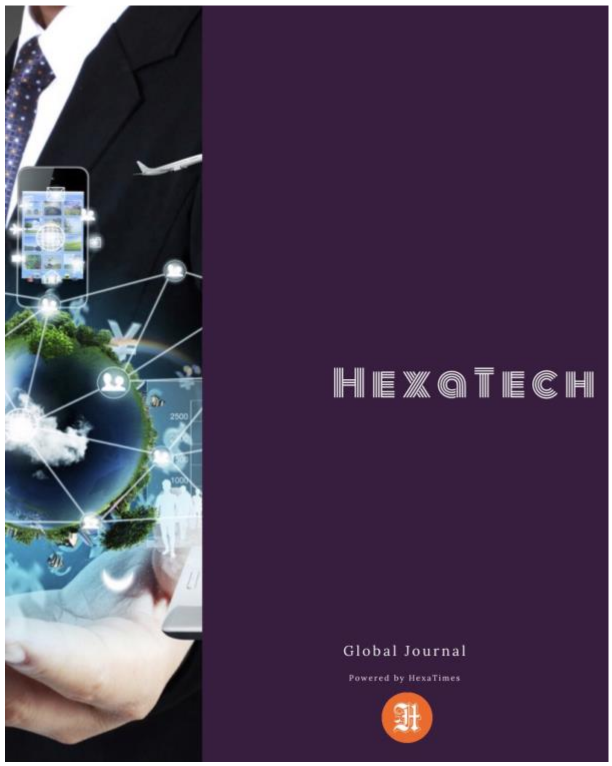


# The Relationship between Inflation and Economic Growth of Oman: An Empirical Analysis from 1980 to 2015

Majeed Ali Hussain[1] AfafAbdull J. Saaed[2]

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# The Relationship between Inflation and Economic Growth of Oman: An Empirical Analysis from 1980 to 2015

Majeed Ali Hussain[1] AfafAbdull J. Saaed[2]
[1] Professor of Econometrics,College of Business Administration American University in the Emirates United Arab Emirates.Dubai International Academic City, Email: mhussain1950@gmail.com
[2] Associate Professor of Applied Economics, College of Business Administration American University in the Emirates Dubai International Academic City, Email: afaf1955@yahoo.com

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**ABSTRACT**

*The aim of the study is empirically exploring the relationship between inflation and economic growth of Oman. Using annual data set on GDP and Gross Domestic Product Deflator (GDPDF) for the period of 1980 to 2015, an assessment of empirical evidence has been acquired through the Autoregressive Distributed Lag (ARDL) Cointegration Analysis test, error correction models and Granger Causality test. model is applied* to *examine* the *both long-run* and *short-run causality issues between the variables under consideration. The bounds tests suggest that the variables of interest are bound together in the long-run when GDP is the dependent variable. the results indicate also that there is significant long run Granger causality from ECT to GDPDF at 5 percent level of significance., The results indicate also that there is significant Granger causality from GDPDF to GDP at 5 percent level of significance and weak. evidence of Granger causalities from GDP to GDPDF at 10 percent level of significant, and weak long run grander causality from ECT to GDP as well. Results suggest that inflation has a positive and significant impact on economic growth. The study also revealed that there is long run co-integration between inflation and economic growth during the period of study.*

**KEYWORDS**: *ARDL,GDP,GDPDF,Oman,Cointegatration Granger Causality*

## 1. INTRODUCTION

The relationship between economic growth and inflation is complex one. The complexity of relationship between inflation and economic growth has been investigated during many studies. Empirical studies conducted for industrial and developed countries found a negative relationship between inflation and economic growth. In contrary, studies focusing on developing countries sample found a positive relationship between inflation and economic growth. Yet investigating ties between economic growth and the rate of inflation (Mamo,2012) was also treated as one of the central subjects of macroeconomics research and policy. There is no clear-cut definition about the relationship between economic growth and inflation. There are many controversial issues and findings about this relationship. Different studies (Mamo, 2012) showed that the relationship between economic growth and inflation may be positive, negative and neutral. A series of studies found no conclusive empirical evidence for either a positive or a negative association between inflation and economic growth, notable among these studies are Wai,1959; Bhatia, 1960; Dorrance, 1963, 1966, Johansen (1967). The second strand of the literature found a negative correlation between inflation and economic growth. Among these studies are Fisher (1993) De Gregorio (1993) Barro(1995, 1996); Brunno and Easterly (1995); Malla (1997); Faria and Carneiro (2001) Dewan & Hussein (2001). While the third strand of the literature found a positive relationship between inflation and economic growth.
Empirical studies performed to investigate the nature of relationship between inflation and growth indicated: bidirectional causality, a unidirectional causality and no causality between inflation and economic growth. However, a good deal of research work has been carried out on economic growth and inflation worldwide, but not much has been carried out using the Omani's economy and within the scope of our analysis

