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# Dynamics and Implication of COVID-19 Pandemic on Inflation Volatility in Selected African Countries: A Dynamic Panel Data Analysis

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**Abstract**

The unending posture of COVD 19 pandemic is given rise to concern of policymakers around the globe, of which several studies have been conducted investigating the challenges of the pandemic. Meanwhile, studies suggested the need for more investigation on the implications of COVID 19 pandemic on macroeconomic indicators which has not been exhaustively investigated. Thus, this study attempt to investigate the impact of COVID is pandemic and other variables on volatility of inflation in some selected African countries using monthly data from January 2020 to December 2020 and employed GMM estimation techniques for the data analysis. The results revealed that the number of COVID 19 cases trigger the volatility of inflation, while the COVID 19 policy measures put in place significantly reduced the volatility of consumer price index in the selected African countries. Finally, the findings implications for policymakers in the selected countries and similar countries in nature were presented in the study.

**Keywords:** African countries; Inflation; COVID 19 pandemic; Policy measures; Generalized Method of Moment (GMM).

## Introduction

The implication of COVID-19 is not only a concern for public health, but its devastating effect on the socio-economic situation around the world is apparent (Chakraborty & Maity, 2020; Habib et al. 2020; Raza et al. 2020). For instance, Sharma et al. (2020) observed that the emerging countries that are already bedeviled with slow growth rate, poor health infrastructure, and huge population where majority of them lives in extreme

poverty are greatly dealt with by the pandemic. COVID-19 and other similar pandemic are known to severely impact the human capital of the nation invaded (Odugbesan & Rjoub, 2020; Odugbesan et al. 2020; Shahzad et al. 2020). Hence, the total expenditure on healthcare becomes increasing (Odugbesan & Rjoub, 2019; 2020). Differently from the impact on human life, Nakada & Urban (2020) and Shehzad et al. (2020) opined that COVID-19 pandemic also impacted economic and social life, which gives room for the increase in the uncertainty in daily life (Caggiano, Castelnuovo, and Kima, 2020). For instance, Dunn, Hood & Driessen (2020) observed that the pandemic has brought about abrupt and severe disruptions to economic activity, among which is the "social distancing" that sharply decreased consumer spending, especially in sectors that are more sensitive to these measures. Meanwhile, consumption was observed to have collapsed during the lockdown, while at the same time, upward pressure was experienced on the real output (Apergis & Apergis, 2020). In addition, Erdogan et al. (2020) observed that the sectors that make valuable contributions to combating the pandemic were observed to experienced significant improvement during this period.

In this regard, policymakers are not only interested in the sectoral development, but also the general economy improvement. Owing to the fact that, at the time there is collective sectoral basis assessment of positive and negative development, there is possibility of making an inference that a recession has happened in all economies during the pandemic process, with attendant effect on recession exacerbation, as well as growth rates reduction that leads to economic challenges like increase unemployment and public revenue reduction. During the pandemic period, the total demand compressions, as well as the production input price reduction are positive factors for addressing inflation. Meanwhile, it is worthy to note that there was difficulty in the supply of intermediate and capital goods, which was as a result of supply chain disruption and this lead to a decrease in production. Under an ideal situation, the prices reduction was a result of the demand contraption, but if the supply reduced same as demand, prices increase may happen. Therefore, there could be a challenge of inflationary trend control owing to the imbalance between demand and supply.

The present pandemic (COVID-19) is identified as one of means through which uncertain economic policies distorted the vision for the economy, has impact on the market participants, and illustrate the global economy's interconnections (Al-Thaqeb, Algharabali, & Alabdulghafour, 2020). In addition, some studies opined that the pandemic has a significant influence on the world's supply and demand at both macro and micro levels (Ma et al. 2020; Shi et al. 2020), which resulted to business closures, government-imposed quarantines, ban on travels, curfews, that have put the world in a "Great Lockdown" with attendant effect on every sector. In addition, Coibon, Gorodnichenko, and Weber (2020) observed that labor market has drastically reduced and the effect is evident on the outputs of goods and services. For instance, COVID -19 pandemic was observed by IMF (2020) to be the most severe economic downturn ever experienced since the "Great Depression". Given the negative implications of COVID-19 pandemic on the local economies and the observed increase in the risk among the developing nations, especially the Sub-Saharan African countries, it becomes imperative to investigate inflation, owing to its direct influence on many macroeconomic variables.

