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Estimating the Determinants of Unemployment in Sudan by Applying the Philips Curve Using the E GARCH Model during the Period 1990-2018

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Abstract:- The study examined the unemployment determinants in Sudan economy. The paper used a quantitative econometric approach. . The paper assumed an inverse relationship between the inflation rate and the unemployment rate. The paper reached that there was positive relationship between nominal wages inflation. The paper recommended using effective economic and rational policy to control inflation in nominal wages and thus influence the unemployment rate and its reduction, in order to improve the Sudan economy and improve the living level.

Keywords:- *Examined, Determinants, Unemployment, Inflation, Nominal Wages, Sudan.*

I. INTRODUCTION

The Sudan economy is an agricultural economy characterized by multiple climates and fertile agricultural lands. It is rich in natural resources and is strategically located in the middle of the African continent. In recent years, the Sudanese economy has suffered from low production and productivity due to the lack of economic policies adopted by the state at that time, in addition to not exploiting economic resources for optimal use, in addition to political and economic instability, all of these factors combined contributed to the deterioration of the value of the local currency to its highest levels and high Unemployment rates, inflation and low standards of living, which negatively affected the performance of the Sudan economy sectors. The study tries to determine the factors of unemployment in Sudan. Also to analyze the future relationship with nominal wages as an independent variable. There are many similar studies have been conducted such as (Fuehrer & Moore, 1995, Galle & Gertler, 1999, Pattini, etal, 2000, and Rod & Welan, 2005) which mainly focused on the Phillips curve. The study problem was formulated in the following main question: What was unemployment the determinants in Sudan? The paper seeks at the determinants of unemployment and the applicability of the Philips curve in Sudan. The main purpose of the paper to estimate determinants of unemployment. It could be look at the literature of paper variables. The paper is based on a descriptive, historical, and analytical approaches by using Eviews programme. Finally, the paper discusses the results and makes recommendations.

II. THE UNEMPLOYMENT THEORIES

Classical theory: It assume that the most important factors affecting unemployment were the demand for labour, which is the demand for derivative labor demand and had a negative relationship to unemployment, and the supply of labour, which is positive with unemployment, and the equilibrium occurs in the labor market with equal demand for labor with the supply of labor. The theory also assumes that the free market and full competition contribute to reducing the unemployment rate because the economy is always operating at full capacity. Unemployment can arise when there is an inconsistency in the labor market due to an increase in the labour supply over the demand for labour. To remedy this problem, the country uses what is known as the hidden economy to influence market demand and employment.

Keynesian Theory: It was built by the British economist John Maynard. The theory assumes a relationship between employment and effective demand for goods and services, in addition to the assumption that prices are fixed. On the demand side, the theory assumes that aggregate demand produces total income at a given price that leads to the employment of new workers, and therefore employment changes when aggregate demand changes. On the supply side, the theory assumes that the job offer represents a job for real wages, but is not flexible due to trade union claims, meaning that wages may remain constant when facing an oversupply of labor. The imbalance between the supply of labor and the intersection of demand for labor and wages leads to involuntary unemployment, i.e. periodic unemployment.

Unemployment and Trade Theory: The theory is based on several assumptions, the most important of which were: that trade has the potential to increase employment opportunities. Trade based on Ricardo's comparative advantage affects unemployment through the difference of technology between countries. Trade increases the marginal productivity of workers in the export sector due to the increase in the local relative prices of produced goods and services. The marginal productivity of workers in a competitive economy will decrease due to trade liberalization. The theory generally assumes that marginal productivity increases for all workers in the economy due to increased efficiency and increased investment, which leads to the creation of new job opportunities and automatically reduces unemployment.

III. LITERATURE REVIEW

Some previous studies were conducted on the unemployment determinants in world countries, and some studies dealt with the determinants of unemployment from a microeconomic perspective in general, while other studies addressed other determinants of unemployment in each of the nude countries.