The rest of the paper is structured as following. The second section explores the empirical literature on inflation and economic growth by giving and analyzing statistics on two macroeconomic indicators, such as GDP growth and GDPDF.The third section we briefly explain the methodology and data that are used for the empirical results. The fourth section explores the empirical findings of the study. In the last section provides the summary and conclusion of the study.

## 2. REVIEW OF RELATED LITERATURE

Understanding the relationship between inflation and economic growth has all along been a key concern in macroeconomic research. Therefore, empirical studies about the effects of inflation on economic growth also have begun to be conducted. In this section we will firstly review empirical studies on the relationship between economic growth and inflation.

Mohsenia and Jouzaryan, (2016) investigated the relationship between inflation, unemployment and economic growth in Iran for the period 1996-2012. The results of the study revealed, both in short and long-run, a negative effect of inflation and unemployment on economic growth. They concluded that policy makers could attempt to control inflation and reduce unemployment to achieve sustainable economic growth.

Datta (2011) when investigating growth and inflation in Malaysia has shown that causality exist between inflation and economic growth in the short run thus inflation affecting economic growth but in the long run economic growth affected inflation.

Mohseni, M. et al (2016) considers a re-examination of the role of inflation and unemployment on economic growth using the ARDL regression model. The results showed a long run negative effect of inflation and unemployment on economic growth.

Aminu and Manu (2014) carried out research on analysis of unemployed resources and inflation in Nigeria from 1986 to 2010 using OLS technique and found that both unemployed human resources, rate of natural resource production (i.e rate of tapped resources), total inflation have positive impact on rate economic growth in Nigeria.

Shahid M (2014), study the effect of inflation and unemployment on economic growth in Pakistan via the ARDL model approach found that a long run relationship between the variables existed.

Umar and Razaullah (2013) found the impact of GDP and inflation on unemployment rate in Pakistan. They are using the time series data since 2000 to 2010 and run regression through SPSS. The results indicate that the F-test value is very low and below the value of 4.00. R square has limited variation i.e 0.70% and 22.8% from the inflation to Gross Domestic Product and unemployment. They found that inflation have negative for Gross Domestic Product and have negative correlation with unemployment.

Muhammad Umair and Raza Ullah (2013) have analyzed the impact of GDP and inflation on unemployment rate of Pakistan Economy in (2000-2010) and their study concluded that inflation has a role which influential but for GDP and unemployment with insignificant levels in the macroeconomics factors of Pakistani economy.

Mahmoud Ali Jaradat (2013) has analyzed impact of inflation and unemployment on Jordanian GDP from (2000-2010) and the empirical results of this study indicate that there is a negative relation between unemployment and GDP, and there is a positive relation between Inflation and GDP. In the other way this study found that there is strong negative significant relation between Unemployment and GDP in Jordan, and there is a strong positive significant relation between Inflation and GDP in Jordan, this can be explained by the reflection of the inflation in GDP.

Ayesha Wajid (2013) empirically analyzes the impact of inflation and economic growth on unemployment by using time series evidence from (1973 - 2010) in Pakistan. This study used Augmented Dickey Fuller (1981) test to test unit root problem and to find out the long run relationship among unemployment, inflation, economic growth, trade openness and urban population he applied Johansen - Juselius (1990) Maximum Likelihood Approach. This study concludes that inflation significantly increases unemployment in the long term; economic growth has a significant adverse impact on unemployment in the long run and in the short run respectively, and the impact of trade openness on unemployment is positively and insignificant in the long run but this impact becomes significant in the short run.