Most studies during this period of COVID-19 pandemic dwell much on the influence of the policy implementation towards addressing the negative impact of the pandemic on the economy, as well as the direct impact of the Pandemic on the economic indicators, with less emphasis on the impact of the pandemic on some macroeconomic variables like inflation. Meanwhile, it is important to study the pandemic impact on each of macroeconomic variables for more robust policies in addressing the fallout of COVID-19 pandemic. For instance, during this period of pandemic, some expansionary monetary policies were initiated with the aim of alleviating the negative impact of recession. Meanwhile, the investigation of the significant impact of the pandemic on the macroeconomic variables has not been exhaustively investigated. The available view studies were concentrated on the developed nation, with less focus on developing nations. Whereas, developing nations are bedeviled with some challenges even before the broke out of the pandemic, therefore, it is expected that the arrays of measures being put in place during the COVID-19 pandemic period would have impact on the volatility of consumers' consumption pattern.

Thus, it becomes imperative to investigate the tendency of the inflation rate in the period of increasing unemployment with the view of guiding the policy makers in formulating policies that will combat the recession. In view of these, having a useful investigation on the inflation level is important to ascertain how the COVID -19 (cases) and other variables like domestic oil price and Covid-19 containment index influence inflation during pandemic. This present study will address two important questions which are: (i) Does the pandemic increase or decrease inflation rate in African countries in the midst of expansionary policies implementation? (ii) What other variables influence inflation rate during the pandemic period. Hence, the study aim is to examine the influence of COVID-19 and other determinants on inflation in selected Africa countries during the pandemic period. The choice of Africa countries is based on the nature of the countries as developing countries which were bedeviled with several economic challenges before the COVID-19 pandemic. Second, there is paucity of studies that investigate the implication of the pandemic on the inflation rate, especially in the context of SSA countries. Therefore, this present study will contribute to the literature by exploring the impact of COVID-19 and other determinants on inflation rate during pandemic period using GMM panel data estimator.

It is a fact that COVID-19 pandemic and the consequent great lockdown results increased uncertainties and changes in consumption trends. Moreover, inflation could possibly arise owing to the continuous "low touch" production and consumption. During the pandemic period, most of developing countries experienced increase of exchange rates which could be attributed to the foreign capital outflows. More so, cash in national currency were converted into reliable foreign currencies by the investors, due to unpredictability of the pandemic end time. The consequence of the uncertainty and increase of exchange rate triggers increase of production cost and aftermath price increase. In view of this, and with the intention of increasing demand, most country's government introduced monetary expansion. This is with the hope of alleviating the contraction tendencies in their economies. Whereas, a monetary expansion that is not in tandem with production increase, will leads to inflationary pressure (Erdogan et al.

2020). However, Victor et al. (2021), observed the emphasized superiority of fiscal policy measures by Keynes over monetary policy, where the government plays a role in regulating macroeconomic variables through direct government intervention. These measures as suggested by Victor et al. (2021) would directly have impact on aggregate demand via the tax rates and direct government spending adjustment. According to Abdullahi et al. (2016), a stable prices and excess capacity, where the output is determined by aggregate demand is assumed in a simple Keynesian model. It is also expected that a multiplier effect on the income level via aggregate demand would occur due to fiscal expansion. Similarly, Jahan et al. (2014) opined that monetary policy exerts short-term impact on inflation, as well as the country-wide demand for goods and services. In the inflationary period, the price levels are reduced through contractionary monetary policy that either reduced money supply or increase interest rate; and the significant issue associated with this include the time lag between the policy changes and economic outcomes.

