

Inflation Dynamics in an Open Economy Phillis Curve Framework: A Case of Nigeria and Sri Lanka

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Abstract

One of the central features of developing countries since the 1960s high rate of inflation, despite the fact that it is undesirable phenomenon. The causing factors of high inflation remained inconclusive by both monetary and fiscal perceptions. This paper seeks to shed some light on the determinants of inflation in Nigeria and Sri Lanka in an open economy Phillips curve framework. The study employed ordinary least squares technique (OLS) on multiple regression equation models and Error Correction Model (ECM) for both countries, utilizing data sourced from secondary sources for the period of 1963 to 2013. The main findings are that monetary variables (money supply, interest rate) as well as import and exchange rate play central role in the inflationary process in these countries, and the election (political activities contribute positively to inflation in Nigeria. The paper then recommends that both the policy makers of countries should develop real political will to overcome corruption especially during campaign and election as well as fiscal and monetary discipline to be able to have greater control on both domestic and foreign economic activities so as to meet the objective of maintaining price stability.

Keywords: Inflation, Phillips Curve, Error Correction Model, Determinants, Money Supply and Election

Introduction

It is generally perceived that inflation oils the wheels of economy. However, too much oil can flood the engine. Indeed, while a little/moderate inflation is generally perceived to be a good thing for the economy, periods of high or hyper-inflation are seen to have negative repercussions which could cripple an economy as they lead to uncertainty, shorter planning horizons and possibly even a diversion of resources away from production which are typical characteristics of most of the developing economies including Nigeria and Sri Lanka. As a result, for policy makers, it is not only important to keep inflation at a low and stable level but necessary as well. In order to avoid future prolonged or continue inflation episodes from occurring, it is important for policy makers to study and understand the factors that served as inflation determinants in the past.

Generally speaking, the dynamics of inflation can be explained in two ways. One school of thought believes that inflation is largely influenced by non-monetary factors such as supply shocks, which somewhat obscures the roles of demand side factors and hence the monetary transmission mechanism in the inflation process. The other school of thought argues that non-monetary factors affects only the short-run path of inflation while in the long-run, monetary variables determines the inflation rate. As a result, it is argued that the standard output gap model of the Phillips curve should offer a reasonable explanation of the inflation dynamics in the emerging and developing economies. However, given the diversity amongst nations in Africa and Asia, inflation should be treated as a country-specific phenomenon, the determinants of which would differ across countries. Thus, it is crucial to investigate the plausible distinct factors that determine inflation in various nations. To this ends, this paper set out to identify the possible relevant macroeconomic variables that helps in determine the behaviors of inflation in Nigeria and Sri Lanka within the frame work of open economy Phillips curve.

Objectives of the Paper

The objectives of this paper include the following;

- To identify the relevant variables influencing inflation dynamics in Nigeria and Sri Lanka, using both theoretical and empirical framework;
- To ascertain which explanatory variables are significant determinants of inflation in Nigeria and Sri Lanka.

Literature Review

This section reviewed and harmonized the different theoretical opinions expressed as well as the empirical stands/outcome on issues related to inflation, to help explain the present and provide a guide for the future, as there has been a long debate without consensus in the economic literature on the causes and manifestation factors of inflation. Macroeconomists and econometricians have given a lot of theoretical explanations and empirical attempts to test the validity of self-selected models. However, for better understanding and great insight, it is paramount to understand the concept of inflation and Phillips curve before the theoretical and empirical review.

Concept of Inflation

Inflation is a serious macroeconomic problem and it is an aspect of macroeconomic instability. It can make the comparison of economic conditions at different point in time quite difficult, create complications for economic measurement, and brings uncertainty when trying to look into the future. Inflation is a substantial and sustained increase in general price level leading to disequilibrium thus undermining the ability of money to serve as a tool for market coordination. In the economic literature, the concept of inflation has been intrinsically linked to money, as captured by the often heard maxim “inflation is too much money chasing too few goods”. Inflation has been widely described as an economic situation when the increase in money supply is “faster” than the new production of goods and services in the same economy (Hamilton, 2001). Usually, economists attempt to distinguish inflation from an economic phenomenon of a time increase in prices or when there are price increases in a narrow group of economic goods or services (Piana, 2001). Thus, the term inflation describes a general and persistence increase in the prices of goods and services in an economy (Ojo, 2000; Melberg, 1992).

