COVID-19 policy responses, inflation and spillover effects in the West African Economic and Monetary Union

Seydou Coulibaly

African Natural Resources Centre, African Development Bank, Abidjan, Côte d’Ivoire

Correspondence
Seydou Coulibaly, African Development Bank, CCIA Bldg, Ave Jean-Paul II, 01 BP 1387, Abidjan 01, Côte d’Ivoire.
Email: s.coulibaly@afdb.org

Abstract
This paper contributes to the emerging literature on the socioeconomic impacts of the coronavirus disease 2019 (COVID-19) pandemic by using a panel fixed effects model for estimating the impact of government policy responses to the pandemic and their spillover effects on the consumer price index for West African Economic and Monetary Union (WAEMU) countries over the period January 2019–July 2020. Across various robustness checks, the OLS and IV regressions provide three major pieces of evidence. First, the COVID-19 confirmed cases positively affect the consumer price index while the overall government policy responses index has a negative impact on the consumer price index. Second, we find that government accommodative policies to COVID-19 in other countries has a positive and statistically significant impact on the host country's consumer price index. Finally, the findings indicate that world food prices and oil prices positively affect the consumer price index. These results suggest that policymakers may consider intensifying the implementation of public policies in response to the pandemic for preserving the stability of prices when the sanitary situation of the COVID-19 deteriorates. While confirming that international prices are among the key drivers of inflation in WAEMU countries, our findings also reiterate the importance of regional cooperation and coordination for fighting the adverse socioeconomic impacts of the COVID-19 pandemic.

1 | INTRODUCTION

The outbreak of the coronavirus disease 2019 (COVID-19) has caused major disruptions of global value chains and economic recession in Africa (AfDB, 2020; Ozili, 2020) and more specifically in the West African Economic and Monetary Union (WAEMU) zone (Bouraima et al., 2020). As part of their responses to the COVID-19 crisis, governments of WAEMU countries have implemented social distancing measures for containing the spread of the virus. The WAEMU countries’ package of policy responses to COVID-19 also includes economic support measures aimed at easing the financial burden of the pandemic on businesses and the most vulnerable households (Levy et al., 2020).

However, the government policy responses to the COVID-19 pandemic and the COVID-19 disease itself may have undesirable effects on consumer prices (Banerjee et al., 2020). In fact, the injection of liquidity into economies for supporting liquidity-constrained firms and households may increase the quantity of money in circulation in the economy. This may cause excess demand and therefore stimulate inflation (Blanchard, 2020). In the same vein, the panic following the detection of the first confirmed case of COVID-19 coupled with uncertainties about the pandemic...
and the speed of the spread of the virus may generate panic buying of various goods including toilet paper, oil and food and thereby stimulate inflation (Ebrahimy et al., 2020). However, the collapse in commodity prices combined with stumbling oil prices, and a depressed labour market due to anti COVID-19 measures (social distancing) is likely to decrease the consumer price index (CPI). Overall, the theoretical impact of the pandemic on inflation is ambiguous, something which should motivate the estimation of the empirical impact of COVID-19 on consumer prices to inform policy responses to the pandemic.

Yet, the emerging literature on the socioeconomic impacts of COVID-19 (Ayittey et al., 2020; Breisinger et al., 2020; Gondwe, 2020; Levy et al., 2020; Ozili, 2020) has so far remained relatively silent about the impact of the pandemic on the general level of prices for African economies, including WAEMU economies. This is surprising because inflation in the WAEMU economies is likely to be affected by the COVID-19 pandemic due to variations in both demand and supply of goods and services from the disruption of global supplier chains and increases in unemployment caused by the COVID-19 crisis. To our knowledge, there are two studies on the economic impacts of the pandemic, including effects on inflation, for African economies (ECA, 2020a; Kinda et al., 2020). However, the studies of ECA (2020a) and Kinda et al. (2020) have not analysed the role played by the spillover effects from government responses to COVID-19 in other countries in the variation of the CPI in the host country. Basically, the domestic responses to the COVID-19 pandemic may cause spillover effects in other countries through the economic spillovers across the economic blocs (Kohlscheen et al., 2020) due to the economic and trade interdependencies between countries of the same economic bloc.

The paper fills an important gap in both the literature on the socioeconomic impacts of COVID-19 and the literature on the determinants of inflation, because, to our knowledge, this is the first paper that estimates the impact of policy responses to COVID-19 and COVID-19 confirmed cases on inflation for a panel of African economies. The analysis of the major drivers of inflation in the context of the COVID-19 crisis would be of particular interest to the monetary authorities of WAEMU countries because the main objective of the monetary policy in the WAEMU zone is to ensure price stability. The target inflation rate for WAEMU countries ranges between 1% and 3%.