Empirically, some studies placed much emphasis on the influence of COVID-19 pandemic on the uncertainty and spending, as well as some economic sectors that are mostly affected (Altig et al. 2020; Apergis and Apergis, 2020; Devpura and Narayan, 2020; Fu and Shen, 2020; Haroon and Rizvi, 2020; Iyke, 2020; Narayan, 2020; Salisu and Sikiru, 2020; Vidya and Prabheesh, 2020; Wang et al. 2020), with few studies investigates the implication of COVID-19 pandemic on inflation rates. For instance, Altig et al. (2020) conducted a comparative study on US and UK examining the economic uncertainty indicators like business growth uncertainty, stock market volatility, as well as GDP growth uncertainty before and during COVID-19 pandemic. The study found significant reactions of economic outcomes to the uncertainty caused by the pandemic, and concluded that volatility was observed to be on increase towards the February ending and got to the peak in the middle of March, but decline towards the end of the month, while the stock price started to recover, while a sharp decline was also noted in the industrial production during the period. Similarly, canonical epidemiology model was utilized by Eichenbaum et al. (2020) to investigate the influence of the COVID-19 pandemic on U.S. economic decisions. It was demonstrated in the study that the consumption which exacerbated the severity of the recession owing to the pandemic was cut back.

The implication of COVID-19 pandemic on consumer spending was demonstrated in the studies of Baker et al. (2020) and Dunn et al. (2020) The study of Baker et al. (2020) found an increase in the credit card spending, retail, and foods in the early period of the pandemic, but observed a sharp reduction in retail and restaurant in the following months, while a significant impact of the pandemic was found on the accommodation and restaurant in the second week of March, 2020 (Dunn et al. 2020). Moreover, the household spending pattern and their macroeconomic expectation was investigated in the study of Coibion et al. (2020) using a survey method covering about 10,000 respondents. The study revealed that about 50% of the respondents lost their income and wealth owing to the pandemic, while the respondents in addition expects a lower inflation in the long-run, foreign stocks into liquid forms of saving, and higher uncertainty. Another study by Pellegrino et al. (2020) that examined the effect of policy

uncertainty reduction on GDP in the context of European Union utilized non-linear VAR and found that pandemic has a higher impact on the economy uncertainty shocks during the periods of negative outlook in the long-run. In addition, revealed that the induced-uncertainty owing to COVID-19 pandemic on industrial production got a peak value at a loss of -15.4% "year-over-year growth" in September 2020, as well as about 1.5% decline in CPI inflation.

The changes in consumer patterns of expenditure that influenced CPI was investigated in another study (Cavalo, 2020), where the study found the inflation resulted from the pandemic in U.S. to be higher than the official CPI (see Table 1). The study concludes that while more spending on food and other categories with increasing inflation were caused by the social distancing precautions and behaviors, this measure also results to losses on transportation and related categories which experience significant deflation. The COVID-19 weights derived from the spending changes in Canada and the U.S. are generally similar. In an average basket for all the economies in the dataset, food and housing have large weights, while recreation and culture, and restaurants and hotels have small weights (Table 5). However, the adjustments to the weights of clothing and footwear and transport differ. Canada's spending changes imply a larger adjustment to the weight on clothing and a smaller adjustment to the weight on transport. This difference between the weights based on Canada and the weights based on the U.S. can have a noticeable effect on the results (Mitchell et al. 2020).

Table 1. COVID-19 Basket Weights implied by Spending Changes in Canada and the US (Global Averages)

| COICOP Division | CPI Weight, Price-updated to April 2020 | COVID-19 Weight, based on Spending in Canada | COVID-19 Weight, based on Spending in the US |
|---|---|---|---|
| 01 Food and non-alcoholic beverages | 27.1 | 38.2 | 36.7 |
| 02 Alcoholic beverages, tobacco, and narcotics | 4.0 | 5.1 | 5.6 |
| 03 Clothing and footwear | 5.3 | 2.1 | 3.9 |
| 04 Housing, water, electricity, gas and other fuels | 17.7 | 21.8 | 22.6 |
| 05 Furnishings and household equipment and maintenance | 5.4 | 5.5 | 5.0 |
| 06 Health | 4.1 | 3.9 | 2.5 |
| 07 Transport | 11.9 | 7.0 | 4.6 |
| 08 Communication | 3.5 | 3.8 | 4.4 |
| 09 Recreation and culture | 5.6 | 1.3 | 2.1 |
| 10 Education | 2.7 | 2.5 | 3.5 |
| 11 Restaurants and hotels | 6.3 | 2.8 | 3.2 |
| 12 Miscellaneous goods and services | 6.4 | 6.0 | 6.0 |

Source: Mitchell et al. (2020), and Cavallo (2020).