Ismael & Sadeq (2016) examine the unemployment and inflation rate by the Phillips curve during the period 1994-2017. In the long run, it is found an inverse relationship between inflation and unemployment, where inflation causes fluctuations in unemployment. In addition, in the short run it is found that inflation rate affects unemployment rate positively, so the Phillips relation not applicable in the Palestinian case. Folawewo & Adeboje (2017) analyzed the relationship between macroeconomic variables and unemployment in the Economic Community of West African States. It focused inflation rate, GDP growth, labor productivity, foreign direct investment and external debt. And employed fixed-random effects and fully modified ordinary least squares (FMOLS) panel data estimation procedures on annual data for the period 1991-2014.Results show that GDP growth has a reducing but insignificant effect on unemployment rate and inflation has a positive impact on unemployment, indicating invalidity of the Phillips curve hypothesis. Also, it is found a positive impact of labor productivity on unemployment rate, meanwhile FDI and external debt exert a weak negative impact on unemployment rate. Lukas etal (2018) examined the unemployment rate of low-skilled relative to high-skilled labour in Switzerland. Between 1991 and 2014, Switzerland experienced the highest relative increase in the low-skilled unemployment rate among all OECD countries. A natural culprit for this development is “globalization” as indicated by some mass layoffs in Switzerland and as commonly voiced in public debates all over the world. Our analysis, which is based on panel data covering the years 1991 to 2008 and approximately 33,000 individuals employed in the Swiss manufacturing sector, does not, however, confirm this presumption. We do not find strong evidence for a positive relationship between import competition and (low-skilled) individuals’ likelihood of becoming unemployed. Salazar (2019) discussed the dynamics of inflation and unemployment can be described by a Phillips curve when allowing for a positive co-movement between trend-adjusted productivity and unemployment. This suggests that improvements in productivity have been achieved by laying off the least productive part of the labor force. Furthermore, the natural rate of unemployment is a function of the long-term interest rate, indicating that monetary policy is not completely neutral in the long run. This result rejects the natural rate hypothesis and, at the same time, provides empirical support for the structural slump theory in a world of imperfect knowledge. The recent theory of imperfect knowledge economics seems to address the problem that many economic models lack: persistence in the observed data. By combining IKE and the structural slumps theory it is possible to obtain predictions that are theoretically and empirically consistent.

IV. PHILIPS CURVE

The appearance of the Philips curve in 1958 is due to the economist William Philips, through which he studied the relationship between inflation in nominal wages inflation and the rate of unemployment in the United Kingdom during the period (1861 - 1957). Phillips expected this function to be non-linearity. When the nominal wages inflation data was represented vertically and the unemployment rate horizontally, the curve shape was flat at high unemployment rates, because the Laborers refuse to provide their services below the prevailing wages level, and therefore the demand for work is low and the unemployment rate is high.

When the unemployment growth rate decreases, the workers will demand Laborers services significantly. When the unemployment growth rate increases, workers do not ask for an increase in wages and receive fewer wages than the average unemployment rate is zero with the average remaining constant. Finally, Phillips pointed out that the rate of nominal wages inflation growth will depend on the rate of growth of retail prices, and arrived at the following model**:** (A. W. Phillips,1978)

$$\frac{w_t}{w_1} = f\left(u_t : \frac{u_t}{u_t} : \frac{p_t}{p_t}\right) \quad \text{.....(1)}$$

Where nominal wages unemployment rate the difference between imported and domestic inflation. Philips estimated the model during the periods (1861-1913), (1913-1948) and (1948-1957). He found anomalous values as a result of the effect of the unemployment growth rate on the nominal wage growth rate. To separate the effect of the nominal wage growth rate, use the averages method for the first period and get the following unemployment rates (0-2%), (2-3%), (3-4%), (4-5%), (5-7%), and (7-11%). (A. W. Phillips,1978)

Multiple linear regressions was not used because it was not suitable for estimating the nonlinear function and used the averages method to characterize the following equation:

$$\frac{w_t}{w_1} + \alpha = \beta u_t^{\gamma}$$

$$\log\left(\frac{w_t}{w_1} + \alpha\right) = \log(\beta) + \gamma \log(u_t) \quad \text{.....(2)}$$

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When the unemployment rate is greater than 5%, the nominal wage growth rate is negative, and then the limit is added (α) to ensure that the nominal wage growth rate plus this limit is greater than zero, and thus obtain a logarithm. Philips performed a regression on the four positive values, ignoring the constant (α) and logarithm (β,γ) of the unemployment rate, thereby obtaining a logarithm and then used them in the graphical examination to find the values that make the curve pass the closest of the remaining two points so that the unemployment rate is greater than 5% and the result was as follows: (A. W. Phillips,1978)

$$\log\left(\frac{w_t}{w_1}+0.90\right)=0.948-1.394\log(u_t)....(3)$$

The values of the other two periods were predicted and it turned out to be an excellent prediction especially for the third period. Numerous studies have been carried out to implement the Phillips curve, the most important of which have been done by (Christopher I. Gilbert ,1976). As he added a random variable to equation (3), it reached estimates that are almost different from the estimates reached by Philips. (A. W. Phillips,1978)

$$\log\left(\frac{w_t}{w_1}+\alpha\right)=\log(\beta)+\gamma\log(u_t)+\varepsilon_t...(4)$$

