UNCERTAINTY OF THE INFLATION AND ECONOMIC GROWTH: THE CASE OF EAST AFRICAN COUNTRIES[1]

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Abstract

Based on a VAR-GARCH model this paper proposes an assessment of the relationship between the uncertainty emanating from the volatility of inflation and the economic growth of the East African countries. The results suggested the continued persistence of volatility in inflation and economic growth but also a very significant magnitude of the uncertainty of inflation. The transmission mechanisms of uncertain inflation on economic growth was observed to differ across countries. Therefore, Macroeconomic convergence, price stabilization and development policies in the region have not been enough to counteract the persistence of fluctuations in inflation and economic growth, hence unable curb the overall negative effects of the interaction of inflation shocks across countries.

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1 Introduction

The impact of inflation on economic activity has led to a proliferation of debates and sometimes contradictory results in the theoretical and empirical literature. The effects of inflation, including uncertainty on the management of macroeconomic policies in developing countries, is a current topic that has been widely discussed in the recent literature on stabilization policies. Failures in indexation remain the bedrock of inflation uncertainty. This makes any forecast difficult. In fact, economic agents who save for their retirement will not be able to anticipate the amount they have to put aside. Similarly, companies that borrow money will not be able to anticipate the price that should be paid in exchange for the goods they produce. Companies will also be affected when they have to decide on the increases to be included in multi-year labor contracts, in order to reflect the expected rate of inflation. For example, if a firm believes that the prices it can charge grow less rapidly than expected in the wage contracts, it will suffer the consequences as an employer (Stiglitz et al., 2007).

The difficulty of finding the optimal formula for a good control of inflation uncertainty stems from the high volatility of inflation. Recurrent fluctuations in inflation can generate a very high average inflation rate and hurt the economy by not promoting investment and savings. This reason justifies the price stability objective set by the monetary and fiscal authorities. Indeed, achieving the objective of price stability requires the imposition of effective constraints on monetary expansion (Cukierman, 1994) that can contribute to improving macroeconomic performance.

Managing the macroeconomic performance of developing countries, particularly those in sub-Saharan Africa, remains constrained by volatility and the uncertainty of inflation. These are structurally different from one another and are therefore likely to be affected differently by the effects of volatility and inflation uncertainty on economic activity. Thus, the transmission of these effects in the economy induces a significant slowdown in economic activity. The considerable imbalances permanently affected by stabilization policies explain their vulnerability vis-à-vis the volatility and uncertainty of inflation. This vulnerability is corroborated by the weakness of automatic stabilizers, which are around 0.03% in the East African zone.

In this monetary union, the empirical literature has not provided enough studies on the effects of fluctuations and the uncertainty of inflation on economic growth. This reflection is an extension of the recent study by Valdovinos and Gerling (2011). These authors have just questioned the link between the uncertainty of inflation and the relative variability of prices. They did not study the cumulative impact of the effects of volatility and uncertainty of inflation on the economic activity of East African member countries. In addition, their study covers a rather short period of observation (1994 to 2009). Our reflection, dealing both with the transmission mechanisms of inflation shocks and the links between the uncertainty of inflation and the economic growth of East African member countries, proposes to close this limit.

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2 Review of the literature

The literature on the real effects of uncertain inflation on economic activity in the economies of developing countries, including those in sub-Saharan Africa, sparked a lively debate in recent years. The effectiveness of macroeconomic policies depends on the level of inflation. Higher inflation is likely to be harmful to growth because, on one hand, it triggers an increase in loans and, on the other hand, a decrease in the rate of capital investment. Thus,

monetary and fiscal policies in a given Nation require the Central Bank to ensure the country has a stable inflation by making fiscal policies to restrain possible asymmetric shocks (Gali and extra, 2008).

In sub-Saharan African countries, inflation can be caused by several factors including the level of budget deficit, monetary, external shocks and the type of exchange rate regime. At this point, Loungani and Swagel (2001) argue that inflation is the main result of the differences in regimes of exchange between developing countries. On the other hand, the contribution of the monetary program to inflation is much lower in fixed exchange and flexible exchange rate regime. From the results obtained by these authors (Evans, 1991; Holland, 1995; Grier and Perry, 1998; Daal and al., 2005; Fountas and Karanasos, 2007) it appears that inflation uncertainty is the main result of the rising inflation.