Concept of Phillips Curve

Basically, Phillips curve is a smooth curve that shows the stylized relationship between wage inflation and unemployment. In other words, by Phillips traditional postulation, there exists a negative (trade-off) relationship between wage inflation and unemployment. It is however important to know that Phillips Curve analysis has hardly stood still since its beginning in 1958. Rather it has evolved under the pressure of events and the progress of economic theorizing, incorporating at each, new elements as the natural rate hypothesis, the adaptive expectation hypothesis etc. Friedman (1968) made a very sharp observation that in the short-run there may be a trade-off between inflation and unemployment rate but in the long-run, there is no trade-off between them. This observation by Friedman propelled many scholars to search for the nature of relationship between these phenomena in the economies. However, Phillips does not conjecture about circumstances in which the apparently stable 1861-1913 curve might shift up or down in the long-run. Also, Phillips does not mention policy implications, and this provides the setting in which Samuelson and Solow (1960) christens the relationship as the Phillips curve and explore its policy implications.

Theoretical Explanations

In recent times, there have been several dominant schools of thought on the nature, meaning, and causes of inflation; the neo-classical/monetarist, the Keynesian school, the neo-Keynesian school, the structural school, the Purchasing Power Parity (PPP) school, the inflation and expectations school, and recent theories of inflation. For the purpose of clarity and understanding, these dominant schools of thought and their views about the concept of inflation are explained in the next sections

Neo-Classical/Monetarist Explanations

The Neo-Classical/Monetarist opines that inflation is driven mainly by growth in the quantum of money supply. The debate between the cost-push and demand-pull theories of inflation led to the revival of the monetary explanation of inflation. The monetary model formally proposed by Friedman (1968) and empirically tested by Schwartz (1973) simply stated that the major factor explaining the current rate of inflation is the past conduct of money to output ratio. In Friedman's (1968) words, "Inflation is always and everywhere monetary phenomenon". The monetarists, following from the Quantity Theory of Money (QTM), have propounded that the quantity of money is the main determinant of price level, or the value of money, such that any change in the quantity of money produces an exactly direct and proportionate change in the price level. The QTM is traceable to Irving Fisher's famous equation of exchange:

$$MV = PQ \dots\dots\dots (1.1)$$

Where M stands for the stock of money; V for the velocity of circulation of money; Q is the volume of transactions which take place within the given period; while P stands for the general price level in the economy. Transforming the equation by substituting Y (total amount of goods and services exchanged for money) for Q, the equation of exchange becomes:

$$MV = PY \dots\dots\dots (1.2)$$

The introduction of Y provides the linkage between the monetary and the real side of the economy. In this framework, however, p, V and Y are endogenously determined within the system. The variable M is the policy variable, which is exogenously determined by the

monetary authorities. The monetarists emphasize that any change in the quantity of money affects only the price level or monetary side of the economy, with the real sector of the economy totally insulated. This indicates that changes in the supply of money do not affect the real output of goods and services, but their values or the prices at which they are exchanged only. An essential feature of the monetarist model is its focus on the long-run supply-side properties of the economy as opposed to short-run dynamics (Dornbush, et al, 1996).

Nevertheless, the model's general weakness is found in its inadequacy to explain general price movement. The truism of direct proportion between change in the quantity of money and change in the price level cannot be accepted in today's world (as there are other factors involved such as infrastructural and structural factors).

Keynesian Explanations

The Keynesians opposed the monetarists' view of a direct and proportional relationship between the quantity of money and prices. According to this school, the relationship between the quantity of money and price is non-proportional and is indirect, through the rate of interest. The strength of the Keynesian theory is its integration of monetary theory and value theory on the one hand and the theory of output and employment through the rate of interest on the other hand. Thus, when the quantity of money increase, the rate of interest falls, leading to an increase in the volume of investment and aggregate demand, thereby raising output and employment. In other words, the Keynesians see a link between the real and monetary sectors of the economy an economic phenomenon that describes equilibrium in the goods and money market (IS-LM). Equally important about the Keynesian theory is that they examine the relationship between the quantity of money and prices both under unemployment and full employment situations. Accordingly, so long as there is unemployment, output and employment will change in the same proportion as the quantity of money, but there will be no change in prices. At full employment, however, changes in the quantity of money will induce a proportional change in price. Thus, this approach has the virtue of emphasizing that the objectives of full employment and price stability may be inherently irreconcilable (Olofin, 2001).