Similarly, the influence of pandemic on the excepted inflation and their volatility in the contest of US economy was investigated by Apergis & Apergis (2020), using swap rates. The authors argued that COVID-19 pandemic increase the inflation expectations and their volatility. This study is similar to the work of Jaravel et al. (2020) who studies the inflation dynamics at the time of pandemic in United Kingdom. The study found the inflation rate in the first month of the lock down to be 2.4% which is considered to be 10 times higher than the rate in the preceding months. Based on this, the study argued that in the preceding year, about 50% of the households experienced inflation, while the rest experienced deflation, and opined that the UK economy may be at risk of stagflation.

In the context of Switzerland, the nexus between inflation and COVID-19 pandemic was investigated by Seiler (2020), using debit card transactions. The study aimed at examining the changes in Swiss consumer price index and consumer spending, and found a higher inflation during the lockdown than the CPI inflation. Meanwhile, a sharp decline in inflation rates during the quarantine process in Canada was demonstrated in the study of Lane (2020), which was argued to be as a result of decrease in gasoline prices, travel services, as well as changes in spending. The study argued further that the fall in inflation experienced during the lockdown could be lower than the conventional CPI measure, and thus stressed the significance of the monetary policy to be future-oriented than usual.

In addition, a potential drivers and dynamics of inflation during the pandemic period were examined by Ebrahimy et al. (2020). The authors revealed inflation of the food prices in the early period of the pandemic, while no evidence of inflation was found in broader indexes. The possible government intervention impact on inflation during the pandemic period was explained in the study of Bresser-Pereira (2020). The study explained that while the monetary policy by government through the buying of securities from the Treasury for the purpose of financing exceptional spending does not against the inflation constraints, it could be in conflict with the fiscal constraints. Bresser-Pereira (2020) stressed further that excess demand that could results to imports increase, and current account deficit that could appreciate the nation currency, trigger inflation, as well as result to currency crisis would not occur from the monetary financing of COVID-19 pandemic. Meanwhile, in contrast to some findings in the literature, the investigation of consumer inflation expectation in the US during the COVID-19 pandemic by Armantier et al. (2020) found no consistent increase or decrease trend at the time the authors completed the research. But, the study opined that there is an indication of unprecedented upward trend in individual inflation uncertainty in the data. From the literature review, it is evident that there is paucity of studies that investigates the impact of COVID-19 pandemic on the inflation during the pandemic in the context of Africa countries, thus the aim of this present study to fill the gap. The remainder of the paper is structured as follows. The next section (section 2) presents the data and method employed for data analysis, while the findings and interpretation were presented in section 3. The discussion of findings and conclusions rounded up the paper in section 4 and 5.

**Methods**

This study aim is to investigate the impact of COVID 19 pandemic and other variables on the volatility of inflation during pandemic period in some selected African countries covered the period from January 2020 to December 2020. This study utilized COVID 19 number of cases as a proxy for COVID 19 pandemic which is in congruent with some studies (Albulescu, 2020; Iyke, 2020; Ma et al. 2020; Nakada & Urban, 2020). The dynamic inflation variable was proxy using consumer price index (CPI) as suggested in the literature (Bacon, 1991; Curry & Weiss, 2000; Warr, 2008). Other variables employed are real domestic oil price and COVID 19 containment and health index. The real domestic oil price was obtained from multiplication of oil price and exchange rate which is consistent with the study of (Jiménez-Rodríguez & Sánchez, 2005), while COVID containment and health index was used as a measure of policy responses to COVID pandemic (Hale et al. 2021). The COVID cases data was sourced from (Our World in Data, 2021), CPI and exchange rate data were sourced from International Financial Statistics, while oil price data was sourced from U.S Energy Information Administration database. All the variables used in the model are in logarithmic. This study used the monthly data of 18 selected African countries[1] for 2020.

