

The Trade-Off between Unemployment and Inflation Evidence from Causality Test for Jordan

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Abstract

This paper investigates the existence of trade-off relationship between unemployment and inflation in the Jordanian economy between 1984 and 2011. Each of Granger-causality test is adopted to check relationship between variables and the direction of causation. Since these techniques are sensitive to stationary, integration and co-integration of the variables ADF and PP tests is applied to test the Stationary and integration order of the series while Johansen-Juselius procedure is carried out to explore the existence of co-integration between variables. The tests reveal that the variables' series have different degrees of integration, thus, their second differenced series - which have the same degree of integration- have been used to inquire about causality between the two phenomena. The results shown no causal relationship between unemployment and inflation in Jordan during the study period which means there is no trade-off relationship between the two variables. This lends support Monetarist school of thought. One of Reasons for this could be the foreign labor, which is not involved in the unemployment rate calculation. Therefore, it may hinder the trade-off between the two variables in the short run. The study recommends that policy makers should pay attention to these findings when they tackle unemployment issue, and encourages them to conduct programs to reduce unemployment rate through creation of productive and labor-intensive projects, also replace foreign labor with local labor, while continuing to control inflation, to ensure that Jordan accomplish a desired rate of unemployment and inflation, which in turn hearten economic growth.

1. Introduction

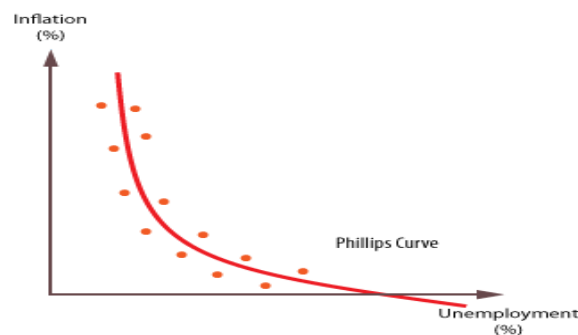
The concepts of inflation and unemployment are of the most important economic phenomena, which is facing any economy in the world. Therefore, the inflation and unemployment are of the basic economic issues, which direct government policies and programs, so the government conducts economic reform programs aimed to address these problems to keep on stable price level and low unemployment rate. Otherwise the government will gamble the economic growth, furthermore, the stability of the community.

Unemployment and inflation as economic concepts are subject of many economic studies, as well as, there are continuous attempts of a number of economists to explain the relationship between the two concepts. Their studies provided explanations of the possible relationship between the two variables in the short-run and the long-run. In the short-run, there is an inverse relationship between the two variables. According to this relationship, when unemployment is high inflation is low and vice versa. While in the long-run the studies imply that unemployment rate would stay fixed in spite of the changes in inflation rate.

The Classic states that there is no relationship between inflation and unemployment as the economy operates under full-employment situation, As long as, there is no interference in the labor market, and flexible prices and wages will ensure the continuity of full-employment, under these circumstances, unemployment that exists in the economy is optional. Therefore, increasing the amount of money in the economy by a certain fraction raises the general level of prices by the same percentage and does not result in an increase in output or employment as long as the economy is operating at full-employment. Furthermore, the classic argued that there is a natural rate of unemployment, which may also be called the equilibrium level of unemployment in a particular economy. Thus, they assumed that in the long-run unemployment rate would stay fixed in spite of the changes in the inflation rate, so there is no relationship between the two variables in the long-run.

Keynes criticized the classic view that the flexibility of wages and prices will eliminate the compulsory unemployment, and he argued that aggregate demand is the main determinant of the level of unemployment and the low rate of unemployment lead to higher general level of prices (inflation). He assumed that in the case of balance, aggregate demand is equal to aggregate supply and that a certain level of actual output is accompanied by a certain level of prices, and if the actual output less than potential output, it means that the economy is suffering from unemployment. If aggregate demand increased, it will raise the price level which means increasing inflation, and drive the total output of the economy to grow, which reduces unemployment, and this shows that the decline in unemployment associate with higher inflation.

