IMF AND WORLD BANK ECONOMIC PROGRAMS ON INFLATION: RELEVANCE TO NEPAD

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ABSTRACT: We examine the relevance to the New Partnership of Africa's Development (NEPAD) of IMF and the World Bank's economic reform programs on inflation and the uncertainty of inflation in Ghana, Senegal and Uganda. The study period is from 1964-2009. GARCH (1, 1) framework is used to generate a time series of conditional variances of inflation as proxies for the uncertainty of inflation and use the granger causality procedure to establish the direction of the relationship between the two variables. We divide the years covered in this study into three segments, the pre-adjustment, adjustment and post-adjustment periods. The granger causality test results show in all three economies sensitivity of the direction of relationship between inflation and its uncertainty to IMF and World Bank inspired policies. Ghana shows significant evidence of the Friedman-Ball hypothesis in all regimes except the post-adjustment period and Senegal confirm the Cukierman-Meltzer proposition in the pre-adjustment and overall periods. In Uganda, results show bi-directional relationships dominating the links between the two variables. Also, evidence is presented indicating the reduction of both inflation and uncertainty of inflation in the countries during the adjustment period.

JEL Classifications: E31, F33, F55 & N17.

Keywords: Inflation Rates, Uncertainty of Inflation and NEPAD.

1. INTRODUCTION

Developing economies in general and African countries in particular have had a long, extensive but checkered history with the two Bretton Woods institutions, IMF and the World Bank. The relationships have been fraught with extremely polarized views about the net effect on development of their economic programs in host countries. Opinions range from criticisms of application of 'one-size-fit- all' models with almost predictable traumatic effect on the cost of living of the targeted country's populace, an over-emphasis on stabilization policies at the expense of development to claims of marginal gains in controlling price pressures.

The broad objective of this paper is to examine the possible effect of IMF and World Bank policies on inflation and inflation uncertainty in the context of one of the central objectives of New Partnership for Africa's Development (Nepad), the creation of an enabling economic and

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business environment to harness the full potential of business activities in African countries. The belief is that the lack of the latter has significantly and critically contributed to the anemic participation of the private sector in African countries in efforts at achieving economic development. Additionally, success in energizing the private sector will enhance the prospect of the eventual emergence of viable and competitive businesses which can help stem the marginalization of the continent in global business and economic activity. In trying to determine whether lessons can be learned from the experiences of African countries with the two institutions, this investigation focuses on two ubiquitous macroeconomic phenomena commonly known as harbingers of the emergence of an unstable and 'unfriendly' economic atmosphere for business, namely inflation and the uncertainty of inflation.

Under the auspices of the World Bank and IMF, a number of countries in Sub-Saharan Africa (SSA) have adopted variations of Economic Recovery Programs (ERP) and Structural Adjustment Programs (SAP) with a view to improving economic performance by controlling inflation, enhancing real growth rates through increased investment and savings, tightening fiscal discipline, and reforming the financial sector. Some countries responded positively to these measures and saw improvements especially in inflation control and economic growth. According to the International Monetary Fund (1996), three countries that demonstrated promise were Ghana, Senegal and Uganda, hence their selection as the focus of this investigation.[1]

During the periods of reform in the selected countries, the levels of inflation declined considerably. Between 1983 and 1991 inflation in Ghana went from 123% to 10.3%, in Uganda inflation fell from 237% in 1986/7 to 3.4% in 1994/5 and in Senegal inflation was reduced from 9.8% for the period 1978-84 to -0.4% between 1989-93.[2] These changes in the levels of inflation coincided with the adoption of various economic policy adjustments programs under the auspices of the IMF and World Bank and appear to have created different inflation regimes in each of the three countries.

Understanding how economic policy changes in the three countries affected the behavior of inflation and inflation uncertainty and the nature of the relationship between the latter variables could benefit NEPAD in its goal to ultimately create an economic environment that enables and is conducive to the emergence and sustainable growth of businesses in member states. The expectations are that achieving the latter will help facilitate economic growth *and* development. To this end, examining any phenomena that potentially can undermine the realization of this goal is of paramount interest and importance to policymakers and in fact to all stakeholders. In this study we focus on inflation and the inflation uncertainty, two variables that can raise the specter of an unstable economic and business environment. Milton Friedman offers an insight on this matter, particularly the issue of uncertainty. In his Nobel memorial lecture, Friedman (1977) discusses the effect of uncertainty of inflation leading to economic inefficiencies that lower output and employment. Increasing uncertainty affects the valuation of long term contracts and undermines the effectiveness of the signaling mechanism of prices in the allocation of resources in an economy. This environment engenders higher inflation risk premia and increases the cost of financing business growth opportunities. In aggregate, uncertainty lowers economic activity which is reflected and results in declining output growth which in turn can compromise general economic wellbeing. Therefore, understanding the behavior of inflation and its variants

in Africa can help guide the hand of the economic planning committees under the auspices of the Nepad Planning and Coordinating Agency (NEPAD's new structure) in formulating programs to pre-empt and contain the potential threat to the creation of an enabling economic and business environment.

The generally accepted consensus in economic literature on inflation is that uncertainty of inflation is positively related to inflation rates, the unresolved issue is the *direction* of this relationship. Knowing the direction enables decision-makers to fashion effectively, policy innovations to address these sources of potential macroeconomic instability. Two main propositions have been advanced on the question of direction, the Friedman-Ball and Cukierman-Meltzer hypotheses. Briefly, the Friedman-Ball hypothesis proposed that the direction of the relationship is from inflation to the uncertainty of inflation while Cukierman-Meltzer argued that the uncertainty of inflation causes inflation to either increase or decrease (Friedman, 1977; Ball, 1992a; Ball, 1992b; Cukierman & Meltzer, 1986).

The granger causality test results appear to show in all three economies changes in the direction of the relationship between inflation and its uncertainty corresponding to the periods when IMF and World Bank policies were implemented. Ghana shows significant evidence of the Friedman-Ball hypothesis in all regimes except the post-adjustment period and Senegal confirm the Cukierman-Meltzer proposition in the pre-adjustment, post-adjustment and overall periods. In Uganda, bi-directional results dominate the outcomes as well as negative signs especially in adjustment and post adjustment eras. These signs may be in part a result of inflation targeted policy innovations motivated by the IMF and World Bank price stabilization objectives on the one hand and on the other hand, reactions by a skeptical populace to government policies.[3] Their skepticism and consequent reactions to policies are a result of mistrust probably borne out of the residual effects of years of unpredictable and unreliable political leadership and a long brutal internal armed conflict. These jointly conspired to create a lack of trust in and uncertainty of actions of the central government authorities. Consequently, reactions to policy innovations may have gone against policymakers expectations and resulted in some ambiguous and bi-directional outcomes.