Moreover, the influence of inflation and the uncertainty of the inflation on growth resulted in anincreased number of contributions and controversies. Thus, Dotseyand Sarte (2000) argues in their study that inflation and growth are positively related on short term while long-term inflation adversely affects growth. They postulate that the inconsistency of inflation can help in generating increased average growth via precautionary savings. Rising it is attributable to the increase in uncertainty on future revenues. The presence of uncertainty in the long term arising from the variability of inflation is probable expected to alleviate the negative impact between inflation and growth since inflation and the volatility of inflation are subject to high correlation.

Conclusions reached by the authors Chang and He (2010), Chang (2012) consider that the relationship between inflation, inflation uncertainty and economic growth depends on inflation level. According to Chang (2010), inflation is positively correlated to the uncertain inflation in a regime characterized by high inflation. These conclusions on positive correlation between inflation and inflation uncertaintyare in contrast with those obtained by Engle (1983), Bollerslev (1986), Baillie, (1996) and Hwang (2001) because they have failed to prove the positive correlation. Moreover, in a country subject to low inflation, the direct effects of inflation on growth are inconsequential, while the indirect negative effects of inflation on growth via uncertain inflation remain highly significant.

They deduct from their study that the negative influence in a high inflation regime is much higher than that of a regime of low inflation. In this way, the control of inflation remains a prerequisite to ensure a certain level of economic growth. Without this control, uncertain inflation resulting from the volatility of inflation disrupts economic forecasts and makes the economic activity more chaotic. In this same dynamic, the study by Evans and Wachtel (1993) shows that the impact of uncertain inflation can induce a decline in economic growth. This result was corroborated in several studies including Davis and Kanago (1996); Grier and Perry (2000), Bredin and Fountas (2005).

Studies in the East Africa concerning the problem of the link between inflation and uncertain inflation and economic growth are nonexistent. The present paper conducts an empirical modeling to check any heterogeneous effects of inflation on uncertain inflation and the variability of relative prices. The results point out that the correlation of shocks to inflation between East African Countries made the common monetary policy a sensible instrument to keep inflation under control.

3 Model Specification and Discussion of Results

Using the annual data (1975 to 2017) from the World Bank Development Indicator (WDI) and respective countries data base i.e. Kenya National Bureau of Statistics (KNBS) this paper considers an extension of the standard VAR-GARCH model composed of two variables, namely inflation and GDP. We denote these two variables respectively by $\prod_t$ and Y_t at time t. The objective of the model is to study the interaction of inflation shocks in the region but also the link between uncertain inflation and economic growth. In addition, the presence of heterogeneity motivated us to do a country-by-country study instead of working on a panel of data. This approach also makes it possible to measure the integration factor. Indeed, for each country, we can see if the other remaining countries, through an index grouping them together, can influence it (transmission effect). Precisely, the model is as follows:

$$\prod{}_t^p = \beta_0 + \sum_{i-1}^{p} \beta_1 \prod{}_{i-1}^{p} + \sum_{i-1}^{p} (\gamma_i Y_{t-1}^p) + \rho_1 L\_\prod{}_t^p + \rho_2 L\_Y_t^p + \varepsilon_e \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (i)$$

$$\sigma_{\varepsilon,t}^t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \sigma_{\varepsilon,t-1}^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (ii)$$

$$b\prod{}_t^p + Y_t^p = \theta_0 + \sum_{i-1}^{p} \theta_1 Y_t^p + \sum_{i-1}^{p} (\mu_i \prod{}_{t-1}^p) + \lambda_1 \sigma_{\varepsilon,t}$$

$$+ \xi_1 F\_\prod{}_t^p + \xi_2 F\_\prod{}_t^p + \nu_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (iii)$$

$$\sigma_{t,2}^2 = \eta_0 + \eta_1 V_{t-1}^2 + \eta_2 \sigma_{v,t-1}^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (iv)$$

The $\prod_t^p$ and Y_t^p variables represent respectively the inflation and the GDP of the country and for this case East Africa countries. The $F\_\prod_t^p$, $F\_Y_t^p$ variables are indices derived from finding the average of GDP and Inflation for the remaining countries for example, if we take Togo as a country of study, then the indices on inflation and GDP will be constructed using a simple average on the following countries: Kenya, Uganda, Tanzania, Rwanda, Ethiopia and Eritrea, Djibouti. All data were smoothed and differentiated to make them stationary at first difference.

