.09(0.04) | 0.04(0.51) | 0.01(0.67) | 0.11(0.13) | 0.16(0.17) | -0.10(0.14) | -0.08(0.34) | 0.02(0.48) | -0.02(0.65) | -0.01(0.91) |
| Wage (-1) | -0.10(0.02) | | -0.05(0.05) | | 0.25(0.05) | | -0.12(0.18) | | | -0.22(0.00) |
| Interest | -0.02(0.95) | -0.32(0.32) | 0.02(0.92) | -2.31(0.00) | -0.54(0.34) | -0.03(0.97) | 1.18(0.04) | -0.13(0.64) | 1.17(0.00) | -0.48(0.04) |
| Interest (-1) | 2.62(0.00) | | 0.28(0.13) | | | | 1.16(0.10) | | | |
| Others' output | -0.59(0.00) | 0.12(0.09) | 0.04(0.34) | 0.18(0.37) | -0.32(0.02) | -0.19(0.21) | 0.07(0.64) | 0.11(0.06) | -0.10(0.13) | -0.09(0.03) |
| Others' output (-1) | | | 0.10(0.03) | | | | 0.55(0.00) | | | |
| Constant | 6.98(0.00) | 2.98(0.00) | 2.98(0.00) | 1.33(0.00) | -0.90(0.00) | 0.26(0.08) | 2.80(0.00) | 2.14(0.00) | 2.51(0.00) | 2.73(0.00) |
| CointEq(-1) | -0.45(00) | -0.58(0.00) | -0.36(0.00) | -0.47(0.00) | -0.58(0.00) | -0.21(0.11) | -0.11(0.00) | -0.36(0.01) | -0.14(0.00) | -0.32(0.00) |
| Cointegration | YES | YES | YES | NO | NO | NO | NO | NO | NO | NO |
| | | | | | Long Run Coefficients | | | | | |
| Own output | -0.08(0.60) | -0.22(0.04) | 0.44(0.00) | 0.31(0.01) | 2.70(0.00) | -0.09(0.82) | 0.02(0.99) | 0.07(0.59) | 1.20(0.30) | -0.38(0.25) |
| wage | 0.25(0.02) | 0.15(0.13) | 0.09(0.55) | 0.19(0.19) | -0.39(0.16) | -0.17(0.64) | 1.46(0.43) | 0.13(0.29) | -0.08(0.78) | 0.52(0.00) |
| interest | -3.21(0.00) | 0.44(0.41) | 0.71(0.23) | -1.79(0.08) | -1.49(0.10) | 0.62(0.79) | -8.93(0.25) | 1.05(0.13) | 3.36(0.27) | -0.96(0.13) |
| Others' output | -0.78(0.00) | 0.59(0.02) | -0.26(0.25) | 0.26(0.14) | -0.41(0.29) | 1.08(0.14) | -3.13(0.48) | 0.34(0.13) | -1.62(0.16) | 0.01(0.97) |

## CONCLUSION

The primary interest of this study was to examine the direction and magnitude of the relationship between employment and output in Botswana. The empirical results show that output growth does not influence employment growth both in the long run and short run. These results explain the observed persistently high unemployment rate despite the country having enjoyed sustained phenomenal economic growth for over three decades. Possible explanations for this could be the structural transformation of growth drivers from labour-intensive sectors to capital intensive sector and improvements in labour productivity associated with modernization of the economy. This suggests that efforts to make the country's growth inclusive, need to be targeted at sectors with high employment elasticities. Growth that is not inclusive breeds a dangerous situation which could exacerbate inequality in the country because only a few people get to benefit from this growth. Labour is the main, if not the only, resource that the poor have in abundance so it is important that economic growth benefits everyone which would help the fight against poverty. The result that wage rate is the most important determinant of employment growth suggests that future wage awards should be justified by labour productivity improvements. Wage increases not matched by productivity gains might worsen the already fragile unemployment situation in the country. The unresponsiveness of employment growth to changes in interest rates could be indicative of labour market rigidities. There is therefore a need for policy reforms to enable labour markets to be flexible enough to respond to changes in the relative prices of factor inputs.

### *Notes*

1. http://data.worldbank.org/data-catalog/world-development-indicators
2. Ipelegeng is a Government of Botswana initiative intended to provide temporary relief to the unemployed, especially those at the lower skills end. According to Kanyenze (2012), it employs about 40,000-50,000 to carry out labour based initiatives and maintenance of government facilities.
3. Long-term unemployment refers to the number of people with continuous periods of unemployment extending for a year or longer, expressed as a percentage of the total unemployed (World Development Indicators, World Bank).

### *References*

(1998), 1995-1996 labour Force Report. Gaborone: Government Printer.