New-Keynesians Explanations

The Neo-Keynesian theoretical exposition combines both aggregate demand and aggregate supply. It assumes a Keynesian view on the short-run and a classical view in the long-run. The simplistic approach to the understanding of this theory is to consider changes in public expenditure or nominal money supply and assume that expected inflation is zero. By this, aggregate demand increases with real money balances and, therefore, decreases with the price level. Neo Keynesian theory focuses on productivity, because, declining productivity signals diminishing returns to scale and, consequently, induces inflationary pressures, resulting mainly from over-heating of the economy and widening output gap. From the Neo-Keynesian perspective, budget balancing and restraints on spending do not control inflation, and persistent budget deficits do not cause inflation. What cause inflation are increase in the velocity of money and the reduction in efficiency caused by excessive present consumption versus investment.

Structuralists' Explanations

The Structuralists attribute the existence and cause of inflation to structural factors and underlying characteristics of an economy (Adamson, 2000). For instance, in developing

countries, particularly those with a strong underground economy, prevailing hoarding or hedging, individual expect future price to increase above current prices and, hence, demand for goods and services are not only transactionary, but also precautionary. This to them creates artificial shortages of goods and reinforces inflationary pressures. The basic argument of the structuralist school is that, given the existence of structural bottlenecks or constrains in an economy, inflation is unavoidable. Implicitly, inflation is structural, and is generated in the course of the attempt to develop in the face of structural rigidities. According to Fasoyin (1986) he asserts that although there are many facets of the structuralist approach, they fall into three broad categories:

1. Inelasticity of agricultural production, particularly of foodstuffs;
2. Foreign exchange bottleneck;
3. Financial constraints.

Perhaps the most popular argument of the structuralist school is that rapid urbanization and rising income generated by import substitution industrialization have led to an increase in demand for foodstuffs which outpaces supply. The structural constraint that has led to disequilibrium in supply and demand of foodstuffs is seen as arising from misallocation of factors of production. The foreign exchange bottleneck arises because capital inflow and earnings from exports are generally inadequate in meeting rapidly rising import demands which are necessary for development. The inadequate public revenue in the face of rapidly expanding public services, especially in the provision of social services and infrastructure, has led to deficit financing with inflationary consequences.

The structuralists then conclude that inflation does not occur in vacuum but as part of a country's historical, social, political and institutional evolution. As Fajana and Aderinto (1980:27) put it; *"the underlying causes of inflation in underdeveloped countries are to be found in basic economic development problems and in the structural characteristics of the system of production in these countries"*.

Purchasing Power Parity (PPP) Theory of Inflation

Underlying the PPP theory is the assumption that all goods are tradable and are physical identical. This theory is used to explain changes in exchange rates in terms of differentials inflation between countries. The argument of this theory is that as long as the prices and currencies of the trading countries are not the same, the rate of inflation of the dominant country will influence the inflation rates of smaller countries. In support of this argument, Garcia, (2010) asserts that exchange rate has a direct impact on the economy via import sector (both final goods and inputs). So an appreciation (depreciation) of the exchange rate can have a positive (negative) impact on the inflation rate and vice-versa. He however concluded that it all depends on whether the pass-through coefficient of the exchange rate to inflation is high or not, which is an empirical question.

Expectations Theory of Inflation

Expectations of future inflation are another important determinant of inflation according to this theory. According to Dlamini, et al, (2001), two categories of expectations can be outlined in this regard, namely rational and adaptive expectations. According to rational expectations, both households and firms form their expectations of inflation by using all the available information including that about current policies to forecast the future. An adaptive expectation on the other hand, is the adjusted (adapted) by some fraction of the forecast error that occurs when inflation turns out to be different than expected. By this, it means that both

households and firms form their expectations of inflation based on recently observed inflation and this may affect the general price level. Proponents of the theory maintain that prices are rising because people expect them to rise, because they have seen them rising. The basic notion of the advocates of this theory is that if policymakers are credibly committed to reducing inflation, rational people will understand the commitment and quickly lower their expectation of inflation.

Recent Theories of Inflation

Literature on recent theories of inflation that have emerged two decades ago emphasized the role played by political stability, policy credibility and the reputation of the government and the political cycles in determining or explaining inflation. According to Selialia, (1995), this emerging literature on inflation has come to be known as the political economy approach to macroeconomic policy. These recent theories of inflation have shifted attention away from traditional direct economic causes of inflation, such as money supply, exchange rate, interest rate, towards political and institutional determinants of inflationary pressures. However, these theories have been criticized as they are too theoretical and the factors involves are not unquantifiable.