Equation (i) tells us that a given country's inflation at time t depends on the past inflation, the past GDP, and the current values of the inflation and GDP indices.

Equation (iii) has a similar explanation to that of equation (i) to which the inflation uncertainty, measured here by $\sigma_{\varepsilon,t}$ has been added. To the left of equation (iii), we also included the term $b\prod_t^p$ to to create a structural dependency between the two variables.

Equations (ii) and (iv) model the conditional variance of the residues from equations (i) and (iii) by a multivariate GARCH model of diagonal VECH type. Precisely, this amounts to

making estimates of univariate GARCHs models. In this estimation of the GARCH part, we have integrated the fact that $\alpha_0, \alpha_1, \alpha_2, \eta_0, \eta_1, \eta_2$ are all positive to ensure the positivity of the conditional variance. To also ensure the second-order stationarity of the individual series, the following constraints were required: $\alpha_1 + \alpha_2 < 1$, and $\eta_1 + \eta_2 < 1$.

Finally, to take into account the annual seasonality and limit the number of parameters to be estimated, we have taken p = 4 since the frequency of the data is quarterly. This bivariate model, denoted VAR GARCH-M, was used by Elder and Serletis (2010) to study the impact of oil price uncertainty on economic growth. Note that it usually has a higher explanatory power than the standard VAR model without the GARCH part. Indeed, in our study, except for Uganda, it remains the best model among the remaining six CIS countries as shown in Table 4 in the appendix. In this table, the CIS has been defined by:

$$SIC = -2 \cdot \log L + K \cdot \log(T) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \quad (v)$$

Tables 1 and 2 show, for each country, the estimation of the model parameters for equations (i) and (iii) on the one hand and equations (ii) and (iv) on the other hand.

Table 1: Estimation of the coefficients of equations (i) and (iv)

Var	Kenya	Uganda	Tanzania	Rwanda	Ethiopia	Eritrea	Djibouti
β_0	0.33***	0.41***	0.32***	0.31***	0.27***	0.23***	0.21***
β_1	0.14***	.018***	0.17***	0.15***	0.11**	0.16***	0.13***
β_2	0.19***	0.081	0.26***	0.23***	0.09*	0.15***	0.14***
β_3	-0.22	-0.22***	-0.40***	-0.11***	-0.33***	-0.38***	-0.43***
β_4	-0.043	0.002	-0.10**	0.0365	-0.05	-0.008	-0.028
γ_1	-0.05	0.005	-0.06	-0.003	-0.011	-0.004	-0.007
γ_2	0.037	0.005	0.007	-0.084***	0.008	-0.06*	0.25***
γ_3	-0.11	0.056	-0.008	0.21***	0.058	-0.12***	-0.097
γ_4	-0.03	-0.069	-0.16**	-0.18**	0.0287	0.32***	0.26*
ρ_1	0.52***	0.35***	0.45***	0.453***	0.681***	0.56***	0.57***
ρ_2	0.17***	0.17***	0.26***	0.0283	0.049	-0.07**	0.13*
b	0.047**	0.218***	0.094***	0.23***	0.55***	0.15***	0.166***
θ_0	-0.01	0.10**	0.007	0.079	0.07**	0.049*	0.05*
θ_1	-0.009	0.057	0.025	0.0376	0.047*	0.025	0.023
θ_2	0.002	0.035	0.013	-0.004	0.09***	0.0012	0.011
θ_3	0.016*	-0.024	0.021	0.0002	-0.11***	0.030	0.003
θ_4	0.32***	0.37***	0.38***	0.31	0.27***	0.34***	0.42***
μ_1	0.31***	0.17***	0.32***	0.13	0.15***	0.18***	0.26***
μ_2	0.019	0.097	0.21***	0.056	0.26***	0.11**	0.30***
μ_3	-0.21***	-0.47***	-0.18***	-0.43***	-0.45***	-0.53***	-0.26***

μ_4	0.60***	24.5***	-0.13**	0.92***	0.42***	0.67***	-0.086
λ	-0.04	-24.2***	0.14***	0.25***	-0.34***	-0.25***	0.029
ξ_1	0.09***	0.026	0.029	0.09**	0.58***	0.077	0.13***
ξ_2	0.018	0.13**	0.14**	0.17*	0.35***	0.051	0.21***

The characters (*), (**), and (***) respectively represent the thresholds of significance of 10%, 5% and 1%.