Fischer studied the relationship between the growth rate of prices and unemployment rate in 1926, by using monthly data for the United Kingdom during the period (September 1915 - December 1924) and reached that if prices increased, 3% of the impact of the rise in the first month, 6% of the second, 7% in the third would be felt And the fourth and fifth in a row, and after that the height will diminish until it fades. Fischer noted that the correlation coefficient between the of inflation rate and unemployment rate is (0.9), and the causality relationship is explained as follows: The causality relationship is conducted from the inflation rate to the unemployment rate, so the unemployment rate is an internal variable, inverse to causality in the Phillips curve. The Phillips original curve explained the applied relationship between the nominal wage growth rate and the unemployment rate, but some studies have indicated that the high price level affects the unemployment rate .(A. W. Phillips,1978)

To clarify the relationship between these two methods, suppose (Y) that they represent the level of real production (at constant prices) and (e) the level of employment, and (μ) mark-up that is, the value of production above the cost of wages.

The equation is written in the form of two-step growth rates, entering the logarithm on both ends of the previous equation, and making the differentiation with respect to time and by rearranging we get the following: (A. W. Phillips,1978)

$$\ln(p_t)+\ln(y_t)=\ln(\mu_t)+\ln(w_t)+\ln(e_t)$$

$$\frac{\partial p_t}{\partial t}=\frac{p_t}{p_t};\frac{\partial y_t}{\partial t}=\frac{y_t}{y_t};\frac{\partial \mu_t}{\partial t}=\frac{\mu_t}{\mu_t};\frac{\partial w_t}{\partial t}=\frac{w_t}{w_t};\frac{\partial e_t}{\partial t}=\frac{e_t}{e_t}$$

$$\frac{p_t}{p_t}=\frac{u_t}{u_t}+\frac{w_t}{w_t}-\left(\frac{y_t}{y_t}-\frac{e_t}{e_t}\right)....(6)$$

When represents the average growth rate of the worker's productivity. If we assume a constant increase in the cost of labour, and that the average productivity growth rate of the worker is constant in each time period: (A. W. Phillips,1978)

$$\frac{p_t}{p_t}=\frac{w_t}{w_t}+\theta....(7)$$

That inflation rate $\frac{p_t}{p_t}$ depends on nominal wage growth rate $\frac{w_t}{w_t}$ which in turn depends on the unemployment rate. According to studies in the United States, the Philips curve was unstable in the short term, and it was modified by Lipsey's attempts, which were as follows:

$$\frac{w_t}{w_t}=\beta_0+\beta_1\frac{1}{u_t}+\beta_2\frac{1}{u_t^{3}}+\beta_3 u_t+\xi_{1t}.....(8)$$

Then he added the inflation rate. (A. W. Phillips,1978)

$$\frac{w_t}{w_t}=\beta_0+\beta_1\frac{1}{u_t}+\beta_2\frac{1}{u_t^{3}}+\beta_3 u_t+\beta_4\frac{p_t}{p_t}+\xi_{2t}....(9)$$

V. DATA DESCRIPTION

The model consists of two variables; Inflation (INF), Nominal Wages (NW) the dependent variable: and one independent Unemployment Rate (UN). Data of the first one variable were collected from the World Bank estimates; the two was obtained from the database of Central Bureau of Statistics. Data sample covers the period 1990-2018. The selection of the study period is due to the fact that it represents an important stage in Sudan economy.