In this section, first of all the tests that are necessary before estimating the model are explained, then the methodology, variables, and the model are described. The first step in the empirical analysis is performing unit root tests. For this reason, we used test such as Maddala and Wu (1999) and Pesaran (2007) panel unit root tests (CIPS). for panel unit root test. The choice of these tests is based on the assumption of MW test that is based on a simple average of the individual "Augmented Dickey-Fuller (ADF) t-statistics" of individual cross-section, while CIPS test assumes cross-section dependence which is in form of a single unobserved common factor. For the data analysis, the generalized method of moment estimator (GMM) was employed for investigating the COVID19 impact on volatility of consumer price index. The GMM is used where the specific unobservable effects of every section and lags of the dependent variables as explanatory variables are the fundamental problems in estimating the models. It is based on dynamic panel models (Barro and Lee, 1996). Linear GMM estimator in the literature of economics was first introduced by Hansen and Singleton (1982). This estimator has quickly become one of the popular econometric techniques, both in the estimation of cross-sectional data and panel data because it is very flexible and requires only weak assumptions. It is necessary to specify the instrumental variables in this approach. The consistency of the GMM estimator is based on the validity of the assumption of no serial correlation between error terms and instruments. This can be performed by the tests that were presented by Arellano and Bond (1991), Arellano and Bond (1995) and Blundell and Bond (1998). The first test that is necessary in this approach is Sargan test. It tests the validity of the instruments which are used in estimation.

The second test is the Arellano-Bond test. This test surveys serial autocorrelation in the error terms of first-order difference. In both tests, if the null hypothesis is not rejected, it

[1]. Madagascar, Mauritius, Rwanda, Uganda, Zambia, Benin, Burkina Faso, Gambia, Mali, Mauritania, Senegal, Sierra Leone, Togo, Cameroon, Bostwana, Lesotho, Namibia and South Africa

provides evidence for assumptions such as the validity of instruments and no serial autocorrelation. It is very important to note that the number of sections (N) is greater than time period (T) in this method (N>T) (Baltaji, 2008; Bond, 2002).

One method to estimate the GMM model is Arellano and Bond method (1991). Arellano and Bond suggested a first-order difference approach for stimulating the model. GMM Estimator makes it possible for researchers to eliminate the problems of serial correlation, heteroskedasticity, and endogeneity of some variables. In this method, the lags of dependent variables are used in the model to consider the dynamic effects. Dynamic relationships are modeled with inserting the lags of dependent variables as explanatory variables in the model. When the lag of dependent variables appears on the right side of equation, OLS estimators are not consistent (Hsiao et al. 1995). Thus, we should use the two-stage least squares method (2SLS) or the generalized method of moment (GMM) to estimate the model. Matyas and Sevestre (1992) believed that the 2SLS estimator may give high variances for coefficients because of the difficulty in selecting instruments, and it is possible that estimates not be statistically significant. Therefore, the GMM technique has been proposed by Arellano and Bond (1991) to solve this problem. This estimator increases the stability of estimation by reducing the sample bias.

Arellano and Bond (1995) suggested two-step GMM estimators using these conditions. As Blundell & Bond (1988) and Arellano & Bond (1995) explained, the asymptotic standard deviation for two-stage estimators has a downward bias and the one-step estimators relative to two-step estimators are asymptotically inconsistent even if the variance of the error terms is equal. Windmeijer (2005) by using Monte Carlo analysis showed that the two-stage estimator has less bias and standard error than the one-step estimator. In this research, we use the two-step estimator because it is more efficient than the one-step estimator. According to theoretical and experimental studies such as Assenmacher and Gerlach (2008), Edwards (1989), and Jalili (2014), the empirical model is as follows:

$$SCPI_{it} = \alpha + \beta SCPI_{it-1} + \theta cov_{it} + \lambda X_{it} + \varepsilon_t + \delta_i \qquad (1)$$

where :

$cov_{it}$: total covid cases for country i in period t

$scpi_{it}$:volatility of consumer price index for country i in period t

$X_{it}$:Vector of regressors and control variables, such domestic oil price and Covid-19 containment and health index[2], affecting the price.