Table 2: Coefficients of equations (ii) and (iv)

Garch	Kenya	Uganda	Tanzania	Rwanda	Ethiopia	Eritrea	Djibouti
α_0	0.261***	0.029***	0.356***	0.148***	0.035**	0.048***	0.960***
α_1	0.905***	0.002***	0.976***	0.967***	0.122***	0.521***	0.977***
α_2	0	0.962***	0	0.006	0.863***	0.456***	0
η_0	0.007**	0.243***	0.029**	0.004	0.321***	0.008	0.066***
η_1	0.553***	0	0.311***	0.237***	0.97***	0.114***	0.547***
η_2	0.434***	0.581***	0.678***	0.751***	0	0.875***	0.441***
$\alpha_1 + \alpha_2$	0.905	0.964	0.976	0.973	.985	0.977	0.977
$\eta_1 + \eta_2$	0.987	0.581	0.989	0.988	0.97	0.989	0.988

The characters *, **, and *** respectively represent the thresholds of significance of 10%, 5% and 1%. The terms $\alpha_1 + \alpha_2$, $\eta_1 + \eta_2$ measure respectively the persistence of the volatility of inflation and economic activity.

Results from the link between inflation uncertainty and economic growth suggest the presence of a negative relationship between the two variables in Uganda, Ethiopia and Eritrea. This is explained by the reluctance of economic agents resulting in lower investment and savings. On the other hand, an increase in the uncertainty of inflation is likely to be detrimental to growth due, on the one hand, to an increase in borrowing and, on the other hand, to a fall in the rate of inflation, capital investment.

Similarly, the positive impact of uncertain inflation on economic growth noted in Tanzania, Rwanda is justified by the formation of precautionary savings, the rise of which is attributable to the increase in uncertainty over future income. As a result, the precautionary savings of economic agents can have positive effects on economic growth over the long term. Uncertain inflation has no effect on economic growth in Kenya and Djibouti, but the inflation index has a positive impact on growth. In fact, as far as Djibouti is concerned, economic agents are insensitive to the repercussions of the persistence of the volatility of inflation since an increase in inflation is favorable to growth over the short and medium term.

In the case of Kenya, the low level of uncertainty is likely to explain its insensitivity to economic growth. This reveals the very significant magnitude of the uncertainty of inflation in some countries such as Tanzania, Rwanda and Djibouti. On the other hand, countries like Eritrea and Ethiopia have average levels of uncertainty.

Table 2 shows the persistence of fluctuations in inflation and economic activity for all countries in the zone except for the case of Uganda where the level of persistence of GDP is medium $(\eta_1 + \eta_2 = 0.581)$ this persistence of the volatility of inflation $(\alpha_1 + \alpha_2 \geq$

0.90) and economic activity ($\eta_1 + \eta_2 \geq 0.97$) reflects the vulnerability of macroeconomic conditions in the East African area.

The results also reveal that the inflation of each East African member country is significantly influenced by the inflation index of the others. The significance of the parameters at the 1% threshold shows the presence of a channel of transmission of inflation in the East African countries. This transmission takes place through the inflation index of the zone and not from one country to another, given the low correlations (see Table 3). In this regard, the transmission of inflation in the zone is accentuated by shocks, such as rising oil and commodity prices.

The analysis of these response functions makes it possible to glimpse the expected effects of the various shocks on economic activity. A positive inflation shock, reflecting an increase in inflation, is reflected in all East African member countries by a negative impact on economic activity in the first year. This fact can be explained by a decline in purchasing power that does not favor consumption. Then, the negative impact decreases to become positive at the end of the second year. This is due, among other things, to the increase in corporate profitability, which is reflected in a strong momentum in the supply of goods.

Likewise, inflation is likely to induce a fall in interest rates and consequently an increase in investment, which favors the resumption of real activity. From the third year, the positive effect takes a downward direction without stabilizing for all countries, synonymous with the absence of effective automatic stabilizers. The short response time reflects the sensitivity of economies to shocks affecting inflation. Moreover, since we have a non-linear model with the presence of uncertainty (standard deviation of the conditional variance), we have distinguished the effect of a positive shock and a negative shock.