Mamo (2012, p.8) states that ''inflation and economic growth are the main concern of most countries of the world.'' Macroeconomists, policy makers and central monetary authorities of all the nations need to know whether inflation is beneficial to growth or detrimental to growth.

Ayesha Wajid (2013) empirically analyzes the impact of inflation and economic growth on unemployment by using time series evidence from (1973 - 2010) in PakistanThe study concludes that inflation significantly increases unemployment in the long term; economic growth has a significant adverse impact on unemployment in the long run and in the short run respectively, and the impact of trade openness on unemployment is positively and insignificant in the long run but this impact becomes significant in the short run.

To capture the relationship between economic growth and Inflation, Economic growth was proxied by the GDP and the GDP deflator (GDPD) is used as a proxy for Inflation. The data covers the period from 1961 to 2013. All the variables are taken on annual basis from World Development Indicators (World Data Bank Online Version). All the variables are transformed in their natural logarithms to avoid the problems of heteroscedasticity and denoted as LGDP and LGDPD.

This study will have to answer following questions regarding the impact of inflation and economic growth in Oman for the period 1980-2015. Which are:

- Does an association exist between economic growth and Inflation in Oman? If so, is it positively or negatively related to economic growth?
- Is the impact of the inflation on economic growth direct or indirect?
- What is the direction of association between inflation and economic growth?

## 3. CONCEPTUAL FRAMEWORK

### 3.1. Data, Model and Methodology

The data used in this study are time series data covering the period 1900–2015 are used in this study. The sample period comprises 35 annual observations. The GDP and GDPDF is obtained from the World Development Indicators, World Bank Group. and Index Moundi. This study used the GDP as Dependent Variable, GDPDEF as explanatory variable. All the variables are transformed in their natural logarithms in order to avoid the problems of heteroscedasticity and denoted as LGDP and LGDPDF.To estimate the relationship between GDPDF and GDP, the imperfect substitute model proposed by:

$$GDP_t = \alpha_0 + \beta_1 GDPDF_t + u_t \quad (1)$$

GDP is Gross Domestic products as a proxy for economic growth, GDPDF is the Gross Domestic Product Deflator used as proxy for inflation $\alpha_0$ is the constant term, 't' is the time trend, and 'u' is the random error term.

The paper employs three steps to estimate the impact of inflation on the economic growth. In the first step the nature of the data or order of integration of the variables, is examined. This is because if the data is found to be non-stationary, as most of the macroeconomic data happen to be, then application of OLS technique may give spurious results. To avoid that, stationary test of the variables is required. For the purpose, Augmented Dickey-Fuller test (ADF-test) and Philips-Perron test (PP test) have been applied. The ADF test assumes that the error term is statistically independent and has a constant variance. Philips and Perron (1988) developed a generalization of the ADF test procedure that allows for mild assumptions concerning the distribution of errors. While the ADF test corrects for higher order serial correlation by adding the lagged difference term on the right-hand side, the PP test makes a correction to the t- statistics of the coefficient from the AR (1) regression to account for the serial correlation in residual term. So, the PP statistics are just modification of the ADF t-statistics that considers less restrictive nature of the error process. For the reason, the present study has also conducted PP test to examine the stationary nature of the variables under consideration. Once the order of integration is known and it is found that all the variables are not stationary but integrated of order equal to or less than one, the presence of long run relationship is examined with the help of bound test approach to cointegration developed by Pesaran et al (2001).

### 3.2. Integration Analysis

The first step involves testing the order of integration of the individual series under consideration. Researchers have developed several procedures for the test of order of integration. The most popular ones are Augmented Dickey- Fuller (ADF) test due to Dickey and Fuller (1979, 1981). Augmented Dickey-Fuller test relies on rejecting a null hypothesis of unit root (the series are non-stationary) in favor of the alternative hypotheses of stationarity. The tests are conducted with and without a deterministic trend (t) for each of the series. The general form of ADF test is estimated by the following regression:

$$DX_t = \alpha + \beta X_{t-1} + \sum cDX_{t-1} + \varepsilon_t \quad (2)$$

where $X_t$ denotes the variables GDP,,D is the difference operator , $\alpha$, $\beta$, and $c$ are the parameters to be estimated, The tests are based on the null hypothesis ($H_0$): $X_t$ is not I(0), If the calculated ADF statistics are less than their critical values from Fuller's table, then the null hypothesis ($H_0$) is rejected and the series are stationary or integrated.