The inflation rate in the WAEMU zone, year-on-year growth, was 1.2% in the first quarter of 2020, while, it was −0.6% for the last quarter of 2019 and −0.7% for the year 2019 (BCEAO, 2020b). In the second quarter of 2020, the inflation rate in WAEMU countries was 1.7%, while it was 1.2% in the previous quarter. During the second quarter of 2020, Benin recorded the highest inflation rate in the WAEMU zone with an inflation rate of 3.1%. This rate is above the zone’s target level of inflation (3%). In the same dynamics, Côte d’Ivoire, Niger and Senegal recorded inflation rates of 2.5%, 2.6% and 2.7% respectively. These national inflation rates are close to the upper limit of the target interval of the inflation rate in the WAEMU zone (BCEAO, 2020b). In the countries of the West African sub-region that are the WAEMU countries’ main trading partners, inflationary pressures exacerbated in 2020. In Nigeria, the inflation rate (on a year-on-year basis) jumped to 12.3% in March 2020 from 12.0% three months earlier. Similarly, in Ghana, the inflation rate increased from 7.8% in the first quarter of 2020, and 7.9% at the end of December 2019% to 11.2% in the second quarter of 2020 (BCEAO, 2020b).

The growth of the inflation rate in the WAEMU zone is stimulated by increases in food prices observed in almost all countries in the zone due to disruption of supply chains caused by the implementation of anti COVID-19 measures. The CPI for food raised from −1.8% in 2019% to 1.5% in the first quarter of 2020% and 3% in the second quarter of 2020 (BCEAO, 2020b). In sum, the inflationary pressures have exacerbated with the outbreak of the COVID-19 pandemic in the WAEMU zone. The inflation has even attained a level beyond the upper bound level for the inflation target of the zone during the second quarter of 2020 in Benin.

The control of inflation is imperative to safeguard the capacities of government to mobilise financial resources from financial markets for financing the government policy responses to COVID-19 as the pandemic evolves. Indeed, a high rate of inflation reduces the net yield of bonds and consequently discourages investors from buying government bonds. The evolution of inflation needs to be monitored in the WAEMU countries because when consumer prices increase, this erodes the purchasing power of households and thereby increases their demand of financial transfers from governments, in an era of downward government revenue pressures due to the COVID-19 crisis.

The remainder of the paper is structured as follows: Section 2 examines the literature on inflation theories and the literature on the impact of COVID-19 on inflation. Section 3 explores the transmission mechanisms of the COVID-19 crisis into inflation. Section 4 examines the stylized facts in the COVID-19 crisis and inflation for WAEMU countries. Section 5 elaborates the empirical strategy and describes the data used to estimate the impact of policy responses to COVID-19 on inflation. Section 6 presents and analyses the estimation results and checks the robustness of these results. Section 7 concludes the study.
The monetarist theory of inflation defends that inflation is always a monetary phenomenon resulting from an exogenous increase in money (Friedman, 1956). The modern version of the quantity theory argues that monetary policy affects the level of unemployment in the short run and determines inflation in the long run (Friedman, 1968). According to the defenders of the monetarist theory of inflation, the general price level increase due to increases in the supply of money for a constant level of output. The quantity theory of money focuses on the role of money and ignores the nonmonetary factors that might affect the general price level. Accordingly, alternative theories of inflation have been developed to complement the monetarist theory of inflation (modern theories of inflation).

The modern theories of inflation are articulated around the determination of prices through market forces. These theories suggest that the general price level is determined by aggregate demand and aggregate supply of goods and services. The variations in the general price level are explained by a change in one or both demand-side factors (demand-pull factors) and the supply-side factors (cost-push factors).

The Keynesian theory emphasizes that inflation results from an excessive aggregate demand in real terms at a full employment level. The post-Keynesians put forward that money supply is endogenous, and inflation is caused by the inconsistency of the desired real wage of workers and the targeted markup of firms (Lavoie, 1992). Although recent studies from post-Keynesian authors indicate that external factors could generate inflation (Vera, 2010; Vernengo, 2003), many post-Keynesian inflation models, however, have ignored open economy considerations (Charles & Marie, 2016).

The structuralists’ theory of inflation takes into account open economy matters to document that inflation has its drivers in the supply side (Sunckel, 1958). Structuralists emphasize that the structural dependence on capital imports and the lack of foreign reserves raise recurrent balance-of-payments problems for developing countries. These authors consider shocks to the terms of trade and the national currency depreciation as the main factors that trigger the inflationary problem.

The global supply chains have been disrupted by the COVID-19 pandemic—something that has caused a shock to the terms of trade and the nominal exchange rate and thereby affected inflation for developing countries, as emphasized by the emerging empirical literature on the socioeconomic impacts of COVID-19. Ebrahimy et al. (2020) empirically analyse the dynamics of inflation during the COVID-19 pandemic. They find an increase in food prices during the lockdown phase of the pandemic for advanced and emerging market economies, whereas there is no evidence of increases in the general price level.