The rest of the paper is broken down into the following sections; section two provides a brief overview of Nepad, this is followed by a section on the literature review of inflation and the uncertainty of inflation and section three present histories of economic policies of each of the three countries. Section four analyzes the empirical tests and the last section discusses implications of the outcome of test and conclusions.

2. BRIEF OVERVIEW OF NEPAD

NEPAD was adopted in 2001 at the African Union meeting in Lusaka, Zambia. A derivative and compromise of previous African economic development programs, NEPAD promises a new comprehensive, broad-based, dynamic approach to addressing the almost perennial problems of pervasive poverty, stunted private sector, low agriculture production and marginalization of Africa in the global economy that the continent faces (NEPAD, 2012). It is viewed as a uniquely African-centered innovative framework to ultimately place Africa on a path to achieving sustainable economic growth and development.[4]

To realize the afore mentioned objectives, NEPAD seeks the creation of an enabling environment that will harness, nurture and boost both organically generated and externally owned business activities in Africa. The hope is that this will help provide the impetus for economic growth as well as improve the standard and quality of lives of Africans in a sustainable way.

3. LITERATURE REVIEW OF INFLATION AND UNCERTAINTY OF INFLATION

Various studies attempt to establish the nature of the relationship between inflation and its uncertainty (Ball, Cecchetti & Gordon, 1990; Evans, 1991; Evans & Wachtel, 1993; Holland, 1993, 1995; Golob, 1994; Thomton, 2007; Payne, 2008; Keskek & Orhan, 2010). In an earlier study of 17 OECD countries from 1951 to 1968 using standard deviation as a gauge for inflation variability, Okun reported that countries which on average experienced high inflation tended to display higher variability in inflation (Okun, 1971).

In a related study, Logue and Willett using 41 industrialized and developing countries from 1950 to 1970 found evidence of a positive relationship between inflation and its variability (Logue & Willett, 1976). However, when the sample was disaggregated into industrialized and developing countries in a regression model, the authors reported that some industrialized countries displayed a negative coefficient suggesting an inverse relationship between inflation and uncertainty of inflation. The authors reasoned that the results may reflect the effect of credible monetary policy measures implemented to reduce inflation in periods of increasing uncertainty. This was more relevant in the industrialized as compared to developing economies where the level of policy credibility is likely to be relatively low. Like Okun, they used the standard deviation of inflation as proxy for variability and uncertainty of inflation.

The use of standard deviation as proxy for inflation uncertainty does not always fully capture actual uncertainty since, in certain cases; variability is predictable (Grier & Perry, 1998). Subsequent efforts to capture true inflation 'surprise' and uncertainty use variations of ARCH/GARCH models to extract and generate conditional variances of the error term of autoregressive models of inflation rates (Engle, 1983; Bollerslev, 1986; Evans, 1991; Grier & Perry, 1998; Nas & Perry, 2000; Fountas, Loannidis & Karanasos, 2003; Bhar & Hamori, 2004; Thomton, 2007; Payne, 2008; Keskek & Orhan, 2010; Fountas, 2010).5 It is argued that this approach captures the *true* surprise and therefore *the* actual uncertainty of inflation. By and large, empirical tests based on the latter procedure have established a positive relationship between inflation and its uncertainty. However the direction of the relationship has been a matter of considerable contention and debate.

Theoretical arguments have been presented by Friedman and Ball positing that high inflation rates cause inflation uncertainty to increase. The main thrust of their argument centered on the uncertainty of agents in an economy trying to gauge the preferences of monetary policymakers toward inflation and the policy responses to rising inflation (Friedman, 1977; Ball, 1992b). Existing literature provides some empirical evidence in support of the endogeneity of the uncertainty of inflation in its relationship with average inflation (Grier & Perry, 1998; Nas & Perry, 2000).

Cukierman and Meltzer (1986) on the other hand, presented a theoretical model that proposed that inflation uncertainty causes inflation rates to either increase or decrease. They argue that high uncertainty of inflation and the murky economic environment it engenders provide monetary policymakers the latitude and incentive to surprise unsuspecting agents. This behavior on the part of policy makers tends to increase the level of inflation rates. This behavior of the policymaker is what Cukierman-Meltzer described as the opportunistic central banker Further, they also argued that the likelihood of the latter scenario occurring was probably a function of the credibility of the monetary policymaker and the central bank.[6] In effect, the afore-mentioned opportunistic behavior of policy makers is *unlikely* to be condoned by a highly credible central bank. This observation may be especially relevant to policy-makers in Africa where in large part monetary regimes and environments lack institutional structures that enhance and promote the independence and credibility of their respective central banks. In what appears to be an exception rather than a rule in Africa, in 2002 Ghana's parliament passed an act to assert legally the independence of the Bank of Ghana (Bank of Ghana Act 612). Even though actual operational and legal independence may bifurcate, recognizing the need for such a change is a move in the right direction and perhaps this 'institutional' reinforcement should be an integral part of Nepad's efforts at rationalizing policymaking with a view to creating an enabling economic and business environment.

In studies to establish the direction of the relationship between inflation and the uncertainty of inflation, Grier and Perry (1998), and Ball (1992b) generated time series data representing inflation uncertainty for G7 countries from a GARCH model and then used the granger causality procedure to test the direction of the link between the two variables. Results indicated that inflation rates appeared to 'granger cause' inflation uncertainty in a significant fashion. Evidence establishing an inflation uncertainty to inflation connection was inconclusive. In the same paper, Grier and Perry found that for the U.S., U.K. and Germany a rise in inflation uncertainty resulted in lower inflation rates while opposite results were obtained in France and Japan. The results seem to be in line with each country's measure of credibility of monetary policymaker's commitment to inflation control as presented by Cukierman's central bank independence indexes (Cukierman, 1992). The U.S. and Germany have higher measures of central bank independence than France and Japan.

Evidence presented by Fountas *et al.* (2003) appears to confirm Grier and Perry's findings. They report a negative relationship between increased inflation uncertainty and average inflation for Germany and Netherlands and opposite results for Spain, Italy and France.[7] The latter group has lower central bank independence measures than the former pair. These results perhaps are underscored by Kydland and Prescott's (1977) proposition of the adoption of 'rules' to enhance monetary policy consistency, a notion presented by Cukierman and Meltzer as the credibility of policymakers.