### 3.3. Autoregressive Distributed Lag (ARDL) Cointegration Analysis

A recent single cointegration approach, known as Auto-Regressive Distributed Lag (ARDL) of Pesaran et al. (2001), has become the most widely used approach by researchers. This cointegration approach, also known as bounds testing, has certain econometric advantages in comparison to other single cointegration procedures.

This study employed ARDL bounds testing the approach of cointegration developed by Pesaran

(1997), Pesaran and Shin (1999) and Pesaran et al. (2001). Due to the low power and other problems associated with other test methods, the ARDL approach to cointegration has become popular in recent years. The ARDL cointegration approach has numerous advantages in comparison with other cointegration methods such as Engle and Granger (1987), Johansen (1988), and Johansen and Juselius (1990) procedures: First, the ARDL procedure can be applied whether the repressors are I(1) and/or I(0), while Johansen cointegration techniques require that all the variables in the system be of equal order of integration. This means that the ARDL can be applied irrespective of whether underlying regressors are purely I(0), purely I(1) or mutually cointegrated and thus there is no need for unit root pre-testing. Second, while the Johansen cointegration techniques require large data samples for validity, the ARDL procedure is statistically a more robust approach to determine the cointegration relation in small samples. Third, the ARDL procedure allows that the variables may have different optimal lags, while it is impossible with conventional cointegration procedures. Finally, the ARDL procedure employs only a single reduced form equation, while the conventional cointegration procedures estimate the long-run relationships within a context of system equations. Basically, the ARDL approach to cointegration involves two steps for estimating long run relationship (Pesaran et al., 2001). The first step is to investigate the existence of long run relationship among all variables in the equation under estimation. The ARDL model for the standard log-linear functional specification of long-run relationship among GDP, and GDPDF may follows as:

$$DGDP_t = \alpha_1 + \sum_i^n \beta_3 DGDP_{t-1} + \sum_i^n \beta_1 DGDPDF_{t-1} + \delta 1 GDP_{t-1} + \delta 2 GDPDF_{t-1} + e_{1t} \ldots\ldots\ldots (3)$$

$$DGDPDF_t = \alpha_1 + \sum_i^n \beta_3 DGDP_{t-1} + \sum_i^n \beta_1 DGDPDF_{t-1} + \delta 1 GDP_{t-1} + \delta 2 GDPDF_{t-1} + e_{1t} \ldots\ldots \quad (4)$$

Where:
D denotes first difference operator
$\alpha_1$ is the drift component
$e_{1t}$ is the usual white noise Residual

Co-integration relationship is conducted by testing:

*Null hypothesis* $H_N$: $\delta 1 = \delta 2 = 0$ *against*
*Alternative hypothesis* $H_A$: $\delta 1 \neq \delta 1 \neq 0$.

### 3.4. Error Correction Model (ECM) Grander Causality

At the second stage, it is also possible to perform for the selected ARDL representation, a general error correction model (ECM) of Eq. (3 and 4) formulated as follows:

$$DGDP_t = \alpha_1 + \sum_i^n \beta_3 DGDP_{t-1} + \sum_i^n \beta_1 DGDPDF_{t-1} + \emptyset_1 EC_{t-1} + u_{1t} \ldots\ldots (5)$$

$$DGDPDF_t = \alpha_1 + \sum_i^n \beta_3 DGDP_{t-1} + \sum_i^n \beta_1 DGDPDF_{t-1} + \emptyset_2 EC_{t-1} + u_{2t} \ldots\ldots (6)$$

Hypothesis for the Granger causality test are:

$H_0 \cdots \sum \beta_1 = 0$, *GDPDF* does not influences GDP

$H_1 \cdots \sum \beta_1 \neq 0$, GDPDF influences on GDP

Where, $\alpha$, $\beta_{it}$ are short run dynamic coefficients to equilibrium and $\emptyset_i$ is the speed of adjustment coefficient, where residuals, $u_{ti}$ is independently and normally distributed with zero mean and constant variance. $n$ (lag length) in equation (5-6) should firstly be determined while applying bound test. Information criteria are used in the determination of optimal lag lengths. We used Akaike Information Criterion (AIC) and Schwartz Criterion (SC) in determination of optimal lag lengths. Since there is autocorrelation in case of lags, there should be no autocorrelation among the error term series for the bound test to provide accurate results.