Empirical Review

Fashoyin (1984) in a study with respect to the impact of structural phenomenon on inflation in Nigeria identified ten structural variables (agricultural bottlenecks, industrial production, imports, exports, food import and production, trade union militancy, indirect taxation on companies, wage bill, government expenditure deficit finance and money supply) responsible for inflation in Nigeria. Regressing the rate of inflation on the ten variables using the Ordinary Least Squares (OLS) approach, the results indicated that money supply, wages, imports, exports, food import and indirect taxation had significant positive relationship with inflation. However, other variables provided inconclusive results due to unavailability of data for computation.

Fatukasi, (2005), in his work investigated the determinants of inflation in Nigeria between 1981 and 2003, by exploring the multi-dimensional and dynamic factors that affect inflation using multiple regression of the Ordinary Least Square (OLS). The results revealed that all explanatory variables (fiscal deficit, money supply, interest and exchange rates) are significantly and positively impacted on the rate of inflation in Nigeria as they accounted for 72% of the variation in inflation during the period with the error term capturing 28%.

Arusha, (2008) modeled for both closed economy and open economy for Sri Lanka, and the estimated regression coefficients based on the variable deletion tests carried out in each model followed by co-integration so as to create the premises for the models to be estimated using Error Correction Mechanism (ECM). The main findings of the study were that the supply side factors were affecting the general level of prices in Sri Lanka. A long-run relationship is found between the price level, real GNP, the exchange rate and import prices. With the opening up of the economy, import prices and exchange rate movements were found to have a significant impact on the general level of prices. The results are consistent with the studies of Nicholas (1990), Nicholas and Yatawara (1991), Weerasekera (1992), Rupananda (1994) who also find supply side factors as important determinants of the general price level in Sri Lanka.

Methodology

The prime consideration in designing methodology is to incorporate all important variables in explaining the causes and factors that determine the dependent variable (in this case inflation). For the purpose of this study, we modeled a baseline Phillips curve for Nigeria and Sri Lanka as follows;

Modeling Baseline Phillips Curve for Nigeria and Sri Lanka

Starting from position of Phillips, there exist a trade-off relationship between inflation and unemployment. This implies a functional relationship between inflation and unemployment. Mathematically if we assume a linear relationship between the variables, it is of the form;

$$INF=f(UN).....(2.1)$$

Econometrically, the above functional relation can be stated as;

$$INF_t=\alpha_0+\beta_1UN_t+U_t..... (2.2)$$

Where INF_t is inflation rate in period t, α_0 is the intercept, β_1 is the coefficient of unemployment rate, UN_t is the unemployment rate in period t. Equation (2.2) is a typical traditional Phillips curve.

The stylized version of the expectation-augmented Phillips curve that takes into consideration the role of expectations which also form the theoretical basis of the study is written in terms of output-gap, and by introducing expectations is typically assumed to be of the following form;

$$INF_t=\alpha_0+\beta_1INF^e+\beta_2(Y_t-Y_t^*)+U_t(2.3)$$

Where INF^e is the expected rate of inflation (expected at the beginning of period t), Y_t is the actual level of output (or GDP), Y_t^* is the potential output and the difference between two is the output-gap and β_1 and β_2 are the coefficients of expected inflation rate and output-gap respectively.

If we use the triangle model of inflation by taking the past inflation rate as a proxy of expected inflation rate, then the Phillips curve may be re-written as;

$$INF_t=\alpha_0+\beta_1INF_{t-1}+\beta_2(Y_t-Y_t^*)+U_t(2.4)$$

Assuming further that output is taken as proxy to unemployment (i.e. $Y_t - Y_t^* = UN_t$), then substituting UN_t for $Y_t - Y_t^*$ gives;

$$INF_t=\alpha_0+\beta_1INF_{t-1}+\beta_2UN_t+U_t..... (2.5)$$

As stated above, the Nigeria and Sri Lankan economies just like every developing economy are characterizes by shocks as a results of fiscal and monetary imbalances. Therefore by letting the variables Z_t account for these shocks that might come through money supply, imports, exchange rate, interest rate, GDP and Election. The inclusion of election as part of the shocks is based on the fact the in most developing countries like Nigeria for instance; during election the politicians normally bring into the economy, the money from abroad for

campaign thereby increase the quantum of money in circulation and in most cases the money were stolen and stored in the foreign accounts.