Fountas (2010), provide evidence in industrial economies supporting the Cukierman-Meltzer Hypothesis, to wit, that uncertainty of inflation has a positive effect on inflation. The study also report mixed support for the Friedman-Ball hypothesis. In contrast, Thomton (2007) and Keskek and Orhan (2010) show stronger evidence in support of the Friedman-Ball hypothesis. Keskek and Orhan (2010), explain that the negative sign resulting from tests of uncertainty of inflation on inflation may be due to the "...'stabilization motives' dominating the opportunistic incentives

of monetary authorities" (p. 42). Payne (2008), in a study of the Caribbean region, shows that innovations to inflation on the uncertainty of inflation are positive for both Bahamas and Jamaica. The author obtains a negative sign in Jamaica for tests of inflation uncertainty on inflation and suggests that as possible evidence of price stabilization actions by policy makers as posited by Holland (1995).

The experiences of the Sub-Saharan African (hereafter SSA) countries in our study, affords an opportunity to examine further the inflation and uncertainty of inflation relationship over changing policy regimes. Bhar and Hamori (2004) report that the nature of the relationship between inflation and its uncertainty differ from one country to another within the European Union (EU). Given the peculiar and different economic experiences in Ghana, Senegal and Uganda, it is interesting and ultimately relevant to the prosecution of general economic policies specifically with reference to price stabilization in African economies and inherently under the auspices of NEPAD, to investigate the behavior of the inflation and uncertainty of inflation as the policy regimes changed in the respective countries. The relevance of this investigation is steeped in the fact that price stability and predictability can serve as an important component for the creation of a stable and an enabling environment for business activities to thrive. This in turn can facilitate the realization of the primary goal of NEPAD, which is to achieve sustainable economic growth and development in Africa. Therefore understanding how past policies impacted vital macroeconomic variables like inflation and its derivative in member states is an important step.

4. ECONOMIC PATH TO GROWTH AND DEVELOPMENT: GHANA, SENEGAL AND UGANDA

As stated earlier, three of the notable SSA successes were Ghana, Uganda and Senegal. All three countries at some point in their economic histories adopted IMF and World Bank sponsored economic reform programs. These three countries were faced with typical problems besetting most African economies, so focusing on them allows us to examine the benefits or otherwise of policy prescriptions targeted at resolving the economic malaise. This may serve as a reference point for the formulation of economic policies to enable Africa realize one of the raisons d'être of NEPAD i.e., to ultimately achieve sustainable economic growth and development.

Some of the problems that have plagued African countries include excessive government intervention in their respective economies which has led to an inefficient resource allocation mechanism. This has direct and negative implications on the growth potential of the private sector. Also, African countries have been beset perennially with low savings rates and meager investment in-flows which have stifled efforts at realizing sustained growth. Other problems are low productivity and increasing exposure and susceptibility to external shocks (Hadjimichael, Nowak, Sharer & Tahari, 1996). The latter serves to undercut and enhance costs of stabilization efforts by governments. Complicating these economic issues are a plethora of political problems and excessive vulnerability of the agriculture sector to the vagaries of the weather. Collectively, these problems result in low growth, high government deficits, high and variable inflation, a stunted financial sector and generally an unstable macroeconomic environment. The litany of the latter economic problems are what motivated the adoption of Nepad, heralded as a

'radically' new approach to tackling seemingly intractable challenges facing the continent (NEPAD, 2012).

In adopting the economic reform programs, the main objective of Ghana, Senegal and Uganda was to improve the macroeconomic environment. Below is an overview of the path each country took to stabilize their respective economies.

Ghana (1983–1991)

Over the period of reform, Ghana made progress in some of the above listed problem areas. While encouraging private savings, the country significantly reduced trade restrictions, liberalized and removed controls on exchange rates. The result was a positive change in national savings from -7.6% in the pre-adjustment period (1970 to 1983) to 8.7% over the adjustment period (1983 to 1991). Also, export as a percentage of GDP increased from 2% in 1982 to 17% in 1987. Efforts to enhance productivity seem to have been fruitful. Total factor productivity growth went from -2.57% from 1976-82 to 2.22% from 1983 through 1986, and eventually to 2.48% from 1987 to 1991. Additionally, real GDP growth went from -1.6% during the pre-adjustment period (1978 to 1983) to 3.6% during the first half of the adjustment program (1983 to 1986) to 4.8% in the second half (1987 to 1991) (Nowak, Basanti, Horvath, Kochhar & Prem, 1996). Of particular interest to this study was the impact of the reform and adjustment measures on inflation. Over the period of adjustment the annual inflation rate went from 122.88% in 1983 to 18% in 1991 and then to 10% in 1992 (Nowak, Basanti, Horvath, Koccar & Prem, 1996).

Senegal (1978–1993)

Between 1974 and 1977, Senegal experienced relatively strong economic growth of 5%, which was largely motivated by good weather and increased exports. This was followed by a period of declining agriculture production due to poor weather conditions and macroeconomic uncertainty resulting in slower economic growth of 2%. During 1978 through 1984, Senegal adopted adjustment programs supported by the World Bank in an attempt to arrest the deteriorating economic situation, but results were weak and not particularly successful. Efforts were revamped and more rigorous adjustment measures were put in place from 1985 to 1988 and this led to improvements in the trade balance, and annual economic growth increased to 4% a year. Measures taken during this period involved financial restructuring and enhancement of fiscal discipline in managing the economy. In the third phase of the adjustment period, from 1989 to 1993, economic circumstances deteriorated again with growth averaging below 1%. However, over the entire adjustment period (1978 to 1993) inflation went from 3.4% in 1978 to -0.59% in 1993 (Tahari, de Vrijer & Fouad, 1996).

Uganda (1987–1994)

After a lengthy and brutal civil war that ravaged and virtually paralyzed the Ugandan economy, the country adopted structural reform policies to rebuild the infrastructure and correct severe economic imbalances. Inflation in 1987 was about 200%; the economy was almost entirely dependent upon coffee production. The real GDP growth rates were -2.4% and 0.3% in 1984/5 and 1985/6 respectively. The currency was overvalued within the fixed exchange rate regime

which lowered the country's competitiveness resulting in deteriorating terms of trade. From 1987 through 1995, the country embarked on adjustment programs that included trade and exchange rate liberalization, removal of price controls, rationalizing of state employment levels and fiscal discipline. These efforts resulted in an increase in the real growth rate from 3.8% in 1987 to about 10% in 1995, averaging about 6.4% a year.[8] A re-alignment in the value of currency improved the external competitiveness; trade increased by 2.6% from 1986/7 to 21.6% in 1994/5, and inflation was reduced from about 200% to 3.4% in 1994/5. Uganda also made progress in the areas of national savings and fiscal deficits. The country's efforts and progress have been described as one of the significant success stories in Sub-Saharan Africa (Sharer & McDonald, 1996).