## 4. EMPIRICAL RESULTS

### 4.1. Unit Root Test

Ideally, Augmented Dicky-Fuller and Philips-Perron test (PP) test has been used to check the unit root of the variables so that it can be seen what technique is appropriate for the model. Usually, time series data show trend with the time. This trend can be removed by differencing. The results of ADF and PP test are in table 1: The results show that all variables are integrated of order one, I(1) at 1%. These results are consistent with previous literature that has found most macroeconomic factors indicators to be non-stationary. at level and stationary in their first difference.

**Table 1**: Unit Root Test

| Variable | ADF test statistic (with trend and intercept) | | P-P test statistic (with trend and intercept) | |
|---|---|---|---|---|
| | *Level* *t-statistics P-value* | *First Difference* *t-statistics P-value* | *Level* *t-statistics P-value* | *First Difference* *t-statistics P-value* |
| LGDP | -0.121640 0.9392 | -6.646152 0.0000*** | -0.044398 0.9478 | -6.674554 0.0000*** |
| LGDPDF | 0.020968 0.9543 | -6.674554 0.0000*** | - 6.849398 0.0000*** | -7.266237 0.0000*** |

*Note:* *** significant at 1% level
** significant at 5% level
* significant at 10% level

### 4.2. Testing for Co-Integration Using the ARDL Approach

The next step is where equation 1 is estimated to examine the long-run relationships among the variables. The calculated *F*-statistics for the cointegration test is displayed in Table 2. The critical value is reported together in the same table which based on critical. when L*GDP* is the dependent variable, the calculated *F*-statistic (*F*-statistic = 6.730074) is greater than the upper bound critical value at 5 per cent level of significance (5.73), using restricted intercept and no trend. Meaning that there is a long run relationship amongst the variables.

But there is no long run relationship amongst the variables when L*GDPDF* is the dependent variable because its F-statistic (1.964889) is lessr than the upper-bound critical value (5.74) at the 5% level of significance. the null hypothesis of no co-integration can't be rejected (Table A3, Appendix A).

The next step of the procedure is to estimate the coefficients of the long-run relationships and associated error correction model (ECM) using the ARDL model. The order of distributed lag on the dependent variables were selected by the Akaike information Criterion (AIC) and turned out to be two. The Akaike information Criterion (AIC), selects an ARDL for model (3) they are ARDL (2,3) and for model (4) they are ARDL (1,2), where the number represents the lags for each of the variables in the two models. The long-run coefficients of the variables under investigations are shown in the following table.

**Table 2**: *F*-statistic of Cointegration Relationship

| Dependent variable | F-statistic | Decision |
|---|---|---|
| LGDP *(LGDPF)* | 6.730074 | Cointegration |
| LGDPDF(*LGDP*) | 1.964889 | No cointegration |
| | | |
| Lower-bound critical value at 5% | 4.78 | |
| Lower-bound critical value at 5% | 5.73 | |

*Lower and Upper-bound critical values are taken from Pesaran et al. (2001), Table CI(ii) Case II.*
*Source: Eviews version 9.*

The results of the error correction model when LGDP as a dependent variable are presented in Table 3. the coefficients in the ECM (-1) = -0.086328 negative and P-value=0.0013 Less than 1 percent level of significance, meaning that there is a SR association ship. The coefficients of ECM terms present the speed of adjustment in the long-run due to a shock. The coefficients of ECM terms imply that 8.63% of the disequilibria in GDP of the previous year's shock adjust back to the long run equilibrium in the current year. is significant, But when the LGDPDF as a dependent variable the coefficients in the ECM (-1) = -0.223013 negative and P-value=0.060 Less than 10 percent level of significance (see Appendix table A1). The second part in table 3 is Long Run Coefficients. LGDP has a positive relationship with inflation and statistically significant at 1percent level of significance. Meaning that when LGDPDF increase by 1 percent LGDP increase by 1.648 units.