So by incorporating the shocks variable, the equation (2.5) becomes;

$$INF_t = \alpha_0 + \beta_1 INF_{t-1} + \beta_2 UN_t + \phi Z_t + U_t \dots\dots\dots (2.6)$$

Where, Z_t accounts for money supply, imports, exchange rate, interest rate, GDP and election period.

Therefore, by incorporating all these macroeconomic variables as shocks into the equation (2.6) the model take the form for baseline Phillips curve as;

$$INF_t = \alpha_0 + \alpha_1 UN_t + \alpha_2 M1S_t + \alpha_3 M2S_t + \alpha_4 IM_t + \alpha_5 EX_t + \alpha_6 IR_t + \alpha_7 GDP_t + \alpha_8 ELEC_t + U_t \dots\dots\dots (2.7)$$

Therefore, equation baseline Phillips curve model for this study.

Based on the above premises, the Phillips curve models can be established for Nigeria and Sri Lanka respectively as follows;

$$INF_{tn} = \beta_0 + \beta_1 UN_{tn} + \beta_2 M1S_{tn} + \beta_3 M2S_{tn} + \beta_4 IM_{tn} + \beta_5 EX_{tn} + \beta_6 IR_{tn} + \beta_7 GDP_{tn} + \beta_8 ELEC_{tn} + \varepsilon_t \dots\dots\dots (2.8)$$

$$INF_{ts} = \alpha_0 + \alpha_1 UN_{ts} + \alpha_2 M1S_{ts} + \alpha_3 M2S_{ts} + \alpha_4 IM_{ts} + \alpha_5 EX_{ts} + \alpha_6 IR_{ts} + \alpha_7 GDP_{ts} + \alpha_8 ELEC_{ts} + \varepsilon_{ts} \dots\dots\dots (2.9)$$

Where

- INF_{ts} = Inflation rate in period t in Sri Lanka.
- INF_{tn} = Inflation rate in period t in Nigeria.
- UN_{ts} = Unemployment rate in period t in Sri Lanka.
- UN_{tn} = Unemployment rate in period t in Nigeria.
- M1S_{ts} = Narrow Money Supply in period t in Sri Lanka.
- M1S_{tn} = Narrow Money Supply in period t in Nigeria.
- M2S_{ts} = Broad Money Supply in period t in Sri Lanka.
- M2S_{tn} = Broad money Supply in period t in Nigeria.
- IM_{ts} = Value of Imports in period t in Sri Lanka.
- IM_{tn} = Value of Imports in period t in Nigeria.
- EX_{ts} = Exchange Rate of Ruppee to Dollar in period t.
- EX_{tn} = Exchange Rate of Naira to Dollar in period t.
- IR_{ts} = Interest Rate in period t in Sri Lanka.
- IR_{tn} = Interest Rate in period t in Nigeria.
- GDP_{ts} = Gross Domestic Product in period t in Sri Lanka.
- GDP_{tn} = Gross Domestic Product in period t in Nigeria.
- ELEC_{ts} = Election period t in Sri Lanka.
- ELEC_{tn} = Election period in Nigeria.
- α_0s and β_0n = The intercepts of the functions.
- $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7,$ and α_8 = Parameters to be estimated for Sri Lanka equations
- $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7$ and β_8 = Parameters to be estimated for Nigeria's equations
- ε_{ts} and ε_{tn} = Stochastic random variable (error terms).

The study then employed the econometric technique of Ordinary Least Squares (OLS) on the baseline Phillips curve regression equations 2.8 and 2.9 (multivariate models) for countries in order to estimate a more specific relationship between inflation and its determinants.

Results and Discussion

Based on the derived baseline models above, the study estimated equations 2.8 and 2.9, and the results are as follow for Nigeria and Sri Lanka;

Variabl e	Nigeria P- P Value	Level of stationarity	Sri_Lanka P-P Value	Level of Stationari ty	SIGNIFICANT VALUE 1% ,5% and 10%
Ext	-4.13	I(1)	-3.29	I(1)	-2.64, -1.95, -1.61
GDP	-17.58	I(2)	-8.91	I(2)	-2.58, -1.94, -1.62
IMt	-10.00	I(2)	-6.87	I(1)	-2.58, -1.94, -1.62
M2St	-9.35	I(2)	-3.3	I(2)	-2.58, -1.94, -1.62
INF _T	-9.81	I(1)	-9.78	I(1)	-2.58, -1.94, -1.62
INF _{t-1}	-9.14	I(1)	-9.49	I(1)	-2.58, -1.94, -1.62
IRt	-8.20	I(1)	-5.42	I(1)	-2.58, -1.94, -1.62
UNEt	-10.14	I(1)	-6.62	I(1)	-2.58, -1.94, -1.62