(2008), 2005-2006 Labour force Report. Gaborone: Central Statistics Office.

Abiodum, B., & Basiru, O. F. (2013), Empirical test of Okun's law in Nigeria. International Journal of Economic Practises and Theories.

Ajilore, T., & Yinusa, O. (2011), Analysis of Employment Intensity Of Sectoral Output Growth in Botswana. Southern African Buisness Review, 26-42.

Akkemik, K. A. (2007), The Response of Employment to Economic Growth in Turkey; An Econometric Estimation. Applied econometrics and International Development 7(1), 65-74.

(n.d.). Bank of Botswana statistical Reports 2000- 2013. Gaborone.

Basu, D., & K.Foley, D. (2013), Dynamics of Output and Employment in the US economy. Cambridge Journal of Economics 37(5), 1077-1106.

Budget, S. (2014), Delivered by Honourable O.K Mathabo: MFDP.

Edge, W., & Lekorwe, M. (1998), Botswana Politics and Society. Pretoria: J L van Schaik Publishers.

Frank, R., & Bernanke, B. (2011), Principles of Macroeconomics, 2nd edition, McGraw-Hill/Irwin, New York

Harvey, C., and Lewis, S. Jr (1990), Policy Choice and Development Performance in Botswana. Macmillan Press, London.

Kaldor, N. (1966), Causes of the Slow Rate of Growth of the United Kingdom: An Inaugural Lecture. Cambridge University Press.

Kapsos, S. (2005), The employment Intensity of Growth: Trends and Macroeconomic Determinants. Employment strategy papers, 12.

Lal, I., Muhammad, S. D., Hussain, A., & Jalil , A. (2010), Test of Okun's law in some Asian countries, Co-integration approach. European Journal of scientific research, 73-80.

Lee, J. (2000), The robustness of Okun's law: evidence from OECD countries. Journal of Macroeconomics 22(2), 331-356.

Leshoro, T. L. (2014), Empirical Analysis of Employment Elasticity of Growth in Botswana. Mediterranean Journal of Social Sciences, 171.

Marinkov, M., & Geldenhuys, J.-P. (2007), Cyclical unemployment and Cyclical output: An estimation of Okun's coefficient for South Africa. South Africa Journal of Economics, 373-390.

Okun, A. (1962), Potential Output:Its Measurement and Significance. Proceedings of the Business and Economic Statistics Section of the American Statistical Soceity.

Okun, A. (1970), Potential GDP: Its Measurement and Significance, The Political Economy of prosperity. Washington DC: Brookings Institution.

Pechman, A. J. (1983), Economics for policy making; selected essays of Arthur M. Okun. London: Massachusetts Institute of technology.

(2014), Population and Housing Census Analytical Report. Gaborone: Statistics Botswana.

Siphambe, H. K. (2003), Understanding Unemployment in Botswana. South African Journal of Economics, 480-495.

Siphambe, H. K. (2007), Growth and Employment Dynamics in Botswana: A Case Study of Policy Coherence . International Labour Office, Policy intergration and Statistics Department, 82.

Sodipe, O. A., & Ogunrinola, O. I. (2011), Employment and Economic Growth Nexus in Nigeria. International Journal of Business and social Science, 2(11).

(1995-2013), Statistics Botswana Reports. Gaborone: Statistics Botswana.

Verdoorn, P. J. (1949), Factors that determine the growth of labor productivity. Productivity growth and economic performance essays on verdoorn's law.

Villarverde, J., & Maza, A. (2009), The Robustness of Okun's Law in Spain,1980-2004: Regional Evidence. Journal of Policy Modeling, 289-287.

Budget Speech, (2015), Delivered by Hon. O.K Mathambo: MFDP.

Botswana, S. (2013), Botswana Core Welfare Indicator Survey 2009/10. Stats Brief July.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001), Bounds testing approaches to the analysis of level relationships. Journal of applied econometrics, 16(3), 289-326.

Oelgemöller, J. (2013), Economic and employment growth in Germany: The sectoral elements of Verdoorn's Law with regional data (No. 63). CAWM Discussion Paper, Centrum fürAngewandteWirtschaftsforschungMünster.

Pessino, C., & Gill, I. S. (1996), Determinants of labor demand in Argentina: estimating the benefits of labor policy reform (No. 114). CEMA.

Mourre, G. (2004), Did the pattern of aggregate employment growth change in the Euro area in the late 1990s; European Central Bank. Discussion paper 358.

Botswana, S. (2013), Botswana Core Welfare Indicator Survey 2009/10.Stats Brief July.

Engle, R. F., & Granger, C. W. (1987), Co-integration and error correction: representation, estimation, and testing. Econometrica: journal of the Econometric Society, 251-276.