5. MODEL, GRAPH AND EMPIRICAL TESTS

5.1. Inflation Data

We obtained monthly inflation rates on the three countries from IMF's international financial statistics (IFS) CD-Rom. The length of the data period for Ghana and Uganda is from 1964 through 2009 and 1968 to 2000 respectively. The series on Uganda begins from 1981(i.e.1981-2009), perhaps due to the turbulent political situation in that country at the time as well as the beginning of the civil war. For purposes of empirical tests, we first delineate the data of each country into three periods, the pre-adjustment period, the adjustment period and the post adjustment period. We then extend the analysis to include the data set encompassing the entire period for each country. We employ a GARCH (1, 1) model which is the best amongst alternatives we considered to generate the conditional variances as gauges for inflation uncertainty.[9] In the tests involving the entire data sets, we use Sims likelihood ratio (1980) to determine the optimal lags on the AR (p) process. This differs from one country to the other in the process of obtaining the conditional means for the GARCH (1, 1) model.[10]

5.2. GARCH Model

The use of a GARCH framework for this study follows the approach of Grier and Perry, Nas and Perry, and Fountas *et al.* (Grier and Perry, 1998; Nas and Perry, 2000; Fountas, *et al.*, 2003).

The AR (1) – GARCH (1, 1) model employed in this study to estimate the conditional variances is as follows:[11]

$$Inf_t = \delta_0 + \sum_{i=1}^{p} \delta_i Inf_{t-i} + \varepsilon_t \tag{1}$$

$$\sigma_{\varepsilon t}^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \sigma_{\varepsilon t-1}^2 \tag{2}$$

Equations (1) and (2) form the general framework of GARCH (1, 1) which assumes that residual variance of inflation follows an AR process. Equation (1) is the AR (1) (i.e. autoregressive of order 1) model used to estimate the conditional mean of inflation (*Inf*) with an error term ε_i. Equation (2) is the conditional variance model where the one period forecast of the variance of

the residual $\sigma^2_{\varepsilon t}$ (conditional variance) is a function of the square of the previous error term, ε^2_{t-1} (the ARCH term) and the last residual variance, $\sigma^2_{\varepsilon t-1}$ (the GARCH term). The objective here is to generate a time series of the conditional variances for all three countries which will proxy for the uncertainty of inflation referred to as *convar* in subsequent models and in the rest of the paper.

5.3. Stationarity Tests

Stability of the data is critical to the quality of the inferences that can be drawn from the respective estimation process. Therefore we conduct a stationarity test on the monthly inflation data for the three countries, i.e. Ghana, Uganda and Senegal. We use Dickey-Fuller (DF) and Phillips-Perron test procedures to determine the stationarity of the data and results confirm that most of the inflation data for the countries are stationary except for the post adjustment series for Ghana and Senegal and the overall data for Uganda.[12] After differencing by order one (d = 1), all the afore-mentioned non-stationary inflation rate series for Ghana, Senegal and Uganda rejected the null hypothesis of non-stationarity.

5.4. Discussion of Results of the AR (p) - GARCH (1, 1) model (Tables 1-6)

Based on equations 1 and 2 estimates of the AR (p) –GARCH (1, 1) model are obtained. This model is employed to capture the time varying variances of the inflation for the three countries, Ghana, Senegal and Uganda. Results show persistence of the ARCH term across the different regimes in all the countries. The GARCH term, however, display consistent volatility clustering across all the economic regimes in only Senegal. In Uganda and Ghana, persistence is present in the adjustment regime. In Ghana, pre-adjustment and post adjustment periods and in Uganda only the pre-adjustment period show a lack of persistence of volatility clustering. These different observations may be due to implications of the relative strength in changing economic regimes on account of IMF and World intervention. In all three countries results of the AR(p)- GARCH (1,1) tests of the entire data display persistence in volatility confirming the presence of both ARCH and GARCH effects over the period of study.

GHANA

Table 1
Least Squares Estimates

Regime	δ_0	δ_1	R^2
Pre-Adjustment (1964: 3-1982:12)	0.83 (0.75)	0.98** (0.01)	0.95
Adjustment (1983:12-1991:12)	0.86 (1.28)	0.97** (0.02)	0.94
Post -Adjustment (1992: 03-2009:6)	0.02 (0.27)	0.36** (0.04)	0.13
Overall (1964: 3-2009:6)	20.98 (1.82)	0.33** (0.04)	0.11

Table 2
Integrated AR (1)-GARCH (1, 1) Estimates

Regime	δ_{0+}	δ_{1+}	α_0	α_1	α_2	Likelihood Function
Pre-Adjustment	0.88	0.96**	34.10	0.74**	-0.06**	-757.08
	(0.50)	(0.02)	(4.46)	(0.17)	(0.02)	
Adjustment	1.25	0.95**	1.73	0.74**	0.23*	-276
	(0.46)	(0.01)	(0.56)	(0.26)	(0.13)	
Post- Adjustment	-0.84	1.03**	20.17	0.25**	-0.33**	-511.42
	(0.01)	(0.00)	(0.09)	(0.00)	(0.00)	
Overall	10.78	0.22**	9.34	1.04**	0.04	-2078.35
	(0.60)	(0.01)	(2.00)	(0.08)	(0.03)	

δ_{0+} & δ_{1+}: Constant and AR Coefficient generated by GARCII (1, 1) Model.
α_1 & α_2: Coefficients of the ARCII and GARCII terms respectively.
**   Significant at the 5% level
*   Significant at the 10% level
( ):   Standard error of the estimate

SENEGAL

Table 3
Least Squares Estimates

Regime	δ_0	δ_1	R^2
Pre-Adjustment	0.97	0.90**	0.81
(1968: 1-1977: 12)	(0.55)	(0.04)	
Adjustment	0.26	0.94**	
(1978: 1-1993: 12)	(0.20)	(0.02)	0.89
Post-Adjustment	-0.16	0.12*	0.02
(1994: 12-2004: 3)	(0.26)	(0.07)	
Overall	4.94	0.17**	0.03
(1969: 03-2009: 5)	(0.46)	(0.04)	

Table 4
Integrated AR (1)-GARCH (1, 1) Estimates

Regime	δ_{0+}	δ_{1+}	α_0	α_1	α_2	Likelihood Function
Pre-Adjustment	0.86	0.90**	8.28	0.33**	0.27	-337.98
	(0.42)	(0.04)	(6.57)	(0.14)	(0.38)	
Adjustment	0.15	0.94**	0.09	0.05*	0.93**	-419.36
	(0.17)	(0.02)	(0.11)	(0.03)	(0.04)	
Post-Adjustment	0.01	-0.21**	0.08	0.22**	0.75**	-297.81
	(0.07)	(0.07)	(0.04)	(0.07)	(0.05)	
Overall	1.42	0.20**	1.85	0.94**	0.14**	-1368.40
	(0.15)	(0.03)	(0.43)	(0.11)	(0.07)	