$\varepsilon_t$: Errors terms Special effects for sections (random or fixed)

$\delta_i$: Special effects for sections (random or fixed)

[2]. This is a composite measure based on thirteen policy response indicators including school closures, workplace closures, travel bans, testing policy, contact tracing, face coverings, and vaccine policy rescaled to a value from 0 to 100 (100 = strictest)((source) COVID-19: Containment and Health Index, May 31, 2021 (ourworldindata.org))

Dynamics in the model has been shown as the lag of dependent variable with $SCPI_{it-1}$

**Results and Discussions**

Before estimating the model, it is necessary to conduct stationary tests for the variables. If the variables are non-stationary, spurious regression might occur. For this reason, we used tests such as Fisher-ADF tests of Maddala and Wu (1999) and IPS test of Pesaran (2007). These unit root analyses indicate the null hypothesis to be the presence of a unit root against the alternative of mean reversion. Two modes are employed for the unit root tests in levels and first differences by specification with trend and without trend. The results as presented in Table 2 indicate that under the Maddala and Wu test without trend, all the variables except oil price which becomes stationary after first difference are stationary at level, while the result under CIPS without trend is similar with all the variables are stationary at level except COVID containment which was found not to be stationary at both level and first difference. Meanwhile, the COVID containment and other variables were found to be stationary at level with Maddala and Wu test under specification with trend, while under CIPS, CPI and COVID-19 cases were found to be stationary at levels, while domestic oil price was found to be stationary after first difference. In summary, all the variables in this study were integrated on I(0) and I(1), and none of them is I(2), which implies that the data are valid and reliable and are good for further analysis.

Table 2. The Results of Stationary Tests for Variables in Levels and First Difference

| Specification without trend | | | | | Specification with trend | | | |
|---|---|---|---|---|---|---|---|---|
| Test variables | ADF-Fisher chi-square | ADF-Fisher chi-square | CIPS | CIPS | ADF-Fisher chi-square | ADF-Fisher chi-square | CIPS | CIPS |
| | Level | D(1) | Level | D(1) | Level | D(1) | Level | D(1) |
| loilpd | 37.434 | 167.811* | -2.140** | -1.510*** | 69.26* | 474.17* | -1.248 | -8.149* |
| lscpi | 79.048* | 97.529* | -4.020* | 0.747 | 62.95* | 77.223* | -2.559* | 2.782 |
| lcov | 715.496* | 358.465* | -4.086* | -1.662** | 308.26* | 206.68* | -4.322* | -2.372* |
| lcchi | 1019* | 490.006* | 1.772 | 0.275 | 711.86* | 322.39* | 4.217 | 1.389 |

*Significant at 1%, ** significant at 5%, *** significant at 10%. loilpd – log of domestic oil price, lscpi – log of consumer price index, lcov – log of number of covid cases, lcchi – log of covid containment and health index.

*Descriptive Statistics and Correlation Matrix Tests*

To regress the primary model, this study applied two statistical validations: statistical descriptive test and relationship matrix test. The findings of the descriptive statistical analysis are laid out in Table 3. According to Table 3, the definitive statistical test shows figures related to maximum values, minimum values, standard deviation values, mean values, and observations value, the sample overall, and between the sample countries. The findings suggest that there is an essential difference between countries and between countries. The results rationalize the implementation of the panel regression approach.

**Table 3. The Results of descriptive statistics**

| variable | Obs | Mean | Std.Dev. | Min | Max |
|---|---|---|---|---|---|
| lscpi | 216 | 0.92117 | 0.59822 | 0.00166 | 3.1127 |
| dlcov | 178 | 10.4249 | 2.85024 | 0 | 17.1421 |
| dloilpd | 216 | 9.24039 | 2.15362 | 5.66126 | 13.5172 |
| dlcchi | 195 | 3.64702 | 0.84805 | -0.65392 | 4.39383 |

Table 4 presents the relation matrix among the used independent determinants in the current study. The findings suggest there is no evidence for a high relationship between volatility inflation and economic determinants. Therefore, this study can proceed with the estimation of other determinants; the scale of relationship is acceptable between and within the used variables. Overall, the analysis can be taken into consideration as a safe estimation from the multicollinearity issue.

**Table 4. The Results of Correlation**

| | lscpi | dlcov | dloilpd | dlcchi |
|---|---|---|---|---|
| lscpi | 1.0000 | | | |
| dlcov | -0.2247 | 1.0000 | | |
| dloilpd | -0.1665 | -0.3140 | 1.0000 | |
| dlcchi | 0.0043 | 0.6851 | -0.6944 | 1.0000 |

In reference to Equation (1), this study examines the effects of COVID cases on the volatility of CPI for selected Africa countries. In this model, domestic oil price and COVID containment and health were used as control variables for analysis. The lag of price that reflects the dynamics of the model and is used in GMM method was inserted as an explanatory variable in the model. The results of the model's estimation using the generalized method of moments are presented in Table 5.