**Table 3**: long-run and short-run models

| ARDL Cointegrating And Long Run Form | | | | |
|---|---|---|---|---|
| Dependent Variable: LGDP | | | | |
| Selected Model: ARDL(2, 3) | | | | |
| Sample: 1980 2015 | | | | |
| Included observations: 33 | | | | |
| Cointegrating Form | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| D(LGDP(-1)) | 0.110996 | 0.050265 | 2.208237 | 0.0362 |
| D(LGDPDF) | -0.043327 | 0.048414 | -0.894931 | 0.3790 |
| D(LGDPDF(-1)) | -1.114672 | 0.061387 | -18.158250 | 0.0000 |
| D(LGDPDF(-2)) | 0.855759 | 0.056914 | 15.035963 | 0.0000 |
| CointEq(-1) | -0.086328 | 0.023992 | -3.598194 | 0.0013 |
| Cointeq = LGDP - (1.6484*LGDPDF + 1.3333 ) | | | | |
| Long Run Coefficients | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| LGDPDF | 1.648369 | 0.141958 | 11.611671 | 0.0000 |
| C | 1.333346 | 0.739957 | 1.801922 | 0.0832 |

We applied several diagnostic tests to the error correction model. We find no evidence of Heteroskedasticity ARCH test, Ramsey reset and Breusch-Godfrey Serial Correlation LM test, misspecification of model respectively but the residuals are not normally distributed.

### 4.3. Granger Causality Test Analysis

The Granger causality test was conducted to eqs. (5 and 6) as such that Table 4 and Appendix A2, summarizes the results of the long-run and short-run Granger causality. The main results are as follows:

1. there is strong evidence of Granger causalities from LGDPDF to LGDP at 1 percent level of significant. Similarly, there is strong long run of Granger causalities from ECT to LGDPDF at 1 percent level of significant._This reveals that there is unidirectional long run Granger causality on Oman.
2. there is weak evidence of Granger causalities from LGDP to LGDPDF at 10 percent level of significant. Similarly, there is weak long run of Granger causalities from ECT to LGDP.
3. there is no evidence of Granger causality from LGDP to ECT and from LGDPDF to ECT as well.

According to the coefficient on the lagged error-correction term, there exists a long-run relationship among the variables in the form of Eq. (6) as the error-correction term is statistically significant, which also confirms the results of the bounds test. In the long run, DGDPDF as a dependent variable (see Appendix A2),

$$DGDP_t = \alpha_1 + \sum_i^n \beta_3 DGDP_{t-1} + \sum_i^n \beta_1 DGDPDF_{t-1} + \emptyset_1 EC_{t-1} + u_{1t} \quad (5)$$

**Table 4**: Pairwise Granger Causality Tests

Pairwise Granger Causality Tests

Date: 06/16/18 Time: 00:36

Sample: 1980 2015

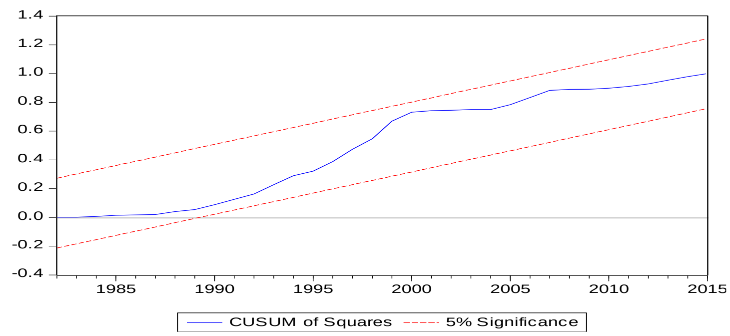
Lags: 1

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| LGDPDF does not Granger Cause LGDP | 35 | 7.29679 | 0.0110 |
| LGDP does not Granger Cause LGDPDF | | 3.92042 | 0.0564 |
| ECT does not Granger Cause LGDP | 35 | 3.23956 | 0.0813 |
| LGDP does not Granger Cause ECT | | 0.11709 | 0.7345 |
| ECT does not Granger Cause LGDPDF | 35 | 5.76546 | 0.0223 |
| LGDPDF does not Granger Cause ECT | | 0.30833 | 0.5826 |

## 4.4. Instability Test

Generally, the instability of coefficients of regression equations are tested by means of Chow (1960), Brown et al. (1975) Hansen (1992), and Hansen and Johansen (1999) tests. The Chow (1960) test reveals a priori knowledge of structural breaks in the estimation period. In Hansen (1992) and Hansen and Johansen (1999) procedures, instability tests require I(1) variables and they show the long-run parameter constancy without incorporating the short-run dynamics of a model into the testing as discussed in Bahmani-Oskooee and Chomsisengphet (2002).. The related graphs are presented in Fig.1. As can be seen from the graphs of Fig 1, the plots of CUSUMSQ statistics are well within the critical bounds at 5% significance level, implying that all coefficients in the error- correction model are stable.