The preliminary estimates from the Economic Commission for Africa indicate that the COVID-19 pandemic is putting downward pressure on commodity prices, foreign exchange, and domestic demand for African economies (ECA, 2020b). In a similar context, Fan (2003) found that the outbreak of the severe acute respiratory syndrome (SARS) epidemic reduced inflation through cuts in demand and accelerated deflationary pressure in China.

Haussmann (2020) draws attention to the fact that there are risks that developing countries will experience inflationary pressure in their efforts to contain the propagation of COVID-19. In fact, these countries may resort to seigniorage or other monetary stimulus and liquidity facilities for financing their anti COVID-19 measures (IMF, 2020, p. 1). This situation may generate inflationary pressures.

Using a computable general equilibrium model calibrated with data from a social accounting matrix including 17 economic sectors for the year 2015, Kinda et al. (2020) simulate the economic impacts of COVID-19 for the economy of Burkina Faso. They find that the COVID-19 pandemic will increase consumer prices, especially agricultural prices (+6%) and the price of catering (+4%) in Burkina Faso.

The main channels through which the COVID-19 crisis may affect inflation are depicted in Figure 1. The COVID-19 pandemic could affect the inflation rate through its impact on income and demand (Abay et al., 2020). The government responses to the pandemic—including market closures, social distancing measures and curfews—will reduce households’ income and thereby affect their demand for services, including transport, restaurants and entertainment. Many landlords could face late payments of rent due to the loss of income of some tenants. The economic recession caused by
the COVID-19 crisis could affect profits and reduce returns on investments for business owners. The social distancing measures as well as lockdowns in Europe, Asia and USA will reduce remittances sent home by African migrants (World Bank, 2020). In addition, job losses will decrease monetary transfers to the most vulnerable households. Losses in household incomes will affect demand for goods and services and could result in changes in prices.

The impact of the COVID-19 crisis on prices may transit through disruptions in production and global supply chains. The pandemic has slowed down economic activity, namely production in China and in Europe, and thereby disturbed global supply chains. Since developing countries import a large share of intermediary goods from developed countries for their industries, disruptions of supply chains may reduce production and aggregate supply and affect consumer prices in developing countries.

The crisis has also reduced demand for commodities and reduced commodity prices. The collapse in commodity prices translates into decreases in income for farmers in developing countries and thereby less household demand. Furthermore, the fall in commodity prices negatively affects exports revenue and may translate into a trade deficit which will depreciate the national currency (with respect to the US dollar) and finally raise domestic prices through increases in prices of imported products.

In sum, as developed above, the impact of the COVID-19 crisis on inflation is uncertain because the pandemic exerts a simultaneous double shock on demand and supply that can tilt the balance towards higher prices or lower prices. This complicates the prediction of the impact of the COVID-19 crisis on consumer prices.
In June 2020, the central bank of WAEMU countries lowered its policy rate from 2.50% to 2.00% to reduce the cost of credit to commercial banks for reducing the cost of credit to households and businesses. This could increase the quantity of money in circulation in the economy and therefore stimulate inflation (Abango et al., 2019; Fadiran & Edun, 2013; Ndung’u, 1994).

4 | COVID-19 AND INFLATION IN WAEMU: STYLIZED FACTS

We examine trends in CPI and trends in the epidemiology of the COVID-19 pandemic from January 2019 to July 2020 for exploring the inflationary or deflationary nature of the pandemic in WAEMU countries. Although the trend in CPI was increasing before the COVID-19 outbreak, the CPI has sharply increased over the early months of the pandemic while COVID-19 confirmed cases was increasing exponentially in WAEMU countries (Figure 2). These observations suggest a positive correlation between the CPI and the COVID-19 confirmed cases.

The government policy responses to the pandemic are likely to affect prices due to their double impact on supply and demand for goods and services. For measuring the government policy responses to the COVID-19 pandemic, we use the overall COVID-19 government response index developed by Hale et al. (2020) based on different government interventions through containment, sanitary and economic measures. The index ranges from the least (0) to the most (100) intense COVID-19 policy responses (Hale et al., 2020). Figure 3 shows that the CPI is relatively large for WAEMU countries (Côte d’Ivoire, Senegal, Togo) that have intensified the introduction of anti-COVID-19 policy measures, suggesting that government responses to the pandemic may have caused upward pressures on prices. However, WAEMU countries like Burkina Faso, Benin and Mali have almost the same intensity of policy responses to COVID-19 as Côte d’Ivoire, Senegal and Togo. But the former countries have recorded much lower levels of CPI compared to the levels of CPI for Côte d’Ivoire, Senegal and Togo (Figure 3). This observation challenges the hypothesis that government responses to COVID-19 may cause inflation. However, the graphical analysis does not allow the determination of the impact of government policy responses to the pandemic on inflation. We therefore undertake an econometric analysis to determine the impact of government policy responses to COVID-19 on CPI for WAEMU economies.