Table 1: Result of the Unit Root Test for Nigeria and Sri Lanka

As Gujarati (2004) points out that economic theory requires that variables be stationary before the application of standard econometric technique. Unit root test is therefore used to test for the stationarity of the data. Phillips-Perron (PP) is used to test the co-integration and unit root tests. If the Phillips-Perron (PP) t-statistic (PP t-calculated) is greater than the PP table value (critical value), and it is stationary, otherwise, it is non-stationary. The result in the table below shows that the majority of the variables are made stationary at the first level difference. GDP and Import for Nigeria and GDP for Sri Lanka are made stationary at the second level differencing (Table 1).

Table 2: Result of Co integration for Nigeria

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.971458	299.7801	125.6154	0.0000
At most 1 *	0.956782	189.5328	95.75366	0.0000
At most 2 *	0.852341	92.14666	69.81889	0.0003
At most 3	0.448428	32.84824	47.85613	0.5652
At most 4	0.278911	14.40375	29.79707	0.8172
At most 5	0.123315	4.266968	15.49471	0.8808
At most 6	0.006019	0.187142	3.841466	0.6653

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level
 **MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.971458	110.2473	46.23142	0.0000
At most 1 *	0.956782	97.38609	40.07757	0.0000
At most 2 *	0.852341	59.29842	33.87687	0.0000
At most 3	0.448428	18.44449	27.58434	0.4586
At most 4	0.278911	10.13678	21.13162	0.7317
At most 5	0.123315	4.079826	14.26460	0.8508
At most 6	0.006019	0.187142	3.841466	0.6653

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level
 **MacKinnon-Haug-Michelis (1999) p-values

Table 3: Result of Co integration for Sri Lanka

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized	Trace	0.05		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.958040	240.4202	125.6154	0.0000
At most 1 *	0.793472	142.1180	95.75366	0.0000
At most 2 *	0.738368	93.22107	69.81889	0.0002
At most 3 *	0.485801	51.65574	47.85613	0.0211
At most 4 *	0.435489	31.03622	29.79707	0.0358
At most 5	0.234296	13.31054	15.49471	0.1039
At most 6 *	0.149910	5.034796	3.841466	0.0248

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level
 **MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized	Max-Eigen	0.05		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.958040	98.30219	46.23142	0.0000
At most 1 *	0.793472	48.89694	40.07757	0.0040
At most 2 *	0.738368	41.56533	33.87687	0.0050
At most 3	0.485801	20.61952	27.58434	0.2999
At most 4	0.435489	17.72568	21.13162	0.1405
At most 5	0.234296	8.275744	14.26460	0.3513
At most 6 *	0.149910	5.034796	3.841466	0.0248

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level
 **MacKinnon-Haug-Michelis (1999) p-values

The result of the co integration for both Nigeria and Sri Lanka for Trace statistics and the Max-Eigen statistics shows that at most two and four of the models for Nigeria and Sri Lanka respectively are co integrating as it can be seen in Tables 2 and 3. This means that two or more of the variables move together over time so that short-term disturbances due to non-stationarity of the variable will be corrected in the long-term. It also means that if, in the long-run, two or more series move closely together, the difference between them is constant. Otherwise, if two series are not co integrated, they may wander arbitrarily far away from each other. If the variables in the model contain unit roots, the Error Correction Model (ECM) is used to examine the long-run or co integrating relationships between the time series. Having

detected the number of co integrated equations (Johansen’s procedure) the disturbances in the models for both countries (Nigeria and Sri Lanka) will be corrected through the use of error correction model (ECM).

Table 4: Linear Regression Model’s Results for Nigeria

Dependent Variable: AIR

Method: Least Squares

Date: 12/04/2014 Time: 20:28

Sample: 1963 – 2013

Included Observations: 51

Variable	Coefficient	Std.error	Z-statistic	Prob.
UN	-0.0042	0.00025	-0.41926	0.1214
MIS	-4.80E-05	0.000247	-0.396129	0.6939
M2S	0.000114	0.000119	0.958287	0.3432
IM	0.004402	0.001681	2.618685	0.0212
EX	0.177719	0.143859	-1.235364	0.2233
IR	0.808623	0.106210	4.788826	0.1562
GDP	-2.80E-05	2.63E-05	-1.442514	0.1562
ELEC	0.501279	2.514497	-0.199356	0.8429
R-Square	0.675319	Mean dependent var		11.04510
Adjusted R-squared	0.589226	S.D. dependent var		9.225407
S.E. of regression	6.846558	Akaike info criterion		6.812243
Sum squared resid	2062.515	Schwarz criterion		7.077395
Log likelihood	-166.7122	Hannan – quinn criter		6.913565
Durbin – Watson stat	1.832971	F-statistics		46.2145

Source: Computed using econometric software (E-views 5.1).