In 1958, the Zealander economist William Phillips carried out Empirical Study of the British economy, using data for the period from 1861 to 1957. This study estimates the relationship between the unemployment rate and the rate of change in the money wage as an indicator of inflation, given that wages represent a large proportion of the cost and thus the price, the results of the study reveal the presence of a trade-off between the unemployment rate and the rate of change in wages as a representative of the rate of inflation.



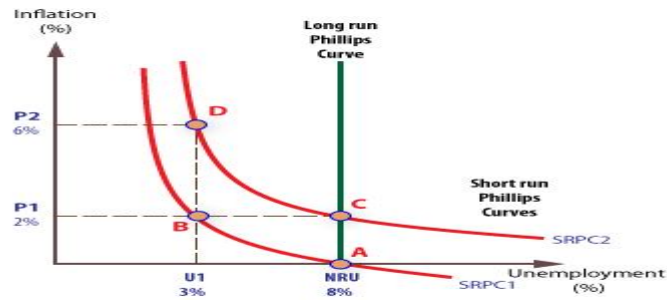
Phelps interpreted the result of the study, that in booms, the demand for labor increase and the unemployment rate decrease then workers have the opportunity to request higher wages while in periods of depression, the demand for labor decrease and unemployment rate increase then the ability of workers to demand higher wages is limited and decreasing wage rate increase significantly.

This finding supports Keynesian thought; therefore, a number of economists in the United States were encouraged to measure the relationship between inflation and unemployment using data on the U.S. economy. The studies revealed the inverse relationship between the two variables, which led to consolidate the results of a Phelps' study and dubbed this relationship as the Phillips curve.

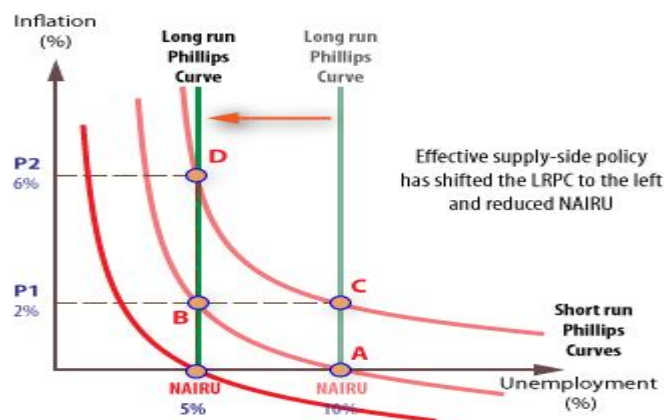
In 1970s, the industrialized nations had experienced an economic phenomenon called stagflation, which means that the economy is suffering from increasing in both unemployment rate and inflation rate in the same time. This phenomenon has cast doubt on the Keynesian thought and Phelps curve. Thus, there is no permanent inverse relationship between inflation and unemployment, but it may be positive relationship. This phenomenon has been interpreted by a number of economists, who linked it to the rise in oil prices during that period and therefore, the high cost of production, which led to change the aggregate supply and thus lower output with rising unemployment rate associated with a rise in prices.

Another explanation indicates that the inverse relationship between inflation and unemployment rate as represented by Phelps curve is only a short-term relationship and unstable, because it prevails for a limited period of time and there are factors lead to trans Phelps curve to another situation, and the major factor that leads to instability is unexpected inflation where the real wage for workers is declining, which motivates them to demand higher nominal wage, as a result the business will reduce the demand for labor, which increases unemployment. So, unexpected inflation is accompanied by an increase in the unemployment rate.

The original Phillips Curve idea was criticized by the Monetarist school among them Milton Friedman, Friedman accepted that the short run Phillips Curve existed – but for the long run, he introduced the concept of the NAIRU, Which is defined as the rate of unemployment when the rate of wage inflation is stable, and argued that Phillips curve in the long-run takes a vertical situation on the horizontal axis (rate of unemployment) and be parallel to the rate of inflation axis to indicate there is no trade-off between unemployment and inflation.



The monetarist said that increase AD to promote economic growth and lower unemployment have a short-run effect on jobs. So, a government could not permanently drive unemployment down below the NAIRU because it would end to higher inflation which finally cause higher unemployment companied with increasing expected inflation. Thus, the long run Phillips Curve is normally drawn as vertical – but it can shift inwards over time.