5 | METHODOLOGY AND DATA

The baseline empirical model specification used in this paper draws upon the generic empirical specification proposed by Goldberg and Knetter (1997) and used by Diop et al. (2008) to estimate the long-run determinants of inflation in WAEMU. Basically, the empirical model is derived from the modern theories of inflation which suggest that inflation depends on market forces guided by goods and services prices. We specify an empirical model inspired by the modern theories of inflation instead of specifying a baseline empirical model derived from the monetary theory of inflation because in the WAEMU zone, inflation is less likely to come from monetary policy actions (Diop et al., 2008; Kireyev, 2015;
Nubukpo, 2007). In fact, the constraints on domestic credit creation for financing public deficits (Diop et al., 2008; Fernández and Gerling, 2011) and the overliquidity of banks and credit rationing observed in the WAEMU zone over the last two decades (Cabilliac & Rocher, 2013; Nubukpo, 2007) suggest a weak reaction of market interest rates and inflation to monetary policy actions (Kireyev, 2015). This motivates Nubukpo (2007) to argue that money is not the main determinant of inflation in the WAEMU zone. Consequently, the following panel fixed effects model articulated around demand-pull and cost-push factors is specified to estimate the impact of government policy responses to COVID-19 on CPI:

\[
\log(CPI)_{it} = \delta \text{Cases}_{it} + \beta \text{Govt}_{it} + \gamma W(\text{Govt})_{it} + \phi P_{it} + \vartheta_i + \mu_t + \epsilon_{it},
\]

where \((CPI)_{it}\) is the consumer price index for country \(i\) in the month \(t\); \(\text{Cases}_{it}\) stands for the number of confirmed COVID-19 cases for country \(i\) at the month \(t\); \((\text{Govt})_{it}\) is the government policy responses to the COVID-19 crisis for country \(i\) at the month \(t\); \(W(\text{Govt})_{it}\) represents the spillover effects from government policy responses to COVID-19 in other countries. Following the literature on the determinants of inflation, we include a vector of prices \((P_{it})\) including oil prices and food prices as control variables in the baseline specification (BCEAO, 2020a, Diop et al., 2008; Goldberg & Knetter, 1997).

\(\vartheta_i\) captures the country fixed effects; \(\mu_t\) is the month time dummy, and \(\epsilon_{it}\) is the usual idiosyncratic error term. The country fixed effects in Equation (1) control for the effect of time-invariant heterogeneities across countries, while the monthly time dummies capture aggregate trends in CPI.

### 5.1 Spillover effects in government responses to COVID-19

Given that the COVID-19 pandemic is a global crisis, studies on the economic impacts of the pandemic may overlook potential regional effects because the economic spillovers across the economic blocs tend to be large in the context of COVID-19 (Kohlscheen et al., 2020). We take on board these considerations in the baseline specification (Equation 1) by including among the explanatory variables the average government policy responses index for the other countries weighted by the inverse geographic distance. In fact, COVID-19 social distancing measures enforced in Burkina Faso, Niger and Mali have reduced the possibilities for the exporters of cattle to collect many sheep and beef for exporting them to Côte d’Ivoire. This has caused upward pressure on the prices of cattle and meat in the neighbouring country Côte d’Ivoire.

Technically, as highlighted by LeSage and Pace (2009), ignoring spillover effects in government policy responses to COVID-19 between economies is likely to create a bias in the estimation of the socioeconomic impacts of the COVID-19 crisis. To our knowledge, this is the first empirical study that takes into account spillover effects in the estimation of the economic impact of COVID-19 for developing countries. The rationale behind using the geographic distance weighting matrix is related to the fact that spillover effects tend to be more pronounced for geographically close countries because—due to the relative lower cost of transport—goods, services, people and capacities are highly mobile between geographically close countries.

We compile a data set on CPI, government responses to the pandemic and COVID-19 confirmed cases for the WAEMU countries. The monthly data on CPI are directly extracted from BCEAO’s Economic and Financial database.

### 5.2 COVID-19 related variables

Data on the total number of COVID-19 confirmed cases have been retrieved on a daily basis from the Oxford COVID-19 Government Response Tracker (OxCGRT) data set for the period 1 March 2020–31 July 2020. The number of daily new cases is aggregated to create monthly confirmed cases for each country. This allows us to link the monthly CPI data with COVID-19 cases and indicators for government policy responses to the pandemic.

The OxCGRT data set is compiled by the University of Oxford (Hale et al., 2020). The researchers from Oxford University assemble information on government responses to COVID-19 across countries over time from national and publicly available sources, including news articles and government press releases and briefings. They use this information to construct series of composite indices that aggregate three major dimensions of government responses to COVID-19, including containment measures, economic support measures and health measures collected daily over the COVID-19 propagation period. The overall government response index combines the three dimensions of government responses to the COVID-19 pandemic, including social distancing, health and economic measures. The indices, which range from 0 to 100, describe variation in government responses to COVID-19, with higher (lower) values corresponding to more (less) intense responses. For running econometric regressions, the daily government
responses score is aggregated using arithmetic averages to create monthly scores of government policy responses to COVID-19 for each country.