Table 5: Linear Regression Model’s Results for Sri Lanka

Dependent Variable: AIR

Method: Least Squares

Date: 12/04/2014 Time: 20:28

Sample: 1963 – 2013

Included Observations: 51

Variable	Coefficient	Std.error	Z-statistic	Prob.
UN	-0.00021	0.000026	-0.002102	0.0026
MIS	-9.80E-05	0.000247	0.396129	0.6939
M2S	0.00245	0.000387	0.958289	0.2332
IM	0.000568	0.000168	2.82176	0.00121
EX	-0.187729	0.143856	-1.32564	0.02312
IR	0.508623	0.106210	4.788826	0.0000
GDP	-3.80E-05	2.63E-05	-1.442514	0.1562
ELEC	-0.501279	2.145447	-0.279356	0.8461
R-Square	0.515319	Mean dependent var		12.05410
Adjusted R-squared	0.449226	S.D. dependent var		10.22614
S.E. of regression	6.245668	Akaike info criterion		5.12675
Sum squared resid	2261.416	Schwarz criterion		8.076395
Log likelihood	-172.6612	Hannan – quinn criter		7.123512

Durbin – Watson stat 1.762971 F-statistics 8.4382

Source: Computed using econometric software (E-views 5.1).

From table 4 above, the results clearly shows that interest rates, Broad money supply, import value, exchange Rate and election are positively related to dependent variable inflation. Indicating that they are important determinants of inflation in Nigeria. R^2 which is coefficient of multiple determination shows that 67% of total variation in the dependent variables are explained by the explanatory variables in the model for Nigeria, and when it is adjusted, it become 58%, and the remaining variation in the dependent variable is due to error terms. The value of F-statistics is 46.214 indicating that the overall model is statistically significant.

On the other hand, table 5 reveals those only Broad money supply, interest rate and import values that are positively related to dependent variables for Sri Lanka Model. Indicating that only three of the explanatory variables can be said to be positively influencing the rate of inflation in Sri Lanka is revealed by R^2 of 51%, indicating that only 51% of total variation in inflation in Sri Lanka is explained by the explanatory variables in the model and the remaining 49% is due to factors outside the model that are represented by error term in the model. Also the F-statistics is 8.3482, shows that though the explanatory power of the model is relatively low compare to the Nigeria’s model, in overall the model is statistically significant

Table 6: Result of Error Correction Model for Nigeria

$$\Delta INF_m = \beta_0 + \beta_1(\Delta INF_{t-1m}) + \beta_2(\Delta IM_m) + \beta_3(\Delta EX_m) + \beta_4(\Delta IR_m) + \beta_5(\Delta M_m) + \beta_6(\Delta UN_m) + \beta_7(\Delta GDP_m) + \beta_8 ELEC_m + \beta_9 (ECM-1) + \varepsilon_m$$

Dependent Variable: D(INFtn)
 Method: Least Squares
 Date: 12/04/14 Time: 14:34
 Sample (adjusted): 1963 2013
 Included observations: 49 after adjustments
 HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFtn_1)	-0.004012	0.052890	-0.075865	0.9402
D(IMtn)	-1.37E-07	5.24E-07	-0.261936	0.7958
D(EXtn)	0.012106	0.025312	0.478276	0.6372
D(IRtn)	0.096508	0.073553	1.312089	0.2030
D(MStn)	-1.28E-06	3.48E-07	-3.687599	0.0013
D(UNEtn)	0.868305	0.045485	19.08982	0.0000
D(GDPtn)	-5.68E-08	3.13E-07	-0.181261	0.8578
DUMMY_V	0.402889	1.033990	-0.389645	0.7005
ECM-1	0.694353	0.177991	3.901055	0.0008
C	1.032136	1.044872	0.987811	0.3340
R-squared	0.972609	Mean dependent var		0.093750
Adjusted R-squared	0.961404	S.D. dependent var		16.01775
S.E. of regression	3.146843	Akaike info criterion		5.380983
Sum squared resid	217.8576	Schwarz criterion		5.839025
Log likelihood	-76.09573	Hannan-Quinn criter.		5.532811
F-statistic	86.79814	Durbin-Watson stat		1.642816
Prob(F-statistic)	0.000000			