**Figure 1**: Plot of CUSUMSQ of Recursive Residuals




*Note*: The straight lines represent critical bounds at 5% significance level. *Source: Eviews version 9*

## 5. CONCLUSION AND IMPLICATION

The literature review provided some useful information into the relationship between inflation and economic growth. Most theories are in support of a negative relationship with the belief that inflation imposes costs on an economy thereby reducing growth.

In this study, the relationship between the inflation and economic growth in Oman has been examined with the data covering 1980 to 2015.

The finding of this study results of unit root ADF and philli perron shows that economic growth is stationary on 1st difference. The paper used the Autoregressive Distributed Lag (ARDL) bounds testing procedure to identify the long run equilibrium relationship between economic growth and LGDPDF when LGDP is a dependent variable. The ARDL results shows that co-integration exist between the variables that shows there is a long run relationship between the variable. Similarly, the results showed that there was positive and significant relationship between inflation and economic growth in Oman economy in the period of study.

The results of the error correction model are negative and statistically significantat5 percent level of significance, meaning that there is a SR association ship. The coefficients of ECM terms present the speed of adjustment in the long-run due to a shock. The coefficients of ECM terms imply that 8.63% of the disequilibria in GDP of the previous year's shock adjust back to the long run equilibrium in the current year.

Finally, Granger causality test also examined based on vector error correction model and the results reveal that, there is strong evidence of Granger causalities from LGDPDF to LGDP at 1 percent level of significant. Similarly, there is strong long run of Granger causalities from ECT to LGDPDF at 1 percent level of significant. This reveals that there is unidirectional long run Granger causality on Oman.

Furthermore, the results of Heteroskedasticity ARCH test, Ramsey reset and Breusch-Godfrey Serial Correlation LM test shows that there is no problem of heteroskedasticity, misspecification of model and serial correlation respectively but the residuals are not normally distributed, and this is the only problem in our model. The model is stable.

## REFERENCES


Aminu U. and Manu D. (2014). 'The growth effects of unemployed resources and inflation in Nigeria', Journal of Economics and Sustainable Development, 5, 2.

Ayesha W. (2013). The impact of inflation and economic growth on unemployment: Time SeriesEvidence from Pakistan 1973-2010 in Pakistan, Retrieved from http://cgr.umt.edu.pk/icobm2013/ind ex. htm I

Datta, K. ( 2011). Relationship between inflation and economic growth in Malaysia. IPEDR Vol. 4.

Dickey DA, Fuller WA. (1981). Likelihood ration statistics for autoregressive time se-ries with a unit root. Econometrica; 49:1057e72.

Dickey DA, Fuller WA (1997). Distribution of the estimators for autoregressive time series with a unit root. J AM Stat Assoc; 74:427 e31.

Engle RF, Granger CWJ (1987). Cointegration and error correction representation:estimation and testing. Econometrica 1; 55:251e76.

Index Mundi web (2013). Jordan Economy Profile 2013, Source: CIA World Fact book. Index Mundi web (2013),

Mamo, F. T. (2012). Economic growth and inflation. Master's Thesis, Södertörns University.

Mahmoud Ali J. (2013). Impact of inflation and unemployment on Jordanian GDP. Retrieved from http://journal-archieves28.webs.com/317-334.pdf

Muhammad Umair and Raza U. (2013). Impact of GDP and inflation on unemployment rate of Pakistan Economy in (2000-2010), Retrieved from http://irm brjournal.com/papers/1371452025.pdf

Mohsenia, M. and Jouzaryan, F. (2016) Examining the Effects of Inflation and Unemployment on Economic Growth in Iran. Procedia Economics and Finance, 36, pp.381-389.