Such change could happen if the economic policies achieve a vital reduction in the natural rate of unemployment as a result of reducing frictional and structural unemployment.

2: Empirical Review/ Framework

In the following a review of some empirical studies of the relationship between unemployment and inflation: AMINU UMARU (2012) investigates the relationship between unemployment and inflation in the Nigerian economy between 1977 and 2009. The results indicate that inflation impacted negatively on unemployment. The causality test reveals that there is no causation between unemployment and inflation in Nigeria during the period of study and a long-run relationship exists between them as confirmed by the co integration test. ARCH and GARCH results reveal that the time series data for the period under review exhibit a high volatility clustering. Ravindra H. Dholakia and Amey A. Sapre (2011) estimate the inflation-unemployment trade-off in India using data for the period 1950-2009. They estimate the regular Phillips curve. The study reveals a regular trade-off between inflation and output or unemployment with inflationary expectations based on the experience of past three to four years.

Mori Kogid, Rozilee Asid, Dullah Mulok, Jaratin Lily and Nanthakumar Loganathan (2011) examine the trade-off relationship between unemployment and inflation using three robust methods; ARDL bounds testing to co integration, ECM based ARDL and Toda-Yamamoto techniques for the period of 1975-2007 in Malaysia. Not only does the study show the existence of the long-run co integration between inflation and unemployment, but there is unidirectional causal relationship running from inflation to unemployment indicating that inflation influenced unemployment. This study eventually reveals the evidence of the inflation-unemployment trade-off relationship in Malaysia. Alfred A. Haug & Ian P. King (2011) examine the relationship between inflation and unemployment in the long run, using quarterly US data from 1952 to 2010. Using a band-pass filter approach, they find strong evidence that a positive relationship exists, where inflation leads unemployment by some 3 to 3.5 years, in cycles that last from 8 to 25 or 50 years.

Their statistical approach is a theoretical in nature, but provides evidence in accordance with the predictions of Friedman (1977) and the recent New Monetarist model of Berentsen, Menzio, and Wright (2011): the relationship between inflation and unemployment is positive in the long run. Fumitaka Furuoka (2007) empirically examines the relationship between inflation rate and unemployment rate in Malaysia for the period 1975-2004. The findings point to the existence of a long-run and trade-off relationship – and also causal relationship between the unemployment rate and the inflation rate in Malaysia. In other word, it has provided an empirical evidence to support the existence of the Phillips curve in the case of Malaysia. Onwioduokit (2006) investigated the relationship between unemployment and inflation in Nigeria and found that there is negative relationship between unemployment and inflation with the coefficient of -0.412, this validates the Philips hypotheses; however, the results of the causality test indicate no causality between unemployment and inflation in Nigeria.

3: Model Specifications for the Study

Using annual data from CBJ's database and IMF's database the present paper examines the relationship between inflation (INF) and unemployment (UNE) in Jordan, while our model will be:

$$UNE_t = \alpha + \beta_{1i}INF_t + \varepsilon \quad (1)$$

Where INF_t is inflation which is measured by consumer price index (CPI), UNE_t is unemployment rate while α and β are the coefficient to be estimated and the U_t is error term.

To ensure the linearity, we have taken the logarithm form of the equation (1) which will yield equation (2) below with “ln” standing for the natural logarithm

$$\ln UNE_t = \alpha + \beta_{1i} \ln INF_t + \varepsilon \quad (2)$$

4: Econometric Methodology

The objective of this section is to examine the presence of interdependence and directions of causality between inflation and unemployment in the case of Jordan. This examination is based on time series data from 1984 to 2011.