5.3 | Oil prices and food price index

We collect monthly data on oil prices in dollars per barrel from Thomson Reuters available through the US energy information administration (EIA) open data application programming interface. The monthly data on food price indices are extracted from the Food and Agriculture Organization of the United Nations (FAO).

Because Guinea Bissau is not among the countries in the main data source for COVID-19 cases and government policy responses, our final data set includes seven countries (all the WAEMU countries except Guinea Bissau). The period of analysis is 19 months, starting from January 2019 to July 2020.

5.4 | Descriptive statistics

For the sample under investigation, the descriptive statistics for the main variables used in the quantitative analysis are reported in Table 1. The average CPI is 103.2 with a maximum of 107.59 observed for the month of June 2020 in Côte d’Ivoire. The average number of COVID-19 confirmed cases as of the end of July 2020 is 529 with the maximum COVID-19 confirmed cases of 15,978 observed in July 2020 in Côte d’Ivoire. On a scale of 0 to 100, the average value of the index for the government policy responses to COVID-19 is 14.5 with the highest value equal to 76.28 observed in Senegal in April 2020. Senegal intensified the implementation of policy responses to the pandemic early, probably because it was the WAEMU country that recorded the first confirmed case of COVID-19.

6 | RESULTS AND DISCUSSIONS

6.1 | Main results

The baseline specification of the paper (Equation 1) is estimated with fixed effect ordinary least square estimator with Driscoll–Kraay standard errors. Following Abay et al. (2020), we transform monthly COVID-19 confirmed cases by using the inverse hyperbolic sine transformation (IHS). This allows us to interpret the estimated coefficients as elasticities for the regressor COVID-19 confirmed cases.

| Variable                              | Observations | Mean  | SD     | Min  | Max     |
|---------------------------------------|--------------|-------|--------|------|---------|
| CPI                                   | 133          | 103.193 | 2.1257 | 98.3 | 107.59  |
| COVID-19 confirmed cases              | 133          | 528.7594 | 1944.047 | 0   | 15978   |
| Government COVID-19 policy responses  | 133          | 14.4494 | 24.8689 | 0   | 76.28   |
| Containment and health measures       | 133          | 15.6244 | 27.0851 | 0   | 81.06   |
| Economic support index                | 133          | 7.9887  | 18.9283 | 0   | 75      |
| Other countries’ COVID-19 policy responses | 133      | 14.6652 | 24.6673 | 0   | 65.859  |
| Oil prices                            | 133          | 49.74789 | 12.6162 | 16.55 | 63.86   |
| Food price index                      | 133          | 95.17073 | 2.9561 | 90.9858 | 102.5194 |
| Learning                              | 133          | 6.6691  | 18.5226 | 0   | 85      |
| Nominal exchange rate US$/FCFA        | 133          | 588.1068 | 9.2036 | 570.993 | 603.901 |

Abbreviations: COVID-19, coronavirus disease 2019; CPI, consumer price index; SD, standard deviation.
The estimation results show that the number of COVID-19 confirmed cases positively affects CPI while the overall government policy responses index has a negative impact on CPI (Table 2). The positive impact of COVID-19 confirmed cases on CPI could be explained by the fact that as the number of COVID-19 confirmed cases increases, people may increase their demand for health goods and services including masks, hydroalcoholic gels, and soaps to protect themselves from the virus. In addition, the pandemic peaked demand for ICT and delivery services. At the same time, disruption in the global value chains and increases in the number of COVID-19 cases may reduce labour supply and therefore reduce the supply of goods and services. The combination of these factors may explain the positive impact of COVID-19 cases on CPI.

The estimation results indicate that the overall government policy responses index has a negative and statistically significant impact on CPI (Table 2), suggesting that the intensification of government responses to the pandemic could help to control inflation. An increase of 1% in the index for government responses to COVID-19 is likely to reduce CPI by 0.05% (Table 2, Column 1). This result could be explained by the fact that governments have responded to the crisis by increasing social transfers to households and by supporting firms for maintaining production. The governments have supported demand through cash transfers to the most vulnerable households. The governments have also provided financial support to enterprises to encourage them to produce for a prompt economic recovery. The combination of these public interventions may have created a net negative impact on consumer prices for WAEMU countries.