**Table 5. The Results of GMM Estimation**

| **CPI : Dependent variable** | | | | |
|---|---|---|---|---|
| **Variable** | **coefficients** | **Std. Error** | **z-Statistic** | **Probability** |
| dLscpi(-1) | 0.73441 | 0.081228 | 9.04 | 0.000 |
| dlcov | 0.07249 | 0.015950 | 4.55 | 0.000 |
| dloilpd | -0.00857 | 0.014613 | -0.59 | 0.557 |
| dlcchi | -0.20678 | 0.104671 | -1.98 | 0.048 |
| CONS | 0.35319 | 0.395731 | 0.89 | 0.372 |
| **Number of instruments** | | | | **14** |
| **No of groups** | | | | **18** |
| **Test** | | **Value** | | **Probability** |
| Sargan test | | 13.49 | | 0.142 |
| Arellano- Band test for | AR(1) | -2.70 | | 0.007 |
| autocorrelation | AR(2) | -0.39 | | 0.698 |

From the results presented in Table 5, we found *dlcov* to have a positive and significant impact on the volatility of CPI. This is an indication that a percentage change in number of COVID-19 cases holding all other variables constant will significantly increase the volatility of CPI by 0.07% at less than 1% confidence level. This implies that COVID-19 changed consumers' spending patterns, as well as changes in demand patterns during the pandemic. Meanwhile, our analysis shows *dlcchi* to have a negative and significant impact on volatility of CPI. The result as presented in Table 4 indicate that a percentage increase in COVID-19 containment decrease volatility of CPI in the selected African countries holding all other variables constant by 0.21% at 5% confidence level. However, the significance of domestic oil price as a determinant of CPI volatility during pandemic period could not be established. Subsequent to the analysis, some tests were observed to ensure that estimates from the analysis are devoid of bias. As presented in Table 4, Sargan test shows that the assumption of the presence of any correlation between the instrumental variables and residuals is rejected. Based on this test, instrumental variables used in the model are valid. To ensure the absence of serial autocorrelation of first-order difference in residuals, the first and second order serial autocorrelation test proposed by Arellano and Bond (1991, 1995) is used. The null hypothesis of this test is the absence of serial autocorrelation which should be greater than 5% in the second order and less than 5% in the first order. Based on the results mentioned above, the null hypothesis, no second-order serial autocorrelation in residuals of first order difference, is not rejected. Therefore, the method of estimation is suitable for this model. Additionally, the first order autocorrelation probability is less than 5% and the null hypothesis of the test is rejected. The results of the observations are compatible with the research of Arellano and Bond (1991). According to the results in Table 5, as we expected, the lag of volatility of inflation to have a positive and significant effect on the volatility of inflation; this result implies the dynamics of the volatility of inflation over time, so volatility of inflation in the current period will be extended to the next period. This means that increase of the inflation volatility in the previous period increases the inflation volatility in the current period.

To check the robustness of our results we used fixed OLS and random OLS estimation. The coefficient estimates in GMM seem to be fairly robust across different estimation techniques in terms of signs and statistical significance.

| Table 6a, Random effect regression result | | | | | |
|---|---|---|---|---|---|
| llscpi | dlcov | dloilpd | dlcchi | CONS | |
| 0.69832* | 0.69832* | -0.00368 | -0.08887 | 0.32328 | |
| Table 6b, fixed effect regression result | | | | | |
| llscpi | dlcov | dloilpd | dlcchi | CONS | |
| 0.48672* | 0.06751* | -0.26767 | -0.33859 | 3.51249 | |
| Hausman test<br>Efficient estimator | | FE-RE | | | |
| $\chi^2$ (Prob > $\chi^2$) | | 167.47(0.060) | | | |

* significant at 1%, ** significant at 5%, *** significant at 10%

However, in order to obtain a single voice in terms of price elasticity, the Hausman test is employed to ascertain the preferred estimator. Under the null hypothesis ($H_0$) of the Hausman test, there is no systematic difference between the designated efficient estimator and the designated consistent estimator. Non rejection of $H_0$ implies that the designated consistent estimator is consistent but the designated efficient estimator is both efficient and consistent and thus is the preferred estimator. Rejection of $H_0$ however implies that the designated efficient estimator is inconsistent which makes the consistent estimator the preferred estimator. From Table 6 it can be inferred that the RE-OLS estimator is preferred to the FE-OLS estimator.