δ_{0+} & δ_{1+} : Constant and AR Coefficient generated by GARCII (1, 1) Model.
α_1 & α_2 : Coefficients of the ARCII and GARCII terms respectively.
**   Significant at the 5% level
*   Significant at the 10% level
( )   : Standard error of the estimate

UGANDA

Table 5
Least Squares Estimates

Regime	δ_o	δ_1	R^2
Pre-Adjustment	1.95	0.99**	0.95
(1981: 1-1986: 12)	(2.88)	(0.03)	
Adjustment	0.83	0.96**	0.95
(1987: 1-1994: 12)	(2.47)	(0.02)	
Post-Adjustment	0.50	0.92**	0.84
(1995: 3-2009: 6)	(0.22)	(0.03)	
Overall	0.07	0.33**	0.12
(1982: 7-2009: 6)	(0.61)	(0.05)	

Table 6
Integrated AR (1)-GARCH (1, 1) Estimates

Regime	δ_{0+}	δ_{1+}	α_0	α_1	α_2	Likelihood Function
Pre-Adjustment	2.65	1.00**	46.55	1.39**	-0.02	-263.57
	(0.02)	(0.00)	(7.89)	(0.10)	(0.00)	
Adjustment	0.89	0.93**	1.54	0.41**	0.63	-340.27
	(0.73)	(0.02)	(1.12)	(0.13)	(0.06)	
Post- Adjustment	0.51	0.92**	2.36	0.09	0.08	-336.14
	(0.22)	(0.03)	(0.77)	(0.12)	(0.32)	
Overall	0.13	0.10**	0.24	0.32**	0.72**	-916.38
	(0.14)	(0.03)	(0.13)	(0.06)	(0.04)	

$\delta_{0+} \& \delta_{1+}$: Constant and AR Coefficient generated by GARCH (1, 1) Model.
$\alpha_1 \& \alpha_2$: Coefficients of the ARCH and GARCH terms respectively.
**   Significant at the 5% level
*   Significant at the 10% level
( )   : Standard error of the estimate

5.5. Country Graphs Reflecting the Influence of Policies on Inflation and Inflation Uncertainty

Graphs of the series of time varying variances of inflation as proxies of uncertainty (*convar*) and inflation rates for the three countries appear to underscore in general, the positive relationship between the two variables. It also shows the stabilizing influence on inflation and its uncertainty of the IMF and World Bank policies. Below, the graphs are examined on a country by country basis.

Ghana

The graphical results for Ghana are shown below in Figure 1. The latter part of the pre-adjustment period (around 1973) through the early stages of the adjustment periods (1983 to early 1984) seem to show relatively high inflation uncertainty and inflation rates, but the picture appears to stabilize during the rest of adjustment period (Mid-1984 to 1991). During this period, inflation rates and the uncertainty of inflation appear to be comparatively lower coinciding with the implementation period of recovery and adjustment programs.
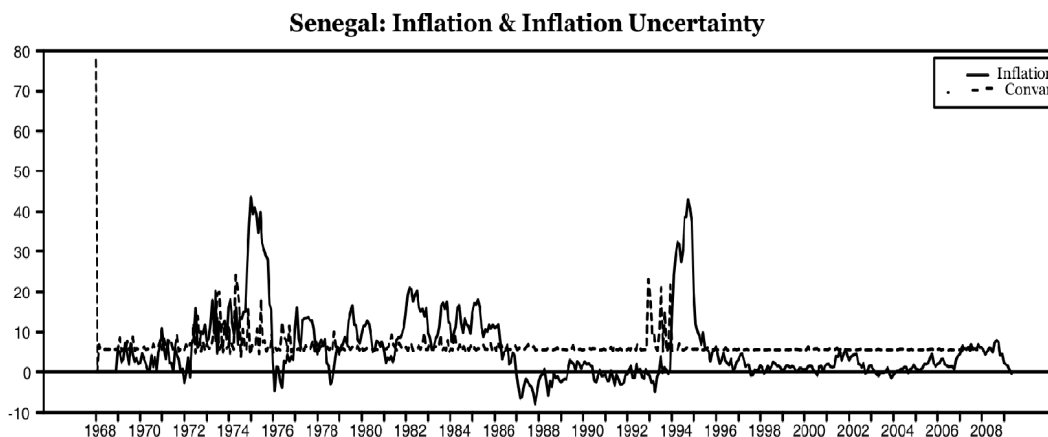
Figure 1: Ghana Inflation & Inflation Uncertainty

Ghana: Inflation & Inflation Uncertainty
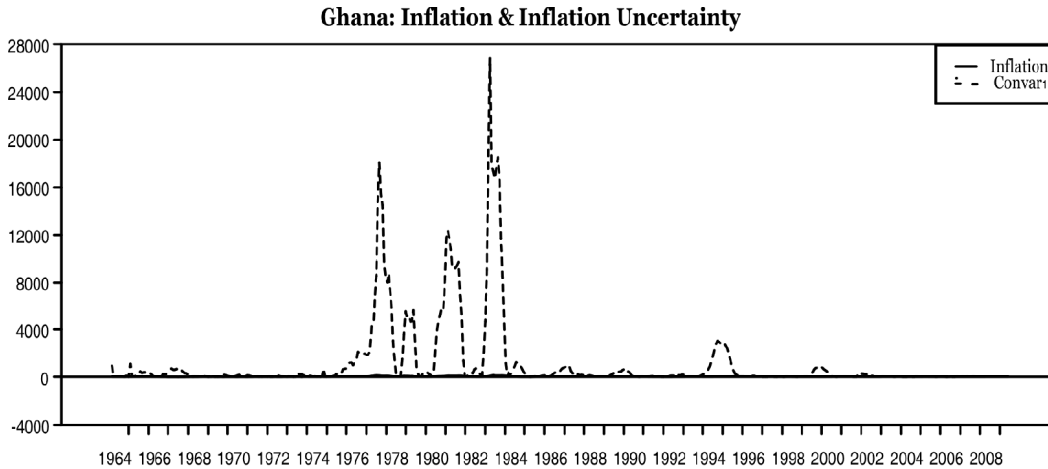
Senegal

Graphical results of Senegal are displayed below in Figure 2. The uncertainty of inflation rates in the pre-adjustment era appears to be relatively high. Comparatively, the adjustment period (1978-1993), displays lower uncertainty levels and more stable and downward trending inflation rates. Inflation becomes negative and inflation uncertainty lowered around 1985 or 1986 coinciding with the implementation of a revamped adjustment program in Senegal after a lackadaisical response of the economy to an earlier set of reform policies.[13] The early part of the post adjustment period (i.e. after 1993) has both increased inflation rates and the uncertainty of inflation followed in about two years by relatively lower inflation and inflation uncertainty. Overall, the graph shows the transition of inflation and the uncertainty of inflation from the pre-adjustment periods to the adjustment and then the post adjustment eras. Visual evidence reinforces the influence of policy innovations in decreasing the two variables during the adjustment period.