The results of stationary and co integration tests determine how Granger-causality test should be applied, as follows:

If the variables (UNE) and (INF) are stationary, the standard Granger-causality test should be carried out by estimating the following regressions:-

$$UNE_t = \alpha + \sum_{i=1}^m \beta_{1i}UNE_{t-i} + \sum_{i=1}^n \beta_{2i}INF_{t-i} + \varepsilon_i \dots \quad (3)$$

$$INF_t = \alpha + \sum_{i=1}^n \beta_{1i}UNE_{t-i} + \sum_{i=1}^m \beta_{2i}INF_{t-i} + \varepsilon_i \dots \quad (4)$$

If the variables (UNE) and (INF) are non-stationary and integrated of order (1), but, they are not co-integrated, the Granger-causality test could be carried out by estimating the following regressions using the first difference series of both variables (Yoo and Kwak, 2004):-

$$\Delta UNE_t = \alpha + \sum_{i=1}^m \beta_{1i}\Delta UNE_{t-i} + \sum_{i=1}^n \beta_{2i}\Delta INF_{t-i} + \varepsilon_i \dots \quad (5)$$

$$\Delta INF_t = \alpha + \sum_{i=1}^n \beta_{1i}\Delta UNE_{t-i} + \sum_{i=1}^m \beta_{2i}\Delta INF_{t-i} + \varepsilon_i \dots \quad (6)$$

In general, if the origin series of both variables are non-stationary and the variables are not co-integrated, the Granger-causality test could be performed by using the same order of integration for both series, and reforming model (5 and 6) to suit the order of difference series.

In model (3 and 5), (UNE) is caused by past values of both (UNE) and (INF). Likewise, in model (4 and 6), (INF) is caused by past values of the two variables. According to Granger, (INF) causes (UNE) in model (3 and 5) if (β_{2i}) is significant from zero, and that (UNE) causes (INF) in model (4 and 6) if (β_{1i}) is significant from zero.

On other hand, (INF) does not cause (UNE) if (β_{2i}) in model (3 and 5) is insignificant from zero, and that (UNE) does not cause (INF) if (β_{1i}) in model (4 and 6) is insignificant from zero. These hypotheses can be verified depending on the joint significance of the parameters (β_{1i} , β_{2i}) which can be tested through the implementation of a simple F-test.

If the variables (UNE) and (INF) are non-stationary, integrated of the same order (d), and co-integrated which means that they have a long-run equilibrium relationship, the Granger-causality test should be carried out through estimating Error Correction Model (ECM) which could have the following form:

$$\Delta UNE_t = \alpha + \sum_{i=1}^m \beta_{1i} \Delta UNE_{t-i} + \sum_{i=1}^n \beta_{2i} \Delta INF_{t-i} + \beta_3 \eta_{t-1} + \varepsilon_t \quad (7)$$

$$\Delta INF_t = \alpha + \sum_{i=1}^m \beta_{1i} \Delta INF_{t-i} + \sum_{i=1}^n \beta_{2i} \Delta UNE_{t-i} + \beta_3 \mu_{t-1} + \varepsilon_t \quad (8)$$

Where (η_{t-1}) and (μ_{t-1}) are error-correction terms. The error correction term (η_{t-1}) in (7) is the lagged value of the residuals from the OLS regression of UNE_t on INF_t and the term (μ_{t-1}) in (8) corresponds to the lagged value of the residuals from the OLS regression of INF_t on UNE_t . In (7) and (8), ΔUNE_t , ΔINF_t and ε_t are stationary, implying that their right-hand side must also be stationary. It is obvious that (7) and (8) compose a bivariate VAR in first differences augmented by the error-correction terms (η_{t-1}) and (μ_{t-1}), indicating that ECM model and co-integration are equivalent representations.

According to Granger (1969; 1988), in a co-integrated system of two series expressed by ECM representation causality must run in at least one way. Within the ECM equation (7), (INF_t) does not Granger cause (UNE_t) if all $\beta_{2i} = 0$ and $\beta_3 = 0$. Equivalently, in equation (8) (UNE_t) does not Granger cause (INF_t) if all $\beta_{2i} = 0$ and $\beta_3 = 0$. Also, (β_3) the parameters of the error correction term indicate the speed of adjustment of any short-run disequilibrium towards a long-run equilibrium between both variables.

The Granger-causality could be claimed if the parameters (β_{2i} and β_3) in (7) and, or (β_{1i} and β_3) in (8) are jointly significant from zero which can be tested by a simple F-test. Similarly, Long-run causality could be claimed if (β_3) the parameter of the error correction term in (7 or 8) is statistically significant which can be tested by t-test.