VI. METHODOLOGY AND DATA

The model consists of three variables; Unemployment Rate (UN) the dependent variable: and two independent variables i.e. Nominal Wages Inflation (NWI) and Unemployment Rate (UN (-1)) to know the determinants of unemployment Rate in Sudan throw time series. The data have been obtained from Central Bank of Sudan and Central Bureau Statistics. The paper used the Exponential General Auto-Regression Conditional Heteroskedasticity Model (E GARCHM). E GARCH Model was proposed by Nelson (1991). The specification for the conditional variance is as follows:

$$\ln(\sigma_t^{\,2}) = \omega + \left|\frac{\sigma_t(\xi_{t-1})}{\sigma_{t-1}}\right| + \sqrt{\frac{2}{\pi}} + \frac{\gamma\xi_{t-1}}{\sigma_{t-1}} + \beta\ln(\sigma_{t-1}^{\,2})$$

The left-hand side is the log of the conditional variance. This implies that the leverage effect γ is exponential, rather than quadratic, and that forecasts of the conditional variance are guaranteed to be nonnegative. Exchange rate is considered as a financial asset. The price of a financial asset is set as the present value of the cash flows expected from the asset. Asset prices change when the expectations of future cash flows change, the uncertainty around them or the rate at which cash flows are discounted changes. Price change by larger amount or more frequently i.e. become more volatile, the greater the number of reasons for investors to alter their views on future cash flows the greater the fluctuation in the discount rate. This requires news (surprises) or unexpected events. CPI (surprises) news affects inflation uncertainty (the vulnerability or sensitivity of prices to the surprise). In many financial and macro variables volatility responds asymmetrically to past negative and positive return shocks, with negative returns resulting in larger future volatilities i.e. leverage effect (Jan 2005). The presence of leverage effects can be tested by the hypothesis that $\gamma \prec 0$ otherwise the impact is asymmetric if $\gamma \mp 0$.

VII. EMPIRICAL EVIDENCE

Annex (1) shows the Descriptive statistics of unemployment rate (UN), nominal wage inflation (NWI) and Unemployment Rate (UN (-1)). Annex (2) shows unit root test for Augmented Dickey-Fuller (ADF) where the unemployment (UN), nominal wage inflation (NWI) and Unemployment Rate (UN (-1)) is stationary with an intercept in level one. Annex (3) indicates the presence of one co integrating equations among these variables at 5% significance level i.e. unemployment (UN), unemployment rate (UN(-1)) and nominal wage inflation (NWI). Annex (4) shows the E GARCH Model output. Annex (5) shows the variables correlation matrix and Annex (6) shows the ARCH test.

- *Main Equation: E GARCH Estimation output*

$$UN_t = 2.971353 + 0.125378\log NWI_t + 0.6635935UN(-1)$$

Z-Statistic (1.9) (2.3) (5.9)

- *Variance Equation*

$$\ln(\sigma_t^{\,2}) = 0.275195 - 0.24\left|\frac{\sigma_t(\eta_{t-1})}{\sigma_{t-1}}\right| - 0.72 + \frac{\gamma\eta_{t-1}}{\sigma_{t-1}} + 0.8$$

Z-Statistic (0.5) -(0.3) - (1.8) (3.4)

$$R^2 = 0.75 \qquad \bar{R}^2 = 0.73 \qquad DW = 1.52$$
$$Arch(F(prob)) = 0.95 \; Arch(\chi^2(prob)) = 0.94$$

The estimated coefficients of mean equation are highly significant. The sign of unemployment (UN), nominal wage inflation (NWI) and unemployment (UN (-1)) were as expected. An increase in nominal wage and unemployment (UN (-1)) leads to an increase in the unemployment rate, which leads to high rates of inflation and a decrease in output, and consequently, the economy will decline. The role of news is shown by the variance equation. The leverage effect term (-0.3), denoted as RES/ SQR[GARCH] (1) in the output, is negative and statistically different from zero, indicating the existence of the leverage effect (positive correlation between unemployment rate and nominal wage in future. It became clear that the past few years that financial policy contributed to increasing debt and high unemployment and inflation, which led to the deterioration and decline of the Sudanese economy.

VIII. DISCUSSION

The Descriptive statistics in Annex (1) showed the mean, medians and standard deviation of unemployment (UN), nominal wage inflation (NWI) and unemployment (UN(-1)).There was a possibility of a simultaneous relationship between unemployment, nominal wage inflation (NWI) and unemployment (UN(-1)). The main determinants of unemployment rate are nominal wage and unemployment (UN(-1)). Nominal wage inflation (NWI) and unemployment (UN (-1)) had positive relationship with the rate of unemployment in Sudan. The study reached that the increase in nominal wages inflation (NWI) and unemployment (UN(-1)) leads to an increase in unemployment in Sudan. Reduced the inflation leads to higher unemployment. And The Phillips curve also indicates that the (NWI) relationship changes over time if the actual employment differs from the full employment. Changes in the unemployment will affect wages. Returning to full employment dynamically over time and hence unemployment decreases. The study recommended to adopting effective economic policy to reduce the inflation and unemployment, and thus improve the Sudanese economy.