Figure 2: Senegal Inflation & Inflation Uncertainty

Senegal: Inflation & Inflation Uncertainty

Uganda

Below, Figure 3 shows that the inflation uncertainty variable appears to be the relatively dominant factor during the pre-adjustment and the first three years into the adjustment periods. The latter observation should perhaps be hardly surprising since it may represent a 'hangover' period from an immediate very turbulent past punctuated in the short term with a slow re-integration of hitherto 'lost' regions back into the fold of Uganda. When coupled with a populace largely suspicious and untrusting of government initiatives and also harboring high negative expectations likely set the stage for the escalation of the level of uncertainty in the near term. This may have delayed the effect of the IMF and World Bank policy initiatives on inflation and its uncertainty. It will be observed that inflation rates were also high over the period mentioned but appear to have fallen during the second half of the adjustment period, and into the post- adjustment era (after 1994). The latter period is marked by both low inflation and inflation uncertainty.

Figure 3: Uganda Inflation & Inflation Uncertainty

Uganda: Inflation & Inflation Uncertainty
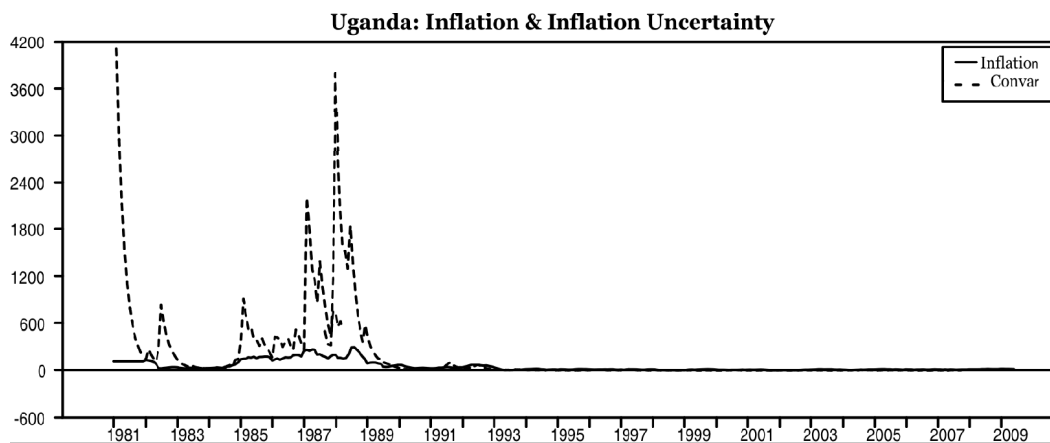
5.6. Granger Causality Tests

Though the graphs appear to show a positive relationship between inflation and the uncertainty of inflation, which was reinforced by most of the correlation coefficients, this hardly establishes causality nor the direction of the relationship between the two variables. The objective of this paper is to investigate whether the changing macroeconomic regimes of the three countries influenced the nature and direction of the relationship between inflation and the uncertainty of inflation. To the extent that inflation and especially its uncertainty can undermine the stability of an economy and potentially stifle business activities by way of elevated risk premiums captured in higher interest rates, the outcome of this study affords policymakers some insight into actions that can effectively control the two variables. For purposes of NEPAD's objectives, this discourse can suggest a policy framework to realize a stable and an enabling environment to achieve economic growth and development. Granger causality affords the opportunity not necessarily to establish causality in strictest sense of the word, but to determine which variable precedes the other. To establish direction of relationship, i.e. which variable granger causes the other, the following equations are estimated;

$$Inf_t = \sum_{i=1}^{p} \delta_i \, Inf_{t-i} + \sum_{i=1}^{p} \beta_i \, Con\,\mathrm{var}_{t-i} + \varepsilon_t \qquad (3)$$

$$Con\,\mathrm{var}_t = \sum_{i=1}^{p} \delta_i \, Con\,\mathrm{var}_{t-i} + \sum_{i=1}^{p} \beta_i \, Inf_{t-i} + e_t \qquad (4)$$

In equations (3) and (4), *Inf* and *Convar* represent inflation rate and the uncertainty of inflation respectively for each country over the periods of study. In equation (3) the testable proposition is whether the coefficients on the uncertainty variable (*Convar*) are zero. If that proposition is rejected, based on an F-test, then it can be inferred that inflation uncertainty precede or granger-causes inflation rates. This result would give credence to Cukierman and Meltzer's proposition (Cukierman and Meltzer, 1986). A similar proposition is examined in equation (4) except that the null hypothesis is to determine if the coefficients of inflation rates (*Inft*) are zero. A rejection of that hypothesis provides support for the Friedman-Ball's postulation that the behavior of inflation causes the uncertainty of inflation to either increase or decrease. The two propositions attempt to establish the *direction* of the relationship between inflation and the uncertainty of inflation. A positive or negative coefficient indicates the nature of the relationship between the latter two variables. A negative sign may result from the monetary policy innovations to correct either high inflation or high inflation uncertainty.

5.7. Results of Causality Tests

In Ghana (see Table 7), there is significant evidence of the Friedman-Ball hypothesis that inflation causes uncertainty in the pre-adjustment, post-adjustment and overall periods. The significant results for the latter periods appear to confirm the positive relationship between inflation and the uncertainty of inflation. However, during the adjustment period a bi-directional relationship is observed and both F-test values are significant at the 5% level. Even though this does not provide clear evidence in support of either the Friedman-Ball or Cukierman-Meltzer propositions, the negative sign may provide some indication of the effect of macroeconomic policy innovation.[14] The latter possibility is included in the Cukierman-Meltzer hypothesis as the targeted effect of policies implemented to reduce inflation uncertainty.