The estimation results show that government policy responses to COVID-19 in other countries have a positive and statistically significant impact on the host country’s CPI (Table 2, Columns 1 and 3). The magnitude of the positive impact of the spatially lagged COVID-19 policy responses variable (0.0035) is higher than

| Table 2: Policy responses to COVID-19 and CPI in WAEMU |
|---------------------------------|------|------|------|
|                                | (1)  | (2)  | (3)  |
| Log (CPI)                      |      |      |      |
| IHS (Covid-19 cases)           | 0.0013*** | 0.0014*** | 0.0009** |
|                                | (0.0004) | (0.0004) | (0.0004) |
| COVID-19 policy responses      | −0.0005*** |      |      |
|                                | (0.0001) |      |      |
| IHS (other countries’ COVID-19 policy responses) | 0.0035*** | 0.0014 | 0.0037*** |
|                                | (0.0011) | (0.0011) | (0.0011) |
| Log (oil price)                | 0.0021 | 0.0114** | 0.0030 |
|                                | (0.0029) | (0.0045) | (0.0032) |
| Log (food price index)         | 0.0581** | 0.0657** | 0.0567** |
|                                | (0.0220) | (0.0277) | (0.0222) |
| IHS (income support)           | −0.0035** |      |      |
|                                | (0.0016) |      |      |
| Containment health index       |      |      | −0.0004*** |
|                                |      |      | (0.0000) |
| Observations                   | 133  | 133  | 133  |
| R-squared                      | 0.430 | 0.404 | 0.426 |
| Number of countries            | 7    | 7    | 7    |

Note: Robust standard errors in parentheses.
Abbreviations: COVID-19, coronavirus disease 2019; CPI, consumer price index; IHS, inverse hyperbolic sine transformation; WAEMU, West African Economic and Monetary Union.

* p < .1.
** p < .05.
*** p < .01.
the magnitude of the direct negative impact of the same variable (0.0005) on CPI, suggesting that domestic policy measures for fighting COVID-19, which are adopted and implemented on a unilateral basis, may not be sufficient for addressing the COVID-19 related inflation issues at country level. These results underscore the importance of adopting a regional approach to fight against the harmful socioeconomic effects of the COVID-19 pandemic.

We disaggregate the overall index for accommodative public policies for responding to the COVID-19 pandemic into its major components to better understand their respective specific impact on consumer prices. In that regard, in Column 2 of Table 2, we test the impact of containment and health measures on CPI. The main result from the paper remains unchanged when the overall index for government policy responses to the pandemic is broken down into several major categories of measures. We find that the index of containment and health measures has a negative impact of CPI (Table 2, Column 2). The estimation results indicate that government economic support measures tend to mitigate inflationary pressure for WAEMU countries (Table 2, Column 3). These results urge policymakers to consider temporarily waiving taxes and custom duties on COVID-19 related medical products as well as expediting the execution of financial transfers to households and the financial support to firms to stimulate the aggregate supply for preserving the stability of prices when the epidemiologic situation of COVID-19 deteriorates.

The estimation results show that food prices have a positive and statistically significant impact on CPI (Table 2), suggesting that an increase in food prices will significantly increase the CPI in WAEMU countries. This result corroborates the conclusion of the study report from the central bank of the WAEMU countries (BCEAO, 2020a) indicating that food prices have been the major drivers of upward trends in inflation rate observed in the WAEMU countries since the year 2019 to June 2020. Similarly, the estimation results show that international oil prices have a positive impact on CPI (Table 2, Column 2). This result suggests that the collapse in oil prices is likely to reduce CPI in WAEMU countries because all these countries are net importers of oil and petroleum products.

### 6.2 Robustness check

#### 6.2.1 Endogeneity of the government policy responses to the COVID-19 pandemic

In the baseline regression (Equation 1), the index for government policy responses to COVID-19 could be endogenous due to reverse causality from inflation to government policy responses and the potential measurement error in the index of government responses to COVID-19. In fact, the macroeconomic situation and, more specifically, the trend in inflation rate may influence the elaboration of the government’s package of policy responses to the pandemic, suggesting a potential reverse causality from CPI to government policy responses to COVID-19. Given that the government responses to the pandemic is multiform and multisectoral and therefore difficult to capture through an aggregate index measured using statistical techniques, we cannot exclude that the index used to capture the government responses to the COVID-19 pandemic is potentially measured with error. In the presence of endogeneity, the fixed effect ordinary least square estimates for the coefficient of the variable government responses to COVID-19 would be biased downward.

We resort to the instrumental variable technique to address the endogeneity issue of the government policy responses to COVID-19 in the regression. We use as instrumental variable the number of days elapsed since the first outbreak of COVID-19 in China to the arrival date of COVID-19 in the host country. Similarly, the government responses to COVID-19 in other countries, which is potentially endogenous because of interdependencies between countries, is also instrumented by the average number of days elapsed since the first confirmed case of COVID-19 in China to the arrival of COVID-19 in the other countries. The rationale behind the choice of this instrument is related to the fact that countries that have experienced the first confirmed COVID-19 case relatively later may have learned and adopted the most effective policy responses adopted by countries that have faced the pandemic earlier (Nguimkeu & Tadadjeu, 2020).