IX. CONCLUSION

EGARCH model was used to estimate determinants of unemployment, the mean equations were found to be determined by nominal wage inflation (NWI) and unemployment (UN (-1)). So the conditional variance (risk) indicates the existence of the leverage effect in future unemployment returns during the period (1990- 2018).The study aimed to establish the main determinants of unemployment in Sudan. Also Based on the regression results, it is clear that the nominal wage inflation (NWI), unemployment (UN(-1)) were the main determinants of unemployment in Sudan- both in the short-run and the long-run, with nominal wage determinant. The coefficient for wage determinant from the estimated long-run unemployment confirms the Monetarists theory of unemployment in the long-run. Base on the estimated result, the independence of the central bank is very important to reform the state of the Sudan economy.

REFERENCES

[1]. A. W. Phillips (1978) the relation between unemployment and the rate of change in the money wage rates in the United Kingdom 1861-1957. Economic, 25(100):283–299, November.
[2]. Pami Dua (2009) Determination of Inflation in an Open Economy Phillips Curve Framework: The Case of Developed and Developing.
[3]. Fialová Kamila & Mysíková Martina (2009) The Minimum Wage: Labor Market Consequences In The Czech Republic, Finance A Úvěr-Czech Journal Of Economics And Finance, 59, 2009, No. 3
[4]. Eita Joel Hinaunye & Ashipala Johannes M (2010) Determinants Of Unemployment In Namibia, International Journal Of Business And Management, Vol. 5, No. 10; October .
[5]. Fuad M. Kreishan (2011) Economic Growth And Unemployment: An Empirical Analysis, Journal Of Social Sciences 7 (2): 228-231, 2011, ISSN 1549-3652, Science Publications
[6]. Afzal Muhammad & Awais Samia, (2012) Inflation-Unemployment Trade Off: Evidence From Pakistan, Journal Of Global Economy (ISSN 0975-3931), Volume 8 No 1, January-March, 2012
[7]. Aminu Umaru & Anono Abdurrahman Zubairu (2012) An Empirical Analysis Of The Relationship Between Unemployment And Inflation In Nigeria From 1977-2009, Economics And Finance Review, ISSN: 2047 – 0401, Vol. 1(12) Pp. 42 – 61, February.
[8]. Doğan Taylan Taner (2012) Macroeconomic Variables And Unemployment: The Case Of Turkey, International Journal Of Economics And Financial Issues, Vol. 2, No. 1, 2012, Pp.71-78, ISSN: 2146-4138.
[9]. Chaido & Melina (2013) Phillips curve inflation and unemployment: an empirical research for Greece, Computational Economics and Econometrics, Vol. 3, Nos. 1/2.
[10]. Aurangzeb, C.D. and Khola, A. (2013). Factors Affecting Unemployment: A Cross Country Analysis. Journal of Academic Research in Business and Social Sciences, 3(1), :219-230.
[11]. Cheema Ahmed Raza, Atta Ambreen (2014) Economic Determinants Of Unemployment In Pakistan: Co-Integration Analysis, International Journal Of Business And Social Science, Vol. 5 No. 3; March 2014 Scientific Research Journal (SCIRJ), Volume II, Issue VIII, August 2014 9 ISSN 2201-2796.
[12]. Kemi F. Akeju & Dayo B. Olanipekun (2014) Unemployment And Economic Growth In Nigeria, Journal Of Economics And Sustainable Development, ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online), Vol.5, No.4, 2014.
[13]. Arslan M. and Zaman R. (2014). Unemployment and its Determinants: A Study of Pakistan Economy 199-2010. Journal of Economics and Sustainable development, 3 (13): 20-24.
[14]. Folawewo, A.O. and Adeboje, O.M. (2017). Macroeconomic Determinants of Unemployment: Empirical Evidence from Economic Community of West African States. African Development Review, 29(2):197–210.
[15]. Ismael, M. and Sadeq, T. (2016). Does Phillips Exist in Palestine? An Empirical Evidence. MPRA. Paper No.70245: 1-10.
[16]. Lukas Mohler, Rolf Weder and Simone Wyss (2018) International trade and unemployment: towards an investigation of the Swiss case, Swiss Journal for Economic and Statistics, issue 154.
[17]. Leonardo Salazar (2019) The Phillips curve and the role of monetary policy in Chile, journal of applied economics an open access journal. Volume 23, 2020.