Ghana

Table 7
Results of Granger Causality Test of the Direction of the Relationship between Inflation and the Uncertainty of Inflation

Regime	H_0 : Inflation does not Granger Cause Inflation Uncertainty	H_0 : Inflation Uncertainty does not Granger Cause Inflation	AIC^{15} Determined Lag Lengths
Pre-Adjustment (1964: 3-1982: 12)	(+)1.89**	(-)0.87	12
Adjustment (1983: 12-1991: 12)	(+)5.90**	(-)9.44**	11
Post - Adjustment (1992: 12-2004: 2)	(+)0.12	(-)0.13	19
Overall (1964: 3-2004: 2)	(+)57.78**	(+)0.1**	6, 3

** F- test values significant at the 5% level.
* F-test values significant at the 10% level.
(+ or -): Net of signs on the coefficients of the F-test (Grier and Perry, 1998; Nas and Perry, 2000).

Results for Senegal, in Table 8, display the expected positive relationship between inflation and the uncertainty of inflation across all the three economic regimes. The outcome of the pre-adjustment era provides support for the Cukierman-Meltzer proposition that inflation uncertainty causes inflation to increase. This result appears to reflect Cukierman-Meltzer's hypothesis of an opportunistic central banker who takes advantage of the uncertain environment to surprise agents with inflationary-inclined innovations. The post-adjustment and the overall periods show a significant positive bi-directional relationship between inflation and the uncertainty of inflation. The adjustment fails to provide support for either hypothesis. All in all, even though the signs are consistently positive, based on the significance of coefficients, the direction of relationship changed from the pre-adjustment era, through the adjustment to the post-adjustment periods. Again, results seem to provide some evidence that policy regime changes may have impacted the direction of relationship between inflation and the uncertainty of inflation.

Senegal

Table 8
Results of Granger Causality Test

Regime	H_0: Inflation does not Granger Cause Inflation Uncertainty	H_0: Inflation Uncertainty does not Granger Cause Inflation	AIC Determined Lag Lengths
Pre-Adjustment (1968:1-1977:12)	(+)1.48	(+)2.03**	5
Adjustment (1978: 1-1993: 12)	(+)0.96	(+)0.63	9
Post-Adjustment (1994: 12-2004: 3)	(+)28.67**	(+)0.03**	1
Overall (1968: 1-2004: 3)	(+)0.001	(+)6.64**	11

** F- test values significant at the 5% level.

* F-test values significant at the 10% level.

(+ or -): Net of signs on the coefficients of the F-test (Grier and Perry, 1998); Nas and Perry , 2000).

The results of Uganda, shown in Table 9, show that following the pre-adjustment era during which the hypothesis that inflation granger causes the uncertainty of inflation is significantly supported, the adjustment regime and overall period provide significant evidence of bi-directional link between the two variables. The negative signs may be capturing the implications of macroeconomic policy actions to lower inflation uncertainty and inflation. The significant negative signs for both the adjustment era and the entire period appear to reflect policy efforts to lower inflation uncertainty as alluded to in the Cukierman-Meltzer proposition. The significant negative sign during the pre-adjustment period may reflect efforts by the government at the time to lower inflation and stabilize the economy. The latter period coincides with the post - Amin era, a time characterized by turbulent and unstable economic and political conditions.[16]

Uganda

Table 9
Results of Granger Causality Test

Regime	H_0: Inflation does not Granger Cause Inflation Uncertainty	H_0: Inflation Uncertainty does not Granger Cause Inflation	AIC Determined Lag Lengths
Pre-Adjustment (1981:1-1986:12)	(-)13.05**	(+)0.44	1
Adjustment (1987:1-1994:12)	(+)6.22**	(-)2.74**	10
Post-Adjustment (1995:1-2004:2)	(-)2.00**	(-)0.09**	1
Overall (1981:1-2004:2)	(+)77.56**	(+)0.01**	9

** F- test values significant at the 5% level.
* F-test values significant at the 10% level.
(+ or -): Net of signs on the coefficients of the F-test (Grier and Perry, 1998); Nas and Perry, 2000).

Results show significant bi-directional links in Ghana during the adjustment period, Senegal in the post adjustment era and Uganda in the adjustment period. In Senegal and Uganda, results of the overall data for the two countries also provide evidence of a bi-directional relationship between inflation and the uncertainty of inflation.

Aside from the bi-directional evidence between the two variables during the adjustment period, results from Ghana provide support for the Friedman-Ball hypothesis. During the adjustment period in Ghana and Uganda, the negative sign in the bi-directional relationship seems to suggest the efforts of monetary policymakers to reduce the level of the uncertainty of inflation. The outcome in Senegal provides support for the positive connection between the two variables in all three regimes and also evidence of the Cukierman-Meltzer proposition during the pre-adjustment era. The latter appears to give some credence to the activities of an opportunistic central banker, i.e., Central Bank policies that accommodate the whims and caprices of a regime as proposed in Cukierman-Meltzer's hypothesis. Generally, this is what is anticipated in African economies, and a good number of emerging economies, where legally binding and enforceable institutional structures restricting 'undue' interference of the executive branch in the operations of various arms of state are absent.

The changes in the both the signs and direction of relationship between inflation and the uncertainty of inflation from one regime to the next, provide some evidence of influence of changing macroeconomic environments. The influence of the IMF and World Bank recovery and adjustment programs on inflation appears to have affected both the nature and direction of the connection between inflation and the uncertainty of inflation.

6. IMPLICATIONS FOR THE NEW PARTNERSHIP FOR AFRICA'S DEVELOPMENT (NEPAD)

The results of the study show how policy actions under the auspices of IMF and the World Bank impact the behavior of inflation and uncertainty of inflation. Generally, the levels of the two variables were lowered and also policies appear to have affected how the two variables related to each other. Inflation and the uncertainty of inflation affect not only the stability of an economy

but as Milton Friedman posited, can undermine business activity and ultimately economic growth. The pricing of inflation uncertainty into interest rates and consequently raising them higher can render prohibitive the cost of doing business. Directly, this will serve as a disincentive to the initiation and expansion of business activity and ultimately undermine the invaluable contribution the private sector can make in a nation's effort to realize economic development and growth. Policies that help achieve the moderation not only of inflation but its uncertainty can in a fundamental way positively influence the creation of the much desired stable and enabling environment to help the growth of business activities and with that enhance the prospects of achieving economic well-being of a society.

The outcome of the IMF and World Bank economic programs in the three countries show varied responses to the policies with differing levels of success. To the extent that both inflation levels and their uncertainty were generally lowered, NEPAD planning and implementation committees may use the underlining polices for reference purposes in fashioning out approaches to realize stable macroeconomies to help create business environs in African countries that are stable and can attract and boost business interests and investments.