What have been mentioned above clarifies that testing of stationary then co-integration are an essential requirements which determine how we do Granger-causality test. So, we perform our analysis in two steps:

First, we test for stationary which empirically examines whether a series contains a unit root. Since many macroeconomic series are non-stationary (Nelson and Plosser 1982), unit root test are useful to determine the order of integration of the variables and, therefore, to provide the time-series properties of data. If the series contains a unit root, this means that the series is non-stationary. Otherwise, the series will be categorized as stationary. In order to implement a more rigorous test to verify the presence of a unit root in the series, an Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are employed.

Then we test for co-integration to verify if the two series are co-integrated or not. Two or more variables are said to be co-integrated if they share a common trend. In other words, the series are linked by some long-run equilibrium relationship from which they can deviate in the short-run but they must return to in long-run, i.e. they exhibit the same stochastic trend (Stock and Watson, 1988). which has some significance in economic terms. Thus, Johansen-Juselius technique is adopted to test for the existence of Co integration relationships between a non-stationary series of the two variables. The Johansen-Juselius procedure of Co integration enables us to examine the existence of Co-integration between two non-stationary series, which requires that the matrix Π does not have full rank ($0 < r(\Pi) = r < n$) where (r) is the number of Co-integration vectors. This procedure depends on the Trace test (λ_{trace}) and The Maximum Eigenvalues test (λ_{max}) to determine the number of Co-integration vectors between variables based on a likelihood ratio test (LR).

The trace test (λ_{trace}) is defined as:

$$Trace = -T \sum_{i=r+1}^n \log(\hat{\lambda}_i) \quad (9)$$

The null hypothesis is that the number of Co integration vectors is $\leq r$ against the alternative hypothesis that the number of Co integration vectors = r .

The maximum eigenvalues test (λ_{max}) is defined as:

$$\lambda_{max} = -T \log(1 - \hat{\lambda}_i) \quad (10)$$

Which tests the null hypothesis that the number of Co integration vectors = r against the alternative that they are $r+1$

Finally, the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Co integration tests is sensitive for the number of lags. So, the choice of the number of lags actually employed was assigned to the Schwarz Information Criterion (SIC).

5: Data Analysis

In this section, first we see the results of the primary analysis of the data series. Basically the time series data has a trend; it was proved by the graphs of inflation (INF) and unemployment (UNE) during the period from 1984 to 2011. The results of unit root test are discussed below with the output of ADF and PP tests. To investigate the existence of the long run relationship, co-integration results also elaborated. Finally, the direction of causality will be analyzed. Table 1 shows the descriptive statistics of these two series.

Table 01: Descriptive Statistics

| variables | Mean | Median | Max | Min | Std. Dev. | Skewness | kurtosis |
|-----------|----------|----------|----------|-----------|-----------|----------|-----------------|
| DLUNE | 0.032521 | 0.022512 | 0.490984 | -0.215520 | 0.136439 | 1.38756 | 6.350552 |
| DLINF | 0.046326 | 0.033099 | 0.228471 | -0.006751 | 0.051172 | 2.107161 | 7.538273 |

5-1: Testing Stationary

The first step in empirical work was to test stationary vs. non-stationary of the series and to determine the degree of integration of both variables. The ADF and PP unit root test with intercept and with intercept and trend are adopted to check whether the series are stationary or they contain a unit root which means they are non-stationary. The results of ADF and PP test are reported in the Table 2 for the level as well as for the first difference of each of variable.

The ADF test imply that (LUNE) is stationary at zero order level with intercept and trend while PP test reveal that (LUNE) is stationary at zero order level with intercept. Thus, the null hypothesis that (LUNE) series contain unit root can be rejected at zero order level and it is strongly rejected for the first difference of (LUNE) series. On other hand, the results of ADF and PP test show that the null hypothesis that (LINF) series contain unit root cannot be rejected at zero order levels, also it is weekly rejected for the first difference of the series, but the null hypothesis of a unit root is strongly rejected for the second difference of (LINF) series.