➢ *Annex (1) Descriptive Statistics*

	UN	NWI	UN(-1)
Mean	15.96786	39.32143	2.73E+11
Median	15.60000	16.95000	20118784
Maximum	21.60000	133.0000	4.57E+12
Minimum	12.00000	7.200000	35171.97
Std. Dev.	2.410172	41.24057	9.27E+11
Skewness	0.698099	1.203062	3.940691
Kurtosis	2.932595	2.974313	18.07503

Jarque-Bera	2.279563	6.755112	337.6016
Probability	0.319889	0. 34131	0.23345
Sum	447.1000	1101.000	7.65E+12
Sum Sq. Dev.	156.8411	45921.19	2.32E+25
Observations	28	28	28

Table 1

- *Annex (2) Augmented Dickey-Fuller test statistic*

Null Hypothesis: D(UN) has a unit root Exogenous: Constant Lag Length: 0 (Automatic – based on SIC, maxlag =7)			
Augmented Dickey-Fuller test statistic		t-Statistic	Prob.*
		-4.248064	0.0026
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	
Null Hypothesis: D(NWI) has a unit root Exogenous: Constant Lag Length: 0 (Automatic – based on SIC, maxlag=7)			
Augmented Dickey-Fuller test statistic		t-Statistic	Prob.*
		-8.146950	0.0000
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	
Null Hypothesis: D(UN(-1)) has a unit root Exogenous: Constant Lag Length: 0 (Automatic – based on SIC, maxlag=6)			
Augmented Dickey-Fuller test statistic		t-Statistic	Prob.*
		-10.16923	0.0000
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

Table 2

- *Annex (3) Co Integration Output*

Date: 04/01/20 Time: 18:47 Sample (adjusted): 1990 2018 Included observations: 26 after adjustments Trend assumption: No deterministic trend Series: UN NWI UN(-1) Lags interval (in first differences): 1 to 1 Unrestricted Co integration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.505419	25.45511	24.27596	0.0354
At most 1	0.213676	7.149979	12.32090	0.3104
At most 2	0.034020	0.899927	4.129906	0.3966

Table 3

➢ *Annex (4) E GARCH Output*

Dependent Variable: UN
Method: ML ARCH – Student's t distribution (BFGS / Marquardt steps)
Date: 04/01/20 Time: 18:29
Sample (adjusted): 1990 2018
Included observations: 28 after adjustments
Failure to improve likelihood (non-zero gradients) after 49 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(4) + C(5)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(6)*RESID(-1)/@SQRT(GARCH(-1)) + C(7)*LOG(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	2.971353	1.553863	1.912237	0.0558
LOG (NWI)	0.125378	0.055449	2.261130	0.0238
UN (-1)	0.663593	0.112579	5.894446	0.0000
Variance Equation				
C(4)	0.274195	0.593852	0.461723	0.6443
C(5)	-0.235980	0.743727	-0.317294	0.7510
C(6)	-0.717852	0.393533	-1.824121	0.0681
C(7)	0.872368	0.257758	3.384450	0.0007
T-DIST. DOF	340.7240	0.324274	1050.728	0.0000
R-squared	0.748699	Mean dependent var		15.96786
Adjusted R-squared	0.728594	S.D. dependent var		2.410172
S.E. of regression	1.255618	Akaike info criterion		3.125544
Sum squared resid	39.41439	Schwarz criterion		3.506173
Log likelihood	-35.75761	Hannan-Quinn criter.		3.241906
Durbin-Watson stat	1.516867			

Table 4

➢ *Annex (5) Variables Correlation Matrix*

	UN	NWI	UN(-1)
UN	1	-0.08	0.51
NWI	-0.08	1	0.02
UN(-1)	0.51	0.02	1

Table 5

➢ *Annex (6) Arch Test (Heteroskedasticity)*

F-statistic	0.004695	Prob. F(1,25)	0.9459
Obs*R-squared	0.005070	Prob. Chi-Square(1)	0.9432

Table 6