As Friedman implied, all else equal, a less 'noisy' economy will afford a more efficient allocation of resources which is globally desirable and augurs well for businesses. Achieving this in the context of IMF and World Bank programs provides a workable template on measures to control prices for Nepad to reference in its desire to create an economically stable and enabling environment that can attract and promote the survival of businesses in Africa.

7. CONCLUSION

We examine the relationship between inflation uncertainty and inflation rates in Ghana, Senegal and Uganda during periods when IMF and the World Bank implemented economic programs. We investigate whether these programs affected the relationship between inflation and its uncertainty. A Garch framework is used to generate time series of conditional volatility and granger causality tests are used to determine the direction of the connection between the two variables during these periods.

Results appear to show that in all three economies, changes in the direction of the relationship between inflation rates and the uncertainty of inflation corresponds to the periods when IMF and World Bank policies were implemented. Ghana shows significant evidence of the Friedman-Ball hypothesis in all regimes except the post-adjustment period and Senegal confirm the Cukierman-Meltzer proposition in the pre-adjustment, post-adjustment and overall periods. In Uganda, bi-directional results dominate the outcomes as well as negative signs especially in adjustment and post adjustment eras. These signs may be in part a result of inflation targeted policy innovations motivated by the IMF and World Bank price stabilization initiatives on the one hand and on the other hand, reactions by a skeptical populace to government policies.[17] Their skepticism and consequent reactions to policies are a result of mistrust probably borne out of the psychological effects of years of brutal armed internal conflicts and unpredictable and unreliable political leadership. These jointly conspired to create a lack of trust in and uncertainty of actions of the central government authorities. Consequently, reactions to policy innovations may have gone against policymakers expectations and resulted in some ambiguous and bi-directional outcomes.

We also discuss the possible relevance of the effect of stabilization aspects of economic programs of the World Bank and IMF on the economies of three African countries, Ghana, Senegal and Uganda to NEPAD. We viewed the general outcome of lowered inflation and uncertainty of inflation over the period of study as some evidence of stabilization successes of IMF and World Bank policies and considered them useful references for Nepad's purposes to create an economically stable and enabling environment to foster private sector investment and business growth.

Admittedly, efforts at the creation and sustenance of a conducive and enabling business environment require answers to more challenges and measures beyond stabilization. Briefly, some of these additional measures include comprehensive policies on environment, security, corruption, infrastructure, legal frameworks, health, sanitation, tax, investment (codes) and political stability. Even though the forgoing are all important contributory factors, the direct influence of inflation and its derivatives on a critical capital intermediation instrument like interest rates, and the overriding strength of the latter's influence on business decisions, arguably make achieving price stabilization and its implications an important condition for realizing and sustaining an enabling and conducive business environment.

The outcome of this study shows that during the period of implementation of the programs both inflation and its uncertainty were lowered, and especially so in Ghana and Uganda. Lessons in inflation control and perhaps even the need for measures to enhance credibility of monetary policy to enhance prospects of achieving price stabilization can be gleaned from the experiences of the three countries under IMF and world programs for the benefit of Africa's economies in furtherance of NEPAD's objectives. Since a primary objective of NEPAD is to create an enabling environment in order to inspire stronger private sector participation to realize sustainable economic growth and development, the policies of IMF and the World Bank that promoted macroeconomic stability may serve as reference points for the formulation of programs to achieve NEPAD's stated objectives.

On an extended level, encouraging signs that African countries are beginning to recognize the import of inflation control and stability in revamping their respective economies is manifest in the passage of an act establishing and protecting the independence of the central bank of Ghana by the Ghanaian parliament in 2002. This measure by the highest law making body in the country effectively acknowledges the need for and institutionalizes the commitment to inflation stabilization and control by the monetary policymakers in Ghana. Given the extensively researched and published observation of an inverse relationship between the level and stability of inflation and the level of central bank independence, Ghana's effort may provide the impetus to the economic implementation authorities to expand the sphere of potential tools to achieve stable and enabling environments in African countries in order to enhance business activity, private sector growth and economic improvement.

As mentioned earlier, by no means is this paper arguing that the achievement of inflation stability alone is a sufficient condition for the creation of an enabling business environment and private sector growth but that its implications on the marginalization of uncertainty in the pricing of funds will help boost the financing of growth opportunities and thereby inspire business activity. Complemented by other political, social and economic reforms and considerations,

which Nepad recognizes, the latter will help provide the impetus for growth in the private sectors and economies at large.

Notes

1. International Monetary Fund (1996, November 11), *Ghana, Senegal and Uganda Adopt Bold Reforms.*
2. Hadjimihael, Nowak, Sharer and Tahari (1996) *Adjustment for Growth: The African Experience.*
3. Thomton, J., (2007) "States that the negative causal effect of uncertainty of inflation on inflation may be signs of a stabilizing central bank" (p. 858). An idea originally presented by Holland (1995).
4. "Nepad is seen by many lending institutions as the best channel for delivering investments for the development of Africa." (NEPAD, 2012).
5. Evans (1991) shows that the changing behavior of agents and policymakers toward inflation can precipitate "both ARCH effects and time variation in the structure of inflation."
6. Kontonikas (2004) reports that the adoption of inflation targets in the U.K. reduced long run inflation uncertainty and inflation rates.
7. The observation on Spain, Italy, France and Japan perhaps may represent some support for Cukierman and Meltzer's (1986) idea of an opportunistic policymaker.
8. This was higher than the average of 1.6% in Sub-Saharan Africa (Hadjmichael *et al.*, 1996).
9. We looked at higher order GARCH models like GARCH (2, 2) and different combinations thereof but found GARCH (1, 1) to be best suited.
10. For the AR (p) process over the entire period of examination, the models were Ghana(p=11), Uganda(p=17) and Senegal (p=13).
11. Engle (2001) described the GARCH (1,1) model as "the simplest and most robust of the family of volatility models." It avoids the short comings of the standard deviation and survey approaches to estimating uncertainty and provides a stronger measure of uncertainty of inflation Ball (1992b); and Cukierman and Meltzer (1986).
12. The null hypothesis of non-stationarity is rejected for Ghana and Senegal.
13. Refer to Senegal's "economic path to growth" narration.
14. Grier and Perry (1998) describe the net negative sign in a similar bidirectional result in the U.S. and Germany as indications of "stabilizing" actions by their respective central banks.
15. Idi Amin ruled from 1971 to 1979 and was followed by Milton Obote from 1980 to 1985.
16. Thomton, J., (2007), "states that the negative causal effect of uncertainty of inflation on inflation may be signs of a stabilizing central bank." (p. 858). An idea presented by Holland (1995).

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