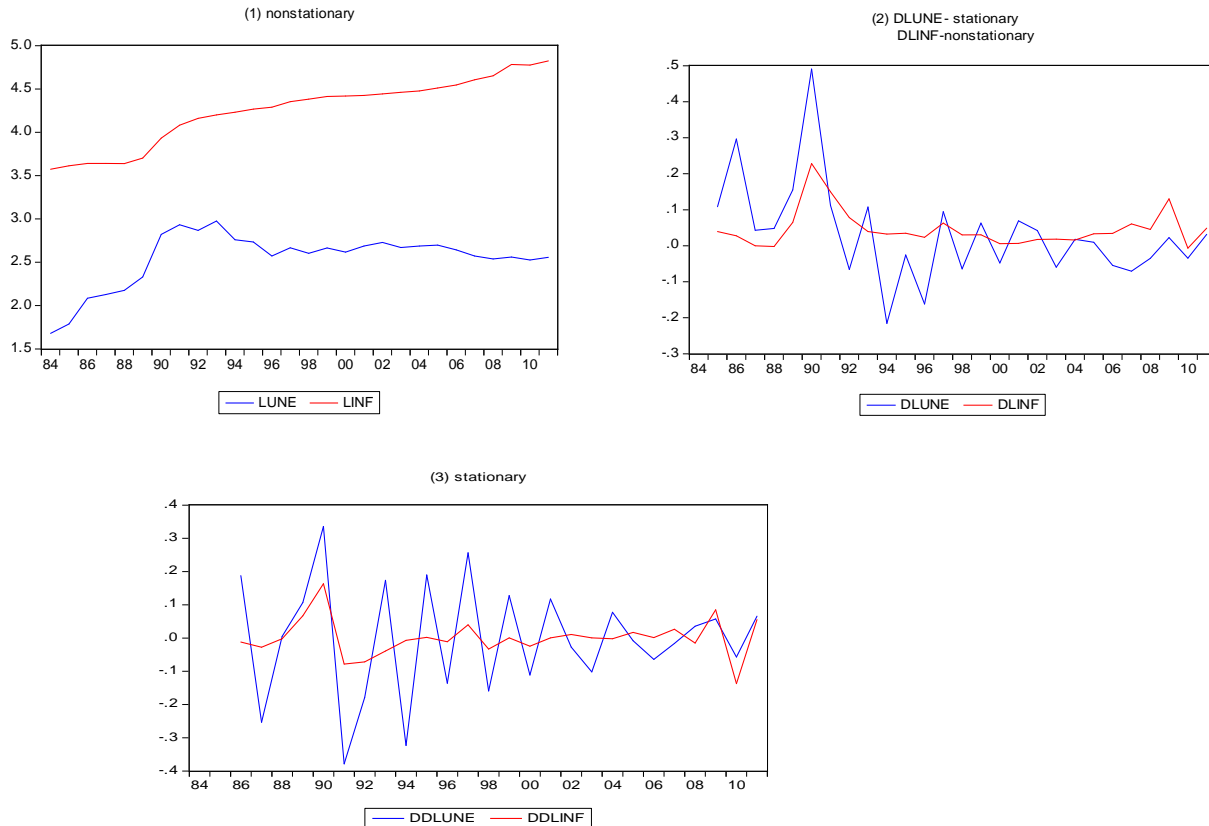
Table 02: Results of ADF and PP Test

| Series | With intercept | | With intercept and trend | |
|------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| | ADF | PP | ADF | PP |
| Levels | | | | |
| LUNE | -2.986225 [-2.502652] | -2.976263* [-3.298256] | -3.622033* [-4.563067] | -3.587527 [-2.419763] |
| LINF | -2.981038 [-1.070280] | -2.976263 [-0.996553] | -3.595026 [-2.131905] | -3.587527 [-1.627291] |
| First difference | | | | |
| ΔLUNE | -3.012363* [-4.663752] | -2.981038* [-3.932259] | -3.644963* [-3.813428] | -3.595026* [-4.566659] |
| ΔLINF | -2.986225 [-2.884358] | -3.603202 [-2.912321] | -2981038* [-3.131654] | -3.595026 [-3.123503] |
| ΔΔLUNE | -2.986225* [-8.703979] | -3.603202* [-8.595533] | -2.986225* [-13.72540] | -3.603202* [-19.38967] |
| ΔΔLINF | -2.991878* [-3.846567] | -3.603202* [-5.672519] | -2.986225* [-6.108423] | -3.603202* [-5.955279] |

-Note: * test critical values which denotes significant at 5% level.