Persaran, H.M., Shin, Y and Smith, J. (2001). Bound Testing Approaches to the Analysis of Level Relationships" Journal of Applied Econometrics.

Pesaran M, Pesaran b. (1997). Working with microfit 4.0: Interactive Economic Analysis. Oxford: Oxford University Press.

Johansen S. (1988) Statistical Analysis of Cointegrating Vectors. J econ DYn control; 12:231e54.

Johansen S, Juselius K. (1990). Maximum likelihood estimation and influence on cointegration with application to the demand for money. Oxf.Bull.Econ Stat:52:169 e210.

Shahid, M. (2014). study on the impact of inflation and unemployment on the economic growth of Pakistan via the ARDL model approach. International Journal of Developing and Emerging Economies Vol.5, No.1, pp.26-39, April 2017 Published by European Centre for Research Training and Development UK (www.eajournals.org) 28 ISSN 2055-608X(Print), ISSN 2055-6098(Online) In line with the above

## APPENDIX A

$$DGDPDF_t = \alpha_1 + \sum_i^n \beta_3 \, DGDP_{t-1} + \sum_i^n \beta_1 DGDPDF_{t-1} + \delta 1 GDP_{t-1} + \delta 2 GDPDF_{t-1} + e_{1t}. \quad (4)$$

**Table A1:** long-run and short-run models

| ARDL Cointegrating And Long Run Form | | | | |
|---|---|---|---|---|
| Dependent Variable: LGDPD | | | | |
| Selected Model: ARDL(1, 0) | | | | |
| Sample: 1980 2015 | | | | |
| Included observations: 35 | | | | |
| Cointegrating Form | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| D(LGDP) | 0.128132 | 0.062854 | 2.038573 | 0.0498 |
| CointEq(-1) | -0.223013 | 0.114626 | -1.945570 | 0.0605 |
| Cointeq = LGDPD - (0.5745*LGDP -0.0501 ) | | | | |
| Long Run Coefficients | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| LGDP | 0.574547 | 0.102598 | 5.599958 | 0.0000 |
| C | -0.050068 | 0.910250 | -0.055005 | 0.9565 |

**Table A3**:LGDPDF dependent variable

| ARDL Bounds Test | | |
|---|---|---|
| Date: 06/15/18 Time: 18:35 | | |
| Sample: 1981 2015 | | |
| Included observations: 35 | | |
| Test Statistic | Value | k |
| F-statistic | 1.964889 | 1 |
| Critical Value Bounds | | |
| Significance | I0 Bound | I1 Bound |
| 10% | 4.04 | 4.78 |
| 5% | 4.94 | 5.73 |
| 2.5% | 5.77 | 6.68 |
| 1% | 6.84 | 7.84 |

$$DGDPDF_t = \alpha_1 + \sum_i^n \beta_3 \, DGDP_{t-1} + \sum_i^n \beta_1 DGDPDF_{t-1} + \emptyset_2 EC_{\ t-1} + u_{\ 2t} \ (6)$$

**Table A2**:Pairwise Granger Causality Tests when LGDPDF **is a dependent variable**

| Pairwise Granger Causality Tests when LGDPDF is a dependent variable | | | |
|---|---|---|---|
| Date: 06/16/18 Time: 00:50 | | | |
| Sample: 1980 2015 | | | |
| Lags: 1 | | | |
| **Null Hypothesis:** | **Obs** | **F-Statistic** | **Prob.** |
| **LGDP does not Granger Cause LGDPD** | **35** | **3.92042** | **0.0564** |
| **LGDPD does not Granger Cause LGDP** | | **7.29679** | **0.0110** |
| **ECT does not Granger Cause LGDPD** | **35** | **5.76546** | **0.0223** |
| **LGDPD does not Granger Cause ECT** | | **0.30833** | **0.5826** |
| **ECT does not Granger Cause LGDP** | **35** | **3.23956** | **0.0813** |
| **LGDP does not Granger Cause ECT** | | **0.11709** | **0.7345** |

$$\mathbf{DGDPDF_t = \alpha_1 + \sum_i^n \beta_3 \, DGDP_{t-1} + \sum_i^n \beta_1 DGDPDF_{t-1} + \delta 1 GDP_{t-1} + \delta 2 GDPDF_{t-1} + e_{1t}. \quad (4)}$$