The response functions of the GDP for the general model and the restricted one look the same for both positive and negative shock. In the case of Uganda, these curves are almost identical for the two models while they differ to varying degrees for the other countries. Indeed, the curve of the general model (BVAR GARCH-M) is much more pronounced than that of the restricted model (BVAR-GARCH) for these countries (Tanzania, Rwanda, Ethiopia, Eritrea, and Djibouti). This difference is attributable to the varying magnitude of the uncertainty of inflation in these countries. With regard to Benin, the analysis of the response functions of the two models remains mixed.

4   Conclusion and Economic Policy Recommendation

This paper proposes an empirical analysis of the relationship between the uncertainty emanating from the volatility of inflation and the economic growth of the East African countries. It also tackles the impact of inflationary shocks on the economic activity of the countries of the zone. The study is based on a VAR-GARCH model that can reveal, on the one hand, the different characteristics of inflation shocks in the union, and on the other hand, the links between uncertain inflation and economic growth. The results suggest the continuous persistence of inflation volatility and a very significant magnitude of the uncertainty of inflation.

Better policy direction and more accommodative stabilization policies are needed to ease tensions in the goods and labor markets and to propel the supply capacity of the economies of the union. The response of macroeconomic stabilization policies is essential to reduce the costly repercussions of the uncertainty of inflation and inflationary shocks in terms of welfare and growth. These policies are often confronted with a dilemma of minimizing the impact of inflation and unemployment.

Macroeconomic stabilization policies aimed at reducing the harmful effects of inflation can lead to rising unemployment and vice versa. Thus, the stabilization function of these policies is underpinned by the need for a perfect combination to jointly and sustainably improve unemployment and inflation. These demand policies are proving to be useful for stabilizing the domestic economy and restoring the external balance as a number of countries have implemented it in the aftermath of the global economic crisis (Darius, 2010). However, the degree of effectiveness of the response or the adoption of appropriate policy responses to inflation shocks is strongly related to the economic environment preceding these shocks.

Moreover, because of the supply-demand imbalance and the persistence of inflation volatility, it is advisable to recommend the adoption of appropriate economic policies that can minimize the gap between actual production and its potential level. . This output gap is negatively related to the real interest rate and positively to inflation. Thus, the macroeconomic policy makers of the union are required to carry out a prospective control of inflation and the output gap in order to better guard against possible shocks. They can regulate demand through productive public investment or spending and the positioning of the economy in the cycle to stabilize fluctuations in economic activity.

In addition, other recommendations to mitigate the negative impact of uncertain inflation on economic growth also relate to structural reforms to improve market flexibility and to certain industries such as agriculture and agriculture-food industries. This flexibility of the markets represents, among other things, a guarantee of protection against the uncertainty emanating from the persistence of volatility, given the almost absolute fixity constraint of the exchange rate. Similarly, it is an imperative according to Dufrénot et al. (2007) to diversify the economy, build stocks to absorb supply shocks in the agricultural sector, put in place shock protection systems and use insurance mechanisms.

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Annexes:

Table 3: Correlation of Inflation Shocks in the East African Zone from 1975 to 2017

	Kenya	Uganda	Tanzania	Rwanda	Ethiopia	Eritrea	Djibouti
Kenya	1	-0.026	-0.095	0.312	0.001	0.303	-0.063
Uganda	-0.026	1	0.211	0.109	0.062	0.076	0.255
Tanzania	-0.095	0.211	1	-0.254	0.278	0.187	0.342
Rwanda	0.312	0.109	-0.254	1	-0.141	0.310	-0.134
Ethiopia	0.001	0.0624	0.278	-0.141	1	-0.037	-0.149
Eritrea	0.303	0.076	0.187	0.310	-0.037	1	0.2030
Djibouti	-0.063	0.255	0.342	-0.134	-0.149	0.203	1

Table 4: Comparison of SIC, see equation (5)

Model	Kenya	Uganda	Tanzania	Rwanda	Ethiopia	Eritrea	Djibouti
BVAR GARCH-M	873.24	1132.69	1178.4	1118.4	1425.4	1090.7	1492.5
BVAR Standard	1054.16	1116.5	1418.1	1248.6	1545.0	1213.4	1655.4