**Conclusions**

Though, studies abound on the COVID-19 pandemic and associated challenges, but the studies that investigate the impact of COVID-19 pandemic on individual macroeconomic variable like inflation are scant, especially within the context of Sub-Saharan Africa countries. Therefore, this present study aimed at filling the gap by examining the effect of COVID-19 pandemic on the volatility of inflation during the pandemic period in selected African countries (Madagascar, Mauritius, Rwanda, Uganda, Zambia, Benin, Burkina Faso, Gambia, Mali, Mauritania, Senegal, Sierra Leone, Togo, Cameroon, Bostwana, Lesotho, South Africa) for the period between January 2020 to December 2020. This study applied GMM technique to achieve a valid estimation being one of the efficient dynamic panel data estimator. In addition, to ensure the robustness of the estimates, static panel data estimators (fixed and random effect OLS) were utilized. This is with the aim of ensuring that the inference from the estimates will be sound and devoid of any methodological error.

In reference to the empirical results from this study, it is evident that COVID-19 pandemic trigger the inflation volatility during the period under study. This finding is consistent with similar previous studies. For instance, Apergis & Apergis, 2020 and Cavalo, 2020 (US economy), Jaravel et al. 2020 (UK), and Seiler, 2020 (Switzerland). These studies argued that the COVID-19 changes the consumer spending pattern and demand during the pandemic period. In addition, the increase in inflation during the pandemic in selected African countries could be as a result of some monetary policy measures introduced during the period to cushion the pandemic effect. Meanwhile, our finding is contrast to the position of Lane (2020) who found a decrease in the inflation rate during the pandemic period in Canada. Though, the finding is not surprising, because most of African countries economies are known for relying on "consumption-driven growth" and "service sectors" job, hence any adverse shock like the COVID-19 pandemic is expected to trigger the inflation. Moreover, this present study demonstrates that during the pandemic period in the selected African countries, the containment measures put in place contributes significantly to the reduction in the volatility of inflation during the period.

From the findings of this present study, we have been able to contribute meaningfully to the literature by providing answers to some salient questions that remain unanswered especially in the African context in respect of knowing if the pandemic increase or decrease the inflation during the pandemic period in African countries; and also, to

know what other factor contributes significantly to the volatility of inflation during this period. Hence, this study demonstrated that while COVID-19 trigger the volatility of consumers' consumption pattern during the pandemic period, the containment measures drives down the inflation during same period. These findings address some observed gaps in the literature and constitute the novelty of our study.

Based on the findings from this study, the pandemic is no doubt has brought a severe recessionary trend in the economy of some African countries. During this period, the fall in economic growth is observed with an increase inflation rate. Thus, it becomes imperative for policymakers in Africa countries to develop self-sufficient strategies in most of economic sectors in case of any global disasters. The policies to be put in place should be both short and medium-term policies that will ensure faster recovery and long-term stability of the economy. Though, the influence of external shocks cannot be totally eliminated, but some critical sectors that are germane in time of disaster should be initiated and supported. In addition, an aggressive direct spending strategy could be adopted by the African countries government to keep the consumption demand high, which will enable a fillip to the production sector.

Though, our study finding provide evidence to argue for the detail investigation of COVID-19 impact on specific macroeconomic factors, and address the gap of paucity of studies in this regard in the context of Africa, our study has some limitations. The limitations lie in the limited number of determinant variables employed in the study, and the paucity of data to cover large number of African countries. Therefore, this study suggests that further studies should investigate other determinant factors of inflation to ascertain their effect during the pandemic period, as this will address possible variable omitted error, as well as expand the countries in the panel for a more robust and generalized results.

**List of abbreviations**

| | | |
|---|---|---|
| ADF | - | Augmented Dickey Fuller |
| CPI | - | Consumer Price Index |
| GDP | - | Gross Domestic Products |
| GMM | - | Generalized Method of Moment |
| SSA | - | Sub-Saharan Africa |
| UK | - | United Kingdom |
| US | - | United State |

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