-The number in parenthesis is the (t) statistic value.

Given the consistency and ambiguity of the results from this testing approach, we conclude that (LUNE) series is integrated of I(1) while (LINF) series is integrated of I(2). Accordingly, the series under investigation have different integration order. Figure (1, 2, and 3) clearly shows the differences in the trend with stationary and non-stationary of the series.



5-2: Testing Co-integration

According to Granger, there is no co-integration between the two variables since their series have different order of integration as mentioned above. This has been confirmed by the result of testing for co-integration or long run relationship between the variables. Johansen-Juselius procedure is used to test for co-integration between them.

Table 3 presents the result of the trace test (λ_{trace}) and maximum eigenvalues test (λ_{max}) statistics for the existence of long run equilibrium between unemployment and inflation based on the logarithm form of their origin series.

Table 3: Co-Integration Test

| Null Hypothesis | λ_{trace} | λ_{max} |
|-----------------|------------------------|------------------------|
| r=0 | 7.944284 [15.49471] | 7.062285 [14.26460] |
| $r \leq 1$ | 0.881999 [3.841466] | 0.881999 [3.841466] |

- *terms in [] indicates 5% level critical value.

The null hypothesis of no Co integration (r=0) based on both the trace test and the maximum eigenvalues test between unemployment and inflation can't be rejected at (5%) level of significance. furthermore, the null hypothesis that ($r \leq 1$) is rejected. The estimated two tests indicate that there is no Co integration vector between the two variables. Thus, a long-run relationship between unemployment and inflation doesn't exist in the country.

5-3- Causality Tests

Having the result of the stationary and co-integration test which reveal that the origin series of both variables are non-stationary and they have different order of integration, also, the variables are not co-integrated. The Granger-causality test is performed by using the second differenced series of both series, and reforming model (5 and 6) to suit the order of difference series. In order to determine which variable causes the other, the test results are presented in Table 4.

Table 4: Granger-causality Test

| Regression | Lag | F-statistics | P-Value | Granger causality |
|--|-----|--------------|---------|-------------------|
| DDLUNE on DDLINF Null hypothesis:DDLINF does not granger cause DDLUNE | 3 | .25815 | 0.8544 | NO |
| DDLINF on DDLUNE Null hypothesis:DDLUNE does not granger cause DDLINF | 3 | 0.84877 | 0.4873 | NO |

As shown in table 4, (DDLUNE) on (DDLINF) is not statistically significant at the 5% level, implying that there is no causality running from (INF) to (UNE). The F statistics imply that the null hypothesis (DDLINF) does not granger cause (DDLUNE) can't be rejected at the 5% significance level. On the other hand, (DDLINF) on (DDLUNE) is not statistically significant at 5% level and the F statistics imply that the null hypothesis that (DDLUNE) does not granger cause (DDLINF) can't be rejected at the 5% significance level. This indicates that there is no causation relationship between unemployment and inflation in Jordan. Thus, there is no trade-off relationship between unemployment and inflation for the period of the study in Jordan.

6. Conclusions and Recommendations

This study represents an attempt to investigate the trade-off between unemployment and inflation in Jordan. Based on annual data from IMF database, the study covers the period 1984-2011. Granger-Causality test is adopted. This technique depends on testing of stationary, integration and co-integration as prerequisites. The tests reveal that there is no evidence of causation between unemployment and inflation during the period of the study in Jordan. In fact there was no evidence of causality running in either direction. These findings lend support to Milton Friedman's thoughts, indicating there is no trade-off between unemployment and inflation during that period in Jordan. One of Reasons for this could be the foreign labor, which is not involved in the unemployment rate calculation. Therefore, it may hinder the trade-off between the two variables in the short run.

Accordingly, the study recommends that policy makers should pay attention to its findings when they tackle unemployment issue, and encourages them to conduct programs to reduce unemployment rate through creation of productive and labor-intensive projects, also replace foreign labor with local labor, while continuing to control inflation. To ensure that Jordan accomplish a desired rate of unemployment and inflation, which in turn hearten economic growth.

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