We follow Lewbel’s (2012) approach to supplement this external instrumental variable by generating heteroscedasticity-based instruments. Lewbel’s (2012) instruments are constructed as \( (Z - \hat{Z}) \xi \), where \( \xi \) are the estimated residuals obtained from the first stage regression of instrumental variable estimation; \( Z \) is a vector of all or some of the exogenous variables \( X \) of the baseline equation with sample mean values \( \bar{Z} \). We select only the \( Z \) variables which are correlated to the endogenous variable in the first stage regression to avoid weak instrument issues. These variables include food price index and other countries’ policy responses to COVID-19.
The main result of the paper remains unchanged when the potential endogeneity of the policy responses to COVID-19 in the host country and in the other countries is addressed.\(^9\) Government policy responses have a negative and significant impact on CPI (Table 3, Column 1). The value of the estimated coefficient obtained with simple fixed effect regression coincides with its value obtained with instrumental variable estimation, suggesting that the simple panel fixed effect regressions carried out in the paper do not suffer from endogeneity bias.

### 6.2.2 Additional control variable

As robustness check, we include the monthly nominal exchange rate US$/FCFA in the baseline regression to test whether the exchange rate fluctuations affect inflation (London, 1989; Miyajima, 2020) in WAEMU countries. The inclusion of the nominal exchange rate US$/FCFA in the baseline regression does not change the main findings of the paper. The increase in COVID-19 cases positively affects CPI whereas the policy responses to the pandemic have a negative impact on CPI (Table 3, Column 2). The exchange rate has a negative but not statistically significant impact on CPI (Table 3, Column 2).

### 6.2.3 Seasonality in high frequency data

The high frequency CPI may create empirical issues because CPI data may exhibit some form of cyclicality over the months. In fact, demand for some goods and some services like transport and tourism may have seasonal dynamics,
with peaks during the holiday and summer months (Abay et al., 2020). To address the cyclicality, we follow the approach of Abay et al. (2020) and Andersen et al. (2020) by comparing CPI on each month in 2020 to CPI on a reference month 12 months earlier. For each month of our window of analysis, 1 January 2019–31 July 2020, we compute the difference between CPI on the month itself and CPI on the reference month the year before, we obtain a seasonally adjusted measure of CPI that we use for conducting the regression in Table 3 Column 3. Again, the main findings of the paper remain stable to the use of seasonally adjusted measures of CPI. The government policy measures reduce CPI while the COVID-19 cases have a positive impact on the consumer price index (Table 3, Column 3).

7 | CONCLUSION

This paper estimates the impacts of government policy responses to the pandemic on CPI for WAEMU countries. Across various robustness checks, ordinary least squares and instrumental variable regressions carried out on monthly panel data over the period January 2019–July 2020 provide three major results. First, while the number of COVID-19 confirmed cases positively affect CPI, the government policy responses to the pandemic have a negative impact on CPI. The estimation results show that CPI drops by 0.05%–0.14% following an increase of 1% in the overall index for government responses to COVID-19. These results suggest that policymakers may consider intensifying the implementation of public policies in response to the COVID-19 pandemic, including a temporary waiving of taxes and custom duties on COVID-19 related medical products and financial support to households and firms to preserve the stability of prices when the epidemiologic situation of the COVID-19 deteriorates. Second, we find in the regression results that government accommodative policies to COVID-19 in other countries has a positive and statistically significant impact on the host country’s CPI. This result reiterates the importance of adopting a regional and global approach to fight the harmful macroeconomic effects of the COVID-19 pandemic. Finally, the estimation results indicate that world food prices and oil prices positively affect CPI, thus confirming that external factors, namely international prices, are among the main drivers of inflation in WAEMU countries.

ACKNOWLEDGMENTS

I am grateful to Eric Nazindigouba Kere and Daouda Drabo for the helpful guidance they provided for the revision of the paper.

ENDNOTES

1The World Bank (2020) estimates that remittance flows to sub-Saharan Africa will decline by 9% and 6% respectively in 2020 and 2021.
2The weights $w_{ij}$ of the geographic distance weighting matrix (after standardisation) are given as follows: $w_{ij} = \frac{1/d_{ij}}{\sum_{j \neq i} 1/d_{ij}}$ for $i \neq j$, 0 for $i = j$.
3The data are available at https://www.bsg.ox.ac.uk/research/research-projects/coronavirus-government-response-tracker#data.
4The time coverage of the quantitative analysis is dictated by the availability of data. In fact, at the time of writing of this paper, the latest available data for the consumer price index was on 31 July 2020. The latest available data on COVID-19 confirmed cases and government policy responses index for WAEMU countries were almost around the same period.
5The descriptive statistics of all the variables for all the countries are available upon request from the author.
6The inverse hyperbolic sine transformation of the variable $x$ is $IHS(x) = \log\left(\sqrt{x^2 + 1} + x\right)$.
7We label this variable ‘Learning’.
8Supplementing external instruments with Lewbel’s (2012) generated-instruments enable to run the Sargan/Hansen tests of the orthogonality conditions or overidentifying restrictions, something which would not be possible in the case of exact identification.
9The instrumental variable regression passes all the diagnostic tests (see the bottom lines of Table 3, Column 1). The first stage regression results, available upon request from the author, show that the set of instruments are relevant.