Table 7: Result of Error Correction Model for Sri Lanka

$$\Delta INF_{it} = \beta_0 + \beta_1(\Delta INF_{t-1s}) + \beta_2(\Delta IM_{it}) + \beta_3(\Delta EX_{it}) + \beta_4(\Delta IR_{it}) + \beta_5(\Delta M_{it}) + \beta_6(\Delta UN_{it}) + \beta_7(\Delta GDP_{it}) + \beta_8 ELEC_{it} + \beta_9 (ECM-1) + \varepsilon_{it}$$

Dependent Variable: D(INFts)
 Method: Least Squares
 Date: 12/04/14 Time: 23:37
 Sample (adjusted): 1963 2013
 Included observations: 49 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFts_1)	0.143908	0.228468	0.629882	0.5353
D(UNEts)	1.643141	1.070605	1.534778	0.1391
D(IMts)	0.000926	0.001725	0.536811	0.5968
D(EXts)	0.111486	0.504433	0.221013	0.8271
D(IRts)	-0.130227	0.899299	-0.144810	0.8862
D(MSts)	-3.39E-05	4.19E-05	-0.807716	0.4279
D(GDPts)	1.02E-05	1.36E-05	0.744972	0.4642
DUMMY_V	15.33809	4.924593	3.114590	0.0050
ECM-1	0.774058	0.314335	3.066972	0.0056
C	-2.408915	2.918628	-0.825359	0.4180
R-squared	0.561206	Mean dependent var	-0.396875	
Adjusted R-squared	0.381699	S.D. dependent var	10.12443	
S.E. of regression	7.961056	Akaike info criterion	7.237307	
Sum squared resid	1394.325	Schwarz criterion	7.695349	
Log likelihood	-105.7969	Hannan-Quinn criter.	7.389135	
F-statistic	9.126380	Durbin-Watson stat	2.166032	
Prob(F-statistic)	0.014029			

Result Output from E-view 5.1

The result in the Tables 6 and 7 above shows the short-run relationship of the Augmented Phillip Curve in Nigeria and Sri Lanka through Error Correction Mechanism.

The result reveals that unemployment rate, exchange rate, interest rate and election period have a positive impact on the current rate of inflation. While previous inflation, importation, GDP and Money supply negatively impact on inflation. Unemployment and money supply showed significant impact on current inflation just like in the long-run model. The short-run model is linearly dependent, with an F p-value of 0.000. There is no auto-correlation because Durbin-Watson value of 1.64. The R-squared shows a strong positive relationship which means that 97% change in the rate of inflation is caused by the changes in the independent variables just like the long-run model. The error correction variable (ECM-1) shows a one-period lagged value of the residual from the static model. Error correlation model is not a model that correct errors, but a model which converges the co integrating relationship of the long-run and short-run model by bringing them to equilibrium through time path adjustments. The adjustment process is expected to meet some criteria.

- i. The coefficient of ECM-1 is expected to be significant
- ii. The coefficient ECM-1 is expected to have a negative sign
- iii. The coefficient ECM-1 is expected to be less than one

The values of the error correction coefficients for both (Nigeria and Sri Lanka) are significant and less than one but not negative. Since the ECM-1 sign is positive, it means

that inflation is above its long-run value. Therefore, to adjust/ bring to equilibrium, the inflation rate would have to be adjusted downwards in the next one year period (Gujarati, 2004). It takes 69% for equilibrium to occur for Nigeria 77.4% for equilibrium to occur in Sri Lanka.

Conclusion

The purpose of this paper was to determine the determinants of inflation in an open economy like Nigeria and Sri Lanka within Phillips curve framework. The impact of the money supply variables on inflation was found to be positive, in both countries, especially the broad money supply (M_2), suggesting that money supply growth in Nigeria and Sri Lanka does not accord with normal behavioral expectations towards inflation. Interest rate and imports also impact positively on inflation in both countries. However, the impact of election that was introduced into the model as dummy variable to depict the politicians spending during campaign has no positive impact on inflation in Sri Lanka but reveals a positive influence on inflation in Nigeria, so also the exchange rate. In conclusion therefore, the policy makers of both countries have to develop a real political will to overcome corruption as well as fiscal and monetary discipline so as to be able to have greater control to meet the objective of maintaining price stability.

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