ORCID

Seydou Coulibaly http://orcid.org/0000-0001-9381-2056

REFERENCES

Abango, M. A., Yusif, H., & Issifu, A. (2019). Monetary aggregates targeting, inflation targeting and inflation stabilization in Ghana. African Development Review, 31(4), 448–461.
Abay, K., Tafere, K., & Woldemichael, A. (2020). *Winners and Losers from COVID-19: Global evidence from Google search* (Policy Research Working Paper 9268). World Bank Group.

African Development Bank (2020). *African Economic Outlook 2020: Supplement Amid COVID-19*.

Andersen, A. L., Hansen, E. T., Johansen, N., & Sheridan, A. (2020). Consumer responses to the COVID-19 crisis: Evidence from bank account transaction data. *Covid Economics*, 7(20 April 2020), 88–114.

Ayittey, F. K., Ayittey, M. K., Chiwero, N. B., Kamasah, J. S., & Dzuvor, C. (2020). Economic impacts of Wuhan 2019-nCoV on China and the world. *Journal of Medical Virology*, 92, 473–475.

Banerjee, R., Mehrotra, A., & Zampolli, F. (2020). Inflation at risk from Covid-19. *Bank for International Settlements Bulletin*, No. 28.

Bouraima, M. B., Zonon, B. I. P., & Qiu, Y. (2020). The first 100 days: A review and analysis of the evolution of the COVID-19 pandemic in the West African Economic and Monetary Union (WAEMU). *Eurasian Journal of Medicine and Investigation*, 4(4), 405–413.

Breisinger, C., Abdelatif, A., Raouf, M., & Wiebelt, M. (2020). *COVID-19 and the Egyptian economy: Estimating the impacts of expected reductions in tourism, Suez Canal revenues, and remittances*. IFPRI MENA Policy Note.

Cabrálic, B., & Rocher, E. (2013). *Les perspectives des Unions Monétaires Africaines*. Revue d’économie financière, 2013/2, No. 110, 99–125.

Charles, S., & Marie, J. (2016). Hyperinflation in a small open economy with a fixed exchange rate: A post Keynesian view. *Journal of Post Keynesian Economics*, 39(3), 361–386.

Diop, A., Dufrénot, G., & Sanon, G. (2008). Long-run determinants of inflation in WAEMU. In Gulde, A.-M. & Tsangarides, C. (Eds.), *The CFA Franc Zone: Common currency, uncommon challenges* (2008, pp. 54–76). IMF.

Ebrahimy, E., Igan, D., & Wiebelt, M. (2020). *COVID-19 and the Egyptian economy: Estimating the impacts of expected reductions in tourism, Suez Canal revenues, and remittances*. IFPRI MENA Policy Note.

Fernández, V. C., & Gerling, K. (2011). *Inflation uncertainty and relative price variability in WAEMU countries* (IMF Working Papers 2011/059). International Monetary Fund.

Friedman, M. (1956). The quantity theory of money: A restatement, In *Studies in the quantity theory of money*. Chicago University Press.

Friedman, M. (1968). The role of monetary policy, In *The optimum quantity of money and other essays*. Chicago University Press.

Goldberg, P. K., & Knetter, M. M. (1997). Goods prices and exchange rates: What have we learned? *Studies in the quantity theory of money*, 30, 635–667.

Gondwe, G. (2020). *Consumer responses to the COVID-19 crisis: Evidence from bank account transaction data*. *Covid Economics*, 7(20 April 2020), 88–114.

Levy, C., Danon, G., & Kouadio, G. (2020). *How could the COVID-19 crisis: Evidence from bank account transaction data*. *Covid Economics*, 7(20 April 2020), 88–114.

London, A. (1989). Money, inflation and adjustment policy in Africa: Some further evidence. *African Development Review*, 1(1), 87–111.

Miyajima, K. (2020). Exchange rate volatility and pass-through to inflation in South Africa. *African Development Review*, 32(2), 404–418.

Ndung’u, N. (1994). A monetarist model of inflation: Kenyan case. *African Development Review*, 6(2), 109–136.

Ozili, P. (2020). COVID-19 in Africa: Socio-economic impact, policy response and opportunities. *International Journal of Sociology and Social Policy*, https://doi.org/10.1108/IJSSP-05-2020-0171.
Sunkel, O. (1958). Inflation in Chile: An unorthodox approach. *International Economic Papers, 10*, 107–131.
Vera, L. (2010). Conflict inflation: An open economy approach. *Journal of Economic Studies, 37*(6), 597–615.
Vernengo, M. (2003). Balance of payments constraint and inflation. Department of Economic of University of Utah Working Paper Series.
World Bank (2020, October). *Phase II: COVID-19 crisis through a migration lens* (Migration and Development Brief 33).

**How to cite this article:** Coulibaly, S. (2021). COVID-19 policy responses, inflation and spillover effects in the West African Economic and Monetary Union. *Afr Dev Rev, 33*, S139–S151. https://doi.org/10.1111/1467-8268.12527